Open Banking

1. Conceptual Introduction

There is another sector where blockchain has the potential to revolutionize an industry that is traditionally an oligopoly, with a high barrier to entry, and closed ownership of data: banking. The many ongoing projects around the world to decentralize the ownership and flow of financial data are currently at varying stages of development. So far, none of them explicitly involve blockchain; however, current developments lay the theoretical groundwork for the banking sector to become one whose data management and flows depend on a blockchain.

As of the end of 2022, the reputation of blockchain-based finance has become decidedly negative. The collapse of many cryptocurrencies, and several pillars in the ecosystem of cryptocurrencies, has associated the concept with a digital Wild West in which an army of young and arrogant cryptobros, all of whom seem to be wearing a trademark uniform of t-shirts and hoodies, hypnotize many unsuspecting marks by chanting a few mantras. The most incomprehensible bubble of them all erupted over, of all things, monkey cartoons. Yet, work to introduce blockchains into the button-down world of banking and finance continues quietly in the background; while it will take some time yet for blockchains to fully emerge into our everyday lives on a fundamentally sound footing, several of the building blocks needed for its growth are already well under development. Metaphorically, t-shirts and hoodies have become out of fashion in the world blockchains; what will come in fashion, instead, are dress shirts and ties.

At present, our banking experience is tied to each financial institution. Someone who holds chequing accounts from banks A and B, holds a mortgage from company C, uses a trading account from institution D, and checks the credit score from company E, would have to interact with five different institutions, on five different platforms. In other words, our data in each institution is closed. What costs are we forced to pay?

It's not just a matter of time and convenience. Under our closed banking approach, it's cumbersome to make comparisons between financial institutions. The cost to switch between financial institutions, even when a better deal is spotted, becomes high enough to deter all but the most persistent consumers. Moreover, since data behind each relationship between a consumer and the institution is proprietary information, it is impossible for third-party fin-tech providers, who might possess unique data analytics technologies, to provide their insights to assist consumers in managing their wealth. Consumers expect free and open competition in all aspects of their life, and financial services are no exception.

Open banking, seeks to empower financial consumers in this fashion. At its core, consumers are recognized as the owner of their financial data. They possess the right to grant or revoke permission for other parties to utilize it according to their own needs. This is done by financial institutions opening up their APIs to third-party developers, which then build applications and other services tailor-made to each customer's needs.

Although open banking, as a mass-market product, is only several years old, the concept itself is decades-old. The first known trial of the concept was conducted in 1980, by the German Federal Post Office. 2000 bank customers were recruited in an experiment, where they could access their accounts from several

banks, using the remote control on their home television sets. In 1998, a project between two major German banks and the Association of German Banks was launched, implementing an institution-independent open protocol for online banking services (Home Banking Computer Interface).

Since then, the rise of the concept of open data, as well as industry initiatives and supportive government regulations, has enabled consumers and businesses in several economies – most notably the UK - to experience the benefits of open banking.

As open banking represents, by its nature, a decentralization of the management of customers 'financial data, it will also create opportunities to decentralize its storage. Indeed, the more interactions between financial institutions and third parties, the higher the cost for banks to manage the interaction of data between its internal systems and third parties. Hence, banks could in due course find it more economical to offload these costs to a decentralized ledger. How this could work in practice will be discussed in a later section.

How did open banking advance to this stage, and what specifically is happening around the world? Things are moving at varying stages, through varying approaches, with varying results.

2. Differing Approaches of Implementation

From a broad sense, there have been two pathways in which open banking has emerged in each jurisdiction: market-driven, and regulatory-driven.

Under the market-driven approach, there is little government direction in the development of open banking: it arises based on agreements between players within the banking sector, with minimal government co-ordination involved. This could be the result of disinterest from government, overlapping jurisdictions that slow down policy development, or a desire for private sector players to set industry standards on their own terms.

Under the regulatory-driven approach, government agencies are deeply involved in the development process; in some cases, governments actively see open banking as a sector in which their countries could claim a first-mover advantage. Many governments set mandates for institutions to open their APIs and establish data security protocols, while some establish a legal right of ownership and portability over customer data.

In practice, the development of open banking in any given country will involve elements of both approaches. Sometimes, a government would establish a legal framework, before allowing new entrants into the market in unexpected ways. Open banking could initially emerge organically from the banking industry, before government policy increasingly drives developments. Governments could also establish a national plan for data management, and promote private sector developments under that plan.

2.1 European Union

The first legal framework in the world, which explicitly enabled what we now know as open banking, was the Payment Services Directive (PSD) of the European Commission. This entered into force in 2007. PSD

was enacted as part of the EU's Single Euro Payments Area, which aimed to eliminate the cost of traditional bank transfers across the single market. However, PSD established payment service providers were established as an industry in its own right, enabling non-banks and non-governments to offer payment services.

A second Payment Services Directive (PSD2), which entered into force in 2018, more explicitly addresses competition in the payment service provider sector. PSD2 requires banks to provide a dedicated API to securely share customer data to both obtain information and to execute payments. However, it does not specify any particular open standard.

The largest regulatory changes include:

- Establishes regulations and harmonization in Account Information Services (AIS) - include the collection and storage of information from a customer's different bank accounts in a single place.
- Establishes regulations and harmonization in Payment Initiation Services (PIS) – execute payments from the consumer's account to the merchant's account by creating an interface to bridge both accounts, filling in the information needed for the bank transfer, and informing the store of the transaction. PS2D also allows clients to make payments to a third party from a bank's app using any of the client's accounts (whether they belong to this entity or not).
- New security requirements, known as Strong Customer Authentication (SCA). This involves the use of two authentication factors for bank operations that were not previously required, including payments and access to accounts online or via apps, as well as a stricter definition of what counts as an authentication factor.

Although PSD2 was groundbreaking in scope, there was significant distance between the legislation and practical application. This means that, while the EU is home to some notable players in the open banking sector, adoption is still at varying stages.

The first major hurdle is the implementation of the EU directive into national laws: this means that the practical roll-out of PSD2 in each EU nation is dependent on their national-level priorities. In turn, this leads to differing interpretations of PSD2 in each nation's laws, as well as varying standards. This creates a hindrance for third-party providers which wish to leverage their technologies throughout the single market.

Complicating the development of Open Banking is another major EU legislation, General Data Protection Regulation (GDPR), which also came into effect in 2018. There have been concerns in the payment services industry that standards for the collection and the transfer of data differ between the two laws, potentially exposing third-parties to further legal risks. After further public consultation, the European Data Protection Board (EPDB) issued final guidelines in 2020 to clarify the relationship between the two laws. For instance, "explicit consent" and "sensitive personal data", in the context of data collection, are mentioned in both laws; however, the EPDB ruled that the meaning of these phrases are not identical under both laws. The guidelines provide giving greater certainty to third-parties going forward.

Another hurdle was a requirement under PSD2's SCA requirements for a re-authentication by the customer every 90 days. This led to a user experience where customers with relationships with multiple

institutions must repeatedly re-authenticate at seemingly unexpected times, which led to attrition rates that put the fundamental business model at risk.

Perhaps the biggest deficiency of PSD2 is that its mandate only covers the area of payment accounts, but not other financial services such as wealth management and consumer lending. This greatly limits the scope of services which could be offered by third-parties, limiting the potential for growth in the open banking sector. This is further complicated by differing definitions of "payment accounts" under banking regulations in each country, creating uneven access to data across the single market.

As a result, the European Commission ordered a review of PSD2 in 2021 from the European Banking Authority (EBA). The EBA responded with a comprehensive opinion in June 2022 with findings about the progress of the implementation of PSD2 and a list of over 200 recommendations. It is expected that, in the coming years, further regulations will be enacted to enhance the legal framework for the open banking sector.

Although the EU's approach for open banking was strongly regulatory-driven, and may seem to have hindered the development of the sector, a world leader in market adoption of open banking did so under the EU's regulatory framework, even though it is no longer a member.

2.2 United Kingdom

According to the Open Banking Implementation Entity (OBIE), the number of active users of open banking services in the UK exceeded 1 million in November 2019, 2 million in September 2020, and 6 million by May 2022. One report predicts that 60% of the UK's population will be users by September 2023.

Although the UK is no longer a member of the EU, it inherited all of the EU's regulatory framework. Hence, almost all of the processes in the development of open banking as described in the previous section is applicable here.

The UK's success in the adoption of open banking is thanks to long-standing support from government, which through a combination of persuasion and mandates, convinced the industry to follow suit.

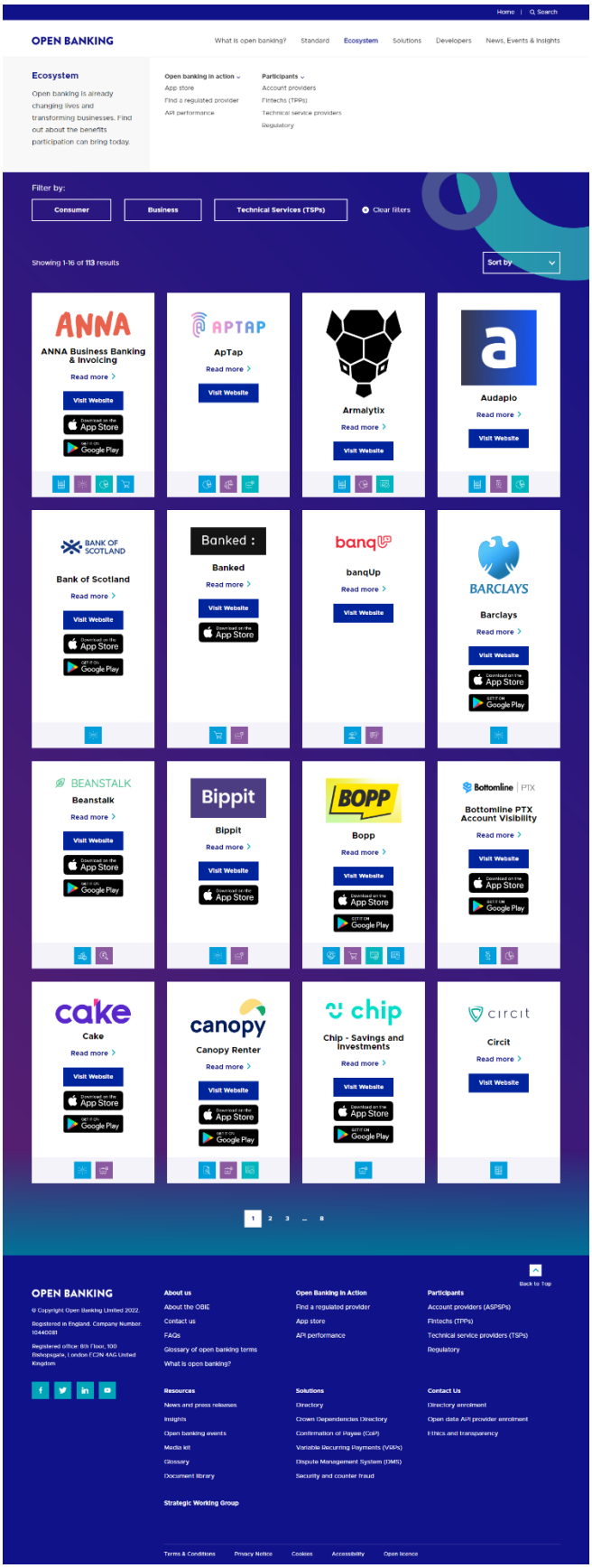
In 2011, the government announced the midata project, where 20 major companies in the fields of energy, technology, finance, and telecommunications, agreed to voluntarily allow customers to download their data on a portable, electronic format. It claimed this would enable customers to better make comparisons between competitors. However, the cumbersome and confusing user experience, as well as the static nature of the downloaded data, ensured that midata never achieved wide adoption.

In 2015, the UK Treasury formed an Open Banking Working Group to determine the parameters in which data sharing would occur. The group consulted banks, civil society groups, consumer groups, and interested third-parties. The group concluded in 2016 that a standardized API should be implemented, and that a decentralized system across different institutions should be established for better security. In addition, learning from the shortcomings of midata, the group recommended that open banking required government mandates for effective implementation. In the same year, the Competition and Markets Authority (CMA) published a report which concluded that there was a lack of competition in the banking sector, and that barriers were too high for new entrants. It recommended that the UK's nine largest banks

– which together account for over 90% of individual and small business customers - be ordered to provide their APIs to third-party providers.

The CMA delegated the details of the implementation – APIs, data structures, and security architectures – to a newly-established private entity OBIE, which would transition to a supervisory role with the maturity of the industry. In order to further expand the reach of the technology, the OBIE's standards and support infrastructure were made available to all banks, not merely the nine subjected to the mandate. It also established a whitelist of approved third-party providers with appropriate permissions called the Open Banking Directory.

The deadline for the going live of the APIs was in December 2018. In June 2020, the OBIE opened an "Open Banking App Store", listing (as of December 2022) 113 apps which had been approved for distribution.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Sort by
ANNA
ANNA Business Banking & Invoicing
Read more
Visit Website
ApTap
Read more
Visit Website
Armalytix
Read more
Visit Website
Audaplo
Read more
Visit Website
Bank of Scotland
Read more
Visit Website
Banked
Read more
Visit Website
banqUp
Read more
Visit Website
Barclays
Read more
Visit Website
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1 2 3 ... 8
Back to Top
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Glossary of open banking terms
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Open Banking in Action
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API performance
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With the development of an open banking ecosystem in the UK, we should highlight some notable examples of its success:

- The UK's tax agency HMRC now offers payment of income tax, value added tax, and corporation tax through a "pay-by-bank" option, which is serviced by an open payments provider Ecospend. The government estimates a significant reduction of transaction fees, as well as transaction errors.

- Quickbooks can automatically obtain bank transaction data, thus automating the bookkeeping process for small businesses, vastly saving time and accounting costs.

- Cleo, aimed at younger customers, combines data from customers' bank accounts to assist in budgeting and saving, through a chatbot, which uses trendy language with online-friendly memes.

- Tully accesses customers' banking information, without the power to transfer money or make payments. It initially provided tailor-made debt advice, before branching out during the pandemic to offer more general financial advice.

- Trustly enables customers on online merchants to directly make payments from their bank account, without creating any account with Trustly. This keeps completely separates the bank from the merchant, adding an extra layer of security. The most notable application is with online casinos, where most banks have banned the use by their credit cards.

British regulators have also moved to address the 90 day re-authentication problem under PSD2, as previously mentioned in the EU section. In November 2021, the Financial Conduct Authority (FCA) modified the 90 day requirement for re-authentication with financial institutions to a mere requirement to re-confirm their consent to access data with the third party provider. From a technical angle, banks will generate a non-expiring token the first time the customer authenticates via the third-party. Before the 90 day period, the third party provider will notify the customer of a request to re-confirm the list of financial institutions with which the third-party will continue having access. This will then start another 90 day period. The new regulations were gradually rolled out over 2022, and the final deadline for financial institutions to comply with the new protocol was September 30, 2022.

2.3 Open Banking in Practice

The most high-profile product of the UK's move to open banking is the fintech unicorn Revolut. Founded in 2015 by the Russian-born immigrant to the UK, Nikolay Storonsky; and who had previously worked at Lehman Brothers and Credit Suisse, Revolut bills itself as "One App, All Things Money". Since even before the formal rollout of the UK's open banking framework, Revolut has gradually expanded both the range of services it offered as well as the markets it serves. Its services run the gamut from commission-free trading on stock markets, to cryptocurrency trading (through a partner bank), to buy-now-pay-later loans, to more niche services such as pet insurance and short-term vacation rentals. All these are offered in addition to the more conventional functions of open banking, such as providing a platform for third-party banks. Despite its status as a non-bank, Revolut issues payment cards with the same functions as those issued by conventional banks.

In Revolut's Series E round of fundraising in July 2021, it was valued at 24 billion Pounds (about 33 billion USD); its backers at the time included SoftBank and Tiger Global Management. Its revenues in 2020 were

a mere $325 million USD, indicating the high hopes placed during its latest round. The fundraising was even feted by then-UK Chancellor Rishi Sunak (now Prime Minister) as a "Great British fintech success story", who then pledged to foster an environment that supports a sector that is "competitive, forward-looking, and dynamic".

While Revolut has obtained a banking license in the European Union, it is only providing e-money services for business customers, and has not stated a timeline to provide services to retail customers. Despite its business model, its growth plan depends on its ability to obtain formal banking licenses in all of its jurisdictions; it has applied for a banking license in the UK and the US (through the State of California), but neither jurisdiction has approved the applications as of December 2022. It has faced growing controversy due to a string of executive departures, scrutiny from regulators about a lack of internal controls, and weak anti-money laundering measures. Its IPO, which was expected in 2022, was postponed. It is speculated that its continued delays in obtaining a banking license in the UK and US were due to concerns about its overly rapid expansion and a culture of pressing the limits of its current regulatory permissions.

The weak regulatory framework has also damaged the experience for retail customers, creating further damage to Revolut's reputation. Several mainstream British media outlets have published complaints from Revolut customers, who had been victims of fraud and robbery, that the company was non-responsive or victim-blaming. As a background, in 2019, the UK's ten largest retail banks voluntarily enacted a Contingent Reimbursement Model Code (CRMC), where they pledged to reimburse victims of Authorized Push Payment scams (where victims were deceived into actively approving payments to a fraudster). The customers complained that, since Revolut is not a bank and not a signatory to the CRMC, it denied responsibility for the losses. One Revolut customer even complained that, after his phone and card were stolen, the thieves made a huge cash withdrawal and went on a shopping spree on central London's upmarket Regent Street; Revolut still refused to accept responsibility.

The emerging story of Revolut is typical of that of many fintech unicorns in recent years. Hence, Revolut's recent troubles don't reflect on the concept of open banking itself. However, it is clear that the open banking sector is not immune to the problems that are plaguing the fintech sector, especially given the still imperfect regulatory framework. Tensions between the wild-west mindset of today's tech entrepreneurs and the staid, conservative environment of the banking sector are inevitable, and must be managed to foster public confidence. In particular, the instances of Revolut denying the responsibilities of banks are only made possible by the non-bank status of fintech players; they will damage public confidence in open banking as a concept, unless the players themselves are subject to the same regulations as banks. The current plight of cryptocurrencies is a cautionary tale in that aspect.

2.4 Open Banking's Place in the World

As the regulatory framework evolves, industry players in Britain have also expressed an intention to further develop the model of open banking into the broader world of open finance; and, furthermore, to export its expertise to other jurisdictions, particularly with a view of entering into agreements on digital trade. Charlotte Croswell, Chair and Trustee of the OBIE, at a speech in October 2022, stated that:

"The UK has an open banking product and standard that is tried, tested and ready to go. It can and should be included as a key asset in future trade negotiations and the UK can offer the skills and expertise to build it in other jurisdictions."

It should be noted that Ms. Croswell made her speech at a conference of the governing Conservative Party at a time when Britain was facing a financial crisis, during a period of political and economic stagnation that started with Britain's departure from the European Union. Hence, her speech should be interpreted in the overall atmosphere of desperation in which it was made.

Nonetheless, her words do appeal to Britain's centuries-old self-identity as a nation built on openness to trade and as pioneer in the world of global finance. Will open banking technology provide an additional chapter in that story?

That remains to be seen.

3. Open Banking and Distributed Ledgers

Having discussed real developments in the area of open banking, we could speculate on how it could take shape as distributed ledgers – of which blockchain is a type - become more widely adopted.

Some authors have already laid out a potential framework on how a distributed ledger-based open banking system could function in practice.

Central banks have been taking a leading role in the development of the framework for a banking distributed ledger. As they already are tasked with regulating the activities of financial institutions, they could implement these regulations on the distributed ledger through smart contracts: in principle, this would guarantee adherence to protocols without additional cost. Since another characteristic of distributed ledgers is the ability of participants to share or un-share any data they wish, the open banking experience becomes more secure under distributed ledger.

Under such an arrangement, banks would no longer be responsible for administering the database containing customers' data, which would be a net positive; if banks increasingly become mere service providers, it would make no sense for them to continue to assume the costs of a closed system.

How would banking distributed ledgers work in practice? This has been a hot topic among the world's central banks, with a flurry of discussion papers, responses, conferences, and even pilot projects on how central bank digital currencies (CBDCs) would be implemented, both as a process and as an outcome.

3.1 Stabilizing Stablecoins

One class of digital currencies in existence – stablecoins – claim an advantage as a storage of value, through reserves backed by assets in the namesake currency; in theory, smart contracts prevent them from ever breaking the peg from the namesake. However, many high-profile stablecoins were exposed as swimming naked when the tide receded during the crypto bust of 2022. In addition, discussion papers by central banks noted that stablecoins tended to exploit the lack of regulations across jurisdictions, thus undermining confidence in the safety of day-to-day transactions. A concentration of economic power, and non-interoperability with each other and other payment systems, were also cited as risks poised by the proliferation of unregulated stablecoins in a discussion paper issued by the Bank of England in 2020.

Although centralized stablecoins such as USDC and USDT attempted to distinguish themselves from algorithmic coins such as TerraUSD and Luna, policymakers have decided that regulation was required for

the entire realm. As the vast majority of stablecoins are referenced to the US Dollar, a focus on regulations in the US is needed. As early as 2014, the State of New York introduced BitLicense, a business licensing scheme for virtual currency activities; the regulations were limited to activities conducted in the state, or involving New York residents (several popular crypto exchanges are not available in that state, as a result). In California, the state legislature passed a bill introducing a licensing scheme for facilitators of crypto transactions; that was vetoed by Governor Gavin Newsom in September 2022. At the federal level, the issue of cryptocurrency regulations gained increased urgency in 2022; it remains to be seen how they will be implemented, but it is highly likely that even stablecoins will be required to be fully backed by reserves at traditional banks. Such a scheme would be reminiscent of the physical banknotes which currently circulate in Hong Kong, which are issued by private, commercial banks under a requirement to deposit a matching amount in US Dollars at the Hong Kong Monetary Authority. It is, however, doubtful that a modern economy could function under several simultaneously circulating stablecoins that are backed by central bank reserves. Unlike in Hong Kong, where banknotes from the three note-issuing banks enjoy equal and universal acceptance, it is highly unlikely that a similar situation could emerge with regulated stablecoins, unless government regulations required interoperability that effectively turned them into CBDCs. Hence, it is assumed that digital currency will become the exclusive domain of central banks, with non-stable coins remaining as niche devices.

3.2 About CBDCs

The Bank of International Settlements, in conjunction with seven central banks from the world's wealthiest economies, has been exploring the potential for a retail CBDC in a modern economy. In October 2020, it released a report detailing common foundational principles and core features of a CBDC. The most important requirements of a CBDC it identified were that it would not damage monetary or financial stability (do-no-harm principle); and that it could coexist and complement other forms of money; and that it promotes efficiency, competition, and innovation.

Likely the most groundbreaking promise touted in the report is the ability to diversify the payments service infrastructure – currently, the high barrier of entry for PSPs incentivizes closed systems and high fees; new entrants find it impossible to compete with proprietary systems and without network effects. A CBDC, where a core ledger with supporting infrastructure and rules would underpin a broader ecosystem of processing infrastructure, would provide a basis for different players – including third parties in the open banking sector – to more effectively deliver services to customers.

The most prominent risk mentioned in the report includes that to financial stability caused by the disintermediation of banks. CBDCs, as a digital version of cash, would remove the requirement to store money in commercial banks. Although most individuals and business will continue to store their savings with financial institutions to maximize their wealth, we could expect that a significant proportion of bank deposits will permanently leave the banking system towards digital cash. This would cause banks to rely more on riskier wholesale sources of funding, rather than on safer deposits.

Perhaps the most sensitive question about CBDCs revolves around privacy. While cash enjoys an absolute guarantee of anonymity as a medium of exchange, this is not true about any digital asset governed by a central authority. A public consultation by the European Central Bank indicated that 41% of respondents ranked privacy as the most important feature desired by a digital Euro, far ahead of even the second choice of security (17%). Given the increased importance this issue has become around the world, it is

inevitable that the concerns expressed in Europe will become a non-negotiable barrier for the success of any CBDC. One potential solution comes with zero-knowledge proof, where one party (a payer) can prove to another party (a payee) whether a given statement is true (is able to pay a given amount) without disclosing any additional information. A paper published by the German blockchain payments provider etonec, in December 2022, claims that this approach is feasible with a fiat stablecoin, thus simulating the anonymity of cash transactions with a CBDC. Beyond privacy concerns, the ability for transactions under CBDCs to be made in adverse circumstances, such as if telecommunications and banking infrastructure were to be disrupted, or in areas without modern infrastructure, is also critical if it were to realize its promise of being a substitute for cash.

Research into the specific architecture of a CBDC is ongoing. Continued discussion papers issued by central banks have elicited a strong response, especially from players beyond the financial services sector. In September 2021, the Bank of International Settlements issued a new series of reports that turned to practical policy and implementation issues of CBDCs. A major hub for CBDC-related dialogue is the Digital Currency Institute at the Massachusetts Institute of Technology. It is currently collaborating with the Federal Reserve Bank of Boston, the Bank of Canada, and the Bank of England. Its flagship project at the moment is Project Hamilton – a collaboration with the Boston Fed "to explore the CBDC design space and gain a hands-on understanding of a CBDC's technical challenges and opportunities". In Phase 1, it "created a design for a modular, extensible transaction processing system, implemented it in two distinct architectures, and evaluated their speed, throughput, and fault tolerance". In the report issued in February 2022, one of the two architectures, among other accomplishments, demonstrated throughput of 1.7 million transactions per second with 99% of transactions durably completing in under a second, and the majority of transactions completing in under half a second. Phase 2, currently ongoing, seeks to add more complex functionalities.

Of course, several countries have already launched digital currencies in a trial stage – most notably, China. Yet, the development of CBDCs is a marathon involving a complex system of moving parts. As technology continues to advance with breakneck speed, and as economies continue to evolve around it, CBDCs are guaranteed to be in a permanent state of flux.

3.3 Payment Without Borders

Cross border payments are an additional area of investigation among the world's central banks. Currently, even routine cross-border payments involving SWIFT are costly and time-consuming due to the layers of correspondent institutions – often in third countries with no relation to the underlying transaction. That creates a demand for exploring the use of distributed ledgers and even blockchain themselves, to provide alternatives.

In 2016, the Bank of Canada and the Monetary Authority of Singapore launched Project Jasper-Ubin, exploring the use of distributed ledger technology to facilitate transactions between the two nations. The design paper noted that, in both countries, "there are limited, incremental benefits of DLT in a domestic context where there is a trusted central party and where centralized systems perform efficiently". It hypothesized that DLT – rather than purely decentralized blockchain - is preferred for cross-border payments due to a requirement for traceability of ownership, and the lack of a single trusted global central player unlike national central banks. Three technical designs were proposed for this task. It should be noted that, while none of the enabled transactions without involving any third parties, they offered an

improvement from SWIFT, by removing at least one intermediary, and reducing the scope of the transaction to purely between the two respective countries. In all cases, the proof-of-concept involves Hashed Time-Locked Contracts (HTLCs), where the sending Singaporean bank generating a secret S, and establishing a secure channel with the receiving Canadian bank to communicate the hash of the secret H(S). A web of instructions involving the execution and generation of HTLCs, and the ultimate inspection and verification of the HTLC in the recipient Canadian bank, then follows. The transaction is concluded with all HTLCs involving the Singaporean bank, the Canadian bank, and the intermediary, redeeming the funds from escrow accounts. It should be noted that during the simulation, Singapore and Canada used different DLT platforms, Corda and Quorum respectively, increasing the complexity of the project.

A much larger trial was hosted by the Innovation Hub of the Bank of International Settlements (BIS) in September 2022, involving the central banks of mainland China, Hong Kong, Thailand, and the UAE. Project mBridge, taking lessons from Jasper-Ubin and other similar trials, decided to create a custom-made blockchain called mBridge Ledger (mBL). mBL was deployed and operated in a high-security, centralised cloud based in Hong Kong. The architecture of mBL was centralized around validating nodes that are operated by the respective central banks, thus creating a decentralized ledger shared by a central repository in each jurisdiction. From there, each central bank would be responsible for onboarding their domestic commercial banks into mBL – thus, the blockchain is private. The validation of the ledger would be permissioned, and performed strictly by the central banks – in contrast to permissionless blockchains such as Bitcoin and Ethereum, where validators perform the service in exchange for gas fees. Such a setup allows governments, through the central banks, to retain full control over cross-border capital flows, a pivotal functionality for any cross-border payment system. mBridge's discussion paper also addressed concerns about privacy – but in this context, focused on limiting access to transaction data purely to the central banks of the jurisdictions involved in each transaction. The nature of cross-border transactions means that pure user-to-user anonymity is not feasible. In 2023 and 2024, mBridge seeks to expand further in functionality, and is testing a new consensus mechanism that promises higher efficiency, scalability, and robustness. Although the six-week pilot project was used to conduct a mere 164 transactions worth about $22 million USD, it is not hard to envisage mBL expanding in scale to include more countries, and more transactions, eventually providing a viable alternative to the current-day SWIFT infrastructure for cross-border payments.

For its part, the Federal Reserve – the central bank of the world's currently dominant currency – wrote in its discussion paper from January 2022, explicitly acknowledges preserving the US Dollar's dominant global role as a motivation for potentially introducing a digital currency. However, it should still be noted that while a distributed ledger could well eliminate the need to use the US financial system to execute transactions, it does not eliminate the demand for a reliable means to store and express wealth; in the absence of other changes, businesses may still choose to price foreign trade in US Dollars, and the world's elite may still choose to store their wealth in US Dollars.

3.4 Potential Applications

Distributed ledgers also promises to bring changes to lending that is the lifeblood commercial banks. Take standard home mortgages: in the current setup, a mortgage application requires a process to verify the borrower's creditworthiness. This includes income, assets, and tolerance of risk. While technologies have

reduced the time and effort required to conduct these checks, the inherent need to separately verify each facet of the application is time-consuming and prone to error. The ability to store such data on a distributed ledger would enable the borrower to immediately share the relevant data in a standard and secure format, cutting administrative costs and reducing banks' credit risks. The additional feature of distributed ledgers, where users have the ability to unshare data when it's no longer necessary, would bolster confidence in the security of their personal information, while reducing banks' data warehousing costs.

A similar process could be used in commercial banking: decisions to issue business loans can be made faster; and based on data that is secure, verifiable, and standardized. The process of repossessing collateral would also be simplified through smart contracts, allowing banks to accept a more diverse set of collateral and even an increased willingness to lend. This, however, still assumes a genuinely competent and impartial regulatory framework that adheres to due process.

On the subject of credit, an unavoidable feature of a modern economy is a system of credit ratings. These represent the creditworthiness of potential borrowers, becoming a virtual gatekeeper to accessing credit. While the previous oligopoly among credit bureaus is being gradually broken by emerging players, the organizational structure of the underlying data remains unchanged, with each financial provider maintaining their own, separate records.

This becomes a major problem when datasets are replicated between different providers, leading to a duplication of errors across different that cause long-lasting harm to consumers. This forces consumers to engage in a slow and confusing process to correct errors across multiple providers, leading to uncertainty in their lives an added data quality costs for providers. A distributed ledge, where financial data is stored in a decentralized ledger that still permits action by a governance body, would enable such errors to be corrected easily and instantly, with a transparent record of changes made. This would lower the costs of data storage among providers, while increasing confidence in the quality of data.

The benefits of distributed ledgers can extend even further into other sectors of the economy. For instance, one of the biggest time-consuming tasks faced by businesses is collecting taxes on behalf of the government; in countries that operate under a VAT system, this task is additionally complicated by having to itemize their expenses and wait for the VAT refund. Especially for smaller businesses, this poses a major cashflow problem. Conceivably, a distributed ledger could enable businesses to both pay the VAT and receive the refund in real-time, thus eliminating the cashflow problems that afflict many small businesses. This concept could be extended to areas like international trade, where the complicated and tedious tasks of paying duties and claiming refunds in different jurisdictions could be simplified, vastly reducing non-tariff barriers that impede trade, especially among small businesses.

Another potential avenue where open banking can bring innovation is the fundraising process for prospective entrepreneurs. With the traditional banking system, it becomes difficult for a prospective VC to crowd-fund due to the inability to securely share financial data. An ability to share verified data – on a portal provided by an authentication service – would increase transparency; and, perhaps, reduce barriers for investors willing to place educated bets on promising ventures.

In brief, while distributed ledgers in the context of open banking do promise to revolutionalize and decentralize the financial sector, the benefits that do occur will come chiefly as a result of simplifying

record keeping, improving data quality, and reducing administration costs. But, the benefits that result from these changes can be unpredictable: we can only speculate on the knock-on effects.

3.5 Changes from the Status Quo

We can expect traditional banks to adapt to the changing realities: indeed, they have already played an influential role in the development of the framework of open banking, and will continue to do so if and when open banking evolves into a broader system of decentralize finance. It is also certain that traditional banks will leverage their existing advantage of knowledge of financial markets to pivot into the new fields. For instance, even if a full evolution into DeFi eliminates the requirement for customers to deposit money at banks, depositors will still demand reliable means to store their wealth. Banks can use their existing insights to recommend products that combine security with a guaranteed rate of return, making a profit on the difference between their actual return from the product and the guaranteed return to depositors. They would have to change the way they compete for funds: more openly advertising their rate of returns to depositors, while relying less on revenue streams that assume a high barrier of exit for depositors. Since traditional banks will have built an enormous advantage in insights, they would enjoy a first-mover advantage as new systems are deployed.

However, it is not just banks that possess vast troves of financial data about customers: virtually every e-commerce company does as well. It is not hard to imagine an e-commerce giant leveraging its insights to launch a foray into the financial sector – most notably, this was attempted by Alibaba. Perhaps they will go-it-alone; perhaps they will seek partnerships with traditional banks, or with other companies that provide insights. Regulators around the world will also look dimly on these financial/commercial behemoths amassing such vast insights over individuals, which ironically would have been enabled by a technology that was touted to decentralize the financial sector and empower consumers. It is certain that this will become a future area of interest for financial and technological regulators around the world.

Although, at this stage, projects in open banking and open finance to decentralize the flow of financial data have yet to involve blockchains, such a step would be a logical conclusion as the open banking and open finance networks become more mature around the world. While blockchain technology is touted to radically decentralize information and power, it is highly likely that there are already first movers who are poised to take advantage of them – even if some of them are non-traditional players in the financial sector. It is certain that decentralization of finance will unleash a period of disruption, though it is unlikely to result in what was promised by its most prominent proponents. The new era will have strong similarities with the old one.