

EUROPEAN TRADE FINANCE

An aerial photograph of a large container ship, specifically a Maersk Line vessel, sailing on the open ocean. The ship is viewed from an elevated angle, showing its deck covered with numerous stacked shipping containers in various colors (blue, red, white). The ship's name, 'MAERSK LINE', is visible on the side of the hull. The water is dark and textured with small waves.

WINTER 2022/3

INFLATIONARY PRESSURES
MEAN A FINANCIAL POLICY
RESET IS NEEDED, ARGUES
AGUSTÍN CARSTENS

GRAHAM BRIGHT
DISCUSSES THE ROLE OF
THE CONTAINER SHIP IN
ENABLING GLOBAL TRADE

ZETZSCHE ET AL CONSIDER
THE LEGAL CHALLENGES
TO DLT-BASED PAYMENT
SYSTEMS

A EUROPEAN PERSPECTIVE ON TRADE FINANCE

Foreword

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elcome to the Winter 2022/3 edition of ETF, a *World Commerce Review* supplement. This publication has been prepared in response to readership demand for an overview of trade finance from a European perspective.

In these turbulent and unique times issues such as geopolitical tensions, macroeconomic volatility, trade digitalisation, sustainability and shifting supply chains will be examined in forthcoming editions, with the most respected authors providing the reader with the most comprehensive information available.

Our brief is to provide all the data necessary for the readership to make their own informed decisions. All editorials are independent, and content is unaffected by advertising or other commercial considerations. Authors are not endorsing any commercial or other content within the publication. ■

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Containing trade

These are disruptive, challenging times. Graham Bright considers the role of the container ship in enabling global trade

As the world implements policies to cope and live with COVID-19 as it re-emerges in new strains, and battles with exponential rising prices for many raw materials and utilities, supply chain inflation, fragmentation, trade is still global.

Businesses across the globe, especially multinationals, cannot stand idle whilst fundamental costs are rising, as we witness an unprecedented era of geopolitical turmoil, recession in leading economies and bleak financial outlook.

With US dollar appreciation having almost reached parity with the Pound Sterling (the highest rate in almost 40 years), businesses are wary of committing to investment plans, as companies assess whether the artificially hiked prices of goods truly reflect the value of those goods.

Whilst the current situation is no doubt cyclical, it is bad news in the short term for most economies. However, the hiatus in trade and forced review of internal strategies has prompted progressive firms to re-evaluate how they will identify and harness future opportunities.

These include product positioning, reducing paper and manual processes, with investment in technology enablers such as trade blockchains which will be of fundamental benefit in improving competitiveness, cost-control and ultimately market share and sustainability.

Globally, trade is predicted to grow by 70% to almost US\$30 trillion by the end of this decade with the majority transported by sea. Having encountered supply difficulties corporates have sought out new sets of suppliers, which were simply not in the supply chain before, often in land locked locations, with challenges of transport, customs and delivery.

But the race for new supplies has led to a new logistical issue, with news of a massive surplus of containers in the US. What this means is that ports in North America could become overwhelmed by a build-up of empty containers, as trans-Pacific supply chains and transportation times gradually return to pre-pandemic levels.

The humble container is the true star. Why? Its fundamental benefits in rationalising, standardising and its re-useability dramatically altered the cost and efficiency model for the industry

Whilst our institution has been involved in the document and instrument side of the business, for example dealing with compliance and operations with letters of credit, standbys, bonds and guarantees, it is hard to ignore the contribution, impact, versatility and simplicity of containers, the true enablers of international trade.

Containers

Just boxes you may think, but the humble container is the true star. Why? Its fundamental benefits in rationalising, standardising and its re-useability dramatically altered the cost and efficiency model for the industry.

As recently as 1956, an American trucking company owner named Malcolm McLean bought a shipping company. His requirement was simple, namely, to find an easier cheaper way to get his goods onboard ship, without damage or pilferage, quickly and cost-effectively. In the past, it took crews of specialist loaders, stevedores, and dockers and adherence to union rules to physically move goods from truck to hold.

The answer was to move a stackable storage vessel, regardless of contents (ie perishable, non-perishable, chemical, plastic or solid), not the goods, and the simple multi-use intermodal steel box (loaded with goods at its starting location, to be transported via road, rail, and sea to the final destination without the goods needing to leave the container) we know today was incepted and patented.

The additional breakthrough was the standardisation of size, through negotiations with the ISO Standards Organisation. The outcome was set the standard sizes that then allowed each ship, port and truck to be able to handle the dimensions with ease.

Today, whilst dimensions of containers have remained constant, a number of adaptations for types of goods have become common. And whole industries have been established to create the right environment for transport of goods requiring heat or refrigeration.

This ensure that goods, no matter how large, or dangerous, may be safely loaded and transported anywhere, to arrive in peak condition.

Containers carry general cargo by rail and sea and their size makes them ideal for storage, enabling liquid cargo or dry bulk shipping, and the wide variety of goods has led to the introduction of container variants.

Open or hard-top containers cater for cargo exceeding regular heights, which will incur higher rental and insurance fees due to the lesser strength of roof materials. Flat racks provide the support for excessive size goods, secured on strong platforms, whereas platform containers transport heavy and out of gauge cargo with high resistance mounting brackets to make transport safer.

Tank containers are commonly used to transport liquid chemicals and beverages, where a tank is constructed inside a general container, which, to avoid rapid movement of the cargo during transport, must be at least 80% filled.

Accidents will happen

Fleets are getting large and the physical size of ships has increased from the Emma Maersk, with a capacity of 15,000 containers (TEU) 10 years ago to Ever Alot, with a capacity of 24,000 containers.

The number of container ships in the global fleet increased from 4,966 in 2011 to 5,534 ships in 2021, while the carrying capacity of the global merchant fleet reached roughly two billion deadweight tons in 2020.

However, not all is well on the high seas. Between 2011 and 2020, some 876 vessels were lost at sea. The majority of ships lost during this period - around 348 - were cargo ships.

Containers stacked on giant vessels are falling over at an alarming rate, resulting in millions of dollars of cargo lost as pressure to speed deliveries raises the risk of safety errors.

Why the losses?

One immediate cause is the effect of global warming causing storms and unpredictable weather. And time pressure is encouraging captains to risk entering a storm rather than take lengthy diversions.

With megaships, more containers are being stacked higher and to capacity, putting undue pressure on operators to deliver faster as demand picks up for all manner of goods. Coupled with inadequate container locking, whole voyages may be put at risk as seen in the following examples:

- One Apus - weather caused the loss of more than 1,800 containers at an average of \$50,000 per box, estimated losses are \$90 million in cargo.
- MOL Comfort - broke in two and sank with its entire cargo of 4,293 containers into the Indian Ocean, resulting in \$400 million claim.
- Maersk Essen - lost about 750 boxes valued at \$12 million.
- Maersk Eindhoven - lost 260 containers when it lost power in heavy seas.

- Ever Given blocked Suez Canal traffic for a week, affecting hundreds of vessels. Although none of the 20,000 containers were lost, late arrival and disruption sent shock waves through the industry. The impact on global trade is ongoing, with financial loss calculated to be > €2 billion.
- Felicity Ace – carrying 4,000 luxury cars – cargo value of \$400 million.
- MSC ZOE - about 200 containers fell into the sea, containing mainly TVs, toys, and furniture on the shores of the Netherlands.

The importance of insurance

These are just some of the cases, and as the old adage says “*worse things happen at sea,*” clearly showing that you cannot fully protect your cargo from accidents.

Even if it is not client containers that went overboard, those on the ship may be damaged along with the goods being transported inside the container. With this insurance, the importer can receive monetary compensation if the container suffers damage, provided they show the relevant documents.

Containers can be insured against adverse weather conditions or a breakdown. Freight forwarder or carrier liability insurance alone is not enough. If the cargo has not been properly insured, all costs, including rescue cost, pass to companies transporting the goods.

Environment impact

Pollution of the marine environment caused by overboard containers is a growing issue. Once breached, containers may be extremely hazardous to sea ecosystems; they may contain acid, alcohol, biological or radioactive goods,

and heavy plastic manufactured products. They pose not only a threat to the environment, but also watercraft and coastal residents.

So far, none of the recent container accidents has been directly attributed to safety lapses. The International Maritime Organization said it is still awaiting results of investigations into the latest incidents and cautioned about making any conclusions before that.

But many experts say the situation has grown more dangerous because of pressure on supply chains since the pandemic. When ships approach heavy weather, captains have the option to steer away from the danger. But the attitude is *"don't go around the storm, go through."*

There's also the health and safety of the seafarers at stake. Raging storms can easily cause multiple tiers of 40-foot containers to displace and topple over causing panic and potential loss of life. The most effective way forward is for shippers to go around storms and maintain vessels properly.

Bottom of form

Countries whose flags the ships are sailing under are required to take responsibility for issuing safety certificates for vessels, while ports that the vessels call at are responsible for ensuring rules on loading containers are followed. This can clearly vary accordingly across the globe.

And spare a thought regarding the ships themselves. As tighter environmental regulations come into force across the globe, newer ships are needed to replace ageing vessels especially across Asia and the Mediterranean.

Conclusion

Moving containers on some of the largest ocean-going ships the world has ever seen, with their ever-increasing capacity, is still the safest and cheapest mode of transport for goods across the globe.

And even when containers have reached the end of their ocean-going or road haulage lives, the environment benefits as they can be repurposed as shops, houses, tool stores, playground structures and modern art, effectively recycled and re-used, albeit in a different guise.

Whilst electronic documents, blockchain, AI etc all have their place in making trade easier, it is still the containers, the ships and logistics that power world trade. ■

Dr Graham Bright is Head – Compliance & Operations, at Euro Exim Bank

DLT-based enhancement of crossborder payment efficiency

Dirk Zetsche, Linn Anker-Sørensen, Maria Lucia Passador
and Andreas Wehrli provide an initial analysis of the legal
challenges related to DLT-based payment systems

Abstract

Financial law and regulation have, to date, assumed that regulated activities and functions are concentrated in a single legal entity responsible and accountable for operations and compliance. Even with regard to financial market infrastructure where the regulatory perspective acknowledges the need for interoperability of many entities as a system, each entity is subject to its own rules and regulations, and can thus meet its own compliance requirements independent of other system participants.

The entity-focused regulatory paradigm is under pressure in the world of DLT-based payment arrangements where some ledgers, and thus the performance of the services as such, are distributed. DLT arrangements could provide an alternative to the traditional reliance on a mutually trusted central entity to transfer funds and enable the creation of new foundational infrastructures by distributing technical functions or linking existing systems.

As such, we identify and outline concepts for use cases where DLT is potentially improving the efficiency of crossborder payments, namely a Best Execution DLT, a DLT application for a Network of Central Banks, a DLT as an AML/KYC utility, as well as DLT arrangements for an Identity Platform, a Small Payments Platform and, finally, an Interoperability Platform connecting multiple closed-loop and proprietary banking systems.

Despite the wide-ranging interest in DLT-based payment systems, research so far has focused on technical concepts and lacked legal details. This paper seeks to fill this gap by providing an initial analysis of the legal challenges related to DLT-based payment systems.

From a legal perspective, the distribution of functions in DLTs comes with new risks created from the joint performance of services and functions as main characteristic of a distributed ledger, and the need for additional agreements, ongoing coordination across, and governance arrangements among the nodes.

Further, in a crossborder context, multiple regulators and courts of various countries (asking for compliance with their own set of rules and regular reporting) will be involved. All of these must decide whether for compliance with any single rule they look at the DLT as a whole (herein called 'the ledger perspective') or each individual node (that is each institution participating in the DLT, herein called 'the node perspective').

Moreover, financial and private law must provide for risk allocation, liability, responsibility and accountability for all legal obligations related to each function and activity.

This paper examines the extent to which the ledger perspective or the node perspective should prevail against the backdrop of a range of DLT use cases, resulting in policy recommendations for regulators.

In this paper, we propose the adoption of what we call an enabling approach for payment systems: ledger operators must specify in a Plan of Operations subject to regulatory approval to which rights and obligations the ledger perspective applies; in the absence of such a stipulation, rules apply based on the node perspective.

However, for systemic risk controls, AML/CFT, data protection and governance, as well as DLT governance, we propose a reversed default rule in which the ledger perspective prevails in the absence of rules stipulating that the node perspective applies.

Finally, in private law matters, we propose protecting consumers and SME clients through a standardized payment services contract structure, without mandating details.

I. Introduction

Crossborder payments suffer from high costs, low speed, limited access, and insufficient transparency¹, and enhanced crossborder payment services would provide widespread benefits for citizens and economies worldwide, supporting economic growth, international trade, global development and financial inclusion².

Distributed Ledger Technologies (DLT) have been proposed³, critically discussed⁴ and even tested by some central banks⁵ and private entities⁶ as technologies that could increase crossborder payments efficiency and financial inclusion⁷.

DLT's conceptual proposition of a distributed and synchronized ledger, shared by various entities, is particularly suited to the creation of a multilateral arrangement for public and private Payment System Providers (PSPs), subject to a set of business and operational rules and agreed technical standards⁸.

DLT enables a new distributed infrastructure for payments, where participating PSPs, the institutional and technical design, and the distinct rulebook for the network represent its architecture.

DLTs have inspired great expectations, indeed. Some argue that DLT could result in faster (almost real-time) processing, easier reconciliation and greater transparency on fees, while foregoing, for instance, the risk associated with intermediaries in the payment chain⁹.

DLT could also result in an auditable source of information in terms of digital identity, shared and verified across a network of organizations aiming at KYC compliance, given that DLTs allow for certification of the payors' and payees' provenance (due to the immutability of data recorded in the ledger) as well as multi-party aggregation¹⁰.

Further, a DLT-reduction of payment costs could enhance financial inclusion and address the issue of pricy remittance transfers¹¹.

Despite the wide-ranging interest in DLT-based payments, the analysis to date has dealt with technical concepts and lacked legal detail¹². This paper aims to fill this gap by offering a preliminary analysis of the legal challenges regarding the DLT-based payment systems.

Financial law and regulation to date assume that regulated activities and functions are concentrated in a single legal entity that is responsible and accountable for operations and compliance. This regulatory paradigm is under pressure in the world of DLT-based payment systems where some ledgers are distributed

To this end, we understand legal challenges as all issues related to law and regulation, including private and public law, financial supervision as well as the system's setup, data privacy and data protection.

In fact, to enhance the efficiency of crossborder payments, it is essential to take a look at law and regulation, for at least four reasons.

- First, law and regulation are part of risk management. Any regulatory approach needs to consider the risks (such as the Herstatt risk¹³) for both payment institutions and end-users. This is true regardless of whether crossborder payments rest on correspondent banks, a closed-loop payment system, a multilateral platform (such as Target2) or a peer-to-peer payment system¹⁴.
- Second, law and regulation – in association with the work of standard-setting bodies – drive the standardization of terminology, interfaces and parties' obligations.
- Third, law and regulation are often a precondition and enabler for crossborder cooperation of regulators.
- Fourth, the regulation of payment systems is often part of a broader policy agenda. For instance, the immense political investment in a harmonized framework for intra-EU/EEA domestic payments¹⁵ is best explained by the goal of supporting the EU's economic and monetary union.

Often, the regional integration agenda conflicts with (1) the global setup and activities of large financial institutions that function as major correspondent banks or as building blocks of interregional multilateral systems, and/or (2) the approach of globally active closed-loop systems that seek to build a global rather than regional payments platform.

In the legal context, the IMF¹⁶ has identified two questions that have yet to be answered:

- First, to what extent does the use of DLT require new interpretations of existing international standards for payment systems and capital market infrastructure more generally?
- Second, what are the implications for regulation, supervision, and oversight in a world that is moving toward greater real-time settlement, flatter structures, continuous operations and global reach?

While comprehensive answers are out of reach, we nevertheless provide some early steps to address these questions. Currently, law and regulation of payments are contingent on the assumption that ownership, governance, accountability and responsibility for legal rights and obligations are concentrated in one legal entity.

In turn – applied to a DLT context – the law so far looks at each node separately, establishing the duties and obligations of that node, and in turn, each node can meet its compliance obligations independently and irrespectively of others.

For this viewpoint (referred to as ‘the node perspective’), the perspective of the ledger is derived from the individual rights and obligations of each node and is thus of secondary importance.

Adapting existing payment laws to DLTs – which by definition rely on some degree of distribution of functions – will require, for single each legal, regulatory and contractual right and obligation, a decision as to whether the technical distribution of functions among the ledgers should be acknowledged by law (ie. whether the law shall adopt what we call herein ‘the ledger perspective’).

In this paper, we examine the extent to which the ledger perspective or the node perspective shall prevail against the background of a number of DLT use cases, culminating with policy recommendations for regulators.

The paper is structured as follows:

- Part II summarizes the current state of research and regulatory reports on the origin and cost drivers of crossborder payments, as well as the potential of DLT to improve crossborder payments in general;
- Part III describes specific use cases where DLT is potentially enhancing the efficiency of crossborder payments;
- Part IV deals with the general legal perspective, arguing that the core legal question is whether the ledger or the node perspective prevails;
- Part V provides policy considerations;
- and Part VI concludes.

II. DLT as a focal point for more efficient crossborder payments

To provide some context on the potential impact of DLT on payments, we first give an overview of the cost drivers, as well as the benefits and risks of DLT-based (crossborder) payments¹⁷.

1. Introducing DLT as an infrastructure

A distributed ledger is *“a database that is consensually shared and synchronized across networks, spread across multiple sites, institutions or geographies, allowing transactions to have [multiple private or] public ‘witnesses.’”*¹⁸

Data sharing results in a sequential database distributed over a network of servers that all work together as a ledger¹⁹. Distributed ledgers are characterized by no (or minimal) central administration and no centralized data storage. They are, therefore, 'distributed' in the sense that permission to record a given piece of information stems from the software-driven interaction of multiple participants.

Coupled with cryptographic solutions, these features (decentralization and distribution across a computer network) reduce the risk of data manipulation, thus solving the problem of trusting third parties, and specifically data storage service providers²⁰.

The modus operandi of distributed ledgers is best understood by contrasting them with a traditional electronic concentrated ledger administered by a single entity. The latter entails a number of risks.

First, if the hardware where the register is 'located' is destroyed, the information contents and the authority to ascertain that they are correct are lost²¹.

Second, an unfaithful administrator (or disloyal employees, as the case may be) can manipulate the information stored in the register.

Third, a cyber-attack may result in manipulations and data losses²².

Distributed ledgers address these problems by raising the barrier for manipulation. The underlying technology requires the consensus of many data storage points ('nodes').

If there are n nodes (instead of one concentrated ledger) and e describes the effort necessary to break into any single server, all other conditions being equal (safety per server etc.), the effort necessary to manipulate all the linked servers will be $n \times e$ rather than $1 \times e$.

The distributed ledgers of today are usually paired with a blockchain protocol²³. Blockchain refers to the storage of all data parts as data bundles (the 'blocks') in a strict time-related series which links each block, through a time stamp, to the previous and subsequent blocks.

The blockchain renders data corruption even harder, because a successful cyber-attack would require simultaneously corrupting not just one set of data, but multiple data sets (ie. the whole blockchain) as well as the time stamps.

Distributed ledgers have provided fertile ground for the application of another innovation that may solve the problem of trust in human interactions: smart contracts.

While neither smart, nor contracts, they are in fact self-executing software protocols that reflect the terms of an agreement between two parties²⁴. The conditions of the agreement are directly written into lines of code.

Smart contracts permit the execution of transactions between disparate, anonymous parties without the need for an external enforcement mechanism (such as a court, an arbitrator, or a central clearing facility). They render transactions traceable, transparent, and irreversible.

Since processes driven by smart contracts are often saved on distributed ledgers, we refer to these three technologies collectively as 'distributed ledger technologies' ('DLTs').

2. DLT as a means to enhance payments efficiency

The Financial Stability Board (FSB) and the Committee on Capital Market Infrastructures (CPMI) identify four impediments to efficient crossborder payments: (1) costs, (2) lack of speed, (3) limited access, and (4) lack of transparency²⁵.

(1) Costs comprise transaction fees, account fees, compliance, FX and liquidity costs and fees along the payment chain, with charges for crossborder payments amounting *“up to 20 times those for domestic transactions.”*²⁶

Some of these costs are related to legal matters: on the front-end, the know-your-customer and client onboarding rules, and ongoing diligence processes to update clients' status later add to the costs.

Meanwhile, back-end costs include costs for compliance, AML and regulatory reporting, as well as negotiation and management of interbank service agreements (including charges)²⁷.

Issues increase with countries less often involved in crossborder transactions²⁸ (ie. where fewer correspondent banks (if any) are active and legal matters non-standard and/or unknown).

(2) As for lack of speed²⁹, the main drivers include a lack of technical integration, manual processes, and the need to review diverging legal requirements.

Meanwhile, (3) limited access impacts SMEs and individuals who might lack access to services to make crossborder payments. Moreover, PSPs may face limitations when it comes to accessing local or foreign payment systems, due to high barriers of a technical, financial or regulatory nature.

In addition to Herstatt risk mitigation, ongoing legal due diligence requirements add to the costs of maintaining a crossborder network.

Finally, (4) transparency is limited since crossborder payment data (with volumes and fees) are rarely published with names of parties and payment institutions involved³⁰. Central banks, applying the 2020 IMF Transparency Code³¹, increasingly abandon aggregated data collection in favour of more granular reporting.

However, additional efficiency gains could stem from integrating correspondent banks and closed-loop systems into one transparent payment architecture and infrastructure run and managed in the public interest³².

Enhancing crossborder payments is a multifaceted problem requiring a comprehensive approach, and DLT could be one way of addressing these inefficiencies. Employing distributed networks for that purpose is not new per se.

Relevant approaches include, for instance, the Hawala payment system³³ dating back to the 700s that, beyond raising criticism due to its intransparency³⁴, is said to have inspired the Ripple DLT³⁵.

In fact, a closer look reveals that DLT comes with features that potentially assist in removing or lowering the four barriers just mentioned.

First, through DLT any data stored on the ledger become very hard to delete (immutability).

Second, DLT relies on the same software code stored and run on multiple ledgers simultaneously, ensuring technical synchronization of all servers participating in the ledger.

Figure 1. Issues of crossborder payments vs. DLT

Issues of crossborder payments

DLT features

Costs
Access
Speed
Transparency

↑↑
↓↓
↓↓
↓↓

↓↓ (immutability ⇒ disintermediation)
↑↑ (multilateral network)
↑↑ (standardization, disintermediation)
↑↑ (all data stored on all nodes)

Once the code has been designed, programmed, and implemented, full technical integration, including a built-in settlement mechanism, increases the speed of technical processing (if the code is well programmed and a sound governance mechanism ensures that code updates are properly managed).

Third, as a multilateral system, a DLT-based system is in principle accessible by many parties at roughly the same time. A DLT creates a network by connecting all nodes by means of a code; each node is connected to every other node, avoiding a single point of failure.

In terms of payment systems, connections represent embedded links across the nodes which could be used for many purposes (information distribution, account relationships, etc.).

Finally, DLT improves transparency as it shares information with all nodes storing the same data almost in real time³⁶, and could therefore improve the efficiency and quality of supervision, even levelling the playing field among small and large firms³⁷.

At the same time, advanced data partitioning concepts, with only a portion of the data accessible to all nodes, potentially reduces data protection and privacy concerns³⁸.

The enhanced transparency, access and speed can be used to create and activate competition as well as for regulatory or supervisory purposes. For instance, through DLT, a payer's institution could ask all ledger participants about their terms.

The institution offering the Best Execution as to costs, counterparty risk and settlement time would then be chosen as the counterparty. Or, given that compliance processes with anti-money laundering, counter-terrorist financing,

and state sanctions determine how 'real-time' any payment can potentially be³⁹, regulators⁴⁰ could become a node in the payments DLT, thereby receiving real-time access in lieu of reports, tap into the data stream for regulatory tracking, and - being technically equipped - intervene if suspicious names or transactions appear in the data stream.

Of course, such applications would depend on the allocation of responsibilities, among private and public authorities (see for all DLT use cases infra, under III.).

3. Challenges and risks

Despite these clear advantages, DLT is not a panacea. The use of DLT is, like any technology, subject to risks and challenges. While this is not the place to discuss the risks and challenges of DLT in general⁴¹, some DLT-related issues also undermine its ability to enhance payment efficiency⁴².

Much of the following, however, depends on what function is distributed (or remains with each ledger participant) in the DLT:

First, distributed ledgers are often accompanied by distributed ownership and governance⁴³; in turn, organizing code updates across multiple computers and engines with a plethora of different source codes and potentially divergent interests of participating institutions may become a technical, organizational and governance challenge.

While these challenges are far from new to the regulators and central banks involved in streamlining their payment systems, crossborder payments often mean circumventing the jurisdictional borders of these same regulators, and by definition involve multiple regulators and central banks.

Second, DLT's increased competition feature could come with fewer revenue opportunities from the large correspondent banks as well as closed-loop systems that currently benefit from an oligopoly position; this could result in less investment in technology and compliance and thus in less efficient payments.

However, new DLT-based products and services could fill the role of pacemakers in the payment services market.

Third, the distributed ledger could increase information costs if information about the ledger participants' creditworthiness and financial capabilities is not readily available; setting strict entry conditions paired with ongoing disclosure as a precondition for ledger participation could address this issue.

However, the risk of errors is real. For instance, the CPMI held that *"in a possible future configuration with many automated contract tools, macroeconomic conditions could automatically trigger margin calls across [financial institutions], leading to severe liquidity demand across the financial system and creating a systemic event."*⁴⁴ Hence, data integrity and privacy can be a challenge.

Fourth, if the account itself is distributed (ie. if the cash 'is on the ledger') unless central banks guarantee its convertibility, trust will have to be vested in all actors in the network jointly; in turn the most financially capable node will effectively vouch for the others, potentially creating perverse incentives for the less capable ones to freeride.

Unless the cash is on the ledger, synchronization with the cash on classic accounts will be not necessarily less complex than today, as it requires strict organization with clearing houses⁴⁵. Also, in order to reap the benefits

of DLT in a crossborder setting, any new infrastructure would need to become interoperable with existing processes and infrastructure.

Fifth, if a consensus algorithm is used to determine the purpose of the settlement, the DLT agreement may lack a strong legal basis for the exact moment when the transfer of an asset is considered final and irrevocable, as the applicable legal framework might lack a clear definition.

Further risks stem from the untested nature of DLT prompting new technology-driven operational risk, potentially triggering a new, entirely tech-based type of systemic risk⁴⁶.

Related to that, the lack of DLT-related skills and knowledge could impair the decisions of PSPs' management, PSPs' staff and the regulators⁴⁷.

It is obvious from the challenges laid out in this section that the architecture of any DLT-based payment system must be carefully designed, considering both the information that can be held on the ledger and the organization of the ledger itself⁴⁸.

III. Specific DLT use cases

1. DLT as a Best Execution Network

a. Objective

At present, the correspondent banks' point-to-point payments potentially allow for oligopolistic rents, as prices within the network rather than market forces determine payment costs⁴⁹.

DLT could be used to create competition among PSPs participating in the network by relying on the information distribution feature inherent in DLTs, similar to the order routing systems used in securities brokerage.

The transparency feature of a DLT could then help to identify optimal counterparty liquidity. This process might be easier to implement in payments than in securities, since payments are based on a chain of bookkeeping entries by the payer and the payee, and the transfer does not rely on a central custodian of the security to which all parties must be connected, directly or indirectly.

b. Architecture and DLT features used

Assume PSP1 located in country A wants to transfer funds to country B. PSP1 has announced an interest in engaging in a payment transfer via DLT using an announcement algorithm.

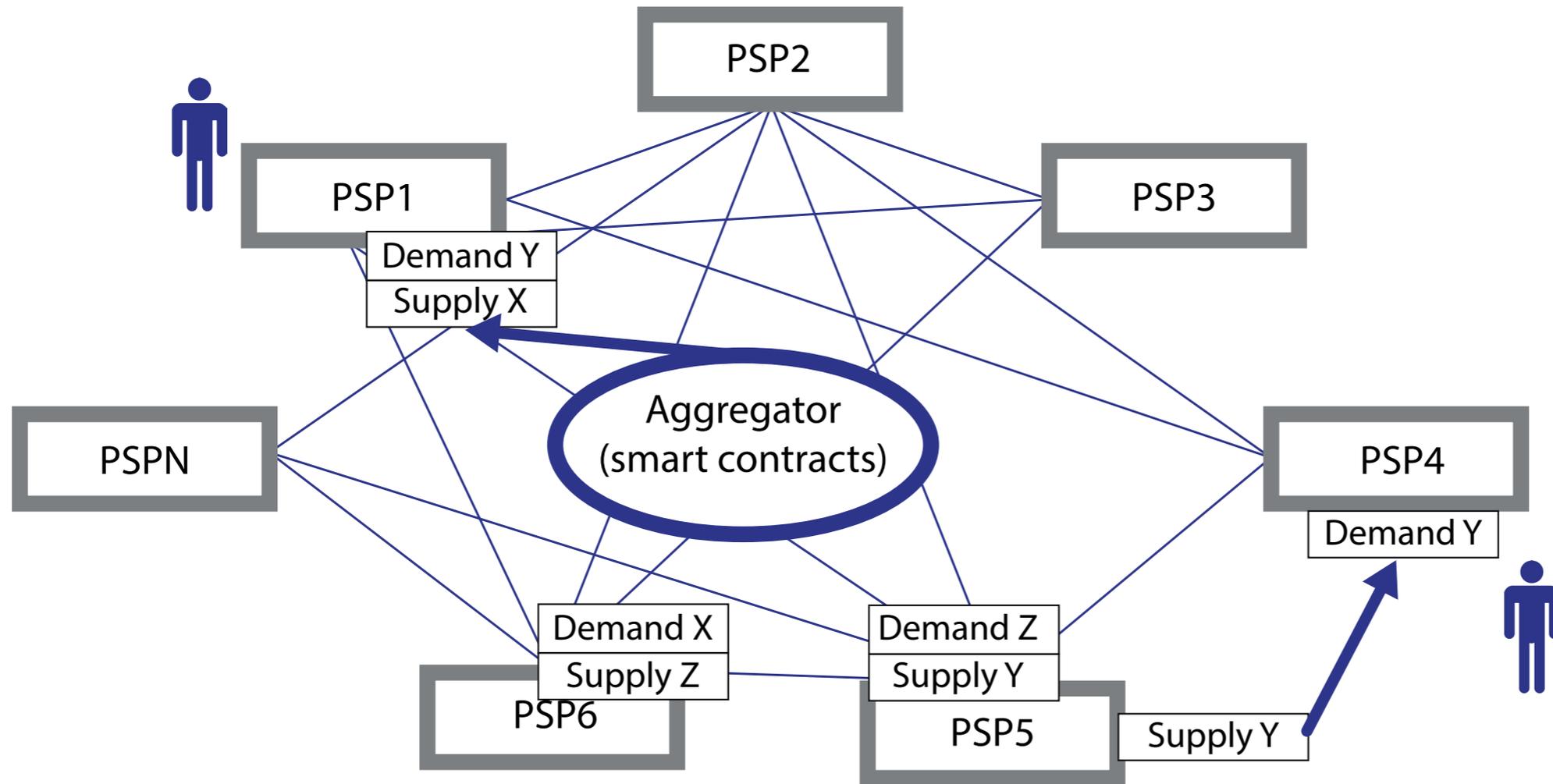
Now two types of PSPs may respond (again by way of algorithms): the first group consists of PSPs with direct representation in B, interested in receiving currency A; and the second group consists of PSPs engaging in multi-aggregate transactions (eg. PSPs in country C with links both to PSPs in A and B which are interested in swapping their position in C- currency into positions in A- and B-currency).

Both the first and the second group disclose their currency transfer rates and any additional costs as well as the offered settlement time (a point in time) by way of DLT.

PSP1 then accepts the offer that represents Best Execution. Connected via DLT, both parties can then create book positions through which crossborder payments are executed.

Of course, this requires a definition of what Best Execution in that context means. To facilitate Best Execution, payment regulators could change the nature of how fees may be set and allocated to clients, including by introducing a fiduciary law-style Best Execution principle into payments⁵⁰.

Figure 2. Best execution DLT



In such a system, DLT relies on the following features, in addition to the basic elements of a payment arrangement, which include a set of instruments, procedures, and rules for transferring funds between or among participants:

- Distribution/Network function linking all PSPs together technically so that they can build up mirror account positions (nostro/vostro accounts) with little effort;
- Transparency function ensuring that all nodes know where the cash is;
- Immutability to ensure that bids are binding, and that failure to close may be automatically penalized.

These three features result in fewer compliance costs, fewer manual processes, and overall greater speed.

c. Examples

Liquidity-oriented marketplaces involving central banks are not novel, per se⁵¹. Also, efforts are underway to improve crossborder payments by connecting payment systems to digital identities across borders⁵². This project could potentially implement a 'Best Execution' component, but in order for the Best Execution Network to operate efficiently it needs to come with amendments to payment laws in many jurisdictions.

d. Challenges

Each element of the Best Execution Network is already available: FX aggregation software is available from various vendors (eg. Software AG), and DLT-based marketplaces with demand and supply offers are available as a SaaS model (eg. Google Workspace, Dropbox, Salesforce, Cisco WebEx, Concur, and GoToMeeting). The unique feature of a Best Execution DLT is DLT governance and participation.

The setting-up of a Best Execution DLT requires careful consideration as to who shall be allowed to participate in the distributed ledger as a node to prevent freeriding and reduce Herstatt risk.

A ledger will function best if all participants have an interest in its proper functioning, and if the rules state that they will be held accountable if it malfunctions. Institutions with better capitalization are targeted more easily as defendants in a lawsuit in case of malfunctions. We envision as ideal composition ledger nodes with roughly the same amount of money at risk.

This can be achieved in two ways: either only institutions with roughly the same credit rating and size function as a node, or the law and regulations cut off unlimited liability for ledger participants but require a minimum capitalization of the ledger itself.

Regardless of which route you take, setting up an appropriate governance scheme with multiple DLT nodes is a challenge. As such, we recommend seeking flexible governance approaches, similar to those used for property rights allocation in the SWIFT system.

SWIFT is not DLT-based, but is rather a multilateral network of institutions that addresses the long-term need to balance the divergent incentives of hundreds of shareholders and several thousand indirect participants from multiple countries; its governance issues are similar to those we are facing with regard to DLTs more generally⁵³.

Another challenge is to convince private actors to participate in that Best Execution DLT. In this regard, we recommend introducing law and regulation to require Best Execution, taking into account customer interests on cost, speed and risk⁵⁴.

2. DLT as a Network of Central Banks

a. Objective

The Best Execution DLT use case faces the challenge that it lacks the central banks' credit and liquidity support⁵⁵ and thus entirely rests on the liquidity of FX markets. This, on a stand-alone basis, could create liquidity shortages in some currencies, or at some point in time. So, central bank involvement could be essential. However, the question that arises is how such involvement should be designed.

Where multiple central banks work on a single system, assigning exclusive jurisdiction to a central bank or oversight body (in the absence of interoperability of multiple single systems) necessarily leads to the fragmentation of DLT-based payment systems, as jurisdictions, for reasons of monetary sovereignty, will hesitate to cede oversight over their payment systems to a foreign central bank because they have a domestic mandate (usually to oversee the stability of the domestic payment system).

Interoperability of multiple domestic systems may provide a solution⁵⁶. Even so, the question remains how jurisdiction over the crossborder dimension of a DLT-based payment system can be assigned in a mutually acceptable manner.

As a solution, we envision the distributed ledger itself to be managed and operated by several central banks mutually, with a common rule book signed up to by all central banks and governance rights split over the participating central banks on a non-exclusive basis.

Such governance rights would depend on (a) the volume of currency in a regulated country, (b) the volume transacted to and from a given country, and (c) the number and nature of users of a payment system.

Yet some crucial decisions about a nation's currency must be retained for each central bank. Decisions reserved for the sovereign include:

- (1) the amount of liquidity supply in a country's currency, beyond the minimum amounts set as part of the general ledger setting,
- (2) monetary sanctions, and
- (3) which financial institutions have access to the central bank balance sheet.

Meanwhile, central banks of other countries must retain sovereignty over central bank access.

b. Architecture and DLT features used

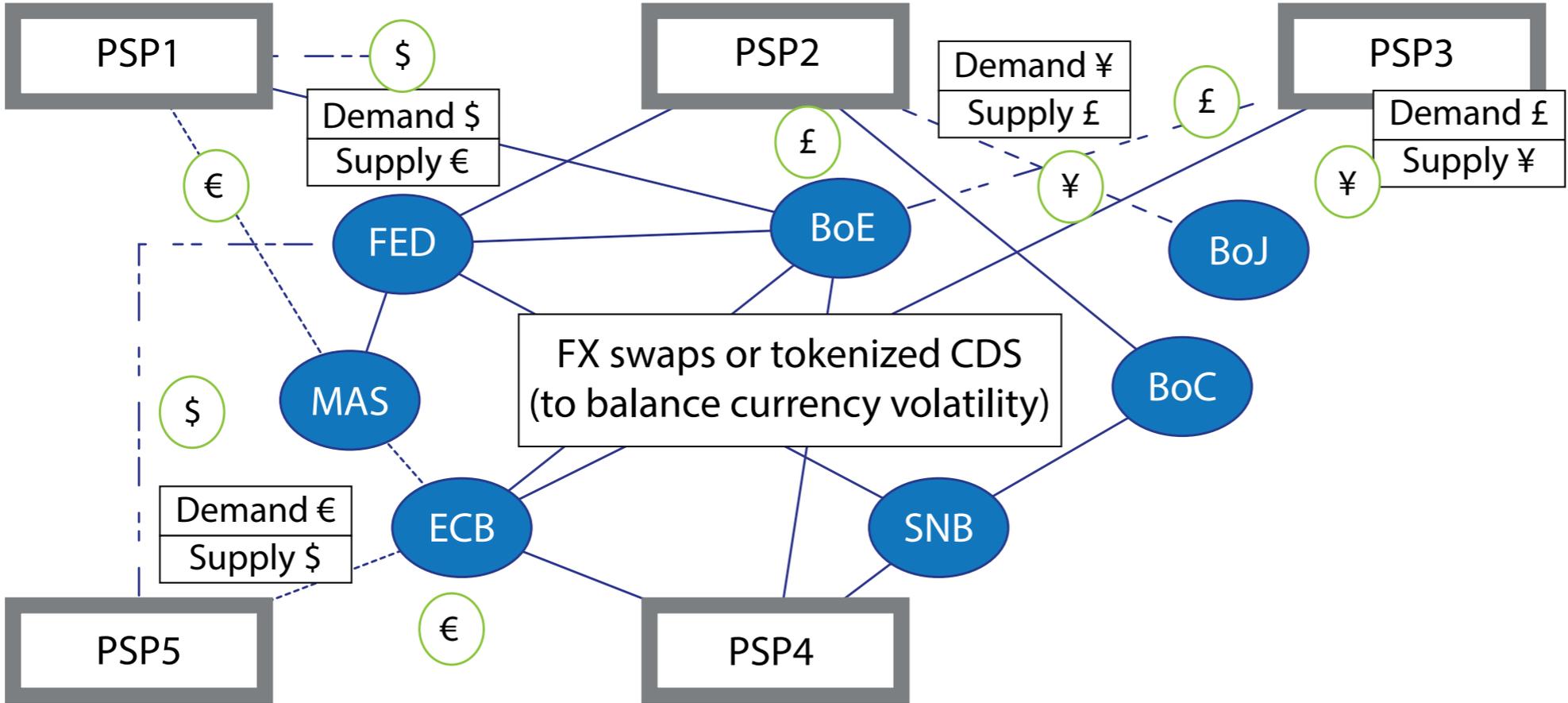
How should such a system be designed? Rather than relying on market liquidity, participating central banks could step in as transactional intermediaries for each currency participating in the payment system.

In addition, rather than linking PSPs as nodes in a ledger, central banks could function as nodes while all PSPs transact only with the distributed ledger; as such leaving them off-chain. This way, the nodes achieve the status of trusted authorities while we also support scaling (due to the monopoly of each central bank for its jurisdiction's currency and the lesser transaction costs when transacting with the nodes).

The ledger is set up in such a way that the supply and demand in each currency are split up and all demand/supply in each currency is exclusively settled by the central bank in charge of that currency.

Figure 3. DLT as a network of central banks

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To ensure that central banks do not set exchange rates by virtue of this mechanism, they engage in internal rebalancing through their links within the ledger. If time and transaction costs were zero, the amount to be rebalanced would also be zero.

However, even under the best technical conditions, it will take some time to rebalance, so there would be some FX risks. Given the immutability of the ledger, the entry and exit date record for each transaction can be computed and turned into a net FX deviation amount between the two dates [entry and exit].

This remaining FX balance is settled across the central bank network by way of FX swaps (traditional or tokenized), with the ledger algorithm creating FX swaps or an amount of tokens equal to the net currency volatility during the transaction.

If the token is issued by a smart contract in an automated manner across all central banks (including the nomination), that token constitutes a new settlement asset only acceptable by the participating central banks as part of the ledger rebalancing process.

Yet it is crucial to provide for such a neutral settlement device, as all other ways would lead to rebalancing in one currency that one of the central banks may not have in the quantity needed for settlement. (Over time, however, if rebalancing amounts pile up in one way, it may be necessary to rebalance the outstanding amount by some type of asset transfer to ensure that the debt owed by one central bank does not become too high).

By relying on a safe settlement asset, the DLT Network of Central Banks benefits from a digital transfer of assets across borders – something that could not be done so easily if it was only currency that was transferred: cash-on-ledger concepts are still in their infancy, and difficult to maintain in a multi-currency framework where then

different central banks would either be exposed to some other country's currency, or gain some leverage over another country's currency.

Hence, a neutral settlement asset with securities and/or derivatives features allows for rebalancing where cash/money lacks transferability – for reasons of legal and monetary sovereignty.

For a Network of Central Banks, the liquidity provision in each currency remains concentrated as this is the original central bank function for each currency. But we distribute the transactional information across all ledger participants and use the network function for settlement. Trust among participating central banks and users is created by immutability and smart contracts undertaking rebalancing across the system.

c. Examples

We are aware that the core functionality, to the extent that derivatives are used instead of money, has similarities with the mCBDC bridge project and the Dunbar project that explore the potential of DLT for an international settlement arrangement involving multiple CBDCs⁵⁷.

However, to our knowledge, our DLT Network of Central Banks, with its split liquidity provision, introduces a different division of functions and a novel rebalancing mechanism.

Further, the BIS Innovation Hub works on connecting central banks using DLT in an effort to create a new foundational infrastructure interlinking existing payment systems as well as creating an international settlement system. Our central bank model pursues the second of these directions.

A working model connecting central banks using DLT could eventually be found in 'CLS NET,' yet on a paid-upfront basis. While providing a settlement mechanism without counterparty risk and potentially creating new liquidity

pools, CLS Net does not make use of two of the key benefits that the use of DLT could result in, which are (1) reducing FX risk between the point in time a transaction is initiated and settled, and (2) that prepayment is not necessary. Of course, if CLS Net would result in a settlement time approaching 0, the FX risk is minimal.

Further, the company Wakandi aims to connect eight African countries and their respective central banks by way of DLT⁵⁸. At the heart stands Wakandi Core with one standard Application Interface that allows multiple formal and informal payment providers to connect by way of DLT.

While connecting private entities seems to work quite effectively, it remains to be seen how the projects succeeds to moderate the jurisdictional conflict among multiple central banks.

As a solution, we envisage that all central banks involved in the project assign private entity Wakandi as service provider, thus each central bank retains formally the governance rights over its currency.

d. Challenges

Again, governance is a challenge when multiple central banks cooperate given that each central bank has a domestic mandate and is subject to legislative constraints.

At the same time, certain central banks already have experience with deep cooperation in the field of payment systems, and experience with aligning technical aspects.

For the Network of Central Banks, we recommend the following stipulations:

1. A DLT as a Network of Central Banks functions best with as many functions as possible automated through

smart contracts, as this type of automation addresses the issue that central banks often have very limited staff, and automation can help to ensure that a system can be run with relatively little overhead. At the same time, such an embedded RegTech approach reduces uncertainty for all participating central banks.

2. For a Network of Central Banks, the central banks need to agree on an arbitration mechanism ex ante.

Theoretically, our central bank network, if truly well-functioning, could potentially wipe out FX markets; if all or most of the liquidity flows through the network there is little room for market-based currency prices.

If this were to happen, the rebalancing mechanism we propose lacks a reference point. To avoid wiping out our FX markets, the network of central banks could come with a marketplace component, such as limiting prices for the respective currency, implicitly creating market prices.

Further, we could foresee central banks taking a more active role in setting currency prices based on the liquidity flows they see over their system and transaction disclosures (including intra-closed loop netting) from payment systems.

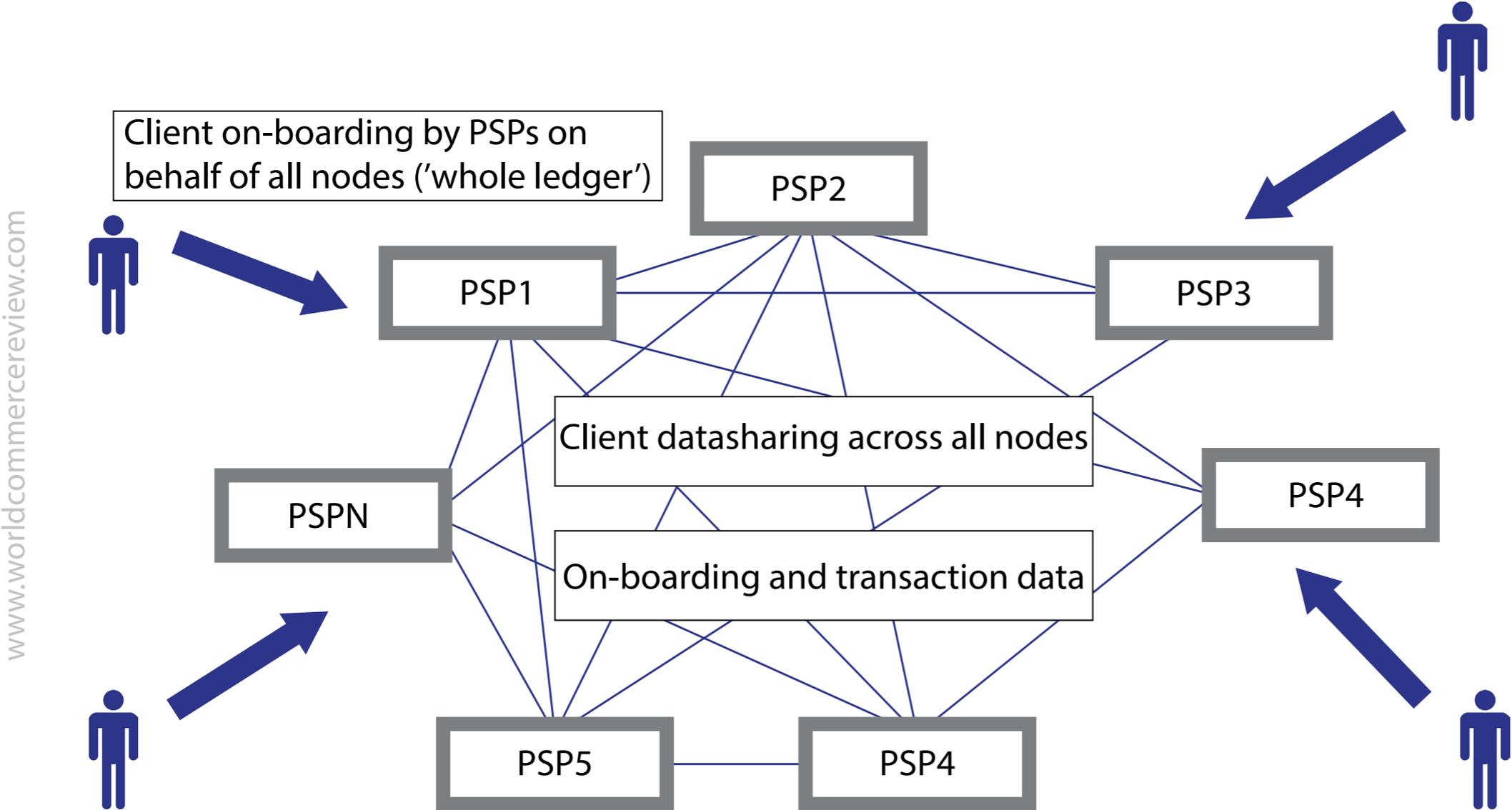
Yet as the establishment of the super-efficiency of the Network of Central Banks is still far away, we leave these fundamental questions regarding the function of central banks for future research.

3. DLT for AML/KYC utilities

a. Objective

A recurring challenge in the domain of crossborder payments is the scope of KYC procedures for financial institutions and other regulated entities.

Figure 4. DLT as an AML/KYC network



DLT could be used to reduce the risk of suspicious transactions and the identification of beneficial owners through embedded RegTech, that is automating certain contractual terms and conditions merged with legal requirements.

This can be done for beneficial owner identification, where legal requirements demand the financial institution to know the ultimate beneficial owner of a transaction, and for assessments of suspicious transactions⁵⁹.

Financial institutions' ability to assess and investigate the full route of a transaction across multiple intermediaries, which could in its entirety be classified as a suspicious transaction, is in fact limited.

Assessments of ultimate beneficial owners are particularly challenging (ie. costly) in times where links between individuals and entities are created through alternative modes of corporate control such as tailor-made derivatives, smart contracts, and private DLT platforms, respectively⁶⁰.

b. Architecture and DLT features used

DLT can be instrumental in addressing said challenges. For AML purposes, transactional information across all ledger participants can be shared and connected with information on beneficial owners. If all PSPs connected to the same individuals share transaction data on a common platform, transactions can be assessed from a life-cycle perspective, and not on a singular basis.

Data shared on the platform are locked and cannot be tampered with. A system-wide AML/KYC utility requires careful consideration of which data are stored on-chain and which are stored off-chain.

c. Examples

For now, most systems rely on third-party service providers to allow for in-system AML/CTF checks. Examples

include the multi-currency Buna payment-platform operated by the Arab Regional Payments Clearing and Settlement

Organization, a subsidiary of the Arab Monetary Fund. Buna is cooperating with Refinitiv⁶¹ to provide comprehensive anti-money laundering compliance through World-Check Risk Intelligence, screening millions of transactions each month⁶². Compared to systems such as that, a DLT utility would directly tap into the databases of all nodes connected to it.

Deutsche Bundesbank 'Amplus' proposes – among other modules – a KYC scheme to support the automation of compliance processes in crossborder payments based on a KYC identifier and supported by a DLT infrastructure where local competent authorities would operate the nodes⁶³.

The proposed governance model would allow for the inclusion of national solutions while at the same time ensuring a sufficient international minimum standard.

d. Challenges

A system-wide KYC utility faces a number of challenges.

First, the coding of smart contracts and algorithms that will connect individuals with their payments and transaction history across the ledger must take into account data privacy regulations, and other data-sharing restrictions.

This could be solved by data partitioning, for instance, by virtue of zero-knowledge proofs⁶⁴, where only parts of individuals' information are shared on the platform. Zero-knowledge proofs could provide the nodes on the

platform with a green/yellow/red indicator on the risks related to the beneficial owner, thereby reducing challenges relating to data protection and cyber-attacks⁶⁵.

Further challenges to overcome include the system risks that may lie in a centralized entity pursuing AML functions, the degree of locked information on the platform in rapidly changing identity cases, and integration into existing AML compliance systems⁶⁶.

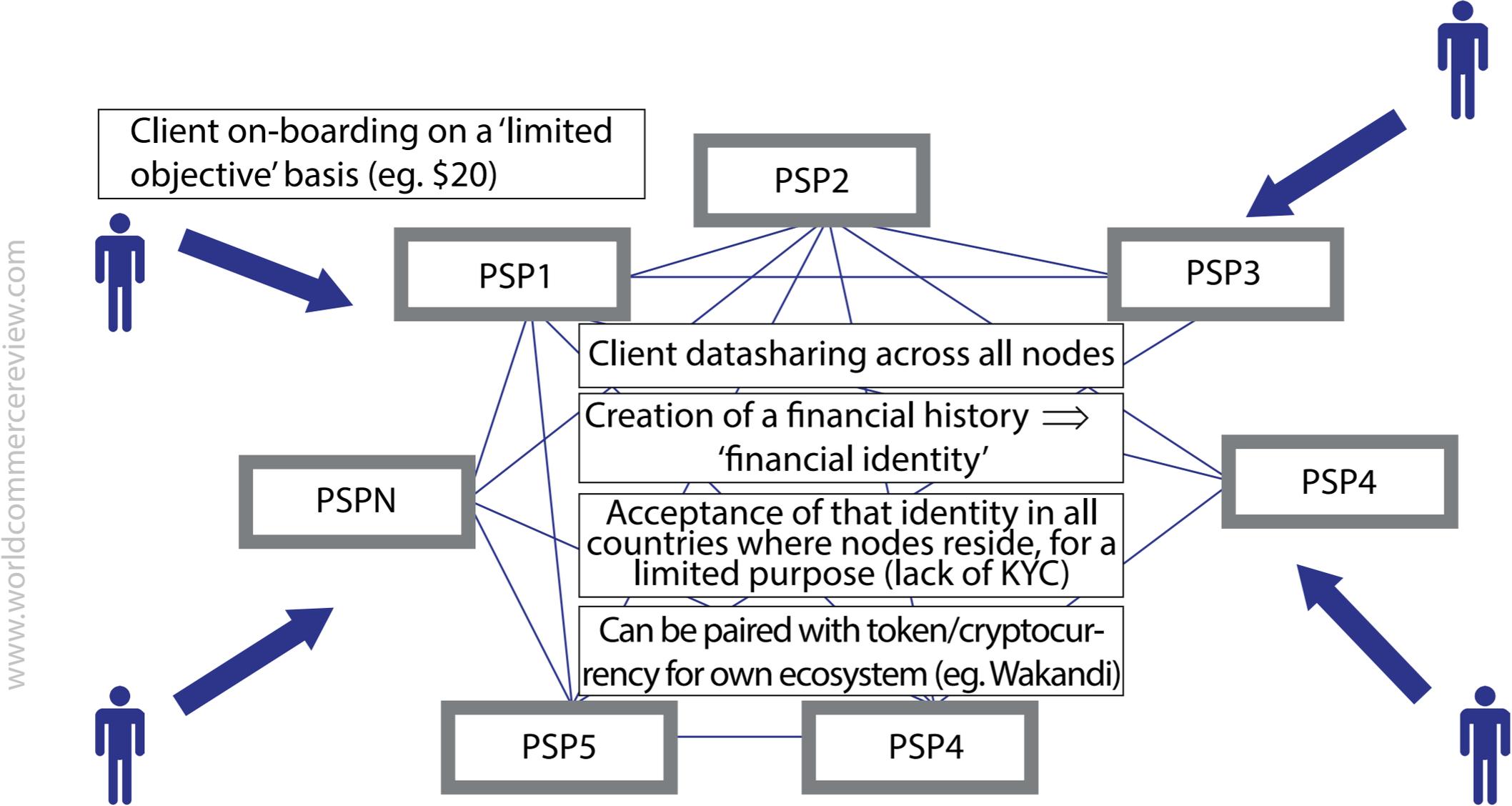
In order to overcome these challenges, we propose:

- Introducing a labelled risk categorization using risk-related identifiers associated with beneficial owners in the system, based on existing KYC procedures in financial entities as nodes. An algorithm may facilitate labelling which is updated on-chain, based on new information on the client gathered by financial institutions which is stored off-chain.
- Using zero-knowledge testing in the transition of on- and off-chain information to decrease/eliminate GDPR risks.
- Using algorithms on the DLT platform capable of detecting alternative control modes as far as relevant for AML/KYC purposes.

4. DLT for Financial Inclusion (Identity Tool)

By reversing the function of DLT-based client diligence, DLT could result in granting financial identities to customers who do not have them for multiple social and economic reasons. In this case, DLT could actually improve financial inclusion.

Figure 5. DLT as an identification network



a. Objective

Rather than defining clients by who they are based on official documents, over time an individual is identified just as securely by tracking data about what they are doing, paired with their personal features such as biometric data.

DLT's inherent feature of locking in information and making it transparent continuously on the ledger may therefore provide solutions to the problem of customer identification.

The data stored via DLT could be turned into a client identification tool based on the financial transactions the clients enter into paired with additional user data taken from their cell phone and e-commerce transactions.

b. Architecture

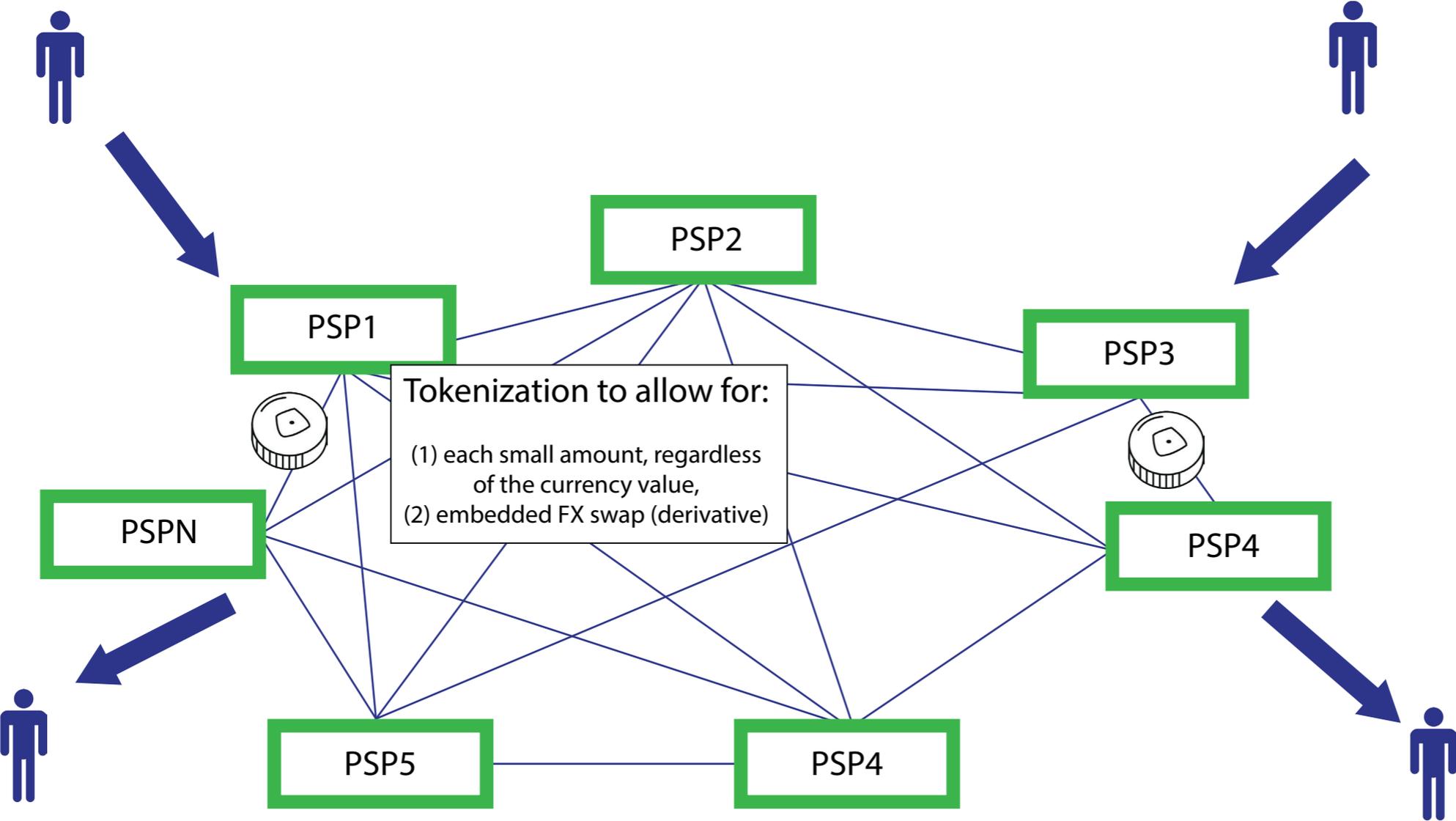
DLT as an identify tool could assign an identification number on-chain based on multiple data points linked together, thereby creating a client e-identity. After the client is identified this way, an e-ID number substitutes for the pool of data assigned to that individual which together describe the individual's activities.

This e-ID number can be used in the chain for payments, banking and non-financial services and functions. The central bank could operate this network in areas of low official identity, add credit data as part of a built-in credit register and checks on the credit institution's interest rates, thereby assisting in limiting the shadow banking market.

c. Examples

While the identity-creating data collection function is at the core of many systems (including India's Aadhaar and Deutsche Bundesbank's Amplus), few payment systems make explicit use of DLT for this purpose.

Figure 6. DLT for small-value payments



One example that comes to mind is the 'UBU' project run by Global Voice which makes use of DLT-based identities within a financial ecosystem drawing on a barter system created by virtue of the virtual currency unit 'UBU'⁶⁷. In addition, some projects that aim to financially include refugees and migrants are also DLT-based.

d. Challenges

The perennial concern regarding cyber-attacks and operational malfunctions in particular relate to DLT as an identification tool. However, the main possible promising feature of a DLT-based Identity Platform is that the identity is stored on an immutable platform, which makes it more difficult to manipulate the ID.

However, customer due diligence without relinking 'banking IDs' to formal identity systems will render participants in such networks incapable of large financial transactions for a long time, meaning that a DLT-based identity works only as a mere starting point.

5. DLT as a Messaging Board for Small-value Systems

a. Target

Using DLT for micropayments has been advocated for some time⁶⁸. With regard to micropayments (to be defined), the costs related to SWIFT are high, as SWIFT charges a per-message fee; negligible for wholesale payments, but expensive for small payments if we assume there are no 'bundling banks' (ie. correspondent banks).

Further, individual assessments and accounting for large numbers of small transactions are time-consuming, as a number of assessors are required to evaluate the transactions where both the time and costs related to the valuers' function are not commensurate with the ordinary risks of small-value payments.

DLT may serve as a means to improve efficiency, reduce costs, and, at the same time, maintain transparency and traceability of transactions.

b. Architecture

A DLT platform for micropayments does not distribute any functions, but rather operates as a messaging board where network participants have access to near real-time sales or usage data.

For micropayments, DLT would be useful not only for its improved transparency and immutability, but also for its ability to automatically collect and disburse payments to participants on the platform.

c. Examples

Various providers have created platforms for micropayments. Pertinent examples include Microsoft's Ethereum-based platform for royalty payments for their Xbox gaming platform to enhance efficiency in the gaming industry.

These platforms pursue their own efficiency gains alongside benefits for their network partners and participants. Microsoft's platform relies on digital contracts between Microsoft and industry participants, where the legal terms of their contractual relations are encoded in smart contracts.

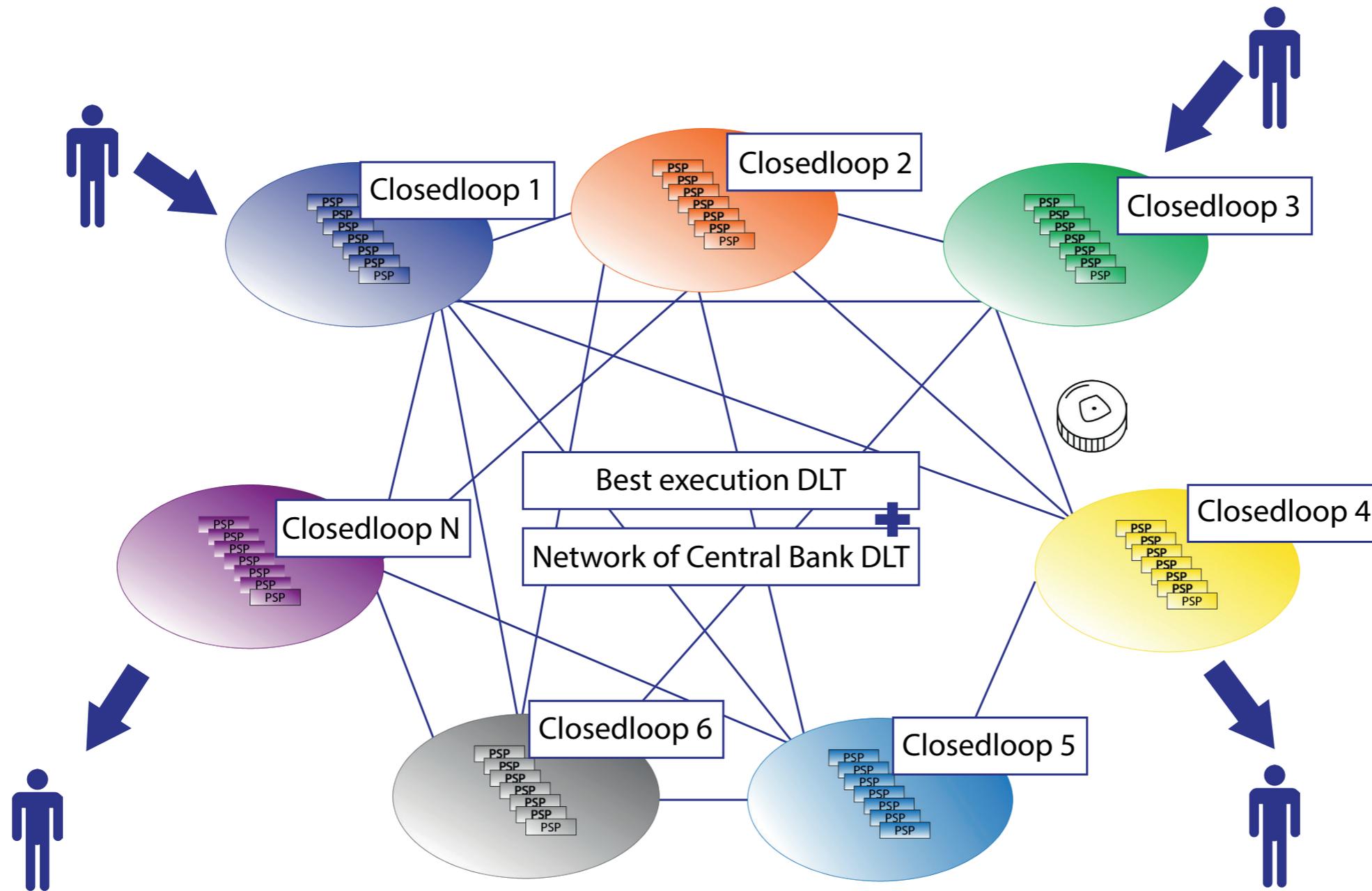
In addition to automated royalty payment calculations, the DLT platform provides contributors with almost real-time disclosure of digital content sold on the Xbox platform, so that each contributor can see their own royalty income derived from the sales.

The time for calculations is said to decrease from 45 days to 4 minutes as a result, and no manual processes are necessary due to the self-executing features encoded in the smart contracts.

d. Challenges

Of course, these small payment platforms are not a panacea. On the one hand, they create lock-in effects, de facto

Figure 7. Interoperability DLT



replacing one silo (that of correspondent banks) with another silo (that of closed-loop systems run by unsupervised commercial entities).

Further, the underlying financial risks are not addressed. Particularly noteworthy here are the FX risks on the consumer's side, as well as risks from market concentration and reliance on one entity which could be understood as a form of systemic risk.

6. DLT as an Interoperability Network of Closed-loop Systems

a. Objective

DLT can be instrumental to build new foundational financial infrastructure that avoids the negative effects of silos (regardless of whether that silo stems from a network of correspondent banks or closed-loop systems) while maintaining the benefits of the silos, which come from technical standardization across countries, by providing an interoperability framework for many different closed-loop systems.

Rather than rebuilding legacy systems, DLT could provide a connector among existing closed-loop systems. Further, we may understand the technical integration provided by some banking groups (such as S&L institutions in Germany and Norway) as the development of regional closed loops.

We further expect, given the costs of creating and maintaining IT infrastructure, that more and more partially-integrated closed loops will develop over time. From this perspective, it is desirable to reach a state in which these hundreds or so of technically-integrated closed circuits (in each of which multiple PSPs participate) interact, to the benefit of the payee and the payer and the financial system and the economy at large.

b. Architecture

Such an interoperability framework could rely on the DLT use cases we have outlined above: we would propose combining the Best Execution DLT (supra, at III.1.) to ensure that closed loops have all payment gateways at their disposal, with the Network of Central Bank approach (supra, at III.2.) being applied to ensure unlimited liquidity.

The Interoperability DLT combines the DLT features of the two models and all four DLT advantages are outlined above in III.2, namely immutability to build trust, technical standardization to achieve speed, network feature that ensures transparency, and access⁶⁹.

c. Challenges

The challenge associated with the interoperability framework is to ensure that closed loops and correspondent banks participate. We propose relying on laws and regulations to provide incentives. To this end, regulators should require:

- 'Best Execution' as part of payment laws (including rules on how to allocate infrastructure costs to payment transactions);
- Detailed pre- and post-execution disclosures to regulators;
- As part of the licensing conditions for any intermediary PSP (closed-loop operator or correspondent bank), participation as a node in the Interoperability DLT;
- As part of the licensing conditions for all PSPs (and in particular PSPs participating in a closed-loop system), a (indirect) connection to the Interoperability DLT by way of a flow-through process, so that tapping into the interoperability framework is as standardized as tapping into payment services in the closed loop.

If DLT now provides better terms with regard to cost, risk and speed than rates offered within the closed circuit or correspondent banking network, regulation would require the intermediary PSP to channel execution through the Interoperability DLT.

The standardizing of closed loops creates a challenge with respect to ensuring that liquidity is actually flowing through the Interoperability DLT, at least initially; for quite some time, the closed loop will appear to operate at lower costs, as past technology investments are sunk costs in that cost calculation, while the costs of maintaining the connection to the Interoperability DLT are ongoing and high per each transaction, if few transactions are processed via the Interoperability DLT.

Thus, the involvement of central banks as providers of unrestricted liquidity is essential to the functioning of the Interoperability DLT. In addition, strict enforcement of Best Execution coupled with standardized disclosure to regulators who analyse the data with advanced algorithms will enhance pressure over time to comply with the Best Execution principle.

IV. The legal challenge: the ledger or the node perspective?

How can the use cases explained above be best reflected in law?

In this section, we will argue that adjusting existing laws to DLTs – which by definition are based on some degree of distribution of functions - will require, for any single legal, regulatory, contractual and other right and obligation, a decision as to whether the technical distribution of functions across ledgers should be acknowledged by law, that is whether the law shall adopt what we call herein ‘the ledger perspective’ or whether it should retain ‘the node perspective’ where the law requires each node to comply with applicable laws and regulations⁷⁰.

While this decision is crucial for any DLT-based payment system, the matter is even more pressing for the crossborder provision of payment services.

1. Introducing the ledger and node perspectives

PSPs and payment infrastructures involved in crossborder payments are subject to the legal and regulatory regimes of multiple jurisdictions. Payer and payee intermediaries must meet the different legal and regulatory requirements⁷¹ of two or more jurisdictions.

In principle, the law and regulation of payments is contingent on the assumption that ownership, governance, accountability and responsibility for legal rights and obligations is concentrated in one legal entity.

In turn, the law so far looks at each node separately, establishing the duties and obligations of that node; for that view (herein referred to as 'the node perspective') the perspective of the ledger – whether it functions well as a whole, and how all the nodes interact – is derived from the individual rights and obligations of each node and is thus of secondary importance.

For instance, we could understand the books of a settlement bank used by a payment system as central ledger; in this case, the node's duties and obligations can be established directly and are not derived from the individual rights and obligations of the payment system participants in the case of a traditional payment system.

A ledger, from the node perspective, is the product of multiple entities cooperating, and the law governing such cooperation, including the rules of delegation, determines the conditions and outcomes of that cooperation.

Even when the law takes the node perspective, the ledger relationship must be considered in terms of the setup of each participant, which is no easy feat: typically, each ledger participant alone has no influence over the ledger and cannot secure its operations on a standalone basis, given that the very nature of a DLT is its distribution across various nodes.

This influences the cybersecurity risk and requires modified operational resilience plans; such a plan could consider, for instance, whether the overall ledger setup and governance is robust, and whether other ledger participants are well capitalized, regulated and supervised.

In addition, outsourcing rules that require the ledger participant to ensure compliance with all laws and regulations and to terminate the relationship in cases of non-compliance make little sense when the DLT is monopolistic, as capital market infrastructure often is; terminating participation is equal to getting out of service. Allocating responsibility in a DLT-based payment scheme is also becoming increasingly difficult.

Further, asking who among several participants issues a payment instrument if the instrument is issued via a DLT that is not controlled by anyone leads to challenges in the application of the law.

Thus, as an alternative, financial regulation could look at the DLT as a whole. Under this contrasting concept, for any single rule, obligation and/or right, the node perspective is replaced by the ledger perspective.

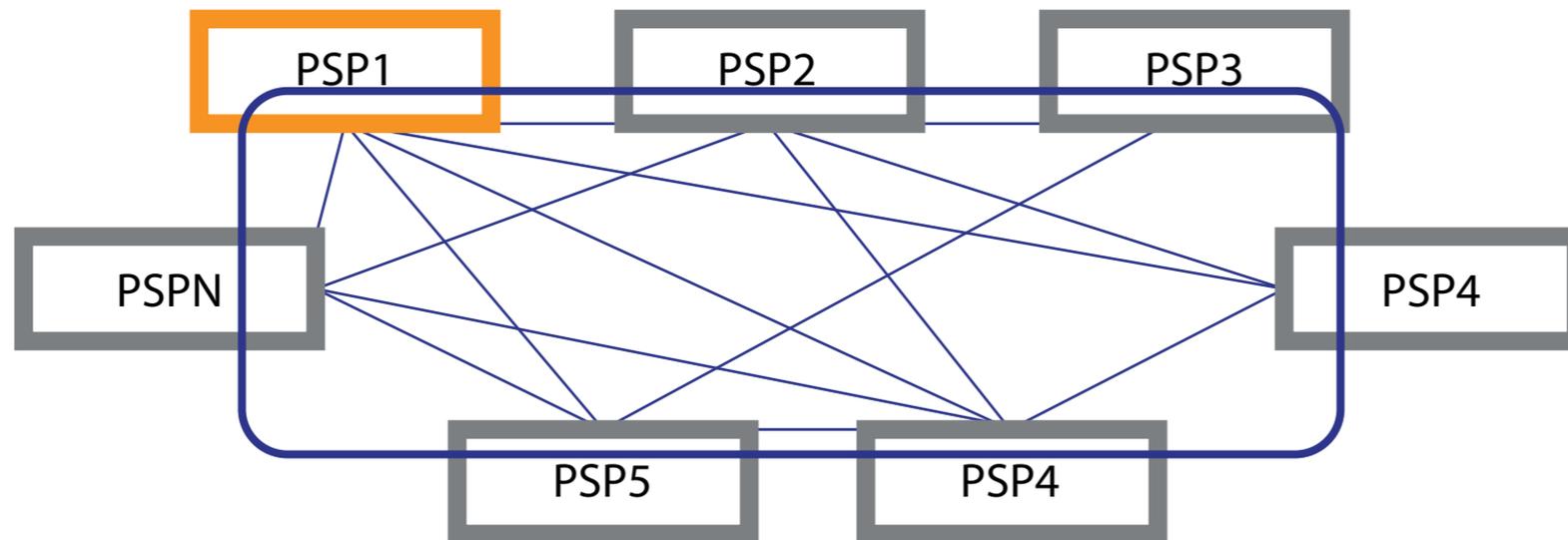
Under the ledger perspective, the technical distribution of functions among ledgers is acknowledged by law; the ledger perspective assigns rights and obligations to the ledger as a whole.

Figure 8. Legal view: ledger or node perspective?

Law usually looks at individual entities (PSP1) contributing to ledger = 'node perspective'

Relevant for:

- determining rights & obligations (liability, responsibilities)
- applicable law, supervisor & courts
- capitalisation, PSP set-up, governance



From a legal standpoint, the ledger perspective is close to assigning entity status to the ledger, albeit – as we will show – not for all of the functions, rights and obligations that the law foresees.

The node perspective applies the law as if an individual PSP were the sole subject of a given regulation. Here, we look at the exposure, costs, and risks of each node as such.

In contrast, the ledger perspective refers to a state where the whole network is subject to regulation and each participating entity is subject to regulation only as a kind of reflection through its participation in the network; in the latter case, liability is intermediated through the network and responsibility is distributed among network participants. Here, we look at the participants only to the extent that they are exposed as network participants.

Example: let us assume there are two DLT participants: A (with an AAA rating) and B (with a junk rating). The node perspective would measure counterparty risk separately, resulting in one very good rating and one very poor rating.

If third-party clients are exposed to counterparty risk with respect to A, they put less capital at risk than clients exposed to B. From the perspective of the ledger, the rating mix of A and B would determine the outcome.

If A is much larger and much stronger than B, the result may be much closer to A's rating than to B's, and vice versa if B's exposures exceed A's capitalization.

Given that payments are in the end a point-to-point transfer of funds from one institution to another, there is an implicit limit to the ledger perspective, ie. the distribution of functions: any distribution of the underlying accounts would result in the socialization of an institution's capital.

In turn, only a part of the functions of a payment system provider can be distributed; however, which of these functions are distributed is of the utmost importance from a legal perspective.

The latter case particularly concerns DLT, as DLT relies on the cooperation of multiple nodes in order to jointly operate a DLT-based system.

As we have discussed elsewhere in more detail, the result of this cooperation by virtue of DLT may be some type of joint liability for the obligations and debts incurred by being involved in the operations of the DLT⁷².

In turn, for legal purposes, it is crucial to clarify which functions of a payment system are performed via the distributed ledger (with all nodes contributing to its functions) and which functions are retained by the institutions connected to the DLT and booked on their very own balance sheet.

To take this further, from a legal perspective the distribution of a function of financial intermediation, resulting in a kind of shared responsibility and accountability, and prompting the need for shared supervision by several regulators, is an abnormal state of affairs and is as such costly: since Aristotle's times⁷³ it has been well known that an asset or service owned by many is essentially owned by none; if no one is truly entitled to its proceeds no one will invest in maintaining the asset or service - a state that according to Ronald Coase is associated with the tragedy of the commons⁷⁴.

We have examined the effect of decentralization on financial services in general elsewhere in more detail⁷⁵. Suffice it to say here that distribution of payment functions does not improve efficiency per se, but it could improve efficiency if the scope of the DLT is limited and its functions are properly designed so that the benefits of distribution outweigh the additional transaction costs it generates.

Hence, from a legal policy perspective, what we need when adopting the ledger view is a justification as to why distributing the function across nodes results in an improvement in efficiency in light of the four features of DLT (data security, technical harmonization and integration, transparency, and access under equal terms) – and where this justification is lacking, retaining the node perspective seems to be the most plausible default option in law.

As such, we see the need for regulators to analyse each individual legal stipulation and to decide whether adopting the ledger view for that function in fact increases efficiency. For this decision, the perspective of the law needs to be taken into account.

This perspective differs depending on the particular area of law we are talking about; specifically,, financial regulation differs from private law.

2. Why it matters: financial regulation and public law

Examples of (broadly defined) financial regulation include areas such as: licensing and authorization, prudential supervision (including risk management, cyber security and other operational risks), financial integrity (eg. anti-money laundering and countering the financing of terrorism and proliferation (AML/CFT)), transparency (including transaction tracking and disclosure of costs and fees), consumer protection and protection of customer funds, transaction limits, foreign exchange regulations, and the law governing the crossborder provision of services.

In all these fields it matters whether we ask the ledger as such or each individual node to comply with the law, and ensure proper enforcement.

Other areas of public law in which adopting the ledger or node perspective is important are:

- data collection, protection and transfer rules;
- capital controls;
- sanctions regimes; and
- tax reporting requirements.

Last but not least, adopting the ledger or node perspective makes a difference particularly for enforcement purposes: should the ledger as a whole or each node be fined for cases of non-compliance, and if so under what conditions? Which directors will be disqualified by financial regulators in cases of non-compliance?

The decision between the node or ledger perspective is even more relevant in a crossborder setting. Financial regulation recognizes three types of conflicts of law rules⁷⁶:

- (1) Incompatibility: a prohibits conduct that is permitted in B. This configuration incurs the greatest costs for intermediaries, as they need to devise alternative solutions, typically involving separate legal entities licensed in different jurisdictions and connected by a contract;
- (2) Restricted eligibility: a establishes additional requirements that may or may not be compatible with the institution's setup and business model in B. This setup requires an additional layer of law/regulation and oversight/enforcement in A that comes with additional costs;
- (3) Eligibility subject to mutual recognition, which is usually based on a substituted compliance/equivalence

test: a recognizes that the law/regulation and supervision/enforcement in B is, in substance, equivalent to and as effectively enforced as in A.

Against this background, it becomes important which regulator holds jurisdiction over conduct. Financial law has several ways to connect the jurisdiction of a regulator.

One category often used for prudential regulation, the organization of financial institutions and standard compliance requirements is the headquarters and/or registered office of the financial institution.

Distribution rules often ask where the institution offers or markets its services, while a third category asks where the effects of an institution's actions are felt.

The focus on effects is the consequence of so-called risk-based regulation, which asks where risks are likely to materialize; the latter category can be found for example in market abuse, data protection and AML/CTF rules, systemic risk oversight, but also in state sanctions laws.

In turn, a payment institution can be subject to the financial regulation of several different countries at the same time: the laws of the country's headquarters for prudential regulation and operational requirements, the laws of the countries where it offers payment services (if only as a correspondent bank), and the laws of all those jurisdictions whose a) citizens' data are stored, and b) currencies are booked in a payment institution's account.

Since violations typically result in (severe) penalties, any payment institution's legal counsel must evaluate its potential involvement with each new country. The PSP's compliance organization must organize and process on a

steady basis the data on sanctions, black-listed individuals and firms. Further, the PSP's data systems must link to the reporting interfaces of each national regulator to which it is bound to report.

3. Private law

The node or ledger perspective also matters for private law. In particular, who is the party to the payment services contract? Each node or the ledger as such? Who is the proper defendant in a lawsuit with customers? Who is liable for damages?

If we take the ledger perspective: what are the conditions for piercing the 'veil of the ledger' (ie. applying a 'look-through' perspective)? The question of governance is pertinent here: who is in charge, who has voting rights, and who can make decisions about ledger operations and technological revamps/updates?

Again, the ledger or node perspective are important legal determinants in a crossborder setting. Meanwhile, private law includes contracts, property and tort relationships between private actors (ie. payment institutions and their clients), and also intra-corporate matters such as legal relationships between DLT nodes.

However, we provide herein examples only on conflict of law rules for contracts. As a matter of principle, entities involved in wholesale business (such as a PSP's relationships with other PSPs) can choose in many cases the jurisdiction whose laws shall apply and which courts shall be responsible for deciding whether one institution owes the other damages from breaches of a contract between them⁷⁷.

However, some mandatory public law rules of a jurisdiction require recognition even if the private law is otherwise freely chosen. In addition, there are certain fundamental principles of private law (called *ordre public*) that always require recognition.

In contrast, when it comes to retail clients and consumers, in principle, the mandatory consumer protection law of one country applies as a minimum standard even if the law and courts of another country govern the legal matter; in some cases, to protect consumers, the choice of law and courts is even void.

In turn, payment institutions among themselves can be subject to the law and courts of one jurisdiction (A) while the law applicable to their relations with their customers is subject to the law and courts of another jurisdiction (B). If the jurisdiction of country A is inconsistent with the jurisdiction of country B, no adjudicating body will address the gap.

For instance, if the law of country A in charge of an inter-bank relationship awards the payee institution damages for the payer's revocation of a payment order (after a certain time limit), but the law of country B in charge of the relationship between the payment institution and the payer does not grant the same claim in the PSP's relationship to its client, the payment institution in B needs to internalize the damages (ie. by paying them out of their own pocket).

Add to that the fact that it is often uncertain ex ante whether or not the law in country B will grant damage claims. Both the damage itself and the costs of assessing legal risk (legal advice) will end up as 'costs' of a crossborder payment system.

Where the mandatory legal background is harmonized, on a public and private law level, standardized agreements may achieve essentially the same results and thus could reduce costs; in the absence of mandatory law harmonization, however, even if the contract wording is similar, the outcome may diverge.

This is particularly true with regard to DLTs where the legal environment in many countries is still, in many respects, uncertain⁷⁸.

4. Use of DLT as a risk-increasing feature of payment systems

Against this background, it is easy to understand why DLT 'can increase legal risks' in an environment where it is difficult to identify the applicable jurisdiction or relevant laws.

While according to the former in most cases the law assigns exclusive jurisdiction with regard to one rule to one country, two difficulties remain: first, the economic actors to whom the law applies come from different jurisdictions; second, in different fields of law, conflicts of law rules may allocate jurisdictions differently - most notably, it may be that the law of one country applies to contracts, that of another to torts, and the law of a third country to matters of financial regulation (including payments regulation, data protection and AML/CTF rules).

In turn, we may see the private law of countries A and B simultaneously applying at the same time that the public law of country C regulates certain aspects of a transaction.

The former does not present a particularly complicated scenario, but rather the ordinary life of a PSP involved in crossborder payments. In turn, we may understand that PSPs move out of certain smaller and less profitable markets to reduce their costs and risks, often referred to as 'de-risking'⁷⁹.

At the same time, regulatory cooperation in a DLT-based setting is under- developed, due to the decentralized performance of services⁸⁰, which further increases complexity.

Regional harmonization projects that include both private and public law dimensions could provide a solution⁸¹: public law harmonization resulting in substituted compliance reduces legal risks stemming from financial regulation, while private law harmonization ensures a harmonized approach to damages for revoked or nullified transactions within a payment chain, so that PSPs do not need to internalize damages resulting from an inconsistent harmonization of laws⁸².

Yet, in reality, harmonization is rarely achieved, and the issue remains how to achieve legal consistency across several regionally integrated regions.

Hence, in the absence of distinctive policy steps which remedy whether a given law allocates rights and obligations to either the ledger as a whole or each node, the use of DLT increases legal risks, which will reduce the attractiveness of DLT as a technology for payment systems.

V. Policy considerations (steps de lege ferenda)

The previous undesirable state can be improved through a clear allocation of rules applied to either the node or the ledger as a whole, and in turn a clear allocation of jurisdiction and supervisory powers based on that. At the same time, mandatory regulation limits innovation. In this section we examine how to bridge this gap.

1. Enabling an approach to financial regulation: opting for either the Ledger or the Node Perspective

a. The plan of operations as a determinant of the ledger or node perspective

We have already shown (supra, at III.) that the distributed part of a payment system can take entirely different forms and functions depending on the use case envisaged.

Figure 9. The Business Plan Concept

Addressing legal uncertainty

Default rule: node perspective

Business plan to assign:

- operator(s) to ledger
- functions to either nodes or ledgers
- accountability and responsibility
- sanctioning powers

Reversed default rule: ledger perspective

- systemic risk
- DLT governance
- AML/KYC and client ID
- data protection and data governance

At the same time, regulators have little experience with DLT arrangements; this is particularly true in the payments context. This makes, in principle, any rule undesirable that presupposes either compliance to be performed by the ledger as a whole, or by each node individually.

For the time being, we suggest refraining from imposing binding standards and guidelines that cement either the ledger or the node perspective for certain functions.

Rather, we recommend that financial regulations be drafted in a way that allows for the adoption of the ledger or node perspective with respect to each legal right and obligation, but requires that the nodes collectively, as part of the licensing process, submit a plan of operations showing whether compliance with a provision will be performed by each of the nodes separately, or by the ledger as a whole⁸³.

Under this approach, applicants will be required to put in place an agreement based on private law devices (contract, corporate or partnership law, secured transactions) that establishes which entity or entities will assume responsibility for compliance with specific provisions of financial regulations.

Regulators are supposed to review the plan of operations and assess whether the proposed arrangement ensures effective compliance. As a default rule (subject to the exceptions discussed below in V.3), all rights and obligations not expressly assigned to the ledger as a whole will remain the responsibility of each node separately; this default rule reflects, in principle, the doctrinal basis of existing financial regulation.

The enabling approach should, in principle, apply to all parts of payment processes subject to supervision and regulatory approval of any kind, ie. where a review by a supervisory authority ensures that the plan of operations aims at rigorous compliance rather than the circumvention of the rules.

A provision could be formulated as follows⁸⁴. Operators of DLT payment infrastructures, and in the absence of an operator of all nodes collectively, shall establish a clear and detailed plan of operations describing how they intend to carry out their services and activities, including a description of critical staff, technical aspects, the use of the DLT and information on how they carry out their functions, services and activities and how functions, services and activities are performed, including the type of DLT used and the function, responsibilities and liability of each node in that DLT.

They shall also have up-to-date, clear and detailed publicly-available documentation on their website at all times, defining the rules under which the DLT payment infrastructure shall operate, including the agreed-upon, associated legal terms defining the rights, obligations, responsibilities and liabilities of the operator of the DLT payment infrastructure, as well as those of all nodes, members, participants, issuers of payment instruments, and/or clients using the DLT payment infrastructure. Such legal agreements shall specify the applicable law, pre-litigation dispute resolution mechanism and jurisdiction to bring an action.

b. Examples

All in all, the more the Plan of Operations deviates from the default state, the more peculiar the arrangements required, and the more rigorously the substitute arrangements need to be scrutinized by regulators. Given the tendency of regulators to prefer proven concepts, we acknowledge some pressure to adopt the default rule, yet if supervised entities provide good reasons to deviate from the default rule, they may receive permission to do so.

A few examples may demonstrate how the Plan of Operations works:

First: the rules on the safeguarding of clients' funds shall ensure that clients' funds are isolated from PSP default risk, but also provide safety in terms of certain operational risks; for instance, safeguarding rules usually require some 'safe' investment policy on non-volatile and central bank deposits.

Given that Payment DLTs take on different forms, any rule anticipating 'cash-on-ledger' would be premature. Most use cases will not require that client funds be held permanently on the ledger itself.

Thus, in principle, the default rule is for nodes to meet the provisions on the safeguarding of clients' funds. However, the default rule concept also allows for a Plan of Operations that requires that all customer funds of all PSPs functioning as nodes be held in an account in the name of the DLT on behalf of all PSP nodes.

Then, the Plan of Operations must also come up with additional safeguards (eg. the omnibus account could be created as a trust account and held by one or several central banks in the name of the ledger).

Further, if client funds are held on the ledger, the Plan of Operations must adjust clients' rights; for instance, in addition to a claim against their PSP (which stems from the clients' payment services contract with the PSP)), the trust arrangement between the ledger and the trustee must be set up to ensure that it benefits the PSPs' customers (ie. the payee and the payer) as third-party beneficiaries in the event of ledger (if any) and/or PSP insolvency.

Second: capitalization and own funds requirements serve to ensure a buffer against a PSP's adverse operational and business developments, such as unexpected damage or reduced profitability for a limited period of time. They also ensure that each PSP has some skin in the game, incentivizing the PSP to maintain operations.

In principle, this logic holds even if several PSPs cooperate through a DLT. However, we could imagine that the ledger itself, if provided with entity status and capital or capital substitutes (insurance), would function

as a risk buffer. Thus, the default rules approach allows for innovation, depending on the function and configuration of each ledger.

Third: the PSP's own governance and conduct of business rules⁸⁵ serve to ensure proper participation of the PSP in the DLT. For instance, we would require a PSP to ensure that its management, as a whole, has the skills necessary to make qualified decisions on how to best participate in the DLT (a distributed view, in contrast, would look at whether all PSPs together meet this test).

Again, the default rule approach allows a different allocation for cases in which the ledger itself usurps the function of client contact (as potentially encountered in a small-value payments DLT).

Fourth: any payments regulation must set rules and procedures to clearly define the point at which settlement is final. It has been argued that, to ensure that DLT-based payments can be integrated into the financial systems, regulators must (be amended to) ensure that DLT-based platforms qualify as 'designated systems' for the purposes of settlement finality, *"because the technical finality of transfer orders processed in a DLT environment need not match the commonly shared legal understanding of the concept of finality."*⁸⁶

Finality of transactions processed in distributed ledger environments may be understood to be probabilistic only (rather than deterministic, as in the case of centralized ledgers), which raises concerns regarding the determination of title transfer thus giving rise to warranted reservations in terms of title transfer⁸⁷.

Further, in the absence of an identifiable entity to operate the platform, doubt emerges with regard to which entity is to guarantee (that is: who is liable for) the finality of transactions⁸⁸.

Our proposal, if adopted broadly for selected parts of financial law, would solve this problem: in the Plan of Operations, the consensus method relying on probabilistic means could be defined as the definitive one, for legal purposes.

In the end, it matters most which entity may stand up for settlement finality with its balance sheet (ie. every decision in the end is a matter of accountability).

Obviously, when DLT has entity status, all nodes collectively could function as a 'entity' (more precisely: entities) in charge of settlement for this purpose.

However, even a group of entities cooperating through the DLT could provide more financial support than a centralized ledger, except for those that are better funded or the central banks themselves.

The same Plan of Operations stipulating that the group (if any) assumes responsibility also needs to stipulate the legal consequences, particularly what type of responsibility is assumed; to ensure the purpose of settlement, unlimited liability is the strongest type of responsibility, of course, but separating liability could also be effective if the formula of separation and the amount are clearly defined.

c. Three accompanying rules

Such an enabling approach must be accompanied by three rules. First, it must be clarified by way of law that the Plan of Operations defines not only rights and obligations, but also describes what sanctioning powers regulators have with respect to the rights and obligations laid out in the plan.

That is, the ledger as a whole or the node will be sanctioned based on the responsibility assigned by the plan. This division of sanctioning power, to be effective, will need to be accepted by various regulators across boundaries.

Of course, sanctioning the ledger as a whole means sanctioning the nodes that rely on it as well, in principle, so the details of the sanctioning power must be carefully considered.

Second, cases of non-compliance shall trigger a review of the Plan of Operations, with regulators entitled to request changes to that plan.

Third, a business plan approach as proposed herein works best if an entity is in charge of applying for supervisory approval (called herein the 'operator' of a DLT payment system). DLT would enable systems without an operator, as in fully distributed public ledgers such as Bitcoin.

Yet, those DLT systems raise significant governance issues. Hence, we propose that in principle each DLT is required to have one operator, or a group of operators, respectively, who jointly assume responsibility for the initial filing.

The law shall stipulate that in the absence of one operator fulfilling the legal filing requirements, all nodes shall be jointly liable for compliance with all rules and regulations applicable to the DLT⁸⁹. This will provide a strong incentive to ensure that an operator, or a group of operators, is put in place.

Over time, this approach will lead to better practice regarding certain functions that could then become the basis for default arrangements (to reduce costs) or even binding rules.

d. Technical implementation

All rules governing payment processes must be reformed to enable the plan of operations approach to ensure openness to innovation. Technically, this can be done with a piece of legislation in the general part of a regulation that overrides existing rules and regulations, clarifying that the entity addressed by the financial regulation could also be multiple legal entities (nodes) connected through DLT that together ensure compliance with some, or all, of the provisions as further described in a Plan of Operations and where private agreements exist that bind all nodes in the manner prescribed. Our proposal is developed infra (Part IV).

2. Crossborder supervision and cooperation

Crossborder supervision and cooperation between payment regulators and central banks are key to ensuring effective supervision and financial system stability. DLT, as part of decentralized finance, comes with significant barriers: all established means of cooperation tend to be too slow and ineffective, while intensive forms of cooperation such as mutual recognition schemes and substituted compliance based on equivalence assessments tend to be difficult to establish politically across a wide range of jurisdictions⁹⁰.

However, in the world of payments, and specifically for crossborder payments where crossborder cooperation is indispensable, the CPMI-IOSCO Principles for Financial Market Infrastructures (PFMI) provide a solution.

The principles require that payment regulators and supervisors should 'cooperate with each other, both domestically and internationally, as appropriate, in promoting the safety and efficiency of FMIs'⁹¹.

Under these principles, the US Federal Reserve System has accepted primary oversight responsibility for the CLS system, in a Cooperative Oversight Arrangement with the ECB and national central banks of various countries.

Within the Eurosystem, the ECB has primary responsibility for the settlement of euro-denominated payments by CLS, in close cooperation with other Eurosystem central banks.

The most intensive form of crossborder cooperation - the supervisory college - may also be appropriate for dealing with DLT-based payment systems. Since we require each DLT to appoint an operator, the supervisory authority responsible for the DLT operator as well as any node supervisor should participate in that college.

This leaves open the question of how to determine the chair of the college. This function could be assigned based on (a) volume processed, (b) entities involved, and/or (c) settlement currency.

Depending on the configuration, we could also provide for different colleges for different parties, with the authority of the DLT operator participating in all of them.

As a result of the establishment of the supervisory college, regulators need to secure the DLT's license to operate in any given country where the DLT's activities are subject to licensing, given the DLT's specific setup.

This can be achieved by a rule embedded in the financial regulation of all participating countries that any license granted under this scheme by the supervisory college provides automatically for the right to perform that service in any country participating in the supervisory college under the conditions stipulated by that college.

3. Reversed default rule in certain instances

Our proposal is based on a default rule concept in which all rights and obligations not expressly assigned to the ledger as a whole will remain the responsibility of each node separately.

However, in certain instances reversing the default rule, that is rendering the ledger perspective the default rule and the node perspective the contractual option (albeit subject to regulatory approval), could enhance efficiency.

a. Systemic risk prevention

Systemic risk controls seek to shed light on interconnectedness. For DLT payment systems as multilateral networks, taking a joint view on the DLT as such increases supervisory oversight and is, in principle, preferable.

Yet, there are limits to the ledger perspective: the PSP's individual operational risk (in particular, tech risk⁹²) from the use of DLT must be assessed separately to incentivize the institution to invest in the best technology and staff to reduce these risks.

However, if the ledger protects these types of risk, the tech risk on the node level can be disregarded for systemic risk purposes.

b. DLT governance

DLT governance requirements, that is the decision-making mechanism which decides the design and all changes to the DLT design⁹³, make little sense if they do not find their counterparts in all participants, so the evaluation of ledger governance must be based on the ledger perspective.

c. AML/CTF

Applying AML/CTF rules to the general ledger as a whole could improve cost efficiency and reduce duplicate compliance checks. That is inherent in using the DLT as an AML/CTF Network (supra, at III.3.).

The nexus of AML/CTF legislation is often a legally defined term such as 'payment service provider' or 'intermediary payment service provider'⁹⁴. Attached to that term are multiple reporting and documentation duties, including that each PSP and intermediary PSP must add their own tracking numbers to enable transaction tracking, report suspicious transactions and establish a compliance organization to ensure such reporting.

The ledger perspective for AML/KYC purposes would allow for centralized AML/KYC checks, efficient intra-ledger processes and operations and the pooling of reporting requirements.

Beyond simplifying reporting to regulators, the ledger perspective allows for the following efficiency gains:

1. Within closed-loop DLT systems, regulators could consider moving from front-end to back-end AML checks, since most relevant transactions stay in the system; this is true at least as long as cash transfers are limited to smaller amounts;

Identification of ultimately beneficial owners could be stored and mitigated on the DLT platform, where algorithms can ensure the accuracy of the information in light of the various modes of enterprise control mechanisms being applied;

2. Auditable data trails could enable regulators to access the entire setup of a transaction to assess whether and to what extent a specific individual or market actor fulfils compliance requirements.

However, the former is subject to the condition that within the distributed ledger all relevant data are accessible for compliance purposes; this creates potentially large pools of unwanted data.

Moreover, involving the ledger for AML/CTF only makes sense if the nodes are themselves relieved of their customer due diligence duties. Hence, our proposal is to adopt the ledger perspective for that field as a reversed default setting.

In such a setting, the ledger is the primary recipient of AML/CTF rules that rely on the various PSPs to perform client due diligence as delegates through outsourcing arrangements for the ledger.

Such an arrangement would facilitate clear responsibilities and sanctions: the mandated ledger operator would be responsible and liable, and regulators would require adequate resources, capital and governance arrangements as a precondition for licensing.

However, we could envisage many intermediate arrangements, in particular 'traffic light' systems in which PSPs and intermediary PSPs rely on client due diligence performed by one node on behalf of the others. As such, the default setting allows for different arrangements, by setting up the Plan of Operations accordingly.

d. Data protection and governance

DLT rests on shared data, hence any node perspective creates costs and barriers in that regard⁹⁵. In terms of data governance, the ledger perspective (disregarding the many nodes) would decrease costs. At the same time, DLT is particularly good at protecting against data corruption and ensuring ongoing data access.

Data protection legislation imposes most obligations and responsibilities to the data controller and data processor⁹⁶. To each of these terms is attached a number of information, documentary and compliance requirements.

When many ledgers are connected, as in the case of a distributed ledger, these duties multiply if each of the nodes is subject to full GDPR compliance expectations. Adopting the ledger perspective for the data processor and data controller could simplify compliance and reduce costs.

However, data protection and privacy rules may limit the ability to save resources. For instance, at present, the EU GDPR and Australian data protection framework are reported to be among the strictest globally⁹⁷. A DLT-based payment system may therefore need to consider and accept these local standards.

In essence, this may ask any DLT including the EU and Australia, to de facto adhere to EU and Australian data protection and privacy laws as a precondition for global reach⁹⁸.

Technology may provide a solution to this undesirable state: we discussed the option supra, in Section III.3. of making use of a so-called 'zero-knowledge proof' for particular parts of information that are locked down in the DLT platform we refer to.

Yet, it will be difficult to implement the ledger view for data governance. In the current state of legal diversity, the lack of data-related equivalence may prompt the segregation of client data on a per-country basis; for instance, the EU does not deem the data governance of US federal laws to be equivalent to the EU's GDPR.

In addition, some countries have instituted regulatory requirements for data localization, ie. key customer data residing in a given country must be stored and processed in that country.

While these data localization rules are intended to ensure operational resilience, they also hinder, from a legal perspective, the ability to treat DLT as a single entity, ensuring the smooth flow of data across all ledger participants.

4. Sanctions

It goes without saying that both the ledger and the node perspective come with their own incentives for financial institutions participating in the DLT; compliance must be ensured by appropriate sanctions.

For legal and political reasons, agreeing on a harmonized catalogue of sanctions is a challenge, yet some harmonization of sanctions is crucial, as a different level of sanctions provides incentive for regulatory arbitrage and thus undermines the effectiveness of any legal ordering crossborder: law is all about sanctions.

To clarify, in order for the Plan of Operations approach to function, we do not need 'full' harmonization of sanctions, but sanctioning along certain previously agreed principles within a certain catalogue of sanctioned conduct.

In the absence of such minimum harmonization of sanctioning powers, only the ledger perspective works from the legal perspective – which means we lose enormous scale potential. Hence, we encourage to invest the political capital to achieve some joint approach to sanctioning⁹⁹.

5. Private law

Our general approach, where the Plan of Operations determines whether compliance is owed by each node separately, or by the ledger as a whole, works less well with regard to private law matters.

One of the reasons is that the Plan of Operations can easily adopt the perspective of the payment system, while private law must consider the perspective of each PSP participating in the system, and the relations of that PSP to its clients.

The difficulties here stem from three aspects: (1) private actors have an incentive to create liability arrangements in their favour, and thus to the detriment of third parties not subject to the contract; (2) usually, the jurisdiction of payment regulators does not extend to private law relationships; and (3) courts deciding on private law are not bound by regulators' approval of these schemes.

At the same time, private law liability impacts the operations and setup of each PSP. Thus, private law arrangements deserve special attention.

a. Wholesale vs. retail clients

We propose that wholesale and retail clients be distinguished. In principle, wholesale clients can negotiate terms with their PSPs and have the means to protect their interests through a contract.

Consumer and SME clients, by contrast, do not have the negotiating power to do so. At the same time, harmonization of consumer protection laws across countries is not yet feasible.

Instead, we propose an approach in which PSPs are subject to contracting for a large number of items, and submitting these contracts for approval by the authorities. In principle, this could lead to some harmonization by way of contract despite the divergence of national laws¹⁰⁰.

b. Private international law

We have set out the difficulties in assigning applicable law and competent courts. For greater clarity, we propose that a private international law provision specific to multilateral payment systems be introduced¹⁰¹.

Such a provision could subject the rights and obligations relating to a distributed ledger (the intra-ledger perspective) to the laws and courts of a country, or relating to the ledger's head office (if any) or the country stipulated in the contract underlying the ledger, addressing the respective legal uncertainties in private international law¹⁰².

c. Insolvency law

One field in which the law, so far, takes the node perspective is in the field of insolvency law. Insolvency proceedings are concentrated in one court proceeding. In many countries, the proceeding takes place at the debtor's 'center of main interests'¹⁰³.

In a DLT situation, where the DLT itself assumes entity status, it can be difficult to determine the debtor's 'center of main interests'. At the same time, insolvency laws exclude certain regulated entities subject to tailor-made resolution regimes from the 'main interest' test, particularly credit institutions and payment systems¹⁰⁴.

This exemption applies, however, only if the DLT itself is a licensed entity within that definition, requiring its own capitalization, reporting and governance. In the absence of the former, the 'principal interest' test applies, creating significant legal uncertainty regarding the applicable insolvency law.

One solution to this insolvency conundrum is to assign a prudential status to the 'ledger', that is, to adopt the ledger perspective for that part of the DLT-based payment system.

Our proposal above requires that an 'operator' for the ledger does not go that far, but we acknowledge that as soon as 'the ledger' turns into some organization, this may have repercussions with regard to the forum in 'the ledgers' insolvency'.

VI. Conclusion

Financial law and regulation to date assume that regulated activities and functions are concentrated in a single legal entity that is responsible and accountable for operations and compliance.

This regulatory paradigm is under pressure in the world of DLT-based payment systems where some ledgers are distributed. While the function of payments as a point-to-point transfer of funds seems to place an implicit limitation on DLT-based distribution of technical functions, DLT-based systems allow for the creation of foundational infrastructure linking existing systems rather than merely new designs on the front-end.

As such, we identify the Best Execution DLT, the DLT as Network of Central Banks, the DLT as AML/KYC Utility, Identity Platform, Small Payments Platform and Interoperability Platform connecting multiple closed-loop and proprietary banking systems.

From a legal perspective, the distribution of functions in DLTs comes with new risks, and the need for additional agreements, and ongoing coordination across, and governance arrangements among the nodes.

Further, in a crossborder context multiple regulators and courts in various countries (demanding compliance with their own set of rules and regular reports) will be involved. All of these must decide whether for compliance with the law and regulations they look at the DLT as a whole (herein called 'the ledger perspective') or each individual node (that is each institution participating in the DLT, herein called 'the node perspective').

Further, financial and private law must provide for allocation of risks, liability, responsibility and accountability for all legal obligations related to each function and activity.

The key decision in the legal design of DLT-based payment systems is for which rights and obligations regulators adopt the ledger perspective, and for which they adopt the node perspective.

In this paper, we propose what we call an enabling approach to be adopted for payment systems: ledger operators must specify in an operational plan subject to regulatory approval to which rights and obligations the ledger perspective applies; in the absence of such a stipulation, the rules apply based on the node perspective.

However, for systemic risk controls, AML/CTF, data protection and governance, as well as DLT governance and, to some extent, insolvency proceedings, we propose an inverted default rule in which the ledger perspective prevails in the absence of rules stipulating that the node perspective applies.

Finally, in private law matters where we need to focus on the perspective of the PSP rather than the system as a whole, we propose that consumer customers and SMEs are protected through a standardized payment services contract structure, without imposing details. ■

ABOUT THE AUTHORS

Dirk A Zetsche is Professor of Law, ADA Chair in Financial Law (Inclusive Finance), and Coordinator, House of Sustainable Governance & Markets, Faculty of Law, Economics and Finance, University of Luxembourg.

Linn Anker-Sørensen is Director - Head of Sustainability Tax & Law, at Ernst & Young Tax and Law Norway; lecturer-in-law, University of Oslo.

Maria Lucia Passador is John M Olin Fellow at Harvard Law School and an Academic Fellow at Bocconi.

Andreas Wehrli is a Senior Adviser at the Swiss National Bank. Formerly Bank for International Settlements.

Endnotes

1. Cf. Financial Stability Board, *Enhancing Cross-Border Payments. Stage 1 Report to the G20: Technical Background Report* (April 9, 2020), <https://www.fsb.org/wp-content/uploads/P090420-1.pdf>, at 2-4; McKinsey & Company, *The 2020 McKinsey Global Payments Report* (2020), <https://www.mckinsey.com/~media/mckinsey/industries/financial%20services/our%20insights/accelerating%20winds%20of%20change%20in%20global%20payments/2020-mckinsey-global-payments-report-vf.pdf>
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4. See Ellen Naudts et al. *DLT for (Crossborder) Payment Systems: Governance and Oversight – an abstract* (Jan. 20, 2021), 1.
5. See International Monetary Fund, Ghatgh Shabsigh, Tanai Khiaonarong & Harry Leinonen, *Distributed Ledger Technology Experiments in Payments and Settlements. Note/20/01*, at 4; World Economic Forum, *Central Banks and Distributed Ledger Technology: How Are Central Banks Exploring Blockchain Today?* (March 2019), http://www3.weforum.org/docs/WEF_Central_Bank_Activity_in_Blockchain_DLT.pdf; César A Del Río, *Use of distributed ledger technology by central banks: A review*, 8 *Enfoque Ute* (2017), <https://www.redalyc.org/jatsRepo/5722/572261717001/html/index.html>; Fred Huibers, *Distributed Ledger Technology and the Future of Money and Banking*, *Acct. Econ. L.* (2021), <https://doi.org/10.1515/ael-2019-0095> (assuming that DLT-based competition and diversity could increase stability and efficiency of the financial system).
6. See, for instance, David Floyd, *Overstock's t0: Reconciling Fiat Currency and the Bitcoin Blockchain*, *NASDAQ* (Dec. 16, 2015), <https://www.nasdaq.com/article/overstocks-t0-reconciling-fiatcurrency-and-the-bitcoin-blockchain-cm555617>

7. Projects in this sense are described in Robert M Townsend, *Distributed Ledgers. Design and Regulation of Financial Infrastructure and Payment Systems* (2020), chapter 8, 115-6.
8. Financial Stability Board, *supra* note 1, at 12.
9. Deloitte-MAS, understanding the regulatory requirements of the MAS Payment Services Act, <https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/financial-services/sg-fsi-payment-services-act-2019-wns.pdf>, 10.
10. Deloitte-MAS, *supra* note 9, 12; CipherTrace, *Cryptocurrency Crime and Anti-Money Laundering Report* (Feb. 2021), <https://ciphertrace.com/2020-year-end-cryptocurrency-crime-and-anti-money-laundering-report/>
11. See Naudts et al. (*supra* note 4), at 4; Jesse Leigh Maniff & W Blake Marsh, *Banking on Distributed Ledger Technology: Can It Help Banks Address Financial Inclusion?*, Fed. Reserve Bank of Kansas City. Econ. Rev. (2017), <https://www.kansascityfed.org/~media/files/publicat/econrev/econrevarchive/2017/3q17maniffmarsh.pdf>, at 59-69; International Telecommunication Union, *Distributed Ledger Technologies And Financial Inclusion* (2017), https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/201703/ITU_FGDFS_Report-on-DLT-and-Financial-Inclusion.pdf; World Bank, *Blockchain & Distributed Ledger Technology (Dlt)* (Apr. 12, 2018), <https://www.worldbank.org/en/topic/financialsector/brief/blockchain-dlt>; Deloitte, *The Changing Paradigm of Distributed Ledger Technologies* (2020), <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology/2020-gbcs-ip-bcm.pdf>, at 2.
12. International Monetary Fund, *Distributed Ledger Technology Experiments in Payments And Settlements* (June 24, 2020), <https://www.imf.org/-/media/Files/Publications/FTN063/2020/English/FTNEA2020001.ashx>, 2-8. See also Christoph Aymanns, Mathias Dewatripont & Tarik Roukny, *Vertically Disintegrated Platforms* (Dec. 20, 2019), <https://ssrn.com/abstract=3507355>; Alexander Lipton, *Blockchains and distributed ledgers in retrospective and perspective*, 19 *J Risk Fin.* 4, 14-15 (2018); Thomas Ankenbrand et al. *A structure for evaluating the potential of blockchain use cases in France*, 17 *Perspectives of Innovations, Economics & Bus.* 77, 83-85 (2017); Deutsche Bundesbank, *Distributed Ledger Technologies in Payments and Securities Settlement: Potential and Risks. Monthly Report* (Sept. 2017), 35-49; Philip Paech, *The governance of blockchain financial networks*, 80 *Modern L. Rev.* 1073 (2017).
13. Hal S Scott & Anna Gelpern, *International Finance, Transactions, Policy, And Regulation* (2020), 728-742.

14. Financial Stability Board, *supra* note 1, at 8, figure 5. For financial market infrastructures, a framework for addressing inherent risks is set out in the Committee on Payment and Market Infrastructures (CPMI) and the International Organization of Securities Commissions' (IOSCO's) report on Principles for Financial Market Infrastructures (PFMI). See <https://www.bis.org/cpmi/publ/d101a.pdf>
15. See, in particular, the Directive 2015/2366 of the European Parliament and of the Council of 25 November 2015, on Payment Services in the Internal Market (PSD 2) and as last building block and the EU Digital Finance Strategy (DFS). In particular, PSD2 aims at enhancing competition, reducing fees and improving system resilience in the payments industry by lowering barriers to entry for Fintech and other new participants seeking access to financial data of payment system users. See also Dirk A Zetsche, Douglas W Arner, Ross P Buckley & Rolf H Weber, *The Evolution and Future of Data-driven Finance in the EU*, 57 *Common Market L. Rev.* 331, 347-9 (2020) (specifying the underpinning on which PSD II started to operate and describing the role of PSD II in "pushing forward the transition to data-driven finance in Europe's Single Payments Market and potentially more broadly").
16. International Monetary Fund, *supra* note 12, 8-9.
17. Mahdi Zamani et al. *Cross-Border Payments for Central Bank Digital Currencies via Universal Payment Channels*, paragraph 2.3.
18. World Economic Forum, *Innovation-Driven Cyber-Risk to Customer Data in Financial Services – White Paper 6* (2017), <https://www.weforum.org/whitepapers/innovation-driven-cyber-risk-to-customer-data-in-financial-services>
19. See Mills et al. *supra* note 3.
20. See Michèle Fink, *Blockchain Regulation and Governance in Europe* 12-14 (2019). See also Sinclair Davidson, Primavera De Filippi & Jason Potts, *Blockchains and the Economic Institutions of Capitalism*, 14 *J Inst. Econ.* 639 (2018) (arguing that blockchain technology is a new governance institution that competes with the other economic institutions of capitalism, ie. businesses, markets, networks, and even governments); Primavera De Filippi & Aaron Wright, *Blockchain and the Law: The Rule of Code* (2018), AT 55, 136-40 (arguing that the spread of blockchain will lead to technology-based

business practices that could induce a loss of importance of centralized authorities, such as government, and urging a more proactive regulatory approach).

21. *In practice, payment system resiliency and contingency plans usually limit this risk with hot copies of the ledger at a secondary site of operations.*

22. *Any server can be manipulated with sufficient computing power and time (even if no other weakness in an encryption system is known to the attackers). See, generally, Jean-Philippe Aumasson, *Serious Cryptography: A Practical Introduction to Modern Encryption* 10-18, 40-48 (2017).*

23. *See, eg. De Filippi & Wright, supra note 20, at 33-58; Dirk A Zetsche, Ross P Buckley & Douglas W Arner, *The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain*, 2018 U. Ill. L. Rev. 1361, 1372 (2018).*

24. *See, eg. Anthony J Casey & Anthony Niblett, *Self-Driving Contracts*, 43 J Corp. L 1, 5 (2017); Joshua Fairfield, *Smart Contracts, Bitcoin Bots, and Consumer Protection*, 71 Wash. & Lee L Rev. Online 35, 36 (2014); Karen EC Levy, *Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and The Social Workings of Law*, 3 Engaging Sci. Tech. & Soc'y 1 (2017); Kevin Werbach & Nicolas Cornell, *Contracts ex Machina*, 67 Duke LJ 313 (2017).*

25. *Financial Stability Board, supra note 1, at 13-14; Committee on Payments and Market Infrastructures, *Cross-Border Retail Payments* (Feb. 2018), <https://www.bis.org/cpmi/publ/d173.htm>. This time-related issue is perhaps even worse given that “the lack of common communication or messaging standards across systems often hinders seamless interoperability” (European Central Bank – Bank of Japan, *Synchronised Cross-Border Payments* (June 2018), <https://www.ecb.europa.eu/paym/intro/publications/pdf/ecb.miptopical190604.en.pdf>, at 1). For a general overview, see Jon Cunliffe, *Cross-border payment systems have been neglected for too long*, *Financial Times* (July 13, 2020), <https://www.ft.com/content/a241d7e0-e1de-4812-b214-b350cbb7d046>*

26. *Scott & Gelpert, supra note 13, at 744.*

27. *The diversification of the front end and the back-end levels is described in Financial Stability Board, supra note 1, at 8.*

28. *Whereas mainstream countries are “moving towards one common global standard for financial messaging, called ISO 20022. Global adoption of this standard is accelerating with a number of high-value payment market infrastructures*

already live and more planned to go live by 2023.” (KPMG, A New Standard for Payments (2020), <https://home.kpmg/xx/en/home/insights/2020/02/payments-standard.html>).

29. The need to accelerate the pace of cross-border payment systems is not, however, a last-minute requirement, as the following contributions testify: Morten Linnemann Bech, Yuuki Shimizu & Paul Wong, *The Quest for Speed in Payments*, *BIS Quarterly Rev.* (March 2017), at 57 ff., http://www.bis.org/publ/qtrpdf/r_qt1703g.htm and IBM Launches Blockchain Banking Network to Speed Cross-border Payments, *ICT Monitor Worldwide* (Oct. 17, 2017).

30. On the general lack of transparency issue, see *Cross-Border Interbank Payments and Settlements. Emerging Opportunities for Digital Transformation* (Nov. 2018), <https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Cross-Border-Interbank-Payments-and-Settlements.pdf>, at 13-14.

31. International Monetary Fund, *The Central Bank Transparency Code* (July 30, 2020), <https://www.imf.org/en/Publications/Policy-Papers/Issues/2020/07/29/The-Central-Bank-Transparency-Code-49619>

32. Casper L Van Ginneken, *Settlement Of Cross-Border Transactions Through Central Bank Digital Currency (CBDC): Analysis From A Risk Management Perspective* (2019), https://essay.utwente.nl/78027/1/Ginneken_MA_BMS.pdf, at 73.

33. Hawala is an informal value transfer system (without money movement) based on the transfer of debt between a network of money brokers (the hawaladars) operating outside of, or parallel to, traditional banking, financial channels, and remittance systems. Hawala is distinguished from other remittance systems by the reliance on trust amidst the brokers that form the Hawala network, rendering it operable even in the absence of legal enforcement. See Gamal Moursi Badr, *Islamic Law: Its Relation to Other Legal Systems*, (1978) 26:2 *Am. J Comp. L* 187–198.

34. NS Jamwal, *Hawala - The Invisible Financing System of Terrorism*, 26 *Strategic Analysis* 181 (2008); Rachana Pathak, *The Obstacles to Regulating the Hawala: A Cultural Norm or a Terrorist Hotbed?*, 27 *Fordham Int'l L.J.* 2015 (2003); Financial Action Task Force, *The Role Of Hawala And Other Similar Service Providers In Money Laundering And Terrorist Financing* (Paris: Financial Action Task Force, 2013); Patrick M Jost & Harjit Singh Sandhu, *The Hawala Alternative Remittance System And Its Role In Money Laundering* (Vienna, Va: International Criminal Police Organization, 2000), at 5.

35. *Due to trust-based account re-balancing similar to modern correspondent banking, Hawala functions cross border without actually transferring money, yet rather than using capital-based counterparty risk mitigation Hawala relies on a kind of collective liability of all nodes. We will turn back to this particularity which is at the heart of the legal dimension of DLT, infra Part IV.*

36. *Committee on Payments and Market Infrastructures, Distributed Ledger Technology in Payment, Clearing and Settlement. An Analytical Framework (Feb. 2017), 1.*

37. *Raphael Auer, Embedded Supervision: How to Build Regulation into Blockchain Finance. BIS Working Papers No. 811 (SEPT. 2019).*

38. *See Xiaohui Yang & Wenjie Li, A zero-knowledge-proof-based digital identity management scheme in blockchain, 99 Computers & Security 102050 (Dec. 2020) (arguing that a non-interactive zero-knowledge range proof protocol could erase data protection concerns).*

39. *Societè Generale, Blockchain and Payments: Lessons Learned and Future Prospects, <https://www.securities-services.societegenerale.com/en/insights/expert-views/banking/blockchain-and-payments-lessons-learned-and-future-prospects>*

40. *We understand regulators to include financial services agencies, central banks, authorities in charge of enforcing AML/CTF rules and potentially law enforcement authorities.*

41. *See Zetzsche, Buckley & Arner, supra note 23, 1374-86, 1391-1403; David C Donald & Mahdi H Miraz, Multilateral Transparency For Securities Markets Through DLT, 25 Fordham J Corp. & Fin. L 97 (2020); GFMA Global Fx Division, Considerations Relevant To Initiatives And Developments In Wholesale Fx Settlements (Sept. 2019), at 4-7 (identifying the following categories: liquidity risk, settlement risk (ie. "the risk that one party to a physically settled FX transaction pays out of the currency it sold but does not receive in full, when due, the currency it bought (the counter-currency)), and disruption risk, namely "the impact of the failure of a new technology or new business model on the existing ecosystem"); Jonathan Rosenoer, Hardening The Chain: DLT And Operational Risk Management, 100 Risk Mgmt Association J. 41 (2018); Paech, supra note 12. See also, for the evolution (rectius, increase) of settlement risk, as CLS and PvP share of FX*

turnover declined, Naveen Mallela, *Industry Initiatives on Multi-Currency, Multi-Entity Shared Ledger Infrastructure* (Jan. 20, 2021), at 3.

42. Cf. *Committee on Payments and Market Infrastructures*, *supra* note 35, 17-19.

43. While no common, predefined governance model for distributed ledgers exist, setups exploit the full range from hierarchy to non-hierarchy, including governance models that some people think are fully decentralized, ie. controlled and influenced by no one. We examine the legal consequences of the choice of a more centralized or decentralized governance *infra*, at IV. Yet, the law requires that someone (either the ledger as a whole or the nodes separately) fulfils regulatory requirements, and any governance model must provide the answer as to who is responsible for doing so. For further details, see *infra*, at V.

44. *Committee on Payments and Market Infrastructures*, *Supra Note 37*, 19.

45. *Société Générale*, *supra* note 38.

46. See Ross P Buckley, Douglas W Arner, Dirk A Zetsche & Eriks Selga, *Techrisk*, *Singapore J. Legal St.* 35 (2020).

47. Marc Hamilton, *Blockchain Distributed Ledger Technology: An Introduction and Focus on Smart Contracts*, 31 *J. Corp. Acct. & Fin.* 7 (2020). See also Lyria Bennett Moses, *Regulating in the Face of Sociotechnical Change*, in *The Oxford Handbook of Law, Regulation and Technology* (Roger Brownsword, Eloise Scotford & Karen Yeung, Eds.) (Oxford University Press, 2017), section 3 (stating that “regulators need to respond to new technologies, not because they are technological *per se*, but because they are new and law and regulation need to be changed to align with the new sociotechnical landscape, including new negative features (harms, risks, market failures, inequality, etc.) it presents.”).

48. *Committee on Payments and Market Infrastructures*, *supra* note 35, 3 and 10.

49. See Dirk A Zetsche, Ross P Buckley, Douglas W Arner & Maria Lucia Passador, *The Case for a Best Execution Principle in Cross-border Payments* (April 26, 2021), *University of Luxembourg Law WPS 2021-002*, *UNSW Law Research Paper No. 21-45*, <https://ssrn.com/abstract=3834335>

50. Additional details are provided in Zetsche, Buckley, Arner & Passador, *supra* note 49.

51. For instance, the Swiss National Bank provides liquidity to market participants via a repo platform operated by Swiss infrastructure provider SIX.
52. See, for instance, the work of the Monetary Authority of Singapore and the work of the BIS Innovation Hub, <https://www.bis.org/review/r210427c.html>. On project Dunbar, see <https://www.bis.org/about/bisih/topics/cbdc/wcbdc.htm>
53. See Raphael Auer & Rainer Boehme, *The Technology of Retail Central Bank Digital Currency* (2020), https://www.bis.org/publ/qtrpdf/r_qt2003j.pdf
54. See Zetzsche, Buckley, Arner & Passador, *supra* note 49.
55. The central bank balance sheet is a public good; central bank money offers the unique features of settlement finality, liquidity and integrity. See *CBDCs: An Opportunity for the Monetary System*, BIS Annual Economic Report 2021, at III., 65, 69-72, www.bis.org
56. The question of interoperability has been discussed under the heading of ‘mCBDC systems’, see Raphael Auer, Codruta Boar, Giulio Cornelli, Jon Frost, Henry Holden & Andreas Wehrli, *Cbdcs Beyond Borders: Results from a Survey of Central Banks*, BIS Paper No. 116 (June 2021), www.bis.org, at graph 6 and pp. 12 et seq. Yet, as we show in the following, a Central Bank Digital Currency is no prerequisite for running a multi-Central Bank payment system.
57. See Raphael Auer, Codruta Boar, Giulio Cornelli, Jon Frost, Henry Holden & Andreas Wehrli, *CBDCs Beyond Borders: Results From A Survey Of Central Banks*, BIS Paper No. 116 (June 2021), www.bis.org, at graph 6 and pp. 12 et seq.
58. See <https://wakandi.com/>
59. See Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU, Article 30 (1) and 44.
60. Linn Anker-Sørensen, *Corporate Groups and Shadow Business Practices* (Cambridge University Press, Forthcoming 2021).
61. Refinitiv is one of the world’s largest providers of financial markets data and infrastructure, serving over 40,000 institutions in approximately 190 countries. It provides leading data and insights, trading platforms, and open data and

technology platforms that connect a thriving global financial markets community - driving performance in trading, investing, asset management, regulatory compliance, market data management, enterprise risk and financial crime fighting. For more information, see www.refinitiv.com

62. Additional information is available at https://www.refinitiv.com/content/dam/marketing/en_us/documents/brochures/world-check-risk-intelligence-brochure.pdf

63. See David Ballaschk & Marcus Härtel, *The “amplus” initiative - a modular approach to improving cross-border payments* (2021, forthcoming).

64. Yang & Li, *supra* note 37.

65. Such categorization resembles the country codes used today where certain codes signal the need for additional due diligence.

66. Dirk A Zetsche, Ross P Buckley & Douglas W Arner, *Digital ID and AML/CDD/KYC Utilities for Financial Inclusion, Integrity and Competition*, *J. Econ. Transformation* 133 (2018); Douglas W Arner, Dirk A Zetsche, Ross P Buckley & Janos Nathan Barberis, *The identity challenge in finance: from analogue identity to digitized identification to digital KYC utilities*, *20 Eur. Bus. Org. L. Rev.* 55 (2019).

67. See <https://ventureburn.com/2019/04/ubu-startup-universal-basic-income/>

68. Cf. Alexander Bechtel, Agata Ferreira, Jonas Gross & Philipp Sandner, *The Future of Payments in a DLT-based European Economy: A Roadmap* (Dec. 18, 2020), <https://ssrn.com/abstract=3751204>; Volodymyr Babich & Gilles Hilary, *Blockchain and Other Distributed Ledger Technologies in Operations* (Nov. 19, 2018), <https://ssrn.com/abstract=3232977>

69. We are so far not aware of live interoperability frameworks. However, the joint Dunbar project by the BIS Innovation Hub and the Monetary Authority of Singapore (MAS) moves towards multi-CBDC settlement, including the exploration of a wide variety of governance, implementation, and policy issues.

70. We acknowledge that the multilateral regulatory approaches for regulating Financial Market Infrastructure established by the BIS/CPMI Principles for Financial Market Infrastructure seek to move in the direction of the ledger perspective, yet stop short of going ‘all in’. Even with regard to financial market infrastructure where regulation

clearly acknowledges the need for interoperability of many entities as a system, each entity is subject to its own rules and regulations established in its home country, and can thus meet its own compliance requirements, in principle, independent of other system participants.

71. Financial Stability Board, *supra* note 1, at 12.

72. See Zetzsche, Buckley & Arner, *supra* note 15.

73. As Aristotle said about children, and Milton Friedman adapted for the overall economy, 'when everybody owns something, nobody owns it, and nobody has a direct interest in maintaining or improving its condition.' See Milton & Rose Friedman, *Free to Choose – A Personal Statement* (Mariner Books, 1990) 24.

74. See, on the original concept, William Forster Lloyd, *Two Lectures on the Checks to Population* (Oxford University Press, 1833). The concept became widely known after being used by Garrette Hardin, *The Tragedy of the Commons*, 162 *Science* 1243 (1968).

75. See Dirk A Zetzsche, Douglas W Arner & Ross P Buckley, *Decentralized Finance (DeFi)*, 6 *J. Fin. Reg.* 172 (2020).

76. See Eddy Wymeersch, *Challenging the Prudential Supervisor: liability versus (regulatory) immunity* (Feb. 2003), <http://www.law.ugent.be/fli/wps/pdf/WP2003-03.pdf>. See also, in the context of Brexit, Matthias Lehmann & Dirk A Zetzsche, *Brexit and the Consequences for Commercial and Financial Relations between the EU and the UK*, 27 *Eur. Bus. L. Rev.* 999 (2016), paragraph II.A.

77. Cf. *The Conflicts of Laws*, JHC. Morris (ED.) (2005), chapters 1-5; Peter Hay, *Conflict of Laws* (2018) and *The Conflict of Laws*, Arian Briggs (Ed.) (2019).

78. Committee on Payments and Market Infrastructure, *supra* note 37, at 16.

79. Financial Stability Board, *supra* note 1, at 12.

80. Dirk Andreas Zetzsche, Douglas W Arner & Ross P Buckley, *Decentralized Finance (DeFi)*, 6 *Journal of Financial Regulation* 172 (2020).

81. See Douglas W Arner, Ross P Buckley, Thomas Lammer, Dirk A Zetzsche & Sangita Gazi, *Building Regional Payment Systems: Towards a Single Rule Book* (2022, forthcoming)..

82. For instance, in the case of the EU where 27 countries of different sizes are tied together under one uniform payment regulation and a payments law directive harmonizing private law, consumers and PSPs benefit from huge costs reductions and depth of crossborder services retained through the European Passport for payment institutions – the most intense form of substituted compliance.

83. While, in principle, a plan of operations is in line with the governance agreement required by Principle 2 of the CPMI-IOSCO Principles for Financial Market Infrastructures, its content and nature may go beyond what is set out in Principle 2. Cf. Principle 2 of the CPMI Principles for Financial Market Infrastructures requires that ‘[a]n FMI should have governance arrangements that are clear and transparent, promote the safety and efficiency of the FMI, and support the stability of the broader financial system, other relevant public interest considerations, and the objectives of relevant stakeholders.’

84. Inspired by, but modified from, Article 6 draft EU PilotR on DLT market infrastructure. See Dirk A Zetzsche & Jannik Woxholth, *The DLT Sandbox under the EU Pilot Regulation* (April 25, 2021). University of Luxembourg Law WPS 2021-001, <https://ssrn.com/abstract=3833766> (highlighting that the PilotR Proposal “foresees a regulatory sandbox approach for the European Single Market, offering firms a set of exemptions from EU financial law allowing them to test distributed ledger technologies (DLTs) in certain activities related to trading, clearing, and settlement. Besides offering room for experiment, the PilotR Proposal supports the education of EU regulators about DLTs in this context, which may come to form the basis for foundational changes to EU law”).

85. Including requirements on the fitness and properness of key staff, the requirements to act honestly, fairly and professionally with a view to the best interest of the clients, conflicts of interest rules as well as board and firm-internal governance arrangement (including lines of defence and reporting lines).

86. See eg. in the context of Article 2(a) EU Settlement Finality Directive (SFD): Phoebus Athanassiou, *Impact of Digital Innovation on the Processing of Electronic Payments and Contracting: An Overview of Legal Risks* 29-30 (October 30, 2017), <https://ssrn.com/abstract=3067222>

87. London Stock Exchange Group, *Response to ESMA Discussion Paper on The Distributed Ledger Technology Applied to Securities Markets* (Sept. 2016), 2; See Also Juan A Garay, Aggelos Kiayias & Nikos Leonardos, *The Bitcoin Backbone*

Protocol: Analysis and Applications (Aug. 14, 2020), <https://eprint.iacr.org/2014/765.pdf>, 4-5; and Randy Sams, *Bitcoin Blockchain for Distributed Clearing: A Critical Assessment*, 4 *Capco Institute J. Fin. Transformation* 39, 44 (2015) 4, 39-46, at 44.

88. See Athanassiou, *supra* note 81, at 29-30. For that purpose existing legislation for securities settlement mandates that a CSD or another system participant will assume responsibility for the irrevocability of the transactions. A similar argument applies to crossborder payments with the need to determine the point in time where the accounts of the banks involved are matched and thus settled.

89. For a similar proposal, see CPMI-IOSCO consultative report *Application of the Principles for Financial Market Infrastructures* (Oct 2021), at 13 et seq

90. Zetsche, Arner & Buckley, *supra* note 71.

91. See CPMI-IOSCO *Principles For Financial Market Infrastructures (PFMI)* (APRIL 2012), at 133, Responsibility E.

92. See Ross P Buckley, Douglas W Arner, Dirk A Zetsche & Eriks Selga, *Special Feature: Techrisk*, *Singapore J. Legal St.* 35 (Mar. 2020).

93. Committee on Payments and Market Infrastructure, *supra* note 37, at 3.3.4, p. 17.

94. See Regulation (EU) 2015/847 of the European Parliament and of the Council of 20 May 2015 on information accompanying transfers of funds and repealing Regulation (EC) No 1781/2006, Art. (5) 'payment service provider' means the categories of payment service provider referred to in Article 1(1) of Directive 2007/64/EC, natural or legal persons benefiting from a waiver pursuant to Article 26 thereof and legal persons benefiting from a waiver pursuant to Article 9 of Directive 2009/110/EC of the European Parliament and of the Council, providing transfer of funds services; (6) 'intermediary payment service provider' means a payment service provider that is not the payment service provider of the payer or of the payee and that receives and transmits a transfer of funds on behalf of the payment service provider of the payer or of the payee or of another intermediary payment service provider.

95. See Committee on Payments and Market Infrastructures, *supra* note 37, at 3.3.5, p. 17; Finck, Ref.

96. Pursuant to Art. 4 (7) GDPR: 'controller' means the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data; where the purposes and means of such processing are determined by Union or Member State law, the controller or the specific criteria for its nomination may be provided for by Union or Member State law; Pursuant to Art. 4 (8) GDPR 'processor' means a natural or legal person, public authority, agency or other body which processes personal data on behalf of the controller.

97. Australian Entities and the EU General Data Protection Regulation (GDPR) (JUNE 8, 2018), <https://www.oaic.gov.au/privacy/guidance-and-advice/australian-entities-and-the-eu-general-data-protection-regulation/>. A general comparison is also available at <https://insights.comforte.com/12-countries-with-gdpr-like-data-privacy-laws>. Cf. Elizabeth Englezos, *A new world standard?: Why Australian businesses should be ensuring their compliance with the EU 'general data protection regulation'*, 115 *Intellectual Property Forum* 39 (2019).

98. See also Elizabeth Englezos, *A new world standard?: Why Australian businesses should be ensuring their compliance with the EU 'general data protection regulation'*, 115 *Intellectual Property Forum* 39 (2019) and Charlie George, *Privacy predicaments: How the new EU General Data Protection Regulation (GDPR) affects Australian companies*, Mondaq Business Briefing (June 8, 2018).

99. For that purpose, lessons may be learned from the development of harmonized sanctioning in EU financial services law: the first step of harmonizing sanctions comprises defining conduct that is deemed a violation. As second step, regulators could agree on criteria for sanction severity, such as transaction volumes, size of the intermediary etc. The last step comprises a harmonized catalogue of minimum sanctions; yet we acknowledge the difficulty to agree on such catalogue in the absence of harmonized economic parameters and accompanying private law, as sanctions imposed by regulators are often supplemented by private law suits.

100. For our proposal we take inspiration from a similar approach in payment laws. See for instance Article 52 of Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market ('PSD2').

101. Our proposal is inspired by Article 6 IV lit. d) and e) of Regulation (EC) No. 593/2008 of the European Parliament and of the Council of 17 June 2008 on the law applicable to contractual obligations (Rome I), providing specialised conflict of law rules for multilateral trading platforms.

102. See Matthias Lehmann, *Who Owns Bitcoin? Private Law Facing the Blockchain*, 21 *Minn. J.L. Sci. & Tech.* 93, 124-7 (2019).

103. See, for instance, Regulation (EU) 2015/848 of the European Parliament and of the Council of 20 May 2015 on insolvency proceedings, OJ L 141, 5.6.2015, 19. 111, at Article 7(1).

104. See Articles 1 (2) and 12 of Regulation (EU) 2015/848 of the European Parliament and of the Council of 20 May 2015 on insolvency proceedings, *supra* note 113.

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The perils of unilateralism

www.worldcommercereview.com

Simon Evenett and Johannes Fritz consider the latest research and find that commercial policies and regulations now fragment the digital economy

The last inventory of digital economy policies was published in 2018. Since then, officials have gone into overdrive, acting unilaterally to regulate and to promote digital activities. Drawing upon an up-to-date inventory of over 15,000 state acts, a [new report](#) assesses whether unilaterally determined policy is fragmenting the digital economy along national and regional lines.

As ever-more-pervasive digital technologies rewire our societies, governments are adopting different approaches to regulate and, in some cases, to promote the digital domain (Global Commission on Internet Governance 2016, O'Hara and Hall 2018, UNCTAD 2021). While governments have taken some joint approaches (Nemoto and Lopez Gonzalez 2021, TAPED 2022), most policy intervention has been unilateral, has not been aligned with trading partners, and often has not been aligned internally either (that is, policy was developed in regulatory silos).

While useful lists of policy interventions in specific regulatory domains have been assembled recently (Cory and Driscoll 2021, Ferracane and van der Marel 2021), the last comprehensive inventory of state action in the digital domain was published four years ago (ECIPE 2018). The upshot: policymakers are flying blind as they both regulate and nurture the digital domain.

This is a recipe for poor public decision-making. Policy incoherence at home can coexist with international regulatory divergence. A fragmented internet and global digital economy denies users choice, diminishes the incentives for innovation, exacerbates trade tensions between governments, and increases the risk of numerous crises.

Still, as a factual matter, where do matters stand? Using novel evidence from the Digital Policy Alert and the Global Trade Alert independent policy monitoring initiatives, a new report assesses whether policy choices are fragmenting the global digital economy (Evenett and Fritz 2022).

The notion of digital fragmentation and the role of policy and regulation

The negative connotation attached to the term 'fragmentation' may be unfamiliar to some trade economists. For them, fragmentation refers to the slicing up of production processes into multiple stages located in different economies, thus resulting in international or global value chains.

In the digital domain, fragmentation refers to the form and consequences of policies that decouple national markets from global markets or that prevent the crossborder deployment of data or digital technologies.

Motivated by statements from experts and businesspeople, Drake *et al* (2016) describe digital fragmentation of the digital economy as *"the internet [being] in some danger of splintering or breaking up into loosely coupled islands of connectivity."*

Since this is a global challenge, ways must be found to engage expertise and officials from developing countries in deliberation and norm formation

Our report focuses on fragmentation risk for the digital economy stemming from commercial policy and regulation choice. Besides outright discriminatory policy choice, fragmentation may occur because of national differences in regulatory approaches to the same digital activity.

Such regulatory heterogeneity arises when (a) when some countries do not have a law widely regarded as necessary to regulate the digital domain, or (b) when there is a material difference across jurisdictions between the legal provisions associated with a particular class of law governing the digital domain.

Filling the evidence gap

We adopt a comprehensive view of the policies affecting the digital domain and their crossborder repercussions. A whole-of-supply-chain approach is taken, considering those policy decisions affecting upstream activities that support the digital economy (eg. the mining of Rare Earths), midstream activities (eg. developments in the critical semiconductor sector and in hardware and software), and downstream activities (eg. platform businesses and digital delivery to customers).

Drawing upon two extensive inventories of public policy intervention – the Digital Policy Alert and the Global Trade Alert – we delineate the global policy landscape towards the digital domain with a focus on the G20 nations and members of the EU.

Evidence on legal and regulatory developments – such as those relating to the governance of data, content moderation, and differential taxation – is presented along with information on resort to trade and investment policy changes and subsidy policies so as to provide a comprehensive perspective. Information on over 15,000 policy and regulatory developments was used to compile this report.

Contours of a highly active, increasingly heterogenous policy landscape

The principal findings are:

1. Governments have gone into regulatory overdrive in digital sectors since the start of 2020.

- Together, European and G20 governments took 1,731 legal and regulatory steps since the start of 2020. Fifty-five percent of those steps have already translated into state action; 41% are in the pipeline.
- The three most active regulatory areas are data governance, online content moderation, and competition law enforcement.
- Resort to regulation is accelerating. The first quarter of 2020 saw 71 regulatory developments; the first quarter of 2022 saw 217.

2. Regulatory heterogeneity is growing, posing an ever-greater risk of digital fragmentation.

- Particular concerns arise concerning rules on the storage, use, and transfer of data, with China, the EU, India, Russia, and the US going off in different directions.
- Divergent regulatory approaches to online content moderation – including demands to takedown material posted on the internet – are emerging.

3. Commercial policy developments over the past decade have erected more and more barriers between national digital sectors.

- A third of global trade in digital economy goods currently faces market access barriers.
- During the last decade, digital economy sectors saw twice as much discrimination against foreign firms than world goods trade overall, as measured by the ratio of discriminatory to reforms measures implemented.

4. Subsidy races are breaking out in the digital economy, most notably in the semiconductor sector.

- Looking across sectors, states tend to substitute digital trade barriers for subsidies. Consolidation of public finances after COVID-19 is likely to result in more digital fragmentation as governments resort more to trade and investment barriers.

5. With no global playbook to guide policymakers and regulators, burgeoning unilateral state action in the digital domain remains uncoordinated, stokes trade tensions on topics from corporate taxation through to competition law enforcement, and chills crossborder corporate deployment of digital technologies.

Fragmentation is not inevitable: the way forward

Digital fragmentation is already happening – that much is clear from the resort to trade and investment barriers documented in our report.

Strictly speaking, the thousands of subsidies lavished on firms in sectors associated with the digital economy do not fragment markets. However, the tendency of governments to substitute between subsidies and digital trade barriers implies that fiscal retrenchment after the COVID-19 pandemic adds to the risk of further digital fragmentation.

The potential for digital fragmentation is all the greater because of the extensive pipeline of regulatory policy announcements recorded by the Digital Policy Alert. At the very minimum, careful monitoring of associated legal and regulatory developments is needed.

As rivalry between these behemoths intensifies, governments would benefit from developing some rules for the road. One risk is that divergent policy becomes a source of tensions between nations.

Another is that the benefits arising from crossborder commercial ties are thrown to the wolves in the name of geopolitics. Those crossborder ties are part of the reality facing officials as they devise approaches to shaping and promoting the digital domain.

The right to regulate the digital domain is not being questioned – rather, the concern is that, without some degree of alignment on how to design regulations and enforcement, emergent digital fragmentation will become entrenched and a heavy price will be paid. The perils of unilateral governance action are becoming clearer.

Some governments have recognised the need for greater alignment in policies towards the digital domain. When compared to the first decade of this century, the electronic commerce chapters of regional trade agreements now include more wide-ranging provisions.

Yet, those provisions do not address all of the forms of crossborder harm done by poorly conceived unilateral state action. Progress at the WTO has been patchy too – a worthwhile attempt to negotiate a plurilateral deal on electronic commerce is still in the works.

Recently, much energy had to be devoted to stopping a step backwards – namely, to counter calls to end the WTO’s Moratorium on Customs Duties on Electronic Transmissions.

Going forward, while there is a strong case for developing new multilateral understandings concerning the digital economy, progress can be made in a number of alternative groupings. For example, aligning digital policies is an important part of the work programme of the recently announced Indo-Pacific Economic Framework. It is central to the activities of the EU-US Trade and Technology Council.

Since this is a global challenge, ways must be found to engage expertise and officials from developing countries in deliberation and norm formation.

Inevitably, this will involve addressing the incentives of firms to deploy digital technologies to close the digital divide, among other pressing digital imperatives. Such deliberations should be informed by evidence on the choices and consequences of unilateral policy as well as collaborative alternatives, where much research remains to be done. ■

Simon Evenett is Professor of International Trade at the University of St Gallen and Johannes Fritz is CEO of the St Gallen Endowment for Prosperity Through Trade

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How technology is reshaping trade



Trade has always been shaped by technology. Robert Atkinson examines how digital technologies are transforming goods and services production

Trade has always been shaped by technology. As technology improved shipping and logistics, trade became cheaper and more extensive. As technology enabled production to be more sophisticated, minimum efficient size of factories got larger, and that meant companies needed to sell to broader markets. Today is no different. New technology developments has the potential to reshape trade patterns, potentially in unexpected ways.

Some, like the rise of digital goods and services promise to expand trade. Others, such as the emergence of what some call 'industry 4.0' (the integration of digital technologies into the production of goods) might actually reduce trade by making it more economical to produce more locally.

Let's start with the fact that if everything was easy to produce and with few economies of scale effects, there'd be little trade, just as there was before the first industrial revolution in Great Britain. At the most extreme level of this, every city would be self-sufficient. It would be like living on the Starship enterprise with everything coming from the replicator: *"tea, Earl Grey, hot."*

But for most industries technology went in the other direction, with massive scale effects and specialization. Consider that **92 percent** of the world's most-sophisticated semiconductors (those made at process nodes 10 nanometers (nm) or below) are manufactured on the island of Taiwan (and the remaining 8 percent in South Korea).

These are exported around the world, not just because their value to weight ratio is so high, but because there are few if any companies in other parts of the world that can even make them. Consider also that **each segment** of the global semiconductor value chain has, on average, enterprises from 25 countries involved directly, and enterprises from 23 countries in support functions.

Likewise, if automation was extremely high there would be less globalization, given how a significant share of global trade is based upon wage arbitrage, with production of lower-skill manufacturing goods often moving from high-wage to low-wage nations.

It makes economic sense for companies do this if the production process requires a significant amount of lower to mid-skilled labour. But if automation technologies improve so that companies are able to replace even more labour with machines, the advantage of producing in a low-wage nation and paying to ship the product long distances is reduced.

Since the emergence of the first industrial revolution, technology has changed trade patterns and flows. Today is no different as digital technologies transform both goods and services production

At the same time, if transportation costs are very low there would be much more trade. Indeed, the rise of the container ship and cargo containers, coupled with electronic data interchange, lowered shipping and logistic costs, leading to an expansion of global trade.

Going forward, the increase in the share of the economy that is digital—and able to be moved around the globe instantaneously and at almost no cost—is growing. This will mean an increase in the share of the economy that is traded.

Case in point, in the old days when one used a bank, all the revenue stayed in the local community and the country. Now with the rise of fintech and online banking, people can bank in cyberspace, turning what was once a local-serving industry into a globally traded one.

When it comes to recent trends, the pattern is on the side of trade contraction. As the McKinsey Global Institute [points out](#), total exports as share of GDP has fallen. Trade is still growing but the share of output moving across borders fell from 28.1 percent in 2007 to 22.5 percent in 2017.

Some of this may be due to technology forces, some to broad economic ones and still others to political ones as more and more countries focus on localization barriers to trade. It's not clear what the future trends will be.

One factor that could continue this trend is the potential increase in automation and robots. To the extent that relative factor endowments determine the international division of labour and trade, the use of robots and other automation technologies could alter the location of manufacturing of particular sorts of goods by altering their relative factor intensities.

Assuming that low-skilled human labour and the use of robots are close substitutes and that robots controlled by high-skilled workers could perform, for example, clothing production and electronics assembly more efficiently than low skilled workers, then these activities become relatively more skill- and capital-intensive.

Doing so would allow countries with a low ratio of low-skilled to high-skilled workers to reduce their labour-cost disadvantage and make labour-intensive manufacturing more competitive. This is because the rate of return of robots and other automation technology is inversely related to the cost of labour: the more expensive the labour, the more likely a firm is likely to automate.

Now instead of a company sourcing production for the North American market in a country like China or Thailand with significantly lower labour costs, the use of more advanced automation technology could make such production in the United States more cost competitive.

The result would be a decentralization of production with more production being located in the markets it is intended to serve. This could at least be true in sectors where economies of scale and minimum factory sizes are not enormous and where there is some interchangeability of products in the marketplace.

For example, imagine that robotics improve and can cost-effectively play a key role in assembling athletic shoes. With these technologies, shoe manufacturers could find it cost effective to produce shoes in high wage nations.

Couple that with the fact that such automated production if it uses flexible automation technologies could enable more customization of products, at the same cost as mass production processes using low-cost labour.

To date industrial robots have primarily been deployed in the automotive, electrical and electronics industries. By contrast, in many labour-intensive industries, such as garment-making, widespread automation is not yet suitable.

But robotics and automation technology is improving, in part enabled by better software, including artificial intelligence, so the potential for the 'robotization' of more industries is certainly possible.

Such effects may be reinforced by combining robotization with other new automation technologies, such as three-dimensional (3D) printing. The latter lowers the costs of prototyping and small volume production and could facilitate the initiation of manufacturing of new products, whose large-scale production could become economically feasible through the deployment of robots.

Indeed, additive manufacturing is becoming more common for product prototyping and some mass production, including by Ford, GE Aviation, Nike, Under Armour, and Siemens.

Some studies have [predicted](#) that once high-speed 3D-printing is mass-adopted and cheap enough, global trade may decrease by as much as 25 percent, since 3D-printing locally can substitute for more centralized production that is shipped widely across the globe.

But while 3-D printing requires less labour and reduces the need for imports and is likely to grow in importance, given the complexity of most production and the inherent limitations of additive manufacturing, it's unlikely that it will be game-changing.

But for all the talk—some might even say hype—about robots, AI and automation, it's not clear just how capable automation technology will become in the next decade.

In other words, current manufacturing systems largely enable either high-volume, low-mix output (eg. producing large quantities of the same unit; mass production) or low-volume, high-mix output (eg. producing smaller quantities of different units; batch production). The latter are often located in lower-wage nations.

But convergence of digital technologies and manufacturing increasingly enables a new production paradigm: a high-volume, high-mix approach that will enable cost-efficient production in smaller factories more evenly distributed around the globe to serve local markets.

Indeed, [Rauch, Dallasega, and Matt](#) have argued that these emerging technologies will enable more decentralized and geographically dispersed manufacturing systems. This could enable more reshoring of work now located in lower wage developing nations.

While increased and improved automation technologies could reverse the decades-long trend in offshoring of production from high-wage countries to low wage, it's not clear what the impact of digital trade—the cross-border transfer of products, services, and data over the internet—will be.

As Microsoft CEO Satya Nadella stated, we saw two years of digital transformation in 2 months. The development and now widespread use of easy-to-use network technologies like video conferencing, cloud computing, and online work management systems means companies will be even more able to and willing to distribute work geographically, including across borders.

Firms and customers can use their personal devices and the internet to find and access digital goods (like music and software) and services (like cloud storage and data analytics services), many of which complement trade in physical things (whether [manufacturing](#) or e-commerce packages).

Digital technologies have changed trade, especially by [lowering costs and enabling trade](#). Despite the popular misconception that data flows only benefit search engines and social networks, the reality is that [most industries](#) rely on cross-border data flows.

Digital technologies and data flows are particularly critical to the automotive and transport sector. As Swedish commercial vehicle manufacturer Scania's [Hakan Schildt told the *Financial Times*](#) in 2018, “[T]ransport is becoming a *data business*.”

As connected devices, data-driven insights, and advancements in AI accelerate innovation in this sector, the ability to exchange data is crucial to improving the quality and safety of vehicles and transportation systems.

In addition, health research is increasingly an international endeavour that depends on the aggregation and sharing of personal data. The ability to transfer and share health data maximizes the potential for individual researchers and life sciences firms—regardless of location—to advance scientific knowledge.

Estimating the value of transatlantic data flows and digital trade [is challenging](#). For example, approximating value by the aggregate volume of data transfers has significant limitations. The value of data depends on its content. Some data flows may be non-monetized—representing intra-company transfers that are commercially valuable, but not captured in a formal transaction.

While precise, comprehensive, and consistent measurement of the value of data and digital trade in and between the United States and EU is not yet possible, there are a range of estimates that support what we know anecdotally—that data and digital trade represent an important and fast-growing part of the global economy.

In August 2020, the US Department of Commerce's report *New Digital Economy Estimates* calculated that the digital economy accounted for 9 percent of US GDP in 2018. Traditional trade statistics capture some of the EU-US digital trade relationship, **but not all**.

The US Department of Commerce's ICT and potential-ICT based digital trade data provides the broadest, and most recent, estimate of transatlantic digital trade, which in total, was **worth \$295 billion in 2018**.

Data flows and digital products and services should be able to flow seamlessly across borders to firms and consumers situated throughout the world. Yet, countries are enacting a growing range of artificial barriers to global digital trade, including regulations on data, intellectual property, and digital platforms, to name just a few. The problem is that international trade rules have not kept pace with technological innovation to ensure these changes are used in this way.

To fully maximize the potential of free global digital trade, the world's leading digital economies need to put in place rules to protect it. Some 71 countries are trying to do this at e-commerce negotiations at the World Trade Organization.

Setting new rules on digital trade will not be easy, but there is a way forward. The United States, Japan, and their partners need to realize that they all share more in common than some of the political and trade tensions suggest and that they all stand to benefit from a deal. This most definitely applies to the EU, who is sadly absent in many digital trade debates.

The growing number of barriers that have been enacted in the last few years show that the alternative—a global internet and digital economy that is fragmented behind digital trade barriers—is a real and dangerous prospect

that will become a near certainty if the world's leading countries can't come together to put in place new, high-standard digital trade rules covering data flows.

In summary, since the emergence of the first industrial revolution, technology has changed trade patterns and flows. Today is no different as digital technologies transform both goods and services production. ■

Robert D Atkinson is President of the Information Technology and Innovation Foundation

The climate of trade

The upward trend in global trade is being compromised. Graham Bright considers the challenges to crossborder trade going forward

The British are obsessed with the blame game. Usual issues with the cost of food, electricity and gas (blaming profiteering energy companies and the Government), airport queues and cancellations (blaming COVID and non-returning staff) and disrupted channel crossings (blaming the French).

But no one can be blamed for the internationally experienced extended period of record-breaking weather, leading to wildfires, floods, loss of life and property, buckled railway tracks, airport runway damage, iPads and mobiles overheating.

Add to this the ongoing problems in world trade of rising tariffs, volume and proliferation of counterfeit goods, intellectual property theft and increasing difficulty in getting redress, and individual governments appearing more protectionist than ever.

However insular or protectionist a country may wish to be, there is no escaping globalisation, with growing interdependence of the world's economies, cultures, and populations.

But the positive trend for international trade may soon come to an end amid tightening policies and geopolitical frictions.

Dramatic rises in crossborder trade in goods and services, technology, and flows of investment, people, and information, integration of international financial markets and the coordination of financial exchange have contributed to global trade hitting a record \$7.7 trillion in first quarter of 2022.

More business is good news, but the continued upward trend for international trade may soon be compromised by tightening policies and geopolitical frictions.

Ultimately, international trade needs collaboration and friends. Especially in these times of global supply chain disruption, first caused through the COVID pandemic, then with deep implications from geopolitical influences such as the Ukraine/Russia conflict and worries of long-term dependence on China.

Finding more trusted friendly trade partners these days or 'friend-shoring' has re-emerged as a strategic policy, even endorsed by the current US administration, to spread risk through diversification, and attempting to minimise the dramatic effects of price increases and economic disruption.

Whilst we think today of trade wars creating economic restrictions to force change of policy, they have been implemented many times in the past

Free Trade Agreements

Conversely to implementing harsh tariffs, there is renewed interest in Free Trade Agreements – FTAs.

Hundreds currently exist, covering bilateral agreements with immediate neighbours, to regions, such as the Gulf Co-operation Council (GCC), to large cross-continent multilateral agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) between 11 countries, and the cross-continent AfCFTA, the world's largest trading area since the establishment of the World Trade Organization with 54 of the 55 countries of the African Union (AU).

The FTA will encourage elimination of trade barriers, provide an economic boost to smaller companies, encourage industrialisation, promote Africa as a powerhouse for alternative supply chain resources, and encourage independent financing and development.

And, further news shows good progress with India and Africa talking to engage in another FTA, namely the Comprehensive Economic Partnership, to cover solar power with clean energy, energy security, jobs to Africa, defence trade, physical and digital infrastructure, and co-creating a start-up ecosystem.

Unexpected consequences of climate change

The location and ongoing sustainability of various traditional industries may be under threat.

Take the global wine industry, with a market size of over US\$400 billion in 2020, employing almost one million people, a major attractor of seasonal labour and economic contributor to over 70 countries. Whilst Italy remains top producer, over 85% of all wines are produced by 28 countries.

Looking at the globe, traditional growing regions for wine are found between 20 and 30 degrees latitude in both the northern and southern hemispheres. However, rising temperatures are causing a significant shift as some wine regions expand and others slowly migrate or even shut down, to the point where there will be a redrawing of the world's wine regions.

I have personally witnessed temperatures of 44 degrees plus in Portugal and Spain, where entire harvests are ruined as grapes boil on the vine. But there are steps being taken to find and invest in new varieties less susceptible to heat and more resistant to rot, to meet the challenge of new regions taking advantage of favourable growing conditions.

Remarkably, England is the latest prize-winning area for white wines and Champagne, and fine wines are available from as far afield as Japan, Cuba, Ireland and Jordan.

Trade wars are not new

Whilst we think today of trade wars creating economic restrictions to force change of policy, they have been implemented many times in the past. And hard to believe previous 'wars' were fought over such goods as pasta, laptops, bananas, tea, opium, chicken and steel.

We may all recall the Boston Tea Party as one of the first trade wars in 1773, but subsequent initiatives were doomed to failure, such as the Embargo Act of 1807 where all goods from Britain were embargoed by the USA. With no other source of supply, prices rose domestically, and shortages were rife.

Another notable failure was during the 1928 Presidency of Herbert Hoover, attempting to help farmers by increasing tariffs on all agricultural products and protecting jobs from foreign competition.

The effect was devastating for the wrong reasons, as each former trading partner increased prices of staple products by 67%, making it uneconomic for the US to export and costly to import, all at the time of the Great Depression.

Tariffs were also responsible for The Chicken War of 1962, where US production methods had reduced prices, the EU raised tariffs to protect its local producers.

Imports from the US fell by 64%, so the US targeted tariffs on multiple industries, such as trucks to hit West German automakers like Volkswagen, brandy to impact French producers, and potato starch to damage Dutch potato farmers.

History shows that there were some benefits derived, across other industries. New assembly methods in the US allowed automakers to avoid automobile import tariffs, including the practice of sourcing parts from abroad and assembling them onshore to count as 'Made in America'.

Environmental effect on shipping

About 90 per cent of the world's trade is transported by ship. With rates on the increase, China's zero-COVID policy has led to a roster system for port workers, with only half working at any one time and confined to the port, while the others are off.

However, if any infection spreads through the terminals it leads to closure, causing even greater delays, with lower handling capacity and longer waiting times for vessels at their berths.

Demand has increased for certain goods like home office supplies and electronics, many of which are made in China and other manufacturing hubs in Asia. But ports like Shanghai are still operating at low capacity, hit by worker isolation through COVID with inevitable longer loading/unloading times.

This timing and manning issue has further manifest itself in revenue of shipping lines, which are making huge profits from massive demand, amid fierce competition for space on container ships.

But there is yet another factor that has recently come to play. Companies are stating their claims regarding green credentials, but unsure given current market conditions, on when and how they will fully comply and achieve their ESG goals.

One consequence is that many shipping firms are not immediately investing in newer larger vessels but using less efficient older vessels. The drawback? Complex rules on emissions may mean they have to sail slower else face penalties.

Conclusion

Finally, as we look at how the world is managing its energy, pricing and resource challenges and pledges towards zero emissions, there is a new race, namely for minerals and critical raw materials.

Wind turbines need copper, and lots of it, to move their generated electricity to substations or national grids for further distribution to houses and industry. Copper demand from green energy will grow six-fold between now and 2030 - or nine-fold if we move even faster to adopt green technologies.

The demand for mobile phones is unabating, with an exponential demand for lithium, the underlying more effective metal found in all rechargeable batteries. Again, insatiable demand for lithium could rise by a factor of 40 in the coming years.

With the worlds' major source of supply for these precious commodities found in Chile, care will be needed in managing the extraction process, its global pricing and environmental impact.

We only have ourselves to blame if demand outstrips supply to the point of total depletion and cause environmental disaster along the way. ■

Dr Graham Bright is Head – Compliance & Operations, at Euro Exim Bank



A story of tailwinds and headwinds

Aggregate supply tailwinds are turning into headwinds, raising inflationary pressures and calling for a policy reset, argues Agustín Carstens

Introduction

My remarks will reflect on aggregate supply's importance for macroeconomic stabilisation. We are used to viewing the economy mainly through the lens of aggregate demand, with supply assumed to adjust smoothly in the background. But we need a more balanced approach. Signs of fragility in supply have been ignored for too long.

Recent events have shown the dangers of doing this. Reinvigorating productivity growth and enhancing the flexibility and resilience of supply will have to play a larger role in policy debates going forward. Let me elaborate on these thoughts.

An era of supply tailwinds

In the three decades leading up to the pandemic, four criss-crossing tailwinds made aggregate supply highly responsive to shifts in aggregate demand: a relatively stable geopolitical environment, technological advances, globalisation and favourable demographics.

A relatively stable global political landscape arose around the broad consensus that free markets and cooperation would support economic growth. At an international level, this helped forge trade agreements that drew more countries into global production networks.

At a domestic level, it helped strengthen market forces through privatising state enterprises, deregulating labour, product and financial markets, and legal improvements, including more secure property rights.

Liberalised and globalised markets, in turn, disciplined policymaking, as they made it harder to deviate from prudent approaches and helped spread best practices, such as inflation targeting.

At the same time, technological advances pushed down costs, made time and physical distance less of a constraint on economic activity and thus provided the basis for a lift in global productivity¹.

Intertwined with these political and technological developments, globalisation expanded the world production frontier. Globalisation in goods and factor markets gave firms access to a larger consumer base, a wider pool of resources, access to international know-how and chances for specialisation.

The sooner policymakers recognise the need for a reset and commit to sustainable growth strategies focused on revitalising the supply side, the stronger and more resilient the global economy will be

Financial globalisation alleviated constraints. As a result, more productive capacity was brought online and opportunities for efficiency gains and cost reductions were exploited on a global scale.

Meanwhile, demographic trends were favourable. The working age share of the global population grew rapidly from 1970 onwards. In advanced economies, baby boomers injected a large cohort of workers into the job market from the 1980s.

And trade brought the previously untapped young workforces of emerging market economies into the global labour pool.

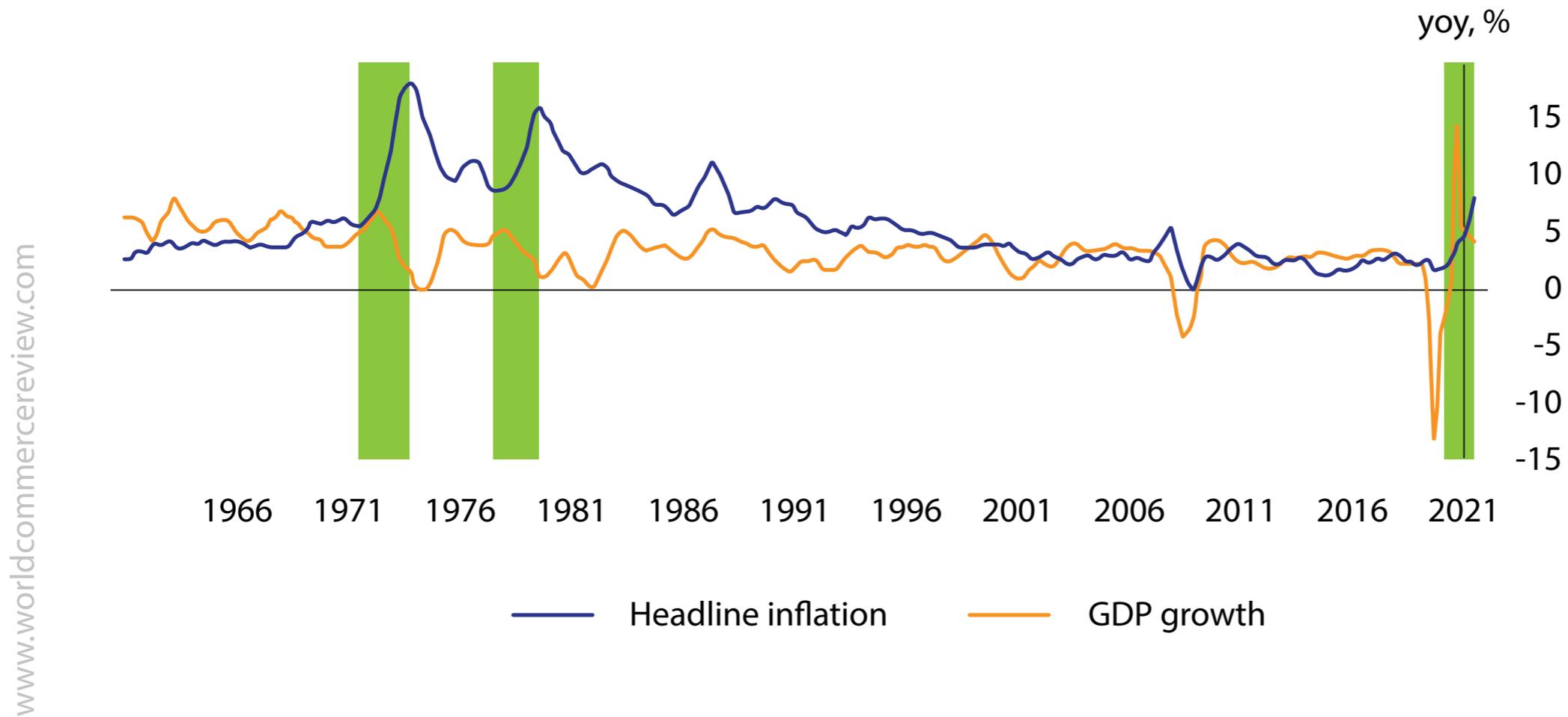
These tailwinds fostered growth alongside low inflation in several ways (Figure 1). A key one was by loosening the link between domestic economic activity and inflation (Forbes (2019)).

Access to cheaper production locations drove inflation down. More contestable domestic markets and sharper international competition weakened the pricing power of firms and bargaining power of workers. And because countries – especially advanced economies – could more easily tap global resources, domestic supply constraints became less binding.

As a result, Phillips curves flattened (Borio (2017))² and global – rather than domestic – slack increasingly became the key driver of inflation (Borio and Filardo (2007), Boissay *et al* (2021)).

At the same time, the tailwinds also made supply more responsive to changes in demand. Producers could easily access a network of worldwide suppliers. This allowed them to take advantage of the best available prices. After disruptions, supply would generally adjust quickly to new demand patterns.

Figure 1. Mostly solid growth and low inflation characterised much of the decades before COVID-19



Notes: Weighted averages based on GDP and PPP exchange rates across 10 advanced economies (AU, CA, DK, EA, GB, JP, NO, NZ, SE and US) and 11 emerging market economies (CL, CO, IN, KR, MX, MY, PH, SG, TH, TR and ZA). Green shaded areas represent persistent inflation periods, where the cumulative rise in inflation was above 5.5 percentage points. Sources: OECD; World Bank; Global Financial Data; national data; BIS.

A build-up of fragilities

The supply tailwinds produced a business cycle distinct from that seen in the post-war period. With inflation low and stable, monetary policy had less need to tighten during expansions than in the past. And in recessions, central banks were usually in a position where they could provide forceful stimulus, confident that inflation would remain under control.

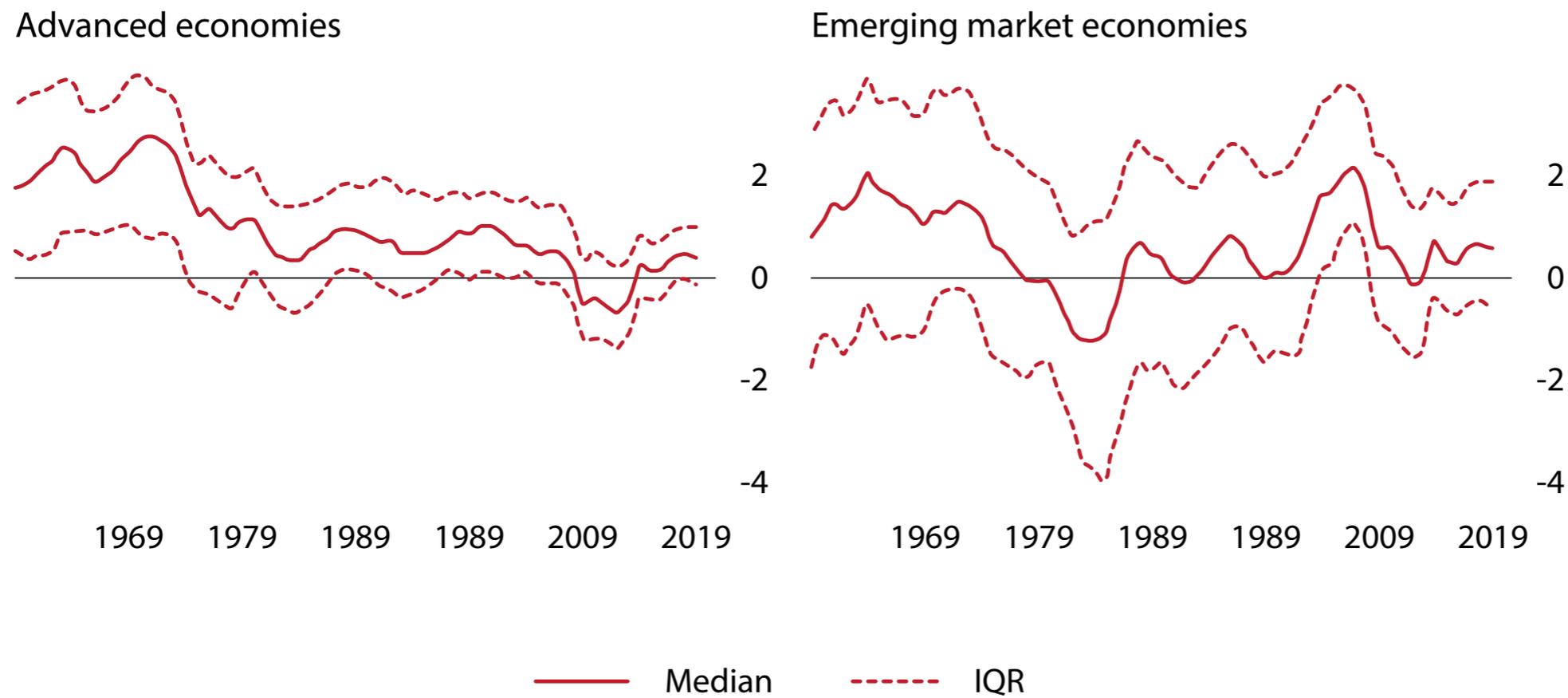
Fiscal policy also had more leeway, as nominal and real interest rates fell to their lowest levels since records began. But, even though macroeconomic conditions remained benign, fault lines emerged.

Low productivity growth was a key warning sign. In advanced economies, it plunged during the Great Financial Crisis (GFC) and never fully recovered, part of a longer decline going back at least to the late 1990s (Figure 2). In emerging market economies, the productivity boost from integration into global networks and structural reforms proved to be fleeting. The post-GFC slowdown has been the steepest and most prolonged of the past three decades.

In retrospect, some slowdown in productivity growth was probably inevitable. Liberalising reforms that improve the quality of institutions³ can deliver rapid productivity gains. But these naturally slow as countries exploit them and approach the productivity frontier. Incremental improvements in institutional quality become harder to achieve.

That said, there is no hiding the fact that the growth-enhancing structural reform drive prevalent during the 1990s and early 2000s slowed significantly in many countries (Figure 3). There are many possible explanations for this. Vested interests resist changes. And, as the benefits of structural reforms accrue only in the longer term, they usually rank low in governments' priority lists.

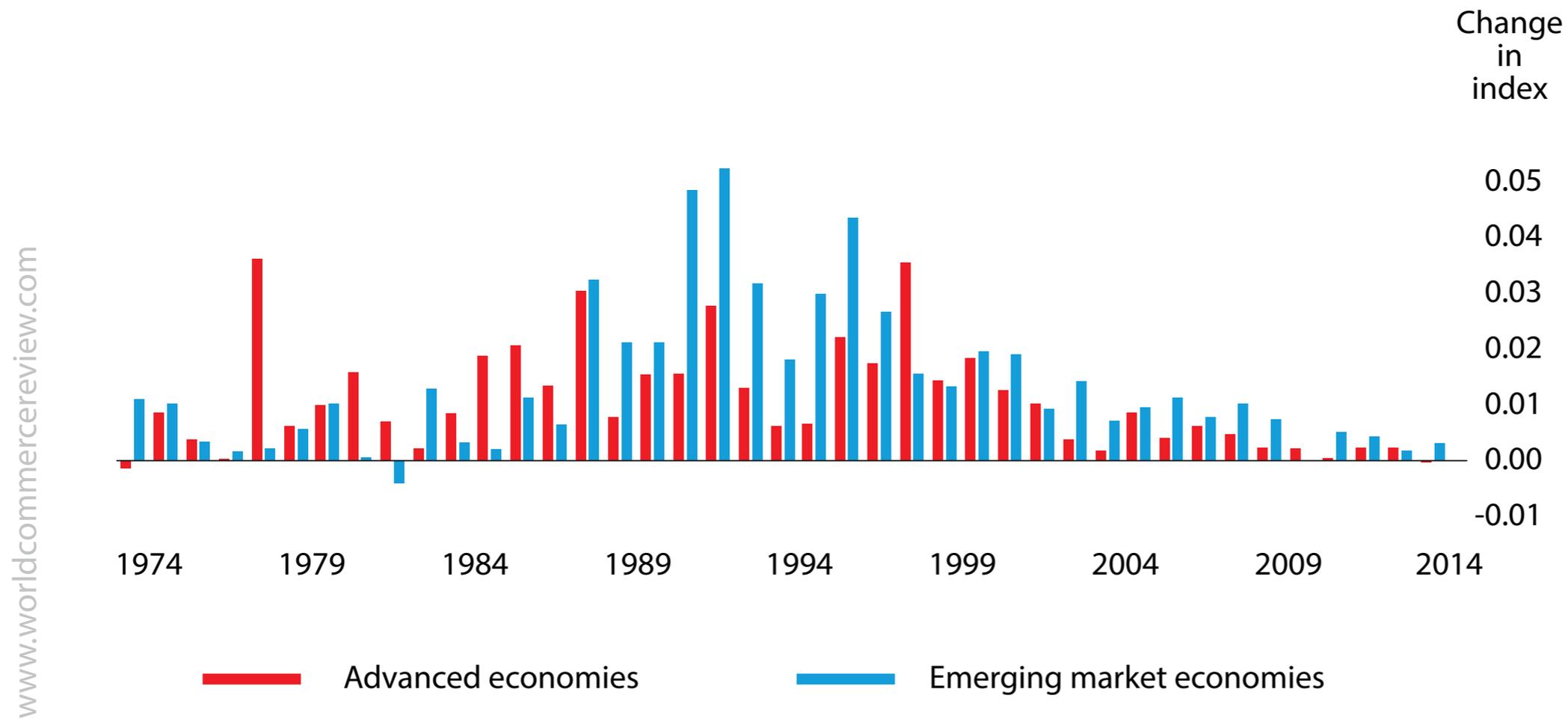
Figure 2. Productivity growth has been difficult to keep up (in per cent)



Notes: Five-year moving averages of median and interquartile ranges of year-on-year changes in total factor productivity at constant national prices. Advanced economies: AT, AU, BE, CA, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, JP, LU, MT, NL, NO, NZ, PT, SE and US; emerging market economies: AR, BR, CL, CN, CO, CZ, EE, EG, HK, HR, HU, ID, IL, IN, KR, LT, LV, MA, MX, MY, PE, PH, PL, PY, RO, RU, SA, SG, SI, SK, TH, TN, TR, UA, UY and ZA; where data are available.

Sources: Penn World Table, version 10.0; BIS.

Figure 3. Structural reforms largely stalled in the 2000s



Notes: Change in average reform index computed as the arithmetic average of indicators capturing liberalisations in five areas: domestic finance (regulation and supervision), external finance (capital account openness), trade (tariffs), product market (network industries) and labour market (job protection legislation). The index ranges from 0 to 1, with higher scores indicating greater liberalisation.

Sources: IMF, BIS.

Paradoxically, the supply side tailwinds may also have played a role. Plentiful global supply and low inflation concealed the costs of low productivity. In consequence, governments lost the appetite for technically difficult – and often politically unpopular – structural reforms. The can was kicked down the road⁴.

Missing the lift that robust productivity growth could have provided, economies had to rely on other sources of growth. Expanding financial systems provided an impetus, at least until the GFC – when the engine of growth fuelled by debt and driven by demand sputtered.

Crucially, this was not neutral for potential growth, as indicated by the break in productivity patterns I mentioned earlier. And fiscal and monetary policies were increasingly called upon to sustain output. Although obscured by acceptable growth, the constraints were increasingly visible, even before the pandemic.

Economies were becoming fragile as private and sovereign debt levels reached historical highs (Figure 4) and inequality rose. The room for policy manoeuvre was eroding, with policymakers forced to do ever more to bring economies back to trend after each downturn⁵.

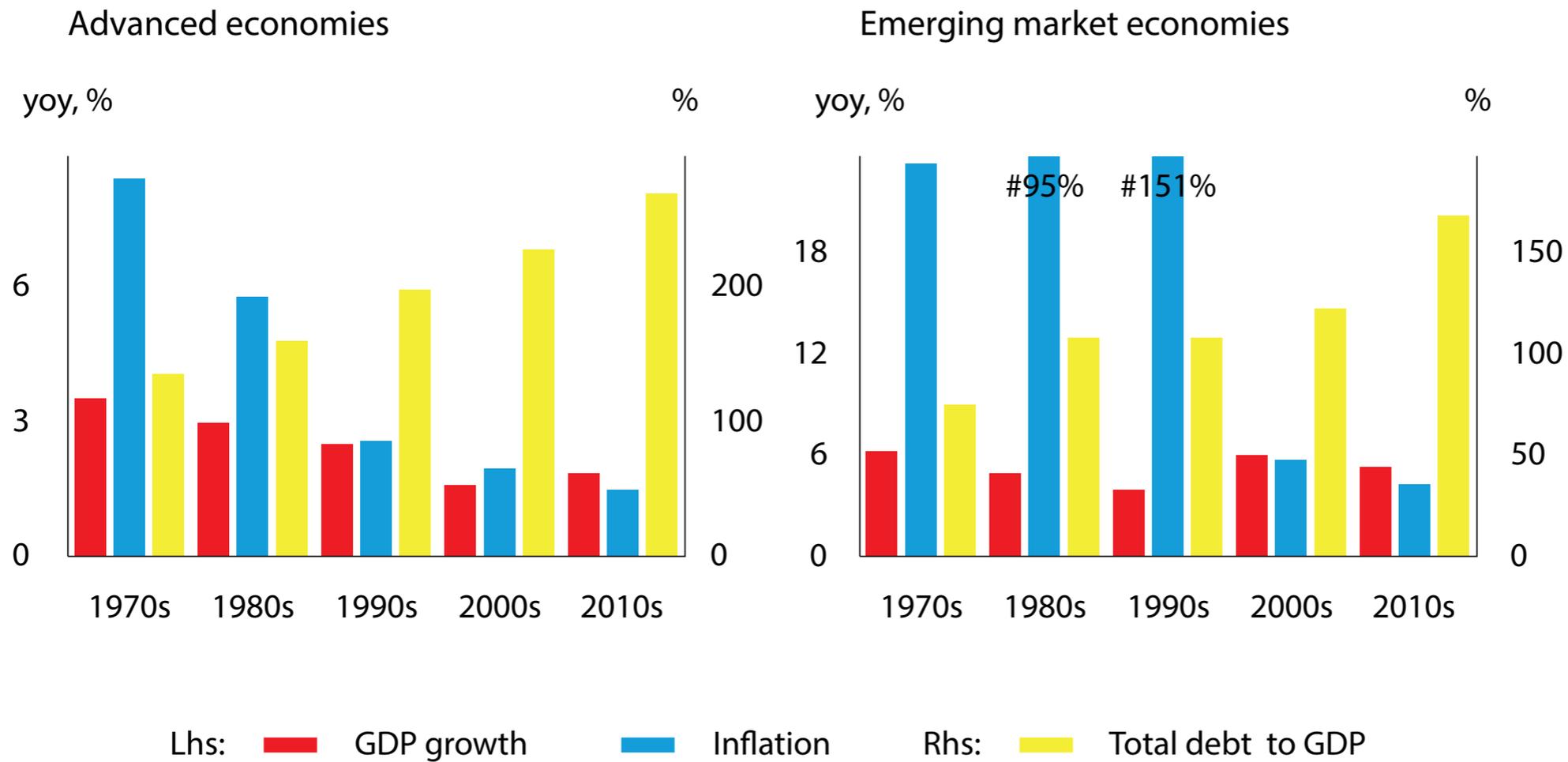
Nonetheless, with supply side tailwinds still lending support, increased reliance on demand management did not lead to higher inflation. Indeed, in many parts of the world, the key challenge for central banks on the eve of the pandemic was to bring inflation back up to target. The winds were about to change, however.

A rude awakening

The pandemic and the war in Ukraine have been a rude awakening both in an economic and humanitarian sense. To be sure, both were exceptional shocks that arose from exogenous causes.

Figure 4. Debt levels climbed as inflation came down

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Notes: Decade average of respective variables where regional aggregates are computed as weighted averages based on GDP and PPP exchange rates. Advanced economies: AU, CA, CH, DK, EA, GB, JP, NO, NZ, SE and US; emerging market economies: AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SG, TH, TR, TW and ZA; where data are available. 2 Sum of public and non-financial private sector debt. Sources: IMF; World Bank; Global Financial Data; national data; BIS.

But they painfully revealed that the supply side could only be stretched so far. This made demand side policy responses far harder to calibrate. I draw several lessons from this experience. First, to fight the pandemic it was decided to bring the global economy intentionally to an immediate standstill in mid-air. But turning on and off supply is not like turning on and off demand. With the benefit of hindsight, it was perhaps naïve to expect that it would be possible to easily reignite the growth engine, quickly recover speed and again fly smoothly. We now know better.

The second lesson is that we cannot take the availability of aggregate supply for granted. The global supply networks that adjusted smoothly to changes in aggregate demand turned out to be far less resilient than we thought. Seemingly robust supply chains broke down in the face of disruptions to a few key production inputs.

The final lesson is the sensitivity of inflation to supply constraints. Policymakers had grown accustomed to decades of ample supply, and, with no experience in calibrating stimulus to restart an engine that had been intentionally switched off, reached for their familiar demand side tools.

These had boosted growth in the past, without stoking inflation. The consequences for inflation when supply could no longer keep up caught many of us off guard.

As tailwinds turn into headwinds

Looking further out, a key challenge I see is that even if the specific supply disruptions caused by the pandemic and the war fade, the importance of supply side factors for inflation is likely to remain high.

This is because the global economy seems to be on the cusp of a historic change as many of the aggregate supply tailwinds that have kept a lid on inflation look set to turn into headwinds.

If so, the recent pickup in inflationary pressures may prove to be more persistent. Let me consider three of the forces I noted earlier: geopolitics, globalisation and demographics.

Even before the war in Ukraine, the political environment had been growing tense and less friendly to the principle of international cooperation.

This backlash reflects, in part, the course globalisation has taken: the perceived uneven distribution of benefits within and across countries and discontent with local and global governance mechanisms.

Greater inequality has given rise to populism, which has threatened the rules-based international trade and finance system, and more broadly democratic norms and institutions, including independent central banks (Goodhart and Lastra (2018), Borio (2019)). Thus, it is not surprising that globalisation has been losing steam.

Other, more structural, factors have also weighed on global trade integration. As emerging market economies converge to their richer trade counterparts, comparative advantage on the basis of wages narrows.

Advances in robotics and information and communications technology (ICT) that decrease the relative importance of labour in production processes could also favour local production and discourage global goods trade⁶.

Recent developments could accelerate this trend further. The pandemic revealed the fragility of global supply chains that prioritised cost reduction above all else.

The war in Ukraine has rattled commodity markets and threatened energy and food security. It has also accelerated the realignment of geopolitical alliances.

As a result, access to global production networks and international financial markets can no longer be taken for granted. A reconfiguration of global value chains could well follow. Some of these developments may be warranted. But we should not imagine that they will be costless.

Meanwhile, demographic tailwinds are set to reverse, and labour may not be as abundant as it used to be. The baby boomers are retiring. The pandemic may leave a persistent imprint on both the quantity and quality of workers.

Labour force participation rates remain below pre-pandemic levels in many countries, signalling a potential shift in attitudes towards work. Lost schooling and disruptions to regular healthcare services during the pandemic could scar human capital. International labour mobility also faces increasing obstacles.

Moreover, even as these tailwinds turn into headwinds, new headwinds are emerging. In particular, the threat of climate change calls for an unprecedented policy-induced reallocation of resources. And it will only intensify war-induced food and energy bottlenecks.

Increasing extreme weather events and an interconnected global food supply system raise the risk of disruptions and higher, more volatile prices, not to mention human costs⁷. Expectations of a shift away from fossil fuels have deterred investment (Meyer (2022)), threatening energy shortages before clean energy options can catch up to meet demand. This pushes up inflation.

Policies to deliver the lift needed and avoid the stall

This new and more hostile supply environment has sobering implications for economic policy. We may be approaching what in aviation is called a 'coffin corner', the delicate spot when an aircraft slows to below its stall speed and cannot generate enough lift to maintain its altitude.

It takes skilled piloting to get the aircraft back to a safer, stable place. Continuing to rely primarily on aggregate demand tools to boost growth in this environment could increase the danger, as higher and harder-to-control inflation could result.

So what needs to be done? Getting the economy back to a durable path starts with a reset to macroeconomic policymaking. As demand side policies cannot substitute for supply tailwinds, we need to be realistic about what these policies can deliver and more keenly aware of the associated costs.

When economic disturbances come from supply as well as demand, the 'divine coincidence' breaks down. In this environment, central banks cannot hope to smooth out all economic air pockets, and must instead focus first and foremost on keeping inflation low and stable (BIS (2022)). Monetary policy needs to meet the urgent challenge of dealing with the current inflation threat.

Fiscal policy should also be aware of tighter limits on what demand management policies can deliver. In a world of unforgiving supply, what fiscal stimulus adds to demand may need to be taken away by monetary policy tightening.

Scarce fiscal resources should instead be used to tackle supply constraints head on, including those imposed by climate change, ageing populations and infrastructure, through growth-friendly actions and support for broad structural reforms. Such a focus on reinvigorating growth through the supply side could also create scope to rebuild fiscal buffers.

The aim should be to create a dynamic, nimble environment encouraging innovation, enhancing resilience and supporting the required institutional, technological and ecological transitions.

Policymakers should focus on fostering investment in healthcare to better protect human capital. They should also promote investment in climate-friendly industries and all types of infrastructure, including digital.

Priority areas of action should involve competition, labour and education policies to provide and sustain the much-needed innovative impetus.

At the same time, reaping the benefits of technological innovation requires a favourable regulatory and legal environment. Efforts to make the financial system more balanced yet more innovative go hand in hand with reforms on the real side.

Sustaining international cooperation in the face of rising protectionist and populist impulses will also be important. One solution could be to promote a 'better' and more sustainable form of globalisation, rather than scaling back trade integration in a major way⁸. This would strike a balance between resilience, sustainability and efficiency⁹.

We can achieve it by giving businesses incentives to set up shorter or more diversified supply chains when the social benefit exceeds the private cost, and by leveraging new technologies to monitor and stress-test systems.

These new arrangements would also have to recognise the redistributive implications of integration and offer concrete remedies, taking to heart the lessons that not all members of society have benefited from globalised trade and finance.

Let me conclude. As any pilot will tell you, when the warning lights flash, there is a premium on timely and decisive action. The sooner policymakers recognise the need for a reset and commit to sustainable growth strategies focused on revitalising the supply side, the stronger and more resilient the global economy will be.

If we manage to do that, new tailwinds may well develop, with substantial benefits for both growth and price stability. ■

Agustín Carstens is General Manager of the Bank for International Settlements

Endnotes

- 1. Intermodal standardised freight containers, introduced in the 1950s and widely adopted over the subsequent decades, drastically lowered shipping costs and boosted international trade (Bernhofen et al (2016)). In the meantime, the information and communication technology (ICT) revolution made it easier for firms to operate on a global scale (Baldwin (2016)), while improving production processes and opening up new business opportunities.*
- 2. Globalisation also affected inflation through commodity prices. The increased importance of emerging market economies and their higher demand for raw materials meant that global commodity prices became more tightly linked to growth in emerging market economies – particularly in China. Given more volatile growth in these economies, this development contributed to sharper commodity price swings. As a result, global commodity price movements came to explain a larger share of the variance in inflation. See Forbes (2019) for more on this effect.*
- 3. These institutions include the rule of law, property rights, competition and human capital. The importance of each factor may vary across countries. For instance, in emerging market economies rule of law and property rights are key to the development of a stable financial system for intermediating domestic savings and to making the most of foreign capital to benefit supply, not least through diffusion of know-how. For advanced economies, competition, labour market and education policies are instrumental to remain on the knowledge frontier and ensure that gains from global integration and technological advances are distributed evenly.*
- 4. Meanwhile, the productivity-enhancing promise of many technological developments – particularly in the information and communications technology (ICT) sphere – has not been realised. Indeed, many new technologies such as big data and artificial intelligence seem to have favoured incumbents and further encouraged concentration, limiting the spread of productivity across the economy. Other explanations for the puzzling discrepancy between rapid ICT innovation and slow aggregate productivity growth include the arguments that the economic benefits of these new technologies are overblown, that productivity is mismeasured or that the gains will take time to emerge given the necessary investment for adoption, including training of current and prospective workers to acquire the skills needed for the digital workplace. See Mihet and Philippon (2019) for a detailed discussion.*

5. *Aggressive monetary policy easing could create conditions that make it necessary to maintain extraordinary accommodation. One possibility is the potential link between monetary policy and the natural interest rate, eg. due to the former's effect on debt (Mian et al (2021)) or because the act of policy easing leads the public to believe that the natural interest rate has declined and save more as a result (Rungcharoenkitkul and Winkler (2021)).*
6. *Conversely, technological advances could facilitate an increase in trade in services and intangibles. Such a shift away from tangibles to intangibles has already taken place in several economies and could explain some of the productivity slowdown. Bailey (2022) shows that, between 2000 and 2007 in six advanced economies, intangible-intensive industries had a more pronounced slowdown in productivity growth than tangible-intensive industries did.*
7. *The global food system involves production, transport, processing, packaging, storage and retail. It feeds the great majority of the world population and supports the livelihoods of over 1 billion people (Mbow et al (2019)).*
8. *For views on what such forms of globalisation could look like, see Rodrik (2011) and Wolf (2019).*
9. *For a discussion of the importance of resilience in promoting macroeconomic stability, see Brunnermeier (2021).*

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The West must learn to understand power politics

The belief in Western Europe is that European integration and international trade are automatic promoters of peace. Patrick van Schie says much of the world continues to think it is power that counts

The shock

The omens were clear: large-scale Russian 'exercises' without a defined end date on the Ukrainian border, troops deployed not only in Russia itself but also in its vassal state of Belarus near the Ukrainian capital Kyiv.

Even more alarming was the build-up of an excessive amount of military equipment, all in all ideally suited to the carrying out of an invasion. Add to this the denials from the Kremlin that any of this was happening.

At the same time, numerous Russian ships were arriving from other waters, including the Baltic, and converging in the Black Sea. American intelligence services predicted a Russian attack on Ukraine, but most of the government leaders in the West and countless experts dismissed the signs of jeopardy, and all expressed their shock when, on the 24th of February, Russia finally invaded Ukraine from the North, East and South.

Why were they so blind to the danger? For years, Putin had been clear on the subject. According to him, Ukraine was not a country but 'a region'; and a region that belonged to Russia at that.

Moreover, as the Kremlin had affirmed in official documents, Russia has the right to interfere in any country the population of which is partly Russian. Putin had already shown that he is willing to suit the action to the word, not least with the invasion in Georgia in 2008 and in eastern Ukraine and the Crimea in 2014. Nevertheless, at the beginning of this year most of those in the West thought that things would not turn out to be that bad.

How can this be explained? It was partly due to the kind of wishful thinking there has always been; it won't happen because we don't *want* it to happen. The prospect of catastrophe is simply too horrific. Think of the atmosphere in Europe for most of July 1914.

Not only were populations everywhere happily celebrating their holidays without a care in the world, and many Western government leaders could not imagine a large-scale war until well into July. Even halfway through the month, political leaders in London were still more actively concerned with the Irish issue than the potential consequences of the murder in Sarajevo of Franz Ferdinand, heir to the throne of the Austro-Hungarian empire.

There is also a parallel to be drawn with the recent COVID-19 pandemic. As the disaster unfolded in China, many Western governments seemed to be behaving as if their own populations possessed a natural immunity to the virus. It wasn't until mid-March that they woke up with a fright and started to panic...

Preparation for war is not an obsolete idea. The purpose of this preparation is deterrence, but also, whenever required, the defence of a truly free democracy

Many countries blindly instituted lockdowns; after all, that's what many other countries were doing. Quite simply, most governments just didn't know what else to do.

The naivety

Wishful thinking, however, is only part of the explanation. In Western Europe in particular, the belief that power politics are old-fashioned has begun to prevail. Diplomatic consultation and right are the standard, and those few countries who chose not to adhere to this line are the exceptions that confirm the rule.

Typical of this way of thinking is the statement 'Putin lives in another world' made by German chancellor Angela Merkel in 2014.

It is not Putin, however, who is living in another world; the West is living in another world. Western leaders are trying to replace power as the decisive factor in mutual relations between countries with treaties and consultation (which incidentally often hide other ways of exercising power).

The belief in Western Europe is that European integration and international trade are automatic promoters of peace. Not only is that an overly optimistic assumption in itself, assuming that – apart from the odd exception – the rest of the world feels as you do, demonstrates a failure to understanding how other people think.

Much of the world continues to think in the terms that have determined international relations for centuries: in the end, it is power that counts. The powerful parties are those who are well prepared and effectively capable of deploying their military resources.

The fact that Western leaders have failed to realise that African leaders still think along those lines is one thing, although it does present an obstruction to the effective development of such countries. Quite another and more serious is the misconception that major international players such as China and Russia cannot see their way to evading Western standards in the international political arena.

It is this very misconception that accounts for the failure to understand that the military build-up of Russia and communist states like China does not have a defensive objective per se, but constitutes, for these countries, a weighty instrument to effectively enforce their demands. Or rather, to quote Von Clausewitz, that the Chinese and Russian armed forces are instruments with which to conduct politics using other resources.

The inability – and sometimes also unwillingness – in the West to actually explore the way of thinking which prevails elsewhere also makes many parties blind to what really counts for Xi Jinping and Putin. Clearly human lives are of no account.

It must already be obvious to anyone simply from studying their criminal regimes that these dictators couldn't care less about the lives and sorrows of other people. Why should Xi Jinping or Putin care about the fate of people elsewhere when they so ruthlessly suppress their own populations?

The fact that the Russian army in Ukraine deliberately attacks so many civilian targets is indeed shocking, but it should not surprise us.

Something else which is *not* ultimately of great importance in countries like Russia and China is the economy. It is therefore an illusion to think that Xi Jinping or Putin will shy away from certain actions because trade will suffer as a result.

Not only can the Russians and Chinese transfer their trade relations from the West to other regions – there are plenty of regimes willing to fill the gap – but above all, the economy is subordinate to politics in their eyes.

For them, trade is not exclusively an economic exchange, it is also a means of acquiring political clout. Moreover, economic interaction is actively used by the regimes in Beijing and Moscow to engage in espionage and to cheat, weaken and undermine the free world using digital resources.

Loss of trade and potential damage to the economy are totally acceptable to China and Russia if they are compensated by political gain, such as an extension of the territory under their control or an enhancement of prestige in their own country.

When it comes down to the nitty-gritty of the issue, trade, and economic and cultural relations in general, also constitute a continuation of politics using other means for such countries.

Actions rather than words

In reaction to the Russian invasion of Ukraine, most of the European NATO member states finally decided it was time to raise their defence expenditure to the level to which they had committed themselves eight years ago following the Russian annexation of Crimea in 2014: viz. 2% of their GDP.

With the exception of a few countries, most European governments had remained convinced since the fall of the Berlin Wall that there could never again be a war on their continent, and so the ‘peace dividend’ of the post-Soviet era could continue to be cashed in.

In part, this boiled down to sponging on the American guarantee of safety (nothing new, because the 'burden sharing issue' had already prevailed at the time of the Cold War), but it also emanated partly from the sincere belief that Europe would, from that time, be safeguarded against a war of any significant scale.

In that context, the civil war in the former Yugoslavia was considered to be a convulsion from a past that Europe had in fact settled, for the most part.

Have the European countries now learned their lesson? The decision to substantially increase defence expenditure seems hopeful, but what really matters is whether the action will be suited to the word, and also whether it will be sustained. After all, the intention was already there in 2014, but intentions are of little value if they remain without consequences.

Moreover, the actual strengthening of Western defences is not merely a matter of money. Will the additional defence expenditure primarily be spent on higher salaries and pensions for armed forces personnel (which may definitely be necessary in some cases) or on a sufficient volume of new, effective military resources (including maintenance) and to improve operational proficiency?

It is gratifying that the Americans are expanding their military presence in Europe and that the rapid deployment force of NATO is being significantly reinforced. This also includes the storage depots in those Eastern European member states near Russia already holding military equipment that is readily available on the ground in the event of a serious crisis.

Nevertheless, this is still less than the Baltic States in particular have demanded. They are insisting on a 'forward defence', meaning the presence of sufficient troops from other NATO countries stationed on their territory as to

represent such a deterrent that a Russian invasion of Estonia, Latvia or Lithuania would be virtually unthinkable – even for Putin.

As long as NATO troops are not present in the Baltic States in far greater numbers, there is a fair chance that the Russians could conquer these states, after which the NATO response would have to be focused on regaining territory rather than defence, inevitably leading to the misery of a war waged on Baltic soil.

Thoughtlessness

In the immediate aftermath of the brutal Russian invasion of Ukraine, that country has enjoyed a huge wave of sympathy in Western Europe. This is understandable, but since then, many European governments have continued to allow their attitude towards the country to be dominated by that sentiment, which is not sensible.

Ursula von der Leyen, President of the European Commission, almost immediately offered EU membership to Ukraine. This has since been agreed by the member states, so Ukraine now has a real prospect of becoming a member of the EU.

Admittedly, candidate membership does not guarantee that Ukraine will be admitted in the near future. The question remains as to whether or not the obstacles to membership remain too high to be overcome, and whether or not the EU can stomach Ukrainian membership.

The battle between Russia and Ukraine is generally represented as a struggle between dictatorship and democracy. It is beyond any reasonable doubt that Russia has developed into a dictatorship in all respects. Then again, some very rose-tinted spectacles are required to perceive Ukraine as a full democracy.

The Democracy Index of The Economist, an objective method of classifying countries published two weeks before the invasion, denoted Ukraine as a 'hybrid' regime. This means that the country features a mixture of democratic and authoritarian characteristics.

For many, the hope is that things may well change for the better, but compared to ten years ago, Ukraine has gone in a negative direction on the Democracy Index. Added to this is the fact that the country is in 122nd position on the Transparency International's Corruption Perceptions Index, hovering between Sierra Leone and Zambia, and ranked only 14 positions above Russia itself.

Objectively, for these reasons alone Ukraine has a very long way to go before it will be able to meet the basic conditions for EU membership. Furthermore, there is no reason to assume that the direction of travel will automatically be positive. Ukraine does not have a history of democracy and good governance.

Sad though it is, the fact that the country is now at war is not going to make a move in the right direction any easier. This means that full membership will either have to wait for many decades, which will cause bitterness in Ukraine, or that the EU will have to relax its minimum conditions, as a consequence of which an unfit country could become a member. The latter option would not be to the benefit of the EU's stability.

Ukraine is a poverty-stricken country. In view of the size of the country, this will constitute a heavy additional financial burden for the EU. In this respect too, the war can only make the situation worse rather than better.

Other than that, the conflict will have to be settled before Ukraine can become a member; this will entail more than just an armistice. It is hard to imagine how a sustainable peace between Ukraine and Russia can be realised in such a way that neither one of the two parties will want to retaliate.

Bear in mind that Putin is definitely not the only one in Russia who thinks that Ukraine is not entitled to an autonomous existence.

NATO and the EU are avoiding a direct confrontation with Russia, and rightly so. Why would we risk the disaster of a nuclear war with Russia now when we failed to come to the aid of the Hungarians when they craved freedom for their country in 1956, the Czechoslovakians in 1968 and the Poles in 1980-81?

Is it fully understood what Ukrainian membership of the EU would mean in terms of security? Section 42, paragraph 7 of the EU treaty stipulates that a member state that is attacked by force of arms must be assisted by the other member states using any resources that are available to them.

In other words, once Ukraine is an EU member, any new Russian attack would mean that the entire EU was automatically at war with Russia. Are we really ready to risk an automatic world war in the future when we are not prepared to do so in the current situation?

Would the majority of EU residents go along with that? Do they realise that an EU membership for Ukraine entails this risk? Do the government leaders within the EU realise this? Or are rational politics based on national interests being superseded here by a rash sentimental gesture?

Learning lessons

The above does not mean that we must shy away from the risk of war under all circumstances. If we were to do that, we would give free reign to aggressive dictatorial regimes.

Western politicians must learn to understand the way of thinking that still prevails in large parts of the world, especially in major powers such as China and Russia.

Understanding what motivates those in power in such countries by no means implies acceptance of what they claim. Such an understanding is, however, a condition of being able to resist their claims to power.

This starts with the realisation that, for countries such as Russia and communist China, the economy is subordinate to political claims to power.

Furthermore, the 'language' that they understand best of all is that of military power. They see the Western propensity to neglect this as a weakness. They also believe that we in the West are not prepared to deploy our military power and suffer major losses.

We must demonstrate our readiness to protect fully fledged, stable liberal-democratic countries. This means credible military deterrents and – should these fail – concrete military assistance.

Obviously, this applies first and foremost to all NATO member states. The task of military defence must be taken seriously, and increasing defence expenditure to 2% of GDP is a minimum prerequisite.

Preparation for war is not an obsolete idea; it is, and will unfortunately remain, a dire necessity, even in the 21st century. The purpose of this preparation is deterrence, but also, whenever required, the defence of a truly free democracy.

Taiwan, ranked number 8 on the Democracy Index, is just such a stable liberal democracy. The country is not recognised by communist China.

China has invested substantially in the build-up of a modern military apparatus of power, and not without reason; Beijing is also using this apparatus for the systematic intimidation of Taiwan, as it has recently demonstrated with its extensive and threatening military 'exercises'.

Moreover, Xi Jinping has publicly announced that he wants to accomplish 'reunification' within one generation. We shouldn't be oblivious to these omens. Neither should we look away from the danger because we do not want to jeopardise our trade interests in communist China.

There are higher values, such as the defence – if necessary – of a stable free democracy. Taiwan is much more deserving of our full military support than is Ukraine. ■

Patrick van Schie is the Director of TeldersStichting, the Netherlands' liberal think tank