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Climate capital. Sam Woods on financial risks and climate change preparedness

Graham Bright discusses technologies that can reduce friction in international trade

Zetzsche et al consider the legal challenges to DLT-based payment systems

21ST CENTURY FINANCE

Foreword

Welcome to the Summer edition of FINANCE2I, a *World Commerce Review* supplement. This publication has been prepared in response to readership demand for an overview of the financial sector in these turbulent and unique times.

All aspects of the sector are examined, 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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Meeting the challenges

International harmony has turned to hatred, co-existence to conflict, and welfare to warfare. Graham Bright discusses technologies that can reduce friction in international trade

Over the past three months, as fear, uncertainty and doubt grip the world, we have witnessed unimaginable change with global implications, leaving us with no doubt we are experiencing the most challenging times ever in our lifetimes.

International harmony has turned to hatred, co-existence to conflict, and welfare to warfare.

As Russia continues its efforts to engulf Ukraine to take control of its Black Sea ports and highly productive fertile plains, just as history shows Napoleon advanced on Moscow two hundred years ago, scorched earth, an angry residual population and destroyed infrastructure is not a victory.

And the repercussions have had dramatic effects across the globe. From an energy perspective, the cost per barrel of oil has had a direct effect on domestic fuel prices, reaching record levels and throwing people into fuel poverty.

Political posturing influencing the supply of gas threatens access to supplies, leading western economies to review energy policy and belatedly look for more self-sufficiency. Perhaps a case of 'too little too late' as thoughts turn to fracking and non-fossil renewable energy.

Just as Oxford University has announced a radical nuclear fusion breakthrough as a possible sustainable green fuel source helping to reduce carbon and power the world, producing energy at less than the cost of production has always been the issue.

However, whilst projects start small and there is promise, it will take years to be economically viable. If we wish to be truly released from energy dependency, this is time we do not have.

For pensioners, the domestic outlook is stark, with many, caught in a real life-threatening dilemma, having to choose whether to heat or eat. Perhaps the only short-term saving grace is less demand for domestic heating as we move into the warmer months of summer.

With inflation rising at record speed and energy prices kept artificially unsustainably low in the past, the removal of the fuel cap will have direct and devastating consequences.

Effecting millions in the UK and especially those living on state pensions, subject to the removal of energy company fuel caps are already under tight financial restraints.

... we are experiencing the most challenging times ever in our lifetimes

With mortgage rises, with general cost of living expenses soaring not linked to increases in wages, we can expect mortgage defaults, more use of food banks, less food in our shops and a heavier burden on Government for financial assistance.

But staple food prices are also rising, with milk estimated to rise by 50%, a shortage of sunflower oil (mainly produced in Ukraine), shortage of foreign causal labour to work on farms, and the Government resorting to pay farmers not to produce certain crops.

With a 4x increase in fertiliser costs from £7,000 to £28,000 per load, food prices must be passed on to consumers as farmers struggle with rocketing costs for feed, fertiliser, fuel and energy, forcing up prices on supermarket shelves.

And the problems are truly global. As an example, the poor coffee harvest in Brazil caused by drought and frost and then container shortages have seen prices rise to all-time highs. Wheat prices have risen nearly 20% in March, with cooking oil, meat and cereals up and rises of 33% in food commodities.

And, with a lack of liquidity in those markets, alternative financing has become a major issue, with banks unwilling to take major positions, but happier to support funds providers and spreading the risk.

The push to reduce reliance on oil and gas, petrol and diesel cars, towards electric vehicles goes some way in resolving at least part of the energy consumption and pricing issues.

However, demand has far outstripped supply and the ongoing shortage of semiconductors and other vital components (mainly manufactured in Ukraine) means waits of up to one year for new vehicles.

With seemingly every product and service in every country experiencing supply issues and price pressure, nowhere is this more felt than in the world of international trade and logistics.

Physical container and transport costs have multiplied, leading to the bizarre situation of procurement and transport for some containers costing more than the contents. As such, trade is non-competitive, uneconomic, unreasonable, and unworkable. Little wonder that factories in high labour cost locations cannot afford to make, move, and market their goods.

And whilst in the throes of writing this article, international events are moving so fast that predicting or even imagining the short-term state of trade is more difficult than ever.

The latest disruption to supply chains concerns natural gas, with threats made to European countries such as Poland, effectively isolating them if they do not pay Russia in local currency.

As EU members scramble to find alternative supplies, including reverting to short-term re-visiting of fossil fuels such as coal and crude oil, eyes are turning to the previously untapped resources of North Africa, where connectivity and volume, principally through Egypt and Morocco, offer the prospect of sustained supply.

As another example of how energy demand has surged, there were some 30 power projects in Africa, where that number now exceeds 110, supported by new regulatory criteria, executed through public private partnerships to finance, build, and operate new facilities, providing sustainability and self-sufficiency.

In international trade, even with shrinking liquidity, there are still seeds of investment in green projects, as companies jump on the ESG bandwagon, toting their plans, but with little real action.

The key problem remains that there are critical raw materials, which do not fit the current ESG narrative that are the cornerstone of global industrial processes. To protect these precious resources, it is heartening to see the inception of initiatives such as the CRM Alliance in an awareness raising advocacy role in the EU identifying the 30 materials potentially at risk.

The viability of global industries such as medical, electronics, steel, aviation, and defence, is almost exclusively based around critical materials, which include tungsten, 17 elements comprising heavy rare earths (HREE), bauxite, lithium, and titanium, vital in joint replacements in the health industry.

Whilst not defined as being scarce, their characteristics include being high supply risk due to where they are found and levels of concentration, lack of viable alternatives and the unabating demand from western economies for their domestic manufacturing processes.

Where these resources are sourced, how they are extracted, transported, costed, consumed, re-used, and contribute to ESG policy will be an increasing issue for investors wishing to receive either penalty or reward for sustainability as countries strive to be competitive, green and digital.

The challenge now is for companies not only to identify which products meet standards from a local perspective but to have complete oversight on responsible sourcing and labour at each stage of the manufacturing and supply process, right back to the factory or farm.

Regarding automating and going more digital, it is estimated that there are four billion paper documents in the ecosystem of trade. Many small SME's and global corporates struggle with inadequate systems and controls, access to liquidity, sparce industry knowledge, cost of US dollars, fraud, corruption, and transport difficulties.

As we prepare to meet the dynamic challenges in the geopolitical and trade spheres, the MLETR, the Model Law on Electronic Transferable Records will, according to International Chamber of Commerce estimates indicate that digitising trade documents could generate £25 billion in economic growth by 2024, and savings of £224 billion.

The solutions are here with a plethora of fintech companies and alternative finance providers offering funds, machine learning, artificial intelligence, blockchain enabled toolkits and applications, the financing and technology is available today.

Moving forward, and organisationally ready to support these new, exciting initiatives, we are using the latest tools and are well positioned to reduce friction in transaction flows, reduce fraud, and improve delivery and trust. ■

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Is the dismal science back?

Daniel Dăianu looks at the role of economics in society and says miracles are not possible, and economics cannot be seen as alchemy

I had qualms about using the expression dismal science to portray economics; this term goes back to the XIX century, in controversial writings by Thomas Carlyle and in Thomas Malthus' thoughts on the scarcity of natural resources facing population dynamics – which is a theme resuscitated by the Club of Rome about half a century ago.

My reservations originated in a fear that this 'dark' qualification would be exceedingly pessimistic, that it is not appropriate to compare the current scientific-technological era with the age when a multifaceted industrial revolution was underway in Great Britain; that the society described by Charles Dickens' gloomy novels is not to be compared with the modern world, that brought many hundreds of millions of people out of abject poverty outside Europe and North America.

On the other hand, feelings and aspirations, joys and apprehensions have roots in people's actual lives, in their social, economic and cultural ties, in the ways in which public authorities cater for basic public needs – with the latter originating in concrete situations.

At the same time, up-to-date technologies do not enhance livelihoods of all individuals automatically. For instance, smart phones do not enable access to civilization, to equal chances for everybody. And such examples are plenty of in our world.

Economics cannot be a factotum…

What has occurred in various domains, in recent decades, can easily induce the perception of economics as a dismal science – as an interpretation of the ways economies/societies evolve and in a normative sense. It pays to remind in this respect the famous Queen Elizabeth II's observation that economists were not capable to anticipate the global financial debacle.

Pieces of bad news keep bumping into us, although not a few individuals enjoy the use of products and services that define modernity and attempt to live normal lives in spite of bad events; cultural life is ever richer, sport events go on despite organizational blows (as was the case during the pandemic), people travel worldwide even when restrictions are tightened, TV channels and other media outlets provide all kind of entertainment.

We are living a very difficult period of time and crises have become almost a constant parameter in our lives; this means that public governance will likely be an exercise of crisis management of long duration, with a derived objective of increasing systems' robustness and resilience

And what matters most, big and small goodies are part and parcel of family lives, as are big and minor disappointments. At the same time, the new industrial revolution, seems to have gone into a shady area in public debate and is not seen as an all-round problem solver.

But it is foolish to blame economics for all that is bad in our world, for natural calamities and ugly things that are not related to Man's action. Similarly wrong is to frown at economics when blatantly mistaken policies are undertaken, or when inter-ethnic and religious conflicts erupt, or military disputes cause havoc.

It is fair to admit however, that economics is not a hard science, be it seen as the queen of social sciences. In addition, since its very inception, economics was filled in with conflicting ideas, controversies.

But it is not difficult to point the finger at bad management practices, which can be entailed, inter alia, by ignoring hard scientific data (rejectionists of COVID-19 and of climate change are clear examples in this regard).

And most of all, one-sided economic ideas, paradigms that prevail in certain periods of time, can undergird poorly defined policies and cause widespread pain. This did happen, for instance, with the *light touch regulation* of financial markets, a blind, driven by vested interests and misconceived ideas, deregulation waves. That *boom-and-bust* cycles accompany the history of finance is no excuse for encouraging and amplifying financial crises via bad policies.

An age of huge shocks, of tail events…

The global financial crisis (The Great Recession), the pandemic, the energy price shock, climate change and, not least , the invasion of Ukraine by Russia have caused havoc in the global economy; these shocks show up in a persistent high inflation (with levels unseen in the past four decades), a fragile post-pandemic economic recovery, lasting supply side bottlenecks (that fuel inflation), regionalization of trade and economic flows that

raise production costs, security and geopolitical motives that increasingly shape policy decisions and influence economies.

The globalization crisis started years ago, well before the eruption of the COVID-19 and the war in Ukraine. Thomas Friedman's *The World is Flat* proved to be a naïve thought experiment, as were other hastened interpretations of the world – like Francis Fukuyama's *End of History*.

China's economic rise in the past decades has made the world economy bipolar (some would say multipolar, if the EU is considered as a cohesive pole). The USA have seen their industrial and technological supremacy menaced by China's steady and fast industrial ascension.

Likewise, during all these decades, fractures and divides have deepened, broadened, in the social and economic fabric of developed societies, and a confrontation between liberal democracy and illiberal/autocratic forms of political governance has gathered pace.

The war in Ukraine has rallied democratic societies together in a confrontation that is ushering in, quite likely, a new Cold War in Europe and other regions of the world; the tendency to end up with several blocs in the global economy will probably accentuate.

Janet Yellen, the US Treasury secretary, talked about a new Bretton Woods, that should be based on democratic, liberal values[1]; this would drive further the global economy in the direction of a geopolitical divide. Implications will be manifold and wide-ranging. There is already talk about the erosion of the *peace dividend* (the share of defence expenses in GDP), that was an outcome of the end of the second world war and, later on, of the fall of the Berlin

Wall. The inference is that public budgets will assign more resources for military expenditure and Europeans will no longer be free-riders (related to the USA), in this regard, within NATO.

Economies will get more of the traits of 'war economies', be these features more or less camouflaged. Not a few EU member states have already announced significant rises in defence expenditure and the NGEU (The European Plan) will quite likely be adapted in view of the new geopolitical an energy context.

Why GDP increases do not influence many ordinary citizens' living standards positively

There is a legitimate question: why so many ordinary citizens do not sense an improvement of their lives when GDP goes up in real terms – as was the case before the pandemic struck and when the recovery started afterwards?

For many individuals, economics appears as a discipline that comes constantly with pieces of bad news, as a dismal science, whose 'sermons' are to be related to various policies.

For instance, rising inflation, diminished real incomes, energy price shocks, etc. weaken the public discourse on economic recovery, or economic growth. There is here a 'Putin effect' too, the multiple implications of the war in Ukraine. But the analysis has to go more deeply.

Several observations could help elucidate the question raised above; some of them predate 2008, the year when the financial crisis erupted:

- Climate change shows up in a rising number of extreme events, that demand governments to step in in order to limit damage; this public intervention means that resources have to be diverted from other uses and, consequently, public budgets get strained.

- The global financial crisis has had lasting effects, among which higher public and private debts. This higher level of indebtedness has been further heightened by the pandemic. And, currently, a tightening of monetary policies for containing high inflation points the finger at a 'debt trap', that creates big headaches to central bankers and governments.

- Distributional effects that relate to a thinning of the middle class in many advanced societies and to rising inequality.

- Market abuse by big companies, tax evasion and tax avoidance weaken public budgets and foster social resentment. Thence a rising public demand emerged for policies that should enhance fairness in society.

- The energy price shock means essentially a rise in the relative price of energy. This rise is, basically, a higher price of life essentials for most citizens. Winners in the global economy are only countries that export energy massively, which are net exporters.

- The situation gets more complicated if key commodities are factored in; the food crisis (epitomized by the surge of prices for grains) is very telling in this regard. Food as well as key industrial commodities can be, are, weaponized.

- De-globalization itself sustains a rise in prices as a reflection of switching costs and higher productions costs.

- Non-conventional systemic risks, among which cyber risks have prominence, proliferate; threats posed by cryptoassets should be highlighted.

- For emerging economies that have large deficits and debts, their inherent fragility is more visible once big central banks tighten monetary conditions.

- Adverse shocks dent potential GDP, as well as potential economic growth. Climate change has to be mentioned in this respect for its major effects.

- In spite of its extolled virtues, artificial intelligence has deleterious effects too: it can 'get out of control' unless properly monitored/used, and it can cause massive labour dislocation, that harms social stability.

- Statistics, as a scientific method, is unclear when measuring welfare and income distribution. This explains why GDP is often seen as a misleading indicator unless other social and economic benchmarks are counted for.

Economic policy faces numerous trade-offs and choices can be quite painful - a spectre of stagflation again

Economic policies are often overwhelmed by shocks and the complexity of conflicting goals, with hardly adequate, optimal, solutions in sight. It is not surprising, therefore, why politicians are reluctant to say it loudly, clearly.

The reason is obvious: they are supposed to solve problems, not to look powerless. In addition, they have to inspire people, even under dire circumstances, they need to find ways out of difficulties and exude trust. It should be said that even when good things can be done these may be obscured by overall circumstances –as in the case of de facto 'war economies', or states of acute emergency.

In deep crises policy choices are often of the sort bad vs. even worse. This is the context that explains quantitative easing (QE) programs adopted by various central banks.

Likewise, reforms of finance, which was derailed by deregulation waves and a plethora of toxic products, neglect of systemic risks and excessive leverage, have to be judged from this perspective as well.

The pandemic has led to a suspension of fiscal rules in the EU in order to avert a collapse of economies, but the flipside is a rise in public debts and budget deficits. And the rise in debts is quite worrisome in view of monetary policy tightening. Higher inflation can ease the impact of higher expenditure for a while, but is not a solution for the long haul.

Currently, central banks are asked to defeat high inflation. But this is mission impossible as a short run endeavour. Those who ask for positive real policy rates by tomorrow sound out of touch with reality. Imagine what would be the effect of the Fed and the ECB raising their key rates to over 8-9% abruptly.

As sensible opinions say, policy rates need to reach levels above longer-term inflation expectations, above neutral rates. Moreover, the ECB is entitled to fear a new fragmentation shock were its policy rates go up brutally. It should be said, however, that major central banks seem to have been behind the curve for quite a while; they have underestimated the impact of supply side ruptures that were entailed by the pandemic and the energy crisis.

The transience of high inflation has proved more of a wishful thinking exercise, although central bankers had motives to fear squeezing economies at a time when the recovery was still pretty fragile. And the war in Ukraine caused additional enormous damage.

The current inflation shock is very much due to supply side ruptures. If a simplistic monetarist thinking would be applied, inflation would have had to be much higher than current numbers indicate; just think that base money in the US rose from c. $840 billion in June 2008 to above $6 trillion in early 2022.

Even now, when high inflation is a rising concern, the massive increase of base money (cash and reserves of commercial banks held at the Fed) is accompanied by a high liquidity preference - which means that money velocity went down dramatically, one cause being *sudden stops* in various segments of financial markets, which turned the Fed and other central banks in *market makers*.

However, the Fed could have been more cautious in view of big fiscal stimuli. Big rises in base money can be noticed in the balance-sheets of the BoE, ECB and other central banks.

In economics one meets a *misery index*, that brings together inflation and unemployment. This index can be used to estimate pain thresholds (trade-offs) when, for example, defeating inflation would cause recession, a *hard landing* - as it did happen in the US following the oil price shocks several decades ago.

A tandem of high inflation and economic stagnation/recession is a big headache for central banks and governments. Real world is made up of multiple equilibria, and some of them can be pretty precarious.

Magic solutions do not exist as the causes of the current very serious situation are, apart from the impact of the Ukraine war, more or less structural.

These causes have accumulated over time and originate in an asymmetry between market entry and exit, with a suboptimal allocation of resources, pro-cyclical policies, neglect of structural policies in the belief that markets always know best and their functioning is smooth, the overlooking of climate change, unmanaged globalization, etc. The war in Ukraine and its widespread implications exacerbate dilemmas and policy trade-offs.

An unprecedented situation

The sequence of major shocks (crises) is unprecedented after the second world war, and it is going to test social and economic stability in many countries very severely for many years to come.

Where inclusion, fairness, solidarity, transparency, sound public finance and the rule of law are better entrenched, where market abuse is less frequent, odds are higher that this period of time (that may be lasting) would cause less damage.

As public policy choices are concerned, it is reasonable to posit that extreme alternatives are not adequate: an individualist focus in which society does not matter vs. a centralizing/administrative approach that opts for an overriding state presence in the economy. It is true that in very hard times (like in the pandemic) more public intervention is asked for in order to secure key public goods and avoid social disintegration, chaos.

However, no less important is the need to protect values that define a democratic society and rules that enable a market economy to function, that stimulate innovation and foster entrepreneurship. But it is not easy to optimize and calibrate policies.

Concrete measures must fit concrete situations, even when lessons are spread around and governments learn from each other. These measures hinge on the functioning of societies, and in democracies, they cannot be introduced discretionarily on a permanent basis. Wherever societies are more divided, deep tensions develop and have nasty political implications.

Final remarks

Economics helps public policy by rationality algorithms/rules and procedures provided it does not succumb to fundamentalism and oversimplifications. Learning by doing also helps.

We are living a very difficult period of time and crises have become almost a constant parameter in our lives; this means that public governance will likely be an exercise of crisis management of long duration, with a derived objective of increasing systems' robustness and resilience.

Miracles are not possible, and economists need more than ever to be humble and intellectually honest in their prescriptions. Economics cannot be alchemy.

Economics and economic practice have their own cycles, they do/can learn from new data and failed policies, interrelate with ideas that percolate throughout our societies; these cycles depend on and influence social and economic dynamics, while pessimism can coexist, or alternate with optimism in the social and cultural ethos, and define a zeitgeist. ■

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Endnote

1. She said it just before the Spring meetings of the IMF and World Bank of April 2022

DLT-based enhancement of crossborder payment efficiency

Dirk Zetzsche, 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 transparency[1], and enhanced crossborder payment services would provide widespread benefits for citizens and economies worldwide, supporting economic growth, international trade, global development and financial inclusion[2].

Distributed Ledger Technologies (DLT) have been proposed[3], critically discussed[4] and even tested by some central banks[5] and private entities[6] as technologies that could increase crossborder payments efficiency and financial inclusion[7].

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 standards[8].

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 chain[9].

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 aggregation[10].

Further, a DLT-reduction of payment costs could enhance financial inclusion and address the issue of pricy remittance transfers[11].

Despite the wide-ranging interest in DLT-based payments, the analysis to date has dealt with technical concepts and lacked legal detail[12]. 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 risk[13]) 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 system[14].

- 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 payments[15] 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 IMF[16] 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) payments[17].

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 ledger[19]. 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 providers[20].

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 lost[21].

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 losses[22].

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 x e rather than 1 x e.

The distributed ledgers of today are usually paired with a blockchain protocol[23]. 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 parties[24]. 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 transparency[25].

(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 transactions[28] (ie. where fewer correspondent banks (if any) are active and legal matters non-standard and/or unknown).

(2) As for lack of speed[29], 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 involved[30]. Central banks, applying the 2020 IMF Transparency Code[31], 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 interest[32].

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.

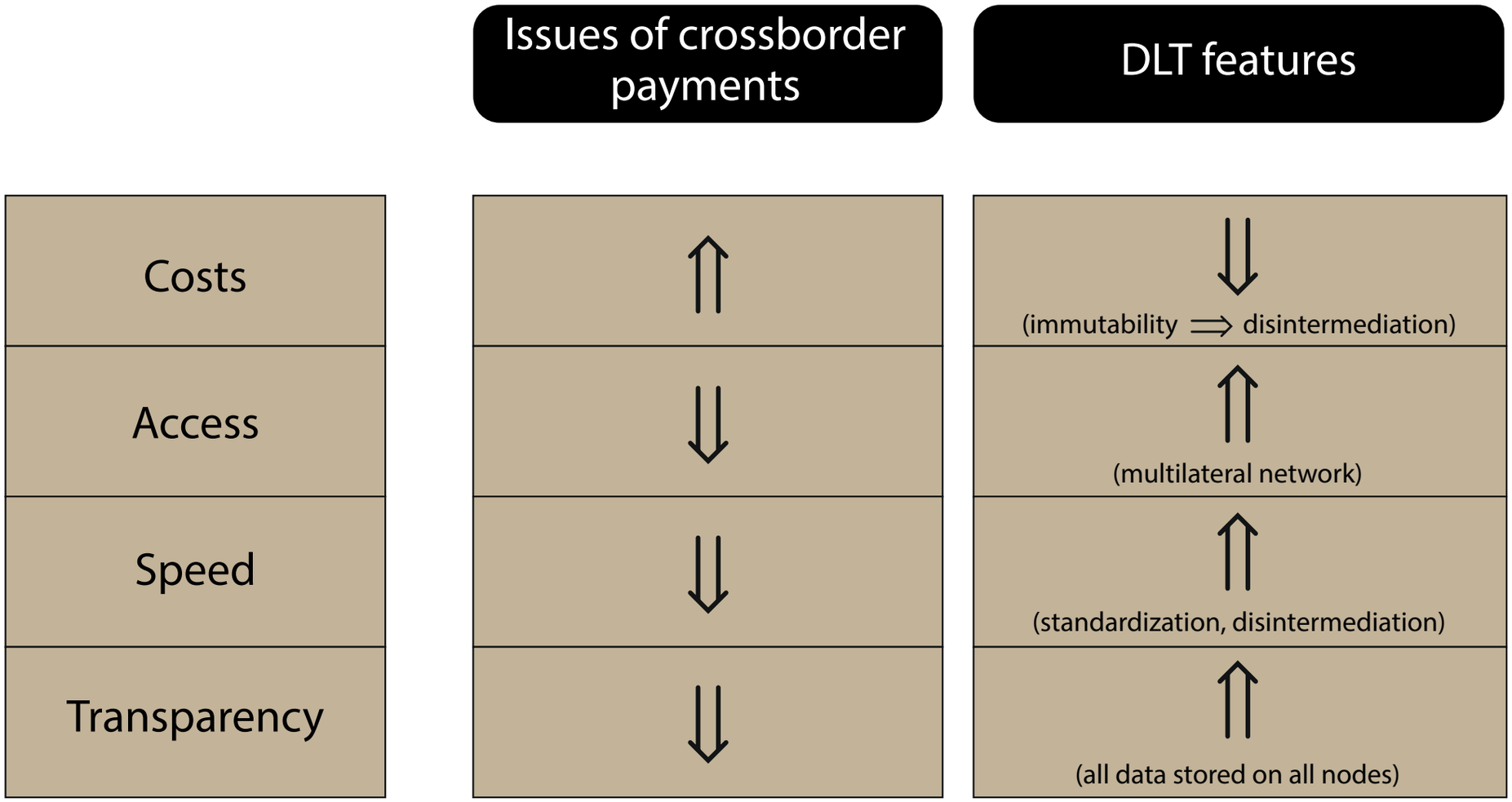
Relevant approaches include, for instance, the Hawala payment system[33] dating back to the 700s that, beyond raising criticism due to its intransparency[34], is said to have inspired the Ripple DLT[35].

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



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 time[36], and could therefore improve the efficiency and quality of supervision, even levelling the playing field among small and large firms[37].

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 concerns[38].

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 be[39], regulators[40] 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 general[41], some DLT-related issues also undermine its ability to enhance payment efficiency[42].

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 governance[43]; 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 houses[45]. 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 risk[46].

Related to that, the lack of DLT-related skills and knowledge could impair the decisions of PSPs' management, PSPs' staff and the regulators[47].

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 itself[48].

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 costs[49].

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.

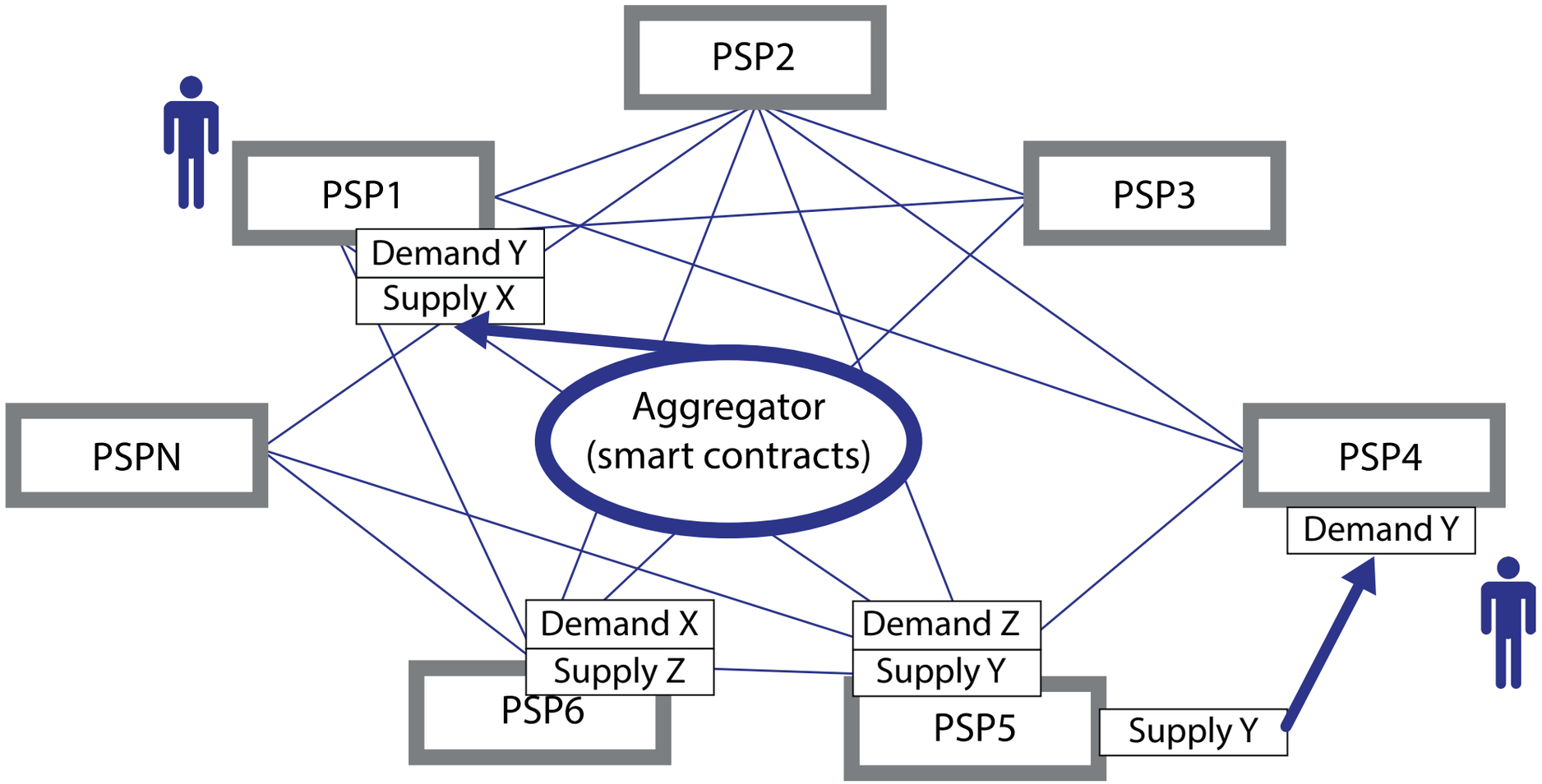
Now two types of PSPs may respond (again by way of algorithms): the first group consists of PSPs with direct representation in B, interested in receiving currency A; and the second group consists of PSPs engaging in multi-aggregate transactions (eg. PSPs in country C with links both to PSPs in A and 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 payments[50].

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 se[51]. Also, efforts are underway to improve crossborder payments by connecting payment systems to digital identities across borders[52]. 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 generally[53].

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 risk[54].

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 support[55] 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 solution[56]. 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.

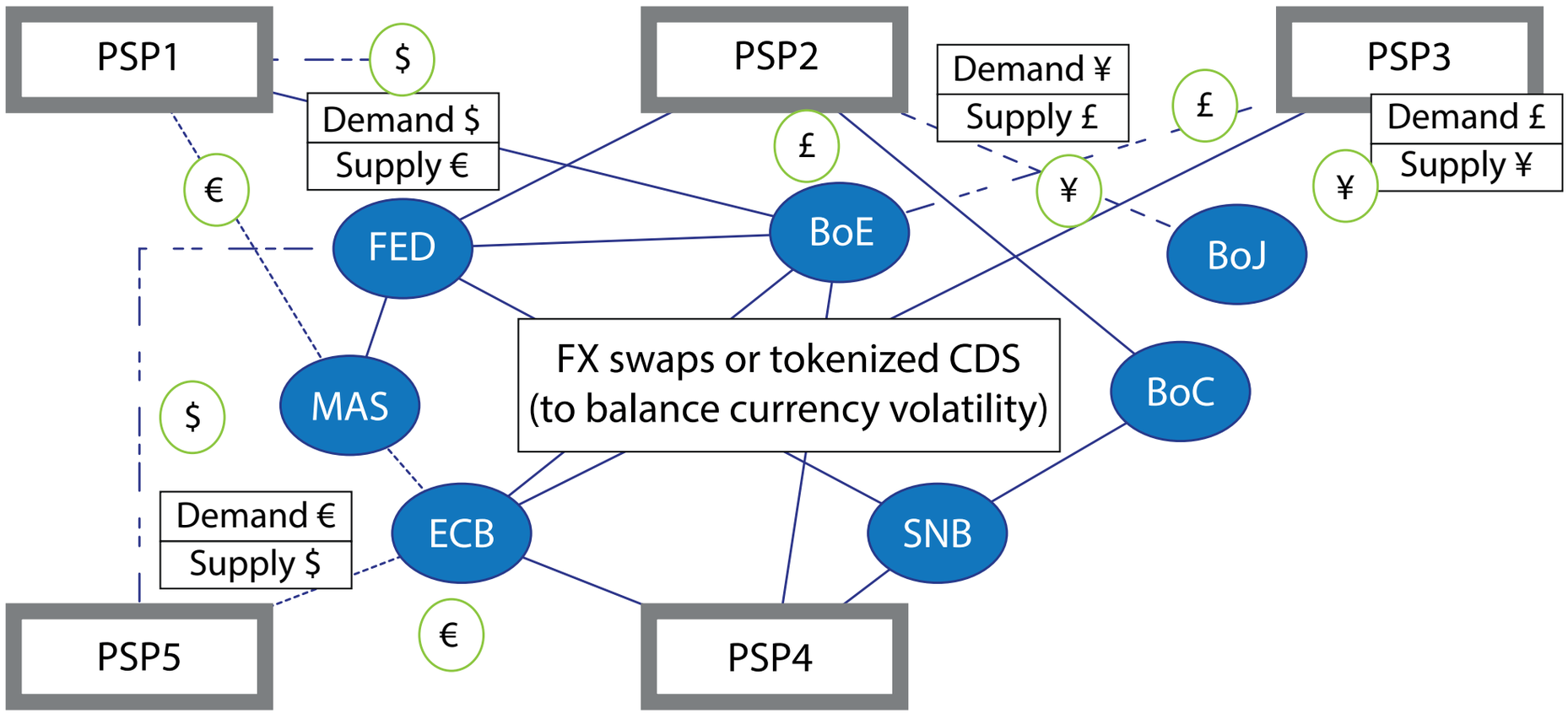
b. Architecture and DLT features used

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



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 CBDCs[57].

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 DLT[58]. 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.

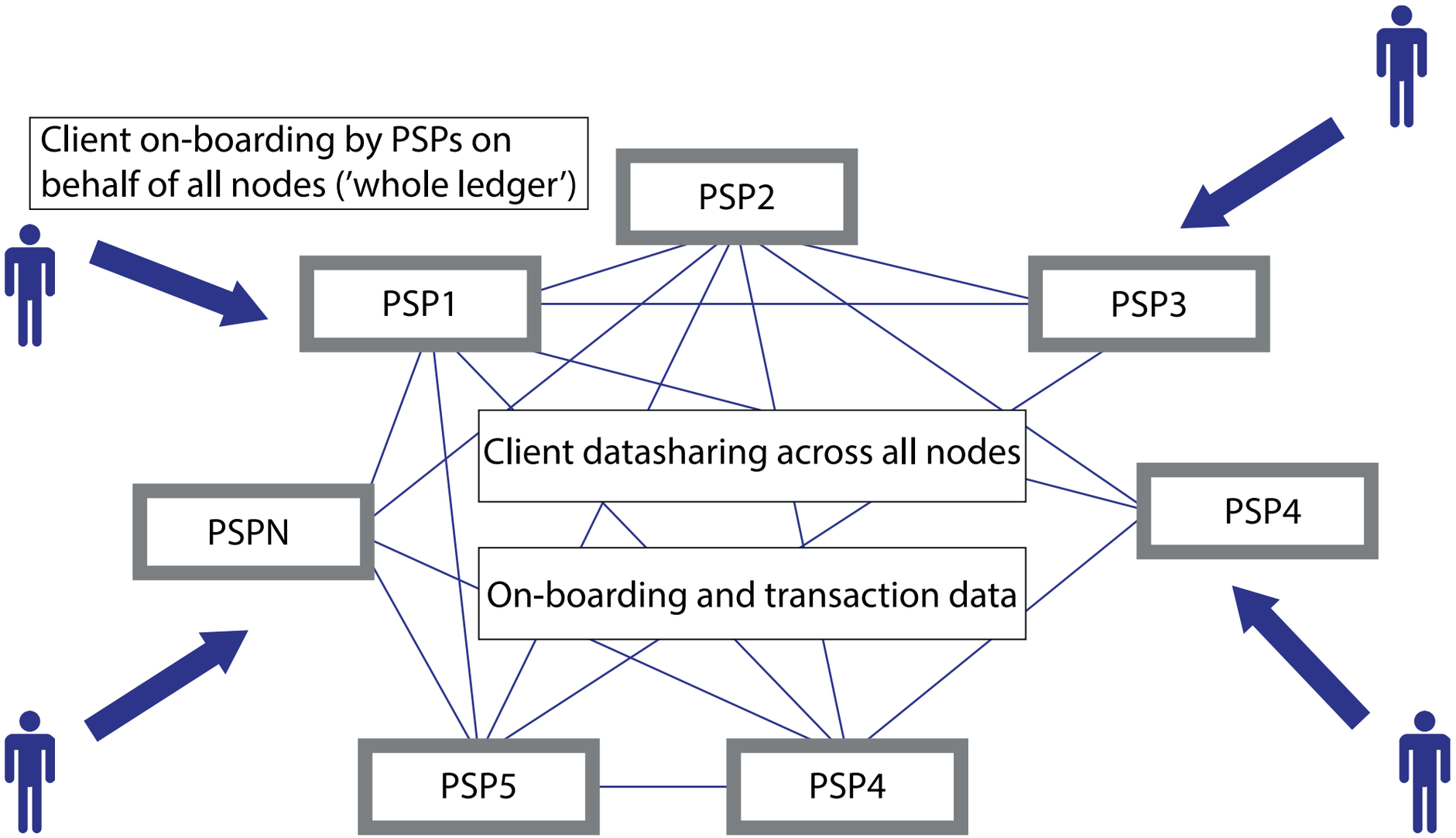
Yet as the establishment of the super-efficiency of the Network of Central Banks is still far away, we leave these fundamental questions regarding the function of central banks for future research.

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 transactions[59].

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, respectively[60].

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 Refinitiv[61] to provide comprehensive anti-money laundering compliance through World-Check Risk Intelligence, screening millions of transactions each month[62]. 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 nodes[63].

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 proofs[64], 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-attacks[65].

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 systems[66].

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.

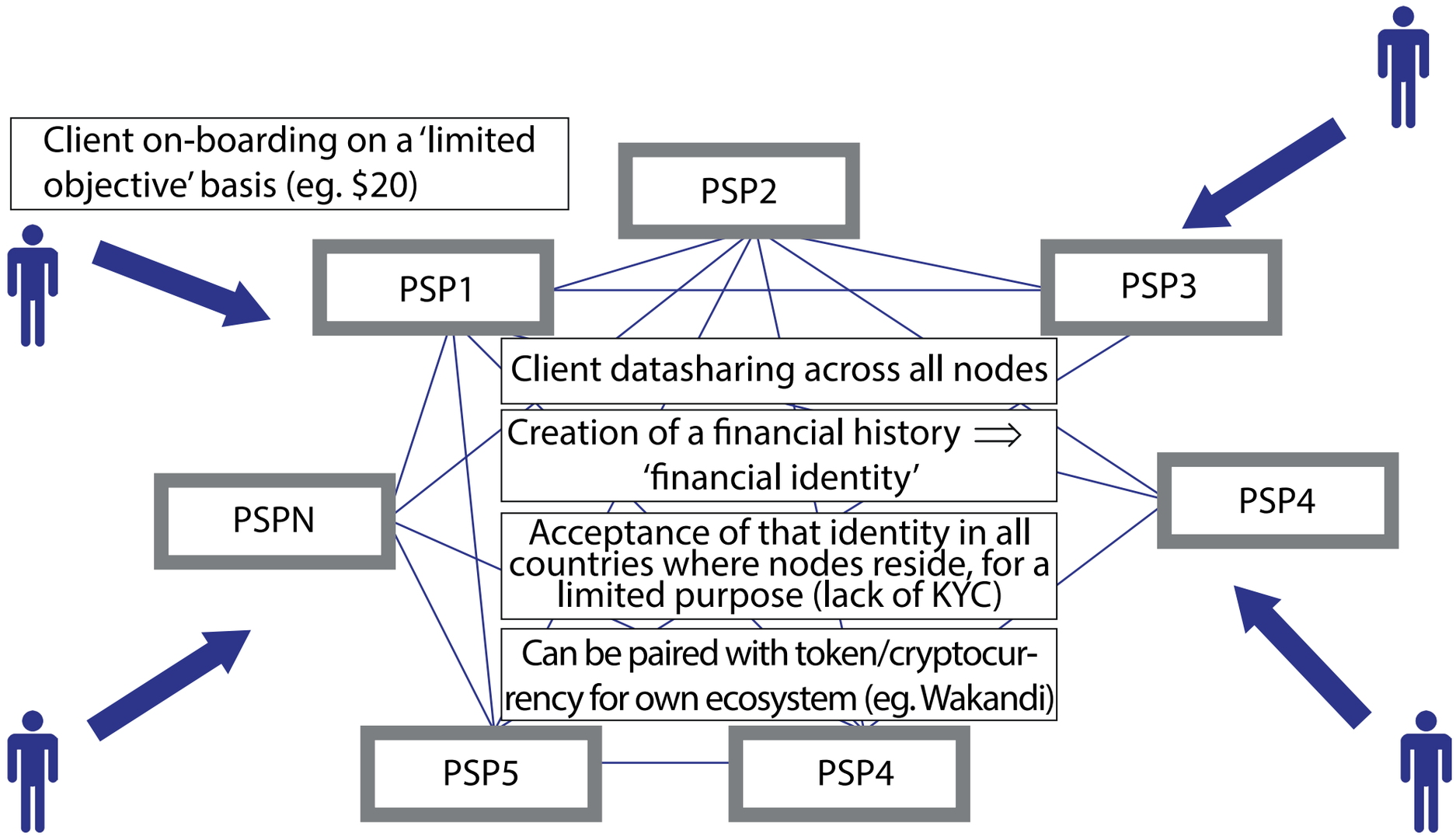
- Using zero-knowledge testing in the transition of on- and off-chain information to decrease/eliminate GDPR risks.

- 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.

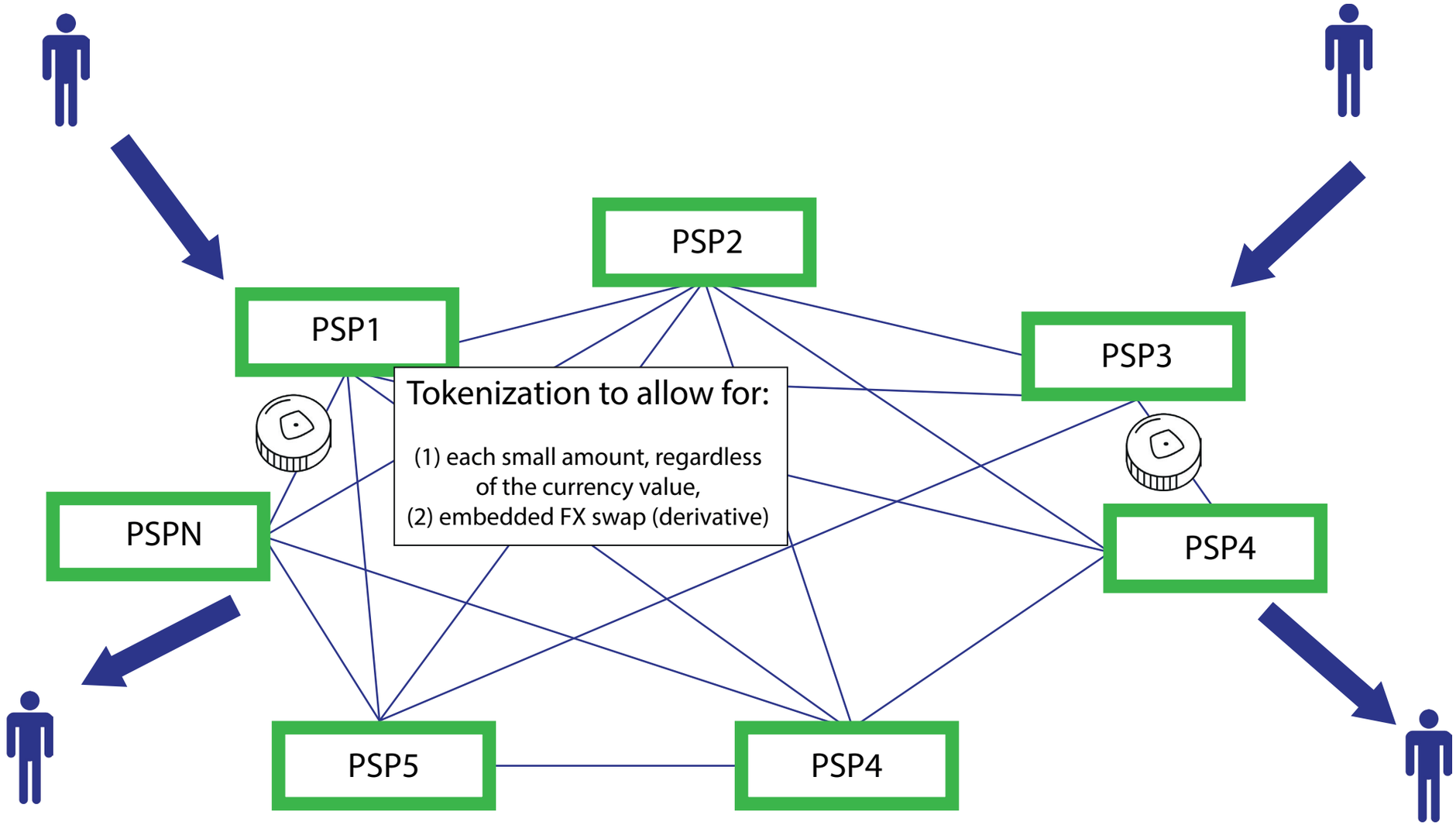
The data stored via DLT could be turned into a client identification tool based on the financial transactions the clients enter into paired with additional user data taken from their cell phone and e-commerce transactions.

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 time[68]. 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.

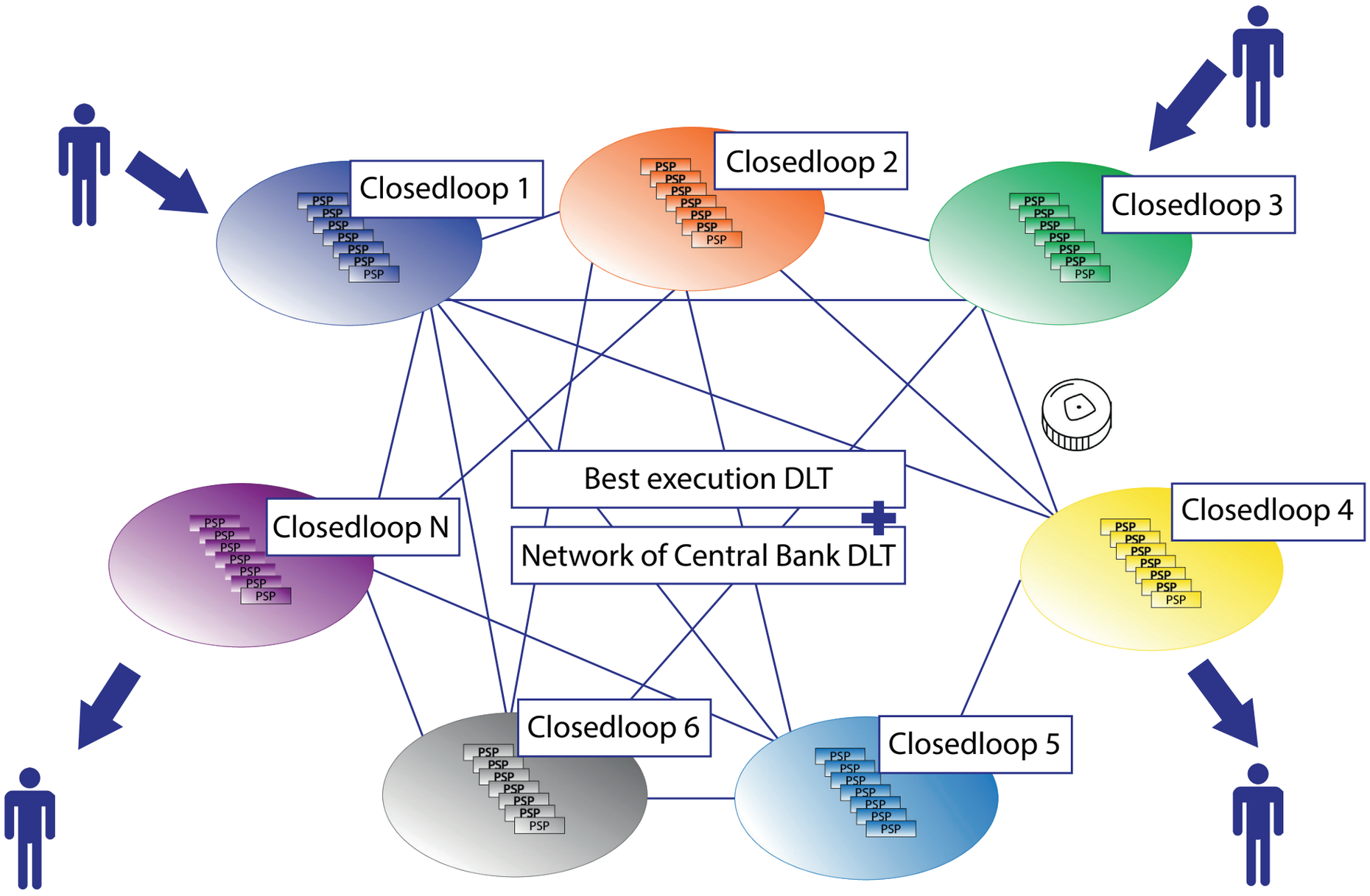
These platforms pursue their own efficiency gains alongside benefits for their network partners and participants. Microsoft's platform relies on digital contracts between Microsoft and industry participants, where the legal terms of their contractual relations are encoded in smart contracts.

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 access[69].

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 regulations[70].

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 requirements[71] 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.

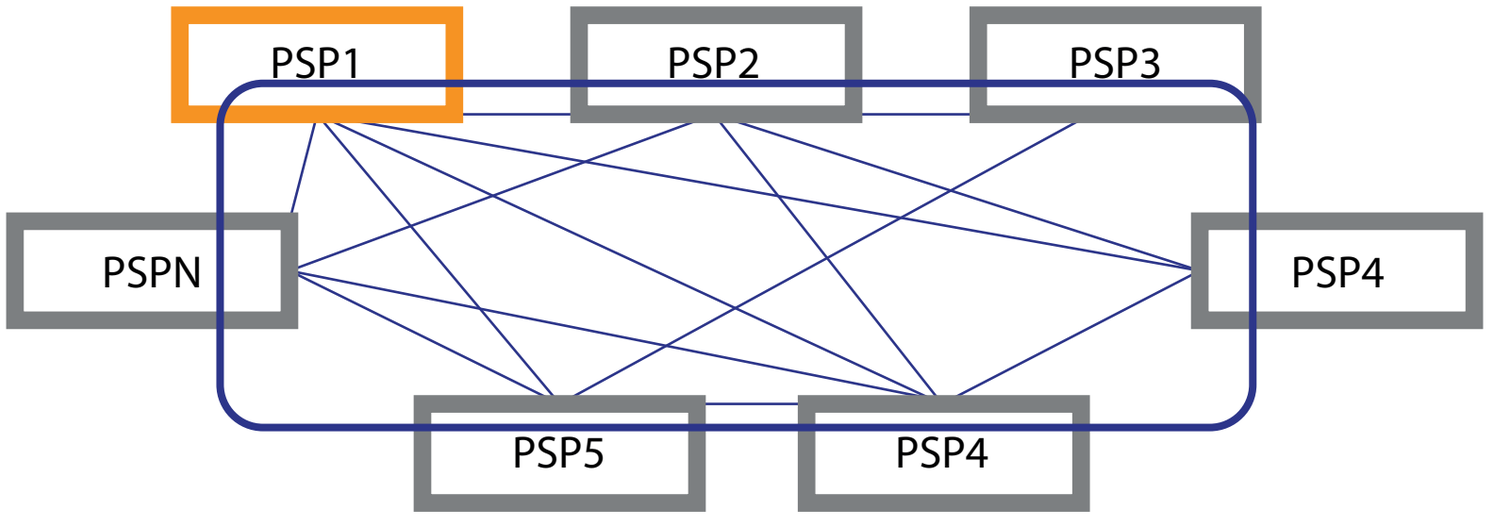
Under the ledger perspective, the technical distribution of functions among ledgers is acknowledged by law; the ledger perspective assigns rights and obligations to the ledger as a whole.

Figure 8. Legal view: ledger or node perspective?

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

Relevant for:

- detemining 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 DLT[72].

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 times[73] 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 commons[74].

We have examined the effect of decentralization on financial services in general elsewhere in more detail[75]. 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 rules[76]:

(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 them[77].

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, uncertain[78].

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 services[80], which further increases complexity.

Regional harmonization projects that include both private and public law dimensions could provide a solution[81]: 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 laws[82].

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 whole[83].

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 follows[84]. 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 rules[85] 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 transfer[87].

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 transactions[88].

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 DLT[89]. 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 jurisdictions[90].

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 risk[92]) 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 design[93], 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 regard[95]. 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 processor[96]. 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 globally[97]. 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 reach[98].

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 sanctioning[99].

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 laws[100].

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 introduced[101].

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 law[102].

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 systems[104].

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. ■

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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

2. See Committee On Payments and Market Infrastructures, Enhancing Cross-Border Payments: Building Blocks of a Global Roadmap. Stage 2 Report to the G20 (July 2020).

3. See David Mills et al. Distributed Ledger Technology in Payments, Clearing, and Settlement, 10-11 (Wash.: Bd. of Governors of the Fed. Reserve Sys., Finance and Economics Discussion Series 2016-095, 2016), https://doi.org/10.17016/FEDS.2016.095

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, Ghiatgh 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 Zetzsche, 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 Zetzsche, 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 & Gelpern, 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 Zetzsche & 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 Zetzsche, 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 Zetzsche, 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 Ill., 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 Zetzsche, 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 Zetzsche, 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. Zetzsche, 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 Zetzsche & 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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For a few cryptos more: the Wild West of crypto finance

Fabio Panetta argues that bringing cryptoassets safely into the regulatory perimeter would promote innovation, whilst avoiding their widespread use for illicit activities and setting the stage for a new bubble

170 years ago Americans pushed westward across the frontier to seek their fortune in the gold rush. Greed and lawlessness turned this promised land into the Wild West, where the few exploited the dream of the many. Fast-forward a century and a half and, amid the global financial crisis, growing distrust of banks, coupled with technological innovation, gave rise to a new dream – a digital gold rush beyond state control.

Satoshi Nakamoto – or rather the software developers using that pseudonym – created the source code of what they thought could be decentralised digital cash. Their 2008 white paper[1] shows a great fascination with technology, notably cryptography, but not necessarily an in-depth understanding of payment and money issues. They aspired to realise an anarchistic utopia of a stable currency free from public scrutiny.

Almost 15 years on, cryptoassets are what everyone's talking about. Crypto enthusiasts marvel at the rise of the crypto market, with many feeling they should take their chances on the crypto gamble. An ecosystem has emerged, from miners to intermediaries, all seeking to expand into digital finance.

Crypto evangelists promise heaven on earth, using an illusory narrative of ever-rising cryptoasset prices to maintain inflows and thus the momentum fuelling the crypto bubble.

But appearances are deceptive. Satoshi Nakamoto's dream of creating trustworthy money remains just that – a dream.

Cryptoasset transfers can take hours to process. Their prices fluctuate wildly[2]. The supposedly anonymous transactions leave an immutable trail that can be traced[3]. A large majority of crypto holders rely on intermediaries, contrary to the avowed philosophy of decentralised finance. In El Salvador, for instance, which is the first country to adopt bitcoin as legal tender, payments are carried out via a conventional centrally managed wallet.

Cryptoassets are bringing about instability and insecurity – the exact opposite of what they promised. They are creating a new Wild West[4]. To quote Littlefinger from Game of Thrones, 'chaos is a ladder'. The story does not end well for this character. However, it only takes a few to climb high on the ladder – even if their gains are only temporary – to convince many others that they are missing out.

The crypto market is now larger than the sub-prime mortgage market was when it triggered the global financial crisis. And it shows strikingly similar dynamics

Indeed, the crypto market is now larger than the sub-prime mortgage market was when – worth $1.3 trillion – it triggered the global financial crisis[5]. And it shows strikingly similar dynamics. In the absence of adequate controls, cryptoassets are driving speculation by promising fast and high returns and exploiting regulatory loopholes that leave investors without protection. Limited understanding of risks, fear of missing out and intense lobbying of legislators drive up exposures while slowing down regulation.

We must not repeat the same mistakes by waiting for the bubble to burst, and only then realising how pervasive crypto risk has become in the financial system. And while some may hope to be smarter and get out in time, many will be trapped.

Now is the time to ensure that cryptoassets are only used within clear, regulated boundaries and for purposes that add value to society. And it is time for policymakers to respond to the people's growing demand for digital assets and a digital currency by making sovereign money fit for the digital age.

I will argue that at present cryptoassets are not only speculative and high-risk investments, but they also raise public policy and financial stability concerns. I will then discuss some elements of the public policy response which is necessary in order to protect investors and preserve financial stability without suffocating innovation.

The rise of cryptoassets

Let me start with the underlying drivers of cryptoassets. At their root, cryptoassets are the result of advances in cryptographic methods and distributed ledger technology. Innovation has made it possible to create an asset that lacks any underlying claim.

In the initial set-up of what we today call 'unbacked cryptoassets', nobody is liable, nor are these assets backed by any collateral or managed by a trustworthy operator. This makes them purely speculative in nature, and hence highly volatile.

To address the risks of unbacked cryptos, 'stablecoins' have emerged, with their value linked to one or more low-risk assets. But, if left unregulated, they are stable in name only. In fact, they can be low-risk but not riskless, and cannot guarantee redeemability at par at any time[6]. They do not benefit from deposit insurance, nor do they have access to central bank standing facilities. They are therefore vulnerable to runs[7]. They are often purely speculative assets, exposed to high financial and operational risks: research finds that one-third of stablecoins launched in recent years have not survived[8].

In spite of these weaknesses, the number of cryptoassets has expanded significantly, with around 10,000 available on the market today[9]. Driving this growth is a complex and opaque crypto ecosystem made up of cryptocurrency miners and service providers, such as exchanges or wallets, that are largely unregulated and insufficiently supervised or overseen.

Within that market is a fast-growing segment of decentralised finance, which uses smart contracts to support trading, lending and investment in cryptoassets – supposedly without relying on intermediaries[10]. This supply of cryptoassets has been met with strong demand from both professional investors and the public. In 2021 around 16% of Americans[11] and 10% of Europeans[12] invested in cryptoassets.

This strong appeal of cryptoassets, especially unbacked ones, is a cause for concern given the lack of fundamentals, the number of recent scandals[13], their use in illegal activities and the high volatility of their prices. All this points to unsound underlying market dynamics.

For one thing, the market is highly concentrated: for example, retail investors holding less than 10 bitcoins own one-tenth of bitcoin supply, while professional investors and high-net-worth individuals hold almost two-thirds[14].

Vested interests of large investors naturally lead to increasing lobbying activities[15]. In the United States, for example, crypto firms spent around $5 million lobbying the Senate in the first nine months of 2021 alone.

Rising prices are fuelled by extensive news reports and investment advice on social media, highlighting past price increases and features such as artificial scarcity to create the fear of missing out. As a result, many invest without understanding what they are buying[16].

Like in a Ponzi scheme, such dynamics can only continue as long as a growing number of investors believe that prices will continue to increase and that there can be fiat value unbacked by any stream of revenue or guarantee. Until the enthusiasm vanishes and the bubble bursts.

Cryptoassets and public policy concerns

Meanwhile crypto enthusiasts will argue that cryptoassets are different and that to regulate them is to stifle innovation. We have heard it all before. But do cryptoassets really generate value for the payment system?

Unbacked cryptoassets cannot fulfil their original objective of facilitating payments. They are simply too volatile to perform the three functions of money: medium of exchange, store of value and unit of account[17].

For example, between November 2021 and January 2022, bitcoin prices fell from roughly USD 68,000 to about $38,000. Their three-month volatility was 60%, almost five times higher than gold and four times higher than US stocks[18].

Such high volatility also means that households cannot rely on cryptoassets as a store of value to smooth their consumption over time. Similarly, firms cannot rely on cryptoassets as a unit of account for the calculation of prices or for their balance sheet.

And this is just as true for stablecoins, given the poor consumer protection and the vulnerability to panic selling that characterise them in the absence of appropriate regulation and supervision. When adequately regulated and supervised, stablecoins are nothing more than e-money arrangements. This is something we have known for many years[19].

So cryptoassets, especially unbacked ones, are not useful as money. But do they at least perform other worthwhile social or economic functions, such as funding consumption or investment, or helping to combat climate change? There is reason to believe that they do the exact opposite.

Cryptoassets are widely used for criminal and terrorist activities. It is estimated that the amounts of cryptoassets exchanged for criminal purposes are substantial, exceeding $24 billion in 2021[20]. Research suggests that as much as $72 billion per year, or about 23% of all transactions, is associated with criminal activities[21]. Ransomware attackers usually demand crypto payments.

Cryptoassets may also be used for tax evasion or to circumvent sanctions. For example, North Korea has actively tried to recruit cryptocurrency experts over the past few years[22]. More recently trading volumes in cryptoassets using the rouble increased after sanctions were imposed on Russia[23]. While we cannot be sure that cryptoassets are actually being used by sanctioned persons or businesses, it nonetheless shows that they provide a potential means to circumvent sanctions[24].

Cryptoassets based on proof-of-work (PoW) blockchains can also cause huge amounts of pollution and damage to the environment. They are created in a decentralised mining process which consumes an enormous amount of energy and computing hardware. It is estimated that mining in the bitcoin network uses up about 0.36% of the world's electricity – comparable to the energy consumption of Belgium or Chile[25].

Worse still, efforts to reduce energy demand may prove futile. The networks' hunger for energy is potentially limitless, since the validation process encourages miners to keep upgrading their computing capacity to ensure system security.

And even where crypto mining uses clean energy or less energy-intensive techniques, this is energy that is not available for other purposes, increasing the consumption of fossil fuels and impeding the fight against climate change.

So cryptoassets are speculative assets that can cause major damage to society. At present they derive their value mainly from greed, they rely on the greed of others and the hope that the scheme continues unhindered. Until this house of cards collapses, leaving people buried under their losses.

Cryptoassets and financial stability risks

Let me now turn to the risks that cryptoassets pose to financial stability. Cryptoassets still comprise a small share of total global financial assets (about 1%). But, as I mentioned, they already have a larger market than sub-prime mortgages had before the global financial crisis started. We cannot afford to ignore them.

Indeed, the popularity of cryptoassets is spreading beyond their core supporters.

The launch of the first bitcoin exchange-traded fund in the United States last October is a sign of increased institutional activity in these assets, largely in response to demand from customers[26]. The retail segment is also growing, with retail investors often attracted by misleading advertisements that fail to clearly set out the risk involved in these products[27].

Big payment networks have stepped up their support services for cryptoassets[28] and intermediaries are seeing a significant increase in retail holdings. For example, Coinbase, which is the biggest US cryptoasset exchange, now has 56 million users – an increase of 65% since March 2020[29].

Cryptoassets pose financial stability risks through three main channels.

> First, stress in cryptoasset markets could spill over to players in the wider financial system through direct asset holdings or ownership of service providers. One measure of such linkages is the correlation between changes in the prices of cryptoassets and of equities, which has been positive since 2020[30].

Second, a fall in the value of cryptoassets might have an impact on the wealth of investors, with knock-on effects on the financial system.

Third, a loss of faith in the value of cryptoassets – for instance because of operational failures, fraud, price manipulation or cybercrime – could lead to a sharp deterioration in investor confidence[31], which could spill over to broader financial markets.

Linkages through these three channels are as yet still limited. But they could increase rapidly if cryptoassets are widely adopted by institutional or retail investors. Such a scenario is not far-fetched. For example, high-net-worth investors, financial advisors and family offices are now leading the charge to invest in cryptoassets[32].

More importantly, big tech players could launch global stablecoins for retail use[33]. We have seen the example of Diem, a cryptocurrency project by Meta, and now Meta's new endeavour[34]. By exploiting their large customer bases and bundling payments and other financial services, big tech firms could significantly strengthen linkages between the cryptoasset ecosystem and the broader financial system.

In a stress situation, a sudden surge in redemptions by stablecoin holders could lead to instability in various market segments. For example, Tether, one of the most popular stablecoins, promises 'stability' by investing in low-risk assets, such as commercial paper, and holds a large proportion of the stock of these instruments in circulation[35].

Large-scale sales of these assets in response to a sudden increase in redemptions could generate instability throughout the commercial paper market. This phenomenon could spread to other stablecoins and related sectors, eventually finding its way to the banks that hold the stablecoins' liquidity.

Such extreme scenarios might not be just around the corner. But the longer we wait, the more exposures and vested interests build up. And the harder it will be for policymakers to act.

Regulating cryptoassets

This brings me to the issue of regulation. Policymakers should not allow cryptoassets and the associated risks to proliferate unchecked. We must decide how to regulate them, following a rigorous risk-based approach tailored to different instruments[36].

The current regulatory approaches differ across countries. Some countries have banned cryptoassets outright while others have restricted their use[37]. This situation is clearly unsatisfactory, as cryptoassets are a global phenomenon and their underlying technologies can play an important role, not only in finance.

We need globally coordinated regulatory action to address issues such as the use of cryptoassets in cross-border illicit activities or their environmental footprint. Regulation should balance the risks and benefits so as not to stifle innovation that could stimulate efficiency in payments and broader applications of these technologies.

Progress is being made in Europe and worldwide, but not swiftly enough to keep pace with the emerging challenges. We need to see faster progress on many fronts. Four of these are particularly relevant.

First, we need to hold cryptoassets to the same standards as the rest of the financial system. This means swiftly implementing all rules to prevent the use of cryptoassets for money laundering and terrorist financing, based on the standards set by the Financial Action Task Force (FATF), and enforcing them effectively[38].

These efforts should also aim to bring peer-to-peer cryptoasset transfers within the scope of the standards for anti-money laundering (AML) and countering the financing of terrorism (CFT).

Second, we should consider how to adequately tax cryptoassets. Currently the tax treatment of cryptoassets is minimal: we know very little about who really owns them, and about the size[39] and the distribution of the capital gains. By its very nature, the cryptoasset market makes it very difficult to identify tax-relevant activities because it relies less on traditional financial intermediaries, who typically provide information for tax purposes[40].

We should bring taxation on cryptoassets into line with the taxation of other instruments and aim for alignment across jurisdictions, given the global nature of the crypto market. The introduction of reporting obligations for transactions above certain thresholds, as just recently proposed by the Organisation for Economic Co-operation and Development (OECD), would enhance transparency and combat tax evasion[41].

There could also be a case for higher taxation of some cryptoassets – such as those based on PoW – above and beyond the taxation of other financial instruments. Negative externalities that lead to sunk costs for society, such as high pollution, could be factored into appropriate taxes levied on participants in crypto markets (issuers, investors and service providers).

Third, public disclosure and regulatory reporting need to be strengthened. The current practice observed in the crypto industry – for example, the disclosure of reserve assets backing stablecoins – is highly problematic[42].

It is not sufficient and differs across products, and can even be misleading to investors and policymakers, mandatory disclosure requirements for financial institutions are necessary to pinpoint where risks emanating from cryptoassets are concentrated.

At the same time, public authorities (central banks, supervisors and AML authorities) need to further improve their data capabilities in order to detect illicit trades and emerging threats to financial stability.

Fourth, given the crucial unanswered questions on issues such as operational risk, volatility and liquidity, regulators should introduce strict transparency requirements and set out the standards of conduct to be followed by professional operators in order to protect unexperienced retail cryptoasset investors.

Europe is leading the way in bringing cryptoassets into the regulatory purview. The finalisation of the Regulation of Markets in CryptoAssets (MiCA) will harmonise the regulatory approach across the European Union (EU).

In a similar way, the European Commission's legislative proposals to create an EU AML/CFT single rulebook will bring all cryptoasset service providers within the scope of the relevant EU framework, which will also provide the basis for a harmonised European approach to supervising them.

Moreover, the proposed Regulation on information accompanying transfers of funds and certain cryptoassets (FCTR) will aim to ensure that cryptoasset transfers which include at least one cryptoasset service provider can be traced and that suspicious transactions can be blocked.

Swift negotiations by the European Commission, European Parliament and the Council of the European Union, together with thorough enforcement by competent national authorities, are necessary given the rapid growth of the crypto market.

Europe's regulatory measures need to go further. We need to focus more on unbacked cryptoasset activities that are undertaken without service providers. In addition, we cannot afford to leave on-chain peer-to-peer payments unregulated, as they can be used to circumvent any regulation.

Finally, if we really want to harmonise supervision significantly across all EU member states, the new European AML Authority should supervise the riskiest cryptoasset providers. But our measures can only be effective if they are matched by ambitious measures implemented by our international peers.

The United States is taking action on this front[43], while the Financial Stability Board (FSB) has made progress in advancing a global agenda of work on cryptoassets[44], in cooperation with other international bodies such as the Committee on Payments and Market Infrastructures, the Basel Committee on Banking Supervision and the FATF[45].

We should build on this momentum and not wait for a crisis to occur before creating a dedicated global policy forum that brings together the key actors needed to address the risks arising from cryptoassets[46].

Conclusion

The westward expansion of the United States in the second half of the 19th century broadly coincided with a period when some states passed free banking laws which eased the requirements for opening a bank, facilitating the emergence of so-called wildcat banks[47].

These banks were typically located in remote areas where wildcats roam, so they were able to get away with issuing their own banknotes to the public, backed by questionable assets, with no intention of honouring them. Many of them defaulted, undermining public confidence in banks.

We should not permit such a situation to happen again in the digital arena with cryptoassets. We need to make coordinated efforts at the global level to bring cryptoassets into the regulatory purview. And we need to ensure that they are subject to standards in line with those applied to the financial system.

In doing so, we will have to deal with complex trade-offs, balancing the goals of promoting innovation, preserving financial stability and ensuring consumer protection. We should make faster progress if we want to ensure that cryptoassets do not trigger a lawless frenzy of risk-taking.

But this is not enough. The growth of cryptoasset markets reveals society's growing demand for digital assets and instant payments. If the official sector – public authorities and intermediaries – does not satisfy this demand, others will step in.

Central banks must engage even more with digital innovation by upgrading wholesale financial infrastructures, operating fast retail payment systems and preparing for the issuance of central bank digital currencies.

The ECB is at the forefront of work in all these areas. We are focusing on a digital euro, in order to allow citizens to use sovereign money to make payments anywhere in the euro area, while protecting its role as an anchor for the payment and monetary system[48]. ■

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Endnotes

1. Nakamoto, S (2008), A Peer-to-Peer Electronic Cash System, Bitcoin.org.

2. The cryptoasset market quadrupled in 2021 alone, reaching nearly USD 3 trillion in market capitalisation in November, before halving within just three months.

3. Holders can choose to be anonymous through encryption, but the blockchain is transparent in terms of what addresses hold which amounts of coins, and the related transaction flows.

4. Gensler, G (2021), Remarks Before the Aspen Security Forum, US Securities and Exchange Commission, August.

5. US Government Printing Office (2007), "Subprime and Predatory Lending: New Regulatory Guidance, Current Market

Conditions, and Effects on Regulated Institutions", hearing before the Subcommittee on Financial Institutions and Consumer Credit of the Committee on Financial Services, US House of Representatives, 27 March.

6. The stabilisation mechanism of stablecoins is crucial to determine whether the coins issued can maintain a stable value. Different stabilisation mechanisms may either require the intervention of accountable institutions, in the role of issuer and custodian, or delegate these tasks to stablecoin users. See Bullmann, D, Jonas, K and Pinna, A (2019). In search for stability in cryptoassets: are stablecoins the solution? ECB, Occasional Paper Series, August.

7. Panetta, F (2021), "The present and future of money in the digital age", lecture, Rome, 10 December.

8. Mizrach, B (2021), Stablecoins: Survivorship, Transactions Costs and Exchange Microstructure, SSRN, 28 April.

9. According to Statista (2022).

10. Decentralised finance grew from about $15 billion at the end of 2020 to $110 billion in September last year, before shrinking to $80 billion in December. See Chapter 3 of International Monetary Fund (2022), Global Financial Stability Report, 19 April.

11. Financial Stability Board (2022), Assessment of Risks to Financial Stability from Cryptoassets, 16 February.

12. Based on the ECB Consumer Expectations Survey (CES), which – among other things – collects information on euro area households' economic and financial behaviour. The numbers in the text refer to the six countries covered in the sample (Belgium, Germany Spain, France, Italy and the Netherlands).

13. See, for instance, US Department of Justice (2022), Two Arrested for Alleged Conspiracy to Launder $4.5 Billion in Stolen Cryptocurrency, February; for instances of Ponzi schemes, see "the Bitcoin Savings and Trust" or the "MyCoin" pyramid scheme in Planet Compliance, The 10 biggest scandals that rocked the Blockchain world, published online, last accessed 20 April 2022, or the "rug pull" scam based on the popular Netflix series "The Squid Game", in Wired (2021), How a Squid Game Crypto Scam Got Away With Millions, November.

14. Sources: Glassnode and ECB calculations.

15. The Economist (2021), Crypto lobbying is going ballistic, December.

16. A survey showed that one-third of cryptoasset investors know little or nothing about these assets. See Cardify (2021), All Aboard The Crypto Train: Who Are The Latest Crypto Investors?, February.
17. See G7 Finance Ministers and Central Bank Governors' Statement on Central Bank Digital Currencies (CBDCs) and Digital Payments, 13 October 2021. Moreover, the European Supervisory Authorities have recently warned that these assets are not suited for most retail consumers as an investment or as a means of payment or exchange; see "EU financial regulators warn consumers on the risks of cryptoassets", 17 March 2022.
18. S&P 500; see Financial Stability Board (2022), Assessment of Risks to Financial Stability from Cryptoassets, February.
19. See European Central Bank (1998), Report on electronic money, August.
20. Chainalysis (2021), The 2021 Crypto Crime report, January.
21. Foley, S, Karlsen, JR and Putniņš, TJ (2019), "Sex, Drugs, and Bitcoin: How much illegal activity is financed through cryptocurrencies?", Review of Financial Studies, May. The use of bitcoins for illicit payments is well documented, although the share of such payments in total bitcoin transactions is disputed. Foley (ibid.) estimates it to be 45%, while Chainalysis' 2021 crypto crime report puts the figure at less than 1% for 2021. At the same time, the low ratio could be because the denominator refers to trade volumes (investment flows) and not payments; see Green, MW (2021), "The Case Against Bitcoin", Common sense, 14 May. Finally, the FATF reports variations in identified illicit bitcoin transactions from 2016 to 2020 to range between 0.6% and 9.9% (relative to the number of transactions); see FATF (2021), "Second 12-Month Review of the Revised FATF Standards on Virtual Assets and Virtual Assets service providers", July.
22. A former US researcher in a cryptocurrency group has been sentenced to more than five years in prison for conspiring to help North Korea evade US sanctions using cryptocurrency. Moreover, the United States Treasury Department has linked North Korean hackers to the theft of cryptoassets tied to a popular online game and worth hundreds of millions of dollars.
23. See Kaiko Research (2022), Bitcoin Dominance Climbs Amid Persistent Volatility, March.
24. On 21 April Binance, the world's largest crypto exchange, announced that it would comply with the European Union sanctions imposed on Russia for its invasion of Ukraine and limit services in Russia. Russian nationals, residents and

businesses in the country with cryptoassets exceeding €10,000 will not be able to deposit or trade them, they may only make withdrawals. See Binance (2022), Changes of Services to Users in Russia, 21 April.

25. See Chapter 2 of International Monetary Fund (2021), Global Financial Stability Report, October.

26. A survey by Intertrust of a group of 100 hedge fund Chief Financial Officers found that, on average, they expected to allocate 7.2% of their funds' assets to cryptoassets by 2026. If replicated across the sector, this could equate to a total exposure of $312 billion. See Financial Times, 2021, Hedge funds expect to hold 7% of assets in crypto within five years, 15 June.

27. In 2022 the cryptoassets exchange, Crypto.com, had two advertisements banned because they were considered to be misleading by the UK's advertising regulator, the Advertising Standards Authority (ASA). See ASA (2022), Ruling on Forisgfs UK Ltd t/a Crypto.com, 5 January.

28. In particular, Mastercard, PayPal and Visa continue building capabilities and strategic partnerships to support cryptoassets (as well as stablecoins).

29. Backlinko (2021), Coinbase Usage and Trading Statistics, April.

30. The returns on bitcoin, for example, were unrelated to those on the S&P 500 index between 2017 and 2019, but their correlation coefficient increased to 35% in the period 2020-21. See Adrian, T, Iyer, T and Qureshi, MS (2022), Crypto Prices Move More in Sync with Stocks, Posing New Risks, IMF Blog, January.

31. Recent analyses from the IMF show that cyberattacks often cause the collapse of decentralised finance platforms: on average, more than 30% of the total deposits is lost or withdrawn after a cyberattack; see IMF (2022), Global Stability Report, April.

32. See Fidelity (2021), The Institutional Investor Digital Assets Study, September 2021.

33. See Panetta, F (2021), "Stay safe at the intersection: the confluence of big techs and global stablecoins", speech at the conference on "Safe Openness in Global Trade and Finance" organised by the UK G7 Presidency and hosted by the Bank of

England, October.
34. See Financial Times, 2022, Facebook owner Meta targets finance with 'Zuck Bucks' and creator coins, 6 April
35. See IMF (2021), op cit.
36. The term cryptoasset is often used to label anything that is recorded via distributed ledger technology (DLT), regardless of whether it constitutes a new type of asset, a financial instrument or a form collective investment. See Bullmann, D, Jonas, K and Pinna, A (2019), op. cit.
37. Egypt, Morocco, Algeria, Bolivia, Bangladesh, Nepal and China have imposed outright bans. Countries that have restricted the ability of banks to deal with cryptoassets or prohibited their use for payment transactions include Nigeria, Namibia, Colombia, Ecuador, Saudi Arabia, Jordan, Turkey, Iran, Indonesia, Vietnam and Russia.
38. The result of a questionnaire launched by FATF in July 2021, showed that less than 50% of reporting jurisdictions – 38 FATF members and 90 FATF-Style Regional Bodies (FSRB) members – had implemented the revised FATF Standards on Virtual Assets (VA) and VA Service Providers (VASPs) in their national law. See Financial Action Task Force (2021), Second 12-Month Review of the Revised FATF Standards on Virtual Assets and Virtual Asset service providers, July. The five most cited challenges and barriers to implementation are: (1) the lack of capacity, expertise and experience in public sector agencies, (2) the implementation of the travel rule and the lack of sufficient technological solutions, (3) challenges in identifying and registering/licensing VASPs, (4) the lack of implementation of domestic regulations for virtual assets/ VASPs and (5) challenges in conducting ML/TF risk assessments and understanding the size of the virtual asset/VASP sector. The FATF addressed these issues in the revised Guidance it released recently. See FATF (2021), "Updated Guidance on Virtual Assets and Virtual Assets service providers", October.
39. According to some simulations by the European Commission, the revenue potential of taxing capital gains on bitcoin across the EU in 2020 alone would have amounted to about €900 million, or 0.3% of the total tax revenue from property taxation in the EU. See Thiemann, A (2021), "Cryptocurrencies: An empirical view from a tax perspective", JRC Working Papers on Taxation and Structural Reforms, No 12/2021.
40. Cryptoassets in most instances do not fall within the scope of the Common Reporting Standard (CRS) developed

by the OECD in 2014, which applies to traditional financial assets and fiat currencies. Even where cryptoassets do fall within the definition of financial assets, they can be owned either directly by individuals in cold (ie. offline) wallets or via cryptoasset exchanges that do not have reporting obligations under the CRS. They are therefore unlikely to be reported to tax authorities in a reliable manner. See OECD (2022) CryptoAsset Reporting Framework and Amendments to the Common Reporting Standard, public consultation document, 22 March-29 April.

41. See OECD (2022), op. cit.

42. See IMF(2021), op. cit.

43. White House (2022), Executive Order on Ensuring Responsible Development of Digital Assets, March. The main policy objectives of the executive order are: 1) protecting consumers, investors and businesses; 2) protecting US and global financial stability and mitigating systemic risk; 3) mitigating illicit finance and national security risks; 4) reinforcing US leadership in the global financial system and in technological and economic competitiveness; and 5) supporting technological advances that promote responsible development and use of digital assets.

44. See FSB (2022), Assessment of Risks to Financial Stability from Cryptoassets, February; FSB (2021), Regulation, Supervision and Oversight of "Global Stablecoin" Arrangements: Progress Report on the implementation of the FSB High-Level Recommendations, October; FSB (2020), Final report and high-level recommendations for the regulation, supervision and oversight of "global stablecoin" arrangements, October. See also CPMI-IOSCO (2021), Consultative report on Application of the Principles for Financial Market Infrastructures to stablecoin arrangements, October.

45. See FSB (2022), letter from the Chair to G20 Finance Ministers and Central Bank Governors, 14 April.

46. See Panetta, F (2021), "Stay safe at the intersection: the confluence of big techs and global stablecoins", op. cit.

47. See Federal Reserve Bank of Philadelphia (2016), Economic Insights, Vol. 1, Issue 3.

48. See Panetta, F (2022), "Central bank digital currencies: defining the problems, designing the solutions", contribution to a panel discussion on central bank digital currencies at the US Monetary Policy Forum, New York, February.

This article is based on a speech delivered at Columbia University, New York, 25 April 2022

EU's proposed crypto regulations are flawed

The crypto markets are in turmoil. Karel Lannoo believes the proposed regulatory framework is not the right remedy

As the crypto world goes through yet another bout of turmoil, it is clear that stronger regulatory oversight of digital assets is needed. The EU will soon roll out a specific regulatory framework for cryptocurrencies and markets. The move comes as digital assets are plunging and a crisis has engulfed some of the world's biggest 'stablecoins'.

Cryptocurrencies have become popular despite the fact that there is very limited or no oversight. Whether they are Ponzi schemes, money-laundering shells or stablecoins pegged to real-world assets, it is difficult for ordinary investors or users to know which is which. Where they are based, how they are organised and who is backing them is often an enigma. This is a cause of concern.

But there are reasons why EU proposals are not the right remedy. Under the planned regulations, only crypto coins authorised in the bloc can be offered to investors. But cryptoassets and exchanges will have a very light supervisory regime, much less than what is in place for financial instruments and other exchanges. That raises the question about why distinct rules are needed.

The industry is divided into three different forms in the proposed EU Markets in Crypto-Assets Act: Non-fungible tokens (NFTs), or virtual gadgets; stablecoins, whose value is meant to be linked to a real-world asset; and digital currencies, which always represent a fixed exchange rate to a hard currency.

Digital currencies can be issued only by banks or fintech companies that already have a license to do so, while issuers of stablecoins must have a minimum level of reserves.

The EU is the first international organisation to propose a specific regulatory framework. Certain member states already have special legislation for tokens and crypto, but there is no agreement on this at a multinational level.

Outside the bloc, countries such as the UK and US and territories including Hong Kong are reluctant to impose dedicated rules and apply existing securities legislation.

This has led to an unclear framework for a digital product that has become an international phenomenon. Consumers have at present little idea of their rights to protection or redress, especially if the transactions take place outside the EU.

... an unregulated crypto sphere just encourages misunderstanding and potential abuse of a fundamentally interesting innovation

Non-EU crypto currencies, such as Bitcoin or Ethereum, will have to register under one of these forms to gain admission to the EU market. A system of mutual recognition is unlikely, given that regulations vary too widely internationally. The brunt of the risks will be borne by the consumer, who will see no difference between EU or international crypto but will still be besieged on social media with adverts for unregulated cryptos, or even flat-out scams.

The EU's Mica proposal raises many more problems. Supervision is very limited and split between national or European regulators. Under the proposed rules, it is much easier to start a crypto exchange than a traditional exchange, which is governed by the European financial markets rule book known as MiFID.

Provisions against market manipulation and insider trading are very light, hardly comparable with existing EU law. And accounting standards and tax rules for crypto companies do not exist. On the other hand, some EU countries also apply existing consumer protection or market regulation to crypto publicity. How that interaction will work in practice remains a big question.

The EU would have been better off considering crypto under existing laws, rather than creating a new regulatory framework. This means applying MiFID for cryptoassets, considering them financial instruments. Electronic money or banking rules could be used for digital money. NFTs do not require separate rules, but can be covered under existing consumer or intellectual property legislation.

Market and business conduct rules should apply regardless of the packaging. Start-ups in the crypto sector will say that this will make the market unattractive, but why should they be subject to lighter supervision for their financial operations?

An international framework is required to regulate crypto with a common approach. Diverse regulatory approaches enable regulatory arbitrage and a race to the bottom, where providers are the winners, and investors the victims. And an unregulated crypto sphere just encourages misunderstanding and potential abuse of a fundamentally interesting innovation.

Even more important is to inform consumers adequately about the dangers of investing in crypto, and the need to distinguish between fraudulent and well-intentioned schemes. ■

Karel Lannoo is General Manager of ECMI and Chief Executive Officer of CEPS

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Old dogs, new tricks

Adapting central bank balance sheets to a world of digital currencies. Andrew Hauser argues that we need to understand these impacts and build them into the design of CBDCs

The explosion of interest in digital currencies poses deep and challenging policy questions on everything from monetary and financial stability, to privacy, competition, money laundering and social inclusion. Public authorities are evaluating the arguments for and against introducing their own Central Bank Digital Currencies (CBDCs)[1]. And in the private sector there's a lively debate about what it might take to make so-called 'stablecoins' genuinely stable.

Up to now, though, there's been less discussion about how central bank balance sheets might need to adjust to support the safe and effective provision of fiat-based digital currencies. I will focus my remarks around five main messages.

1. Retail CBDCs could be a big deal for central bank balance sheets

Let's start with retail CBDC – a central bank liability, in digital form, held directly by individuals, and used to make day to day payments. Many of the raw ingredients of a CBDC are already familiar to central banks: individuals can already hold our liabilities, in the form of physical banknotes; and we already provide digital liabilities, albeit to only a few depositors (predominantly banks).

The new thing would be to combine those ingredients together, at scale. The question of whether to do so is complex, and beyond the scope of my remarks. The UK will publish a consultation on this issue later this year. But the implications for central bank balance sheets will also depend heavily on how any CBDC is designed: on who can hold it, where it can be used, how much can be held, and whether it is interest-bearing (Table 1).

Design choices that placed the economic features of CBDC close to today's banknotes might have relatively limited implications for central bank balance sheets, at least in normal economic conditions. Choices that positioned the economic features of CBDC closer to today's retail commercial bank deposits could have a more material impact.

Table 1. Central bank balance sheet impact depends on key CBDC design choices

	Design feature	Banknotes	Retail CBDC	Retail commercial bank deposits	*Memo: central bank reserves*
Things we know	**Form**	Physical	Digital	Digital	*Digital*
	Access	Anyone, retail focussed	Anyone, retail focussed	Anyone meeting bank requirements	*Banks and other reserves holders only*
	Can be used to pay	Anyone, retail focussed	Anyone set to receive CBDC, retail focussed	Any bank account holder	*Banks and other reserves holders only*
Design choices	**Remuneration**	None	← Under consideration →	Commercial bank chooses rate	*Central bank chooses rate*
	Size limits on individual holdings	None, but large-scale use poses AML and physical challenges	← Under consideration →	May be limits for AML, deposit protection etc	*None, but aggregate set by central bank*
	Typical payment size	Small	← Under consideration →	Variable	*Large*
	Usable hours	24/7	← Under consideration →	Can be 24/7	*Weekday business hours*
Current size in UK		£80 billion	← Under consideration →	£2,200 billion	*£950 billion*

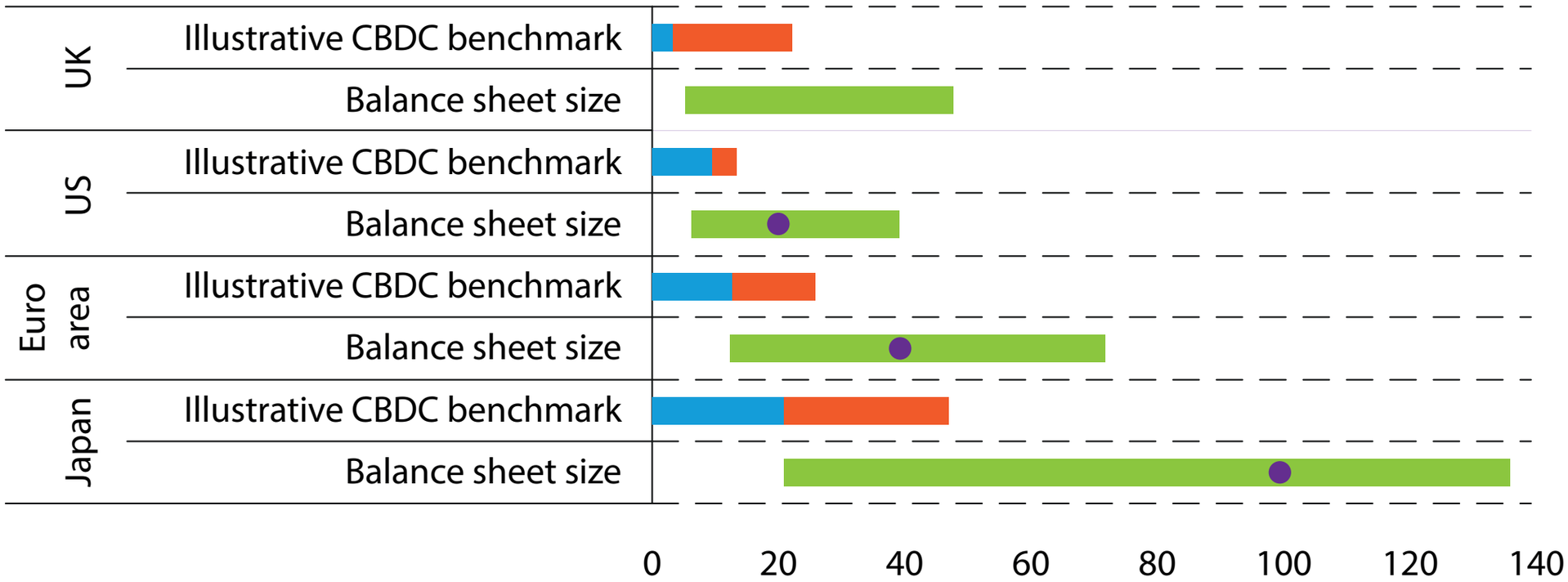
Source: Bank of England

To give some sense of potential scale, Chart 1 compares two stylised benchmarks – the stock of banknotes; and 20% of retail commercial bank deposits[2] – to the size of central bank balance sheets between the period before the Global Financial Crisis and today. In the UK, the upper end of that benchmark range is nearly half the size of the Bank of England's balance sheet today, and six times that in 2007.

Those are big numbers. But they aren't unprecedented in the history of central banking. In the UK, even the top end of the range in Chart 1 would still leave the stock of publicly-provided means of payment at around the levels seen in the mid-20th century (Chart 2).

... if digital currencies took off at scale, careful thought would be needed as to how best to structure such asset holdings to manage balance sheet risks, and minimise any unintentional interference with other policy uses of the balance sheet

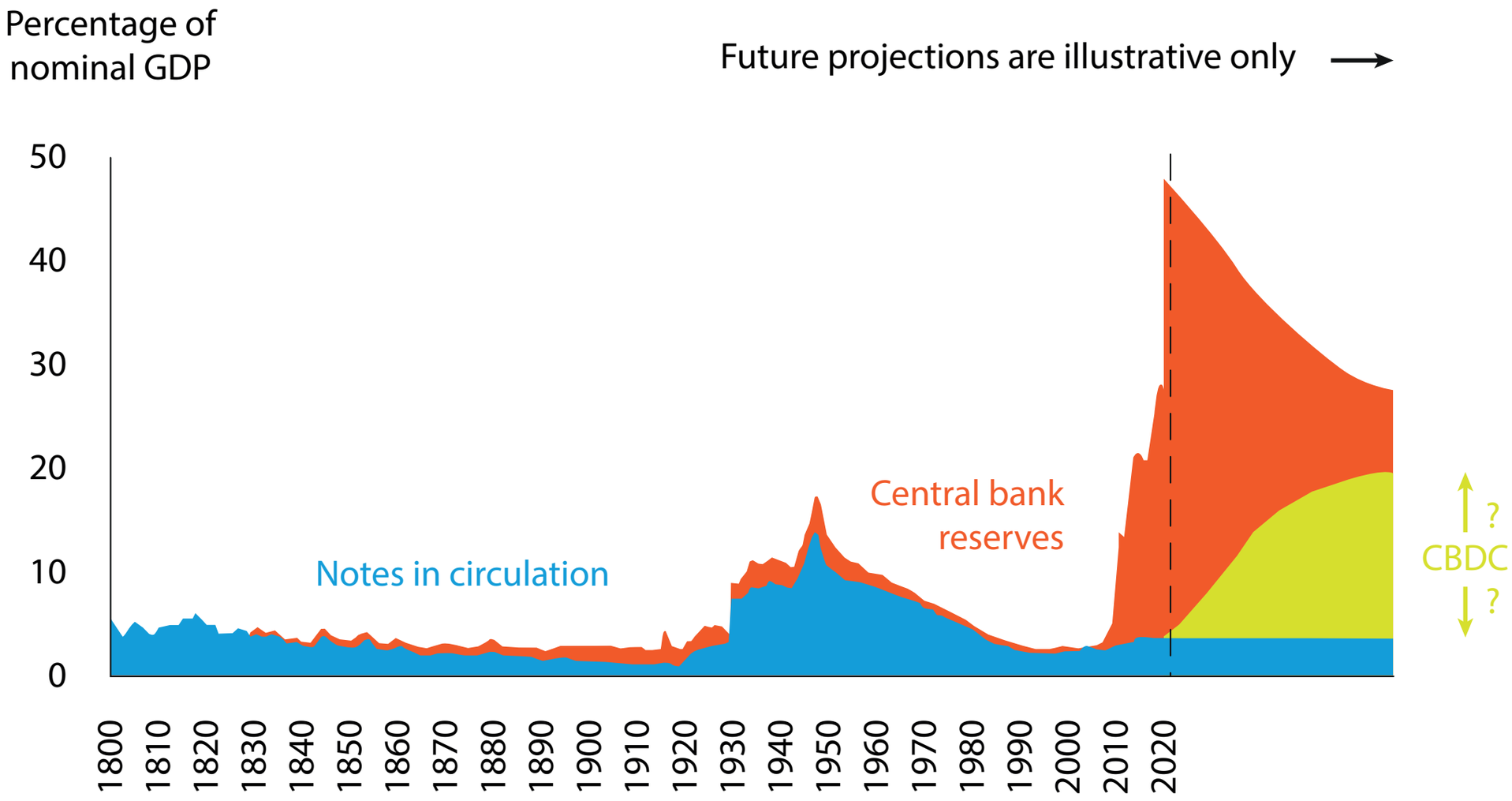
Chart 1. Scaling CBDC relative to central bank balance sheets



Illustrative CBDC benchmarks = currency in circulation and 20% of retail deposits, as of May 2022. Balance sheet bars show, at the lower end, the value of central bank balance sheets as of 2007 Q1, and at the upper ends as of today. The purple markers show 2019 Q1 values.

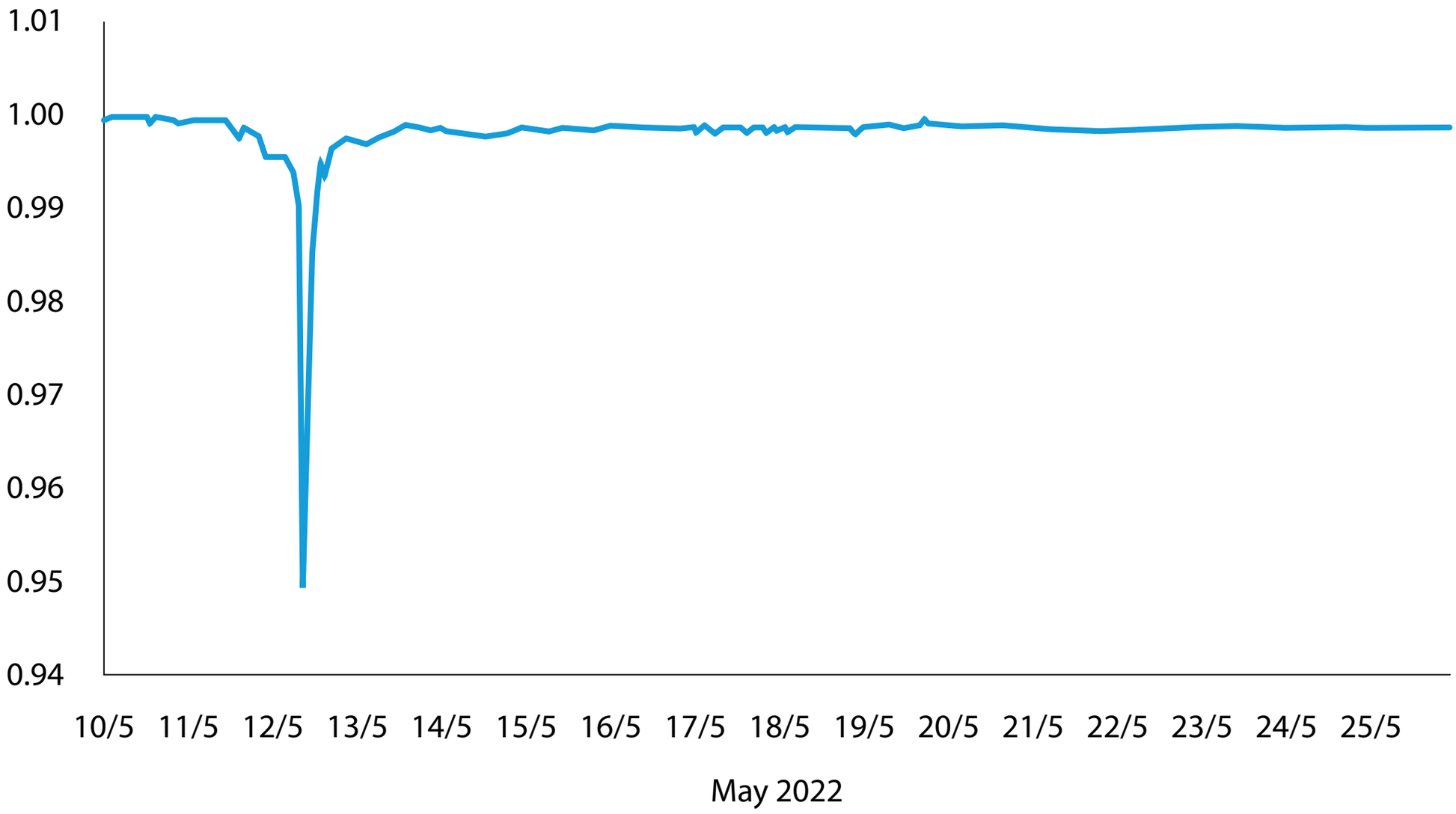
Sources: Individual central banks' published data, IMF, Bank calculations.

Chart 2. Illustrative long-term changes in the BoE balance sheet



Sources: Bank of England, IMF.

Chart 3. Price of Tether (USDT) in $US



Source: Bloomberg Finance LP Digital Asset Research, Inc.

This underscores the point that, while the technology for any future CBDC may be new, the use of the central bank balance sheet to provide state-backed transactional money would not be: indeed, it is one of the oldest functions of central banks.

2. Stablecoins that are truly stable may have much the same impact

As public authorities reflect on the case for CBDCs, private sector providers have been developing so-called 'stablecoins', which claim to be pegged to the value of fiat currencies.

I say 'claim', because recent weeks have suggested such promises may be less than fully credible. The value of TerraUSD – once one of the larger 'stablecoins' by market capitalisation – fell to zero in just a few days. And Tether, sometimes asserted to be the backbone of the cryptocurrency ecosystem, lurched precariously below parity for a period (Chart 3).

These gyrations have multiple causes. But 'stable' they are not. And the lack of complete, real time, information on the assets backing the promise of convertibility[3], means that holders of such coins must accept at least the possibility of finding themselves badly out of pocket.

Such 'buyer beware' warnings may be sufficient for coins that are only in niche use. But they cannot be enough for any that reach systemic scale. And that is why the Bank of England's Financial Policy Committee has recommended that, in the UK, any stablecoin that reaches systemic size should also meet standards equivalent to those expected of commercial bank money[4].

In practice that is likely to mean being issued by a bank, or by a non-bank that: is subject to rigorous central bank regulation and supervision[5]; provides coinholders with a robust legal claim; is insolvency remote; and transparently backs its coins with a precisely defined set of high quality and liquid assets.

It's too soon to say what those assets should be. But, to take one example proposed by some, if a systemic stablecoin were required to be fully backed by deposits at the central bank, the implications for central bank balance sheets could be very similar to CBDC (Chart 4).

This would also be the case if a 'narrow bank' chose to issue its own tokenised deposits and put all the proceeds into holdings at the central bank. Indeed, arguably any stablecoin with a credible link to fiat currency relies ultimately on settlement in central bank money.

Of course, that does not mean that it is central bank money: even fully-backed, regulated stablecoins would remain the liabilities of private sector companies, and hence pose a range of risks not associated with CBDCs.

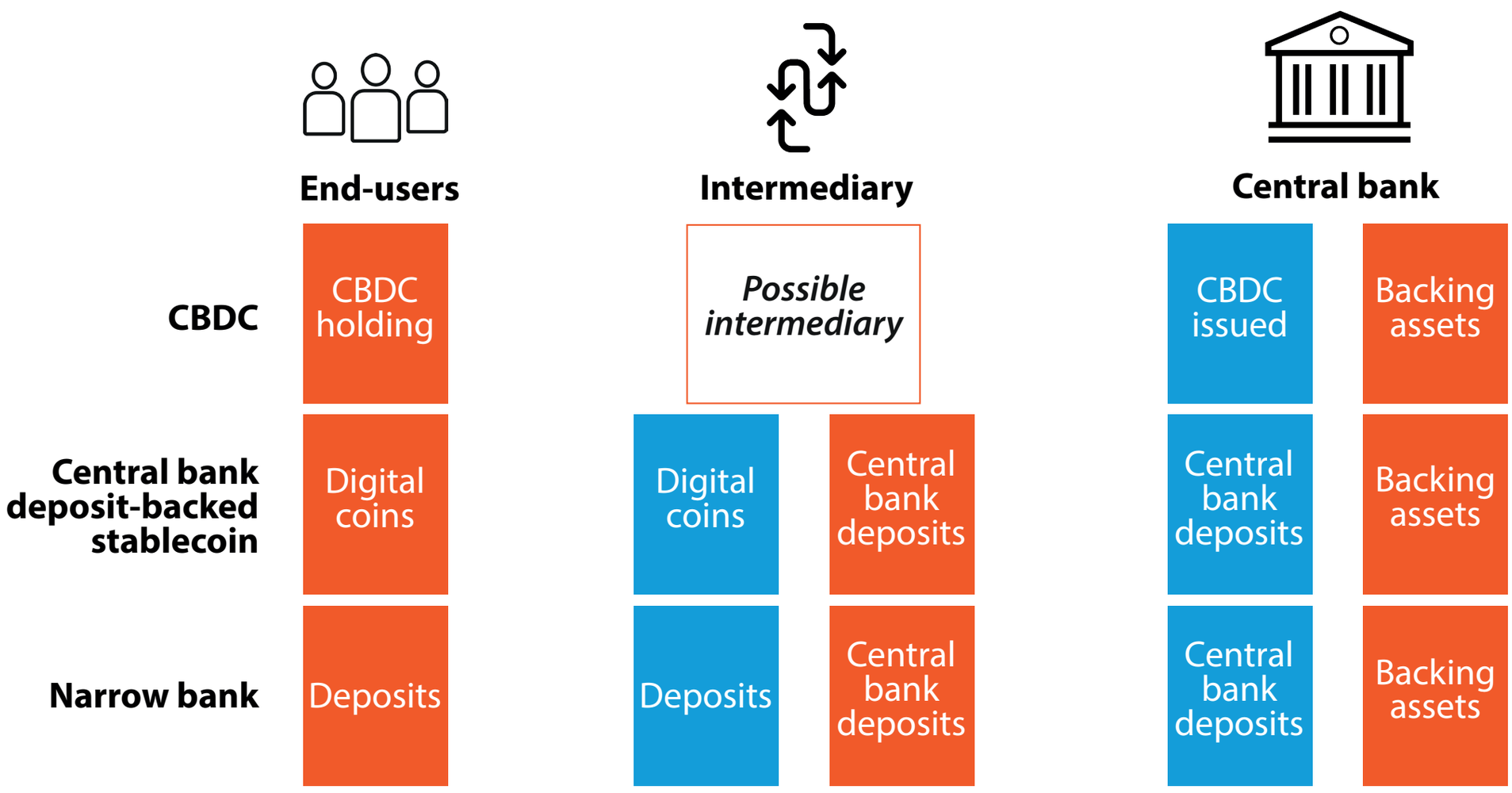
3. Digital currencies may alter the transmission mechanism for monetary policy

A key unknown in assessing the impact of digital currencies lies in judging the extent to which they may affect the flow, and pricing, of money and credit in the economy – which in turn has implications for the transmission mechanism for monetary policy.

When a bank creates a new loan, it must retain or attract sufficient deposits to fund it[6]. Digital currencies do not fund credit creation, but they do increase the competition for, and hence the cost of, deposits, with knock-on implications for the price and availability of credit.

The size of these effects will depend heavily on the eventual design of any systemic digital currencies, their attractiveness relative to bank deposits, the availability and price of alternative funding sources for banks, and borrowers' ability to substitute between types of credit.

Chart 4. Similar balance sheet impact for CBDC and CB-backed systemic stablecoins



It is not a foregone conclusion that these effects will necessarily be large. Indeed, an illustrative scenario published by the Bank of England in 2021 suggested that the steady state impact could be quite modest, with lending rates rising only slightly, and credit provision falling by a little over 1% – though varying the assumptions can generate somewhat larger results (Chart 5).

More serious disruption to credit supply could occur if deposits transferred into digital currencies in an unexpectedly rapid or disorderly way, for example during a stress event. But a range of design choices, including potential holding limits, could in principle be deployed to deal with such situations.

And banks suffering sudden deposit outflows may also, as now, draw on market-wide central bank liquidity insurance facilities[7] – though the pricing of such facilities, and their implications for encumbrance, make them less well suited to providing long-term structural support.

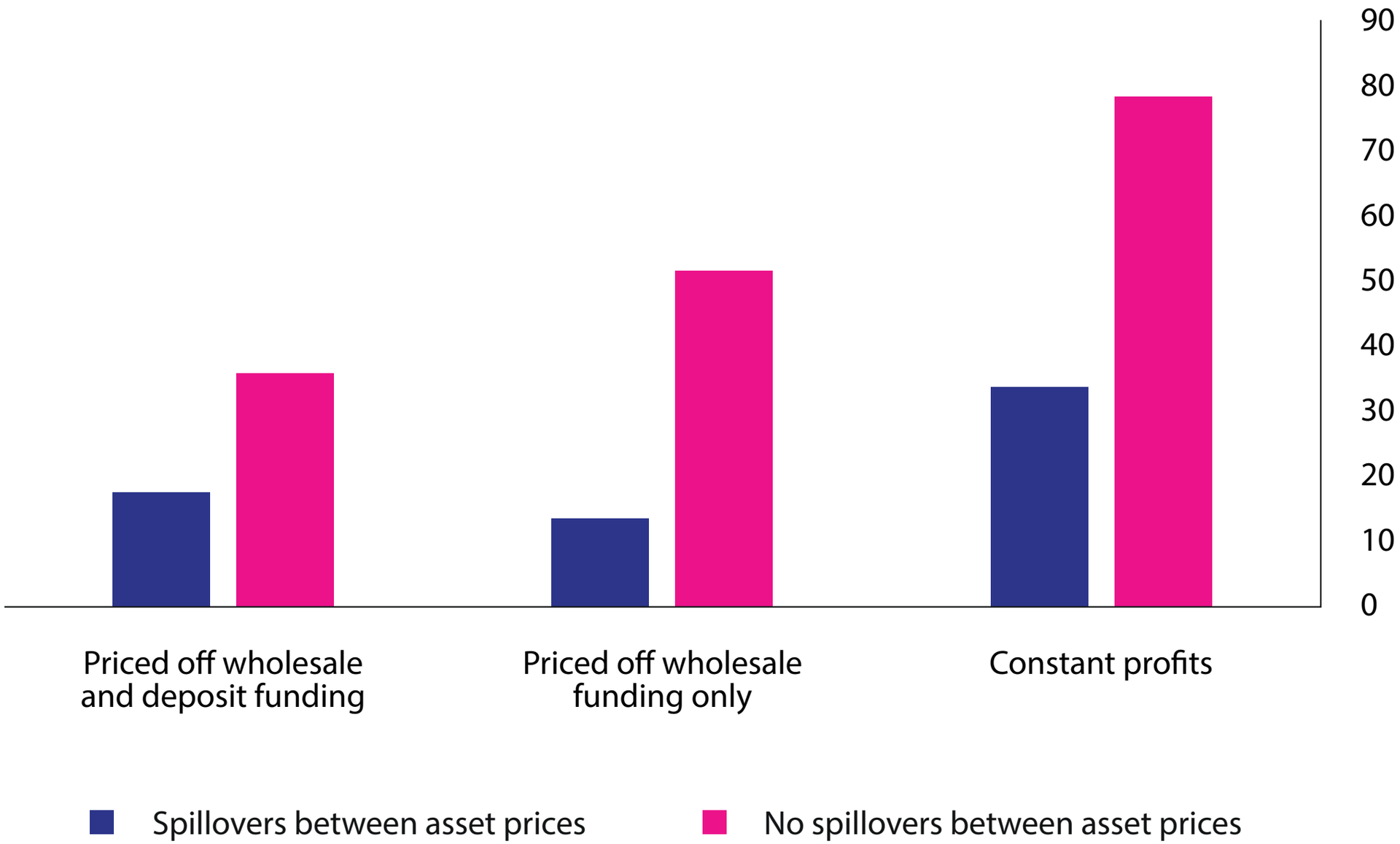
A particularly sensitive question is whether central banks may seek to use CBDCs, or other forms of digital currency, to enhance monetary policy implementation – eg. by overcoming the effective lower bound to interest rates, or injecting liquidity directly into the retail sector[8].

But there is no sign that central banks are thinking of digital currencies in this way. The Bank of England, for example, has stressed that any CBDC would complement, not substitute for, physical cash[9].

4. Digital currencies may affect the way central banks deliver monetary control

Over and above any impact that digital currencies may have on the transmission mechanism, they could also have implications for how central banks achieve 'monetary control': ie. ensuring that short term market rates are aligned with official rates chosen by policy makers[10].

Chart 5. Changes in the lending rates associated with introduction of new forms of money under different bank pricing and asset spillover assumptions



Source: Bank of England Discussion Paper: "New Forms of Digital Money"

Today, most central banks achieve this control by ensuring they at least meet banks' demand for central bank reserves, and remunerate those reserves such that market rates trade near or at the official rate. Other things equal, flows into digital currencies issued or backed by the central bank, will drain reserves from the system. That could complicate monetary control if it causes banks to bid up for reserves, pushing up on short term market rates relative to official levels.

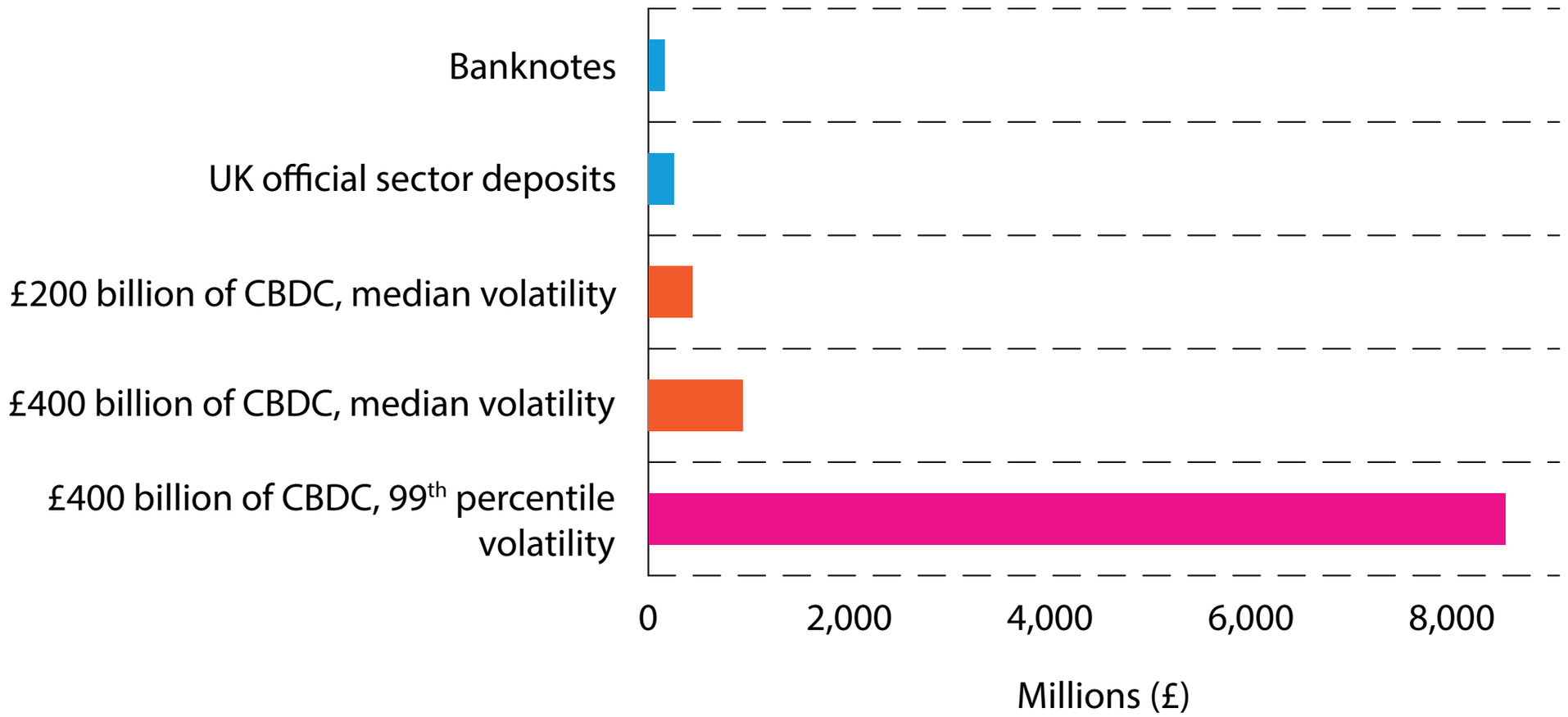
Such effects – ingloriously known as 'autonomous factors' in central banking jargon – are nothing new. Increases in physical banknotes or government deposits, for example, also drain reserves – and scaling that historical variation by the sort of estimates for CBDC size shown in Chart 2 suggests that day to day variation in CBDC demand would not pose materially greater uncertainty (the orange bars in Chart 6).

Sharper and less predictable inflows, eg. during a period of stress – proxied in the purple bar in Chart 6 using the extreme tail of existing autonomous flows – could however drive rather larger volatility.

Whether this matters for monetary control depends on the level of reserves at the point digital currencies are introduced, and the type of monetary control regime being operated. As of today, most major central banks use so-called 'floor' systems, with a level of reserves (injected via QE) that far exceeds most estimates of aggregate demand from the banking system. With such abundant reserves, even quite large unexpected variations in reserves holdings need not threaten monetary control ('Zone A' in Chart 7).

That may change as central banks unwind their QE holdings[11]. As the aggregate level of reserves falls, the chances of a sudden reserves drain pushing up on market rates increase ('Zone B' in Chart 7). Of course, no-one knows with any certainty where this inflection point lies. So central banks must either aim to stop asset unwind well before that point is reached (the approach announced by the FOMC), or have tools in place ready to allow banks to replace the

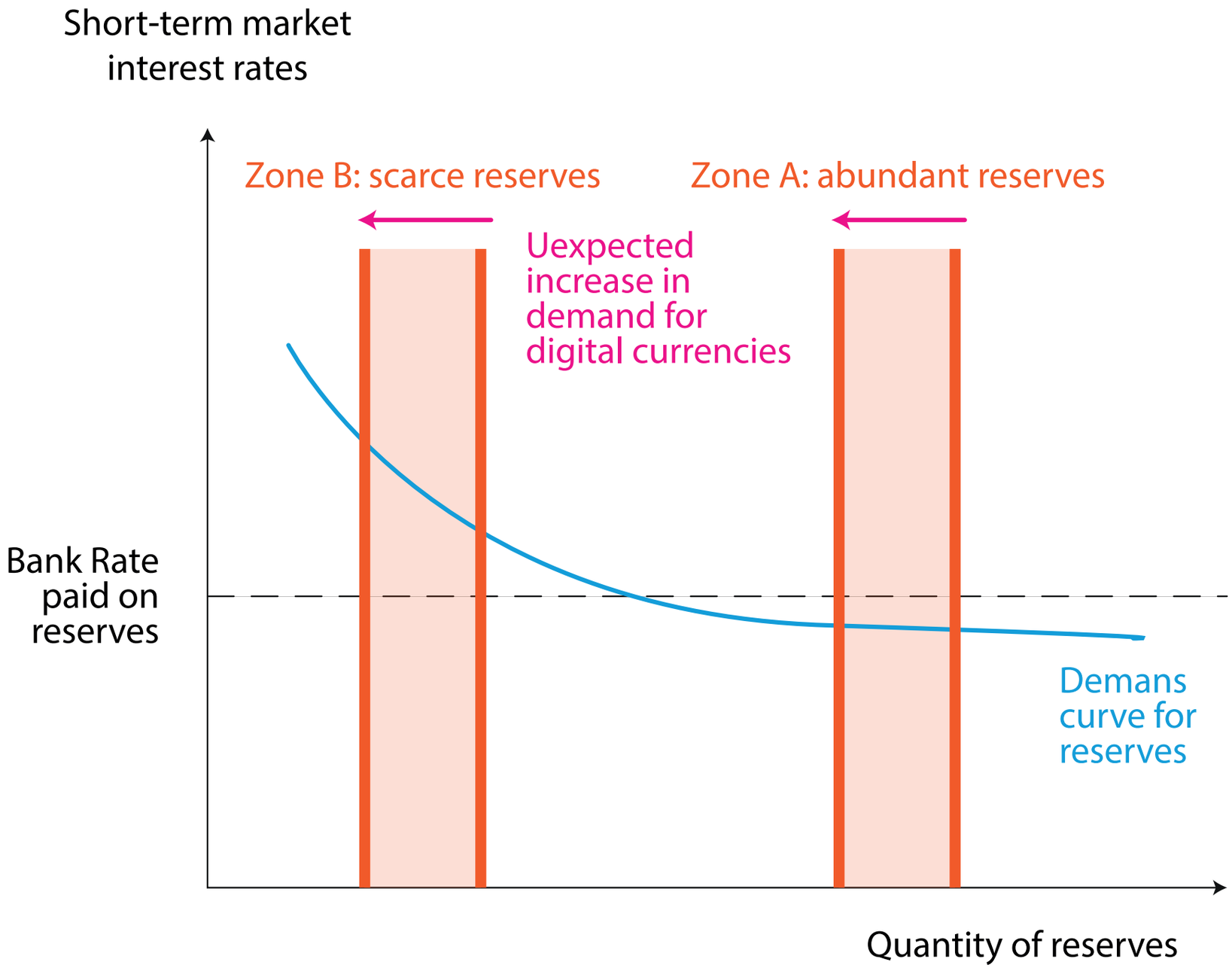
Chart 6. Potential volatility in autonomous factors (gross weekly flows)



Median gross weekly flows over past 10 years, illustrative example of possible 'business as usual' CBDC volatility using scaled median weekly banknote flows as a proxy; illustrative example of possible sharp inflow into CBDC using 99th percentile weekly banknote flows as a proxy

Source: Bank of England, Bank calculations.

Chart 7. Monetary control in a floor system with digital currencies



reserves depleted by asset sales/redemptions as and when they need to (the approach we expect to take in the UK)[12].

None of this fundamentally changes the nature of the challenges facing central banks in maintaining monetary control. But it does underscore the importance of reflecting operational needs in the design of potential future digital currency frameworks[13].

5. Digital currencies may alter the size and composition of central bank assets

Most of my remarks today have focused on the potential implications of digital currencies for central bank liabilities. But of course, for every liability, there also has to be an asset.

Whether those assets are, in total, any larger than today depends, in part, on whether new digital currencies cause a net increase in demand for central bank liabilities, or simply substitute for reserves or banknotes.

A narrow digital currency that largely cannibalised banknote demand, for example, might have little or no impact. By contrast, a broad digital currency with many attractive payments features could materially increase the demand for central bank liabilities.

The impact of any increase in demand on the size and composition of central bank assets depends on whether, and how, central banks choose to accommodate that demand. I've already noted that, in systems like the UK's, digital currencies may cause some banks whose deposit bases have been partially disintermediated to increase their borrowing from market-wide facilities.

A more interesting case could arise if the central bank chooses instead to back persistently higher demand with more long-lasting assets, for example to reduce rollover risk. At modest size, that may look little different to today's banknote programmes.

But if digital currencies took off at scale, careful thought would be needed as to how best to structure such asset holdings to manage balance sheet risks, and minimise any unintentional interference with other policy uses of the balance sheet[14].

Conclusion

CBDCs, if adopted, would be the first new type of central bank liability for centuries. They could have important implications for the size, composition and risk profile of our balance sheets; for the monetary policy transmission mechanism, and for monetary control. We need to understand these effects, and build them into the design of CBDCs and our operational toolkits.

But, by themselves, balance sheet considerations do not obviously present any 'redline' arguments against CBDC adoption, if that is the chosen way forward.

Indeed, while the technologies for such currencies would be new, the use of the central bank balance sheet to provide state-backed transactional money is one of our most longstanding functions. The dog may be old, but it can still perform new tricks! ■

Andrew Hauser is Executive Director for Markets at the Bank of England

Endnotes

1. The Bank of England's work in this area is available at: UK central bank digital currency.

2. This is the assumption used in the illustrative scenario in Section 3 of the Bank's 2021 discussion paper New forms of digital money, and reflects the share of UK deposits that is non-interest bearing.

3. See eg. Crypto industry shaken as Tether's dollar peg snaps; 'We're Not Revealing Our Secret Recipe', Tether's CTO Says; and Whereabouts of Terra's Bitcoin Reserve a Mystery After Transfers.

4. See Record of the Financial Policy Committee and https://www.bankofengland.co.uk/financial-policy-summary-and-record/2022/march-2022

5. As proposed by the UK Treasury.

6. See for example, 'Money creation in the modern economy'.

7. The Bank's Index Linked Term Repo facility, for example, operates weekly, and allows all eligible counterparties to bid for six month liquidity against the full range of eligible collateral (see Bank of England Market Operations Guide).

8. See, for example Securing macroeconomic and monetary stability with a Federal Reserve–backed digital currency

9. See for instance Innovation to serve the public interest - speech by Andrew Bailey.

10. This issue, and others discussed in my remarks, are also well covered in this 2018 report by the Bank for International Settlements' Committees on Markets and Payment and Market Infrastructures: Central bank digital currencies.

11. In the UK, the Bank's Monetary Policy Committee (MPC) voted to begin balance sheet unwind in February 2022 – see Monetary Policy Report - February 2022 – and gave further detail on its approach in its May Report: Monetary Policy Report - May 2022.

12. See Waiting for the exit: QT and the Bank of England's long-term balance sheet - speech by Andrew Hauser.

13. It is worth noting that, if digital currencies are not limited to primarily retail use, they could provide a conduit for wholesale market participants to disintermediate money markets, driving rather more profound changes in market functioning and bank funding.

14. This is just one aspect of a much wider set of questions about how to manage the touchpoints between the much wider set of uses to which our future balance sheets will be put that central banks will face in the years ahead, as discussed in: Bigger, broader, faster, stronger? How much should tomorrow's central bank balance sheets do - speech by Andrew Hauser.

I am very grateful to Joshua Jones and India Rimmer for their assistance in preparing these remarks; and to Andrew Bailey, Sarah Breeden, Shiv Chowla, Rohan Churm, Jon Cunliffe, Rafael Kinston, Jeremy Leake, Amber McAlone, Ali Moussavi, Huw Pill, Dave Ramsden, Francine Robb, Christina Segal-Knowles and Cormac Sullivan for their advice and comments. This article is based on a speech delivered at Federal Reserve Bank of New York and Columbia SIPA Workshop on 'Monetary Policy Implementation and Digital Innovation', New York, 01 June 2022.

Climate capital

The BoE recently tested the UK's largest banks and insurers on how prepared they are for financial risks caused by climate change. Sam Woods reviews the results

Climate change is now firmly in the focus of prudential regulators across the globe. In that context, I want to outline the results of our first exploratory scenario exercise on climate risk – the 'CBES'[1] – which were published 24th May. But before that, I want to put those results in context, and set out how I see climate risk fitting within the Prudential Regulation Authority's (PRA's) wider mission[2].

The role of prudential policy

Tackling the threat from climate change will involve efforts by governments across the globe, as well as by many other organisations and individuals.

In the UK, the effort to get to net zero greenhouse gas emissions is being led by government, with a wide range of other public bodies doing their part. Where does prudential policy fit into this effort?

The role of prudential policy is to ensure the safety and soundness of banks and insurers, so that they can continue to provide vital financial services to the real economy. Getting our core job right, and so maintaining financial stability, is far and away the most important thing we can do to support the fight against climate change.

Achieving net zero will not be possible unless our societies make considerable investments in developing and disseminating new technologies, and will require major changes across the economy. A stable financial system can support households and businesses through these changes, and channel investment where it needs to go to support the transition.

Transitioning to net zero will be a major challenge for our institutions and societies even in a benign economic environment – doing so without confidence in the basic functioning of the financial system would be near impossible.

It is therefore vital that firms can withstand risks to their safety and soundness, including those that arise as a consequence of climate change – both 'physical' risks like flooding and extreme weather events, and 'transition' risks that arise as the economy moves away from carbon-intensive activities.

Firms therefore need to understand, at a granular level, how their balance sheets and business models are exposed to both present and future climate risks, so that they can take the right risk management actions today.

This includes investing in their data and modelling capabilities, and carefully scrutinising the data they get from third parties. It means ensuring Boards and senior executives see climate risk as a strategic priority[3]. And ultimately, it means ensuring firms hold sufficient financial resources to absorb losses arising from climate change.

More generally these results bring home the fact that uncertainty around the impact of climate change – even given a pre-determined scenario – remains extremely high

Climate and capital

Should climate risk be captured in capital requirements?[4] In one sense, the answer is an obvious yes. Climate change will inevitably drive losses for banks and insurers – even in a scenario where governments around the world take swift and early action to bring us to net zero.

Just as with any other risk, PRA-regulated institutions must have the resilience to keep serving the real economy in the face of these losses. Capital requirements are an important part of how we deliver that resilience.

That said, while capital can address the financial consequences of climate change, we don't think it is the best tool to address directly the causes of climate change – for example by reducing capital requirements to subsidise 'green' assets, or increasing them to penalise carbon-intensive ones. How to address the causes of climate change is a decision for governments and parliaments, not financial regulators[5].

For one thing, by diverting the capital framework from its core goal of keeping the financial system standing, such interventions carry significant risks. At worst, we might end up under-capitalising banks and insurers for the risks they face, raising questions about their overall resilience. Or we could end up over-capitalising them inefficiently, reducing their ability to support the economy through the transition.

And there is little evidence that fine-tuning capital requirements in this way would actually achieve its intended goals. In the EU, changes made to the bank capital framework with the aim of supporting SME lending have had little demonstrable impact[6].

In the absence of evidence that capital requirements actually work as a way of directing lending, it seems unwise to incur these costs – particularly when we have not been given any mandate to do so.

Our focus is therefore on ensuring the financial system can withstand the risks arising from climate change. This raises some fundamental questions. How can we tell whether the capital regime is effectively capturing climate risks? There are two kinds of gap we might need to fill.

The first is 'regime gaps'. These occur when the design, methodology or scope of the capital framework does not adequately cover risks from climate. To give one example: some aspects of the Pillar 1 capital framework for banks use a one-year time horizon for calculating potential unexpected losses.

Of course, as policymakers, we do not have a one-year time horizon: we will need a viable banking and insurance sector right through the transition and beyond. The one-year horizon is, in effect, a modelling assumption.

It may be reasonable for many risks, but seems particularly ill-suited for climate change, a risk which is structurally building over time and will not fully crystallise in a one-year horizon[7].

The second type of gap takes the form of 'capability gaps'. Even if we were satisfied that climate risk was captured by the regime in theory, do firms and regulators have the data and modelling abilities to ensure it is captured in practice?

This is a major challenge: climate risk is very different from traditional financial risks, and we cannot rely on historical data to size it. Another factor that makes this difficult is the need for banks and insurers to understand the carbon impacts of the real economy firms they finance.

It can be hard to judge where real economy firms are, never mind where they are going – and it is the latter that is most important when thinking about future risks.

The Climate Biennial Exploratory Scenario (CBES)

The Bank's exploratory climate scenario exercise – which we call the 'CBES' – was launched last year and is intended to help address these capability gaps.

For the largest UK banks and insurers, we asked for granular analysis of the risks they might face, and their strategic responses, in three stylised 30-year scenarios:

- An 'early action' (EA) scenario where climate policy is ambitious from the beginning, with a gradual intensification of carbon taxes and other policies over time.

  As a result, global warming (relative to pre-industrial levels) is successfully limited to 1.8°C by the end of the scenario, falling to around 1.5°C by the end of century. You could view this as a reasonable best-case scenario for climate risk.

- A 'late action' (LA) scenario where policy measures are delayed by a decade, and then are implemented in a sudden and disorderly way, leading to material economic and market disruption.

  Ultimately, global warming is still limited to 1.8°C by the end of the scenario (2050) relative to pre-industrial levels, but then remains around this level at the end of the century[8].

- A 'no additional action' (NAA) scenario in which governments around the world fail to enact policy responses to global warming, other than those actions already taken. As a result, global temperature levels continue to increase, reaching 3.3°C higher relative to pre-industrial levels by the end of the scenario.

In the scenario this leads to serious environmental impacts, including extreme weather events, destroyed ecosystems and rising sea levels. In some cases these changes are irreversible.

While these changes take longer to manifest, they give rise to increasing and irreversible shocks that continue to grow beyond the scenario: UK and global GDP growth are permanently lower and macroeconomic uncertainty increases.

Broadly speaking, the first two scenarios focus on risks from the transition to net zero, whereas the third one focuses on physical risks from climate change. And to reiterate a theme I will come back to later, the risks from climate change have been managed by the end of the first two scenarios – whereas in the third they continue to build.

CBES headlines

The results of the CBES have been published, and I would encourage anyone with an interest in this topic to read them in full. For me the main headlines from the results publication are:

- The stylised scenarios used in this exercise are illustrations of possible paths for climate policy and global warming, not forecasts. The projections made by banks and insurers are uncertain, but suggest that overall costs will be lowest with early, well-managed action to reduce greenhouse gas emissions and so limit climate change.

- UK banks' and insurers' projections suggest that they are likely to be able to bear the costs of transition that fall on them. In part, that is because a significant portion of these costs may ultimately be passed on to their customers.

- In the No Additional Action scenario, households and businesses vulnerable to physical risks would be

particularly hard hit, as general insurers would pass on the cost of higher claims into premiums, or otherwise refuse to renew insurance for some customers.

- Governments set public climate policy, which will be a key determinant of the speed and shape of changes in the global economy. Banks and insurers have a collective interest in managing climate-related financial risks in a way that supports that transition over time. They will need to improve their management of these risks in order to be able to do so.

Within this, I wanted to pick out a few particularly interesting lessons.

The first key lesson from this exercise is that over time climate risks will become a persistent drag on banks' and insurers' profitability – particularly if they don't manage them effectively. While they vary across firms and scenarios, overall loss rates are equivalent to an average drag on annual profits of around 10-15%.

These are big numbers, and the limits of the exercise mean the actual impact could well be larger due to some significant exclusions[9]. But it bears repeating that based on this exercise the costs of a transition to net zero look absorbable for banks and insurers, without a worrying direct impact on their solvency.

By themselves, these are not the kinds of losses that would make me question the stability of the system, and they suggest that the financial sector has the capacity to support the economy through the transition.

But any positive message needs to be taken with a major pinch of salt: both because there is a lot of uncertainty in these projections and because this drag on profitability will leave the sector more vulnerable to other, future shocks. A world with climate change is a riskier one for the financial system to navigate.

A second key lesson is that how and when we transition makes a big difference. Costs to the financial sector will be substantially lower if early, orderly action is taken. For example, projected climate-related bank credit losses were 30% higher in the LA scenario than the EA scenario.

Among other factors, this reflects that in the scenario, adjusting late and abruptly to climate risk triggers a messy recession – with rising unemployment as the corporate sector adjusts. So early action is important to lower the cost of the transition. If we are ever to reach net zero, a number of sectors are going to have to adapt their business models on a fundamental level.

As the report sets out, it will be in the collective interests of financial institutions to support counterparties that have credible plans to adapt – and ultimately reduce their exposures to those sectors of the economy that are inconsistent with a net zero policy[10].

At the same time, the financial sector cannot run ahead of the real economy: we need real change to make the economy more energy efficient and expand the provision of renewable energy. While that process takes place, banks and insurers need to provide finance to more carbon-intensive sectors of the economy, precisely in order to allow them to invest in the transition.

Cutting off finance to these corporates too quickly could prove counterproductive, and have wide-ranging macroeconomic and societal consequences, including through elevated energy prices – potentially akin to those whose negative effects we are experiencing today.

Another key point for me is that no action on climate delivers the worst outcome from our scenarios. A naïve comparison of loss rates in the two net zero scenarios and the NAA scenario might suggest otherwise; in fact for banks, credit losses were lower under no action than for late action.

But this is misleading because of the very different endpoints of the scenarios. Under both the LA and EA scenarios, climate change has broadly been brought under control by the end of the 30-year period.

By contrast, with no additional action the impacts will persist well beyond the 30 years of our scenario – incurring substantial economic costs not captured in these estimates[11].

Even sticking within the 30-year bounds of the scenario – and focusing on financial sector impacts – the NAA scenario is pretty grim. Projected impairment rates for banks are up 50% compared with normal levels. And whereas the 'transition' scenarios offer clear opportunities for banks to increase their profits by investing the transition, the 'no action' scenario offered no such opportunities.

Instead, the world gets poorer and more uncertain for all sectors, particularly those directly exposed to physical risks. The 'no action' scenario is particularly unpleasant for life and general insurers – even sticking to the 30-year window, their losses in this scenario were worse than in the transition.

For instance, UK and international general insurers, respectively, projected a rise in average annualised losses of around 50% and 70% by the end of the NAA scenario. It's worth emphasising that these costs would be mostly passed on to consumers through higher premiums.

Ultimately, in a 'no action' scenario, we would see a reduction in access to lending and insurance for so-called 'climate vulnerable' sectors and households.

To give an example of what this means, homes at risk of flooding would likely become prohibitively expensive to insure or borrow against.

Like so many of the impacts of climate change, this cost would be borne unequally: 45% of the mortgage impairments in the scenario are accounted for by just 10% of the country[12]. And there is evidence that in areas particularly at risk of flooding, many homes could become uninsurable.

Finally, the CBES exercise is a measure of the progress banks and insurers are making in their climate risk management. Overall, this is a good news story: we were encouraged by the progress firms have made. But there is still much more to do. We will give firm-specific feedback to participants, but key themes include:

- The need for more data on, and understanding of, customers' current emissions and transition plans. This can include looking through complex chains of financial relationships between clients and counterparties to see the underlying emissions.

- The need to invest in modelling capabilities and doing more to scrutinise data and projections supplied by third parties.

- The need for some firms to consider more deeply how they would respond strategically to different scenarios, including thinking through the implications of different paths for climate policy.

More generally these results bring home the fact that uncertainty around the impact of climate change – even given a pre-determined scenario – remains extremely high. As you will see if you read the report, the error bands around all these estimates are very wide[13].

This presents a challenge when considering implications for policy – and highlights the importance of continuing to plug the kinds of capability gaps I discussed earlier. As the results publication sets out, the Bank will engage

with firms individually and collectively to help them target their efforts, and share good practices identified in this exercise.

Implications for policy

I hope it's clear by this point that the CBES will be a valuable tool for helping us and financial firms to understand the challenges ahead. This exercise is not going to be used to set capital requirements for banks and insurers. But it clearly sheds light on that debate.

The CBES results make clear that climate risk is a first-order strategic issue for the firms we regulate. But in my view it is not yet clear that the magnitude of transition costs require a fundamental recalibration of capital requirements for the system[14].

A persistent drag on profitability would be very nasty for firms, but so long as they are able to continue to make sufficient profits to maintain their capital buffers, its impact on safety and soundness might be less material. Had the results of this exercise suggested a fundamental threat to the solvency of these firms, our response would of course have been quite different.

Set against that high level view, though, a world with climate change is without doubt riskier than one without. And so I see a number of challenges which underline the need for further work:

- To the extent that climate change makes the distribution of future shocks nastier, that could imply higher capital requirements, all else equal.

  So a key judgement will be: are current capital levels sufficiently high to guard against unexpected shocks during the transition?

- Even if capital levels are appropriate in aggregate, that does not mean that the capital is held in the right places. As we have seen, some of these risks are highly concentrated in particular sectors.

  A second key judgement will therefore be: does the framework of capital requirements capture climate risk at a sufficiently granular level?

- We also need to ensure firms have the right incentives to continue to improve their capabilities and meet our expectations.

  The CBES results show that while progress has been made, there is still much to do. From the point of view of capital, this suggests a third key judgement: are we satisfied that firms are building the capabilities they need – and if not, do we need to introduce more incentives?

Most fundamentally, the CBES results are a snapshot – based on current data and modelling capabilities and focused on a specific set of scenarios and risks. I have highlighted the significant uncertainty as well as the gaps that underlie these results.

To my mind the most notable exclusion is traded or market risk for banks, which might be where a transition shock would be most likely to manifest – indeed current and recent stresses in energy and commodity markets illustrate this point.

As we build capabilities, we will be better able to size the risk and its potential policy implications. We will also learn over time whether the real world looks more like the EA scenario, or if we are living in a 'late' or 'no' action world.

All of this will inform the PRA's judgements about capital requirements and any other responses to climate risks. Today's publication is important step forward, but it is not the last word. ■

Sam Woods is Deputy Governor of the Bank of England and Chief Executive Officer of the Prudential Regulation Authority

Endnotes

1. Climate Biennial Exploratory Scenario.

2. For the purposes of this speech, I focus on the prudential regulation and financial stability aspects of climate risk, as opposed to the Bank of England's other responsibilities as a central bank.

3. The PRA's supervisory statement on enhancing banks' and insurers' approaches to managing the financial risks from climate change.

4. The PRA Climate Change Adaptation Report 2021 set out some of these issues in more detail.

5. My colleague Sarah Breeden also reflected on the role of government, central banks and financial firms in the economy's transition to net zero in a recent speech: Balancing on the net-zero tightrope .

6. For example, EBA research on the 'SME supporting factor' introduced as part of CRR found no evidence that it was effective in reducing pricing or increasing lending. EBA-Op-2016-04 Report on SMEs and SME supporting factor.pdf.

7. That said, there is a legitimate question about how far the current capital framework should capture risks 20+ years in the future. I return to this point later on.

8. You may find it counterintuitive that the 2050 temperature outcomes do not differ wildly across these two scenarios – but that reminds us that changes in climate policy take a long time to feed through to climate outcomes.

9. Risks outside the scope of the exercise include traded risk for banks, and mortality risk for life insurers. It is worth noting

that the impact could also be lower, most obviously because the modelling constraint of a fixed balance sheet in the CBES limited firms' room to adapt to evolving risks.

10. Within the corporate sector, the industries with biggest losses from the transition are mining (including extraction of petroleum and natural gas), manufacturing, transport and wholesale & retail trade. The cumulative impairment rate on lending to these sectors averaged 35%. Insurers projected heavy corporate bond and equity losses in similar sectors, especially oil and gas.

11. It's also probably fair to say that our ability to model the NAA scenario is more incomplete than the EA and LA scenarios – so there are greater risks of uncaptured or unanticipated losses in that scenario.

12. Based on analysis on the location of impairments within the four-digit postcodes analysed.

13. And we know there are gaps. Since this was our and the firms' first exercise we deliberately chose not to capture all possible sources of risk.

14. But this is something that the Bank will be exploring further, and where we have invited external analysis and research to inform our views. We will be holding a conference later in the year to discuss.

This article is based on a speech given at a webcast hosted by the Global Association of Risk Professionals, May 2022.

EU economic resilience tested

The EU has revised growth forecasts down. Maarten Verwey, Laura Bardone and Kristian Orsini say the Russian invasion is exacerbating pre-existing headwinds to economic growth

Russia's invasion of Ukraine has led the European Commission to revise its EU growth outlook downwards, and the forecast for inflation upwards. As this column discusses, by exerting further upward pressures on commodity prices, causing renewed supply disruptions and increasing uncertainty, the war is exacerbating pre-existing headwinds to growth, which were previously expected to subside.

Nevertheless, the economy is expected to keep expanding, and inflation is set to gradually decline towards, though remain above, 2% throughout the forecast horizon. Should further disruptions in energy markets occur, the economy would not escape stagflation.

…but economic expansion in the EU is set to continue and inflationary pressures to abate…

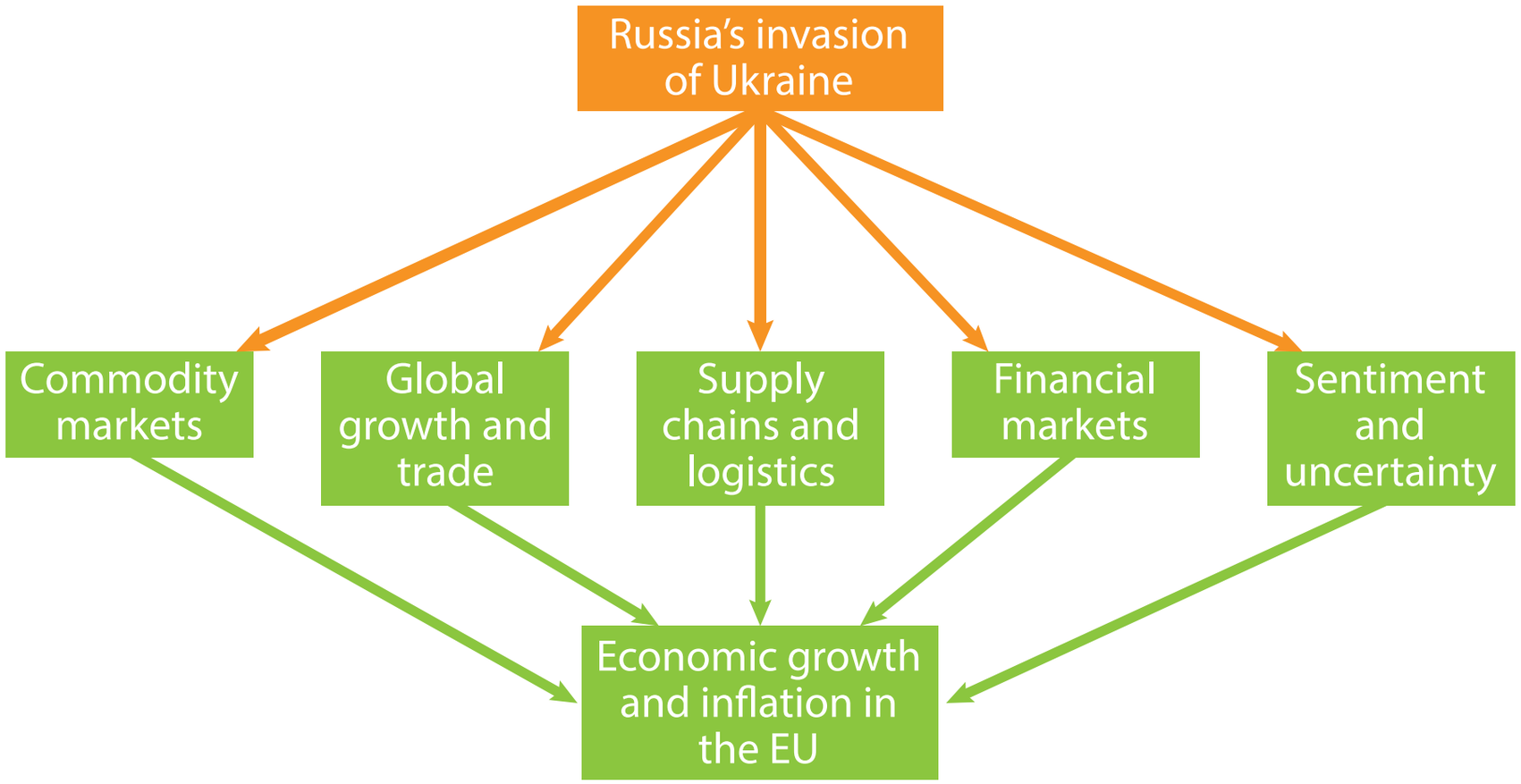
The current shock bears many similarities with that occurring in the 1970s, when oil prices skyrocketed as the Organization of Arab Petroleum Exporting Countries (OAPEC) curtailed supply in response to the Yom Kippur war in October 1973.

This alone has led observers to evoke the spectre of stagflation. Yet, similarities should not be overemphasised. First, at least so far, the magnitude of the energy commodity price increase has been smaller than in the 1970s (Ha *et al* 2022).

Admittedly, the price of gas is now around six times higher than the pre-pandemic benchmark, an increase that is even larger than the surge in oil prices between October 1973 and February 1974.

Yet, the increase in the price of oil – which still is the primary source of energy for the EU – has been more contained, at roughly 60% above pre-pandemic levels.

Figure 1. How Russia's invasion of Ukraine is affecting the EU economic outlook



Second, in the 1970s, OAPEC controlled nearly 60% of the world oil supply, whereas today Russia accounts for a much lower share of both oil and gas global supply (12% and 17%, respectively; British Petroleum 2022).

Third, four decades ago, production in advanced economies was much more energy-intensive than it is today, thanks to progress achieved in energy efficiency and a larger share of services (IMF 2022c).

Fourth, other structural characteristics of the economy also differ: back in the 1970s, widespread wage and price indexations, highly regulated and oligopolistic markets, and trade protectionism were key in propagating and prolonging price shocks.

Policymakers have to preserve incentives to diminish energy consumption and ensure public finances to remain on a track of long-term sustainability

Finally, prevailing demand management policies were slow to respond to the untested supply shock (ECB 2000).

Despite revising the projections for growth downwards and for inflation upwards, the European Economic Spring 2022 Forecast (European Commission 2022b) still projects the economy to keep expanding over the forecast horizon, and inflation to gradually converge towards – but remain above – target. This is not the full-blown stagflationary scenario of the 1970s.

Real GDP growth in both the EU and the euro area is now expected at 2.7% in 2022 and 2.3% in 2023, down from 4.0% and 2.8% (2.7% in the euro area), respectively, in the Winter 2022 interim forecast (European Commission 2022c).

The downgrade for 2022 must be read against the background of the growth momentum gathered by the economy in spring and summer last year, which adds around 2 percentage points to growth over this year ('carry-over effect'). Within-year growth has been reduced from 2.1% to just 0.8%.

In turn, the projection for inflation has been revised up significantly. In the EU, HICP inflation is now expected to average an all-time high of 6.8% in 2022, before declining to 3.2% in 2023. In the euro area, inflation is projected at 6.1% in 2022 and 2.7% in 2023. This compares with 3.5% and 1.7%, respectively, in the Winter 2022 interim forecast.

The economic expansion is upheld by residual tailwinds from the ongoing post-pandemic re-opening of contact-intensive services, as well as the resilience of the economy built through strong policy action at EU and national levels in response to the pandemic crisis.

A strong and still improving employment situation, high accumulated savings and the full deployment of the Recovery and Resilience Facility (RRF) and accompanying reform agenda are set to support private consumption and investment. Fiscal measures to offset part of the impact of rising energy prices on vulnerable households and energy-intensive firms are adding to this support.

Still, the unprecedented nature and size of the shocks ushered in by the war make the baseline projections of our forecast subject to considerable uncertainty, and the balance of risks surrounding them skewed towards adverse outcomes. Risks are heavily dependent on the evolution of the war and its consequences for energy markets.

The forecast is based on the assumption that geopolitical tensions do not normalise over the forecast horizon and that energy prices evolve in line with the indications from futures markets. It does not factor in large-scale interruptions in the supply of oil and/or gas commodities, which reflects the situation on the cut-off date of the forecast.

… still severe disruptions in energy markets could tip the EU into stagflation…

Shocks reverberating from an evolution of energy markets that depart from these key assumptions are assessed through model-based scenario analyses. A first adverse scenario assumes oil and gas prices 25% above the baseline throughout the forecast horizon. A second, more severe scenario considers an outright cut in gas supply from Russia.

Both scenarios are associated with further increases in risk premia and negative confidence effects. The results of the simulation exercise show that the shocks in energy markets strengthen the stagflationary forces at play, and result in lower growth and higher inflation than in the baseline.

Figure 2a. EU GDP growth forecast (Spring and Winter)

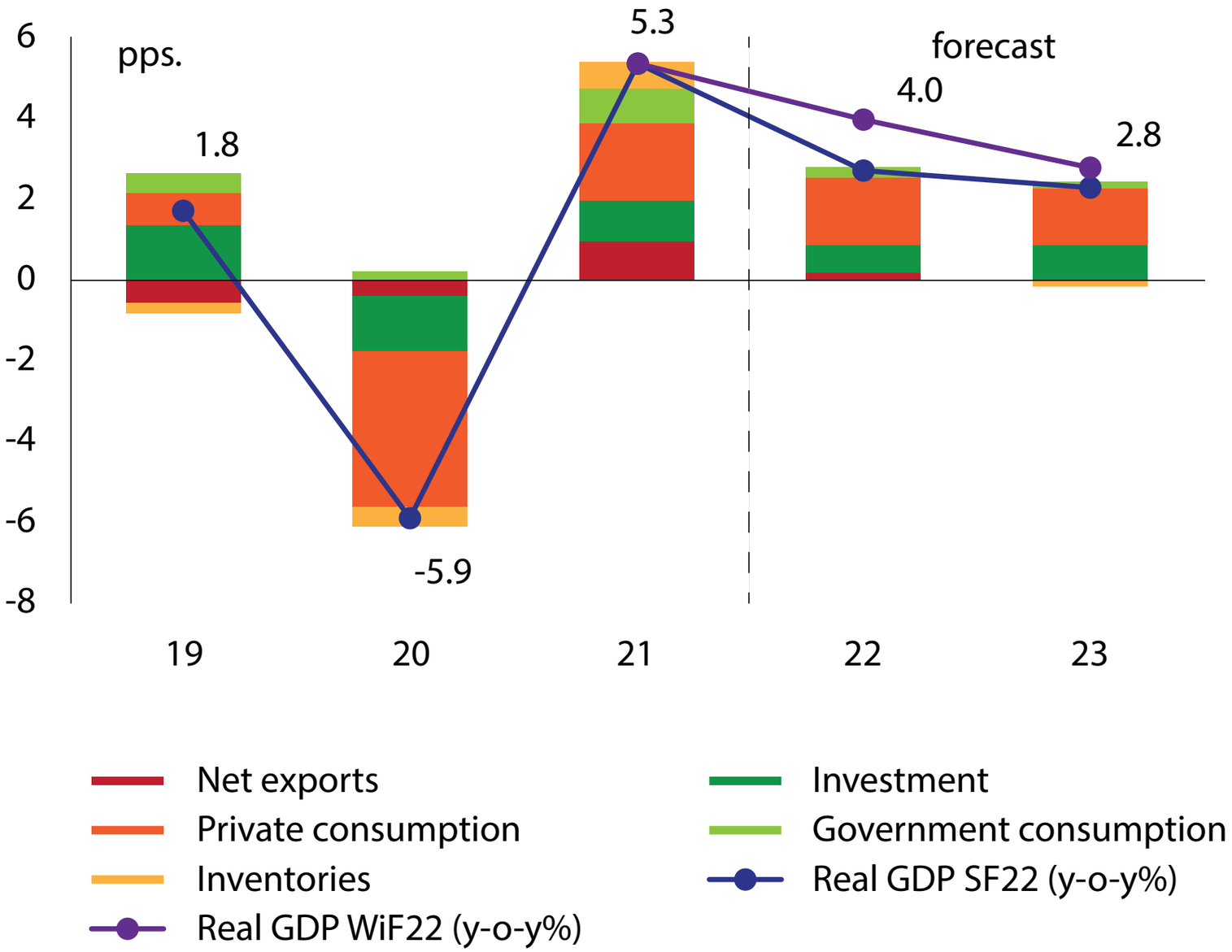
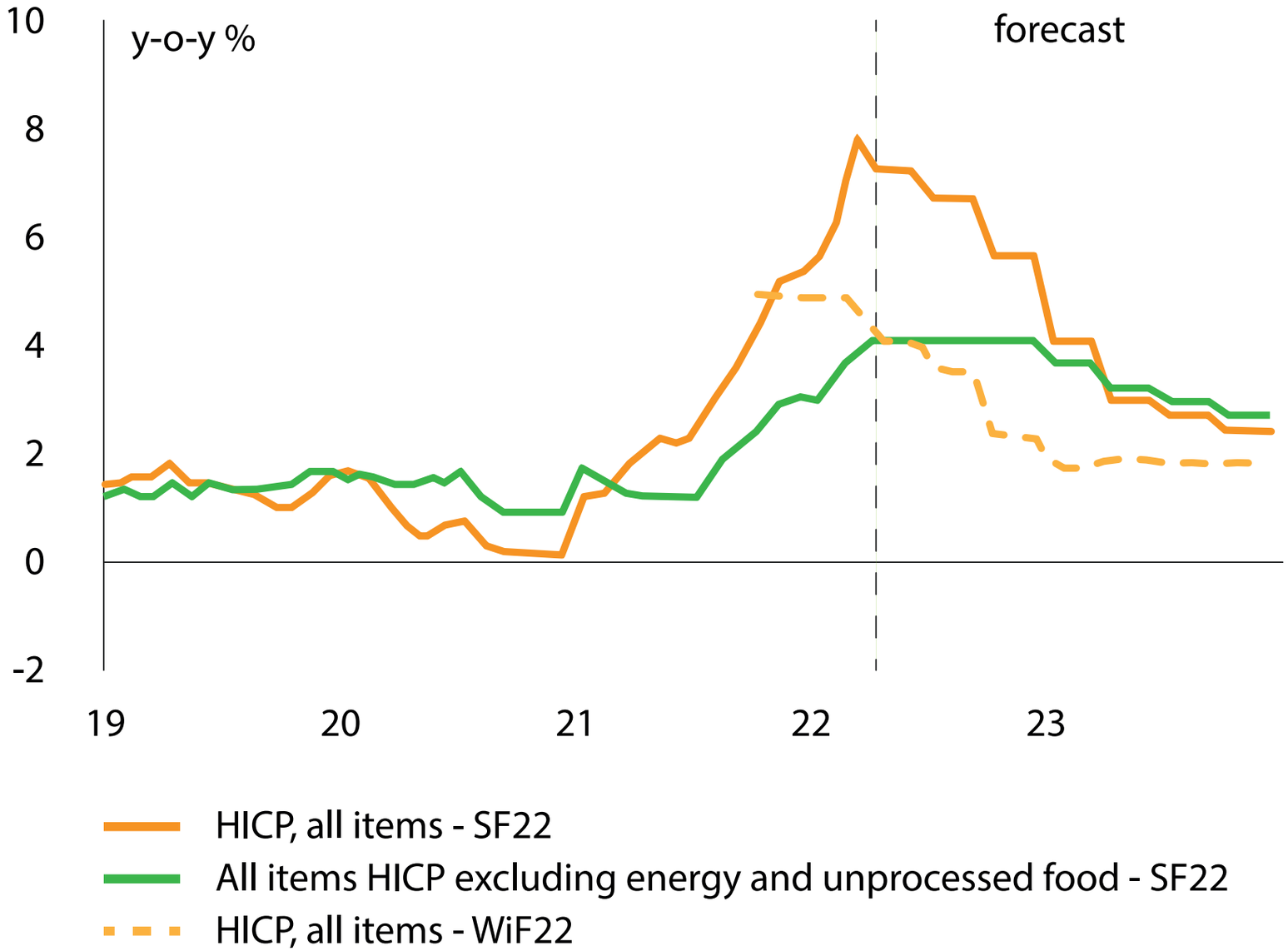


Figure 2b EU inflation forecast (Spring and Winter)



Thanks to the strong carry-over from 2021, the euro area economy would still manage positive annual growth rates in the two forecast years, but net of the carry-over effect from 2021, the economy would contract in 2022.

A sharp reduction in gas supplies from Russia would imply a substantial deterioration of the economic outlook: GDP growth rates would be around 2½ and 1pps. below the baseline in 2022 and 2023, respectively, while inflation, proxied by the private consumption deflator, would be 3 percentage points higher in 2022 and more than 1 percentage point above in 2023.

… reinforcing the need to frontload energy transition

Substantial macroeconomic risks stemming from the EU's high dependency on imports of oil and gas from Russia reinforce the case for an accelerated decarbonisation of the economy. Policy action should target both supply (eg. investing in renewables sources or LNG terminals) and demand (eg. facilitating energy efficiency or electric car charging stations).

It is crucial that the RRF can be counted upon to face this new challenge. The timely implementation of its investment and reform pillars is as relevant as ever to reduce fossil fuel dependency from Russia and enhance the long-term growth potential of the EU economy.

Within the framework of the REPowerEU plan (European Commission 2022d), the Commission stands ready to scale up its support projects and reforms that accelerate the energy transition. Projects completing the internal market in energy and those with a strong cross-border dimension should be privileged. Unused loans in the RRF can be an additional source of funding.

Figure 3a. Real GDP growth rates across scenarios, euro area

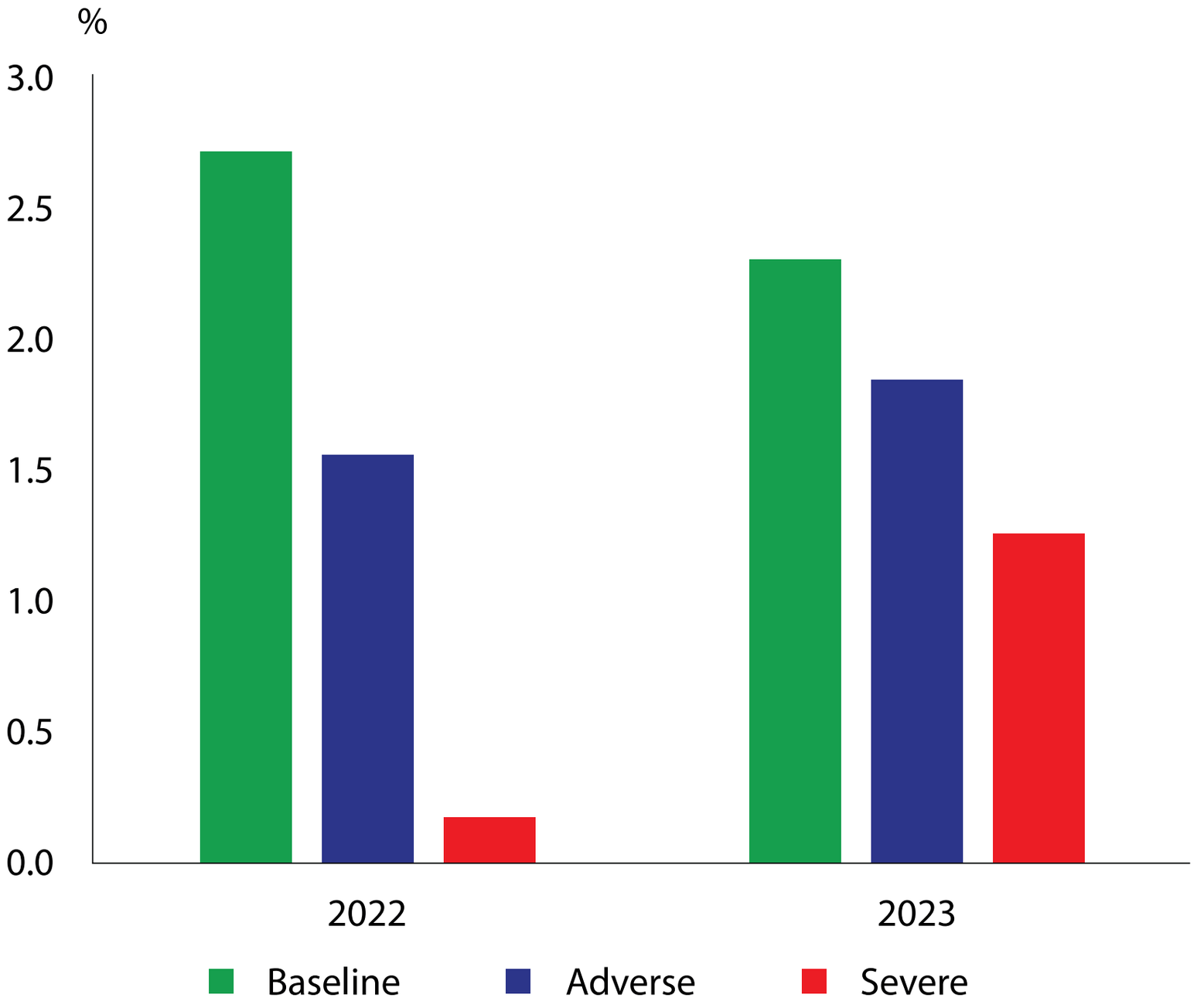
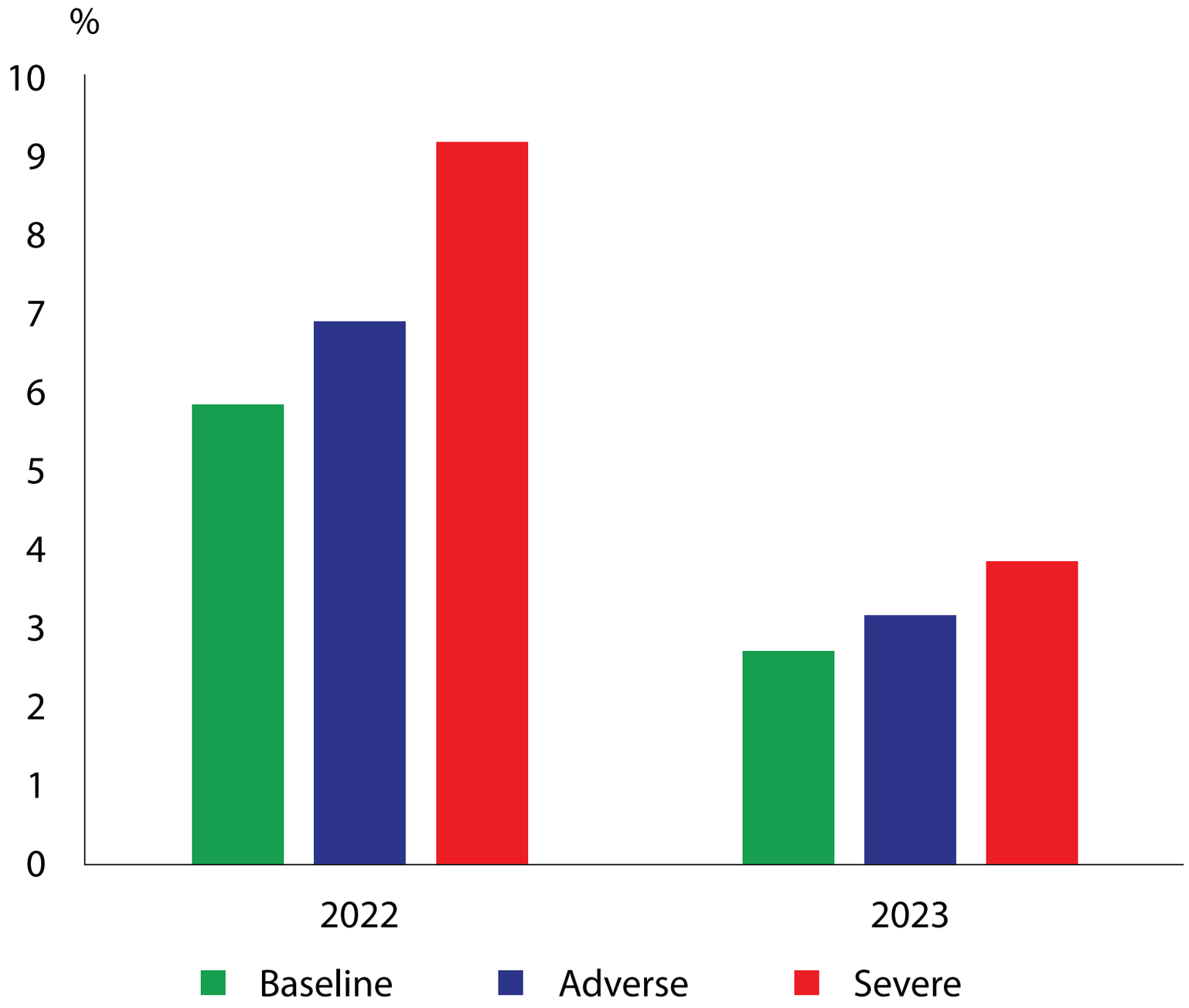


Figure 3b. Inflation rates across scenarios, euro area



Policymakers will have to recalibrate their policy tools deployed during the pandemic. Over the past couple of years, fiscal firepower was successfully mobilised to support aggregate demand and stabilise employment, thereby also safeguarding price stability in face of deflationary risks.

This response has proved highly effective in protecting EU citizens and preserving the economy's productive capacity in a context of a temporary shock, expected to have overall limited transformational consequences. Faced with a potentially permanent shock that largely weighs on the supply side of the economy, policy action should no longer aim at avoiding excessive dislocations but rather accompany and accelerate structural change.

In facing these new challenges, attention needs to be paid to distributional aspects. While softening the impact of rising energy prices on vulnerable households and energy-intensive industries, policymakers have to preserve incentives to diminish energy consumption and ensure public finances to remain on a track of long-term sustainability. ■

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Brand implications for successful M&A

Gonzalo Brujo shares his insight into ensuring a brand is market-ready and has considered all aspects of strategy for the best outcomes of any prospective deals

The business world has braced itself for multiple economic shocks recently, not least from the impact of the COVID-19 pandemic. But amid all the uncertainty and restrictions imposed by lockdowns, M&A activity reached record levels – hitting $6 trillion at the end of 2021.

While there have been further global events to negatively affect businesses this year – the Ukraine war and now rising inflation being the most shattering– M&A deals will remain very much part of the global corporate landscape. Indeed, any brands looking to be world leaders will have to acquire businesses to grow and extend into new categories and arenas and reach new consumers.

If we look at those brands that have excelled in the tech space – and now dominate as the best global brands – acquisitions have supported their growth. From their founding year until 2020, Apple made 123 acquisitions, Amazon 111, Google 268, and Facebook (now Meta) 105.

Last year, the biggest M&A deal was between AT&T's WarnerMedia and Discovery – worth $43 billion. But while mergers and acquisitions are a huge part of the business landscape and are assumed to lead to business growth, their outcomes are less than certain (merger failure rates are between 50–85%).

Two well-known failure cases are AOL & TimeWarner and Daimler-Benz & Chrysler, which can be explained in cultural and brand terms. In a nutshell, they both lacked a clear brand strategy. In the particular case of Daimler & Chrysler, each brand agreed to the deal with very different ambitions – meaning the merger would never succeed.

For any company embarking on a deal of this nature – or starting the process of searching for one – there are some essential brand implications to consider and the first and foremost is that the brand will play a critical role in any M&A deal.

Indeed, the strategic, cultural, and brand implications of merging two organizations are just as important to the long-term success as the price of the deal. So, to determine how to build a market-ready M&A brand, we need to start by considering the myriad reasons for an M&A:

- Grow market share
- Improve customer experience
- Improve value chain positioning

Businesses use M&A deals to transcend their own arenas or to gain new expertise – this simple aim makes business sense and can be hugely successful

- Increase shareholder value
- Access new distribution channels
- Expand capabilities and access to technology
- Access key talent
- Expand geographically and demographically
- Expand into new industries and offerings
- Cut costs and boost revenues
- Increase competitive advantage
- Customer-focused opportunities.

As global competition intensifies, M&A is – and will continue to be – a cornerstone of many growth strategies. The expectation is that M&A will increase shareholder returns and fuel future business growth but, as already mentioned, many have ultimately shown negative returns.

Ultimately, the M&A journey is a maze. From pre-deal to post-merger, there are a million twists and turns and unforeseen roadblocks, both internally and externally.

When looked at in this light, it's easy to see why so many M&A ventures don't reach their intended results:

- Unclear business and brand strategy
- Lack of a clear, strategic plan for becoming market-ready
- Not understanding the risks to current customer loyalty and key revenue streams
- Overlooking cultural integration risks that could lead to low talent retention
- Failure to identify brand equities and sources of growth
- Limited evaluation and consideration of customer alignment with the brand promise.

However, these issues can be mitigated. There are four clear steps to help ensure a brand is ready for the process.

1. Create a strategic foundation

The path to success starts with a strong strategic foundation for the brand and the business. It is important to clearly understand where the company is today (its departure point) and where it will be tomorrow (its ambition).

This will become the framework for evaluating potential M&A candidates and ensuring key decision-makers and leaders are on the same page.

A clearly mapped M&A strategy trajectory guides the company moving forward, but it is essential to ask the right questions at each turn. The 'sweet spot' of any M&A is the intersection of current and future marketplace expectations and the sustained ability of the brand to deliver on those expectations. This will allow potential synergies, opportunities, and risks to be unearthed.

That means looking closely at the internal employee impact, and the external customer implications of the M&A. This will help complete the outline of the growth narrative — the challenges, opportunities, and implications of the M&A on your company, brand, and audiences in the short and long term.

Additionally, considering your shareholders' stakes is equally crucial – it will help dealmakers engineer powerful alliances that can create value for all. The motivation for a merger must proportionately represent the ambitions of the business and the shareholder. The financial health of the enterprise and the financial health of the shareholder should be considered in concert.

In addition, the values and the behaviours of leaders must connect with the sentiments and priorities of the shareholder. Any perception of personal gain and prejudice, at the expense of the vast population of shareholders, invites cynicism and concerns that the deal may be motivated by greed and control.

The language and tone used to communicate the merger must be consistent with the brand; then it will be familiar – and respected – by the employees. Often, a large portion of shareholders includes current and past employees.

When a corporate speaks and behaves in ways that contradict the style and reputation of the brand, it invites sceptics who will challenge the intentions of leaders, building mistrust and suspicions.

The onus is on the leadership team to create open and frequent dialogue to build understanding and advocacy among shareholders. Mergers are complicated chapters to write and execute – it's important to recognize the emotional current that flows throughout. Shareholders are a powerful force for change and their inclusion in the process is an asset, not a source of contention.

2. Design a market-ready plan

The next phase is setting the building blocks for a market-ready brand. This means creating a migration plan on top of your strategy and outlining exceptional customer experience principles that will lead to future growth.

The insights gained by laying a strategic foundation will help guide this growth process and allow you to make informed, strategic decisions on how to implement the M&A, internally and externally.

For instance, in a market such as financial services, there can be huge logistical problems with M&A especially as companies are likely operating on completely different platforms with associated differences in security. This has a significant impact on customer experience – following a merger the way customers navigate may have to change.

The growth story is imperative to define the internal and external narrative moving forward. It should be derived from your company's M&A strategy vision – explain the central rationale for the move and create a common set of expectations around the results of M&A for both customers and employees. This could include your new name, visual system, customer experience principles, and key messages.

When BB&T and SunTrust merged to become Truist, it was the largest merger bank in the US. One of the reasons for the success of this merger was a clear purpose – its strategy was to be the main financial institution of the future and so invented a different way of banking.

The plan will dictate the integration and optimization strategy for the foreseeable future. Based on the information obtained about the implications on employees and customers, you can set the timeline and key milestones for the merger.

Culture eats strategy

During a transition, it's even more vital for an organization to align the brand, people, and culture with the vision for the new business. Your brand is the red thread that connects employees to customers and is the one thing that will differentiate you over time.

When the people inside an organization understand who they are and what they stand for, they can nurture, evolve, invigorate, and truly bring the brand – and the business – to life. This is about identifying cultural alignments and building employee engagement as well as a retention plan.

In an M&A situation, we need to protect the equity that we have in the current culture and examine existing strengths. We want to bring those forward to create something new and inspiring that will help employees through this tremendous change.

What is the role of the brand in this endeavour?

- The brand can provide clarity and sense of purpose
- Your brand can help align the dots across the organization
- Your brand can give leadership a fresh platform for storytelling—one that is inspiring and helps employees to understand their roles in the new organization.

For example, when Thomson and Reuters merged, the research showed the two companies had strong, but different, brand attributes that needed to remain intact in the new brand. The combination would not only enhance their existing strengths but also create a new one.

Joining the brands created key foundational attributes of global, accurate and unbiased, timely, trusted and customer focused. Research pointed to Thomson Reuters being compelling for customers because of three brand pillars: relevant depth, practical intuition, and immediate effectiveness.

3. Equip the business

It's easy for leaders and the integration team to lose focus once the merger is complete and to stray from the agreed-upon timeline.

While it is important to nail the operational integration, it is just as important to be aware of – and remain focused on – the changing conversations happening among employees and customers.

This is where most M&As fail to realize their potential and succumb to the many risks, such as loss of customers, loss of talent, and failing to achieve synergies and cost-cutting goals.

The market-ready plan gives the organization a roadmap to bring the new brand to life internally before the external launch. The goal is to have the new M&A brand prepared for life in the customer's world.

Some tactics that can ensure successful integration as you bring the new brand into the spotlight are:

- Conduct leadership and employee engagement programs

- Merge verbal, visual identity systems, digital touchpoints, messaging, and voice principles
- Deliver brand management tools and training
- Track key internal KPIs that were set out at the beginning of the M&A
- Communicate the M&A to customers and the sales team
- Secure quick sales to reinforce confidence in the M&A
- Communicate clearly about internal restructuring and changing roles
- Build detailed customer transition plans
- Identify (or create) pilot projects and experiences
- Establish an external launch and communications plan.

4. Deliver the promise

When it's time to deliver the M&A brand's promise to customers and shareholders, it moves from being a theoretical construct or set of talking points in a press release, to the real world.

People will be engaging with your M&A brand through the stories you tell, as well as the products, experiences, and services you deliver. Your promise and vision need to come through in a compelling and clear way.

This is the time for your brand to shine – listen to, and engage with, your customers to ensure that they understand how the M&A is adding value to their lives. Their feedback, combined with employee feedback, will also allow your brand to be flexible and continue to evolve after the launch.

The proof of success

Businesses use M&A deals to transcend their own arenas or to gain new expertise – this simple aim makes business sense and can be hugely successful. But you need a strong brand and a strong ambition. Communication of those ambitions is vital; without it, the purpose of the deal may not resonate with the parties you need it to most.

Taking employees on this journey so that they feel comfortable and not fearful – but rather excited and involved is part of the battle. Your brand culture will help you through this. If you can convince your internal public of the merits of the deal, you will be better placed to do the same with your customers.

Of course, shareholders want to make money – and that can't be ignored in M&As – but they won't make money without customers. There is always politics at play and the more open and transparent you can be, the better in the long run.

Ultimately the biggest success for M&A is that the brand catalyzes positive change. ■

Gonzalo Brujo is Global President at Interbrand

Data management in the age of cloud

The advantages of moving data management to the cloud is increasingly being realised. Mark Hermeling looks at the do's and don'ts for financial services firms

For financial services organisations, migrating entire data management ecosystems to the cloud was once an ambitious goal. Today, it is a reality that many are embracing and see tangible benefits from. Over the past few years, businesses have been moving market and reference data to the cloud in an aim to reduce the costs of infrastructure and maintenance as well as increase scalability, elasticity and flexibility.

The latter is important as it relates to being able to effectively deal with fluctuating data volumes and adapting to changing provisioning requests from the business. This helps achieve increased agility and resilience and future-proof the infrastructure so it can withstand the challenges of tomorrow. When it comes to cost, moving market data management to the cloud helps bring down the spend through appropriate-sized infrastructure, centralised licensing and easily shared data sets.

The wider move to the cloud and its advantages is continuing today. In fact, according to the recent Market Research Future report, the financial cloud market is expected to reach the US$52 billion mark by 2028 and is projected to grow at an astounding compound annual growth rate (CAPR) of 24% between 2018 and 2028.

Another report from Allied Market Research forecasts that the global finance cloud market will reach US$90 billion by 2030. All of the above-mentioned benefits are certainly driving this market dynamic, and so is the pandemic which highlighted the need for infrastructural change and greater agility amongst financial services companies.

However, as firms seek to transform data management, they need a steer towards overcoming the hurdles along the way, minimising risks and ensuring the cloud migrations go as smoothly and successfully as possible.

Navigating data management challenges

Financial services firms have often followed a convoluted and siloed approach to provisioning market data to

their businesses processes, which translates into high maintenance costs and unpredictable change cycles for the smallest of adjustments.

Past mergers and acquisitions are adding to the complexity and are reflected in an often highly complex and heterogeneous application landscape, causing a multitude of disparate data sources, databases and redundant data management.

Whilst external reporting requirements are growing and existing set-ups are impacting new product development, financial firms need a solution fast to untangle the costly web and unfold new opportunities that cloud migration can present.

The promises of greater mobility, flexibility and scalability when moving entire ecosystem to the cloud are not just empty ones

A scattered and redundant architecture can not only inflate the running costs of on-premise applications but also prevent businesses from having quick and easy access to reliable information when they need it. It is often the case that departments do not have a single source of truth and encounter multiple data duplicates and validation rules which can lead to ambiguity and inconsistencies.

As well as high levels of manual data validation and verification, financial services firms are often lacking data consumption and sourcing monitoring and measuring capabilities. It is hard to create authoritative sources of market and reference data that can become an internal service bureau to make the best use of vendor-sourced data.

Very few firms can say they are managing and consistently using such data in an efficient, fault-proof way, which leads to further data discrepancies, duplications and higher costs. This could further be fuelled by regulatory requirements such as BCBS239 for banks to be able to identify and standardise the source and provenance for all data.

Demonstrating data lineage is difficult when there is a lack of transparency or controls. It can be hard for firms to pinpoint the origin of specific data points, leading to the value of data decreasing and becoming somewhat unusable and causing ineffective controls of the overall cost base.

For financial services firms, reference data, however, is not an area where mistakes can happen or can be managed in a substandard way. It is the type of data that helps organisations function smoothly and, if impacted, can have serious implications on the day-to-day operations, service providers or regulatory agencies.

As it involves the most complex transactions and numerous entities, contingencies and dependencies, the industry is pursuing a policy of standardising it. It is not a straightforward process as large data volumes make up transactions, there are different variations in data types and the rate of change in markets and their products is substantially high.

There is also the case of data and metadata that cannot be separated and should be managed cohesively as the contextual information defines its use cases. Permissions management and origins tracking is an integral part of data management and governance, making it easier to determine the sensitivity levels of pieces of data, what can be shared where and with whom and what are the permitted use cases from a business, content licensing, legal and regulatory perspective.

Considering the complexity and number of data challenges that financial services firms are facing today, it is becoming ever clearer that a market data management transformation has to accelerate, with the move to the cloud as an enabler of change.

Moving data management and whole ecosystems into the cloud

As the need to shift market and reference data management is apparent, financial services firms are embarking on a journey to move whole data ecosystems to the cloud. This allows to improve efficiency in multiple areas and across processes, lowering the costs at the same time. Embracing a hybrid or cloud infrastructure can help eliminate a multitude of time-consuming manual processes and bring together fragmented systems that are scattered on-premise.

Supporting this move, data vendors are now starting to push their products directly onto cloud platforms such as AWS, Microsoft Azure, Oracle Cloud Infrastructure and the Google Cloud Platform. In addition to this, providers

of portfolio management systems, trading solutions, risk and settlement systems and other applications are also migrating to the cloud, as they are attracted by the enhanced security and scalability, increased efficiencies and reduced costs that this deployment can bring.

Rather than financial institutions placing individual applications in the cloud or using specific software as a service provider to host their data management platforms, they are more frequently moving their entire data ecosystem. Data providers too increasingly make their data directly available on cloud platforms and cloud-based data warehouses.

The implications are that data management systems need to be both cloud agnostic and cloud native to optimally source, integrate, quality-control and distribute market data. That means systems need to be first designed and built to run in the cloud and to work effectively in that environment.

Otherwise, the migration will fail, let alone bring any operational or cost efficiencies. At the same time, systems should not rely on a single cloud provider's proprietary service or in any way be locked into a single cloud vendor. Vendor lock-in in cloud computing could negatively impact a business as data sets will be very difficult to move once they're set up and may require reformatting. There are always additional risks that vendor's quality of service will decline over time, there will be a significant price increase, or worst-case scenario, a vendor goes out of businesses.

It is, therefore, important to reduce the dependence on a single provider from the start and opt in for a 'lift and shift' mentality to place data operations on a future-proof footing.

In addition, financial services firms need to consider the security element when moving their ecosystems to the cloud. Keeping valuable data safe should be a priority in today's climate as cyberattacks are on the rise and they increase in sophistication. Thus, developing a robust information security strategy, implementing enhanced permissions management, monitoring usage and data quality are becoming critical.

Security in the cloud should certainly not be seen as a roadblock to migrate as providers have made strides and advancements in their technologies as well as their corresponding level of compliance.

The more a company automates to put more applications in the cloud, or simply more directly connect them, then data quality becomes extremely critical. This is because the process removes what is typically a manual step in between cloud and on-premise, which could act as a safety net to prevent mistakes escalating quickly into major problems.

There is, however, a solution that can ease the process. Through partial or full utilisation of vendor managed solutions, financial firms can experience a 'one stop shop' for the end-to-end provision of market data from vendor feeds all the way through to the distribution to their clients.

Doing it once, doing it right

If firms focus on the delivery of achieving reusable assets that generate recurring value and develop sustainable and cost-effective solution, they will be well-positioned to meet their migration goals. However, this has to start with a comprehensive market data transformation plan first. This should focus on creating recurring value and developing collaborative and sustainable relationships among market data vendors, IT, and business units.

Transformation should be fuelled by the use of configuration-driven products, as these can be much more closely aligned to the specific business needs. This can apply both to the initial transformation and shift to the cloud as well as in supporting change afterwards. Configurable products will typically result in faster turn-around on business decisions about new datasets and process change.

In this process, firms need the ability to link different external data sets with their internal data sets. They need robust data quality management including lineage and audit to track data flows and explain data values. Monitoring consumption will help optimize data sourcing and identify underused and overused data sets to maximize Data ROI. It will also secure compliance with content licensing and other usage restrictions.

Adopting a managed services approach can help financial firms achieve the transformation goals, optimise their cloud environments and data usage to achieve the highest level of efficiency, addressing key migration challenges along the way and building an infrastructure that can deliver cost-effectiveness and scalability for years to come.

The right data management solution from an experienced and flexible vendor will make sure that users and applications are effectively supplied with the data they need to do their jobs. It is important to note though that vendor managed solutions must be cloud neutral to allow firms to interact with data on any public cloud platform and reap the most benefits.

Accelerating cloud migration

The ongoing migration of financial services market reference data to the cloud is nothing new, however, the process is certainly picking up speed. At the same time as data management solutions and processes are moving over to the cloud, data vendors are putting data on public cloud platforms.

Downstream, application providers are also doing the same to facilitate the acceleration. This not only creates a healthy competition and hunger for new customers, but also facilitates technological advancements and innovations that later on financial firms can benefit from. Thus, the time is now to overcome the cloud concerns and instead confidently move data ecosystems.

Indeed, this has started to happen as there is a greater need amongst financial service organisations to move their market and reference data to the cloud as they battle for a spot in a very competitive landscape. Choosing cloud-native solutions and opting it for a managed services approach can inject the needed level of competitiveness, agility and business resilience that financial companies are searching for post-pandemic. As long as these solutions are also cloud-neutral and cloud-agnostic, not allowing any lock-ins, they will be able to deliver the scalability that financial firms need if they are to future-proof their operations.

The promises of greater mobility, flexibility and scalability when moving entire ecosystem to the cloud are not just empty ones. A managed services provider will enable firms to realise a full array of benefits that cloud can offer, from better data management and governance to streamlined processes and cost efficiencies. All whilst removing the laborious every-day task of data processing and platform maintenance.

As market and reference data plays a central role in business processes as well as finance and risk, it has to be migrated smoothly, without any interruptions or mistakes. With a trusted provider's expertise and know-how, financial services organisations can – and will – successfully speed up their deployments and reap the rewards for years to come. ■

Mark Hermeling is the CTO of Alveo

Fiscal support and monetary vigilance

Olivier Blanchard and Jean Pisani-Ferry consider the economic policy implications of the Russia-Ukraine war for the European Union

Summary

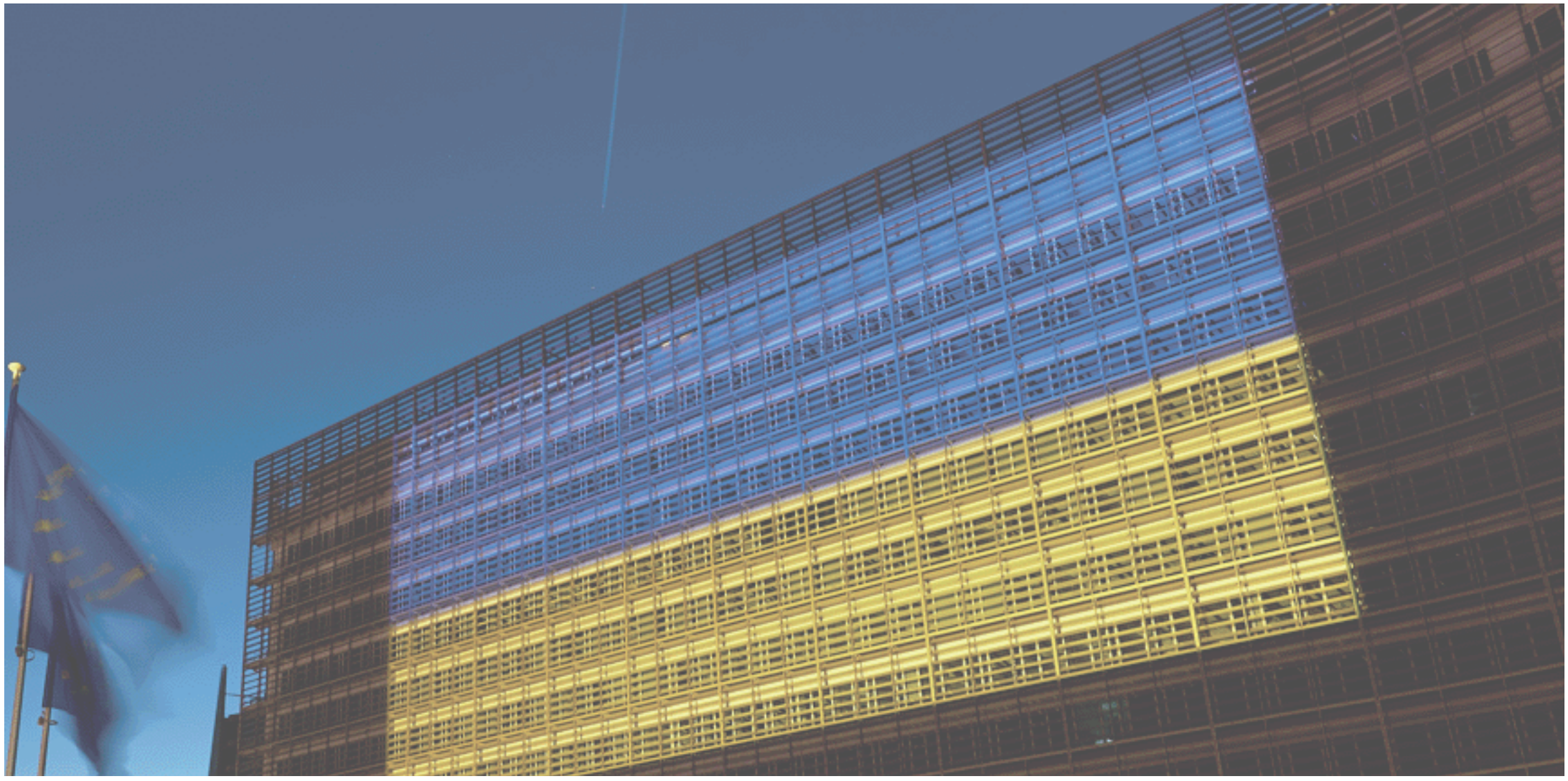
For Europe, the war in Ukraine is a first-order economic shock. While the direct fiscal implications of taking care of refugees, increasing military spending and strengthening energy autonomy remain limited, the impact of elevated energy and food prices on national income and its distribution is potentially significant. This raises three macroeconomic challenges for policymakers:

- How best to use sanctions to deter Russia while limiting adverse effects on the European Union economy: in this respect, it is important to distinguish between oil and gas. For oil, Russia can diversify away from the EU market and, despite sanctions, sell on the world market where it operates as a price taker. For gas, the European Union has substantial leverage because Russia depends on the pipeline infrastructure linking it to the European market. However, gas supply from other sources is relatively inelastic.

- How to deal with cuts to real income because of the increase in the energy import bill: if governments want to protect buyers, they must decide on mechanisms and how to finance the extra spending. Fiscal support and thus some additional deficit finance may be needed, though debt should remain sustainable.

- How to deal with the increase in inflation as a result of higher energy and food prices: there is a need to avoid a de-anchoring of inflation expectations, which is even more challenging than usual given that inflation had already substantially increased before the war. Preventing this risk would call for a tightening of monetary policy. However, the loss of real income is likely to lead to weaker aggregate demand, implying a need to loosen policy.

Policymakers must cope with these conflicting objectives, ensuring that policy instruments complement each other. A combination of well-designed fiscal support to households and tripartite wage discussions may help soften the trade-off the central bank faces. However, the outcomes of the war in Ukraine are unpredictable, and policy must be able to respond quickly to changing circumstances.



Introduction

Nobody can predict with much confidence how the war in Ukraine will evolve and what its geopolitical consequences will be over the next few months, let alone the next few years. Nevertheless, policymakers must think about the implications of the war and the appropriate responses, realising that they will need to be adapted as circumstances evolve.

Moreover, policymakers must think coherently about the joint implications of their actions, from sanctions on Russia to subsidies and transfers to their own citizens, and avoid taking measures that contradict each other. This is what we try to do in this Policy Contribution, focusing on the macroeconomic aspects of relevance for Europe.

We start by exploring the implications of the war. We review the various channels through which it is affecting macroeconomic perspectives. The upshot is that although demand, financial and wealth channels all enter into play, and although the direct budgetary implications of the war matter – because of increased defence spending and the cost of protecting refugees – the war's main impact on Europe is likely to be felt through energy prices and, to a lesser extent, food prices.

We then discuss the factors likely to determine the evolution of energy prices. What hap- pens depends both on Russian actions, even in the absence of sanctions, and on the effect of potential sanctions on Russia's behaviour. In this respect, one must distinguish between oil (and coal) on one hand, and gas on the other.

For oil and coal, Russia is a quasi-price taker in a competitive world market. It faces a very elastic demand curve. For gas, because trade relies on a specific infrastructure, the market is the EU market, the demand is rather inelastic, and Russia can be regarded as a quasi-monopolist.

This has very different implications both for the likely behaviour of Russia in the absence of sanctions, and the effects of sanctions such as tariffs on prices and Russian exports. Given technical constraints, a full embargo on gas is not feasible. Tariffs, however, are feasible, they would be effective, and they should be considered, despite likely strong effects on consumer gas prices.

Our working hypothesis in the rest of this Policy Contribution is that energy prices are likely to increase relative to their pre-war levels, although there is considerable uncertainty about the size of the increase.

The war's main impact on Europe is likely to be felt through energy prices and, to a lesser extent, food prices

So far, both sides have de facto sheltered oil and gas trade from the fallout from the conflict. The large variations in the oil market and even more so in the gas market are due to expectations of Russian actions and sanctions. But the 'balance of energy terror' is precarious and cannot be taken for granted.

We then examine the implications of the war for EU fiscal and monetary policy. Leaving aside the various sources of spending – from defence to refugees to the need to adapt the energy infrastructure to a changed supply of energy – the central fiscal policy issue is, to the extent that food and energy prices increase, whether and how to offset some of the loss in real income of households. Two main issues are involved.

The first issue is how best to do it: through subsidies, transfers or price regulation. The main question here is how the combination of such measures interacts with embargos or tariffs in determining the total effects of sanctions, the prices of energy imports and the implications for inflation.

The second issue is whether these measures, if taken, should be financed by taxes or by debt. While there is a strong political argument for levying an exceptional 'war' tax, the loss of real income due to the higher price of imports and the uncertainty associated with the war are likely to lead to weak aggregate demand; deficit spending may be needed to maintain or at least limit the decline in output. Debt, even if it ends up higher as a result, will remain sustainable.

Turning to monetary policy, the standard recipe in response to an increase in energy or food prices – namely, accommodation of first-round effects and tightening to limit further effects – must be re-examined. On one hand, the additional inflation comes on top of already high inflation, raising the risk of a de-anchoring of inflation expectations. On the other, despite fiscal support, aggregate demand is likely to be weak and put downward pressure on inflation.

The first effect suggests tightening, the second suggests loosening. For the time being, the two indeed roughly cancel each other out, which suggests that monetary policy could roughly remain for the moment on its intended pre-war track, but should be ready to adjust one way or the other.

There is, in the current context, an important, and unusual, interaction between fiscal and monetary policy. The more fiscal policy protects the real income of workers, the weaker the demand for wage increases is likely to be in further rounds. The more a decrease in inflation becomes credible, the less the European Central Bank will have to tighten to achieve lower inflation. In effect, larger deficits can lead to a smaller output cost of fighting inflation.

A final and interesting question is whether this dampening role of fiscal support could be explicitly taken into account in wage negotiations. During the pandemic, government-financed furlough- and business-support schemes socialised income losses and proved a very potent and cost-effective way to minimise economic and social disruption.

There is a case for a tripartite dialogue between governments, employers and employees and, ideally, for a quid pro quo of wage and price moderation in exchange for significant fiscal support.

We start in section 1 by looking at the channels through which the war will affect the EU economy. We review in section 2 the factors likely to determine the evolution of energy prices.

In section 3 we discuss the implications for both output and inflation in the European Union, and in section 4 the implications for EU fiscal and monetary policy. We draw conclusions in section 5.

1 The economic impact of the war

Nature of the shocks

Our working assumption is that the conflict, which began with Russia's invasion of Ukraine on 24 February 2022, will not be resolved in the short term. Over the next 12 months or so, we envision a stand-off, or a Russian occupation with Ukrainian resistance, or a ceasefire followed by acrimonious negotiations. We posit that reaching a permanent settlement will take longer.

In this context we assume the following:

- The breach of United Nations principles (which had been observed for three- quarters of a century on the European continent) will continue to cloud the horizon and affect confidence beyond the direct effects of the war.

- Most Ukrainian refugees will return to their hometowns, but only gradually as widespread destruction will prevent their relocation.

- The crisis will result in a lasting increase in European defence spending.

- Coming on the heels of the pandemic, this new shock will lead global firms to further reconsider their reliance on extended supply chains and just-in-time delivery schemes.

- The war will affect Ukrainian (and potentially Russian) agricultural crops and exports, reducing global supply and increasing world food prices.

- Beyond its immediate reaction to the war, the European Union will embark on an accelerated reduction and the eventual elimination of its reliance on Russian energy through alternative sourcing, and a faster transition to renewable energy.

- Sanctions will likely endure and escalate, leading to a substantial decrease in Russian exports of oil and gas, whether this is triggered by an EU decision or by a decision of the Russian government to restrict such exports. This is a major issue, both geopolitically and economically, and we investigate it in detail in the next section.

A major issue is whether the European Union will continue to respond in unified fashion to an unfolding crisis. While its initial common response was strong, divisions have emerged within the EU on the appropriateness of sanctions, especially in the field of energy.

Decisions on sanctions are part of foreign policy, where individual EU member states have veto power. Energy policy is largely a national prerogative and the EU does not have the legal means to settle differences by putting decisions to a qualified majority vote.

Our working assumption is nevertheless that the crisis will eventually trigger common responses and strengthen solidarity among its members.

Table 1 summarises our assumptions, distinguishing between short-term and longer-term effects. In this Policy Contribution we focus on short-term implications. We intend to return to the long-term implications in another brief. Most of the assumptions are straightforward. Some hypotheses deserve deeper examination.

Table 1. Main assumptions on the implications of the Russia-Ukraine war for the EU

Item	Short term (1–2 years)	Long term (3–5 years)
Exports foreign direct investment (FDI), and financial linkages	Large inflow Immediate fiscal cost Capital losses for European companies	Restructuring of trade and FDI linkages
Refugees	Large inflow Immediate fiscal cost	No lasting effect as most refugees are likely to return or integrate into the labour market Fiscal cost of reconstructing Ukraine
Defence	Support to Ukraine (weapons)	Lasting increases in defence budgets
Efficiency		Increased emphasis on resilience Deglobalisation
Confidence	Precautionary saving	Potential risk premium on Europe, but also potential drive toward closer policy integration within the EU
Food prices	Significantly higher prices Spillback from adverse developments in developing countries	No lasting effect
Energy	Significantly higher prices Supply disruptions Additional cost of alternative sourcing	Change of sourcing Integration at EU level Accelerated transition to renewables (implying additional investment)

Source: Bruegel.

Exports, foreign direct investment, and financial linkages

Exports to Russia have dropped substantially and are likely to decrease further as a result of the combination of EU sanctions, restrictions imposed by the Russian government and delivery problems.

Anecdotal evidence indicates that, even in the absence of legal restrictions, European firms are already reluctant to trade with Russia, fearing legal and payment problems.

According to EU trade statistics[1], exports of goods to Russia amounted to €89 billion in 2021; if they were to stop – a maximalist assumption – this would lead, other things being equal, to a decrease in aggregate demand for EU goods of 0.6 percent of 2019 GDP[2]. A 50 percent reduction in goods exports to Russia would cut 0.3 percent of GDP off aggregate demand.

The European Union also accounts for three-quarters of foreign direct investment in Russia, for a total of more than €300 billion at end-2019[3].

Assuming half of the value of this investment will be lost, this would represent about 1 percent of EU GDP and less than 2 percent of its stock of outward FDI. Although significant for several banks and companies, such a loss cannot be considered to be of major macroeconomic relevance.

During the 2008 global financial crisis, links between financial institutions played a major role as default by one institution triggered default by some of its creditors.

Although Russia has made visible efforts to meet its external commitments and stabilise the economy, a default of the Russian government remains a distinct possibility.

The evidence suggests, however, that this is unlikely to lead to major problems for the EU financial system. Subsidiaries of Russian banks have already been closed and liquidated without putting the financial system in danger.

Non-energy and non-food imports from Russia and Ukraine are of minor economic significance. Their interruption may, however, add to the broader disruption of supply chains due to the pandemic.

Refugees

The flow of refugees from Ukraine has reached 4.6 million people (not counting 7.1 million displaced persons in Ukraine) at the time of writing, mostly women and children (UNHCR, 2022). The outflow continues (though at a slower pace), so that 5 million – and maybe more – is a plausible number.

This is a human drama of gigantic proportions and poses major problems of organisation and allocation across countries. Yet the likely macroeconomic costs appear relatively limited.

Estimates of the annual fiscal cost of providing shelter, food, healthcare and education to refugees vary from €9,000 to €25,000 per person per year[4]. On the assumption of a cost of €10,000 per refugee (per year), the cost of financing 5 million refugees for one year is €50 billion, or 0.35 percent of EU GDP.

Even this number overestimates the cost, because within a few months some refugees will return, some will find work, and some will emigrate from the European Union.

Food

Russia and Ukraine are major producers and, even more relevant, major exporters of food, wheat in particular[5].

According to the Food and Agriculture Organisation (FAO), Russian and Ukrainian exports of wheat accounted in 2019 for 23 percent of world exports and 7 percent of world production.

In Ukraine, planting for the next harvest may be difficult. Distribution issues, given the fighting in the ports along the Black Sea, may further decrease exports. The market price of wheat has already increased nearly 50 percent from $7.70 a bushel before the war to $11, a level last seen for only a few days in 2008 (Macrotrends, 2022).

Because the European Union is a net exporter of agricultural products (in 2021 its trade surplus was close to €50 billion, according to Eurostat), the global price rise may well improve its terms of trade. Two important caveats are in order, though.

The first is that the loss to EU consumers (as opposed to the European Union as a whole, ie. producers and consumers taken together) may be large, an issue to which we return in section 3. The second is that elevated food prices are already having dramatic consequences for many emerging-market and developing countries, affecting their growth and macroeconomic stability, and potentially affecting the European Union in return.

2 The energy conundrum

Much of the economic interdependence between Russia and the European Union results from the fact that Russia is Europe's main supplier of fossil fuels. So far, both sides have mostly refrained from using energy as a vehicle for pressuring the other.

But on 8 April, the EU decided to ban imports of Russian coal, starting 22 August (Bown, 2022). Some EU countries have already gone further. On 30 March, for example, Poland announced its decision to stop importing any Russian energy by the end of 2022.

On 27 April, Russia discontinued gas shipments to Poland and Bulgaria, arguing that these two countries had failed to comply with the requirement that gas be paid for in rubles. This move triggered an immediate increase in the price for LNG.

In thinking about what may happen to energy prices, as a function of both Russian decisions and potential sanctions, it is important to distinguish between oil (and coal) and gas.

Oil and gas

Energy data are easily confusing because of the heterogeneity of measurement units, so a short summary of the situation is a useful starting point.

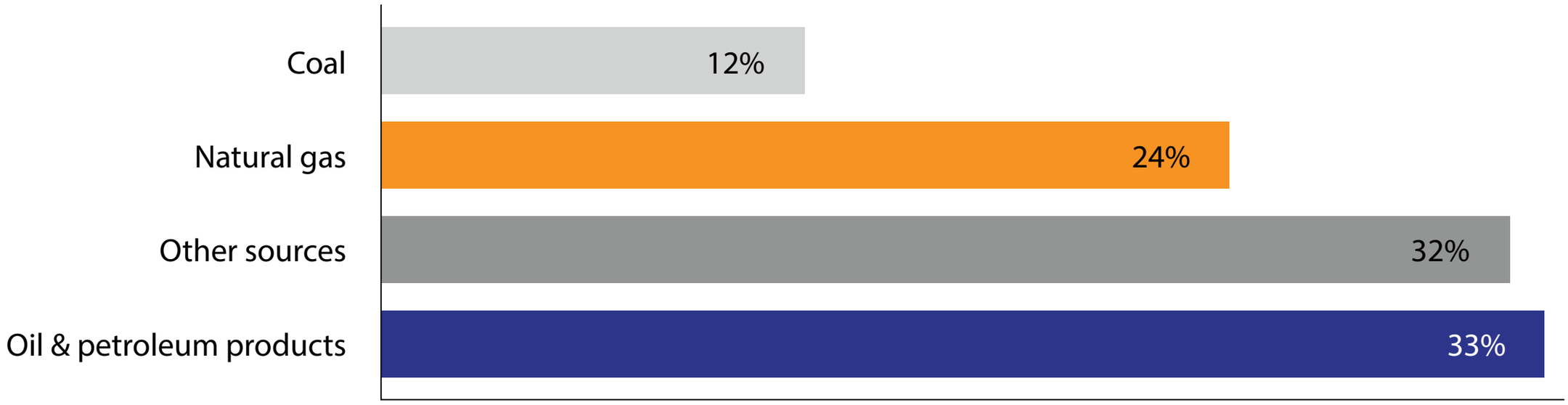
The supply of energy in the EU27 (excluding the United Kingdom) essentially relies on oil (33 percent, virtually all imported), gas (24 percent, primarily imported) and coal (12 percent, primarily imported) (Figure 1).

Other sources include renewables (domestic), nuclear (essentially domestic, as the fuel itself is a small part of the total cost) and imported electricity. Russia is a major supplier of oil, gas, and coal.

Before the war, Russia's export price closely followed the global market price for Brent, an indication of high substitutability. Because Russia is one among many suppliers of oil to the European Union, we assume that lower EU imports from Russia can be replaced by imports from elsewhere. And lower Russian exports to the West can be partly offset by purchases by India and China.

Unlike oil, the market for gas is regional. There are, broadly speaking, three markets globally: Europe, North America and Asia. Prices on these markets are related, as liquefied natural gas (LNG) can be shipped to any of them, but

Figure 1. Primary energy sources, EU27, 2019



Source: Authors' calculation based on Eurostat energy balances. Proportions are based on the energy content (Terajoules) of the various sources.

they can differ significantly. Starting in 2021, high demand in Asia led to a major divergence between the North American gas price and the prices in Asia and Europe (Figure 2).

The relevant market for discussing the impact of an EU sanction is therefore the European market, not the world market. Gas is used in electricity generation (1/3), by industry and services (1/3), and by households (a smaller third).

It is very substitutable in some of its uses (gas-generated electricity can be replaced by electricity generated from other sources), much less so for some others (a gas-powered heating system cannot burn oil or coal).

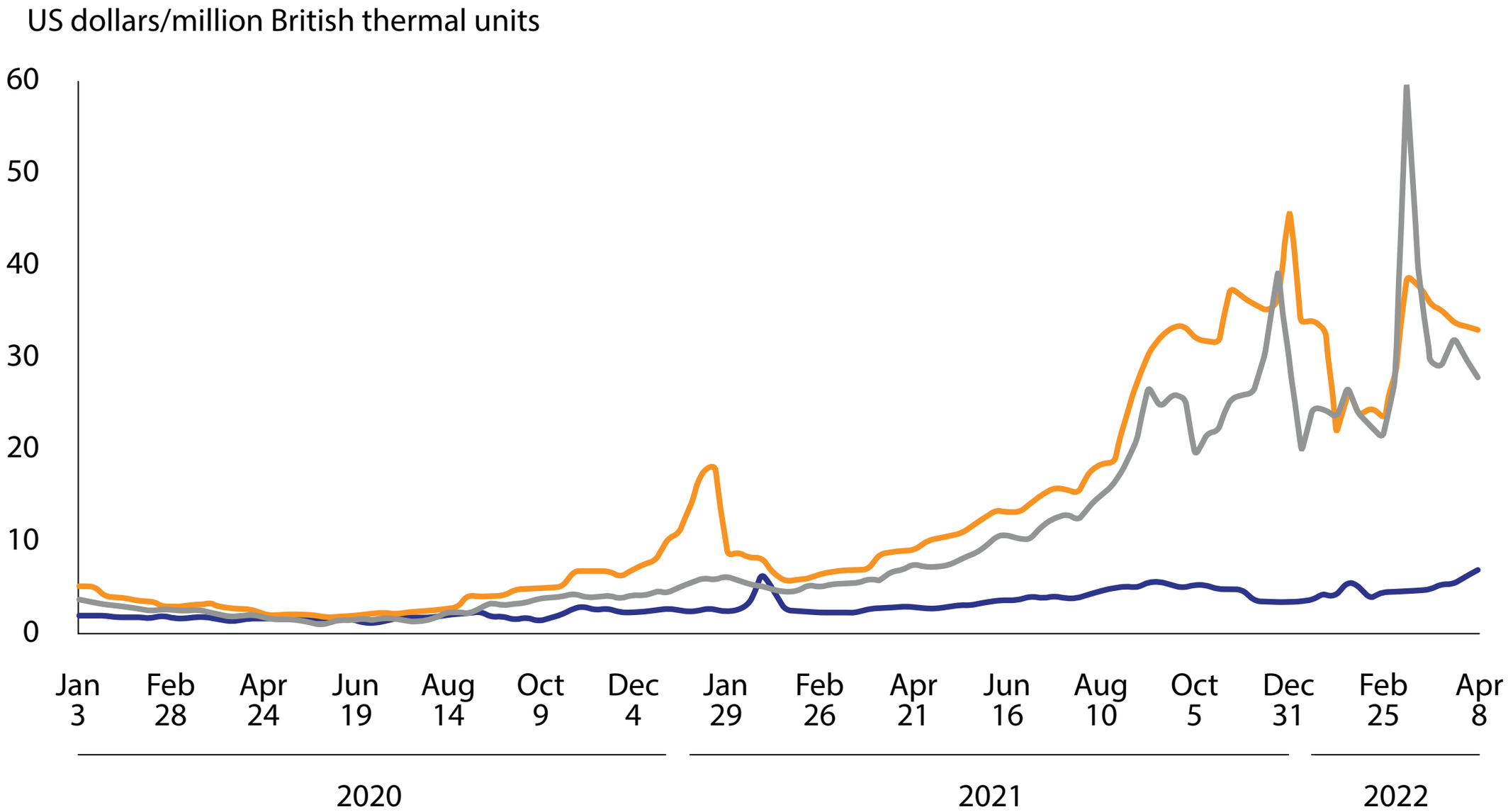
On average, Russian gas accounts for 8.4 percent of primary energy supply in the European Union, but there are wide variations across member states. For example, Portugal does not import any gas from Russia, but in Hungary, Russian gas accounts for 28.5 percent of the supply of primary energy (Pisani-Ferry 2022).

Although not entirely interconnected (Spain and Portugal, for example, have limited pipeline connections to Northern Europe), price differences in the European Union can be largely arbitraged away through internal transactions on imports from the rest of the world, provided – which is not a given – there is political agreement to do it[6]. In what follows, we treat the EU market as one.

Thinking about the determination of energy prices

Even in the absence of sanctions, Russia may want to behave strategically in determining its oil and gas export policy. In the case of oil, it may want to increase revenues to finance the additional spending associated with the war. This would lead to an increase in the world supply of oil and thus a decrease in the world price.

Figure 2. Gas prices in Europe, Asia and the United States, January 2020 to April 2022



Note: TTF = Dutch TTF natural gas hub price. Henry Hub refers to pricing of natural gas futures on the New York Mercan- tile Exchange.
Source: Bloomberg.

Russia, however, faces a series of constraints. Additional supply is currently limited by the difficulty of placing cargoes on the international market (which is reflected in the discount between the prices of Ural and Brent oil). Moreover, Russia is part of the OPEC+ coalition, which constrains its capacity to increase exports.

In the case of gas, a more subtle effect is relevant. The EU is scrambling to reduce its dependence on Russian natural gas, but its commitment to lowering imports by two-thirds by the end of 2022 is optimistic[7]. On the supply side, some Russian gas can be replaced by gas from Norway, Algeria and Azerbaijan, but these countries have limited capacity.

The rest must be delivered by ships as LNG, but in the short run the number of LNG ships is fixed and additional supply can come only from diverting shipments destined to Asia. On the demand side, the ability to replace gas by alternative sources of energy is also constrained by existing equipment.

Recent research (IEA, 2022a; McWilliams *et al* 2022) concludes that the European Union cannot, over this year and next, fully replace imports of Russian natural gas[8]. In the short run, then, the EU demand for gas is relatively inelastic and, under plausible assumptions, the price elasticity of EU demand for Russian gas (total demand less imports from the rest of the world) may well be less than one.

Under standard monopoly assumptions, such a low elasticity would lead Russia to set a very high price, even in the absence of war[9]. The reason Russia did not do so in the past is that the long-run elasticity is surely greater than one, and so it faces an intertemporal trade-off: a very high price raises revenues in the short run but decreases them in the long run.

The war, however, has two effects on this computation. The first is an even greater need for higher revenues today, leading to an increase in the price. The second is that the anticipation of future sanctions, and the clear decision of

the European Union to wean itself off Russian gas exports, reduces the effects of an increase in the price on future revenues, again leading Russia to increase the price while the demand is still there.

In short, ignoring sanctions, Russia may want to increase energy export revenues. But while for oil this would imply increasing the volume of exports (given the world price), for gas it would imply increasing prices (and therefore decreasing export volumes).

True, long-term gas contracts normally preclude such behaviour, as they specify the indexation of prices on the TTF (Title Transfer Facility) market price.

But Russia has some flexibility to shift part of its supply from deliveries within the framework of existing contracts to over-the-counter sales. More fundamentally, contracts can, after all, be revised or broken.

Turning to sanctions, whether embargos or tariffs, the market structure is again fundamental, and one must discuss separately the effects on oil and gas exports.

Sanctions: oil

To sanction Russia, the European Union could emulate the United States and United Kingdom and declare an embargo on Russian oil. This would be the most straightforward approach as a European embargo would strengthen the prevailing reluctance on the part of energy companies, shipowners, banks and insurers to take part in Russian exports.

Such a measure would not prevent Russia from exporting altogether – it would find alternative buyers, such as China, India or others, as it already does – but an embargo would certainly increase the discount on Russian oil, as already seen with the Ural price discount relative to the Brent price, at close to 35 percent at the time of writing.

In other words, the Western strategy would be (it largely is already) to keep Russian oil on the market, while finding ways to push its price down. If, on net, Russian exports decreased, the world price would go up, unless the drop in Russian exports was offset by the decisions of other producers, from Saudi Arabia to Iran to Venezuela, to increase production.

The rise in the world price would depend, in the end, on Russia's ability to find other buyers and on other countries' decisions to sell more. To get a sense of how the price impact would depend on the decrease in world supply, it is worth looking at history.

The 1973 OPEC embargo decreased global supply by 7 percent and led to an increase in the price of 51 percent. The 1978 Iranian revolution decreased global supply by 4 percent and led to a price increase of 57 percent. The 1980 Iran-Iraq war decreased global supply by 4 percent and led to a price increase of 45 percent. The 1990 Gulf War decreased global supply by 6 percent and led to a price increase of 93 percent (Hamilton, 2022).

Russia accounted in 2019 for about 13 percent of world production and its exports for a similar proportion of world trade, so a large decrease in Russian supply, not offset by an increase in supply elsewhere, would have dramatic effects on the price (BP 2021)[10].

History may not, however, be a reliable guide. The effects of lower supply depend on the elasticity of both non-Russian oil supply and world demand for oil. And both are different from what they were in the 1970s or even 1990s.

The price elasticity of supply has increased since the episodes cited above, especially as the United States has started exploiting shale oil. But it takes time before new drills start adding to output.

The price elasticity of demand may have declined as oil is increasingly used where substitutes are lacking, however (for example, for fuelling motor vehicles and airplanes).

And government measures to partly protect buyers, be they firms or consumers, from the price increases may further decrease the demand elasticity.

As discussed in section 4, in late 2021 and again since the start of the Russia-Ukraine war, several governments have introduced energy-related transfers and subsidies. To the extent that they affect the price signal, such measures reduce the demand response.

This is of no importance if a small country subsidises in isolation: the effect on world demand is too small. But if many do – and this would be the case if the European Union joined the United States and the United Kingdom in offering subsidies – the result is bound to be a larger increase in the global market price.

Sanctions: gas

The market structure for gas can be viewed as consisting of a monopolist Russia facing a large number of EU buyers who can purchase gas from other sources but only at a sharply increasing cost.

As we have seen, even in the absence of sanctions, Russia might want to increase its price and reduce supply. The question here is what would happen if the European Union decided to use sanctions, most likely through a tariff on Russian exports[11].

It would be a strong signal that EU member states stand ready to jointly confront Russia. A common tariff would preserve the freedom of private contracts and be legally implementable, as the European Union (as well as the

United States and other countries of the coalition supporting Ukraine) has revoked Russia's most favoured nation status. We assume that, in response, private contracts would be either broken or renegotiated.

In that context, the effect of the tariff depends on the elasticity of the net demand for Russian oil (the demand for Russian gas minus the supply of non-Russian gas to the European Union). In general, a tariff will increase consumer prices, but less than one for one; equivalently, it will decrease the pre-tariff price, but less than one for one.

In the special case when the elasticity of EU demand is constant, theory predicts that Russia should keep its (pre-tariff) price unchanged, leading to a one-for-one increase in consumer prices and a decrease in demand. Russian revenues will decrease as demand decreases.

In the case of linear demand, the effect of the tariff on the consumer price will be less than one for one – Russia will decrease its pre-tariff price, but less than one for one.

Demand will decrease less than in the constant elasticity case. Russian revenues will decrease because of lower demand and lower pre-tariff prices.

Interestingly, a small tariff can actually increase EU welfare: while consumers pay more, the revenues from the tariffs exceed the extra spending, and so, properly redistributed, buyers can be better off.

The point is nicely made by John Sturm (2022), who showed the relationship to the welfare-improving tariff argument that is standard in international trade. Larger tariffs will have an adverse effect on Russian revenues, but also on EU welfare. Assuming linear demand, Daniel Gros (2022) found that a 30 percent tariff on Russian gas would actually maximise EU welfare.

Beyond this rate, the tariff would decrease EU welfare but could substantially reduce Russian revenues. Gros found that a 60 percent tariff would reduce Russia's gas export revenues by three-fourths, but at some welfare cost to the European Union.

3 Commodity price increases, inflation and real income

The previous discussion has made clear that, depending on many factors, both those affecting Russian decisions and those affecting the choice and intensity of sanctions, there is substantial uncertainty about the future evolution of oil and gas prices.

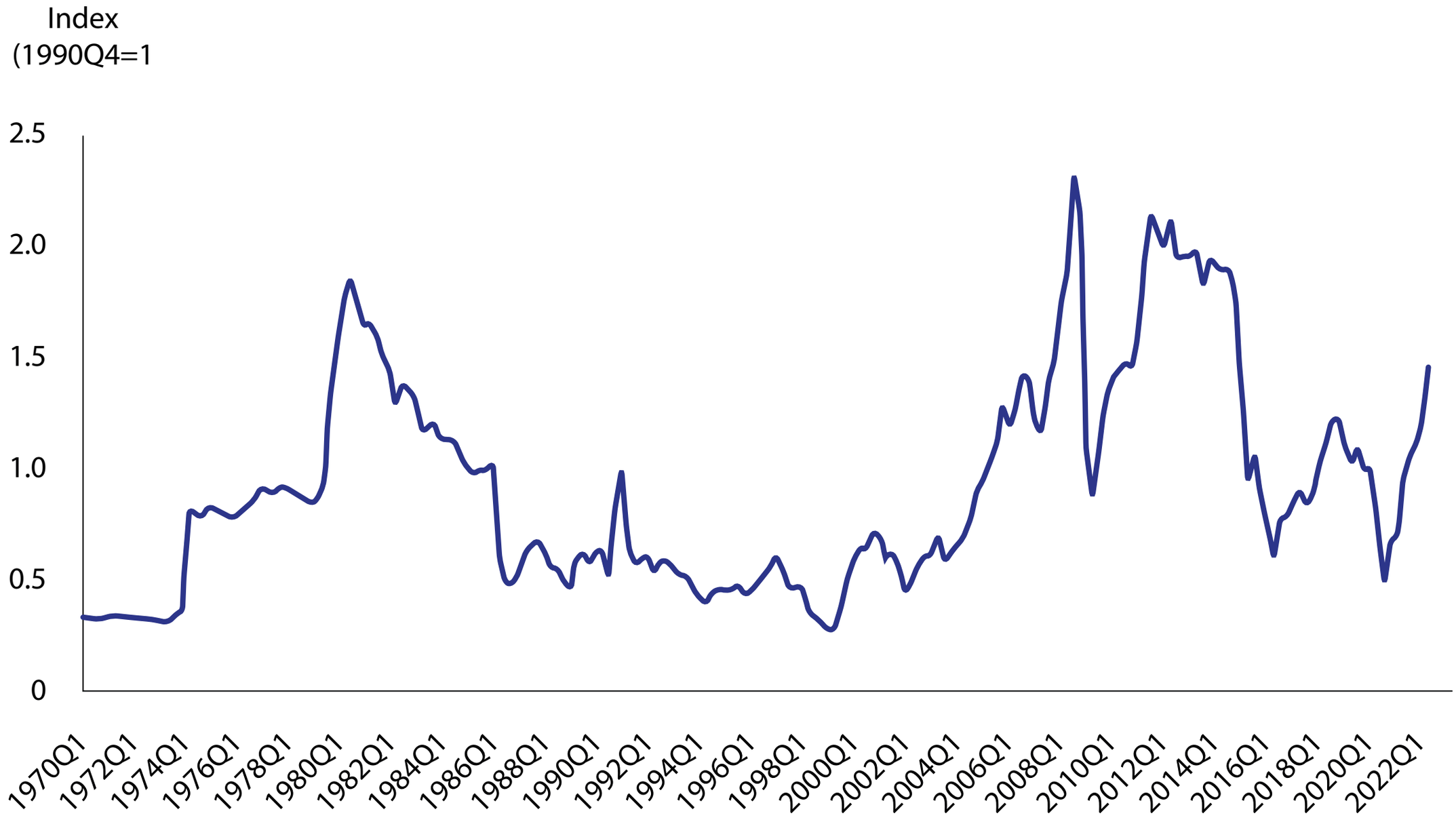
We are less pessimistic than the latest joint forecast of the five main German institutes for economic research (BMWK, 2022), which, in its central scenario, has the price of Brent reaching $135 per barrel and the price of gas in Europe roughly doubling to €200 per MWh.

In the rest of this Policy Contribution we assume – while realising the very large uncertainty associated with this assumption – that Russian decisions and more stringent sanctions will lead to an increase in both oil and gas prices of 25 percent relative to pre-war levels.

Commodity prices have increased many times in the past. To take just oil prices: the Brent price went from $10.27 a barrel in February 1999 to $133 in July 2008, and then went from $40 in December 2008 to $123 in April 2011. It remained above $100 until August 2014.

Given inflation since 2014, $100 then would correspond to $120 today, so the current real price of oil has not yet reached historical records (Figure 3). As a result, economists have a decent understanding of the effects of commodity price increases on the economy.

Figure 3. Real price of oil, 1970Q1–2022Q1, index (1990Q4 = 1)



Source: Authors based on OECD and US Bureau of Labor Statistics via Macrobond. World Brent price deflated by US consumer price index (CPI).

Inflation

The immediate and most visible effect is indeed the effect on inflation. The effect can be quite large. Electricity, heating fuels, and transportation fuels accounted in 2021 for 9.6 percent of personal consumption expenditures in the euro area, and food on average represented 15.7 percent of the consumer basket (as per European Central Bank HICP weights for 2021). In total, the share of consumption that is vulnerable to the direct impact of price rises is high.

Empirical estimates generally indicate that the pass-through of commodity price rises onto consumer prices is partial but quick.

A 2010 detailed Eurosystem study (ECB 2010) found, for an oil price around $100 per barrel, an elasticity of the energy component of the HICP (harmonised index of consumer prices) to the oil price of 0.4 (largely because of price-insensitive excise taxes), 90 percent of which was effective within a month.

These estimates are somewhat outdated, however, because they assume an indexation of the gas price on the oil price (which has been discontinued) and rigidity of the electricity price (which does not hold anymore) (ECB, 2010, table 9).

Let us then take 10 percent for the share of energy in private consumption and assume a 50 percent pass-through. The direct impact of the assumed 25 percent rise in prices is thus 25 percent $\times$ 0.1 $\times$ 0.5 = 1.25 percent. For food, let us assume a 15 percent share, a 10 percent increase, and also a 0.5 pass-through. The impact is 10 percent $\times$ 0.15 $\times$ 0.5 = 0.75 percent. This implies a 2 percent initial increase in the cost of a consumption basket.

These first-round effects can hardly be avoided, but they are just the beginning. Subsequent rounds reflect the responses by firms and workers.

Producers of goods that use energy or agricultural products as an input increase their prices to re-establish their markups. Workers whose wages lagged consumer prices in the first round ask for nominal wage increases to re-establish their real wage.

These lead to further increases in prices and wages. The strength of these further rounds depends on how hard firms try to re-establish markups, and how hard workers try to maintain their real wage.

Eventually, if commodity prices remain high, the pressure on inflation stops only when either the firms that use these commodities accept lower markups and/or workers accept lower real wages.

As we shall see, what happens to inflation and activity over time then depends on both monetary and fiscal policy, as we discuss later.

Real income

These inflation dynamics are present whether or not an economy produces or imports these commodities. But whether the economy is a net importer or not makes a significant difference to what happens to aggregate real income.

Take the case of the United States, which roughly covers its energy needs domestically. An increase in the price of energy is reflected in a decrease in the real income of energy users (consumers and firms) and an increase in the real income of energy producers (and their shareholders).

The effect on the US real income as a whole is roughly equal to zero. The effect on aggregate demand depends on both energy users' and producers' marginal propensity to spend, and so may go up or down.

The European Union, however, imports nearly all the gas and oil it consumes, so an increase in prices leads to a decrease in the real income of energy users and an increase in the real income of foreign producers, who are unlikely to spend much on EU goods.

Thus a price increase in these commodities is likely to have a large adverse effect on domestic demand. In both cases, energy users, especially consumers, may be worse off. But the effect on aggregate demand depends on whether the country is a net importer or not.

It is useful to think about the implications of both oil and gas price increases for the EU real income and get a sense of magnitudes.

Start with oil. Oil markets appear to assume that the reduction in global supply will be limited. The Brent price was $99 per barrel the day before the war started, up from $78 at the start of 2022; it went up briefly to $133 but, at the time of writing (mid-April 2022), was down to $110.

Assume an increase in the price from $78 to $100, roughly 25 percent. Imports of oil (from Russia and elsewhere) by the EU27 were equal to 5,900 million barrels in 2021.

Such an increase in price would imply a decrease in real income for the European Union of $5{,}900 \times 22/1.1$ (for the dollar-euro exchange rate), thus €118 billion, or 0.84 percent of 2019 GDP (oil import data from Eurostat).

Gas markets have also retreated from the elevated prices of February, but they remain high. Assume that the percentage increase in the average price of gas for the European Union is the same as for oil, about 25 percent. Imports of gas (from Russia and elsewhere) were equal to €170 billion in 2021.

This implies a decrease in real income for the European Union of 170 × 0.25 » €42 billion, or 0.3 percent of 2019 GDP.

Under these fairly moderate assumptions, the war-induced increase in oil and gas prices would take a little more than 1 percent of GDP off the real income of the European Union. But this would come on top of the effect of previous price hikes since 2019.

Overall – and disregarding the lockdown period in 2020 during which prices and quantities collapsed – EU imports of energy, which amounted to 2.6 percent of GDP in 2019, would have exceeded 5 percent of GDP had prices remained at their early 2022 level, and would increase to more than 6 percent based on our assumptions.

Distribution effects

Beyond the aggregate loss of real income for consumers, distribution effects are important. Consumption of gas, utilities, and food (as a share of total consumption) is higher for low-income than for high-income households – although there are clear differences across countries: based on Eurostat data, the difference is small in Scandinavian countries, for example, 26 percent for the bottom income quintile versus 25 percent for the top quintile in Denmark.

It is larger for France and Germany, 25 percent versus 21 percent in France, 26 percent versus 21 percent in Germany. It is even larger for poorer countries, for example, 31 percent versus 23 percent in Spain, and 50 percent versus 37 percent for Bulgaria[12, 13].

Moreover, the consumption patterns of lower-income households are often more rigid, as a larger part of their income is pre-allocated to rents and other monthly payments they cannot easily modify. Thus, apart from the aggregate effects on output and inflation, one must take into account that poor households suffer more than richer ones from an increase in commodity prices. This has clear implications for fiscal policy.

4 Implications for policy

We finally turn to the fiscal and monetary policy responses. In the short run, the main issue, and the source of potentially large spending, is whether and how to protect consumers from the commodity price increases.

Tax and transfer measures

Under our moderate price increase assumptions, the median increase in the price of the consumption basket, given wages, is about 2 percent[14]. But the decrease in real income for the lowest income quintile in the most affected countries (eg. Slovakia) is twice as high, 4 percent.

This is a very large number, knowing that the dispersion of income effects among households even within an income bracket can be very large, depending on living conditions, and recognizing that the increases in commodity prices may be larger than in our assumptions[15].

The question, then, is how much and how best to protect households. Since energy prices started to ratchet up in late 2021, EU member states have been busy introducing a series of schemes intended to soften the shock. These schemes can be grouped under three headings[16].

Temporarily lower energy taxes

A first possibility is direct across-the-board subsidies, for example, in the form of cuts or rebates on energy taxes, which are high in most EU countries.

France, for instance, introduced in February a 1-year cut in electricity taxes (at a cost of €8 billion or 0.3 percent of GDP) and on April 1 a reduction of gasoline taxes of 15 cents per litre for a period of 4 months, at an estimated cost of €2.2 billion, about 0.1 percent of GDP[17].

This subsidy is presented as an emergency stopgap until a more targeted system is introduced in early summer. It is highly visible, a political advantage. Similar temporary cuts to excise taxes have been introduced elsewhere, notably in Germany where, on 23 March 2022, the gasoline tax was lowered by 30 cents per litre[18].

Lump-sum transfers

An alternative approach is to provide transfers that are independent of the consumption of food, oil, and gas. Germany, for example, introduced on 23 March 2022 a universal lump-sum transfer (*Energiepreis-Pauschale*) of €300 per person plus supplements for children.

France introduced last year an *indemnité inflation* of €100, given automatically to people with an income no higher than €2,000 a month, at a cost of €3.8 billion, or about 0.2 percent of GDP[19].

Such measures are unlikely to affect market prices for food, oil, and gas substantially (only to the extent that the additional income is spent on these goods), and thus have the effect that the transfers go mostly to consumers rather than commodity producers.

There may be feasible schemes to target transfers more accurately to better protect those who both have a low income and spend more of it on food, oil, and gas. For example, in the case of electricity, one might make transfers proportional to a recent utility bill and, combining it with household income information, limit it to those with income below some threshold.

Or gasoline cheques – a given amount of money to be spent only on energy or gasoline – might be issued; indeed, an energy cheque exists in France and a gasoline cheque is being discussed in the United States. To the extent that the cheque is less than what the recipient spends on energy, this measure does not affect the marginal price s/he faces and thus does not affect incentives to reduce energy consumption. Its political acceptability may however be lower than for across-the-board subsidies.

Price regulations

Yet another approach is to decouple some prices, such as the electricity price, from their marginal cost. The issue has become particularly salient in the face of extremely large fluctuations in the market price of natural gas – which is the relevant marginal cost in the production of electricity. Spain especially has been vocal in criticising the inflationary effect of electricity pricing, and in March it obtained EU authorisation to temporarily disconnect the Iberian Peninsula from the EU electricity market.

France has asked the country's main electricity company to limit the price increase to 4 percent for 2022 and to satisfy demand at that price, thus asking the company to absorb a large part of the cost, leading to a large anticipated decrease in cash flows and a large decrease in market value.

This entails an inefficiency, as the price is less than marginal cost, but allows for a potentially large increase in consumer surplus – at the cost of a larger decrease in producer surplus. From a welfare viewpoint, the gain in real income of consumers may well dominate the loss in efficiency[20].

Potential perverse effects of subsidies

Two main objections can be raised against subsidies. The first is that they increase the demand for energy, thus contributing to keeping energy prices high[21]. The issue is familiar from the standard discussion of tax incidence.

Consider subsidies to the various uses of oil. The effect on consumer prices depends on what happens to the market price of oil. If only one country uses such subsidies and it is small relative to the world market, the world market price will not change and thus the subsidy will be reflected one-for-one in a lower consumer price.

If, however, all EU countries, and possibly other countries such as the United States, introduce such subsidies, then the relevant supply curve is the world supply curve, which is inelastic in the short run.

In the extreme, if the supply curve is fully inelastic, the effect will be to increase the market price one for one and leave the consumer price unaffected[22]. In other words, the subsidies will go to the oil producers, including Russia. In practice, the outcome is likely to be less than a one-for-one effect of subsidies on market prices, but it is still unappealing.

The second, more specific but highly relevant objection, is whether subsidies may go against a possible future tariff and actually strengthen Russia's hand in its confrontation with the European Union.

As discussed in the previous section, a tariff on gas would lower both the price and the volume of Russian exports, while the corresponding revenues could be used to soften the impact on consumers. The question, however, is how this subsidy should be designed. A direct domestic gas price subsidy, such as a lowering of indirect gas taxes, would increase the demand for gas and the price charged by Russia, countering the effects of tariffs.

Governments should not use the revenue from a tariff on Russian gas to subsidise energy consumption in a way that lowers the marginal price of gas on the European market. They should rather rely on transfer schemes that do not affect the marginal price.

Taxes versus debt finance

The next question is by how much fiscal measures should be financed through additional taxes versus debt finance. Tariff revenues may help, but, as we discussed earlier, tariffs are unlikely to yield much revenue for oil; they are likely to yield more in the case of gas.

Immediate discretionary fiscal spending essentially consists of defence procurements (including for the provision of weaponry to Ukraine), assistance to refugees, measures in support of households, and emergency investments to adapt the energy system.

Under our price assumptions, fiscal costs range from small to manageable: in 2022 they should not exceed one-sixth of a percentage point of EU GDP for defence, one-third for assistance to refugees, and, depending on the decisions of different member states, between half and a full percentage point for measures in support of households[23].

A more challenging question is how much emergency energy investments may cost. We do not have a good estimate but assume that it should not exceed half a percentage point. Altogether, therefore, the discretionary fiscal cost of the war should remain within 1.5 to 2.0 percent of GDP.

This would be less than half the fiscal cost of the pandemic support measures, which in Europe typically amounted to 4 percent of GDP in 2020.

Should this additional spending be financed through taxes or debt? On traditional public finance grounds, there are good arguments for relying partly on debt finance. Part of the increase in spending is likely to be temporary, thus justifying tax smoothing.

On political economy grounds, the notion of a war tax – a *"Putin tax,"* as President Biden has called it in the United States, although he was referring to the decrease in real income rather than an explicit tax – may be less unpopular than in other circumstances and underscore the point that contrary to current perceptions in Western Europe a war, even an economic war, is not free.

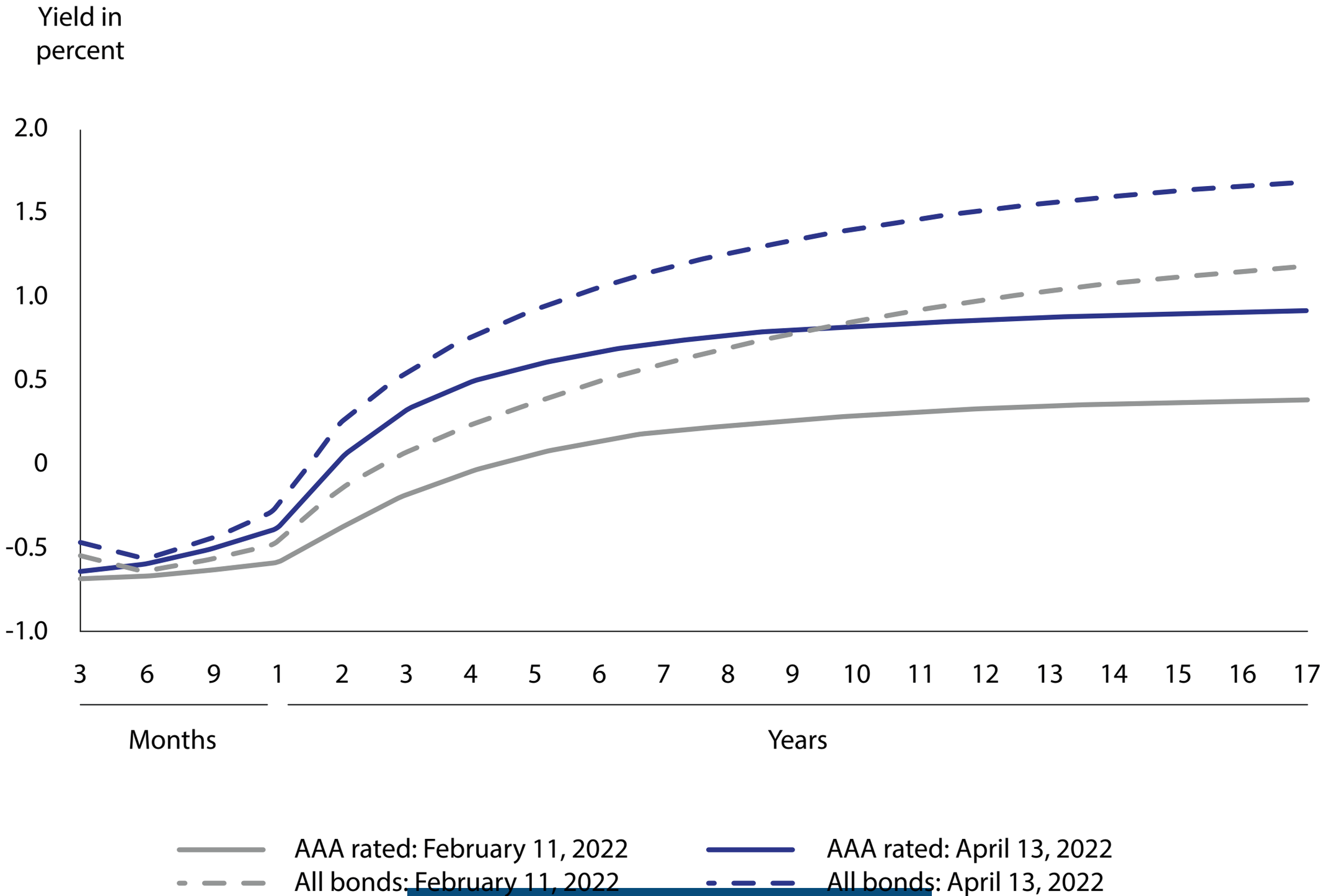
On macroeconomic stabilisation grounds, the case for relying largely on debt finance is strong. The decrease in real income for the European Union is large and is likely to lead to lower consumption. Export demand from Russia is likely to be drastically lower.

Higher uncertainty, which played a large role in reducing consumption and investment during the COVID-19 crisis, may play a substantial role again. Fiscal support and reliance on debt finance rather than on a tax increase to offset the higher spending are likely to be needed[24].

This raises the standard question about debt sustainability (a question one of the authors has addressed at length in other writings; Blanchard, 2023). While it may well be that slowing inflation will require temporarily higher real interest rates, the factors behind low neutral real rates have not changed, and – provided inflation remains under control, so that the inflation risk does not start being priced in real bond rates – the neutral rate should, after a bump, remain low in the medium run.

The evidence so far is that 10-year benchmark bond rates have increased by 50 basis points only since the start of the war, a limited upward adjustment in view of the magnitude of the geopolitical and economic shock (Figure 4). In the short run, debt dynamics are likely to remain extremely favourable. ECB (2022a) March forecasts of euro area real GDP growth, nominal policy rates, and inflation for 2022 are 3.7 percent, 0.8 percent (for the 10-year yield), and 5.1 percent.

Figure 4. Euro area yield curves, 11 February and 13 April 2022



Note: The solid lines show the yield curve for AAA-rated sovereign bonds only. The dotted lines show the same for all euro area sovereign bonds.
Source: European Central Bank. https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html

This implies a value for (r – g) of (0.8 percent –5.1 percent –3.7 percent) = –8 percent[25]. Combined with a debt ratio of 98 percent, this would allow EU governments as a whole to run primary deficits of 8 percent while keeping debt ratios constant. Thus, there is substantial room to run temporary larger deficits if needed.

Monetary policy

The typical advice to a central bank hit with an increase in commodity prices is to accommodate first-round effects (it cannot do much about those anyway) and limit subsequent-round effects, if necessary through lower output and higher unemployment, until inflation is back to target (Blanchard and Galí, 2007).

One can expect firms to eventually re-establish their markup. Thus, how much the central bank needs to lean in and slow activity depends very much on the behaviour of wages. Having suffered a decrease in their real wage in the first round, workers will want to catch up and will ask for a nominal wage increase.

And if they expect inflation to remain high, they will ask for higher nominal wage growth in addition. The strength of this first effect, workers' desire to catch up, depends, among other factors, on how much of a decrease in real income they suffer in the first round and how strong they are in bargaining, thus on the tightness of the labour market.

The strength of the second effect, expected inflation, depends on the credibility of the central bank strategy and its commitment to return inflation to its target.

There is in this context an important interaction between fiscal and monetary policy. To go back to the various protection measures governments may use, price subsidies – to the extent that they mechanically reduce the

increase in consumer prices – or price ceilings (as in the case of the delinking of the electricity price from its marginal cost) decrease first-round inflation and thus limit the initial decrease in the real wage.

This in turn decreases wage pressure in subsequent rounds, making it easier for the ECB to reduce inflation over time. Transfers do not affect first-round inflation, but they limit the initial decrease in real income, thus potentially reducing wage pressure in second and subsequent rounds.

To put it strongly, more protection and higher deficits reduce the need to tighten monetary policy to return inflation to its target. There is therefore a clear trade-off: from an efficiency perspective as well as to ensure the effectiveness of sanctions, governments should avoid income support measures that weaken the price signal and may in fact benefit Russia.

But from an inflation control perspective, they should rely on measures that have a direct, measurable impact on consumer prices. Some measures qualify on both accounts (as indicated, this is the case of transfers based on past energy consumption, if the lower average price paid by consumers is reflected in the construction of the CPI, which in principle it is). But many of the measures introduced so far do not pass the test.

Tripartite wage discussions

One can go a step further and make the case for tripartite discussions, if not negotiations, between firms, workers, and the state. So long as commodity prices remain higher, real wages and/or markups must be lower.

As we have discussed, the state can limit the decrease in the real income of workers through subsidies, transfers, and price regulations, financed by a mix of taxes on the better off, or debt finance, shifting some of the burden to future taxpayers.

Inflation is an extremely inefficient way of reaching an outcome, relying on either workers or firms to give up and accept lower real wages or lower markups. A negotiation in which workers, firms, and the state agree on a better outcome and, by implication, smaller second and subsequent rounds of inflation is clearly desirable.

Is it achievable? The role of such social negotiations has long been debated, and the usual answer is that it requires an unrealistic degree of coordination across firms and across unions. This time may be different, and tripartite negotiations, or at least discussions, should be an option that governments consider.

Any success in reducing the size of second-round effects allows for a more relaxed monetary policy. Two other factors are relevant here, although they move desirable monetary policy in opposite directions.

Potential de-anchoring of expectations

Inflation due to the commodity shock comes on top of an inflation rate substantially higher than what was forecast for 2021. Even before the war, this had led to concern about a de-an- choring of inflation expectations, which would make the job of the ECB more difficult.

Based on the *ECB Survey of Professional Forecasters* (ECB, 2022b), long-run expectations of inflation have started to increase, with the average forecast going from 1.8 percent at the start of 2021 to 2.1 percent in April 2022 (Lane, 2022)[26]. This was initially a welcome development after years during which inflation was expected to undershoot the target, but the worry now is that the additional first-round inflation due to the war will lead to outright de-anchoring.

As recently pointed out by Isabel Schnabel (2022) of the ECB Board, this argues for a tougher monetary policy stance in subsequent rounds than would be the case in the absence of higher previous inflation.

Potential weakness of private demand

The other relevant factor is the effect of the war-related shocks on aggregate demand. The reduction in real income even partly compensated by subsidies and transfers, diminished exports, investment losses, and a dent in overall confidence are good reasons to think that, even with fiscal support, aggregate demand will be weaker, apart from any monetary tightening.

This suggests less need for tighter monetary policy than was the case before the war and, other things equal, argues for looser monetary policy.

Which of these factors will dominate and whether ECB monetary policy will have to be tighter or looser than was intended before the war is difficult to assess at this point. The size of the shocks, the strength of second-round effects, the anchoring of inflation expectations, and the weakness of aggregate demand are all uncertain.

Markets have a hard time assessing what the net effect should be on monetary policy: the euro yield curve went sharply down as the war started, but is now a bit higher than before the war (see Figure 4)[27].

The current ECB stance of no major adjustments due to the war appears to be the right one at this point[28]. But the ECB will have to adjust its stance and be unusually nimble to avoid either lasting inflation or a recession.

5 Conclusion

For Europe, the war in Ukraine is a first-order economic shock. While the direct fiscal implications of taking care of refugees, increasing military spending, and strengthening energy autonomy remain limited, the impact of elevated energy and food prices on national income and its distribution is potentially large.

It would get larger if future European sanctions affect the global oil market or the supply of gas to the EU market. This raises three macroeconomic challenges for policymakers.

The first is how best to use sanctions to deter Russia while limiting adverse effects on the EU economy. In this respect, it is important to distinguish between oil and gas. For oil, Russia can diversify away from the EU market and, despite sanctions, sell on the world market where it operates as a price taker.

The implications are that the spillback from EU sanctions is global and that a European embargo or tariffs on oil may have limited effects on consumer oil prices. For gas, the European Union has substantial leverage because Russia is almost completely dependent on the pipeline infrastructure linking it to the European market.

But because supply from other sources is relatively inelastic, Russia faces a sharply downward sloping demand curve and enjoys significant market power. Given technical constraints, and this strategic game, an embargo on gas is not feasible. Tariffs, however, are feasible; they would be effective, and they should be considered, despite likely strong effects on consumer gas prices.

The second challenge is how to deal with the decrease in real income due to the increase in the energy import bill. Here, two issues require policy clarity.

First, if governments want to partly protect buyers – consumers and firms – from the increase, they have choices among measures, from direct subsidies to targeted transfers, regulations, and price caps. For gas and to a lesser extent oil, subsidies – especially across-the-board tax cuts – may partly offset the effect of sanctions and as such are undesirable.

Lump-sum transfers that do not affect the marginal price, and consequently do not diminish incentives to reduce demand, are preferable, especially if directed to low-income and other most affected households.

Second, governments must decide how to finance the extra spending. Because some of the spending is temporary and because of uncertainty, the loss of real income, and lower exports to Russia, all leading to weak aggregate demand, fiscal support and thus some additional deficit finance may be needed.

Even if deficits are larger, given high inflation and the still low nominal rates, debt ratios are likely to decrease over the next one or two years, and debt will remain sustainable.

The third macroeconomic challenge is how to deal with the increase in inflation as a result of higher energy and food prices. Two forces are at work.

The first is the need to avoid a de-anchoring of inflation expectations, more of a challenge than usual given that inflation had already substantially increased before the war. Preventing this risk would call for a tightening of monetary policy.

The second factor is that the loss of real income is likely to lead, even with some fiscal offset, to weaker aggregate demand, implying a need to loosen policy.

The challenge for policymakers is to cope with these conflicting objectives. In this context, policy instruments complement each other. A combination of well-designed fiscal support to households and tripartite wage discussions may help to soften the trade-off that the central bank is facing.

In each of these three dimensions, there is considerable uncertainty as to the outcome. Energy prices may increase much more than they have so far, or instead return to pre-war levels.

By implication, the loss in real income and the inflationary pressure may be much larger, or instead be less of an issue than currently forecast.

This leads to our last conclusion. Fiscal and monetary policy should be nimble, consisting of measures easy to adjust as the need may be. ■

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Endnotes

1. See https://webgate.ec.europa.eu/isdb_results/factsheets/country/details_russia_en.pdf

2. Nominal GDP of the EU27 was €14,017 billion in 2019 (Source: Eurostat).

3. European Commission, Russia fact sheet; see https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/russia_en

4. See the recent survey by Darvas (2022). The upper estimates are based on Swedish data. Pisani-Ferry (2022) used a €10,000 estimate based on the cost of the 2015 wave of refugees to Germany. Costs are bound to be lower in Poland and other frontline countries than they were in Sweden. We, therefore, stick to the €10,000 estimate.

5. For more detail on the implications of the war for food prices, see FAO (2022). See also Ritchie (2022).

6. For example, LNG imports from the rest of the world can be directed to countries where excess demand is the highest.

7. See the European Commission (2022) communication of 8 March 2022.

8. For more discussion of the underlying elasticity of substitution between gas and other sources of energy, and its implications for GDP if there were a full embargo on gas, see Bachmann et al (2022), Baqaee and Moll (2022), and Moll (2022).

9. We think of Russia as a monopolist facing a large number of buyers. In the presence of a tariff, and coordination among buyers, it may then become more appropriate to think of the European Union as a monopsonist. In this case, the right conceptual frame is to treat the outcome as the outcome of a game between the two players. Because European coordination is still lacking, we have not explored the implications of this alternative way of thinking about the market.

10. Here and elsewhere, unless specified otherwise, we are using 2019 data as a benchmark, because 2020 data were affected by the COVID-19 shock and 2021 data are not always available.

11. There is a legal debate as to whether such an action would require unanimity within the European Union. Sanctions are decided by unanimity on the basis of Article 29 of the Treaty on the European Union, but implemented by a qualified majority. Trade policy decisions are taken by a qualified majority. And in the field of energy, each member state has the right to determine "the general structure of its energy supply" (Article 194 of the Treaty on the Functioning of the EU).

12. These numbers are constructed as the ratio of food consumption (CP01) plus electricity, gas, and other fuels (CP045) plus operation of personal transportation (CP072) to total consumption, for each quintile. Numbers are from Eurostat-data.xlsx.

13. Some of the numbers that have been published appear much higher. For example, BLS data for the United States for 2020 give a ratio of consumption of food, transport, and utilities to disposable income of 74 percent for the bottom quintile versus 20 percent for the top quintile. But this reflects, partly, different definitions of what is included in the smaller consumption basket and, mostly, the fact that the analysis looks at the ratio of consumption of gas, utilities and food to disposable income rather than to consumption. In the lower quintile are many individuals and households who are dissaving and for whom disposable income is small relative to consumption.

14. Building on the previous discussion of inflation, to the extent that final goods producers do not fully reflect the increase in commodity prices and accept a decrease in their markup, the effect in the initial round will be smaller than the number in the text. But, if they re-establish markups over time, the number in the text is the relevant one.

15. In the French case, Douenne (2019) provided evidence of the vertical and horizontal dispersions of the effects of a carbon tax.

16. In October 2021 the European Commission introduced a toolbox of measures to tackle the energy situation, as feasible options for member states to consider. See https://ec.europa.eu/commission/presscorner/detail/en/IP_21_5204

17. For details about the French measures, called bouclier tarifaire, see Gouvernement français (2022).

18. See the 23 March German government measures (see https://www.bundesfinanzministerium.de/Content/DE/Downloads/2022-03-23-massnahmenpaket-bund-hohe-energiekosten.pdf). Another set of measures in support of affected business was introduced 8 April (see https://www.bundesfinanzministerium.de/Content/DE/Downloads/schutzschild-fuer-vom-krieg-betroffene-Unternehmen-massnahmenueberblick.pdf).

19. This payment was introduced in 2021, thus before the Russia-Ukraine war, to offset the already large increase in many commodity prices in 2021.

20. For more on the measures taken by EU members, including subsidies, transfers, and price regulations, see Sgaravatti et al (2022).
21. They also go against the need to decarbonise the energy system.
22. The slope of the supply curve was the subject of a Twitter discussion between Paul Krugman and Jason Furman (https://twitter.com/jasonfurman/status/1496483717027618826?s=20&t=Q1d9Glf5i7J1c9T9XaI0UA).
23. The German support programme consists of two packages of about €15 billion each.
24. It is interesting in this respect that Germany decided to combine both approaches by financing a defence fund through debt at 3 percent of GDP, while committing to finance the permanent increase in military spending through taxes.
25. The ECB also gives two other scenarios, one adverse and one severe. In the severe scenario, growth is 2.3 percent, the 10-year yield is 0.8 percent, and inflation is 7.1 percent, implying a value for (r – g) of –8.6 percent.
26. The increase from 1.8 to 2 percent was desirable; the issue is whether it would stop there.
27. See, for example, the ECB's yield curves for 23 February, 3 March and 17 March (https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html).
28. We thus largely agree with the analysis and conclusions of Isabel Schnabel (2022) in her 2 April speech.

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