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FINANCE 21

GRAHAM BRIGHT CONSIDERS THE ROLE OF THE FINANCE SECTOR IN COLLABORATIVE TRADE

ANDREW BAILEY LOOKS AT THE VARYING FORCES AFFECTING MONETARY POLICY

FINANCE DISRUPTED. BENOÎT CŒURÉ FOCUSES ON THE ROLE THAT CENTRAL BANKS ARE HAVING

21ST CENTURY FINANCE

Foreword

Welcome to the Winter 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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The hard yards

Andrew Bailey looks at the varying forces currently acting on the British economy and what they mean for monetary policy

I am going to discuss the state of the economy and monetary policy as the recovery from COVID unfolds. The title of this article, *The Hard Yards*, is I think a saying that originated in sailing, though I associate it more with forward play in rugby. I remember saying, around a year ago when the recovery looked rapid, that the hard yards were yet to come, and while I don't want to claim any great prescience, it appears to be turning out that way.

Nor do I have any claim to originality – Milton Friedman and Anna Schwartz wrote in their monetary history of the US that the most notable feature of the revival of the US economy after 1933 was not its rapidity but its incompleteness[1].

I, and other MPC members, have also used the analogy of a bridge to describe the role of economic policy in the age of COVID, the bridge to the other side of COVID. We are still on that bridge.

The rate of recovery has slowed over recent months, and that slowing is continuing. Relative to the fourth quarter of 2019, on the latest data to July, the level of GDP was 3.5% lower. That's around one percentage point below the level consistent with the August *Monetary Policy Report*.

There is a crucial distinction here between growth rates and levels of activity. It is inevitable in a bounce-back that the growth rate will slow as the recovery nears its endpoint. It is not though inevitable – or desirable – that the previous level is not regained.

Recovery in some consumer-facing services appears to have been delayed. We had seen a recovery in activities such as eating in restaurants, but activity is levelling off. Consistent with the impact of supply bottlenecks and disruption, construction output fell in July, and manufacturing output stalled. Surveys and the reports of the Bank's Agents, suggest the impact of these supply-chain issues is broadening out.

Pulling this together, the recovery has slowed and the economy has been buffeted by additional shocks. The switch of demand from goods to services, as COVID has faded in terms of its economic impact, has not taken place to date on the scale expected.

Meanwhile, supply bottlenecks and labour shortages have weighed on output, and are continuing. Indeed the number of high profile supply bottlenecks appears to be increasing. I must say that when I heard that we were suffering a shortage of wind to generate power, I was tempted to ask, *"and when are the locusts due to arrive."*

... the recovery is weakening. A lot therefore turns on how effectively supply capacity is rebuilt and over what time, and how the labour market evolves. These are truly hard yards

A number of these supply bottlenecks are not obviously a product of COVID, though others are. It is also possible that the economic fragility created by COVID has amplified the impact of other shocks – either that or the gods really are against us. I think it is more likely COVID amplifying at work.

I want now to turn to the labour market, because here we appear to have a big puzzle. Let's start with the very good news. So far we have not seen a major upturn in unemployment or substantial corporate distress, despite one of the largest economic downturns in history. That is a notable success for economic policy all round.

Put simply, if the authorities have the tools and the credibility, they can do a lot to help. And, it follows, that in such a situation they should do just that, they should not hold back.

But we are left with a puzzle in the labour market. Data from HMRC suggest that there were around 1.7 million jobs covered by the furlough scheme in July, and as a reminder it comes to an end this month.

The number of advertised job vacancies was at a record level in August of over 1 million. The number of people unemployed in the three months to July was 186,000 higher than immediately pre-COVID, and the number of inactive people was 634,000 higher.

Now, of course, it is possible to reconcile these numbers, but to do so involves a lot of movement of people from furlough, unemployment and inactivity, in ways not so far seen.

There are a number of possible outcomes to this puzzle, which have different implications for the labour market. The first is that the furloughed workers will largely be re-absorbed into their old jobs, and so even with a further reduction in unemployment and inactivity, we are left with an excess of job vacancies.

If these excess vacancies are associated with shortages of workers in particular sectors, this may push up on wages. This could also happen if furloughed workers do not return to their old jobs, but are not suitable for those jobs and sectors where there are a high number of vacancies.

In other words, there is a mismatch in the labour market. Such an outcome is likely to raise the rate of unemployment consistent with stable wage growth ie. the NAIRU.

The second outcome is different. Vacancies may be temporarily higher, and above their steady state level in the short-run, if firms are anticipating that it will be harder to find workers in the future when unemployment falls. In that scenario, demand picks up, the impact of matching frictions in the labour market dissipate over time, and both vacancies and unemployment fall. The NAIRU would be less affected in this scenario.

Another possible explanation is that the level of advertised vacancies is elevated due to employers overestimating the growth of demand to come just as the speed of the recovery falls off. In this case, some of the vacancies turn out not to be jobs as employers change their mind, or at least hiring is put back.

The implications of these labour market outcomes are quite different for growth, inflation, and thus monetary policy, which illustrates the uncertainty we face.

Before turning to inflation, I want to say something on earnings. On the face of it, headline earnings are elevated. Pay growth of around 8% for July (the latest available number) is very high. But there are a couple of COVID-related distortions that have been pushing up on this growth: there is a large base effect from the fall in average earnings last year, and a compositional effect from the pattern of impact of COVID on activity across the economy and how that relates to typical pay rises by type of job[2].

All of that said, we think the rate of growth of earnings in an underlying sense is probably around the 4% level – higher than we saw before COVID, and somewhat higher than we would expect to see in these economic conditions.

But, there is another interesting development. The dispersion of pay growth has risen quite markedly – so for the high numbers we read about, there are also low ones. I am going to come back to this point.

The final piece of the economic picture I want to cover is inflation. Having been well below target last year and into this year, it has risen rapidly to 3.2% in August. Much of the latest rise reflects base effects from last year, but we have also seen unusually strong rises in some items, including some foodstuffs, used cars and accommodation.

Our forecast in August had inflation rising to 4% by the end of this year, and developments since then mean that inflation is likely to rise to slightly above 4%. The major contributors to the further increase are not base effects but rather the strength we are now seeing in goods and energy prices.

Our view is that the price pressures will be transient – demand will shift back from goods to services, global supply chains are likely to repair themselves, and many commodity prices have demonstrated mean reverting tendencies over time.

But, the pressures are very much still with us, and there is still we believe pass-through to retail prices to come, and manufacturers' output prices are still rising rapidly. Added to that is the uncertainty around how the labour market puzzle resolves itself, and how that will affect employment and earnings. Meanwhile, just to remind, the recovery is weakening. A lot therefore turns on how effectively supply capacity is rebuilt and over what time, and how the labour market evolves. These are truly hard yards.

I am going to turn to the setting of monetary policy. Monetary and fiscal policy have operated independently but consistently – unsurprisingly I would emphasise – to provide the bridge through COVID, supported I should add by the stability of the financial system and macroprudential policy.

We have had to rely on asset purchases to do a lot of the work because of the proximity of interest rates to the lower bound. There is plenty of debate around QE, some parts of that debate are better founded than others. I am not going to cover that in any detail you will be relieved to hear, save to make a few points relevant to the current context.

First, we do think that the impact of QE is most pronounced in conditions of market instability, as we saw in March last year. Second, we think that a larger part of the impact of QE comes from the initial announcement of the stock of assets to be purchased, rather than the subsequent flow of purchases. As a reminder, the current round was announced last November when things looked bleak on the COVID front.

This begs a pertinent question: what impact do you get from continuing purchases in market financial conditions, and particularly at a time when inflation is rising as it is? The reason in my view is that QE does have an effect in stable conditions, and it is an important one, though I should emphasise on the second part of the question that because we regard the current upturn in inflation as transient, our view on the continuing role of QE is conditioned by our forecast in August that had inflation returning to target within an acceptable period of time.

One channel through which QE operates is to keep rates further along the curve down relative to where they would be otherwise. In that sense, the transmission mechanism is somewhat different to a change in Bank Rate, though the outcomes will likewise be seen in activity and inflation.

For all the noise about QE, the key thing for me is that it has thereby contributed to keeping stable the cost of finance for companies during the COVID period, and that has been very important both for monetary and financial stability.

QE has also provided insurance against the sort of market volatility and dysfunction that we saw at the outset of COVID. It has therefore helped to prevent any liquidity-driven rise in yields, should such an event have occurred and in particular ensuring that the corporate sector was supported through this crisis. That said, the current programme of asset purchases is currently scheduled to end in December.

It follows that the monetary policy response, if we need to make one, to the inflation pressure should involve Bank Rate not QE. There is no reason to beat about the bush on this point.

Let me turn to that response. The MPC's task is to set monetary policy to meet the inflation target, and in a way that helps to sustain growth and employment. The remit makes clear that it is appropriate to focus on inflation in the medium term, which is appropriate given the lags between changes in monetary policy and the impact on inflation. In our view, there are good reasons why the current above target inflation will be temporary, as I described earlier.

In considering how to use monetary policy, it is also important to understand the nature of the shocks that are causing higher inflation. The shocks that we are seeing are restricting supply in the economy relative to the recovery of demand.

This is important because monetary policy will not increase the supply of semi-conductor chips, it will not increase the amount of wind (no, really), and nor will it produce more HGV drivers. Moreover, tightening monetary policy

could make things worse in this situation by putting more downward pressure on a weakening recovery of the economy.

But what is crucial here is whether and how expectations of future inflation respond to these supply shocks, and thereby embed rising inflation. The most commonly talked about mechanism goes from higher inflation expectations, to companies feeling able to raise prices and employees asking for higher wages, to wage pressure and more persistent inflation.

In this way, what start out as relative changes in price levels for some goods and services can become generalised and turn into persistent inflation. I take this risk very seriously, it has form so to speak.

That's a world where people expect further price rises and thus seek to hold lower money balances relative to income than they otherwise would. But, in a world where people expect the price rises to be temporary and reversed, they will delay spending, and hold higher money balances relative to income than they otherwise would, and the growth of demand will be weaker.

As a pertinent example, will secondhand car prices stay elevated? Now, of course, it all depends on how badly you need that car, and in reality some price levels may stay elevated and some may not.

Monetary policy should not respond to supply shocks which do not become generalised through their impact on inflation expectations. In more modern times, and certainly in the life of the MPC, supply shocks have tended to be temporary in terms of their impact on inflation. But if that is not likely to be the case in our assessment, we will step in and adjust policy as needed. Nothing has changed in our approach.

To illustrate this approach, let me briefly summarise the announcement we made recently, drawing out the differences of view, which are very reasonable differences. The MPC emphasised that the inflation target applies at all times, with a clear focus on medium-term prospects for inflation rather than transient factors. The judgements required by this medium-term focus are particularly important and challenging at a time like this of very large shocks to the economy.

For most members of the MPC, the outlook for the labour market – as I described earlier – is highly uncertain and to some degree likely to be resolved in fairly short order, and this justified a wait and see approach on policy in view of the continuing belief that higher inflation will be temporary.

Within this view, some members put more emphasis on the continuing shortfall in the level of GDP relative to pre-COVID, while others emphasised the continuing direction of travel towards closing that gap and the evidence of cost pressures accompanying the closing.

But all of this group were of the view that the stimulus to monetary policy enacted in response to COVID would need to start to unwind at some point, that unwind should be enacted by an increase in Bank Rate, and if appropriate would not need to wait for the end of the current asset purchase programme.

The other view places more weight on current evidence of cost and price increases and accompanying signs of labour market and capacity pressures, leading to more persistent excess demand and higher inflation. Moreover, a policy change now would contribute to ensuring medium-term inflation expectations remain well anchored.

From this, I would draw out a number of important points. The great strength of the MPC process is that nine reasonable and I would say well informed people can differ on these interpretations, and we do so transparently.

But, all of us believe that there will need to be some modest tightening of policy to be consistent with meeting the inflation target sustainably over the medium-term. Recent evidence appears to have strengthened that case, but there remain substantial uncertainties and we are monitoring the situation closely.

Let me finish with a thought which builds on the whole area of supply shocks. As I mentioned earlier, we are seeing currently a much greater dispersion of wage settlements. What if this is the beginning of a more far-reaching structural change in the economy which alters relative pay across occupations? To be clear, I am making no prediction here, but rather asking the question in the context of monetary policy. The first thing to say is that such changes do happen.

Since the 1980s, we have seen a structural increase in the pay gap between higher and lower earners. We have also seen more structural changes in retirement ages over a longer time. So, structural changes can happen. It is not the job of monetary policy to prevent such changes, but rather to ensure that they do not have negative consequences for monetary stability, such as dislodging inflation expectations.

On this point, it is worth remembering that an important reason why we have a positive rather than zero inflation target is to enable such changes in relative earnings to happen in a world of downward nominal wage rigidities.

I started by quoting Friedman and Schwartz, and so I will end by doing the same. They emphasised the need to distinguish a change in price (or wage) levels from a persistent increase in the rate of change[3].

In my view, drawing this distinction is a crucial issue that we will be dealing with for some time. And of course, since it involves predictions of the future, for policymakers the task will not be easy.

In conclusion, the yards will be hard I'm afraid, and we must stick to the task. ■

Andrew Bailey is Governor of the Bank of England

Endnotes

1. Milton Friedman and Anna Jacobson Schwartz, "A Monetary History of the United States, 1867-1960", Princeton University Press, 1971, p. 493

2. The furlough scheme, meanwhile, has pulled down measured average wages. The scheme has helped workers stay attached to their jobs but generally at lower pay than usual. But the compositional effect has more than offset this.

3. Milton Friedman and Anna Jacobson Schwartz, "A Monetary History of the United States, 1867-1960", Princeton University Press, 1971, p. 498

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Monetary policy during an atypical recovery

The economy is back from the brink, but not completely out of the woods. Christine Lagarde says the euro area is going through a highly atypical recovery

The economy is back from the brink, but not completely out of the woods. After a highly unusual recession, the euro area is going through a highly atypical recovery. This atypical recovery is leading to rapid growth, but also to supply bottlenecks appearing unusually early in the economic cycle. It is also causing inflation to rebound quickly as the economy reopens. And it is helping to accelerate pre-existing trends and new structural changes brought about by the pandemic, which could have implications for future inflation dynamics.

But it is important today to take a step back. To understand how monetary policy should operate in this environment, we need to recognise where we have come from and where current trends suggest we are going. As John Maynard Keynes wrote, policymakers must always *"study the present in light of the past for the purposes of the future."*

We are coming from a decade of strong disinflationary forces that have depressed the whole inflation process. And while the robust recovery is supporting underlying inflation trends, what we are seeing now is mostly a phase of temporary inflation linked to reopening. Structural changes could create both upward and downward pressures on prices.

So, we still need an accommodative monetary policy stance to exit the pandemic safely and bring inflation sustainably back to 2%.

The inflation process before the pandemic

In the decade before the pandemic, inflation across advanced economies consistently surprised on the downside. The inflation process appeared to have slowed down along the transmission chain: from activity and employment to wages, and then from wages to prices. This was largely down to three factors.

First, gauging the true level of slack in the economy became harder[1]. Estimates of structural unemployment were consistently revised down as the economy strengthened[2]. And even as unemployment came down, many more people were drawn into the labour market, especially women and older people[3].

Second, structural changes in labour markets meant that receding slack fed more slowly into wage growth. Employment increased rapidly after 2013 but was mainly channelled into lower-paying jobs[4]. In parallel, global forces – such as globalisation and automation – reduced workers' bargaining power[5].

The pandemic has caused a recession like no other, and a recovery that has few parallels in history. The inflation response reflects the exceptional circumstances we are in. We expect that those effects will ultimately pass

Third, when wage growth did eventually pick up, firms were reluctant to pass on cost increases to consumers. Instead, we saw firms squeeze their profit margins[6]. This also reflected broader structural trends such as the digitalisation of services and the expansion of e-commerce[7].

Recession and reopening

Then, the pandemic hit, which led to a highly unusual recession followed by a highly atypical recovery.

In conventional business cycles, the depth of the slump normally determines the pace of the recovery. After exceptionally deep recessions, both demand and supply are often impaired for many years. From the onset of the great financial crisis, for example, it took seven years for euro area GDP to get back to its pre-crisis level. Growth never reconnected with the trend we thought possible before 2008.

But during the pandemic, though GDP saw its steepest collapse on record, the overall economy has reopened largely intact[8]. We now expect GDP to exceed its pre-pandemic level by the end of this year – three quarters earlier than we forecast last December – and it should come close to reconnecting with its pre-crisis trend in 2023. From its trough, the recovery in GDP is the steepest in the euro area since 1975.

This outcome is largely attributable to the combined response of monetary and fiscal policy, which has preserved both demand and supply. For instance, real labour income fell by 3.6% in 2020, but household real disposable income dropped by only 0.2%, because government transfers filled the gap. This is in stark contrast with the sovereign debt crisis, when disposable income fell by 2% year-on-year.

The atypical nature of the recovery is creating frictions in the economy, which can produce opposing effects on growth and inflation.

In certain sectors, supply shortages are holding back production, which is unusual so early in the business cycle. ECB analysis finds that exports of euro area goods would have been almost 7% higher in the first half of this year were it not for supply bottlenecks[9]. These risks to growth could mount if the pandemic continues to affect global shipping and cargo handling as well as key industries like semiconductors.

At the same time, the reopening is also pushing up inflation, which reached 3% in August and is expected to rise further over the coming months. Higher inflation today is largely the result of two exceptional effects.

First, inflation collapsed last year when lockdowns were imposed, which is creating strong base effects as activity recovers. Half of total inflation in the euro area today is due to energy prices, which are making up the lost ground from 2020. Base effects from last year's German VAT rate cut and the unusual timing of sales periods are also playing a role.

In fact, the low inflation rate last year and the high inflation rate this year equal, on average, the inflation rate observed in 2019 before the pandemic. So the price level now is roughly the same as if inflation had remained stable at its pre-pandemic level.

Second, imbalances between demand and supply in some sectors are pushing prices up.

Goods inflation rose to 2.6% in August, well above its historical average of 0.6% as – in addition to base effects – global supply chain disruptions met a sharp recovery in demand for durable goods[10]. Consumption of durables is already 1% above its pre-crisis trend[11], while shipping costs are around nine times higher today than in June last year.

Services inflation has also been rising – to 1.1% in August[12] – and it would have reached 2% using the consumption weights of last year, slightly above its historical average. This is also largely the result of demand returning to the sectors hardest hit by the lockdowns. Inflation in high-contact services accounts for virtually all of the rise we are seeing in services.

Once these pandemic-driven effects pass, we expect inflation to decline.

Base effects should drop out of the year-on-year calculation early next year, although we are seeing further increases in oil and gas prices.

It is harder to predict how long supply chain disruptions will last, but their ultimate impact on inflation will depend on how persistent they are and whether they feed through into higher than anticipated wage rises. Following the Japanese earthquake and nuclear disaster in 2011, production is estimated to have returned to normal after seven months for Japanese firms[13]. However, given the special nature of the pandemic and the recovery, it cannot be excluded that the resolution of supply-side bottlenecks may take longer now.

Monetary policy should normally 'look through' temporary supply-driven inflation, so long as inflation expectations remain anchored. Indeed, we are monitoring developments carefully but, for now, we see no signs that this increase in inflation is becoming broad-based across the economy. A 'trimmed mean'[14] of inflation – which removes the items with the highest and lowest inflation rates – stood at 2.1% in August. Furthermore, wage developments so far show no signs of significant second-round effects.

Inflation expectations also do not point to risks of a prolonged overshooting. Long-term market-based measures have risen by around 50 basis points since the start of the year – to around 1.75%[15] – and survey-based measures

have risen slightly to 1.8%[16]. This represents a move in the right direction. But it is still some distance away from our symmetric 2% target.

Inflation dynamics beyond the pandemic

In fact, looking beyond the pandemic, we expect inflation to only slowly converge towards 2%.

This is visible in the outlook for underlying inflation, which is a good indicator of where inflation will settle over the medium term. We currently project core inflation – which is one measure of underlying inflation – at 1.5% in 2023. Our survey of monetary analysts also points to a gradual convergence of inflation, which is expected to climb to 2% and stabilise at that level only five years from now[17].

This partly reflects the continuing pull of the structural factors that depressed inflation before the pandemic. But the pandemic has also created some new trends, which may have implications for the inflation outlook. Let me point to three.

The demand side

The first relates to changes on the demand side of the economy. Historically, core inflation in the euro area has mostly been driven by services inflation, which has contributed 1.1 percentage points to the long-term average of 1.3 percentage points. This is both because services have a higher weight in consumption[18], and because goods inflation has been held down by global forces of automation and competition.

Services inflation is closely linked to the strength of the domestic economy. It depends heavily on wage growth, as wages make up around 40% of the inputs for consumer services – double the share for goods. And robust domestic demand is crucial for a strong pass-through from wages to services prices[19].

So the key question today is whether the transition out of the pandemic could lift the outlook for domestic demand and thereby contribute to more dynamic services inflation. Here we see forces that point in different directions.

First, owing mainly to lockdowns, households are sitting on a large stock of savings that they have accumulated during the pandemic. Our new consumer expectations survey suggests that households are not currently planning to spend those savings. But this might change if the economy continues along a dynamic recovery path, causing people to adjust their risk assessment.

Indeed, research suggests that consumption is influenced by people's past experience of recessions, and the previous recessions in the euro area hit consumers especially hard[20]. From the onset of the great financial crisis and the sovereign debt crisis, it took seven years for consumption to get back to where it was at the start of 2008.

But by the end of 2022, we expect consumption to be almost 3% above its pre-pandemic level. And if that positive outlook is appropriately supported by the right policy mix, it could produce a virtuous circle, where people become more optimistic, upgrade their expectations of future income, and then spend more of the savings they have built up. This would help close the output gap from the demand side and put upward pressures on wages.

At the same time, there are forces that point to a slower pick-up in services inflation. As I said in my speech here last year[21], there are limits to how much services can be consumed, meaning they are unlikely to benefit from the same kind of pent-up demand as goods. At the end of the second quarter, services consumption was still about 15% below its pre-pandemic trend, even as restrictions were being eased.

The pandemic has also produced considerable slack in the labour market. Employment is now recovering quickly, but we have so far observed that labour force participation is rising even faster. This is good news for the economy,

but it also means that we expect unemployment to fall below its pre-crisis level only in the second quarter of 2023, and wages to grow only moderately.

The supply side

The second trend is related to changes on the supply side of the economy.

The pandemic has delivered a major shock to global supply chains and domestic labour markets. It has significantly accelerated the process of digitalisation – by seven years in Europe, according to one estimate[22]. And it may have distributional consequences that lead to changes in social contracts[23].

In the long run, some of these changes might dampen inflationary pressures.

For example, digitalisation could trigger a second wave of globalisation based on the virtualisation of services. It might lead to higher trend productivity, which could temper unit labour cost growth even as wage growth becomes stronger. And it could also shift activity more towards digital 'superstar' firms that have considerable market power and whose pricing is less sensitive to the business cycle[24].

But over the coming years, there is also a chance that prices will be pushed up.

For instance, today's supply shortages may induce firms to diversify their supply chains or re-shore some of their production. Previous pandemics like SARS were found to have had this effect[25]. That process could lead to higher cost structures that prioritise resilience over efficiency, which are then passed on to consumers. Geopolitics might also interfere in trade patterns and accelerate these shifts.

In parallel, faster digitalisation in Europe could initially create skill mismatches and scarcities, leading to wage increases even in the presence of persistent slack. The rate of job reallocations in major economies is estimated to double between 2019 and mid-2022[26]. This dynamic could also be reinforced by a renewed focus on inequality, which could lead to upward pressure on wages via rising minimum wages[27].

The green transition

The third trend – which is probably the most important yet least explored – is the green transition, the shift towards a low-carbon economy.

The pandemic has given the green transition a boost. It could lead to an accelerated increase in auction prices in the EU Emissions Trading System, the introduction of carbon prices covering a wider range of economic activities, and the adoption of a Carbon Border Adjustment Mechanism – all of which could have a direct inflationary impact.

The Network for Greening the Financial System estimates that implementing ambitious transition policies in Europe could gradually increase inflation relative to its previous trend by up to one percentage point over the transition period, before returning to that trend[28].

The green transition is also likely to make the pass-through of energy prices to consumer prices more complex. As energy supply shifts towards renewable sources, it will no longer be sufficient to look mainly at oil prices: we will also have to understand the energy mix and how the different sources are linked and can be substituted for each other.

Renewable energy in the euro area has increased from 5% of total available energy in 1990 to about 15% today. Similarly, the share of natural gas has increased from 17% to 24%. Oil, meanwhile, has dropped from 43% to 38%.

The ongoing rise in natural gas prices is testament to the complexity this creates, as that rise partly reflects unusually low wind energy production in Europe this summer and the need to fill the gap with conventional energy sources that can be mobilised quickly.

This, in turn, is having knock-on effects on other industries that rely on natural gas, like fertiliser manufacturing, and the industries that are dependent on by-products of fertiliser production, such as food packaging.

So we will need to understand these various transmission channels better. The impact of the green transition on inflation will ultimately hinge on the development of energy supply and the net effects of fiscal measures.

The increased use of natural gas to stabilise electricity production is only a bridge technology and will over time subside as new technologies for energy storage and distribution are more widely deployed. And the impact of carbon pricing will depend on whether the additional revenue is used to cut other consumption taxes, such as electricity taxes or VAT, directly support vulnerable groups or foster green investment.

If it is not, there is a risk that higher carbon pricing might reduce purchasing power and lead to relative price changes that push down underlying inflation. Research finds that introducing carbon taxes in euro area countries tends to raise headline inflation but lower core inflation[29].

Policy implications

So how should monetary policy behave in this environment? The key challenge is to ensure that we do not overreact to transitory supply shocks that have no bearing on the medium term, while also nurturing the positive demand forces that could durably lift inflation towards our 2% inflation target.

Our new forward guidance on interest rates is well-suited to manage supply-side risks. This guidance ensures that we will only react to improvements in headline inflation that we are confident are durable and reflected in underlying inflation dynamics. And the fact that inflation can move moderately above target for a transitory period allows us to be patient about tightening policy until we are certain that such improvement is sustained.

In terms of supporting demand, our monetary policy will continue to provide the conditions necessary to fuel the recovery. Indeed, our forward guidance has already led to a better alignment of rate expectations with our new inflation target, while helping to strengthen inflation expectations, which lowers real interest rates.

We expect to see further progress toward an even tighter alignment between the expected time of lift-off for our policy rates and the most likely inflation outlook as markets continue to absorb the rationale and key purpose of our forward guidance.

All this should provide a decisive boost to private spending once the uncertainty brought about by the pandemic fades, especially given the new investment needs created by the green and digital transition. The European Commission estimates that we need to see investment of around €330 billion every year by 2030 to achieve Europe's climate and energy targets[30], and around €125 billion every year to carry out the digital transformation[31].

Going forward, the contribution of fiscal policy, and therefore the appropriate policy mix, will remain important. Fiscal policy is likely to stay supportive, with the cyclically-adjusted primary balance expected to be -4.1% this year, -1.6% next year and -1.5% in 2023. But the scope of pandemic-related fiscal transfers will need to change from a blanket-based approach to a more targeted action plan.

Fiscal policy will need to be surgical, meaning focused on those who have suffered particular hardship. It will need to be productivity-enhancing, meaning that it facilitates structural changes in the economy and shifts activity towards future-oriented sectors, and delivers on the agreed reform programmes under the Recovery and Resilience Facility. And, taking a medium-term perspective, fiscal policy will need to follow a rules-based framework that underpins both debt sustainability and macroeconomic stabilisation.

For our part, monetary policy is committed to preserving favourable financing conditions for all sectors of the economy over the pandemic period. And once the pandemic emergency comes to an end – which is drawing closer – our forward guidance on rates as well as purchases under the asset purchase programme will ensure that monetary policy remains supportive of the timely attainment of our medium-term 2% target.

Conclusion

The pandemic has caused a recession like no other, and a recovery that has few parallels in history. The inflation response reflects the exceptional circumstances we are in. We expect that those effects will ultimately pass.

But the pandemic has also introduced new trends that could affect inflation dynamics in the years to come. Those trends could produce both upward and downward price pressures. So, monetary policy must remain focused on steering the economy safely out of the pandemic emergency and lifting inflation sustainably towards our 2% target. ■

Christine Lagarde is President of the European Central Bank

Endnotes

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Adapting to change

COP26 has shown that consensus is not just confined to politics. Graham Bright considers the finance sector's role in promoting collaborative trade

If the recent UN COP26 *Conference of the Parties* has taught us anything, it is that nations can come together, appreciate the enormity of the task of tackling climate change, agree to closer political and economic ties and above all leave a planet cleaner and more sustainable for generations to come, with consensus.

And consensus is not just confined to politics. Banking and insurance are sectors actively in not only exploring but implementing practical solutions which will protect and promote future collaborative trade.

From standardised Basle III compliant policy wording in insurance markets to interoperability in open banking platforms, the challenge is on.

Above all there seems to be more global acceptance to take on the investment and navigation through new technology projects with blockchain and AI elements, with a vision to improve systems, supply and services.

With a raft of new ideas in the digital space, advanced technologies, emerging players in fintech challenging traditional delivery methods, the key drivers to competitive, sustainable international trade will be standardisation, rationalisation and re-usability of processes.

And this drive for smarter, faster, more efficiency and trusted process is not from the industry, but from savvy tech-enabled consumers.

Customers are reverting to pre-pandemic demand for goods, not only defined as what they need, but what they want and can easily get, as consumerism through the power of advertising re-emerges.

As the world gets to be a riskier place through cyberattacks, ongoing shortages and trade disputes, and active conflicts in over 40 countries, consumers are unphased by the underlying problems surrounding current issues with global supply chains. A possible lack of Christmas turkey and toys seems to be the biggest issue for many.

But let us get back to consensus, a general agreement.

Consensus can certainly be seen in the proliferation of free trade agreements. In Africa, putting aside nationalism, protectionism and isolationism, long debated differences between nations have finally resulted in 54 participants able to collectively exploit the new demand for raw materials and services.

... adapting to change in financial markets is a must as global companies cannot rely on past performance, budget or organisational structures

From vaccines to technology, the political will, means and finance have been made available to build manufacturing centres, reduce dependency on expensive imports and export more competitively through supply of finished goods to new markets.

More importantly, the example of the African AfCFTA gaining wide consensus, with a number of countries agreeing process, taxonomies, customs duties, acceptable documents, payment methods, infrastructure routes, all in the name of building resilience, creation of wealth in like-minded countries, is one where the continent may greatly benefit.

Nations are able to bypass latent technologies and take advantage of latest cost-effective advanced communications networks, supporting smart mobile technology for payments, and use of sophisticated applications (for example created and maintained by new technology centres in Ethiopia).

These new apps are for example, helping farmers and remote communities improving crop yield, and entrepreneurs to realise new projects providing payment and loan gateways to connect, enfranchise and lift some 30 million people living in extreme poverty, offering the unbanked financial security and bank accounts.

The consensus model for Africa will change perception, allowing it finally to be seen as a global collective powerhouse. No longer the continent to be feared or exploited but a major player in supply of the worlds limited precious resources.

Africa has the potential to create more goods locally and become more self-sufficient as opposed to remaining a victim to large external economic forces, excessive cost of loans and dependency on both international and charity.

It is sobering to think that without investment and further industrial development, it is forecast by The World Bank that 90 percent of the world's poor will reside in Africa by 2030.

Ultimately, by standardising and harmonising both international and domestic regulatory practice, reducing and uncomplicating tariff barriers and minimising punitive tit-for-tat tariff measures, technology will be a critical factor in assisting with economic efficiency, digitising documents and digitalising process for faster, trusted, cost-effective outcomes for all.

Today, multilateral and bilateral agreements between nations number in the hundreds, covering geography, farming, IT, intellectual property, and all manner of collaboration, where the goal is not always profit but fair, sustainable, ongoing trade.

The importance of these agreements and their action cannot be underestimated, and whilst we are in the later stages of the pandemic, with signs that trade is edging back to pre-COVID levels, there is cautious optimism of normality on high streets and improved global trade albeit with higher prices and threat of rising inflation.

But consensus in not confined to international trade. A different type of consensus, in blockchain, is a major element driving the power consumption required for validation of computational transactions.

Consensus protocols form the backbone of blockchain by helping all the nodes in the network verify transactions, making sure one hacker cannot access more than 51% of the nodes and therefore gain control, vast arrays of computers are now required to be the first to validate and then earn from the process.

There is always a price to pay. In the early days, consensus was simple, where a lone home computer could validate a transaction, consuming a negligible amount of electricity. But with multiple coins and enormous demand to earn (rewards equate to approximately 6.25 new Bitcoins for guessing the hash key correctly) it is no surprise that mining can be very lucrative, but needs major investment.

Due to the scale and size of the Bitcoin public ledger, distributed across many multiple network nodes, today it is estimated that 12 years of household electricity is consumed per coin mined.

This staggering operational cost has fuelled demand for faster devices, more efficient processors, better cooling systems and higher pressure on electricity supplies, costs which are out of reach for individuals but only sustainable by nation state funded or large corporation budgets.

According to the *New York Times*, the process of creating Bitcoin to spend or trade consumes around 91 terawatt-hours of electricity annually, more than is used by Finland, a nation of about 5.5 million.

It will be fascinating to see how mainstream crypto becomes, how consensus protocols which favour large arrays will flourish and to what extend the world can satisfy its unquenching thirst for energy.

In conclusion, adapting to change in financial markets is a must as global companies cannot rely on past performance, budget or organisational structures.

As the businesses of the world embrace digital processes, we see change in working practice, more cross-border agreements, new international entrants to support supply chains, new economic centres and mobilisation of people, and witness the continuing shift from agricultural to industrial economies.

Companies are at a critical stage as they must all prepare themselves for change, by standardising, rationalising and re-using systems and process immediately if they are to compete, work with consensus, collaborate and continue to exist in our new world. The time is now. ■

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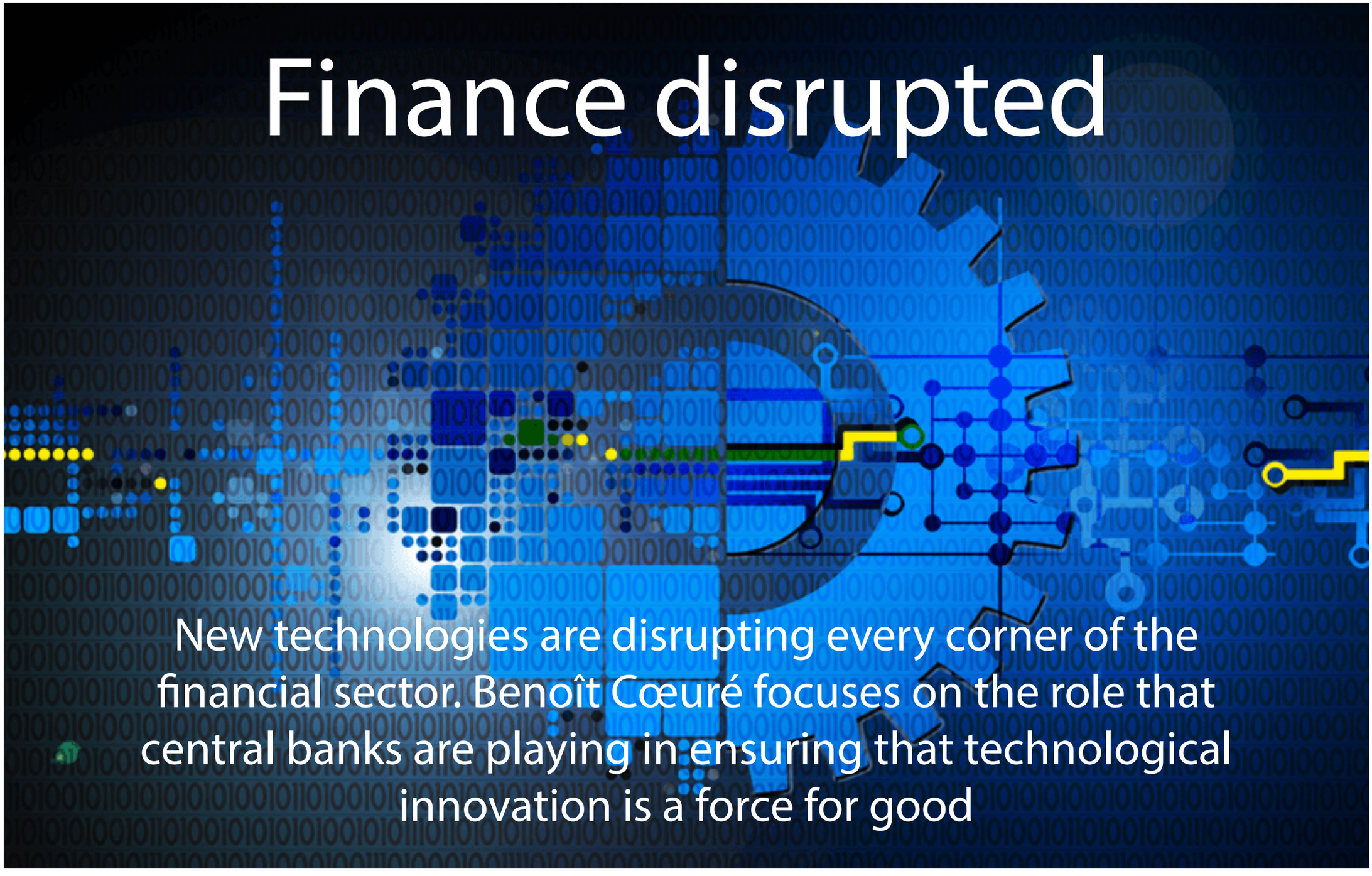
Finance disrupted



New technologies are disrupting every corner of the financial sector. Benoît Cœuré focuses on the role that central banks are playing in ensuring that technological innovation is a force for good

Let me begin by stating the obvious: we live in an age of disruption. We hear every day about businesses, industries, and governments being disrupted. And, of course, our private lives have been disrupted by the pandemic. But I would like to talk about a specific type of disruption – disruption arising from technological innovation in the financial sector.

Two years ago, *Banking disrupted* was the title of the *22nd Geneva Report*. The report presciently raised competition issues arising from big techs and fintechs. I would like to make the point that disruption goes well beyond banking.

Think of cryptocurrencies[1], the rapid rise of decentralised finance, or DeFi, and digital ID systems using biometric data. Think of the explosive growth of data and how firms – particularly big techs – exploit these data. Think of the massive hacks that regularly compromise the personal data of millions of individuals.

What do these stories tell us? They tell us that technological innovation and associated disruptions can be good or bad. New technologies can foster greater efficiency, financial stability and inclusion. But they can also do the opposite, spawning financial instability, loss of privacy, and financial exclusion.

The Great Financial Crisis didn't stem from technological change but from opacity and greed, but it taught us a useful lesson: when finance doesn't work, it takes a heavy toll on society. It took a decade to clean up the mess and reform the financial system.

New technologies are disrupting every corner of the financial sector. Should we let disruption run its course, whatever the consequences? Or do we want to harness the power of innovation in a way that preserves the best elements upon which the financial system is built?

I think the answer is clear. And this is where central banks must step in.

I will focus on the role that central banks are playing in ensuring that technological innovation is a force for good, and in developing innovative technological solutions themselves – both domestically and, increasingly, internationally. I will focus on the work we are carrying out at the BIS Innovation Hub, and on the technological disruptions we see in payments and money, banking supervision, and financial markets. At the end, I will share some tentative thoughts about the consequences of innovation for monetary policy implementation.

... central banks are pursuing innovation and actively developing technological public goods. All of this is meant to have the global financial system deliver greater benefits for citizens

Digitalisation disrupting payments and money

Payments and money first jump to mind. This is an area of rapid and unprecedented change. Cash is declining while digital payments are on the rise. COVID-19 has just given another jolt to this transformation.

Change started with how customers make payments. We can use our smart phones and watches. Contactless and mobile payments have become part of daily life in many countries including emerging and developing markets. Four in five Kenyans are using a mobile money service like M-Pesa[2]. Alipay and WeChat Pay accounted for 94% of all retail payments in China last year. Gloves with payment functions are being prepared for the Beijing Winter Olympics.

Most of innovation has been on the 'front end' but in recent years, it has moved to the 'back-end,' the part of the payments system that consumers don't see, involving money flows, and clearing and settlements between financial institutions – the part that not long ago used to be called 'plumbing'[3].

Fast payment systems are a great example, although consumers don't see the new plumbing that is needed to ship money in real time between banks. Services such as the UK's Faster Payment Scheme or the ECB's TIPS allow real-time payments 24/7 and deliver new benefits to consumers.

But other changes come with risks as well as opportunities. Think of global stablecoins, especially if issued by big techs. They are promoted as a way to provide faster and cheaper cross-border payments and deeper financial inclusion. And they do.

But they also pose significant risks: they can create closed ecosystems or 'walled gardens' that fragment the monetary system, by potentially taking large volumes of payments outside the system that has central banks at its

centre. Stablecoins may also pose risks for financial stability. As clarified yesterday by the Committee on Payments and Market Infrastructures and the International Organisation of Securities Commissions, stablecoin arrangements should observe international standards for payment, clearing and settlement systems to safeguard financial stability, if they perform a payment function and are found to be systemically important[4].

Walled gardens also have serious implications for competition. They augment the already significant market power of big techs. They also risk threatening consumer privacy and challenge existing regulatory practices[5].

The history of private money initiatives is not a happy read. Whenever faced with the conflict of interest between making their money stable no matter what and making a profit, private issuers have always chosen profits.

This is where central banks come in.

Money is ultimately a public good whose stability and use needs to be protected by the public sector. This is why so many central banks around the world are working on central bank digital currency, or CBDC – essentially, to ensure that the next generation of money continues to serve the public interest.

If well-designed, CBDC could be a safe and neutral means of payment and settlement asset, serving as a common platform around which a new payments ecosystem can develop. It could enable an open finance architecture that welcomes competition and innovation; and preserve democratic control of the currency[6].

The BIS Innovation Hub (BISIH) is helping to foster the international development of CBDC. Our centres in Hong Kong SAR, Singapore and Switzerland are building six proofs of concept, or prototypes, with ten central banks in Asia, Europe, the Middle East and Africa, looking at different types and uses of CBDC.

We are looking at wholesale CBDC, which may be used only by central banks and large financial institutions, to facilitate cross-border payments and avoid the use of the correspondent banking system that we all agree is slow, opaque and expensive. And we are investigating the digital equivalent of cash – general purpose (or retail) CBDC[7]. With the opening of new BISIH centres and partnerships, there will be more projects to come.

Big data and algorithms disrupting banking supervision

It's not all about CBDC though. Far from it. Innovation in the financial sector is usually referred to as fintech. Let me narrow the focus to regtech and suptech – the use of technology to improve financial regulatory compliance and supervision.

Algorithms, artificial intelligence and machine learning, empowered by big data, are transforming financial services. When big techs and credit platforms provide credit, some say that they turn data into collateral[8]. Actually, what they are doing is using data to reduce the need for collateral.

These firms know a lot about us. They collect enormous amounts of data about our preferences, spending habits and payment history – and those of our peers, who may be similar to us - even before we ask for a service or apply for a loan.

By using artificial intelligence and machine learning to study a treasure trove of data – typically more than 1,000 data points – they can determine how much we can borrow and repay. And they do it in part by using information that until recently did not have much financial value, like the model of smart phone someone has, or their browsing habits.

Collateral is needed when lenders don't have enough information about a borrower. Data help close the gap. This is very beneficial for the so-called 'thin file' customers, those who could not get a loan because of lack of credit history and couldn't build a credit history because nobody would give them loans – a chicken-and-egg problem.

There is a financial inclusion benefit from the use of non-traditional sources of data for lending decisions, but also a potential risk for privacy and the management of personal data.

Against this landscape which is changing in quick and often unpredictable ways, financial supervisors have mostly analogue tools. Their workflows are heavily manual. Data collection typically involves reports submitted by paper or email, with file size restrictions and operational and security risks[9].

For example, performing a cross-firm review often requires going through spreadsheets and PDF files from different sources, minutes of meetings and data from different systems and in different formats. Most of these data are one or two quarters out of date, some could be from previous years.

Figuring out what is going on from these fragmented and outdated pieces of information is, to put it mildly, challenging. Understandably, supervisors are increasingly worried about being left behind.

Technology can change this game, by giving supervisors access to a lot more data, structured, unstructured, with better quality and granularity than ever before. It can also give them effective means to extract, query and analyse data.

To perform the same cross-check review that I just mentioned, a digitally native supervisor could build integrated platforms to avoid using spreadsheets and PDFs. She could use artificial intelligence tools to crunch the data and

apply natural language processing and machine learning algorithms to real-time, typically unstructured data from news and market developments.

The BIS Innovation Hub is doing exactly that. The BISIH Singapore Centre is working with the Monetary Authority of Singapore, the Bank of England and the International Swaps and Derivatives Association on project Ellipse, a prototype which investigates the feasibility of an integrated regulatory data and analytics platform.

Tools based on project Ellipse would enable supervisors to digitally extract, query and analyse in real time large and diverse sources of structured and unstructured data that are relevant to the residential mortgage market, and anticipate supervisory action[10]. Looking ahead, we will also investigate ways to use the suptech toolbox to support the green and sustainable finance agenda[11].

Changes in market structures

I just mentioned the problems of having data that are a quarter too old. Let me now discuss the risks of data that is a thousandth of a second too old.

I'm talking about the intense digitalisation of financial markets. High frequency and algorithmic trading have introduced new actors and redefined market structures. High frequency trading deploys latency arbitrage, or 'sniping'.

Simply put, if you are ultra-fast, you can jump the queue and make a great deal of money. The speed required to gain an edge - millionths or billionths of a second - renders humans and slower computer systems obsolete. A recent BIS working paper estimated that latency arbitrage accounted for 20% of FTSE stock trading volume and imposed a roughly 0.5 basis point tax on trading, increasing the cost of liquidity[12].

This transformation has given rise to new risks. As noted by the BIS Markets Committee, FX execution algorithms have enhanced the matching process between liquidity providers and consumers in a highly fragmented market, but they shift the execution risk from dealers to users (that is, firms and investors), who may be less capable of managing these risks[13].

The problem is not new, of course. In the past decade, algorithmic trading has contributed to the occurrence of flash crashes. In May 2010, a flash crash wiped $1 trillion of value of the Dow Jones index in about half an hour[14]. It may get even worse as computers become even faster and more powerful.

And just imagine what the future advent of quantum computing could do. If quantum computers were able to resolve in minutes the calculations that might take conventional computers months or years, imagine what they could do with the processes that normal computers can already process in nanoseconds.

Other changes in market structures stem from non-banks and fintech firms expanding their footprint in financial intermediation and challenging the role of banks. How can we trace financial contagion spreading in the non-bank financial intermediation universe, by trying to aggregate data from banks, asset managers, other non-bank institutions, clearing houses, and so on?

Looking ahead, how can we identify and analyse risks arising from decentralised finance platforms, or DeFi, and the ways in which they spill over to traditional finance?

Here also, new tools will be needed, and here also, the BIS Innovation Hub is helping. The BISIH Swiss Centre is building a tool to monitor trading in fast-paced foreign exchange markets in real time. Project Rio is a central bank-

specific market monitoring platform. The cloud-based stream processing platform will process real-time financial data feeds and compute relevant liquidity and market risk measures in real time. Watch this space!

Conclusion

The central banking community is playing a critical role to ensure that technological innovation and its associated disruptions are a force for good. With this goal in mind, central banks are pursuing innovation and actively developing technological public goods. All of this is meant to have the global financial system deliver greater benefits for citizens.

Could technological innovation also disrupt the conduct of monetary policy? This could be the next battle line. There are so many dimensions to this question, and I certainly don't have all the answers. I will simply raise two questions for our discussion.

First on CBDC. A great deal is being written about the effect that a retail CBDC could have on monetary policy. Some academics[15] have suggested that it could provide an effective way to implement deeply negative interest rate policies and overcome the 'effective lower bound'. But if CBDC offers lower interest rates than cash or commercial bank deposits, would you still want to use it? The answer is: up to a point – but we don't know what that point is.

I believe in fact that CBDC could have a greater impact on fiscal policy. Think of the extraordinary support that some governments provided to the population during the pandemic. Some countries showed great ingenuity in using digital technology to reach those most in need[16].

Others mailed cheques to people while bank branches were closed because of lockdowns and people were told to stay home. Imagine how much easier it would have been to transfer digital money to people's e-wallets in real time.

My second question is about technological innovation in market structures. Financial intermediaries are key nodes for monetary policy transmission. Could changes in financial structures affect how they work? It all depends. Disintermediation in forms that by-pass these intermediaries may make this channel less effective – unless central banks consider broadening access to their balance sheets or introducing new instruments.

As a thought experiment, let's imagine a world where treasuries are exchanged as tokens on decentralised platforms. How would this affect market concentration and the role currently played by large primary dealers and custodian banks in liquidity provision and price discovery? Would current frictions be reduced?

How would shocks to the supply and demand of Treasuries be transmitted through the market, and ultimately affect financial conditions? We may never go there, but if we do, consequences for financial stability and monetary policy effectiveness will deserve careful scrutiny.

These are all complex questions that will engage policy makers. What is clear is that we are in the midst of an age of disruption – for the financial system and the world. The road ahead is exciting abut we don't know where it will take us three, five or 10 years from now.

However, what we know is that the direction we take will be defined by our own choices as policy makers and as market participants. I look forward to joining you all for the journey. ■

Benoît Cœuré is Head of the BIS Innovation Hub

Endnotes

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7. For an overview of BIS Innovation Hub projects, see www.bisih.org

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Under the western sky: the crypto frontier

Carolyn Wilkins talks about cryptoassets and the 'financial ecosystem' they are a part of. She looks at the risks and opportunities decentralised finance may bring and the regulatory response to these

"I'm a poor, lonesome cowboy and a long way from home." - Lucky Luke

I am writing about cryptoassets and the ecosystem of financial services that is developing around these assets. This new frontier has been compared to the Wild West, conjuring up images of lawlessness, and bandits whose purpose is crime. We should not forget the Wild West is also home to law-abiding pioneers, whose purpose is reinvention and expansion[1].

We are seeing expansion now. The crypto market has exploded from just US$16 billion five years ago to some US$2.6 trillion today[2]. Whilst that is a small share of the US$250 trillion global financial system, it is still an average annual growth rate of over 150 per cent.

We are seeing reinvention. The crypto ecosystem is challenging a traditional financial ecosystem that is, in places, inefficient and exclusive. Pioneers - from fintech to big tech – are creating new markets and targeting the margins of traditional financial services. And, Canada has been home to pioneers like Vitalik Buterin, the co-founder of Ethereum.

Unfortunately, we are also seeing crime. Much of the crypto-related illicit activity has so far been made up of scams and darknet markets[3]. Ransomware attacks grew an astonishing 300 per cent last year as work-from-home practices to combat COVID-19 presented new vulnerabilities for businesses[4].

It is all enough to make one feel somewhat like Lucky Luke; a poor lonesome cowboy and a long way from home.

I hope to help us feel a little closer to home by sharing my views on three features of the crypto ecosystem that are relevant to those who depend on efficient, stable, and trustworthy financial services.

1. Cryptoassets are the bedrock of the emerging financial ecosystem, so supporting consumer protection and financial soundness is the first order of business for regulators. In this regard, there are important differences between cryptoassets that are backed and those that are not.

2. The opportunities and risks extend well past the cryptoassets themselves to encompass a rapidly expanding range of financial services, from lending to insurance. These crypto-based services are increasingly being enabled by decentralised protocols – or DeFi.

The future of this new frontier depends critically on the regulatory response to these new activities and how fast the traditional financial system modernises

3. The future of this new frontier depends critically on the regulatory response to these new activities and how fast the traditional financial system modernises. This will take major investments in domestic and cross-border payments, as well as digital governance.

Before I delve in, I will mention that the views I express here are my own and do not necessarily reflect those of the Bank of England or any of its policy committees.

Cryptoassets are the bedrock of the emerging financial ecosystem

Let me start with the bedrock of the emerging financial ecosystem. The world's first cryptoasset based on blockchain technology was launched over a decade ago by the mysterious Satoshi Nakamoto. It initiated a wave of innovation with now more than 14,000 cryptoassets in existence[5].

A handful, including Bitcoin, Ether, Litecoin and Cardano, have dedicated communities of backers and investors, although many others have little or no trading volume.

While cryptoassets are often discussed as a single asset class, they differ in terms of whether they are backed and their underlying economic function. These differentiators are important when it comes to understanding what value these assets could add to the financial system, and what type of risks need to be managed.

Let us start with unbacked cryptoassets, taking Bitcoin as an example. Many proponents initially heralded Bitcoin as a revolutionary challenge to fiat-based monetary systems. Yet, Bitcoin has no intrinsic value and lacks a credible mechanism to stabilise its value, so its price is highly volatile.

This means it is not useful as a store of value or a means of payment[6]. The claims that the finite supply of Bitcoin somehow protects its value from eroding are doubtful because the total supply of cryptoassets has no upper bound.

In fact, Bitcoin serves as a speculative asset rather than money, and is at least in part a symptom of the prevailing low interest rate environment and search for yield. That is why, in many jurisdictions, individual holdings are viewed as investments and subject to capital gains tax at disposal[7].

When you add to the mix estimates showing that the Bitcoin network currently uses as much energy as the Netherlands, the overall net benefit of Bitcoin to the public interest is questionable[8].

Since around 95 per cent of the US$2.6 trillion crypto market is unbacked, the bulk of these assets are vulnerable to major price corrections. This raises significant issues related to investor protection and market integrity, particularly given that exposure to these assets is widening to the retail investor via crypto exchanges like Binance, Coinbase and Wealthsimple, and new financial products such as crypto-based ETFs.

That is why regulators around the world have turned from simply monitoring the situation to action. The Basel Committee on Banking Supervision has proposed that banks back crypto positions one-to-one with capital, which sends a strong signal about their assessment of the risks associated with unbacked crypto exposures[9].

The Canadian Securities Administrators has recently required crypto trading platforms that offer custody services and that are operating in Canada to register and is developing its regulatory and supervisory capacity[10].

In the UK, cryptoasset businesses must comply with the Money Laundering Regulations (MLRs) and register with the Financial Conduct Authority, which has also banned the sale to retail clients of crypto derivative products[11].

This work is critical to driving out the bandits and creating an environment for crypto businesses and investors that both supports innovation and competition and mitigates risks.

To try to address the issue of instability of unbacked cryptoassets, crypto pioneers have introduced 'stablecoins'. These aim to achieve a stable value against a fiat currency or other assets by maintaining reserves or backing-assets to help achieve this.

Stablecoins, such as the USD coin, are not yet widely used for mainstream payments. Instead, they currently act as a bridge for investment in unbacked cryptoassets or collateral for loans and play a key role in the development of decentralised finance (DeFi).

In theory, stablecoins could yield important benefits in terms of lower-cost, real-time and competitive payments services, both domestic and cross border. In practice, these will only be realised if stablecoins are safe.

US regulators found that Tether, another big stablecoin, had falsely claimed that its tokens were fully backed by US dollars. This highlights legitimate concerns about both quality and transparency of backing arrangements[12].

The Bank of England's Financial Policy Committee on which I am a member has set out two main expectations for systemic stablecoins. These were clearly articulated in a recent speech by my colleague Sir Jon Cunliffe[13].

The first is that any payments chains that are based on a stablecoin should be regulated to standards equivalent to those applied to traditional payments chains.

The second is that stablecoins used as money-like instruments should meet standards that are equivalent to those provided by commercial bank money – bank deposits. As Canada considers its regulatory response to stablecoins, it can look to these examples and the international work in this area.

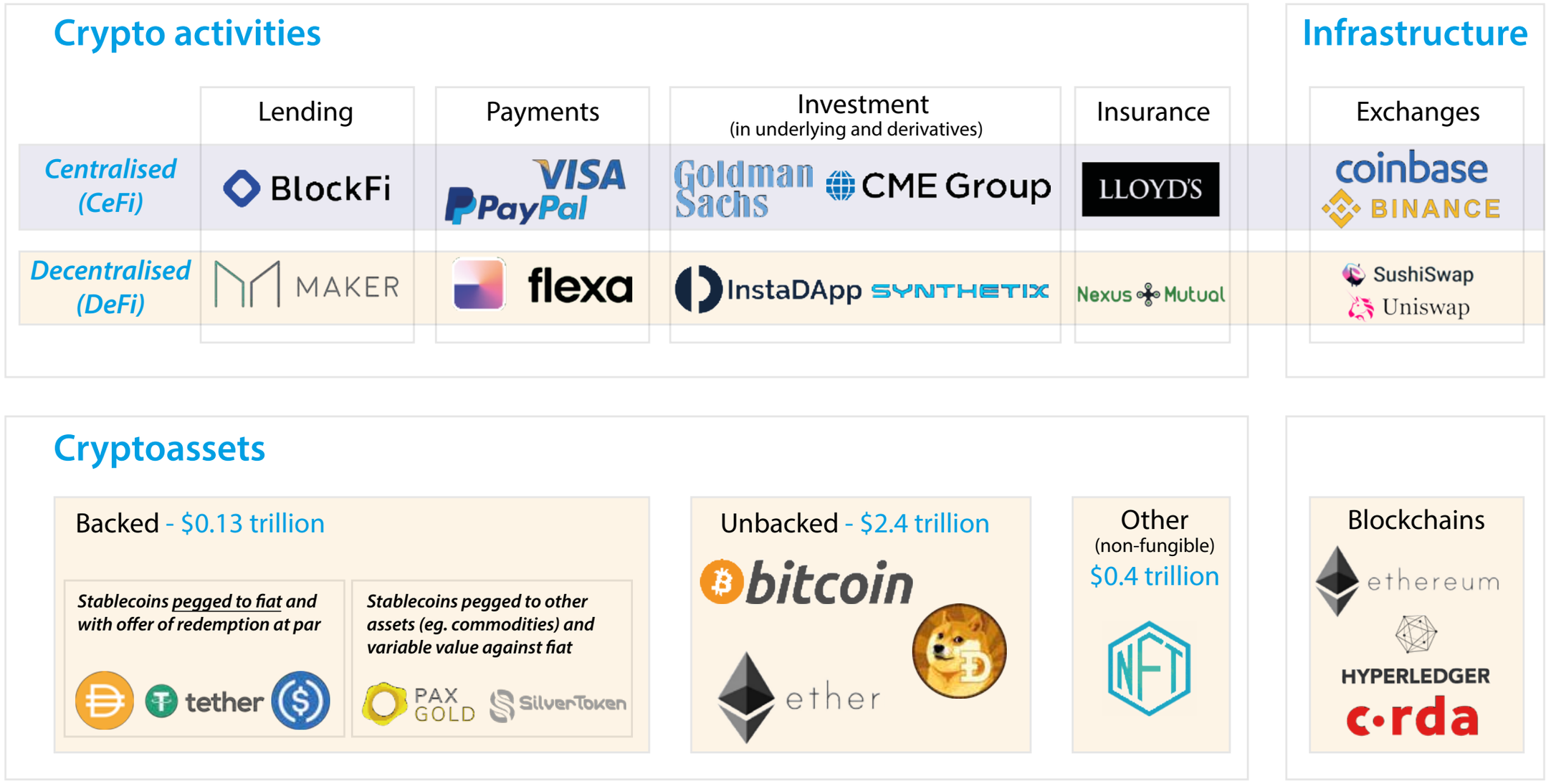
I agree with Jon that international co-operation is critical to ensure common stablecoin standards and avoid regulatory arbitrage across sectors and jurisdictions. The recent CPMI-IOSCO consultation on how the international standards for FMIs, the Principles for Financial Market Infrastructures should apply to stablecoin arrangements is a major step forward in applying 'same risk, same regulation' to systemically important stablecoins that are used for payments[14]. The Financial Stability Board is also working with standard-setting bodies to address any potential gaps in international standards.

The issue extends past cryptoassets themselves to the emerging financial ecosystem

Stablecoins and unbacked cryptoassets are facilitating a broader range of services than just payments, including lending, investment products, and even insurance. This brings me to my second point, which is that the issues extend past the cryptoassets themselves to the emerging financial ecosystem. The fact that this ecosystem is increasingly interconnected with the traditional financial system raises financial stability concerns.

These crypto-enabled services are offered in both a centralised (CeFi) and decentralised (DeFi) manner (Figure 1). In the CeFi space, I have already mentioned the exchanges run by newcomers, Binance and Coinbase, but traditional financial institutions such as Goldman Sachs and the CME Group have also begun facilitating investment in crypto underlying and derivatives.

Figure 1. Stylised map of cryptoassets, crypto activities and infrastructure



Because these entities have a legal structure and centralised governance, regulation and supervision should be straightforward. Compliance is nonetheless an issue, as the UK Financial Conduct Authority said that Binance's UK affiliate had failed to respond to some of its basic queries, and therefore was prohibited from undertaking regulated financial services activity in the UK[15].

DeFi has more novel features than CeFi, and so presents some unique opportunities and risks. First a definition. 'DeFi' refers to a variety of financial products, services, activities, and arrangements that are supported by smart contract-enabled distributed ledger technology. The distinguishing factor from centralized finance is that these DeFi protocols take the place of intermediaries.

Ethereum is now the predominant blockchain on which DeFi protocols and applications function, with 70 per cent of the DeFi value locked in worldwide on the Ethereum blockchain.

I see from my work with the Creative Destruction Lab at the Rotman School of Management that there is a lot of energy and investment dollars going into development. The total value locked in DeFi now is over US$100 billion, and growing fast[16].

That is because DeFi has several potential advantages over centralised ecosystems. Decentralisation reduces the reliance on intermediaries and their inefficient infrastructure.

The real opportunity is with smart contracts, which enable automated execution and creation of new financial instruments and digital assets. These contracts are enabled by the fact that DeFi protocols can integrate with each other and so data are easily shared, as opposed to traditional siloed platforms that do not talk to each other. DeFi

protocols are also open source, so the code is also visible and auditable, and every transaction is visible on the blockchain.

Despite some asserted distinctions from more traditional or centralised financial products, services, and activities, DeFi arrangements raise familiar issues.

The most immediate relate to fraud, misappropriation, and conflicts of interest, including those arising from misleading disclosures, misuse of inside information, and manipulative trading activities.

And, in some cases, despite claims of decentralisation, operations and activities within DeFi are governed or administered by a small group of developers and investors. This raises serious governance issues, including whether miners, programmers, and others should have fiduciary duty[17].

There is also risk related to money laundering and terrorist financing. That is why FATF (the Financial Action Task Force) recently updated their guidance for virtual assets and virtual asset service providers and added new guidance on how DeFi and distributed applications (DApp) relate to the FATF Standards[18].

Investors and users of DeFi are also exposed to important risks related to the underlying technology.

Security around smart contracts has improved since US$50 million of Ether was stolen in the decentralized autonomous organisation ('DAO') in 2016, but significant losses from cyber attacks remain frequent. One major DeFi platform disclosed last summer that cyber bandits made off with digital assets worth more than US$600 million, and there have been over 24 such robberies so far this year[19].

Many of these hacks have been 'flash loan attacks' that take advantage of temporary defects in price feeds. This has prompted insurance markets – like Lloyd's of London - to provide users with insurance against losses due to hacks or malfunctioning software[20].

The question for financial stability regulators is what risks does DeFi present, and are they important enough to be of systemic importance – either now or in the future. Price volatility is one issue that I've already mentioned. The share token of a DeFi protocol called Titanium that was once worth US$2 billion fell precipitously to near zero earlier this year[21].

The emergence of leveraged players only magnifies this risk. A sharp fall in the value of cryptoassets could trigger margin calls, forcing leveraged investors to liquidate positions. This could snowball into other asset class, especially if interconnectedness with traditional financial system keeps growing.

We are even starting to see synthetic collateral to get leverage. For instance, Synthetix allow users to take positions without ever holding the underlying asset[22].

This is reminiscent of the emergence of synthetic collateralised debt obligations (CDOs) leading up to the global financial crisis. The Bank of England, along with international partners, is developing a framework on how to deal with these important financial system issues.

Future depends on how traditional players modernise

The 200-Bitcoin question is how successfully DeFi will ultimately compete with CeFi and traditional finance. When I refer to 'traditional', I am referring to a system that has fiat at the core, and relies on intermediaries and trusted

third parties, including central banks. The advantage of this is an ability to see who you are dealing with and who is accountable.

Nevertheless, as Jeff Bezos famously said, *"your margin is my opportunity."* That means the traditional world cannot avoid competing along similar lines as DeFi – increasing quality of services, reducing costs to customers, and increasing inclusion.

Modernisation efforts in the traditional space will have to push further than replacing mainframes and better mobile banking apps. And, competitors are not standing still, whether they are banks and other FIs, or Big Tech.

This is a very positive outcome in terms of contestability of financial services.

Central banks also need to modernise. In that regard, there are over 50 central banks that are researching and experimenting with their own digital version of cash – central bank digital currency. The Bank of Canada and the Bank of England have been collaborating closely on these efforts[23].

No decision has been taken yet in most jurisdictions, including Canada and the UK. Much of the public discourse so far has focussed on winners and losers if this were to happen. One particular concern is that a CBDC would compete too successfully with bank deposits, and potentially raise the cost and undermine the stability of this source of bank funding. I think increased contestability for deposits would be positive, and the CDBC could be designed to avoid any instability in bank funding.

The deeper issue relates to importance of universal access to a safe medium of exchange. It is foundational to trust in the financial system and is therefore a public good. Do we really want private profit-making institutions

or protocols to be the only game in town in a modern economy? Also, there is potential for CBDC to enable innovations like private, fiat-backed stablecoins, and smart money.

If the traditional financial system to compete with the emerging ecosystem private and public efforts will need to focus on three building blocks. The first, I have already spoken about: a legal, policy and regulatory framework for the crypto ecosystem.

The second relates to modernising the payments landscape both domestically and cross-border. We urgently need more efficient wholesale and retail cross-border payments, including remittances; the door is wide open for disruption from cryptoassets given how inefficient and costly payments systems are today.

International and domestic authorities are taking forward implementation of the G20 Roadmap to enhance cross-border payments and ambitious targets for addressing challenges have been set for 2027[24]. Enhanced operating hours and increased direct access to domestic payments systems will help support cross border payments.

Payments Canada and the Bank of Canada are working right now on a domestic payments infrastructure that delivers 24/7, real-time, and low-cost clearing and settlement of transactions that can accommodate a wider universe of payment service providers. And the Bank of England is also developing a Renewed RTGS system[25].

The third building block relates to up-to-date data governance. We need a well-articulated data management framework, including for open banking, which recognises the rights of users of financial services and the protection of their privacy, as well as ethical use of personal data.

Whilst central banks have a role to play in this space, there is a vital role for government. GDPR covers this for UK and EU, but we are still waiting in Canada.

While the work related to these building blocks is underway, the many outstanding issues and divergent interests call into question whether progress will be made fast enough and risk producing a fragmented regulatory landscape and further unchecked growth in the crypto ecosystem.

Conclusion

I have said that cryptoassets are the bedrock of the emerging financial ecosystem, so supporting consumer protection and financial soundness is the first order of business for regulators. We must recognise that the opportunities and risks extend well past the cryptoassets themselves to encompass a rapidly expanding range of financial services.

The future of this new frontier depends critically on the regulatory response to these new activities and how fast the traditional financial system modernises.

Regulators and policymakers may feel like poor lonesome cowboys and a long way from home in this modern Wild West, but we must crack on.

To get the most out of these innovations, we need to modernise our legal and regulatory frameworks so that businesses and investors have clear and predictable rules of the game, and the risks to the financial system are managed.

This will take major investments in domestic and cross-border payments, as well as digital governance. If we do that, we will realise the promise of reinvention and expansion for those who rely on efficient and trustworthy financial services. ■

Carolyn A Wilkins is an external member of the Financial Policy Committee at the Bank of England

Endnotes

1. For example, see Gary Gensler's remarks before the Aspen Security Forum.

2. Given the volatility in cryptoasset prices, it is worth noting that the figure quoted is as of 18 November 2021 (Global Cryptocurrency Market Charts | CoinMarketCap).

3. Chainalysis (2021) "The 2021 Crypto Crime Report", February 2021.

4. See recent remarks by Homeland Security Secretary Alenjandro Mayorkas.

5. Given the volatility in cryptoassets, it is worth noting that the figure quoted is as of 18 November 2021 (All Cryptocurrencies | CoinMarketCap)

6. See Foley, Karlsen and Putnins (2019) "Sex, drugs and Bitcoin: How much illegal activity is financed through cryptocurrencies" The Review of Financial Studies, 2019.

7. See Guide for cryptocurrency users and tax professionals - Canada.ca and UK: Overview of the taxation of cryptoassets - KPMG United States

8. See, Bank of International Settlements (2021) "Central Bank Digital Currencies: an opportunity for the monetary system", Annual Economic Report 2021, Chapter 3, p.67.

9. See Consultative document - Prudential treatment of crypto-asset exposures | BIS

10. See Joint Canadian Securities Administrators/Investment Industry Regulatory Organization of Canada Staff Notice 21-329 Guidance for Crypto-Asset Trading Platforms: Compliance with Regulatory Requirements | OSC
11. HM Treasury has also consulted on bringing certain cryptoassets into scope of financial promotions regulation to enhance consumer protection.
12. Because of lack of transparency Tether recently was compelled to deny claims that it held commercial paper held by Chinese real estate firm Evergrande.
13. See Is 'crypto' a financial stability risk? - speech by Jon Cunliffe | Bank of England
14. See the recent CPMI-IOSCO consultative report.
15. See UK's FCA says it is 'not capable' of supervising crypto exchange Binance | Financial Times
16. Source: defipulse.
17. See for example FSB (2019) "Decentralised financial technologies: report on financial stability, regulatory and governance implications", June 2019.
18. See FATF (2021) Updated Guidance for a Risk-Based Approach for Virtual Assets and Virtual Asset Service Providers
19. See Decentralized Finance—Risks, Regulation, and the Road Ahead | King & Spalding – JDSupra
20. Lloyd's Launches New Cryptocurrency Wallet Insurance Solution For Coincover | Lloyd's
21. Iron Finance's Titan Token Falls to Near Zero in DeFi Panic Selling | CoinDesk
22. See Synthetix – Synths
23. See Central bank digital currencies - executive summary | BIS
24. See G20 Roadmap for enhancing cross-border payments: First consolidated progress report | Financial Stability Board
25. See RTGS Renewal Programme | Bank of England

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Stablecoins and payments innovations

Christopher Waller reflects on stablecoins, and raises the risks and benefits they have, in particular the lack of a regulatory and supervisory framework

The US payment system is experiencing a technology-driven revolution. Shifting consumer preferences and the introduction of new products and services from a wide variety of new entities have led to advancements in payments technology.

This dynamic landscape has also sparked an active policy debate—about the risks these new developments pose, how regulators should address them, and whether the government should offer an alternative of its own.

Earlier this year I spoke about the last of these questions: whether the Fed should offer a general-purpose central bank digital currency (CBDC) to the American public[1]. My scepticism about the need for a CBDC, which I still hold, comes in part from the real and rapid innovation taking place in payments.

My argument—simple as it sounds—is that payments innovation, and the competition it brings, is good for consumers. The market and the public are telling us there is room for improvement in the US payment system. We should take that message to heart and provide a safe and sound way for those improvements to occur.

My remarks focus on 'stablecoins', the highest-profile example of a new and fast-growing payments technology[2]. Stablecoins are a type of digital asset designed to maintain a stable value relative to a national currency or other reference assets. Stablecoins have piggybacked off the recent increase in cryptoasset activity, and their market capitalisation has increased almost fivefold in just the past year[3].

Stablecoins can be thought of in two forms. Some serve as a 'safe, liquid' asset in the decentralised finance, or DeFi, world of crypto-trading. Examples include Tether and USD Coin. Alternatively, there are stablecoins that are intended to serve as an instrument for retail payments between consumers and firms.

Although these types of stablecoins have not taken off yet, some firms are working to assess the viability of such stablecoins as a retail payment instrument. This growth in usage of stablecoins and their potential to serve as a retail payment instrument has prompted regulatory attention, including a new report from the President's Working Group on Financial Markets (PWG). This report urges the Congress to limit the issuance of 'payment stablecoins' to banks and other insured depository institutions.

The United States has a long history of developing, refining, and integrating new payment technologies in ways that maintain the integrity of its financial institutions and its payment system

Fostering responsible payments innovation means setting clear and appropriate rules of the road for everyone to follow. We know how to handle that task, and we should tackle it head-on. The PWG report lays out one path to responsible innovation, and I applaud that effort.

However, I also believe there may be others that better promote innovation and competition while still protecting consumers and addressing risks to financial stability. This is the right time to debate such approaches, and it is important to get them right. If we do not, these technologies may move to other jurisdictions—posing risks to US markets that we will be much less able to manage.

Stablecoins: what's old, and what's new

Stablecoin arrangements involve a range of legal and operational structures across a range of distributed ledger networks. They are a genuinely new product, based on genuinely new technology. But despite the jargon surrounding stablecoins, we can also understand them as a new version of something older and more familiar: the bank deposit[4].

As I have said before, both the government and the private sector play indispensable roles in the US monetary system. The Federal Reserve offers both physical 'central bank money' to the general public in the form of physical currency and digital 'central bank money' to depository institutions in the form of digital accounts.

Commercial banks, in turn, give households and businesses access to 'commercial bank money', crediting checking and savings accounts when a customer deposits cash or takes out a loan. This privately created money serves as a bridge between the central bank and the public.

Commercial bank money is a form of private debt. The bank issuing that debt promises to honour it at a fixed, one-to-one exchange rate with central bank money. The bank itself is responsible for keeping that promise.

However, the bank is supported in that task by a tried-and-true system of public support. That includes regulation and supervision, which ensure banks are safe and sound, not taking imprudent risks in their day-to-day business; the availability of discount window credit, which ensures well-capitalised banks can meet their emergency liquidity needs; and deposit insurance, which protects consumer deposits if the bank fails.

Put together, those programs leave very little residual risk that a depositor in good standing will ever have to leave the teller empty handed. They make a bank's redemption promise credible, and they make commercial bank money a near-perfect substitute for cash. As a result, households and businesses overwhelmingly use commercial bank money for everyday transactions[5].

This arrangement has many advantages. Small retail customers do not have to spend their time vetting the safety and soundness of their banks—regulators and supervisors do that for them. Consumers have a safe place to keep their savings and a nearly risk-free way to make payments, which are settled in ultrasafe central bank liabilities.

Banks can focus their effort on investments, products, and services from a place of safety and soundness. Communities and customers benefit from those efforts in the form of more efficient capital allocation and higher-quality, lower-cost financial products.

These advantages, however, are not cost free. Regulation ensures that commercial banks issue 'sound money' by making sure those banks are safe and stable, and that they bear the risks of their own investment decisions.

But regulation also imposes costs, from the expense and time required to seek a banking charter to the costs of compliance with an array of regulations.

While regulations are necessary, they also limit free entry into at least some of the markets in which banks operate. As a result, regulatory oversight can insulate banks from some forms of direct competition. The Congress has long recognised the importance of private-sector competition and customer choice, particularly in payments, and the Congress and the Federal Reserve take regular steps to preserve a competitive payments marketplace[6].

The objective of stablecoins is to mimic the safe-asset features of commercial bank money. They typically offer a fixed exchange rate of one-to-one to a single asset or a basket of assets. Payment stablecoins tend to choose a sovereign currency as their anchor, typically the US dollar.

Stablecoin issuers suggest that one can redeem a stablecoin from the issuer for one US dollar, although redemption rights are not always well defined. Nor is the entity responsible for conducting redemption always clearly specified.

To enhance the credibility of redemption at par, some stablecoin issuers go further, promising to limit the investments they make with the money backing each stablecoin by keeping it in cash or other highly liquid assets. In this respect, stablecoins can resemble a 'narrow bank', a well-known payment-only banking structure that monetary economists have studied for more than half a century[7].

Constructed this way, stablecoins also resemble currency boards, which peg a foreign currency to the dollar and hold dollar reserves to back up redemption promises.

Although stablecoins try to mimic commercial bank money, they differ dramatically in terms of the payment networks they use. Dollar-denominated commercial bank money is a settlement instrument in a wide range of asset markets, and customers can transfer it using a wide range of payment platforms.

However, commercial bank money is not 'native' to public blockchains, the distributed networks that support trading and other activity involving cryptoassets. Stablecoins help fill that gap as a less volatile anchor for cryptoasset transactions and an 'on-ramp' for digital asset trading.

Promises and risks

This role—as a more stable private asset in digital markets that otherwise lack such assets—has meaningful benefits by itself, helping make those markets deeper and more liquid. A well-designed, well-regulated stablecoin could also have other benefits, which go well beyond digital asset markets.

It might allow for different activity on distributed ledger technology, or DLT, platforms, like a wider range of automated (or 'smart') contracts. It might serve as an 'atomic' settlement asset and thus help bring some of the speed and potential efficiencies of digital asset markets into more traditional ones.

With the right network design, stablecoins might help deliver faster, more efficient retail payments as well, especially in the cross-border context, where transparency can still be low and costs can still be high.

Stablecoins could be a source of healthy competition for existing payments platforms and help the broader payments system reach a wider range of consumers.

And, importantly, while stablecoins and other payment innovations could create new risks, we should not foreclose the possibility that they may help address old ones—for example, by providing greater visibility into the resources and obligations that ultimately support any system of privately issued money.

These benefits are substantial, and even where they are still uncertain, it is important to recognise them. But to capture those benefits, stablecoins must bridge the biggest gap between them and commercial bank money: robust, consistent supervision and regulation and appropriate public backstops.

Strong oversight, combined with deposit insurance and other public support that comes with it, is what makes bank deposits an acceptable and accepted form of money. Today stablecoins lack that oversight, and its absence does create risks. The PWG described several such risks in its report, but I will highlight just three.

The first is the risk of a destabilising run. The United States has a rich history of privately created money, stretching back to promissory notes that merchants and lawyers issued on the early frontier[8].

Some of these instruments worked well for long periods; others came from unregulated or unscrupulous issuers, who promised safety and stability at a more attractive rate of return.

When these instruments went bad, the consequences could extend well beyond the depositors, investors, or even institutions who put their principal at risk. It is important not to overstate these risks; if the investors that participate in stablecoin arrangements know their money is at risk, then a run on one issuer is less likely to become a run on all of them.

But without transparency into those risks, or with retail users that are less able to monitor them, the possibility of widespread losses is more of a concern. As I mentioned, for commercial bank money, regulation, supervision, deposit insurance, and the discount window make this dynamic more remote by giving a bank's creditors less reason to run.

The second risk is the risk of a payment system failure. Stablecoins share many of the functions of a traditional payment system. If stablecoins' role in payments activity grows—which, again, could be a good development—their exposure to clearing, settlement, and other payment system risks would grow, too.

Stablecoins also present some unique versions of these risks because responsibility for different payment functions is scattered across the network. The United States does not have a national payments regulator, but it does have strong standards for addressing payment system risk, especially where those payment systems are systemically important. Regulators should draw on those standards with care and take a fresh look at what should or should not apply in the stablecoin context.

The third risk is the risk of scale. Stablecoins, like any payment mechanism, can exhibit strong network effects; the more people use a payment instrument, the more useful it is, and the greater the value it delivers to each participant. For this same reason, network effects can be (and usually are) highly beneficial.

As a result, rapid and broad scaling of a payment instrument is socially desirable. In fact, in a perfect world, there would be one payment system and one payment instrument that everyone uses. The problem with this is that, in our imperfect world, this would confer monopoly power over the payment system.

Any entity that has control over a large and widely used payment system has substantial market power and thus the ability to extract rents in exchange for access—which, again, hurts competition and decreases the network benefits to consumers.

Thus, there is a trade-off between the efficiency of having one large network and the cost of monopoly control of that network. I believe that we are a long way from a monopoly in stablecoin issuance; I see a lot of interest in offering this type of payments competition and ensuring that there are relatively few barriers to entry.

In my view, having stablecoins scale rapidly is not a concern as long as there is sufficient competition within the stablecoin industry and from the existing banking system. In this world, some form of interoperability is critical to ensure that competition allows consumers to easily move across stablecoin networks, just as they can move between different commercial bank monies or sovereign currencies.

Looking beyond the banking model

Jurisdictions around the world are grappling with these same risks, trying to foster the potential benefits of stablecoin arrangements while minimising their costs. The PWG report described one approach to that cost-benefit equation: restricting the issuance of 'payment stablecoins' to insured depository institutions and imposing strict limits on the behaviour of wallet providers and other nonbank intermediaries.

Given the economic similarities between payment stablecoins and bank deposits, I have no objection to the idea of banks issuing both instruments. The United States has a tried-and-true system for overseeing and supporting the creation of commercial bank money, and there is no reason to suggest it could not be adapted to work in this context.

However, I disagree with the notion that stablecoin issuance can or should only be conducted by banks, simply because of the nature of the liability. I understand the attraction of forcing a new product into an old, familiar structure. But that approach and mindset would eliminate a key benefit of a stablecoin arrangement—that it serves as a viable competitor to banking organisations in their role as payment providers.

The Federal Reserve and the Congress have long recognised the value in a vibrant, diverse payment system, which benefits from private-sector innovation. That innovation can come from outside the banking sector, and we should not be surprised when it crops up in a commercial context, particularly in Silicon Valley.

When it does, we should give those innovations the chance to compete with other systems and providers—including banks—on a clear and level playing field.

To do so, the regulatory and supervisory framework for payment stablecoins should address the specific risks that these arrangements pose—directly, fully, and narrowly. This means establishing safeguards around all of the key functions and activities of a stablecoin arrangement, including measures to ensure the stablecoin 'reserve' is maintained as advertised.

But it does not necessarily mean imposing the full banking rulebook, which is geared in part toward lending activities, not payments. If an entity were to issue stablecoin-linked liabilities as its sole activity; if it backed those liabilities only with very safe assets; if it engaged in no maturity transformation and offered its customers no credit; and if it were subject to a full program of ongoing supervisory oversight, covering the full stablecoin arrangement, that might provide enough assurance for these arrangements to work.

There should also be safeguards for other participants in a stablecoin arrangement, like wallet providers and other intermediaries. Again, however, not all of the restrictions that apply to bank relationships might be necessary.

For example, there is no need to apply restrictions on commercial companies from owning or controlling intermediaries in these arrangements. The separation of banking and commerce is grounded in concerns about captive lending—the idea that banks might lend to their owners on too favourable terms, giving the owners an unfair subsidy and putting the bank on shaky ground.

These traditional concerns do not apply to wallet providers and other intermediaries who abstain from lending activities. There are new questions to consider, such as around the use of customers' financial transaction data, but where anticompetitive behaviour happens, existing law (and particularly antitrust law) should still apply.

Policymakers will continue to work through these questions in the coming months, but in the process, we should not let the novelty of stablecoins muddy the waters. The United States has a long history of developing, refining, and integrating new payment technologies in ways that maintain the integrity of its financial institutions and its payment system.

Stablecoins may be new, but their economics are far from it. We know how to make this kind of privately issued money safe and sound, and, in designing a program of regulation and supervision to do so, we have plenty of examples to draw on. In the interest of competition and of the consumers it benefits, we should get to work. ■

Christopher J Waller is a member of the Federal Reserve Board of Governors

Endnotes

1. See Christopher J Waller (2021), "CBDC: A Solution in Search of a Problem?" speech delivered at the American Enterprise Institute, Washington (via webcast), August 5.

2. These views are my own and do not represent any position of the Board of Governors or other Federal Reserve policymakers.

3. See President's Working Group on Financial Markets, Federal Deposit Insurance Corporation, and Office of the Comptroller of the Currency (2021), Report on Stablecoins (PDF) (Washington: PWG, FDIC, and OCC, November).

4. This analogy applies to the economics of stablecoins; I make no comment on their legal status.

5. See Waller, "CBDC," in note 1.

6. See Federal Reserve System (2021), "Fostering Payment and Settlement System Safety and Efficiency (PDF)," in The Fed Explained: What the Central Bank Does, 11th ed. (Washington: FRS), pp. 84–111.

7. See, for example, Milton Friedman (1960), A Program for Monetary Stability (New York: Fordham University Press).

8. See Justin Simard (2016), "The Birth of a Legal Economy: Lawyers and the Development of American Commerce," Buffalo Law Review, vol. 64, no. 5, pp. 1059–1134.

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CBDC in an historical perspective

Monetary transformations through history have been driven by changing technology and the demands to effectively satisfy the functions of money. Michael Bordo argues that technological change is inevitable

Debate swirls in monetary policy circles over whether, how, and when to introduce central bank digital currencies (eg. Allen *et al* 2020, Auer and Bohme 2020, Auer *et al* 2020, Agur *et al* 2020; see also the Vox debate on *The future of digital money*). This debate has a strong resonance with earlier crossroads in monetary history when major transformations took place.

In today's crossroad, advances in technology – digitalisation – have led to the development of new forms of money. These include virtual (crypto) currencies like bitcoin, stable coins like libra/diem, and central bank digital currencies (CBDC) like the Bahamian sand dollar.

Today's innovations have a resonance with earlier major shifts in monetary history, and in a new paper (Bordo 2021) I examine the case for CBDC through this lens.

My overview of the history of monetary transformations suggests that technological change in money is inevitable, driven by the financial incentives of a market economy. Government has always had a key role in the provision of currency (outside money), which is a public good. It has also regulated inside money provided by the commercial banking system. This held for fiduciary money and will likely hold for digital money.

Monetary transformations in history

Monetary transformations in history have been driven by changing technology, changing tastes, economic growth, and the demands to effectively satisfy the functions of money. Money (and finance) has evolved with human history (Goetzmann 2017). Three historical transformations set the stage for the current digital transformation.

In the 18th and 19th centuries, new financial technology led to the advent of fiduciary money (convertible bank notes), which greatly reduced the resource costs of specie (Smith 1776). In addition, the exigencies of rising costs of

war finance in the early modern era led to the issue by governments of inconvertible fiat money. CBDC as a social saving over fiat money promises to be the next generation in this progression.

The early record of poorly regulated commercial banks issuing notes, ostensibly convertible into specie, has been used to make the case for government regulation of commercial banking and for a government monopoly of the note issue (Friedman 1960). The record of free banking in the US was one of considerable instability (Gorton 1986).

Digitalisation in money may promise to be the future. Central banks could learn the lessons from history and provide digital currency to effectively fulfil their public mandates

The high asymmetric information costs of a multiple currency system created an inefficient payments system[1,2]. The note issue eventually gravitated towards a central bank/government monopoly. The present day rise of cryptocurrencies and stablecoins suggests that the outcome may also be a process of consolidation towards CBDC.

Central banks, from the 17th to 20th centuries, evolved to satisfy several important public needs: war finance; an efficient payments system; financial stability; price stability; macro stability. Through a slow and painful learning process, monetary policy has evolved into the present-day flexible inflation targeting based on credibility for low inflation. CBDC could follow in this tradition.

The case for CBDC

The basic case for CBDC – defined as an asset in electronic form which serves the basic functions of paper currency, with universal access and legal tender – can be traced back to the classical economists' argument that currency is a public good that would appropriately be provided by the government (Friedman and Schwartz 1986). CBDC would satisfy the basic functions of money: a unit of account, a medium of exchange, and a store of value (Bordo and Levin 2017).

The key factors driving interest today in CBDC include the following:

- CBDC would be the 21st century version of Adam Smith's social saving of fiduciary money by reducing the costs of issuing and operating physical currency (by between 0.5% and 1.0% of GDP according to IMF 2020) and by reducing the monopoly rents earned by the commercial banking system (Barrdear and Kumhoff 2016, Andolfatto 2019).

- Digitalisation has greatly reduced the use of cash in several countries (eg. Sweden and Norway). CBDC would provide a payment media which has all the attributes of physical cash but is less subject to theft and loss.

- CBDC would increase financial inclusion for disadvantaged groups that do not have access to bank accounts.

- CBDC may head off the threat to monetary sovereignty from stablecoins issued by global digital services companies like Facebook, which would threaten central banks' ability to conduct monetary policy.

- CBDC would provide a secure reliable currency, free from the dangers of fraud, hacking, money laundering and financing terrorism.

Implementation of CBDC in the real world

Implementation of CBDC raises a number of important questions about its design which have been examined closely by central banks. One issue is the choice of retail versus wholesale CBDC. Significant improvements in the wholesale payments clearing mechanism suggest that the key issue is retail CBDC.

Here, the public good aspect of currency provides a strong rationale for either direct provision or at least close regulation and supervision by government. Accounts at the central bank are eminently feasible, but the private sector has a comparative advantage in financial innovation.

Hence, in advanced countries, a two-tiered or public–private arrangement may be preferable. Designated institutions could offer CBDC accounts to the public or serve as conduits for the central bank (Tobin 1987)[3].

Second, concern among prominent officials (Carstens 2021, Cecchetti 2021) that account-based CBDC which is the most secure direct liability of the central bank would lead to disintermediation and runs from the commercial banking system.

Research suggests that disintermediation could be offset by central bank balance sheet policy, by restricting CBDC holdings, or by tiering interest rates on CBDC and non-CBDC accounts (Kiester and Sanchez 2019, Brunnermier and Niepelt 2019, Kumhof and Noone 2018, Bindseil 2020). Moreover, central banks have adequate lines of defence to deal with runs in the form of supervision and regulation, deposit insurance, and lender of last resort[4].

CBDC and monetary policy

Researchers have argued that interest paid on CBDC could improve the transmission mechanism, especially the lending channel (Barrdear and Kumhoff 2019, Williamson 2018, IMF 2020, Meaning *et al* 2018). It would also reduce and simplify central bank balance sheets and move us back towards a bills-only policy. Using the interest rate on CBDC as the policy rate could allow central banks to move from the current 'floor system' back to a 'corridor system' (Meaning *et al* 2018).

In Bordo and Levin (2017), my co-author and I argue that allowing the interest rate on CBDC to go negative, along with incentives to reduce cash holding, would eliminate the effective lower bound as a constraint on monetary policy. We also argue that interest on CBDC could be used to foster true price stability. Finally, paying interest on CBDC could be used to improve the lender-of-last-resort function and financial stability.

CBDC and the open economy

CBDC has very important implications for the open economy. First, it could greatly improve cross-border payments

(IMF 2020). With digitalisation, payments could be done almost instantly. It would create a social saving, similar to the first transatlantic cable in 1866 (Garbade and Silber 1978).

Some stablecoins promise to arrange peer-to-peer payments through their established networks. Were stablecoin providers to dominate these arrangements, this could threaten monetary sovereignty and also be a source of credit risk. This makes the case for CBDC or some regulation. But sovereign CBDCs would need to make arrangements for interoperability with their foreign counterparts.

Second, a system of CBDCs that closely links the monetary and payments systems of different countries could lead to an amplification of the spillover effects of domestic monetary policy on other countries.

Third, CBDC and stablecoins could lead to currency substitution — dollar digitalisation — which could impact the monetary sovereignty of state-owned enterprises, especially those with weak monetary and financial institutions. Effective currency competition could occur because of the ability of stablecoins to separate the functions of money (Brunnermier *et al* 2019). Indeed, stablecoins could challenge the dollar's dominance because of the superiority of their networks.

However, currency competition from private platforms could run into the problems of interoperability and coordination that plagued multiple competing currencies in the 19th century. Like them, information asymmetry would make the case for CBDC. A system of interconvertible CBDCs would eliminate the imperfect substitutability of private digital currency (Eichengreen 2019).

Lessons from an historical perspective

Four key lessons follow from history on the case for central bank provided digital currencies:

1. Technological change in money/financial innovation is inevitable, driven by the financial incentives of a market economy.

2. Government has a key role in the provision of money. Outside money is a public good which it is necessary for the central bank to provide. This holds for fiat money and digital money. The ability to issue it depends on the credibility of the issuer. If that falters, currency competition from other CBDCs or stablecoins will erode monetary sovereignty.

3. Interest-bearing CBDC could improve the transmission mechanism and transparency of monetary policy. It could greatly simplify central banks' balance sheets and help them move back to a simpler framework that existed before the Global Financial Crisis. Moreover, CBDC could revolutionise monetary policy if the interest rate on CBDC is used as the policy rate.

4. CBDC is a global innovation. It could transform international payments like the first transatlantic cable did in 1866. It could also exacerbate currency substitution and require international monetary cooperation. CBDC and stablecoins could also challenge the international monetary system. The fundamental forces leading to currency domination are unlikely to change, but digitalisation could accelerate the shifts driven by them, as occurred in the 20th century when the dollar eclipsed the pound.

Digitalisation in money may promise to be the future. Central banks could learn the lessons from history and provide digital currency to effectively fulfil their public mandates. ■

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Endnotes

1. The experience of many other countries with free banking and competing currencies was similar.

2. A notable exception was Scotland in the 18th and 19th centuries (White 1984), although Goodhart (1988) attributed this to the banks being an oligopoly, the bank owners subject to unlimited liability, and the presence of the Bank of England as a lender of last resort.

3. Token based CBDC, which are the most cash-like and anonymous but prone to loss or theft, could be used for small transactions.

4. Of importance to central banks, they have devoted considerable resources to security issues including anti- money laundering and anti-terrorist requirements.

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Is ‘crypto’ a financial stability risk?

Jon Cunliffe looks at the impact of ‘crypto’ on the stability of the UK’s financial system and asks whether the world of ‘crypto finance’ poses risks to financial stability

Cryptoassets have grown by roughly 200% in 2021, from just under $800 billion to $2.3 trillion today. They have grown from just $16 billion 5 years ago. $2.3 trillion of course needs to be seen in the context of the $250 trillion global financial system. But as the financial crisis showed us, you don't have to account for a large proportion of the financial sector to trigger financial stability problems – sub-prime was valued at around $1.2 trillion in 2008[1].

When something in the financial system is growing very fast, and growing in largely unregulated space, financial stability authorities have to sit up and take notice. They have to think very carefully about what could happen and whether they, or other regulatory authorities, need to act.

At the same time, they need to be careful not to over-react – particularly when faced with the unfamiliar. We should not classify new approaches as 'dangerous' simply because they are different. Innovation, technology and new players can tackle longstanding frictions and inefficiencies and reduce barriers to entry. Throughout history, they have been key to driving improvement and to increasing resilience in financial services.

I will give you my conclusions at the outset. Crypto technologies offer a prospect of radical improvements in financial services. However, while the financial stability risks are still limited, their current applications are now a financial stability concern for a number of reasons.

Cryptoassets are growing fast and there is rapid development of new applications for the technology. The bulk of these assets have no intrinsic value and are vulnerable to major price corrections. The crypto world is beginning to connect to the traditional financial system and we are seeing the emergence of leveraged players. And, crucially, this is happening in largely unregulated space.

Financial stability risks currently are relatively limited but they could grow very rapidly if, as I expect, this area continues to develop and expand at pace. How large those risks could grow will depend in no small part on the nature and on the speed of the response by regulatory and supervisory authorities.

I will explain today what lies behind these conclusions and what they imply. First, however, we need to explore what lies behind the 'crypto' label in the financial system.

Crypto itself is the underlying technology – the application of cryptographic innovation to the recording and to the transfer of the ownership of assets, often on public networks open to all. Recording and transferring ownership of

Crypto technologies offer a prospect of radical improvements in financial services. However, [...] their current applications are now a financial stability concern for a number of reasons

assets is the bedrock of the financial system's role in storing value and in making transactions. Crypto technology enables – though it does not require - recording and transfer to take place without the banks or custodians that have historically carried out this function.

Within finance, the crypto label covers a multitude of different innovations in financial assets, markets and services. From a financial stability and from a regulatory perspective, what matters is not the underlying technology but how it is used and for what purpose.

In other words, we should not regulate technologies but rather the activities the technology is performing. And in doing so, we need to ensure a consistent approach to risks, regardless of the technology used.

I will not attempt a detailed taxonomy of all the crypto innovations in the financial sector - in all probability a few will have been added by the time I have finished speaking. But in order to discuss the most prominent risks, it is worth breaking them down into unbacked cryptoassets used primarily as speculative investments and backed cryptoassets intended for use as a means of payment.

I will also touch briefly on the recent development of decentralised crypto platforms and markets that are beginning to offer a broad range of financial services.

Unbacked cryptoassets

Unbacked cryptoassets make up nearly 95% of the $2.3 trillion. They are essentially non-replicable strings of computer code that can be owned and transferred without intermediaries. Bitcoin, of course, is the most prominent example, but there are now nearly eight thousand unbacked cryptoassets in existence.

These have no intrinsic value – that is to say there are no assets or commodities behind them: the value of the cryptoasset is determined solely by the price a buyer is prepared to pay at any given moment.

As a result, their value is highly volatile. Bitcoin's price movements have, for example, been twelve times more pronounced than that of the S&P500. For this reason, the main use of unbacked cryptoassets is for speculative investment.

Some, like bitcoin, also have limited issuance and therefore claim to be a hedge against inflation. Although originally also mooted as a means of payment, the volatility of their value makes unbacked cryptoassets generally unsuitable for making payments - except for criminal purposes[2].

Attitudes to unbacked cryptoassets, however, appear to be shifting – in the UK fewer holders now say they see them as a gamble and more see them as an alternative or complement to mainstream investment. Around half of existing holders say they will invest more[3].

And while retail investment predominates in this market, there are signs of growing institutional investor interest, with these investors now thinking about whether to have crypto in their portfolio. More complex investment strategies are beginning to emerge, including crypto futures and other derivatives[4].

At the same time, core wholesale finance and financial market infrastructure firms are putting their toes in the water. Several global banks are offering, or are planning to offer, digital asset custody services. Some international banks have started to, or are looking at, trading cryptoasset futures and non-deliverable forwards; and offering wealth management clients cryptoasset investments, following client demand.

Others have developed exchange platforms facilitating matched trades, or offer customers access to other crypto exchanges through their apps. Leading payment firms are also exploring ways of allowing people and businesses to use certain stablecoins for payments and for the settlement of transactions within their networks.

There are well founded concerns around unbacked cryptoassets in relation to investor protection, market integrity and financial crime. I will return briefly to these later, as they can have financial stability implications, although they are not usually the concern of financial stability authorities.

A more direct issue from a financial stability perspective, given the unbacked and volatile nature of these assets, is the implications of a major price correction. Such major corrections have been relatively frequent in the short lifespan of unbacked cryptoassets.

The price of bitcoin has fallen by over 10% in a single day on nearly 30 occasions in the past five years, with the largest of these - a fall of nearly 40% following a cyber-incident at a prominent exchange - coming in March last year[5].

The forward looking question is what could result from such events, if these cryptoassets continue to grow at scale, if they continue to become more integrated into the traditional financial sector and if investment strategies continue to become more complex?

In thinking about this, we should be clear that investors losing money on speculative investments does not, in and of itself, constitute a financial stability problem, though it may well be a major concern for authorities responsible for investor protection.

It is a necessary feature of the financial system that investors who understand the risks of speculative investments can make losses, including large ones, as well as gains. The responsibility of the financial stability authority is to ensure that the system is resilient so that price corrections – and consequent losses – can occur without knock on effects on the financial system as a whole and without damage to the real economy.

A comparison of two major price corrections illustrates the point.

In the dot-com crash of the early 2000s investors lost over $5 trillion following a sharp correction in equities, with the technology-focussed NASDAQ losing over 75% of its value. In the months before the crash, the index had a market capitalisation of roughly $3.6 trillion and this followed five years of exuberant growth, averaging 42% each year. In this instance, the losses for investors were material but there was no loss of financial stability.

By contrast, the collapse of the $1.2 trillion market in sub-prime mortgage backed securities in 2008 triggered the great financial crisis. In that case, the knock-on effects of a price collapse in a relatively small market was amplified and reverberated through an un-resilient financial system causing huge and persistent economic damage.

Whether a major price correction is absorbed by the system, admittedly leaving some investors with very sore heads or whether it is amplified into a systemic impact depends on a number of key characteristics of how the asset is integrated into the financial system, especially interconnectedness and leverage.

It depends also on the resilience of the system at the time of the correction – the liquidity in the system under stress and the ability of core elements of the system to absorb any losses.

So a necessary thought experiment from a financial stability perspective is what would happen in the financial system if there was a massive collapse in the price of unbacked cryptoassets - at the extreme end, if the price fell to zero.

Such a collapse is certainly a plausible scenario, given the lack of intrinsic value and consequent price volatility, the probability of contagion between cryptoassets, the cyber and operational vulnerabilities, and of course, the power of herd behaviour.

Indeed the stress test scenarios to which we and other authorities subject the banking system are if anything much further into the tail of the probability distribution. The financial system is far more resilient today than it was in the recent past, following the reforms put in place in the post-crisis period. Of course, this does not mean there are no challenges, as the market disruption at the onset of COVID-19 (the 'Dash for Cash') reveals.

A massive collapse in cryptoasset prices, similar to what we have seen in tech stocks and sub-prime, is certainly a plausible scenario. In such a price correction scenario, the first question that arises is the degree of interconnectedness between crypto and the conventional financial sector.

The simplest form of connections are direct exposures, people or institutions holding cryptoassets for speculative purposes. As a large proportion of this activity is still being carried out outside the traditional financial sector, regulators have a limited line of sight into who is holding these assets.

It is clear, however, that there are a large number of retail investors in this space – FCA survey research estimates 2.3 million adults own cryptoassets in the UK alone[6]. However, the possible losses to retail investors, while raising, as I

have said, investor protection concerns, is currently unlikely by itself to be large enough to be a financial stability risk.

The picture is less clear for financial institutions. It is useful to distinguish between institutional investors and banks. A recent report identified 150 to 200 specialist crypto hedge funds[7]. The investors behind these funds are typically high net worth individuals and family offices.

In many respects this is a similar story to that of retail investors, though we would expect more appetite to take leveraged positions in these sectors. (I would note in passing that the recent Archegos episode is an illustration of the damage that can be done to bank balance sheets by speculative and non-transparent fund leverage).

There is also evidence of significant and growing interest from traditional hedge funds, though data are very limited – in one recent survey of hedge funds, 21% of respondents indicated they were currently investing in digital assets and digital assets averaged 3% of their assets under management[8].

Banks on the other hand have, as yet, much more limited direct exposure to crypto with their activities largely consisting of agency services. However, there is clearly a prospect for the degree of interconnectedness to rise in the near future. We are starting to see proposals not just for agency services like custody and trading platforms but also for balance sheet exposure including offering broker-dealer services.

In response to these developments, the Basel Committee on Banking Supervision is consulting on the capital treatment for cryptoassets on bank balance sheets[9]. Banking industry bodies, however, have in turn been explicit in their view that the *"[currently] limited exposure [of banks to crypto assets]…is neither desirable nor sustainable"*[10].

Direct exposures provide an immediate channel by which losses could be transmitted from cryptoassets to the existing financial sector. However, there are also potential second round or indirect effects which can spread the impact into other asset classes.

For example, a severe fall in the value of cryptoassets could trigger margin calls on crypto positions forcing leveraged investors to find cash to meet them, leading to the sale of other assets and generating spillovers to other markets.

We saw last year, during the dash for cash, that this dynamic can put pressure on the amount of liquidity in the system. Similarly, there is the possibility of contagion. A large fall in crypto valuations could affect investor risk sentiment more broadly, causing investors to sell other assets that are judged to be risky and those perceived to have a similar investor base.

Interconnectedness creates the possibility that shocks are transmitted through the financial system. However, to gauge the possible impact of a price correction shock, we also need to look at the degree of leverage, given its amplification effect.

We know that the possibility exists today for retail investors and institutions to take leveraged positions, through unregulated as well as regulated derivatives infrastructure - including leverage of up to 100 times. At present, it does not appear such services are widely used – our best estimate of the derivative markets that offer leveraged exposures to cryptoassets is that they total around $40 billion.

On the other hand, and similarly to the story for interconnectedness, there is evidence of rapid growth. To take one example, CME crypto futures trading volume has increased tenfold over this year to around $2 billion a day.

All of this needs to be seen in the context of the lack of transparency that makes assessment of the risks more difficult and of some of the broader issues around cryptoassets and the platforms on which they trade.

I have mentioned the justifiable and growing concerns around investor protection, law enforcement and market integrity. These concerns – and the need for regulation to address them - have increasingly been highlighted, in particular by securities regulators[11]. I will not set them out here.

Risks in these areas are not the direct responsibility of financial stability authorities and do not normally pose risks to the financial system as a whole. But they can be a trigger for destabilising market corrections. And, as has been observed by the Financial Policy Committee of the Bank of England, at sufficient scale they can lead a damaging and general loss of confidence in the financial system[12].

Taking together the volatility of unbacked and largely unregulated cryptoassets, their nascent but fast-growing integration into the financial sector and the appearance on the scene of leveraged players, my conclusion is that while a severe price correction would not cause financial stability problems now, all else equal, the current trajectory implies that this may not be the case for very long.

Backed cryptoassets for payments use, aka 'stablecoins'

As I noted earlier, the price volatility of unbacked cryptoassets makes them unsuitable for use as a settlement asset in payment systems. In order to facilitate payments in cryptoassets, a number of cryptoasset models have emerged that are denominated in fiat money and backed with a pool of assets. The asset pool is intended to stabilise the value of the cryptoasset or 'coin' relative to the fiat peg – hence the name 'stablecoins'.

Stablecoins constitute a relatively small proportion of cryptoassets – at $130 million they make up just over 5% of all cryptoassets, though they have more than doubled since 2020, when they represented around 2% of the total. Their use in crypto payment systems has so far been mainly for payments within crypto markets, though there are some signs that they are just beginning to be used by wholesale financial market players and large corporates.

There are, however, in prospect, a number of proposals, including from big tech platforms, to expand existing schemes or develop new ones as payment systems for use at scale by the general public.

From a financial stability perspective, this poses rather different questions to those posed by unbacked cryptoassets used for speculative investments.

Large scale retail payment systems, capable of performing millions of transactions per minute, are a key part of the core infrastructure of the financial system. Households and businesses depend on them, increasingly so given the trend away from physical cash in many advanced economies. Disruption to their continuous and effective operation, or loss of confidence in them can jeopardise financial stability and cause major economic damage.

Technological advances and innovation have been welcome and powerful drivers of improvements in the speed, efficiency and functionality of the way we transact, not just in recent decades but throughout history.

Crypto technology offers the prospect of further transformation in the way we pay and the use of money as a means of transaction. However, the development of stablecoins for general purpose use at scale cannot be allowed to come at the cost of lower standards or higher risks to financial stability.

Regulatory authorities will need to ensure that the standards that apply to current systemic payment systems apply equally effectively to any systemic or likely to be systemic payment system using stablecoins.

However, applying this principle of 'same risk, same regulation' to systemic payment systems based on stablecoins and crypto technology poses a number of a challenges.

Unlike existing payments systems which operate in central bank or commercial bank money, stablecoin payment systems issue their own money, the 'coin'. This raises fundamental issues around the safety and interoperability of private money used in our economies.

Stablecoin arrangements can be decentralised on public networks, with no overarching entity responsible for their operation. They can also be structured in novel ways as sets of separately operated yet interdependent functions that can frustrate comprehensive, end to end, risk management.

A major step towards ensuring the consistent application of international standards to crypto-based financial services was the publication recently by CPMI-IOSCO[13] of a report, for consultation, on how the international standards for systemic payment systems, the Principles for Financial Market Infrastructures (PFMI) should apply to stablecoin arrangements.

The report confirms that the international standards do apply to systemic or likely to be systemic stablecoin arrangements. Crucially, it provides guidance on how the standards apply to some of the novel features of stablecoin arrangements that distinguish them from existing payment systems. I will briefly describe a few of the most important elements.

As I have noted, a particular challenge of stablecoin arrangements is that they can be organised to separate out the functions of creating the settlement asset itself, of transferring it between buyers and sellers and of storing it.

The guidance makes clear that even if these functions are carried out by separate entities, the standards apply to the arrangement as a whole and that the entity carrying out the transfer function is responsible for managing the risks to its safe operation from other functions in the arrangement.

The guidance also clarifies the high standards the 'coin' must meet if it is to settle payments.

Existing payment systems are required to use the highest quality money - central bank or commercial bank 'money' with minimal liquidity or credit risk, as the settlement asset. In other words they transfer high quality liquid claims on the central bank or on commercial banks between the buyer and the seller.

Central bank money, effectively a claim on the state, is the safest, highest quality money in modern advanced economies. For this reason, the PFMIs call for systemic payment systems and other financial market infrastructure to settle in central bank money where possible.

Where central bank money is unavailable, systemic payment systems may use commercial bank money instead. The liquidity and creditworthiness of commercial bank money is underpinned by the extensive regulation of banks, by central banks' lender of last resort function and by deposit guarantee schemes.

This means that the money issued by a commercial bank in the form of deposit accounts can be exchanged, on demand and at par value for central bank or other commercial bank money whenever the holder desires.

Stablecoin payment systems issue and use their own money – the coin - as the settlement asset between buyers and sellers. The guidance sets out that the assets backing the stablecoin should enable the coin to observe the same high standards of creditworthiness and liquidity that apply to money used in existing systemic payment systems.

This is crucial to ensure that confidence in the coin can be maintained in normal times and in stress. To this end the guidance also covers users' claim on the issuer and/or the underlying assets and their right to redeem in central bank or commercial bank money at par at least by the end of day.

An important element of the guidance covers governance and makes clear that a stablecoin arrangement needs to be governed by one or more discrete legal entities with accountability for the operation of the arrangement and for the management of risk.

This includes ensuring that any wider interdependent functions within the arrangement are governed in such a way that the arrangement can meet this governance standard as a whole. A decentralized crypto-algorithm on the internet would clearly fail this requirement. I will return to this point briefly in the next section on decentralised finance.

The guidance, now out for consultation, clarifies that the international standards for payment systems apply to stablecoin payment arrangements. The guidance will provide the foundation for regulation to bring systemic stablecoins within the regulatory perimeter.

It will remain, of course, a decision for individual jurisdictions whether and, if so, under what regulation to permit the operation of systemic or likely to be systemic stablecoin payment systems[14].

If implemented by jurisdictions, the guidance will, in my view, be likely to lead to changes in the structure of some existing stablecoin arrangements, including with regard to the asset pool and loss-absorbing capital and also with regard to the responsibilities of arrangement operators. The guidance should play an important role in enabling current and prospective stablecoin initiatives to design and structure their arrangements to come within the international standards.

The standards do not address all of the potential financial stability risks from stablecoins used for payments at systemic scale. There is also the possible impact on the banking system. If households and firms shift to holding and using stablecoins for transactions, rather than holding and using commercial bank money in bank deposit accounts, there could, in some scenarios, be a material shift of deposits out of the banking system.

A number of central banks have modelled and estimated the scale and nature of very similar possible impacts on the banking system from the introduction of a central bank digital currency (CBDC)[15].

Future demand from households and firms for stablecoins, and the scale of any consequent substitution away from bank deposits, is impossible to predict with certainty. But a series of assessments have fairly consistently reached the conclusion that, with careful design and implementation, the steady state impacts of substitution from bank deposits would probably be limited, though there could be greater risks in the transition.

It is not the responsibility of financial stability authorities to preserve any particular business models, including in banking. The banking system has, throughout its history adapted to technological innovation and competition from new players and it will need to continue to do so. (Indeed, banks have benefited in recent decades from the technological innovations that have driven transactions away from cash to electronic transfer of bank deposits).

However, financial stability authorities do have a legitimate interest in ensuring any transition is smooth and does not generate instability.

Decentralised finance – 'DeFi'

Finally, I would like comment briefly on a more recent set of applications to finance of crypto technology on public networks– the rapid initial growth of decentralised finance, or 'DeFi'.

DeFi is a development that demonstrates the increasing complexity, and potentially growing risk in the crypto ecosystem. The label refers to decentralised, algorithm-based financial services that rely on smart contracts and are delivered over DLT platforms without intermediaries.

The most prominent use for DeFi at present is the provision of credit. Lending currently represents nearly half of the DeFi market. However, the DeFi model and technology can be deployed to replicate a range of financial services such as savings, trading, insurance and derivatives. DeFi is very small at present but growing very fast, from less than $10 billion at the start of 2020 to nearly $100 billion last month.

The highly decentralised and global structure of the DeFi sector along with the difficulty to trace end users provide a unique set of challenges for regulators.

Even on an initial view it is clear that the sector is opaque, complex and undertakes financial activities that carry risk – activities that are regulated with the traditional financial sector. There are pronounced market integrity challenges given the absence of investor protection, AML and other market integrity provisions. Moreover, even were such provisions in place, there may be no one for regulators to engage and hold accountable. In practice, the degree of decentralisation currently varies across platforms.

However, in an extreme form, a DeFi platform could be completely decentralised with no identifiable legal entity, ownership nor even a point of human contact.

DeFi is still in its early infancy but its rapid growth means that regulators, domestically and internationally, need to think seriously now about the risks of a broad range of financial services being effected through DeFi platforms and how to ensure risks are managed in the DeFi world to the same standards as they are managed in traditional finance. At the Bank of England we have begun work to this effect.

Conclusion

At the beginning of this talk I set out my conclusion that while financial stability risks from the application of crypto technologies are currently limited, there are a number of very good reasons to think that all else equal this might not be the case for very much longer.

All else is not, of course, equal. Although crypto finance operates in novel ways, well-designed standards and regulation could and should enable risks to be managed in the crypto world as they are managed in the world of traditional finance.

Indeed, bringing the crypto world effectively within the regulatory perimeter will help ensure that the potentially very large benefits of the application of this technology to finance can flourish in a sustainable way. As the chairman of the SEC has observed, *"financial innovations throughout history do not flourish outside public policy frameworks."*[16]

Developing the standards and regulation that effect those public policy frameworks is, and should be, a painstaking, careful process. But one cannot help observing that in the two years it has taken to develop the draft CPMI-IOSCO guidance, stablecoins have grown sixteen-fold, although admittedly only to a relatively small amount.

Regulators internationally and in many jurisdictions have begun the work[17]. It needs to be pursued as a matter of urgency.

Technology and innovation have driven improvement in finance throughout history. Crypto technology offers great opportunity. As Emerson said: *"if you build a better mousetrap the world will beat a path to your door."*

But it has to be a truly better mousetrap and not one that simply operates to lower standards – or to no standards at all. ■

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Endnotes

1. Pinto, E (2010), 'Sizing total exposure to subprime and Alt-A loans in US first mortgage market as of 6.30.08'
2. Illicit activity where the benefits from anonymity outweigh the costs from volatility and fees. See for example FATF (2019), Guidance for a Risk Based Approach to Virtual Assets and Virtual Asset Providers. This dynamic was evident in a prominent early use of Bitcoin being the facilitation of transactions on the Silk Road, an online marketplace for illicit goods, and remains in evidence today, with a growing use of Bitcoin to facilitate ransomware attacks.
3. FCA: Research Note: Cryptoasset consumer research 2021.
4. There is currently more than $40 billion open interest in cryptoasset derivatives - the majority of which is positioned on unregulated exchanges where margin calls can be as little as 1%. Mainstream institutional investors are primarily active on regulated exchanges such as the CME, which offers Bitcoin and Ethereum futures. Some hedge funds have begun to trade the basis between the cash asset and futures price, while a small number of asset managers have used futures to

gain exposure without holding the 'physical' cryptoasset. And a small number of banks have begun offering their wealth management clients exposure to cryptoassets through futures and non-deliverable forwards on an agency basis.
5. Forbes – 'Here's what caused Bitcoin's extreme plunge', Mar 19 2020.
6. FCA: Research Note: Cryptoasset consumer research 2021.
7. PWC, 'Crypto Hedge Fund Report' (May 2021).
8. Based on 39 hedge funds surveyed in PWC's 'Crypto Hedge Fund Report' (May 2021).
9. BCBS: Prudential treatment of cryptoasset exposures – June 2021.
10. Joint Trades Comment Letter on the Consultative Document on the Prudential Treatment of Cryptoasset Exposures – October 2021.
11. By way of example, see recent statements from Nikhil Rathi 'Seizing opportunity – challenges and priorities for the FCA', 22 September 2021 and Gary Gensler 'Remarks before the European Parliament Committee on Economic and Monetary Affairs', 1 September 2021.
12. For example, "The [Financial Policy] Committee noted that any loss of confidence in a payment system and the unit of payment within it could spill over and disrupt other payment activity, with broader implications for financial stability" (FPC Record, December 2019).
13. The Committee on Payments and Market Infrastructures (CPMI) are the global standard setter for payment, clearing and settlement services at the Bank for International Settlements, and the International Organization of Securities Commissions (IOSCO) are the global standard setter for securities markets regulation.
14. For example, Chinese authorities have opted to prohibit the operation of cryptocurrencies, including stablecoins. See 'China expands crackdown by declaring all crypto activities 'illegal'" Financial Times, September 24 2021'.
15. See for example 'New Forms of Digital Money' (June 2021), Bank of England or 'Central Bank Digital Currencies: Financial Stability Implications' (September 2021), BIS and Seven Central Banks.
16. Financial Times, 01 September 2021, 'Crypto platforms need regulation to survive, says SEC boss'.

17. For example the cross-regulator Cryptoassets Taskforce in the UK, the President's Working Group on Financial Markets in the US and the proposal for a regulation on Markets in Crypto-assets (MiCA) in the EU

The views expressed here are not necessarily those of the Bank of England or the Financial Policy Committee. I would like to thank Natalia Dobrovolschi, Rachel James, Yuliya Baranova, Paul Bedford, Emma Butterworth, Tiago Dos Santos, Ronnie Driver, Owen Lock, Irina Mnohoghitnei, Matthew Osborne, James Pople Hoskins, Samantha Riley, Simon Scorer and Cormac Sullivan for their help in preparing the text. I would like to thank Andrew Bailey, Elisabeth Stheeman, Lee Foulger, Tom Mutton and Christina Segal-Knowles for their helpful comments on the text. This article is based on a speech delivered at SIBOS 2021.

The present and future of money in the digital age

The digital euro is an ambitious goal that can improve the efficiency of the financial system. Fabio Panetta says we must make it a driver of stability and inclusive progress

The topic of this article – the present and future of money in the digital age – has certain unique features. It is an age-old topic, because we have been talking about money for millennia, from the times of Ancient Greece and pre-Republican Rome. But at the same time it is a topical issue, because the digital revolution is transforming the role and the nature of money.

It is a subject for specialists: economists, lawyers, and technology experts. Yet it concerns each and every one of us. We all use money in one form or another – every day, and often several times a day. And we are all involved in the changes currently under way.

At the international level the digitalisation of money and payments is being examined by the G7 and the G20. In Europe, it is frequently discussed by Finance Ministers in the Eurogroup. It is on the agenda of the European Commission and the European Parliament. It was addressed by the heads of state or government at the Euro Summit last March. And it is of course central to the agenda of the European Central Bank (ECB).

This strong focus can be explained by the far-reaching changes that are under way. Digitalisation is changing the way we work, interact with each other and use our time. It is changing consumption habits, social relations, and our very culture. It is, in effect, changing the way we live.

Money and payments are also undergoing rapid change. Innovative tools are emerging. Not so long ago, cash was more or less the only way to make an immediate purchase. Today, however, we have grown accustomed to using forms of private digital money such as online bank transfers, payment cards and applications on our smart phones or watches. These are changes that directly affect the role of central banks.

In October the Eurosystem opened the investigation phase for the possible introduction of a digital euro: electronic money issued by the central bank.

If a digital euro were issued, it would have significant consequences. It would have not only economic and financial repercussions, for instance as regards the transmission of monetary policy, financial stability, and the operation of the international monetary system. It would also have wider relevance for global geopolitical equilibria and the fundamental rights of individuals, such as the right to privacy.

The digital euro project can be a success if we can ensure effective multi-level cooperation. Public authorities will have to work closely with private operators – consumers, intermediaries, firms and merchants – to understand their needs and how to meet them

I will illustrate the key characteristics and implications of this new money. And I will then discuss how we can maximise its benefits and reduce its risks.

The digital euro: what it is (and isn't)

The digital euro would be a form of sovereign money provided by the ECB in electronic format. It would be used by anyone – households, businesses, commercial outlets – to make or receive retail payments throughout the euro area. It would give citizens the same services they now obtain from paper banknotes: access to a secure payment instrument that is cost-free, easy to use and universally accepted within the euro area.

The digital euro would complement cash, not replace it. It would provide people with fuller and easier access to electronic payments, promoting financial inclusion. Unlike cash, it could be used not just for people to transfer money to each other or for purchases in commercial outlets, but also for online purchases. And as it would be a central bank liability, the digital euro would, like banknotes, be free of any risk, be it market risk, credit risk, or liquidity risk.

Cryptoassets and stablecoins[1]

The digital euro has nothing to do with cryptoassets such as Bitcoin. As it would be issued by the central bank, the value of the digital euro would be guaranteed by the State.

Cryptoassets, on the other hand, are not issued by any accountable entity: they are notional instruments with no intrinsic value, which do not generate income flows (such as coupons or dividends) or use-value for their owners. They are created using computing technology and their value cannot be ensured by any party or guarantee.

Cryptoassets are exchanged by operators whose sole objective is to sell them on at a higher price. They are, in effect, a bet, a speculative high-risk contract with no supporting fundamentals. That is why their value fluctuates wildly; hence cryptoassets are not fit to perform a currency's three functions: means of payment, store of value and unit of account.

The value of cryptoassets is growing rapidly and currently stands at over 2,500 billion dollars[2]. That is a significant figure with the potential to generate risks to financial stability that shouldn't be underestimated. For example, it exceeds the value of the securitised sub-prime mortgages that triggered the global financial crisis of 2007-2008.

In spite of the substantial sums involved, there is no sign that cryptoassets have performed, or are performing, socially or economically useful functions. They are not generally used for retail or wholesale payments, they do not fund consumption or investment, and they play no part in combating climate change.

In fact, there is clear evidence that they do the exact opposite: cryptoassets can cause huge amounts of pollution and damage to the environment[3]. And they are widely used for criminal and terrorist activities, or to hide income from the eyes of the tax authorities[4]. Moreover, they provide legitimate investors with no protection whatsoever against IT or cyber risks[5].

On the whole, it is difficult to see a justification for the existence of cryptoassets in the financial landscape.

The digital euro also differs from stablecoins.These are digital instruments whose value is linked to that of a portfolio of low-risk assets (reserve assets) such as currencies or securities. Without appropriate, rigorous regulation, stablecoins too are unfit to perform the functions of money: as they are low-risk but not risk-free, they are particularly vulnerable to possible runs in the event that holders experience a loss of faith[6].

Their dissemination could influence monetary policy implementation and undermine the efficiency of the securities markets[7]. For example, one of the most widespread 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.

In a situation of stress, large-scale sales of 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.

These risks could be amplified by a lack of transparency around the composition of reserve assets, by a lack of checks on conflicts of interest between issuers and holders of stablecoins[8], by cases of fraud[9] or mismanagement[10], and by the link between stablecoins and cryptoassets[11].

In sum, stablecoins are not therefore so 'stable', and that's why I have previously referred to them as 'unstable coins'[12]. In fact, a third of stablecoin initiatives launched on the market in recent years have not survived[13].

The risks posed by stablecoins would be reduced if reserve assets could be held entirely in the form of risk-free deposits at the central bank[14]. However, this would limit monetary sovereignty as one of the key tasks of the central bank – money creation – would in effect be delegated to private operators. They would perform that task with the aim of maximising profits, rather than fulfilling public interest objectives such as inflation control and the cyclical stabilisation of the economy.

Furthermore, the use of money would become expressly or implicitly onerous. This would affect access to a vitally important service which central banks have been providing to citizens for centuries on behalf of the State for free and in the general interest.

If they are kept within a framework of effective rules and checks, some privately issued digital finance instruments can increase the efficiency of payments, especially international payments. Europe is at the forefront of regulation, supervision and oversight of digital finance[15].

In countries outside Europe calls for stricter controls are becoming louder[16]. But the largely uncontrolled development of digital finance – in particular decentralised finance[17] – and cross-border interlinkages mean that further action at the global level would be desirable.

In the circumstances I have described, a digital euro would bring stability to the world of digital finance.

Why we need central bank digital money

For the ECB, the need to explore the introduction of a digital euro arises from the evolution of people's payment habits. The way we make our purchases has been changing, especially since the start of the pandemic[18]. Two trends are emerging.

The first is the tendency to use digital instruments[19]. Many of us regularly make payments using cards or apps on our mobile devices.

The second is online shopping. Consumers are buying goods and services – food, clothing, package holidays – not only in bricks and mortar local shops, but more and more on the internet[20].

Cash is increasingly used as a store of value and decreasingly as a means of payment[21]. The cash stock has continued to increase, driven by the precautionary demand for cash. However, only about 20% of the stock is now used for payment transactions, down from 35% 15 years ago.

Cash purchases are therefore decreasing. If this trend were to continue, banknotes would eventually lose their central role and become a marginal means of payment. Even central banks' efforts to continue to supply banknotes would not be enough to preserve that role in the face of insufficient demand for cash as a means of payment. Citizens could therefore lose a simple, safe and reliable means of payment that is provided for free by the State and universally accepted.

This would create a need to introduce a public digital currency.

But let me say, first, that not everyone agrees with this hypothesis. Some people feel that public digital currency would be redundant, given the vast supply of private electronic payment instruments available[22]. But this theory fails to recognise the central role of public money (that is, central bank money) in the economy[23].

Confidence in savings held as private money is largely determined by the strength of central bank money – the monetary anchor – and by the convertibility of private money into public money.

Central bank money is a safe form of money that is guaranteed by the State, by its strength, its credibility and its authority. Other forms of money consist of private operators' liabilities[24]; their value is based on the soundness of the issuer and is underpinned, in the last analysis, by the promise of one-to-one convertibility with risk-free central bank money[25].

This promise can prove to be ephemeral – for example when private issuers manage their capital or liquidity imprudently. It must therefore be repeatedly confirmed through the conversion of private to public money. For instance, our readiness to deposit our money with banks is underpinned by the knowledge that we can go to a branch or cash machine and withdraw cash from our deposits. This tells us that our money in the bank is safe.

It reassures us that we will be able to convert private money (deposits) into public money (cash) in the future too. Bank runs and financial crises start when confidence in the convertibility of private money disappears.

In practice, many people are unaware of the differences between public and private money. This is what economists call 'rational inattention'[26]. However, people know that banknotes protect them from the consequences of intermediaries potentially defaulting and they make their payment and savings choices accordingly.

This does not mean that the safeguards put in place to protect savings – legislation and banking supervision, deposit insurance schemes, capital markets supervision – are not important. On the contrary. They must, however, be flanked by convertibility to ensure the orderly conduct of payments, the stability of the financial system and the soundness of the currency.

Without the anchor of sovereign money, people would have to constantly monitor the safety of private money issuers in order to value each form of money. This would undermine the functioning of the payments system and confidence in savings.

History shows that access to public money is essential to instil confidence in private money, ensure the correct functioning of the payments system and safeguard financial stability. Periods in the past when various forms of private money co-existed in the absence of sovereign money – for example the free banking episodes of past centuries – were marked by recurrent crises[27].

Today, citizens hold central bank money in the form of banknotes. As I mentioned previously, in the future – in a digitalised world – cash could lose its central role. Central banks must therefore ensure that central bank money is fully usable and can retain its role as a payments anchor. That is the primary objective of the digital euro.

Benefits of the digital euro

The digital euro is therefore essential to the orderly conduct of payments in a digital world. But the decline in the use of cash is not the only factor that could transform the payments market. Other factors, also significant, have prompted the ECB to study the issuance of a digital euro[28].

Monetary, financial and political sovereignty

First, there is the need to assert our sovereignty in the monetary and financial fields, in keeping with the goal of safeguarding our strategic autonomy as established by the European Council[29]. The ability to make payments safely and efficiently, without external influence, is a fundamental need for the economy and for society as a whole, especially in a large jurisdiction like the euro area.

Two-thirds of digital retail payments in Europe are currently brokered by foreign operators[30]. Looking to the future, digital currencies issued and controlled outside the euro area – by private actors or foreign countries – could grow in importance, to the point of replacing existing means of payment.

The European financial system would thus be subject to decisions made by foreign actors and this in turn would place our legislative and regulatory powers at risk. A payments system based on technologies and practices designed, managed and supervised elsewhere would undermine the ability of the European authorities to exercise their supervisory control.

Such a system could be under-protected from external threats, including IT threats. It would expose people, businesses and states to the danger of the improper use of confidential information. It would make the information needed to combat unlawful activities harder to trace.

And the list could go on. But it is clear that a payments system and financial sector dominated by foreign operators would be unfit to support the single currency, and simply unimaginable in the world's second economy.

The 'colonisation' of the European payments system is not an imminent danger. But nor is it a remote one, given the speed at which digital finance is changing. Since early 2020 the value of stablecoins in circulation has risen from 5 to 120 billion dollars[31]. At the same time, the Big Tech[32] companies have expanded their financial business.

The convergence of these two tendencies – the growth of stablecoins and Big Tech's expansion in the finance sector – could have a drastic impact on the functioning of financial markets and supplant traditional intermediation and payment services. And that would give rise to the risks I described earlier[33].

To prevent these dangers we need to adjust the regulatory and supervisory framework. But that is not enough. The transformations under way should be governed by providing innovative and efficient financial services capable of meeting the emerging need for immediacy in our society, as well as the more general trend of digitalisation of the economy. The introduction of a digital euro would be a step in that direction.

Sovereignty and the international role of the euro

A digital euro accessible to foreign users would cut the cost of using our currency in cross-border payments and increase its suitability as a global invoicing currency. This would increase the international role of the euro, thereby strengthening Europe's strategic autonomy, lessening the global domination of the dollar and reducing global dependency on a single source of liquidity.

It would strengthen the 'Brussels effect': the influence exerted by the EU on the international stage by asserting and advancing its principles, decisions and institutional and legal practices[34].

ECB analyses show that the effects of this would be significant but less important than the fundamental drivers of the international role of a currency, such as the size of the underlying economy, its economic policies, the development of its capital markets, and the efficiency of its institutions[35].

Protecting confidentiality

Individuals have a fundamental right to privacy, which is enshrined in national and European regulations[36]. In the public consultation conducted by the ECB in 2020, 43% of respondents ranked privacy as the most important aspect of the digital euro, well ahead of other features[37].

Such a focus on privacy comes as no surprise. Misuse of confidential data that can be inferred from payments could lay bare private aspects of our lives such as our political leanings, sexual orientation or state of health.

This could impinge on personal liberties and interfere with the rights of individuals and with the rules that underpin the functioning of a modern liberal democracy.

The data contained in digital payments are frequently used by private companies for various purposes. Some payment companies are moving from a fee-based business model to a data-driven business model in which services are supplied free of charge in order to obtain detailed information on customers.

Digital payments therefore put privacy at risk and may give rise to misuse of confidential information. Data protection regulations aim to prevent abuses but cannot always keep pace with technological innovation, as was demonstrated by the case of Cambridge Analytica.

If it were offered by an independent public institution such as the central bank – which has no interest in exploiting payment data for any purpose – the digital euro would enhance confidentiality in electronic transactions by protecting against unwarranted intrusions.

Sound transparent governance that complies with the national and European regulations would ensure that information on users is only used for permitted purposes, such as combating illicit activities.

Confidentiality is distinct from anonymity[38]. Digital payments could ensure different levels of confidentiality[39], to be defined in line with general interest objectives. The technical experiments conducted by the Eurosystem confirm this possibility.

In any case, cash will remain available. Consumers will be able to continue to make anonymous payments with banknotes if they wish to do so.

Competition and efficiency

The European digital payments market is highly concentrated. Two US intermediaries handle two-thirds of card payments, while another US operator dominates online payments. Digital payments seem to be expensive for many users and are in fact mainly used by people with medium to high incomes.

The digital payments market could become more concentrated in the future owing to the expansion of the big tech firms, which have already shown a tendency to adopt anti-competitive behaviours[40]. Benefiting from their very large number of customers, network effects and economies of scale, these operators could obtain very large market shares[41].

This could cause traditional intermediaries to exit the market and damage competition, leading to an increase in fees and a deterioration in the quality of services with effects on other sectors such as insurance services and credit, and also on commerce itself[42].

In such a context, traditional anti-trust measures may prove to be ineffective given the length of time needed for the investigations and the speed at which the digital economy is advancing.

A digital euro would directly boost competition by making a free and easy to use digital means of payment available to everyone. But it would also have an indirect effect: the option to use the new form of money would allow European intermediaries – including small intermediaries which typically have less capacity for innovation – to offer products with a higher technological content at a competitive cost, making them better able to compete with global operators.

Effects on the monetary and financial system

The digital euro can bring about significant changes in the monetary and financial system which should be analysed in depth in order to assess how to design the new form of money in a way that harnesses its benefits and avoids undesired effects. I will now recall the main topics that are central to the Eurosystem's deliberations.

Monetary policy

Depending on its features, the digital euro could influence monetary policy. One important aspect is the possible application of interest rates. A digital euro earning no interest would replicate the characteristics of cash; with no limits on holdings[43] it would prevent the central bank from applying rates below zero, so savers – by holding digital euro – would avoid negative returns without bearing the risks and costs of owning huge quantities of banknotes.

Conversely, if interest was payable on the digital euro it could strengthen the transmission of monetary policy, but there would be a risk of diverting bank funds.

The impact on monetary policy would also depend on the reallocation of private financial wealth that the digital euro will bring about. Switching funds out of banknotes and into the new form of money would change the composition of central bank liabilities, without other significant effects.

On the other hand, if the digital euro attracted deposits (and the banks did not have the unencumbered reserves to cope with the outflow of funds), it could affect the cost and supply of credit and the transmission of monetary policy through bank balance sheets. The central bank could mitigate or eliminate these effects by increasing refinancing of banks or through asset purchases, thereby expanding its own balance sheet.

This list of possible effects could continue, analysing in greater detail different potential remuneration methods[44], possible compensatory measures and aspects such as the impact on the central bank's balance sheet and on seignorage.

But the main consideration is that the digital euro project does not aim to change how monetary policy is implemented. The changes that it will bring will depend on its features, which should be carefully studied and defined, but they would not interfere with the actions of the central bank.

The banking and financial system

The digital euro could affect banks' activities and the functioning of the financial system. In addition, if it is incorrectly designed, it could result in tensions and instability[45]. This could crowd out banks from the payments market.

In addition, in the absence of limits to its use, it could attract large volumes of deposits. This could make banks' funding unstable and more costly and have a negative impact on their profitability and credit offering. Ultimately, it could affect the real economy.

The risks would be greater in times of crisis. If there were doubts about the soundness of intermediaries, savers could transfer their funds out of bank deposits and to the central bank quickly and free of charge, including for large amounts. This could trigger a 'digital run' on bank branches. The possibility of this happening could encourage savers to reduce their bank deposits, even during normal times[46].

However, these risks would only materialise if the instruments put in place to protect financial stability – banking supervision, deposit insurance and the central bank as the lender of last resort – proved to be ineffective.

Above all, these risks can be kept in check by designing the digital euro in an appropriate manner in order to control its use as a form of investment. The debate on this issue focuses on two scenarios.

The first foresees the setting of a ceiling on the amount of digital euro that can be held by individual users[47], or on aggregate transactions, ie. on a weekly or monthly basis – to limit the outflow of bank deposits into the new form of money[48].

The second is based on a two-tier remuneration system which discourages holding digital euro in amounts above a certain threshold[49].

These constraints would make the digital euro an efficient means of payment available to everyone while ensuring that it would not be used excessively as a form of investment that would crowd out other financial instruments,

particularly bank deposits. Their introduction would remove the risk of instability, thus safeguarding financial intermediation. But in assessing the impact of the digital euro it would be wrong to assume that tomorrow's financial system will be like todays, because it will be different, even without the digital euro.

In the absence of government intervention, the system could be dominated by major global players, primarily big tech, who will be much less concerned than the central bank about the stability of the financial system. If properly designed, the digital euro will therefore avoid worse scenarios, thus conferring stability on the financial system[50].

To ensure the project's success, in order to avoid instability, the digital euro will be introduced in close cooperation with euro area intermediaries who will be authorised to handle the distribution and provision of services to the public, and it will be compatible with the additional services that they offer.

This will stimulate innovation: the new form of money will provide intermediaries with a regulatory infrastructure capable of connecting systems that are currently separate, such as retail payment schemes, the digital identity, the digital signature and electronic receipts.

This would make advanced payment methods available, such as programmable payments, online purchases subject to delivery of the product, payments based on the use of a certain good or service, or automatic cash transfers to and from the government.

Building on these payment innovations, the digital euro can act as a driver for modernising the financial and economic system as a whole and making it more efficient, extending the use of technology in dealings between households, firms, intermediaries and the government.

The international monetary and financial system

A digital euro that can be used without any constraints by non-residents could affect the structure and functioning of the international monetary and financial system through two channels[51]. First and foremost, it could increase the international transmission of shocks and exchange rate volatility, by influencing capital flows[52].

This would occur because its liquidity, low risk and potential rate of remuneration would make the digital euro attractive to international investors, reinforcing the relationship between exchange rates and interest rate differentials – the so-called uncovered interest rate parity – and amplifying portfolio adjustments triggered by monetary shocks.

The effects would be considerable for emerging economies that have strong trade or financial ties with the Single Market, as they would be more exposed to effects stemming from the euro area. These countries' central banks would be forced to take more decisive action in dealing with monetary or real shocks, suffering a loss of autonomy as a result.

Second, the digital euro could spread in third countries to the extent that it would crowd out local currencies, leading to a digital 'euro-isation', which could hamper the transmission of monetary policy and lead to financial instability.

The risks would be greater for emerging economies that have weak currencies and economic fundamentals, and close trade and financial ties[53] with the Single Market and which are integrated into global value chains[54].

Conclusion

The digital euro project can be a success if we can ensure effective multi-level cooperation. Public authorities will have to work closely with private operators – consumers, intermediaries, firms and merchants – to understand their needs and how to meet them.

Only then can we avoid two opposite risks: being 'too successful' and crowding out intermediaries and private financial instruments, or being 'not successful enough' and generating insufficient demand.

As regards ties with private operators, we engage with user discussion groups, with committees made up of banking and payments experts, and with technology experts. For the ECB, the aim of the project is not to enter the retail payments market but to offer an efficient, secure and low-cost form of digital money which intermediaries can use to satisfy citizens' needs.

Our task will be easier if there is genuine cooperation within the private sector itself, between intermediaries in all euro area countries, to launch pan-European payment initiatives capable of offering services across the entire euro area, of strengthening the ability to compete with the major international operators and of consolidating Europe's autonomy.

Cooperation within the public sector is crucial for defining the characteristics of the digital euro and for reconciling the conflicts arising from several objectives: the right of individuals to confidentiality versus the public interest in maintaining the level of transparency required to combat illicit activities; the benefits of allowing the digital euro to be widely used versus the need to safeguard financial intermediation; and the benefits from the widespread international distribution of the new form of money versus the need to avoid instability in other countries.

Some choices relate to monetary policy and the payments system and fall within the remit of the Governing Council of the ECB. Others relate to more general issues, such as the protection of privacy, which require the involvement of Europe's co-legislators. There is already intensive cooperation between the ECB, the European Parliament, the European Commission and the Eurogroup.

Lastly, there is a need for close cooperation at the global level. Around 80 countries are currently assessing the introduction of a digital currency. International cooperation is needed to define shared principles on economic and regulatory issues and to connect the various projects.

This type of approach will enable us to build an efficient system for international payments in the future by providing low-cost services to multiple sections of the world's population experiencing hardship, including migrants, thus promoting financial inclusion. The ECB is part of the initiatives launched by the G7, the G20 and the Bank for International Settlements.

The digital euro is an ambitious and complex goal that can improve the efficiency of the economic and financial system. We must make it a driver of stability and inclusive progress, capable of strengthening ties between economies and financial systems at the global level and of overcoming gaps and barriers between countries. ■

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Endnotes

1. The definition of cryptoassets can include assets that are not liabilities of any issuer, and stablecoins. The classification used in the text keeps these two categories separate.

2. See International Monetary Fund (2021), Global Financial Stability Report, "COVID-19, Crypto, and Climate. Navigating Challenging Transitions", October, and 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.

3. For example, producing and trading Bitcoin alone wastes huge amounts of energy: the equivalent of the entire annual energy consumption of a country with millions of inhabitants like Switzerland.

4. It is estimated that the amounts of cryptoassets exchanged for criminal purposes are substantial, surpassing 2.8 billion dollars for Bitcoin alone in 2019 (see Chainalysis (2020), "The 2020 State of Crypto Crime", January). Other analyses in 2020 show that the volume of criminal activity exceeded 3.5 billion (see Ciphertrace (2021) "Cryptocurrency crime and anti-money laundering report", February). These studies are backed up by various operations carried out in recent years by Europol and Interpol to break up criminal organisations engaged in money laundering and selling weapons and drugs using cryptoassets.

5. There have been several cases of holders of cryptoassets losing all their savings after having lost their blockchain passwords.

6. Stablecoins can usually be converted to cash. Conversion mechanisms differ, however, from those of bank deposits or electronic money. In the case of bank deposits, one-to-one convertibility is based on deposit insurance schemes, financial legislation, and prudential supervision. The value of e-money holdings is protected by the fact that customers' funds must be deposited with third parties in cash format. The lack of such mechanisms could fuel runs on stablecoins if holders – who bear the risks of fluctuations in the value of reserve assets – expect a significant decrease in the redemption price or perceive the issuers as being incapable of absorbing losses.

7. See Panetta, F (2020), "The two sides of the (stable)coin", speech at Il Salone dei Pagamenti, November.

8. See the report prepared by the President's Working Group on Financial Markets, the Federal Deposit Insurance Corporation and the Office of the Comptroller of the Currency "Report on Stablecoins", November 2021.
9. See Mizrach, B (2021), "Stablecoins: Survivorship, Transactions Costs and Exchange Microstructure".
10. See Commodity Futures Trading Commission press release, "CFTC Orders Tether and Bitfinex to Pay Fines Totaling $42.5 Million".
11. In September 2021, approximately three quarters of exchanges of cryptoassets on trading platforms involved stablecoins. In that sense, stablecoins are also tainted by the illegal activities associated with cryptoassets.
12. See Panetta, F (2021), interview with Financial Times, conducted by Martin Arnold, 20 June.
13. See Mizrach, B (2021), op. cit.
14. See Panetta, F (2020), "From the payments revolution to the reinvention of money", speech at the conference organised by the Deutsche Bundesbank on "The Future of Payments in Europe", November.
15. The European Commission recently introduced a Proposal for a Regulation on Markets in Crypto-assets (MiCA). The ECB has updated its Payment Instruments, Schemes and Arrangements (PISA) supervisory model for electronic payment products to include digital payment tokens such as stablecoins.
16. With regard to the United States, see "Report on Stablecoins", (2021), op. cit., and the remarks of the Securities and Exchange Commission Chair, Gary Gensler, before the Aspen Security Forum, August 2021.
17. Decentralised finance (DeFi) is designed to provide financial services without intermediaries, using smart contracts on blockchain and stablecoins to facilitate the transfer of funds. See Bank for International Settlements (2021), "DeFi risks and the decentralisation illusion", BIS Quarterly Review, December.
18. See Panetta, F (2021), "Cash still king in times of COVID-19", keynote speech at the Deutsche Bundesbank's 5th International Cash Conference, Frankfurt am Main, June.
19. If given the choice, almost half of euro area consumers would prefer to pay with cashless means of payment, such as cards. See ECB (2020), "Study on the payment attitudes of consumers in the euro area (SPACE)", December.

20. Internet sales in the euro area have doubled since 2015. In August 2021 the Eurostat index of retail sales via internet or mail order houses (seasonally and calendar adjusted, index 2015=100) stood at 206.
21. See Zamora-Pérez, A (2021), "The paradox of banknotes: understanding the demand for cash beyond transactional use", Economic Bulletin, issue 2, ECB, Frankfurt am Main.
22. See Waller, CJ (2021), "CBDC: A Solution in Search of a Problem?", speech at the American Enterprise Institute, Washington, D.C., August.
23. For an analysis of the role of public money in the economy, see Panetta, F (2021), "Central bank digital currencies: a monetary anchor for digital innovation", speech at the Elcano Royal Institute, Madrid, November.
24. For example, deposits are a liability for banks.
25. One-to-one convertibility with the common monetary anchor is what makes these regulated forms of money convertible with each other at par and is why they are perceived as interchangeable when making payments.
26. See Sims, CA (2003): "Implications of rational inattention", Journal of Monetary Economics, 50(3), pp. 665-690.
27. See Eichengreen, B (2019), "From commodity to fiat and now to crypto: what does history tell us?", NBER Working Paper Series, No 25426, January; Rolnick, AJ and Weber, WE (1983), "New evidence on the free banking era", American Economic Review, Vol. 73, No 5, pp. 1080-1091.
28. This paragraph only covers the main benefits of a digital euro. For a full analysis see ECB (2020) "Report on a digital euro", October.
29. The heads of state or government espoused the principle of European strategic autonomy at the summit of 2 October 2020.
30. ECB (2019), Card payments in Europe, April.
31. 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.
32. The term Big Tech refers to technological giants such as Google, Amazon, Facebook and Apple (GAFA).

33. See Panetta, F (2020), "The two sides of the (stable)coin", speech at Il Salone dei Pagamenti, November; Panetta, F (2020), "From the payments revolution to the reinvention of money", speech at the Deutsche Bundesbank Conference on the "Future of Payments in Europe", Frankfurt am Main, November.
34. See Bradford, Anu (2012), "The Brussels effect", Northwestern Law Review.
35. See ECB (2021), "Central bank digital currency and global currencies", The international role of the euro, Frankfurt am Main, June.
36. The right to privacy is enshrined in the European Charter of Fundamental Rights.
37. The other features highlighted in the consultation were the security of payments and usability throughout the euro area, which were ranked first by 18% and 11% respectively.
38. See Panetta, F (2021), "A digital euro to meet the expectations of Europeans", introductory remarks at the ECON Committee of the European Parliament, April.
39. The degree of privacy could vary, for example, depending on the amount of the digital euro transaction or whether the payment takes place remotely or in person.
40. See "Into the danger zone. American tech giants ae making life tough for startups". The Economist, 2 June 2018.
41. See Panetta, F, (2020), "The two sides of the (stable)coin", op. cit.
42. For example, in November 2021 Amazon announced to customers in the United Kingdom that from 2022 it would cease to accept Visa credit cards issued in the United Kingdom and offered affected customers a discount of GBP 20 on their next purchase via an alternative payment method.
43. See the paragraph on the effects on the banking and financial system.
44. With a rate of return that is fixed or variable, only positive or even negative, the same as or different from the key ECB interest rates, etc.
45. The impact of the digital euro on the banking and financial system is explored in greater detail in Panetta, F (2021), "Evolution or revolution? The impact of a digital euro on the financial system", speech by Fabio Panetta at a Bruegel online seminar, February.

46. See Kumhof, M and Noone, C (2018), "Central bank digital currencies – design principles and balance sheet implications", Staff Working Paper, No 725, Bank of England, May.
47. See Panetta, F (2018), "21st century cash: central banking, technological innovation and digital currencies", in Gnan E. and Masciandaro, D (eds.), Do We Need Central Bank Digital Currency?, Conference Proceedings 2018/2, SUERF, pp. 23-32.
48. For example, individual users could be allowed to hold a maximum of €3,000, with a provision for amounts above this threshold to be transferred automatically to a bank account.
49. For example, a certain rate of return could be established for amounts up to €3,000, with penalising remuneration set for amounts above that figure. This proposal was put forward in Panetta, F (2018), "21st century cash: central banking, technological innovation and digital currency", in Gnan E e Masciandaro, D (eds.), Do We Need Central Bank Digital Currency?, Conference Proceedings 2018/2, SUERF, pp. 23-32; Bindseil, U (2020), "Tiered CBDC and the financial system", Working Paper Series, No 2351, ECB, Frankfurt am Main, January; and Bindseil, U. and Panetta, F (2020), "Central bank digital currency remuneration in a world with low or negative nominal interest rates", VoxEU, October. An in-depth analysis of how we could avoid the digital euro being used excessively as a form of investment is outlined in Bindseil, U, Panetta, F and Terol, I (2021), "Central Bank Digital Currency: functional scope, pricing and controls", Occasional Paper Series, No 286, European Central Bank, December.
50. At the same time, the digital euro could make it easier for the authorities to intervene in times of stress, for example by providing the central bank with real-time data on aggregate savings outflows.
51. The impact of the digital euro on the international monetary and financial system is explored in greater detail in Panetta, F (2021) ""Hic sunt leones" – open research questions on the international dimension of central bank digital currencies", speech at the ECB-CEBRA conference on international aspects of digital currencies and fintech, October.
52. See Ferrari, M, Mehl, A and Stracca, L (2020), "Central bank digital currency in an open economy", CEPR Discussion Paper Series, No 15335, October; and Committee on Payments and Market Infrastructures, BIS Innovation Hub, International Monetary Fund and World Bank (2021), "Central bank digital currencies for cross-border payments: Report to the G20", July.

53. See Aviat, A and Coeurdacier, N (2007), "The geography of trade in goods and asset holdings", Journal of International Economics, Vol. 71, No 1, pp. 22-51.
54. See Ikeda, D (2020), "Digital Money as a Unit of Account and Monetary Policy in Open Economies", Discussion Paper Series, No 20-E-15, Institute for Monetary and Economic Studies, Bank of Japan, December.

I would like to thank Federcasse for inviting me to speak at this edition of the Lectiones cooperativae. These lectures are an occasion to reflect on issues of broad significance and their implications for the application of the principles of cooperation. They offer us the opportunity to seek a deeper understanding of the changes taking place in the economy and in society. This article is based on a lecture delivered at the Federcasse Lectiones cooperativae in Rome, 10 December 2021

The challenges of the digital euro

Denis Beau argues it is unlikely that banks will be erased from a future payments landscape in which stablecoins and central bank digital currency dominate

Over the past two years, most central banks around the world have been giving increasing thought to the idea of creating a digital form of their currency, a central bank digital currency (CBDC), to maintain the stabilising role of central bank money in a rapidly changing payments landscape: according to the BIS, about nine out of ten central banks have reported that they have launched studies.

To date, only two retail CBDCs have been introduced (in Caribbean archipelagos: the Sand Dollar in the Bahamas and DCash for the Organisation of Eastern Caribbean States), but over twenty pilot projects are underway around the world.

This observation naturally raises questions about the timing, form and role of central bank money in tomorrow's payments landscape and about the role of banks and commercial bank money in a world of stablecoins and central bank digital currencies.

From my point of view as a central banker responsible for ensuring that our payment system functions properly, it is difficult to answer these questions on the role of banks with anything other than caution yet confidence for two main reasons, on which I would like to focus my remarks at this point.

First, the stability of our payment system does not rest solely on our ability to make our central bank money available in digital form, and second, the effective introduction of such a digital currency raises complex problems that cannot be solved to the detriment of commercial banks in order to produce the expected effects.

1. The stability of our payment system does not rest solely on our ability to provide a CBDC

Changes in payment expectations and habits resulting from the digitalisation of our economies, the implementation of new technologies such as distributed ledgers, the emergence of new players such as fintechs

and big techs, and the development of the use of new settlement assets such as cryptoassets are likely to profoundly alter our euro payments ecosystem.

These innovations have the significant potential to improve the functioning of our payment system, in particular by making payment means simpler, easier and cheaper to use, and faster if not instantaneous.

My conviction is that, given the way in which investigations are being conducted into a digital euro [...] it is unlikely that banks will be erased from a future payments landscape in which stablecoins and central bank digital currency dominate

However, these innovations also carry risks for the smooth functioning of our payment system. In order to fully understand the scope of these risks, I believe it is important to recall the organisational principles of our payment system, which are at the root of its efficiency and stability.

a. The organisational principles of our payment system

The first is the dominance of currencies linked by a legally binding rule of convertibility at par: central bank or public money, and commercial or private money, issued by regulated financial sector players, first and foremost banks.

The second is that only central bank money is legal tender and must therefore be accepted by all.

The third is the complementary roles played by the dominant currencies: central bank money fulfils an integrating and anchoring function that guarantees the efficiency and stability of our payment system, while commercial money, and the services associated with it, which are traded on a highly competitive market, plays a key role in trade and the financing of the economy.

b. The risk of calling into question the foundations of the efficiency and stability of our payment system

However, these foundations are threatened by the diffusion of innovations across the payments field, which has been sped up by the health crisis and social distancing, if no measures are taken to preserve them.

Indeed, the reduction in the use of banknotes for transaction purposes and the prospect of the development, within the networks of the major global players in digital services, of cryptoassets as a means of payment, whose link with central bank money is complex and fragile, to say the least, if not non-existent for some, are likely to call into question the integrating and anchoring role that central bank money plays in our payment system.

These threats are reflected in a rise and a change in the dimension of the risks that any wave of innovation naturally carries, and which the health crisis has helped to amplify.

First of all, there are risks of a setback in terms of efficiency. Two risks are likely to change in scope:

- The risk of fragmentation of the payment system, both for everyday trading and between financial players due to a lack of secure and efficient structural interconnection, through convertibility at par between cryptoassets and central bank money, between old and new payment solutions.

- The risk of concentration, or even the emergence of monopolistic situations for the benefit of global digital giants and their private settlement assets, and therefore of Europe's increased dependence in terms of payment services vis-à-vis foreign players, with the associated issues of personal data protection and industrial and monetary sovereignty.

Then there are risks of a setback in terms of security. Prior to the health crisis, the risks of financial instability associated with the large-scale use, as a means of payment, of cryptoassets with unstable value, uncertain convertibility into central bank money, and without a responsible issuer and credible lender of last resort in the event of a destabilising shock, had been clearly identified.

With the crisis and the acceleration of the digital transformation, IT risk, and in particular cyber risk, has taken on a new dimension and added an operational dimension of systemic importance to the risk of financial instability, which also concerns cryptoassets.

c. Levers for action

For a central bank such as the Banque de France, which is responsible for ensuring the smooth functioning of our payment system, the objective is thus to make sure that innovations deliver the expected benefits for users in terms of speed, cost savings and ease of use, but without undermining the efficiency and stability of our overall payment system.

As a result, at the Banque de France, we are not ruling out that we might need to issue a digital form of our currency, to preserve the anchoring role of central bank money by providing it in a form that is better suited to the new, highly digitalised payments landscape.

This is why we have taken an ambitious experimental approach to a CBDC: we are currently in the process of finalising our programme of experiments on an 'interbank' or 'wholesale' CBDC, to test whether and how it could improve the performance, speed, transparency and security of transactions between major financial players, especially for cross- border payments.

In parallel, the Banque de Franceis closely involved in the investigation phase launched by the Eurosystem in July for the retail digital euro, which would be used by the general public in everyday payments.

However, a CBDC is not the only, or indeed the most urgent instrument we need to use.

We also regard regulation as a priority, because the smooth functioning of our payment system depends, first and foremost, on a regulatory framework that is clear, fair ('same activity, same risk, same rule') and balanced – in other words capable of encouraging innovation and at the same time maintaining the stability of our payment system.

This is why we have welcomed and are supporting the proposed Markets in Crypto-Assets (MiCA) regulation and the Digital Operational Resilience Act (DORA), presented in September 2020 – even though there is still room for progress on these texts in order to reconcile pragmatism and flexibility with the necessary requirements in terms of risk control and the prevention of regulatory arbitrage.

Moreover, other regulatory changes will have to be introduced which are also very important. I'm referring in particular to the supervision of the development of decentralised finance, where the usual regulatory frameworks are constrained by the fact that issuers and service providers are not easily identifiable in an environment where protocols are automatically executed without intermediaries, and there is no fixed jurisdiction for the services offered.

Lastly, in order to be effective, regulation must be multidimensional and coordinated at national and international level. At the Banque de France, we are very attached to coordination with other national and European regulators, which seems all the more essential given the increasingly cross-cutting nature of the issues.

This is also a priority for us, to limit regulatory arbitrage or indeed prevent it altogether. For this reason, we are closely involved in the work of multilateral fora (G7, G20, FSB, CPMI), especially on cryptoassets and the improvement of cross-border payments. Another action we see as a short-term priority is to facilitate and accompany initiatives by regulated players, which can help to foster a diverse and competitive market for efficient solutions, tailored to user needs.

Our institutions – such as the Banque de France's Lab, its Infrastructure, Innovation and Payments Directorate (DIIP), the ACPR's Fintech-Innovation Uni with its ACPR-AMF Fintech Forum – are fully mobilised to facilitate these initiatives and help them grow.

Among these initiatives, three in particular are worth highlighting. First, those in the field of instant payments, which open a new chapter in the payments industry. Second, the continuing development of open banking, thanks to the European financial sector's work on APIs. And last but not least, the European Payments Initiative (EPI).

Some major decisions on the effective launch of EPI are due to be taken in the next few weeks. But I would just like to remind you here that the Banque de France fully supports this initiative, as do the other Eurosystem national central banks and the European Commission, and currently seven EU member states, including France, that publicly announced their support for the initiative in a statement published on 9 November.

2. The introduction of a CBDC raises complex issues that need to be resolved without penalising banks in order to produce the desired effects

The second reason why we should take a cautious but confident approach to the role of banks in a world of stablecoins and CBDCs relates to the challenges that need to be met to ensure the digital euro contributes positively to the European financial system and payments landscape.

a. Avoiding disruptive effects for financial intermediaries

This implies making complex economic, financial, technical and organisational choices, to avoid generating disruptive effects for financial intermediaries that would conflict with our mandate to safeguard monetary and financial stability.

These disruptive effects could materialise in two ways:

- First, if the introduction of a CBDC were to lead, in normal periods and in periods of stress, to the conversion of a large share of bank deposits into assets held in CBDC.

A reduction of this size in deposits would have serious consequences. It could undermine banks' profitability and their ability to meet regulatory requirements, and ultimately affect their capacity to finance the real economy.

- The issuance of a CBDC could also reduce the role of banking intermediaries in client relationships, depending on the architecture chosen by the Eurosystem, which could restrict access to client information. To avoid these undesirable consequences, it is essential that commercial banks be involved. Their input is needed, for example, to set limits and/or remuneration disincentives for CBDC holdings.

In addition, choosing an intermediated architecture would allow us to exploit financial intermediaries' expertise in customer interface management, and thus preserve the essential role they play in this field.

b. Avoiding impediments to the conduct of monetary policy

Choices will also need to be made to avoid any adverse consequences for monetary policy conduct. The introduction of an unremunerated retail CBDC with no holding limit could make it difficult for central banks to pursue a negative interest rate policy, as market participants would prefer to hold the CBDC instead of assets remunerated at negative rates. This effect could be avoided by setting an appropriate level of remuneration for the CBDC.

c. Improving the efficiency and integration of payment solutions

Choices will also need to be made to ensure that the CBDC complements existing payment solutions, so that it can increase the efficiency and integration of certain market segments. This notably applies to cross-border payments. The work conducted under the aegis of the G20, in which the Banque de France played a leading role, has

confirmed that a CBDC can bring benefits in this area. However, to fully exploit this potential, central banks will need to coordinate their efforts to ensure that CBDCs in different jurisdictions are interoperable.

In its experiments on a wholesale CBDC, the Banque de France tested the main multiple-CBDC arrangements identified in the literature. As described in the report published by the Banque de France on 8 November, these experiments showed the different ways in which CBDCs can be made interoperable and highlighted the benefits of a CBDC in a cross-border setting (eg. more efficient correspondent banking, settlement security).

Lastly, choices will need to be made so that the CBDC interacts smoothly with private initiatives such as the EPI project, in order to strengthen the integration of the European payments market.

Conclusion

I would like to come back to a question that comes up regularly, about the future role of banks and commercial bank money in a world of stablecoins and central bank digital currencies and respond with one conviction and one wish. My conviction is that, given the way in which investigations are being conducted into a digital euro, which I have just summed up here, it is unlikely that banks will be erased from a future payments landscape in which stablecoins and central bank digital currency dominate.

My wish is that banks will assist the ECB and Eurosystem central banks in conducting these investigations, so that we are ready when needed to roll out a digital euro that can be a positive addition to the European payments landscape. ■

Denis Beau is First Deputy Governor of the Bank of France

This article is based on a speech delivered at the conference The new challenges of financial regulation, organised by Labex Réfi, Paris, 19 November 2021.

Laying the foundations for a net zero financial system

Andrew Bailey sets out the work the Bank of England is doing on climate change to ensure firms address climate risks, using the power of disclosure to incentivise change

It is a great pleasure to be at COP. What struck me was the range of the agenda over the COP fortnight and how diverse this essential agenda now is – from finance to gender and innovation to youth empowerment. This is of course not surprising, as we know that climate change is an issue that will touch each and every one of us, the way that societies operate and the way that we live our lives, particularly as we emerge from COVID.

And a microcosm of this can be seen in central banks. When we started talking about climate at the Bank of England in 2015, our work was wholly focussed on the risks to the banks and insurers that we regulate. Six years later, the agenda has touched all areas of our organisation – from the way we heat our buildings, to the way that we manage our holdings of corporate bonds for monetary policy purposes.

It is included in all of our remits and embedded in all of our decision-making processes. The Bank's staff are actively involved as part of their day job or in the contribution they make to the way of life at the Bank. This is a mark of progress. The more we consider climate across our BAU activities and take informed actions on the back of those considerations – the better equipped we will be to facilitate a smooth transition.

That said, I have no doubt that this ever-accelerating agenda can be hard to follow. So let me try and piece together the different threads of the Bank's work, drawing out some key areas where I believe we have reached a series of pivot points as to the scale of our ambitions in the future. And let me then set out where I think the next frontier of work will be and where we will usefully invest our efforts over the coming period.

The first pivot point is microprudential. Since we started our work on climate in 2015, we and the financial sector have come a long way. In particular, since the PRA set its climate-related supervisory expectations[1] in 2019, we have seen a step change among senior executives and boards at firms.

Some firms are exhibiting genuine ambition in how they embed climate-related financial risks, demonstrating what can be achieved and highlighting where other firms could, and should, do more. And we have been enabling firms on their journey, through the Climate Financial Risk Forum, a group of industry representatives chaired jointly by us and the FCA which has just published its second set of practical guides[2], and with a particular emphasis on aiding smaller firms which may not have easy access to the expertise needed for this new agenda.

And of course we have shared all our learnings with international colleagues, whether on disclosure in the G7 or on supervisory expectations in the Basel Committee (BCBS) and the Network for Greening the Financial System (NGFS)[3]. But there is much further to go.

In six years we have learnt a lot, achieved a lot, but as with everything on climate change, there is an awful lot more to do. We will look forward, challenge ourselves to go further, and deliver tangible action

That is why, as we enter 2022, we will be shifting gears in our supervisory approach domestically to ensure firms are identifying and addressing climate related financial risks. Rather than focusing solely on enabling, we will through active supervision be focusing also on ensuring our supervisory expectations on climate are met[4].

Where progress is insufficient and assurance or remediation is needed, the PRA will request clear plans and, where appropriate, consider exercise of its powers and use of its wider supervisory toolkit.

A key part of this toolkit is regulatory capital requirements, which help to ensure that firms have sufficient resources to absorb future financial losses. This supports their safety and soundness and contributes to the stability of the financial system as a whole.

We already expect firms to hold capital against material climate-related financial risks and our existing toolkit enables us to take action. But we recognise capital may have a bigger role to play. Last week we published a report[5] that sets out our thinking on capital and what further work is needed over 2022 to determine if further changes to the regulatory capital framework are necessary.

Let me be clear. Regulatory capital can and should provide resilience against the consequences of climate change, namely financial risks. But it is not the right tool to address its causes. Addressing the causes – driving the transition - is for climate policy and is rightly the responsibility of governments.

The second pivot point is scenario analysis. We have spent several years developing climate scenarios as part of our work within the NGFS[6]. Scenario analysis is a key tool for understanding how firms and our economies are exposed to the risks from climate change under a range of potential future pathways.

The Bank of England[7], alongside more than twenty other NGFS members[8], is using these NGFS scenarios to run exercises, and as results come in over 2022 we will be able to assess the risks to the financial system. These scenarios are not just for use by regulators and governments, the NGFS deliberately made them openly available for use by firms whether in finance or in the real economy and other organisations in their own scenario analysis. The NGFS has also been open in how the scenarios have been constructed so that experts can challenge and suggest improvements.

We are now also starting to utilise the scenarios for a range of other topics, such as the impacts on the macroeconomy, both from the physical impacts of climate change as well as the different transition pathways to meet net zero commitments.

The MPC has had its first discussion on climate change. Under the UK's G7 Presidency this year, we have been able to catalyse action to prioritise furthering our understanding of the macroeconomic impacts of climate under different transition paths, with the G7 committing in June to embed climate change considerations into economic and financial decision-making, including addressing the macroeconomic impacts[9].

And we will continue to work with other central banks, finance ministries, and international organisations to make progress on this important topic, including through the NGFS and the Finance Tracks of the G7[10] and G20[11].

This brings me to the third pivot point. For the past two years, we have issued broad TCFD-based climate disclosures. These disclosures set out our climate change strategy and demonstrate how companies can and should share information about the measurement and management of climate-related risks.

We will be launching a new approach to investments by the Corporate Bond Purchase Scheme (CBPS), drawing on feedback on a discussion paper we published in May. Our approach will use our role as an investor for monetary policy purposes to incentivise firms to take meaningful actions in support of climate transition.

It will therefore take an important step for central banks in focussing on the impact of the financial system on climate change, as well as vice versa. We are also implementing changes to achieve our 2030 milestone towards meeting our net zero emissions target for 2050 across all our operations.

That brings me nicely to international cooperation. For many topics we say global issues need global solutions. That may be even more true here than for other topics. No country, company or person can tackle climate change alone. We must continue to work together, after all that is why the 26th Conference of Parties is happening and why we are here.

We play a very active role within the NGFS, where the 90+ members, including the Bank, pledged their action. We chair the Sustainable Insurance Forum, contribute our thinking in the international standard setters. We will continue to play our role, a leading role.

In six years we have learnt a lot, achieved a lot, but as with everything on climate change, there is an awful lot more to do. We will look forward, challenge ourselves to go further, and deliver tangible action. Let me conclude by highlighting three points here.

First, in terms of its economic effects, we are already beginning to see the impact of climate change. An example of this is energy prices – we must be able to manage the resilience and thus economic effects of the transition as we reduce the use of hydrocarbons but still rely on them.

Second, we must ensure that the supply chains which will support the renewable economies of the future are robust, otherwise we will compromise the change we must achieve.

Third, we must use the power of disclosure for companies to incentivise change over an acceptable timeframe. I know that last message is not always popular – it doesn't have the message of stopping investment, but rather incentivising it to change in its impact - but it is realistic and will lead us to the goal that we must achieve. ■

Andrew Bailey is the Governor of the Bank of England

Endnotes

1. Supervisory Statement SS3/19: Enhancing banks' and insurers' approaches to managing the financial risks from climate change.

2. See the Climate Financial Risk Forum page

3. Network for Greening the Financial System.

4. The PRA's Climate Adaptation Report sets out our supervisory strategy in response to climate change from 2022.

5. PRA Climate Change Adaptation Report 2021 - Climate-related financial risk management and the role of capital requirements.

6. See Network for Greening the Financial System Scenarios Portal.

7. ie. via the Bank of England's Climate Biennial Exploratory Scenario (CBES).

8. Scenarios in Action: A progress report on global supervisory and central bank climate scenario exercises.

9. See G7 FINANCE MINISTERS & CENTRAL BANK GOVERNORS COMMUNIQUÉ.

10. See G7 Finance Ministers agree to work together to address global supply chain pressures.

11. See Fourth G20 Finance Ministers and Central Bank Governors meeting.

I am grateful to Theresa Löber and David Gayle for their help in preparing these remarks. This article is based on a speech delivered at COP26.

Better sustainability data needed

To accelerate the low-carbon transition in capital markets investors need trustworthy sustainability data. Alexander Lehmann says regulators should remain alert to misconduct in capital markets

Capital reallocation towards sustainable investments is viewed as essential to Europe's low-carbon transition. The European Union has already developed global standards with its taxonomy of sustainable activities and disclosure rules applying to financial market firms.

But data on the environmental, social and governance (ESG) characteristics of companies, which are used extensively in asset management, remain a source of much frustration, and are increasingly in the regulators' spotlight.

ESG quality means many things to many investors

ESG-focused investment has been a key trend in capital markets over the past two years. Outside the United States, the share of ESG-dedicated retail funds has jumped to 13% of total assets under management (though this share is only 1.5% within the US).

While many existing funds have been simply re-labelled as sustainable by excluding certain industries, a big boost to this expansion came from EU requirements under the 2019 Sustainable Finance Disclosure Regulation (SFDR, (EU) 2019/2088) to label sustainable investment funds as either promoting positive environmental or social practices (so-called Art. 8 funds), or having such factors as their primary investment objective (Art. 9 funds).

Ratings and metrics that measure the ESG qualities of companies guide investor capital allocation and risk management. A metric for the environment pillar in an overall ESG score could for instance be based on carbon emissions, energy efficiency, other pollution or investment in low-carbon technologies.

Computation of such data is of course based on extensive subjective judgements about which metrics to include, how to weigh data and what amounts to acceptable or desirable benchmarks in individual industries.

Unlike for credit ratings, which is an opinion on a company's ability and willingness to pay, there is no well-defined ESG outcome that confirms the initial assessment. History is a poor guide to climate risks.

The ESG data industry is undergoing a rapid expansion and is changing as methodologies are improved. The product offering has broadened beyond ratings and rankings and now includes screening services, indices and benchmarks. Data inputs and raw company data are a major constraint, though the accounting bodies are rapidly developing sustainability standards.

The understanding of ESG performance and data to measure it will continue to evolve within an industry that is both competitive and innovative

For now, EU plans for more detailed and wider corporate sustainability disclosures, perhaps accessed through a centralised data platform, offer little immediate benefit to investors and data providers.

Technological innovations are rapidly evolving and may fill some of these gaps, also for smaller companies. New tools draw on earth observation data, automated analysis of company reports, and carbon footprint accounting based on payments data.

For financial markets to function efficiently, data should be of uniform quality, updated regularly and free from bias: eg. arising from company size, geography or industry. Current ESG data falls well short of this ideal.

Divergence between ratings from different providers can be attributed to the inclusion of different categories, different measurements and different weighting, and also to the rating provider's other unrelated assessments of the same company.

A portfolio of securities highly rated on issuers' ESG scores is not necessarily one with low carbon emissions. A high score in the 'E' pillar may not equate to low carbon emissions, as good intentions and forward-looking transition plans are often taken into account.

Will ESG data repeat the credit ratings debacle?

It all sounds similar to credit ratings, which played a major role in fuelling excessive investment in mortgage-backed securities ahead of the global financial crisis.

The current surge in sustainable investing could lead to a green bubble and erosion of the quality of investment advice and sales practices, which are familiar from earlier boom-bust cycles.

No doubt, the boom in sustainable investment products can give rise to new patterns of market misconduct, which is the traditional realm of securities markets supervisors, such as the European Securities and Markets Authority.

Misconduct could take the form of mis-selling (of products inappropriate for the end-investor's sustainability preferences) or misrepresentation (the deliberate distortion of true sustainability characteristics). Greenwashing securities is one form of the latter, in which marketing is used to portray an organisation's products, activities or policies as environmentally friendly when they are not.

Better ESG data that is transparent and explained clearly to end-investors could stem this practice, though in the first instance the capital market or intermediary (the asset manager or broker) is at fault.

The European Commission may be emboldened to examine ESG data and data providers given its experience of regulating credit ratings. It was the first major jurisdiction to do so after the global financial crisis, with comprehensive rules, designed to address conflicts of interest and inadequate credit rating methodologies, taking effect in 2013.

Yet, the parallels are more limited than they appear. ESG data does not have the same significance in financial regulation as credit ratings once did. There is also not the same degree of industry concentration, which could give rise to correlated rating actions.

Indeed, the ESG industry seems highly competitive as start-ups enter and new products are offered, though mergers of ESG data providers with established credit rating agencies should be watched.

The EU is particularly concerned by greenwashing in the context of its plan to expand green assets as a core component of its still nascent capital markets union. The confusion over ESG data could indeed deter institutional and retail investors (even if data is properly disclosed but poorly understood), or lead to capital misallocation in a green bubble (in which key risks are not reflected in the data).

In July 2021, the European Commission therefore set out to examine how ESG risks are reflected in existing credit ratings, which are already regulated, and also whether the ESG industry itself warrants regulation. Other market regulators are looking at the same issue; the International Organisation of Securities Commissions is developing guidance.

The Commission's approach

Two central tenets of capital market regulation are that the characteristics of financial instruments should be explained transparently, and that the preferences of end-investors must be taken into account in any sale. Retail investors traditionally benefit from additional protection and higher standards of disclosure.

In its efforts to strengthen the integrity of ESG investing, the EU should in the first instance hold brokers and asset managers accountable for any market misconduct, whether due to the poor use of ESG data or otherwise.

The European Securities and Markets Authority and national supervisors already have the legal basis for closer scrutiny, though may need to be better resourced in their enforcement actions.

This needs to be backed up by strong audit functions at national level, which should expose governance failures in capital market issuers.

ESG data is the new currency of sustainability-based investing and is indeed integral to this strategy. The underlying methodologies and the way data is integrated into the investment process will reflect the diversity of investor views. An ESG score may or may not impact credit quality but established rating agencies should demonstrate that they take such factors into account.

Providers of ESG data and sustainability ratings are legitimate targets for regulators where conflicts of interest, market dominance or poor disclosure of methodologies are concerned. The understanding of ESG performance and data to measure it will continue to evolve within an industry that is both competitive and innovative. Better products should be allowed to emerge in the marketplace, not defined in regulation. ■

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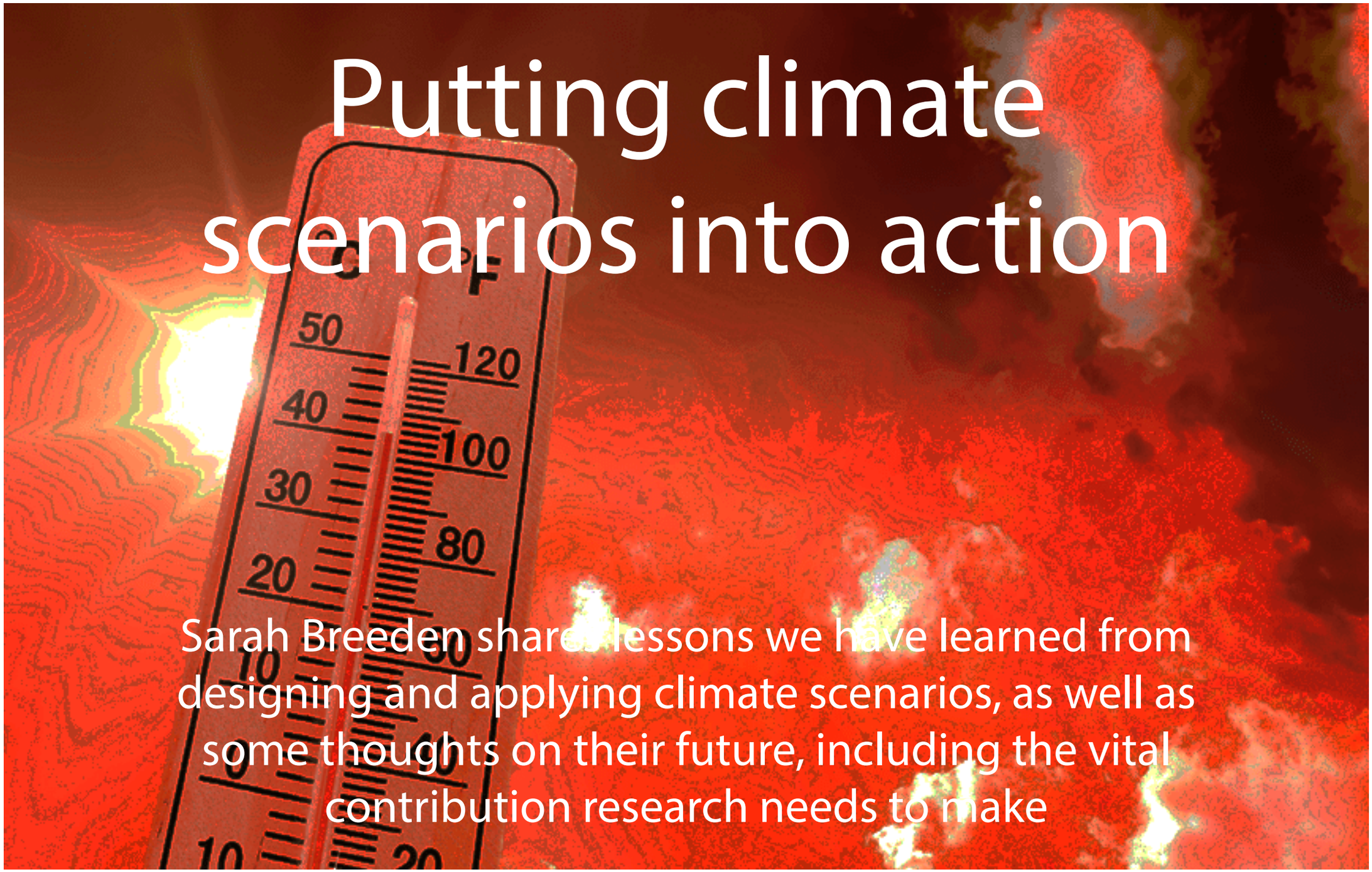
This article was first published on Bruegel.



Putting climate scenarios into action

Sarah Breeden shares lessons we have learned from designing and applying climate scenarios, as well as some thoughts on their future, including the vital contribution research needs to make

Climate science tells us that the planet has already warmed by about 1.1 degree Celsius since pre-industrial times[1]. Indeed, the news is full of the devastating effects of physical changes already taking place around us. And existing commitments from countries to reduce greenhouse gas emissions are not enough to keep warming to well below 2 degrees, let alone 1.5[2].

The United Nations Intergovernmental Panel on Climate Change (IPCC) estimates we will reach 1.5 degrees by 2040 even under their 'very low emissions' scenario[3]. Failure to formulate more ambitious commitments and deliver against them this decade will mean we miss the last opportunity significantly to deter the course of climate change.

The case for action is clear - the question is whether our actions will match that case, in particular whether we turn aspiration into action on the scale required. Delivering a path to net zero requires all of us to take necessary steps – governments and business, investors and individuals, as well as central banks and financial regulators.

Here at the Bank of England, we have taken a range of actions in line with our objectives – including setting expectations for banks and insurance companies on their approaches to managing climate-related financial risks, running a system wide climate scenario exercise, and setting out how to green our corporate bond purchase scheme[4] – to play our part in the transition to a net zero economy.

Through all this work, one thing has become abundantly clear – that the actions we take today will determine the consequences we face in the years to come. And so if we are to take the right decisions, we must stretch our horizons, taking different decisions today well before the consequences of inaction manifest at scale.

This needs to occur across the entire economy. And the financial system needs to be a key enabler. As central bank and financial regulator, these implications put climate change squarely within our remit. We cannot solve climate

change and drive the transition – those with the responsibility and tools to do this sit elsewhere in government and industry. But we must ensure that the financial system is resilient to climate-related financial risks, that it can support the transition, and that we understand its macroeconomic impacts.

I want to speak specifically on the system-wide and economy-wide impacts of climate change, using insights from the most recent work we have done on climate scenarios through the central banks and supervisors Network for Greening the Financial System (NGFS).

... climate scenario analysis is of fundamental importance in managing the risks from climate change, helping us to chart the course to net-zero and to drive different decisions today

I will cover three things: first, lessons we've learned from designing climate scenarios? second, lessons we've learned from applying them? and third, I will share some thoughts on the future of scenario analysis – including the vital contribution research needs to make.

Scenario analysis

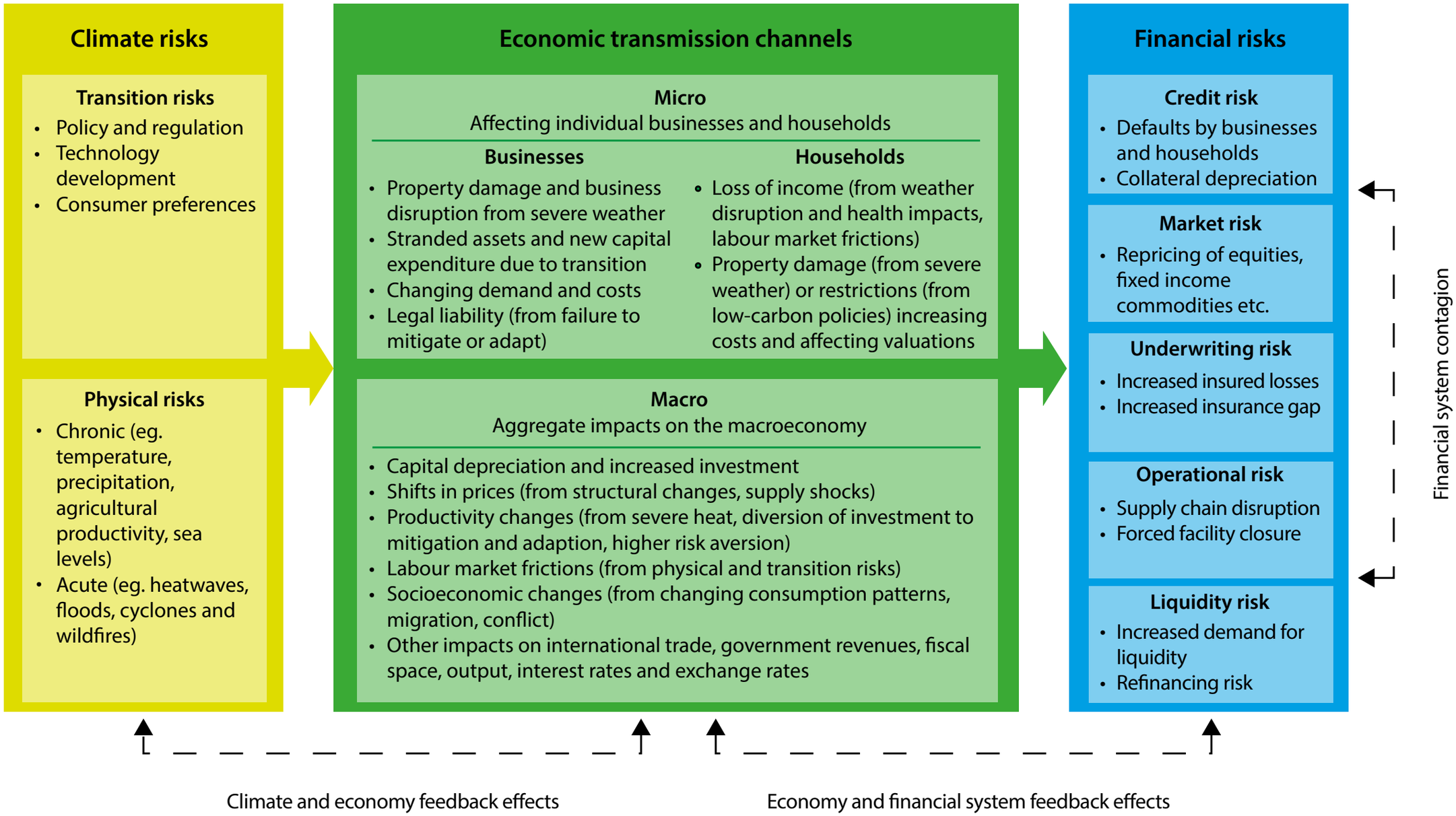
The first step in understanding the impact of climate change to the macroeconomy and the financial system is to recognise that we must look forwards not backwards.

The risks from climate change are unprecedented. They cannot be assessed solely by looking at past data. And depending on our actions today, we could see fundamentally different future outcomes – from a hot house world with extreme physical risks, to futures where we limit the worst effects of climate change but with potentially high transition risks.

While it is certain that a combination of these risks will materialise, it is not clear which path we are on. To navigate these various future pathways, and to understand what future financial risks and economic costs we may see, central banks and financial regulators have turned to scenario analysis.

Scenario analysis is fiendishly complicated. Figure 1 highlights that the transmission channels from climate risks to economic and financial risks are numerous, with significant interdependencies. A holistic analysis therefore requires macroeconomic and top-down approaches to be complemented and augmented by granular and bottom-up risk assessments. A major challenge to doing this is that the prerequisite data and methodologies to translate climate outcomes into macroeconomic and financial risks are incomplete and inadequate. And of course the future path of climate risks themselves is subject to huge uncertainty. Any such exercise is complex and complicated.

Figure 1. Transmission channels



NGFS Climate Scenarios for central banks and supervisors'

To support central banks, supervisors and the financial system with the assessment of these risks, and to bridge some of these modelling and data gaps, in 2019 we launched a project to co-design climate scenarios with a consortium of world-leading climate scientists and close to 60 other central banks and supervisors under the Macrofinancial workstream of the NGFS. In June of this year we published the most recent version of our scenarios[5]. As chair of this workstream, I am proud of the progress we have made in just a few years, and the lessons we have learned along the way. Let me share a few.

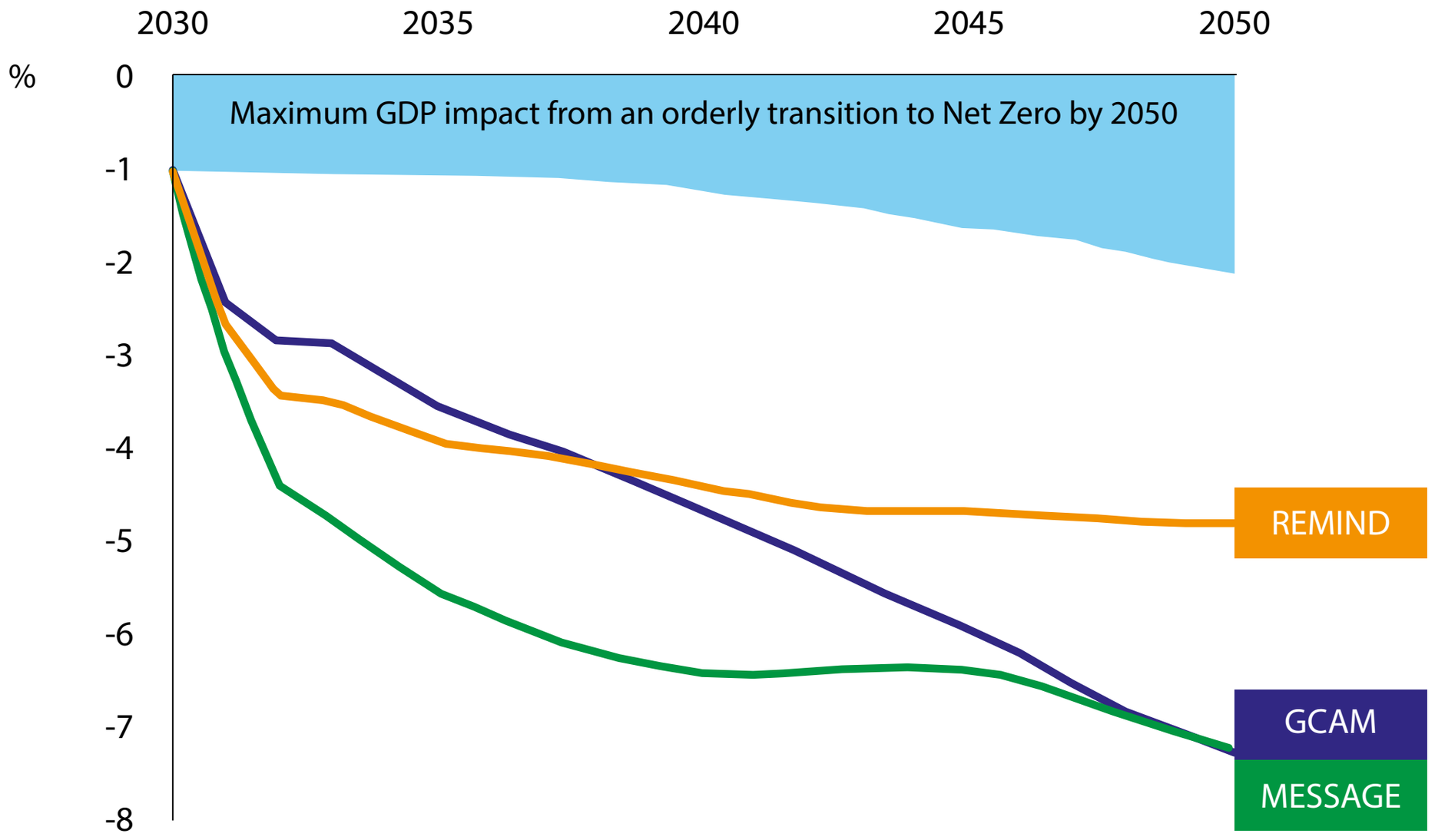
1. Lessons from designing the NGFS climate scenarios

Although we often emphasise the uncertainties inherent in climate projections, it is worth emphasising how much we already know. The scientific basis is unequivocal.

We also have a clear picture of where our emissions come from and how they can be reduced, so we know what the building blocks of the transition are – from increasing the share of renewables in the energy mix to more sustainable buildings and agriculture, alongside carbon capturing and offsetting where possible whether through new technologies or nature-based solutions like afforestation. A number of different types of policy measures can help us get there.

We have also learned that the cost to the economy in aggregate of getting to net zero need not be substantial. Our latest economic modelling shown in Figure 2 suggests that reaching net zero, if the transition is managed well, might have a small or negligible effect on economic aggregates such as GDP, unemployment and inflation. The Sixth Carbon Budget produced by the UK Committee on Climate Change estimates the net costs of the transition will be equivalent to less than 1% of GDP over 2020-2050[6].

Figure 2. GDP impact from delaying the transition across models



Based on the NGFS scenarios 'delayed transition' and 'Net Zero 2050'. Modelled with NiGEM, using transition pathways from three integrated assessment models: GCAM, MESSAGE-GLOBIOM, REMIND-MAgPIE.

But we also know that those costs depend on whether the transition is orderly or disorderly. And that it takes time to implement policy and for markets to adapt to the changes. That means that if meaningful action is delayed by another ten years, the transition would need to be much sharper.

The NGFS estimate that GDP in 2050 would be more than 5 percentage points lower than it would have been if we acted today – even before accounting for possible feedback loops, for example if losses in the financial sector amplify the slowdown in the real economy. And of course the longer we leave meaningful adjustment, the greater the physical risks, leading to higher costs particularly later in the century.

Third those impacts from physical risks will be significant (Figure 3). Analysis by the NGFS indicates that even if we limit the rise in global mean temperatures to 1.5 degrees, physical risks are likely to dominate the potential impacts of transition[7]. And if instead we continue on our current trajectory well above Paris goals, global losses just from the impact of physical risks on labour and agricultural productivity could be as high as 13% of GDP by the end of the century – and that is before accounting for sea level rise, more extreme weather events, food insecurity, migration and displacement of people[8].

This number is therefore very much a lower estimate. And as high levels of warming are unprecedented, we should remain cognisant that we are unlikely to be able fully to capture the delicate balance between the climate, living conditions, ecosystems and the economy with the models at our disposal.

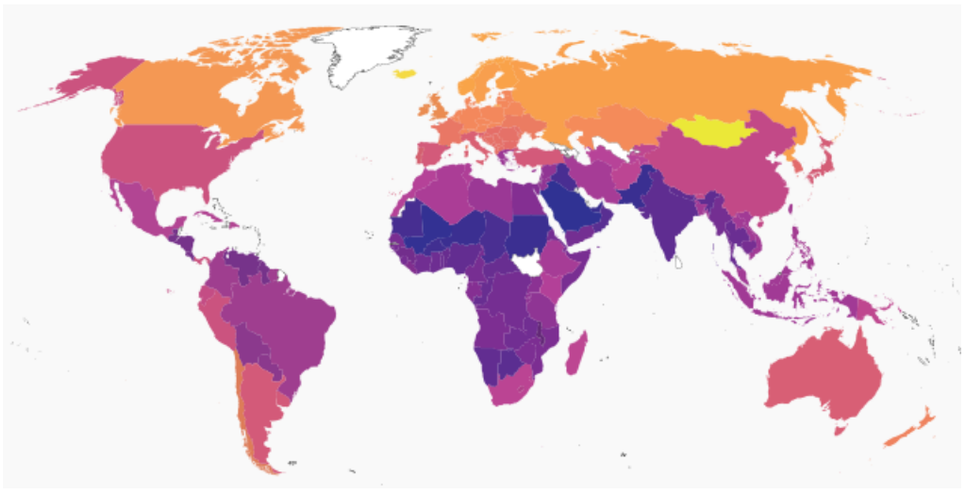
Clearly, investment is needed to help adapt to these inevitable physical changes, which in turn should reduce damages. The Global Commission on Adaptation estimates that $1.8 trillion of global investment in adaptation this decade could generate $7.1 trillion in net benefits[9]. In our focus on the transition to net zero, we must not forget the need to build resilience and to adapt to these physical risks.

Figure 3. Physical risk GDP losses

Physical risk GDP losses by country

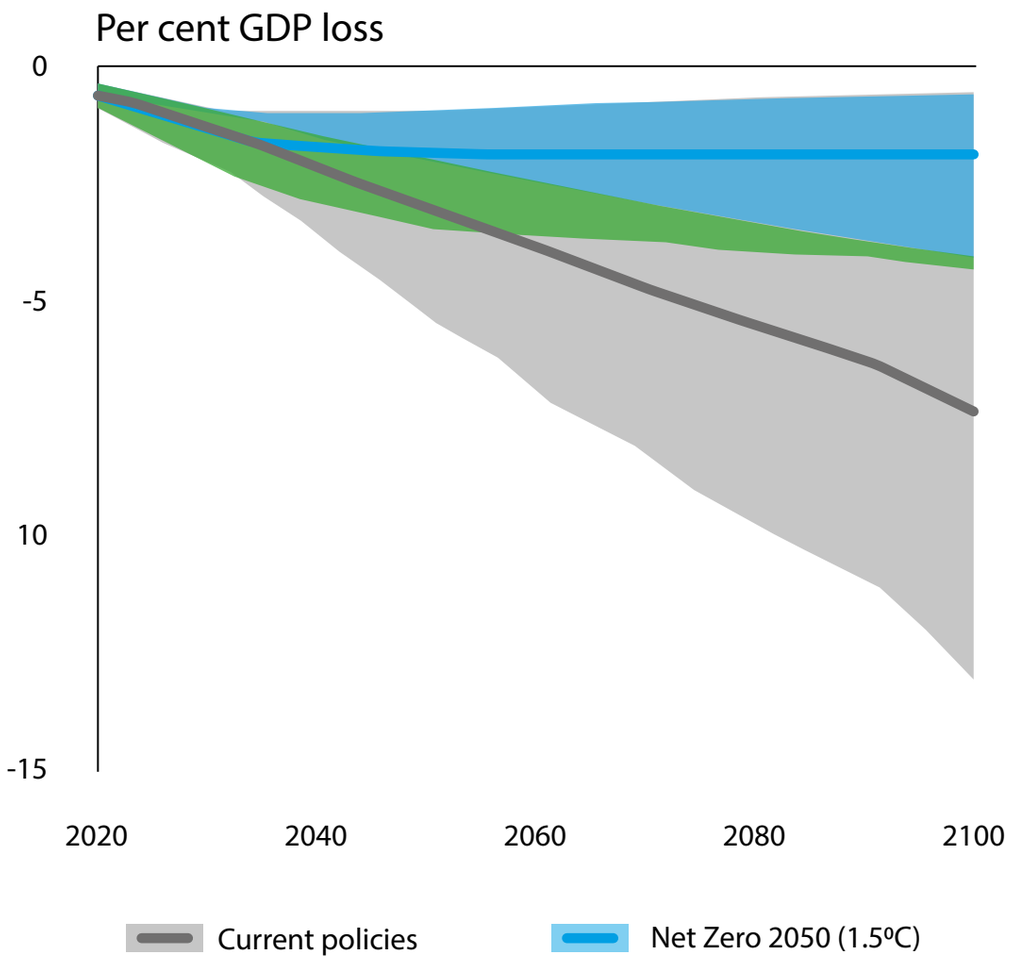
Current policies (95th percentile damages)

Per cent GDP loss relative to prior trends



Source: Calculations by PIK based on scenario temperature outcomes and damage estimates from Kalkuhl and Wenz (2020). Base year for warming is 2005.

Physical risk GDP losses



Source: IIASA NGFS Climate Scenarios Database, REMIND model. 2005 used as the base year.

So what do I take from all this? The cold hard climate physics could not be clearer in underlining the importance of early action. And the returns to investment in mitigating and adapting to climate change now are high.

2. Lessons from applying climate scenarios: findings from the NGFS Scenarios in Action report

So far, I have spoken about some of the key lessons learned while designing the NGFS scenarios. I will now speak about what we have learned from applying these scenarios to macroeconomic and financial risk assessment.

Many central banks and financial supervisors are already using climate scenarios to assess the risks to their economies and financial systems. The NGFS published a report surveying the climate scenario exercises of 30 NGFS members.

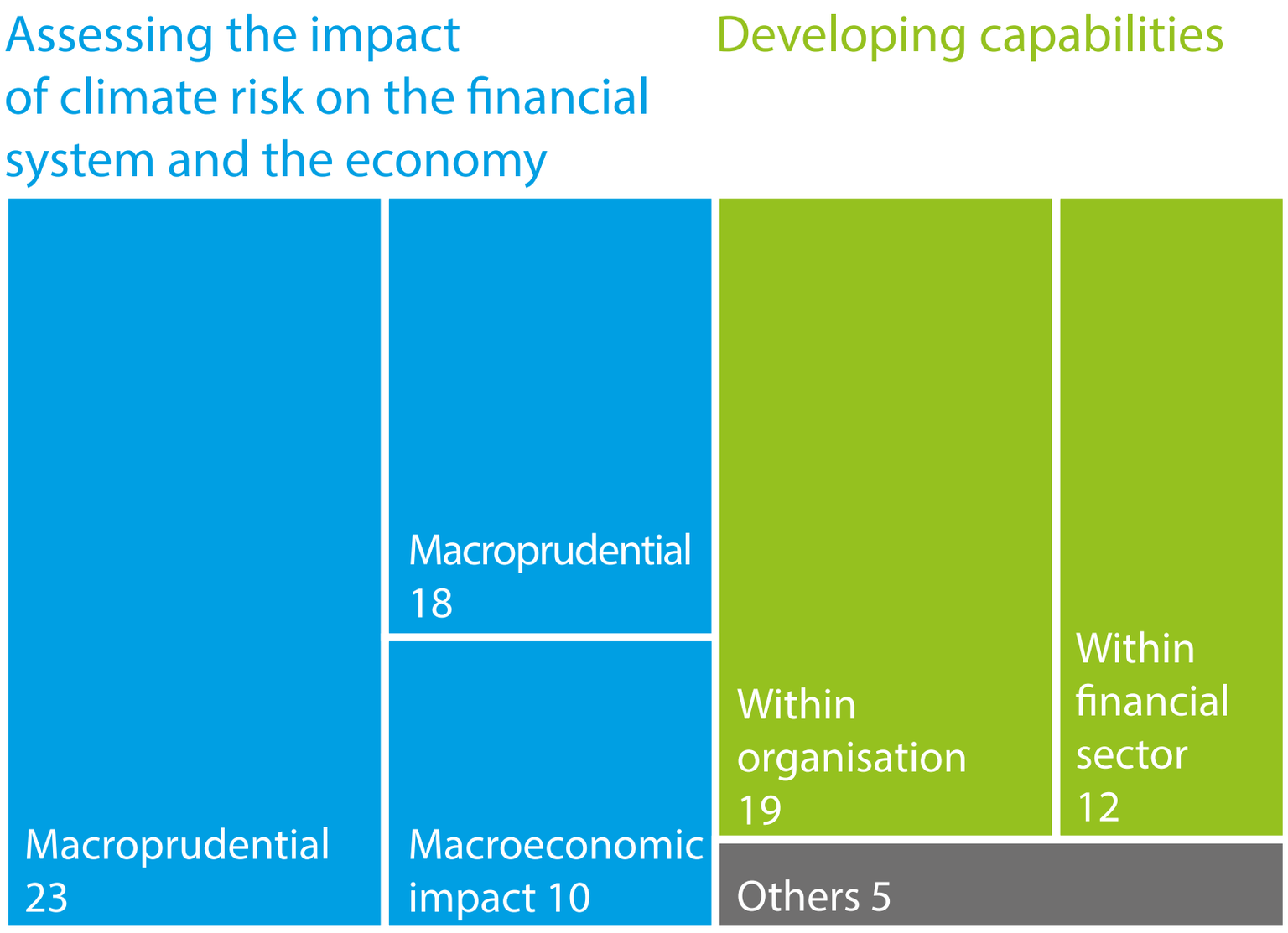
At the moment, only four of these exercises have been completed and their results published, but things are developing rapidly in this field, with another 21 exercises scheduled to be completed within the next 12 months. It has been thrilling to see that the NGFS scenarios serve as a foundational component in the significant majority of these exercises.

Objectives

The objectives of the climate scenario exercises undertaken by NGFS members vary (Figure 4). While all exercises aim to assess risks, the focus of this assessment ranges from risks to individual institutions, to risks to the wider financial system, to risks to the broader economy.

Moreover, as most of us are doing this type of climate scenario analysis for the first time, it is often equally as important to promote an awareness of the risks and to develop capabilities for assessing these risks, as it is to quantify the risks – learning by doing you might say.

Figure 4. Objectives of climate scenario exercises



Many members attributed more than one objective to their exercises, hence why the number of objectives (87) is larger than the total number of members (30).

Scope

The scope of exercises varies as well (Figure 5). All exercises surveyed in the report cover the banking sector, and about half of them include additional financial firms such as insurers and pension funds.

All but one exercise includes transition risks, and about half of the exercises cover the physical risks from climate change. This might seem strange but there are two key reasons some exercises have chosen not to cover physical risks – firstly, transition risks are seen as a more pressing matter for certain sectors such as banking, and secondly, transition risks are comparatively easier to model.

However, a comprehensive risk assessment will require us to look at both types of risk. I expect this will increasingly happen as our methodologies for analysing these risks improve.

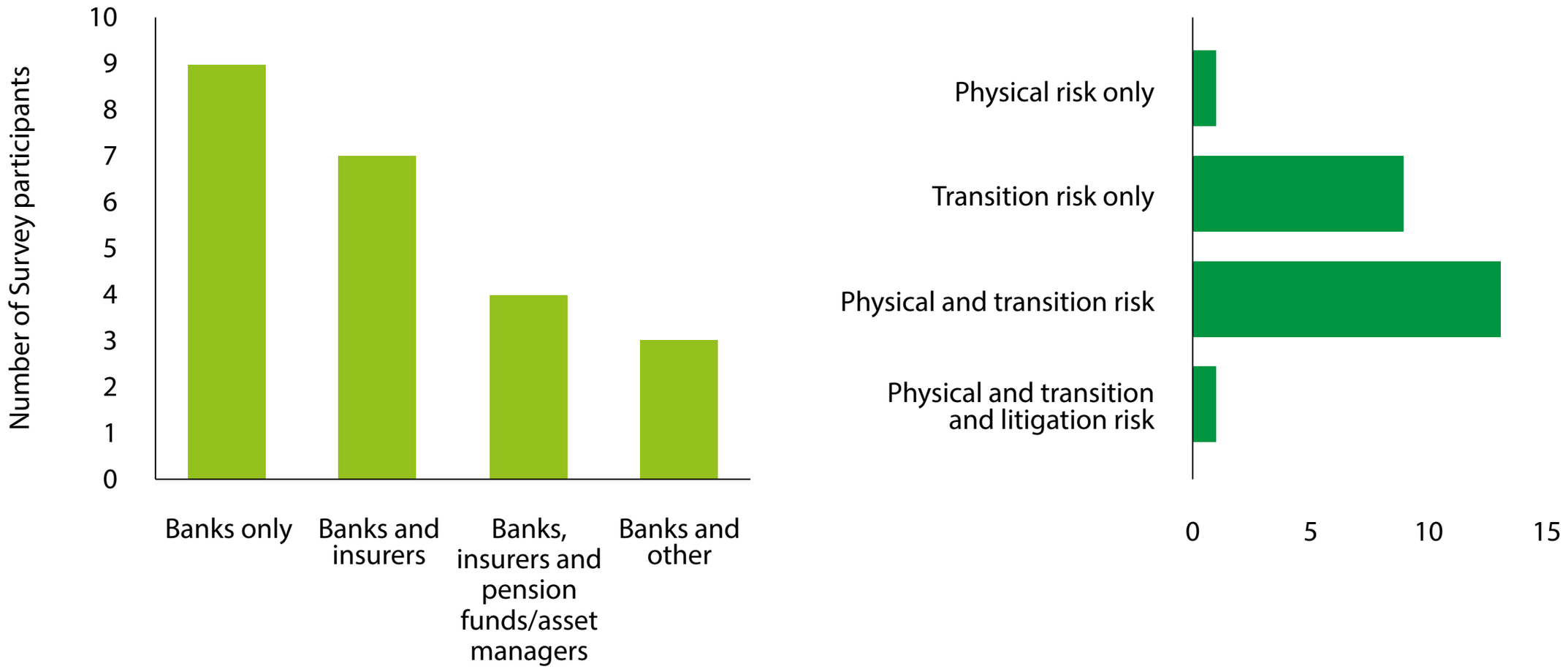
To date, only one of the exercises surveyed includes climate litigation, the Bank of England's own Climate Biennial Exploratory Scenario (CBES), reflecting the complexities associated with modelling this risk. Across the world, there are increasing numbers of climate-related cases[10] being litigated.

The impacts of such litigation can pose material financial risks to firms and create uncertainty over their operating environment[11]. This could have a material impact on the stability of defendant companies, creating risks for investors, insurers, and the wider financial system, so we need to continue to adapt future scenario analyses to capture as many of these interactions as possible.

Challenges

The report also highlights a number of challenges that central banks and supervisors encountered when applying climate scenario exercises.

Figure 5. Scope of climate scenario exercises



- First, immaturity in this complex field means further enhancements are needed. The NGFS scenarios are a critical component in the significant majority of the climate scenario exercises that we surveyed.

  The scenarios have been designed to be flexible, and indeed, we are seeing NGFS members build on these in their own exercises by tailoring them to the specific needs of their jurisdiction. In the last two years we have made huge strides in adding country-level data for hundreds of variables which can support jurisdiction specific assessment. But even so more development is needed.

- Second, data challenges take time to resolve. Even though scenario analysis helps generate relevant data that can help build the full picture, it is a gradual process and getting the right data to undertake scenario analysis remains a key challenge.

- Third, uncertainties remain around the estimates of macroeconomic and financial impacts. Although we have a good sense of the direction of the impacts from climate change, there is still much uncertainty around their exact size and composition – and this begins with the underlying physics.

  For example, projections of future temperature rises are subject to considerable uncertainty bands, especially in scenarios with high emissions[12]. There's also uncertainty about the pace and composition of the transition. So it's important to make our methodologies robust considering multiple scenarios and outcomes rather than single estimates.

In light of these challenges, no members as of yet envisage specifically calibrating regulatory capital requirements on the basis of their exercise. However, some members expressed interest in this topic and indicated that they may include it as an objective for future exercises.

Technical design features

Technical design features can be useful in dealing with the challenges I just described. Let me draw out two points:

i. Firstly on the type of scenario exercise being undertaken.
Some climate scenario exercises are conducted entirely by the central bank or supervisor, where they use existing datasets at their disposal to make scenario-based calculations – often referred to as desk-based exercises.

Others have opted for an approach where financial firms themselves are responsible for calculating the scenario impacts, based on a scenario that the regulator has provided them with – similar to how we conduct traditional stress tests.

Exercises are split evenly between these two types, highlighting that each approach is useful for different reasons. If financial firms make the calculations, they are forced to collect relevant data and build up internal risk management capabilities and awareness of climate-related risks.

But this can make comparability tricky as firms will take different approaches. If the regulator leads the exercise, the methodology applied can be consistent across firms. This is also often a simpler and quicker approach.

ii. Secondly, on time horizons and assumptions.
Most exercises look at a time horizon of 30 years, consistent with the fact that most emissions reductions must take place over the next three decades to meet the Paris goals[13].

Some exercises look further into the future to include the more extreme physical risks that could arise later in the century. There are also exercises that look at shorter horizons of just a few years.

An issue when looking at longer time horizons is that exposures change over time. Financial firms continuously adjust their exposures to manage risks while aiming to profit from new opportunities. If we assumed that they can do this perfectly, we would by definition find that the direct risks they face are very small.

But of course firms would continue to face indirect risks as temperatures rise – it is not possible to diversify away from exposure to the planet. And we know perfect management of even firms' own direct exposures does not always happen, especially in stress, as might occur with a sudden adjustment in asset prices – a so called climate Minsky moment. And we are of course interested in what would happen if firms failed to adjust their business model or manage the risks adequately.

To assess the full size of the risks, three quarters of climate scenario exercises assume that financial firms' balance sheets are frozen in time. This is a huge simplification but it allows the climate specific impacts through the course of the exercise to be more easily identified. Others have instead allowed for changes to balance sheet to be modelled, sometimes subject to restrictions.

Understanding these technical aspects of climate scenario exercises is crucial properly to appreciate and contextualise the results. The Bank of England is also dealing with these complex challenges and design choices through the CBES, which launched this summer, the results of which are due to be published next year.

3. The future of climate scenarios

As I hope you have appreciated, we have learned a lot from designing and applying climate scenarios. But this is just the beginning. There is more we need to do, iteratively adjusting the nuts and bolts in the models – and even when we think we have got it right, we will find further room for improvement.

Central banks and supervisors have a lot to gain from these improvements – as this will help us better understand how climate risks affect the financial system and the economic outlook in order to consider our potential policy responses. We will therefore continue to share our experiences, and plan to publish further reports in the future to summarise the progress we have made.

We will also continue to improve the NGFS scenarios themselves. We are working on adding more sectoral detail to the scenarios so the distribution of risk across the economy becomes more apparent, and to include more physical risks so the cost of inaction becomes clearer.

But we need your help too. Let me highlight a handful of areas where more research is needed, and where scenario analysis can be usefully applied.

First, on policy levers. Our NGFS scenarios use a shadow carbon price, which serves as a proxy for a range of different potential climate policies – whether carbon taxes, business regulation or investment in research.

In aggregate, climate policies will need to create the relative price shift that internalises the costs of emissions and drives an economy-wide shift to net zero. Our NGFS analysis suggests that these will need to add up to an equivalent global shadow carbon price of over $150 a tonne within a decade if we are to reach net zero by 2050 in an orderly way. Estimates of the average global price of carbon today are nowhere near that[14], meaning that investments being made today lack crucial pricing signals that could fundamentally change investors' decisions.

In this context, further research to anticipate the challenges and opportunities that come with different approaches to climate policy and carbon pricing, to further understand the right mix of policy tools to support a swift yet

smooth transition to net zero and to develop comprehensive frameworks to better capture the impact of this mix of tools on the economy, are essential.

Second, on macroeconomic implications, we have identified three key areas where we think there is a need for further work and research:

- further integrating climate and macro modelling – climate models typically don't model the economy in much detail, and macro models don't capture climate risks well, so we need to do more work on integrating models across the different disciplines if we are to do a better job of understanding what might happen?

- understanding and sizing different transmission channels and improving our understanding of how they interact? and

- going beyond the aggregate impacts to understand distributional implications, for example across sectors and geographies.

Finally, research around the monetary policy implications of climate change and the transition to net zero have only recently started to emerge.

We know that domestic and international climate policy will have an impact on inflation, growth, and labour markets[15]. It is also clear that the physical risks from climate change will impact macro variables – for example, changes in weather patterns and increased reliance on bioenergy could increase the volatility of food and energy prices, and hence the volatility of headline inflation rates[16]. And we know too that the impacts will become larger if we fail to act at all.

We also know that to meet climate goals, we need a structural shift across the economy. And that will affect expected long-run steady state variables, such as the natural rate of interest (r*) and the natural rate of unemployment (u*). All of which matter for monetary policy makers.

The unknowns I have just talked through – policy levers, macroeconomic impacts, and monetary policy impacts – are all ripe areas for further research.

These efforts will not only help central banks and supervisors, but will also ensure that the NGFS scenarios can continue to be used by financial institutions in the private sector, industry and policymakers for their own purposes. We will continue our dialogue with these stakeholders and take on their feedback as we determine where to take the NGFS scenarios next.

Conclusion

To conclude, climate scenario analysis is of fundamental importance in managing the risks from climate change, helping us to chart the course to net-zero and to drive different decisions today.

As stewards of the financial system, scenario analysis must remain a core component of the central bank and supervisory toolkit. Indeed, our supervisory work has also indicated that scenario analysis is an area where our regulated firms need to do more.

Our case study report shows the extent to which these scenarios are being applied. And our international engagement this year, including through the NGFS, the G7, the G20 and the FSB, has shown us that scenario analysis is becoming an increasingly important tool for academia, financial institutions, businesses and policymakers around the globe.

The science tells us we are fast approaching a point of no return for the planet. That means we all need to work together to understand the risks, develop the analytical capabilities, and formulate the solutions.

It's an ambitious ask but humanity is best placed to achieve the impossible when there is a will and a way. Let's get to work. ■

Sarah Breeden is Executive Director, UK Deposit Takers Supervision, at the Bank of England

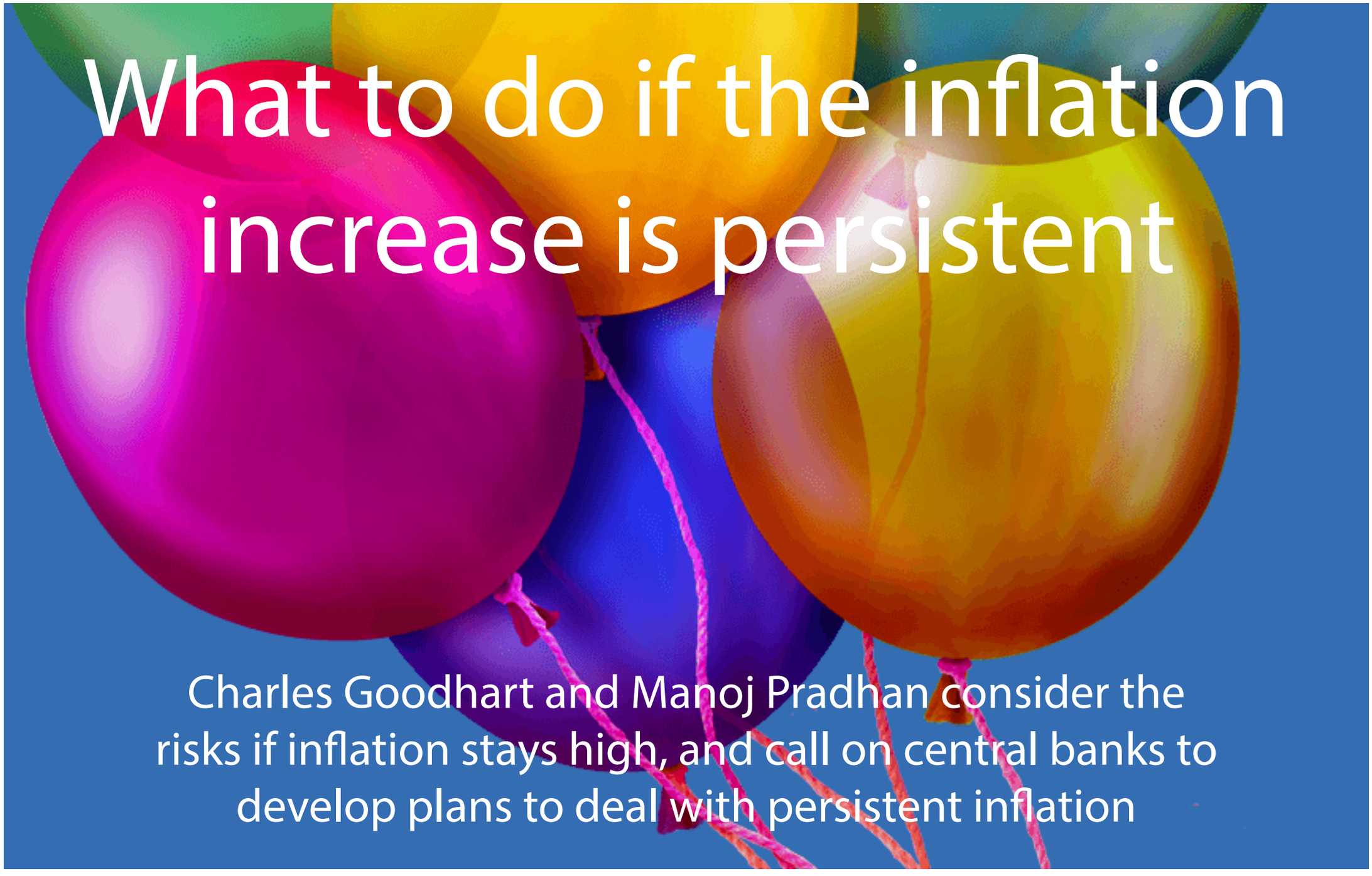
Endnotes

1. IPCC 'AR6 Climate Change 2021: The Physical Science Basis'
2. UNFCCC 'Nationally determined contributions under the Paris Agreement'
3. IPCC 'AR6 Climate Change 2021: The Physical Science Basis'
4. Options for greening the Bank of England's CBPS discussion paper
5. See NGFS Scenarios Portal
6. Climate Change Committee 'The Sixth Carbon Budget: The UK's path to Net Zero'
7. This is true for an orderly transition. In a very disorderly scenario, transition risks will outweigh physical risks.
8. See Quiggin, et al 2021 for an overview of how these additional risk factors might play out.
9. Global Commission on Adaptation 'Adapt now: A global call for leadership on climate resilience'
10. For example, see Milieudefensie et al. v Shell or Neubauer et al v Germany
11. S&P Global Ratings, 2021: Climate Change Litigation: The Case for Better Disclosure and Targets
12. IPCC 'AR6 Climate Change 2021: The Physical Science Basis'
13. IPCC 'Global Warming of 1.5 ºC' report

14. IMF 'A Proposal to Scale Up Global Carbon Pricing'
15. NGFS 'Climate Change and Monetary Policy: Initial takeaways'
16. Batten, S et al 'Climate change: Macroeconomic impact and implications for monetary policy'

I am grateful to Maria Pardo, Zane Jamal and Edo Schets for their assistance in drafting these remarks. This article is based on a speech given at the MIT Golub Center for Finance and Policy 8th Annual Conference

What to do if the inflation increase is persistent



Charles Goodhart and Manoj Pradhan consider the risks if inflation stays high, and call on central banks to develop plans to deal with persistent inflation

The current mini surge in inflation is forecast to return to central bank targets towards the end of 2022, or shortly thereafter. However, there is also a risk of inflation remaining persistently high for longer. This column discusses the implications of such a contingency for central banks and monetary policy. The authors warn that sudden policy reversals could lead to severe downturns in financial markets and significantly damage public sector balance sheets. Instead, they call on central banks to develop concrete plans for dealing with persistently higher inflation, with a particular focus on their balance sheet policies in a world of rising nominal interest rates.

At one point during the ECB's recent Sintra Conference, a prominent central banker spoke about 'longer-lasting transitory factors'; meanwhile, the adjective 'transitory' is becoming replaced by 'temporary'.

Although central banks have slowly and painfully been giving ground on forecasts both for the scale and duration of the current mini surge in inflation, they, and most mainstream economists, remain in denial that it could become a more persistent feature of future years and decades.

Inflation projections have been 'marked to market' to reflect the higher inflation prints we have seen, and some persistence has now has also been added. However, inflation is still forecast to return to central bank targets towards the end of next year, or shortly thereafter. In other words, it is still 'transitory', just for a bit longer (Ha *et al* 2021). Let us fervently hope that they are right.

But what if they are wrong? What might happen if, say by mid-2022, there is little sign of inflation retreating from its end-2021 levels (of about 4-5% in Consumer Price Index (CPI) for all of the US, UK, and EU), with expectations of future inflation trending slowly up at all horizons, continuing shortages of labour, and workers, even where there

are no shortages, demanding higher pay to compensate for both past and expected future inflation (eg. Voinea and Loungani 2021, Ball *et al* 2021).

Would it then be right to leave real interest rates at significantly negative levels, with unemployment trending downwards (who knows what the equilibrium natural rate might be), a growing need for infrastructure and green investment, and public sector deficits still historically elevated?

... central bank economists need to start thinking about the effect of rising nominal rates, at the same time as real rates remain strictly negative

Financial markets are currently expecting the Federal Reserve, for example, to start raising policy rates as early as September 2022, with four or five hikes of 25 basis points over the course of 2022-23. Breakeven inflation rates (the difference between nominal yields and inflation-protected securities) in the US at the five-year horizon are hovering around 2.7% (note that the two-year breakeven rate is higher, not lower, than the five-year, so we are being conservative with our measure of expected inflation). So markets appear to be comfortable with the real policy rate remaining persistently negative over the next few years.

So how will central banks react if, and when, they begin to discover that their forecasts and models have been systematically wrong? The most worrying possibility is that central banks might reverse policies suddenly and dramatically, with a 180-degree course correction entailing 50 basis point hikes and shrinking balance sheets.

One can see only too easily how this might happen. After months, some of us might say years, of getting forecasts and policies wrong, central banks might feel that their credibility is at stake. Having stated that they were supremely confident in their ability to control inflation, they might feel forced to try to demonstrate that capability quickly and suddenly.

What this might mean in practice could be a rapid shift from a policy of glacially slow increases in nominal rates, plus a very slow taper of quantitative easing (QE), to one of increases in nominal interest rates of, say, 50 basis points per meeting, and no replacement of maturing central bank holdings of QE-related debt.

But such a sudden shift of policy would be horrendously risky. Such monetary tightening would likely cause a rapid collapse in asset prices, including bringing to an end the world's most coordinated housing boom.

In view of the additional debt and high leverage of the private non-financial corporate sector, it could cause a steep rise in bankruptcies and non-performing loans (NPLs). We could get a depression of an awe-inspiring scale. The effect on the public sector balance sheet would be devastating. Tax revenues would fall, while public sector expenditures and debt service would rise sharply.

Under these circumstances, there would be no advantage or case at all in reversing course so sharply that inflation became replaced by deflation. There are many worse outcomes than a few years of moderate inflation, say in the 4% to 5% range. Even if central bank credibility takes a knock, one could always blame unforeseen events and/or the policies of predecessors.

So what should central banks now do against the possibility that moderate inflation becomes more persistent and increasingly engrained in the system?

The first need is to have a plan about what one might do under such circumstances, even if such a scenario is still thought unlikely. The Bank of England is to be greatly applauded for having worked out such a plan, and it makes sense. Indeed, it would be good to start putting that plan into operation, with a symbolic tiny increase in nominal interest rates in the immediate future.

Next, central bank economists need to start thinking about the effect of rising nominal rates, at the same time as real rates remain strictly negative. With higher and more persistent inflation, it will take some time for a slow increase in nominal rates to bring real rates back to zero; but rising nominal rates on their own will have significant effects not only on financial markets, but also on the real economy.

In these conditions the concentration on r* is misplaced. The rate of change of nominal interest rates will be an important factor affecting the economy on its own, even when real rates remain strictly negative.

In addition, central banks may find themselves having to think harder and quicker about their balance sheet policies, and the form of their monetary operations (see also Cecchetti and Tucker 2021).

A floor mechanism for setting interest rates, plus quantitative easing, had many advantages during the years after the Global Crisis. Not only was it easy to manipulate, but it provided commercial banks with a huge buffer of liquidity, thereby making them much more resilient in the face of the COVID-19 shock. But when nominal interest rates start to rise, the disadvantages, in some large part political, of this technique will become increasingly apparent.

At a time of worsening debt service ratios, the need for increased taxation and the transfer of increasingly large payments from the public purse to commercial banks for holding reserves at the central bank will become increasingly politically unpopular, not to mention the adverse effect on central bank profitability.

You do not have to be a populist politician to see how this conjuncture could become widely unpopular, and difficult to defend.

So, central banks need to consider what their balance sheet policies should become in a world of rising nominal interest rates, and whether the current structure of quantitative easing and the massive availability of additional liquidity is still going to be optimal in such a different situation.

First, central banks will have to bear capital losses on their holdings and could need recapitalisation from governments. That process will have to be structured in a way that does not raise questions about central bank independence (see Allen *et al* 2021).

Second, many of the quasi-fiscal uses of quantitative easing (such as propping up mortgage-backed securities (MBS) markets when they had assumed macroeconomic importance) will have to be unwound.

Finally, over a structural horizon, as age-related government debt rises, central bank balance sheets are more likely to expand than shrink. The balancing act will be about avoiding the creation of moral hazard by monetising too much of the debt, versus doing so little that markets push interest rates higher because of concerns surrounding the financing of this debt.

And, through all of that, central banks need to pull these policies together in a way that convinces financial markets that an orderly evolution is not just possible, but likely. In other words, fighting the right war is difficult enough. Fighting the last war would be a catastrophe. ■

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Monetary arithmetic and inflation risk

The balance sheets of the ECB, BOJ and the Fed increased sevenfold between 2007 and 2020. Marek Dabrowski believes a continuation of asset purchasing involves the risk of higher inflation

Fiscal and monetary policy responses to the 2007-2009 global financial crisis (GFC) and the 2020-2021 COVID-19 crisis led to rapid increases in public debt and central bank balance sheets in most advanced economies. However, inflation remained at record-low levels until early 2021.

At first glance, this looks like an invalidation of the identities that describe the relationship between money supply and inflation. This entails the risk of over-optimism: downplaying inflation risks in economic policy debates could have negative macroeconomic consequences. In fact, the monetary arithmetic has not stopped working.

Rather, changed parameters must be correctly understood, in particular in the context of increased engagement of central banks in public debt financing.

Three identities (equations that remain valid though the values of variables may change) describe the relationships between money supply, money demand and inflation.

The first illustrates the impact of changes in the stock of broad money (money supply) and money velocity on inflation:

$$MV = PQ$$

where M = stock of broad money (money supply), V = money velocity, P = price level, Q = output (real GDP).

The fractional-reserve banking system determines M in the money multiplication process, so one must analyse the link between central-bank money and broad money. This is the subject of the second identity:

$M = \varphi Mh$

where Mh = monetary base, φ = money multiplier

Finally, the level of φ is described by the third identity:

$\varphi = (c_d + 1)/(c_d + r_d)$

where c_d = CU/D, r_d = R/D, CU = currency in circulation, R = reserves (mandatory and voluntary/ excess), D = deposits (demand and time).

Governments and central banks must consider all of the relationships between monetary and fiscal policies, particularly the role of interest rates close to zero and massive QE in lowering public debt-service costs

How can the low inflation/rapidly expanding monetary base puzzle be explained?

Since the GFC, the main central banks have expanded their balance sheets dramatically, chiefly due to quantitative easing. The COVID-19 crisis has further intensified various asset purchase programmes.

According to the IMF International Financial Statistics, the balance sheets of the European Central Bank, the Bank of Japan and the Fed have all increased about sevenfold. But inflation stayed low throughout the 2010s (Figure 1).

Thus, the relatively stable relationship between the stock of money and inflation and other economic variables observed in the past seems to have recently disappeared. However, the monetary arithmetic remains valid.

A rapid expansion of central bank balance sheets in key currency areas and the resulting rapid increase in the monetary base, without higher inflation, was possible thanks to decreasing V and φ.

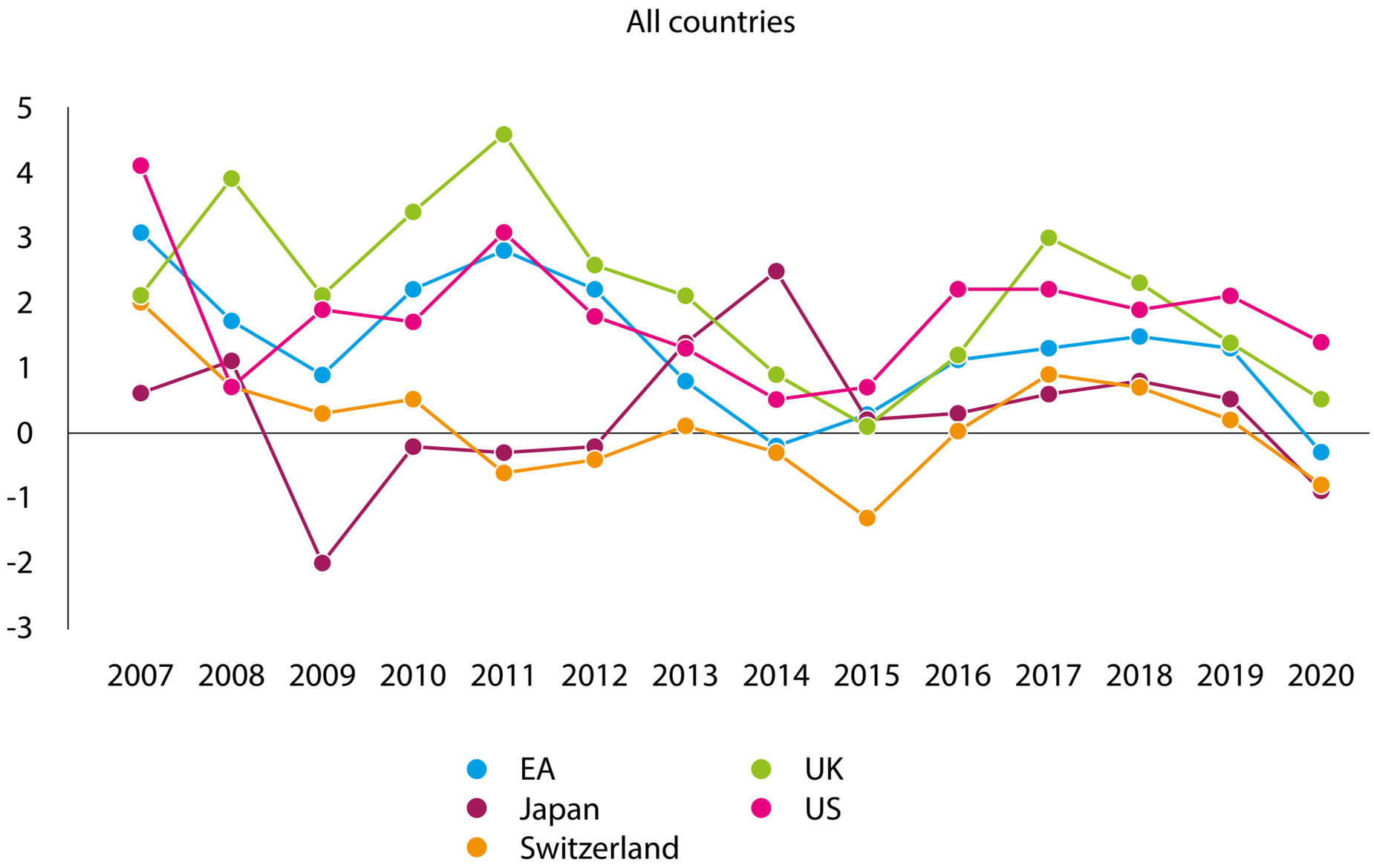
V: The increasing demand for global currencies

Demand for broad money (which is, by definition, inversely related to V) has increased across all currencies, except for the British pound (Figure 2).

This increasing demand has come partly from the outside (ie. from non-residents), given the increasing global role of key currencies and the tendency towards currency substitution in other currency areas, especially emerging-market economies, during periods of prolonged financial turmoil and associated macroeconomic uncertainty.

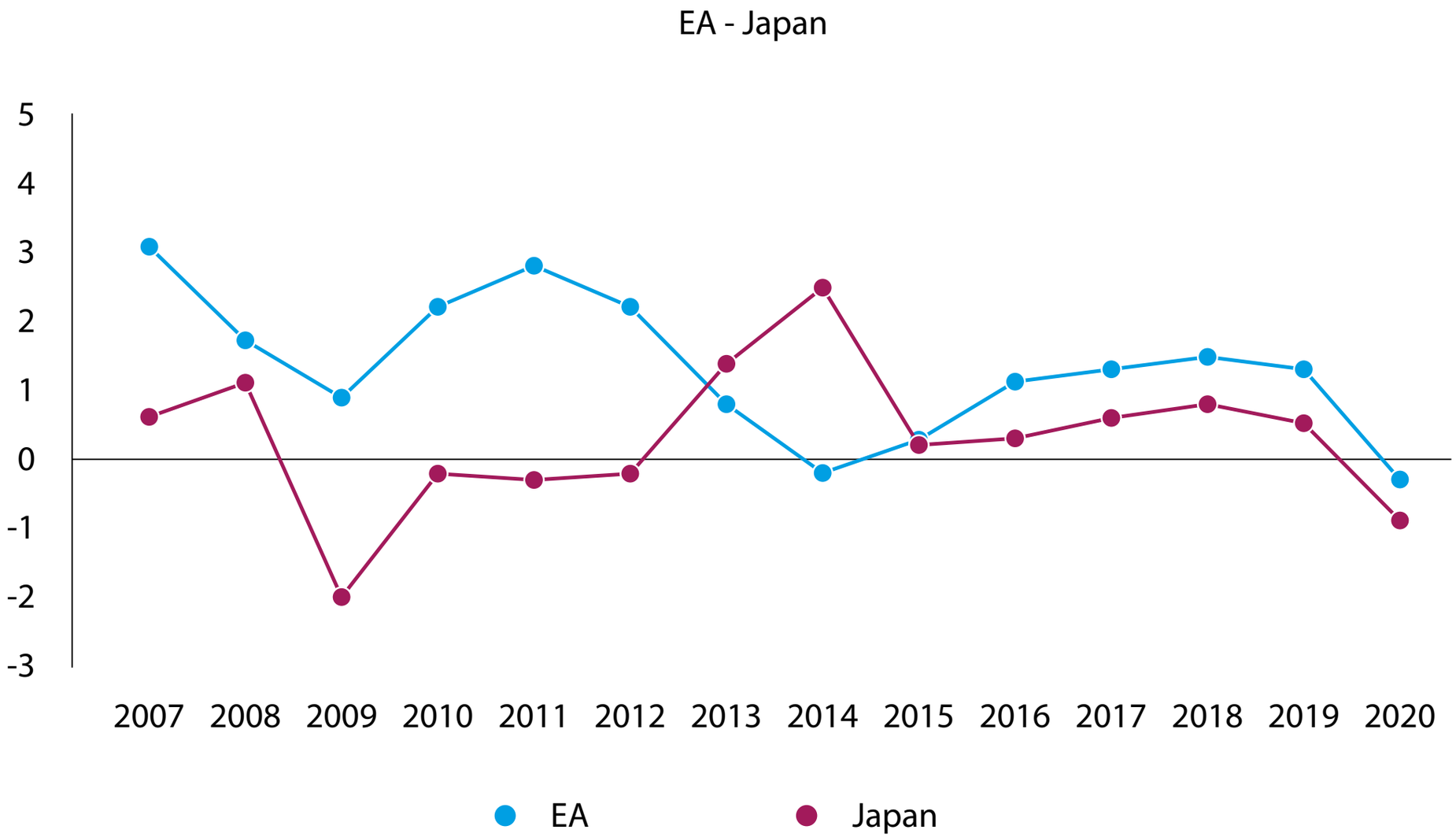
For example, the increasing demand for the Swiss franc in the 2010s was caused by the flight to safe but liquid assets during the European financial crisis of 2010-2015.

Figure 1a. End-of-year inflation (CPI) in key currency areas, 2007-2020, in %



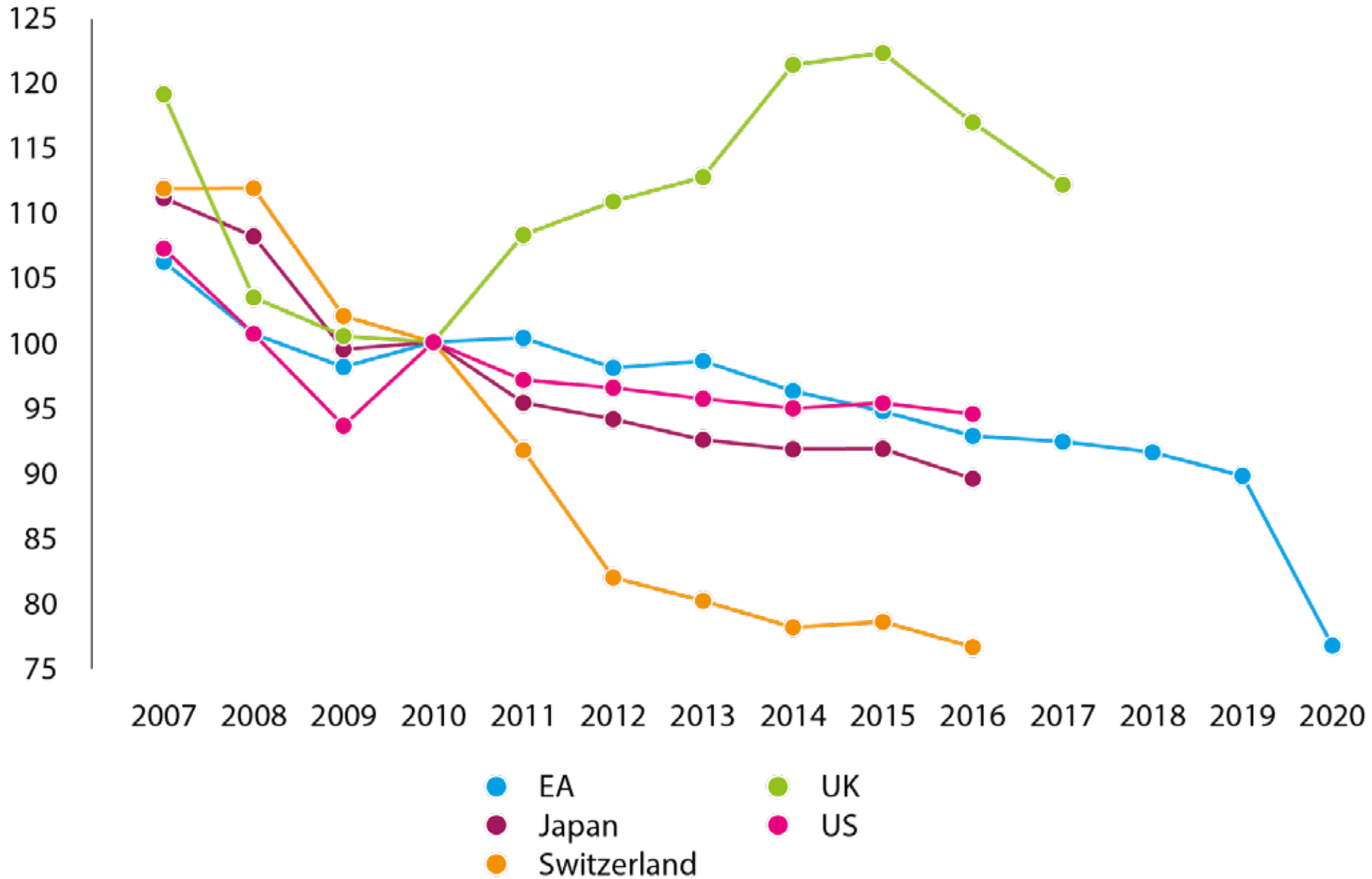
Source: IMF World Economic Outlook database, April 2021.

Figure 1b. End-of-year inflation (CPI) in key currency areas, 2007-2020, in %



Source: IMF World Economic Outlook database, April 2021.

Figure 2. Income velocity of broad money (V) in key currency areas, 2007-2020 (nominal GDP/broad money), 2010=100



Source: IMF International Financial Statistics (www.data.imf.org).

Increased demand for money can also be explained by deleveraging and the precautionary saving of residents during the GFC and European crisis, and the consequences of economic stagnation.

COVID-19 has brought a new surge in demand for money balances (decrease in V) caused by the self-restrained behaviour of consumers and investors, by lockdowns and the prohibition of certain types of activities, by restrictions on the movement of people, and by closed borders and disrupted supply chains. Private spending has decreased, and private saving increased, justifying a new round of monetary expansion by central banks during 2020-2021.

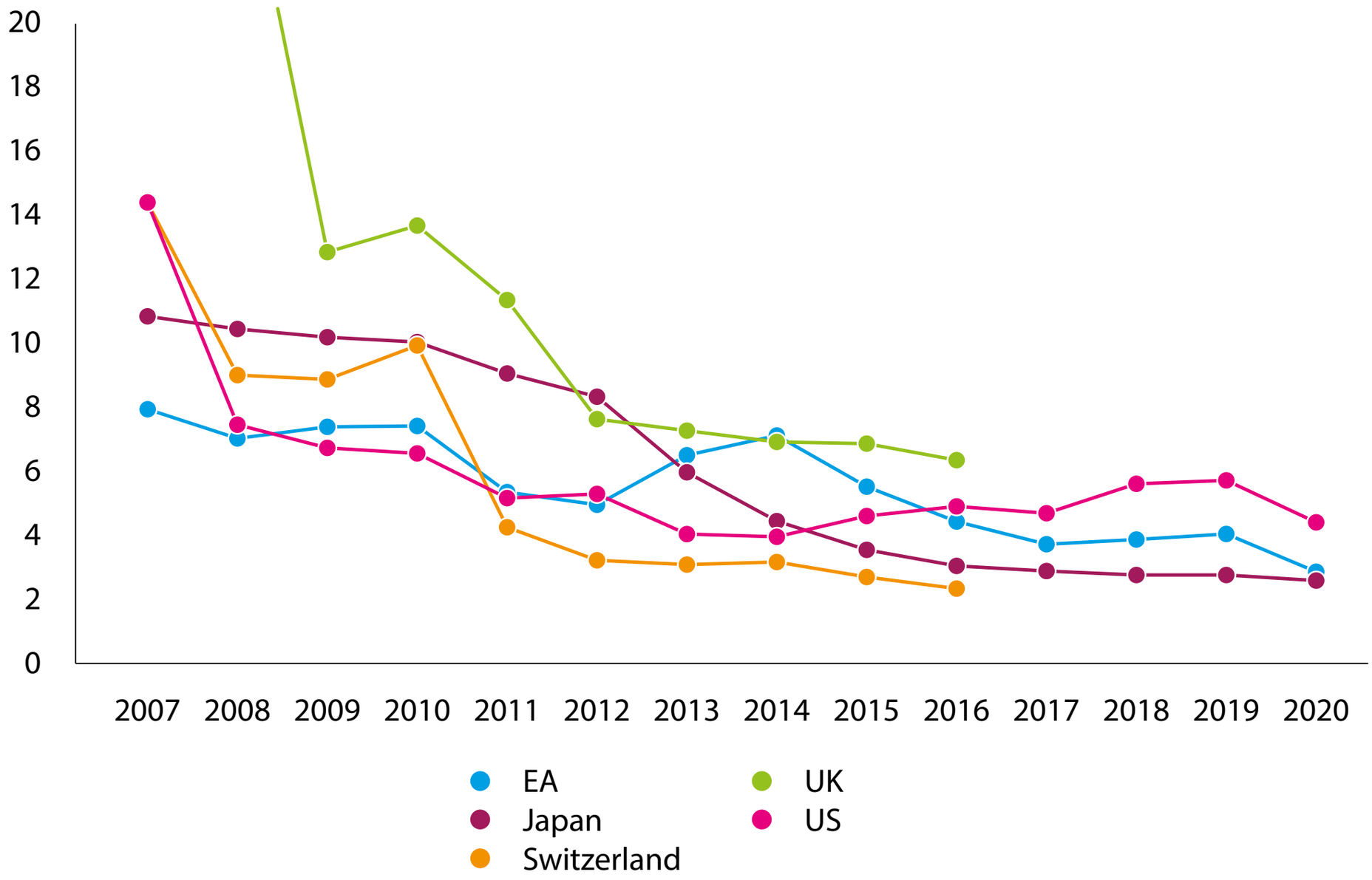
Yet the deflationary shock during the COVID-19 crisis has been different to that experienced during the GFC. Economic agents could not spend on the goods and services they wanted to buy, meaning forced saving (flow) and monetary overhang (stock). The latter represents repressed inflation.

Forced saving and monetary overhang have been temporary, closely related to the stringency of lockdown measures. When lockdowns started to be relaxed in the first half of 2021, demand for money began to return to the pre-crisis level. This is probably a key factor explaining the inflation surge in most currency areas in the first half of 2021.

φ: The declining money multiplier and its determinants

There has also been a dramatic decline in φ in key currency areas (Figure 3). Among the reasons for this, one can mention the immediate consequences of the GFC, which damaged the process of financial intermediation for several years. Banks, other financial institutions, non-financial enterprises, and households had to repair their balance sheets, making them cautious about fresh borrowing and lending.

Figure 3. Money multiplier in key currency areas, 2007-2020 (M/Mh), logarithmic scale



Source: Bruegel based on IMF International Financial Statistics (www.data.imf.org).

In particular, commercial banks have preferred to retain additional liquidity and capital margins (beyond that required by prudential standards), rather than become engaged in risky lending.

Furthermore, since the GFC, regulatory authorities have seriously tightened the prudential norms for commercial banks and non-banking financial institutions, including the capital adequacy ratio and liquidity coverage ratio, anti-cyclical capital buffers, risk assessment methodology. A similar effect was delivered by fiscal instruments, such as taxes on banking transactions, introduced in several countries.

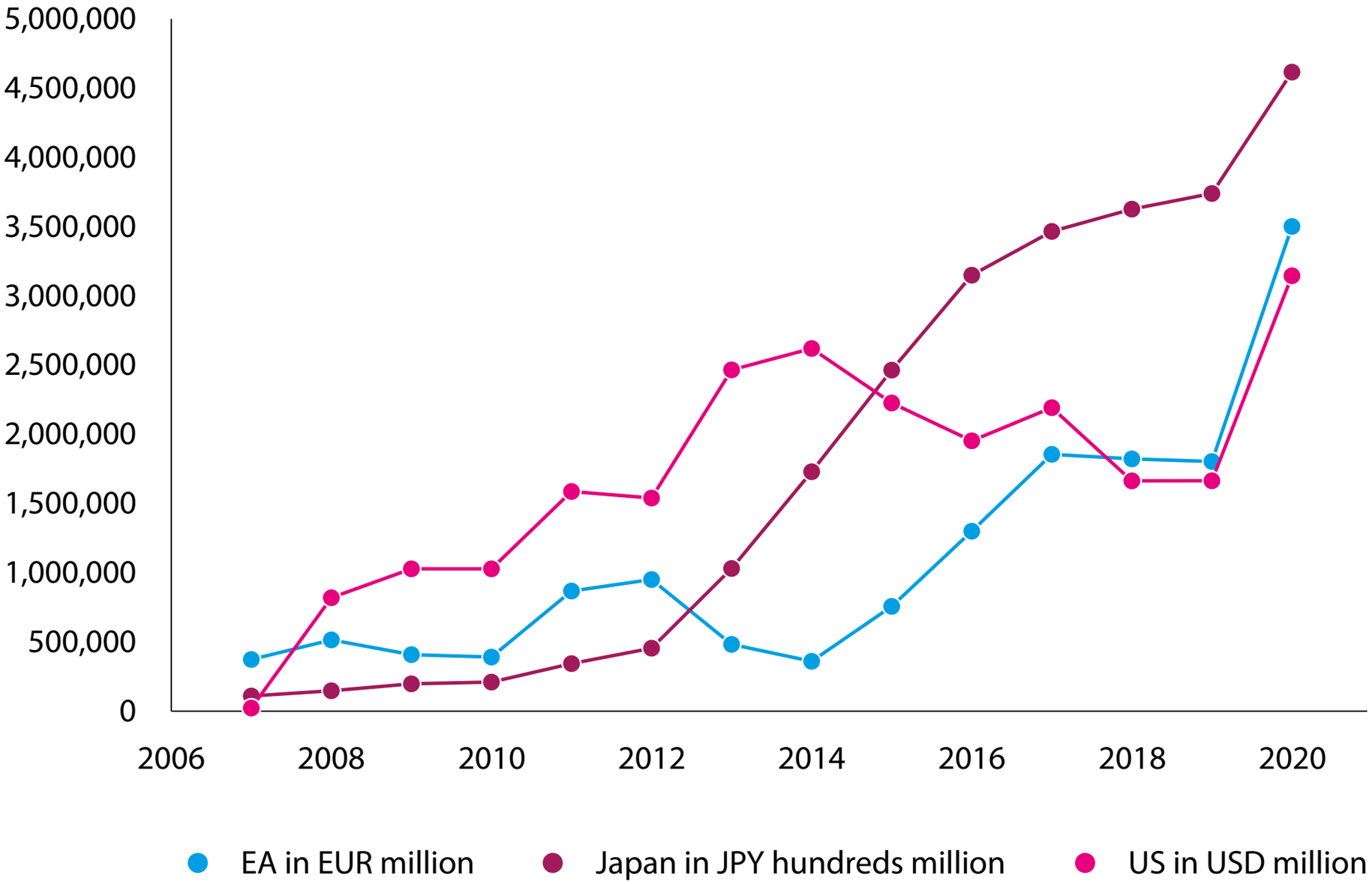
Finally, QE has also depressed φ, the effect of increased commercial banks deposits at central banks, which coincided with periods of QE intensification, such as in 2020 (Figure 4).

A comparison of Figures 3 and 4 suggests that rapid increases in commercial bank deposits at central banks have coincided with rapid decreases in φ. Increases have followed the launching/intensification of QE, that is, 2008-2013 in the US, 2015-2017 in the euro area, since 2012 in Japan, and 2020-2021 in all analysed currency areas.

In contrast, when central banks have stopped or slowed down direct asset purchases (eg. the Fed in 2014-2019 and the European Central Bank in 2012-2013 and 2017-2019), bank deposits at central banks have decreased and, as a result, φ has stabilised or (in the US) even increased somewhat.

A detailed understanding of this somewhat perverse effect of QE is hampered by a lack of sufficient empirical research on commercial banks' responses to unconventional monetary policy measures. Probably, QE removed so many low-risk liquid securities from the financial market that commercial banks had to increase their voluntary deposits at central banks to meet their liquidity coverage ratios and manage their liquidity (despite negative interest rates on their deposits in the euro area and Japan).

Figure 4. Central bank liabilities to other depository financial corporations (commercial banks deposits at central banks) in key currency areas, 2007-2020



Source: Bruegel based on IMF International Financial Statistics (www.data.imf.org).

A decrease in φ after the GFC can be explained by an increasing reserve-to-deposit ratio (r_d; see the third identity). It was a combined effect of tighter prudential regulation, more conservative behaviour of commercial banks and other lending institutions, and QE. However, the second determinant of changes in φ, that is, the cash-to-deposit ratio (c_d), also increased (Figure 5) in the US dollar and euro currency areas.

Higher demand for cash may look surprising considering the rapid development of electronic payments and policy efforts to reduce cash transactions. On the other hand, low inflation and low interest rates have reduced the opportunity costs of keeping money balances in a cash form.

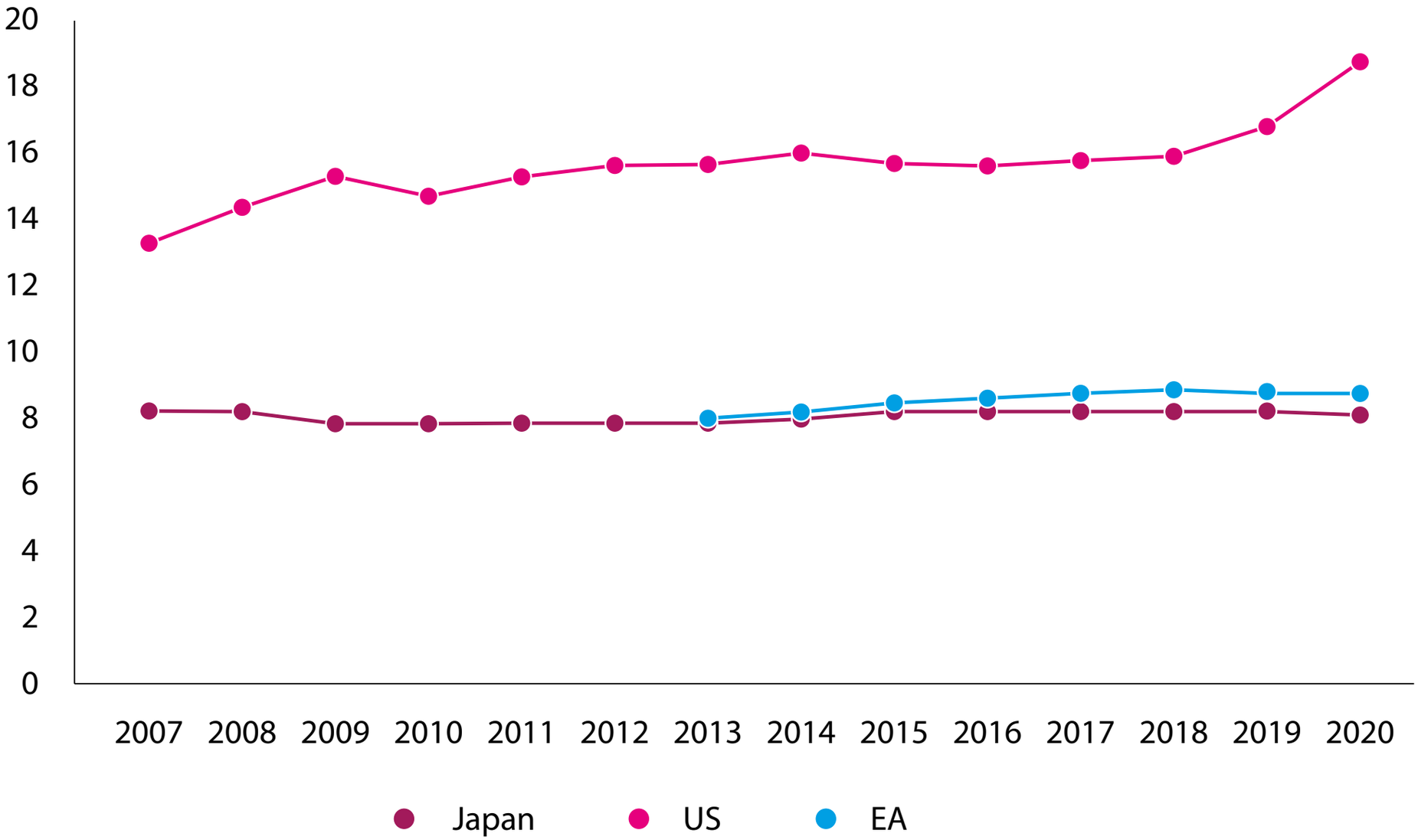
Is higher inflation in 2021 a temporary phenomenon?

Most advanced economies, where vaccination rates are relatively high, relaxed their COVID-19 lockdown measures in the first half of 2021. This led to economic recovery, but accompanied by higher inflation in the US, large parts of the euro area and the United Kingdom (Table 1). Inflation in Japan and Switzerland remains low.

Higher inflation should not be surprising given the temporary character of 'forced' saving and monetary overhang during the early stages of pandemic, and their post-lockdown unfreezing. The critical question is whether this is a temporary phenomenon (after which inflation will go down) or the beginning of the period of higher inflation. Central banks in key currency areas believe in the first scenario (see here and here) and continue with current monetary policies. The IMF takes a similar tack.

But to identify whether low-inflation optimism is justified, the future dynamics of Mh, φ, and V should be assessed, especially in the context of continuing QE: avoiding the inflationary consequences of increased Mh would require further decreases in φ and V.

Figure 5. The share of CU in M in key currency areas, 2007-2020, in %



Source: Bruegel based on IMF International Financial Statistics (www.data.imf.org).

Table 1. HICP in the euro area and other key currency areas, Jan-Aug 2021, annual percentage change

Country/currency area	2021M01	2021M02	2021M03	2021M04	2021M05	2021M06	2021M07	2021M08 (a)
EA	0.9	0.9	1.3	1.6	2.0	1.9	2.2	
Austria	1.1	1.4	2.0	1.9	3.0	2.8	2.8	3.1
Belgium	0.6	0.3	1.6	2.1	2.5	2.6	1.4	4.7
Cyprus	-0.8	-0.9	0.3	1.2	1.5	2.2	2.7	3.3
Estonia	0.3	0.5	0.9	1.6	3.2	3.7	4.9	5.0
Finland	1.0	0.9	1.4	2.2	2.3	1.9	1.8	1.8
France	0.8	0.8	1.4	1.6	1.8	1.9	1.5	2.4
Germany	1.6	1.6	2.0	2.1	2.4	2.1	3.1	3.4
Greece	-2.4	-1.9	-2.0	-1.1	-1.2	0.6	0.7	1.2
Ireland	-0.1	-0.4	0.1	1.1	1.9	1.6	2.2	3.1
Italy	0.7	1.0	0.6	1.0	1.2	1.3	1.0	2.6
Latvia	-0.5	-0.2	0.3	1.7	2.6	2.7	2.8	3.6
Lithuania	0.2	0.4	1.6	2.4	3.5	3.5	4.3	4.9
Luxembourg	1.1	-0.5	2.5	3.3	4.0	3.4	3.3	3.5
Malta	0.2	0.1	0.1	0.1	0.2	0.2	0.3	0.3
Netherlands	1.6	1.9	1.9	1.7	2.0	1.7	1.4	2.7
Portugal	0.2	0.3	0.1	-0.1	0.5	-0.6	1.1	1.3
Slovenia	-0.9	-1.1	0.1	2.2	2.2	1.7	2.0	2.1
Slovakia	0.7	0.9	1.5	1.7	2.0	2.5	2.9	3.3
Spain	0.4	-0.1	1.2	2.0	2.4	2.5	2.9	3.3
Switzerland	-0.6	-0.4	-0.2	-0.1	0.3	0.5	0.5	
US (b)	1.2	1.6	2.8	4.9	6.0	6.4	6.3	
Japan (b)	-0.6	-0.4	-0.2	-0.4	-0.1	0.2		
UK (b)	0.7	0.5	0.7	1.5	2.1	2.5		

Source: Eurostat. Note: a = estimate; b = CPI.

Regarding φ, it is difficult to find arguments for its further decline unless there is a new major banking crisis. Instead, financial intermediation should recover once the COVID-19 pandemic ends and commercial banks complete recapitalisation processes.

Furthermore, if central banks stop QE or reduce their balance sheets, commercial banks may reduce their voluntary reserves deposited at central banks, contributing to increasing φ. Of course, the net impact on M can remain negative, but proportionally less than Mh reduction.

Continuation of a low V will depend, all other things being equal, on the resilience of low-inflation expectations. These are based on public trust in the determination and ability of central banks to deliver on their price stability mandates. There is certain inertia at work. More than three decades of low inflation have helped to anchor firmly these expectations in most advanced economies.

Disanchoring will not happen immediately. However, inflation expectations will not stay low forever regardless of the course of monetary and fiscal policy and the current inflation record. Continuation of monetary and fiscal expansion against the first inflationary signals may undermine expectations.

Once expectations become disanchored, higher V could push inflation up, which will contribute to a further increase in V. It is challenging to determine the precise expectation breaking point but continuation of expansionary monetary policy and downplaying of inflation risk when inflation is on the rise almost everywhere brings such a breaking point much closer. Furthermore, the revisions to monetary policies strategies completed by the Fed in August 2020 and ECB in July 2021 include declarations of 'symmetric' treatment of inflation targets. In practical terms, this means readiness to run/tolerate inflation 'moderately' above the target, following periods below the target.

Such an announcement when inflation is on the rise (the case of ECB) may be taken by markets and the general public as a sign of central banks' unwillingness to react firmly against price increases.

Increasing fiscal dominance

Expanded central bank balance sheets have become dominated by government bonds on the asset side. Such an effect of QE, even if initially unexpected and undesired, is unsurprising and unavoidable. QE absorbed the bulk of commercial papers and securities of sufficient quality and liquidity acceptable to central banks.

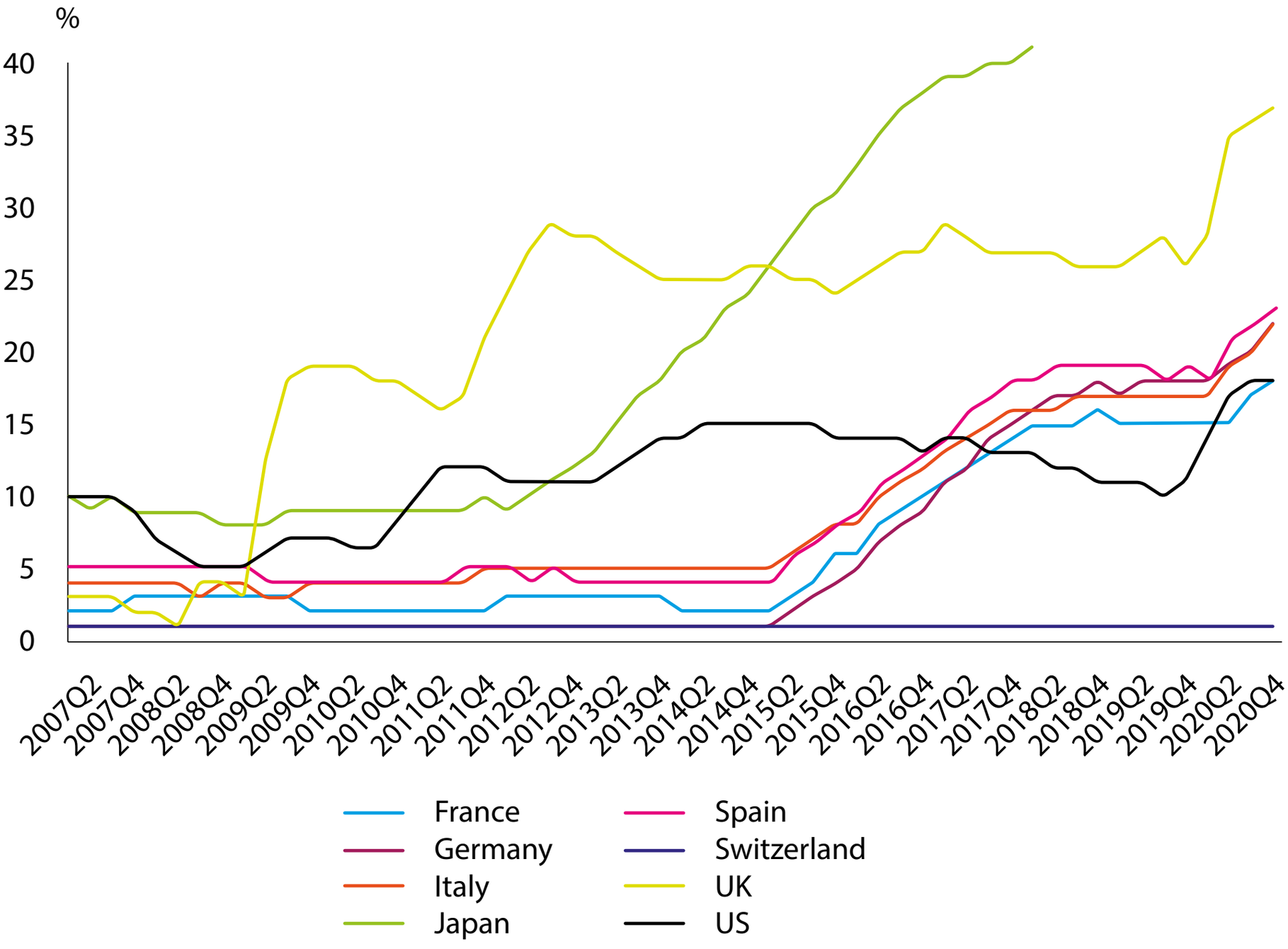
Hence, a continuation of QE has required more reliance on government bonds, leading to an increasing share of the stock of general government debt holdings being held by central banks (except in Switzerland; Figure 6).

The eventual result is an increasing fiscal dominance, or in other words, a rising monetary policy dependence on fiscal policy. In practice, central banks may become hostage to fiscal authorities and their inability or unwillingness to carry out necessary and timely fiscal adjustments. In turn, this may create a severe obstacle to monetary policy tightening and reversal of QE when inflation pressure returns.

In such circumstances, central banks will be confronted with an increasingly difficult dilemma. Fulfilling their price stability missions will require first stopping QE and then reducing their balance sheets, while hiking interest rates.

Curtailing QE and hiking rates will increase governments' interest payments and further deteriorate their fiscal positions. Some governments may face sovereign insolvency risks, undermining the stability of their financial sectors and boosting inflationary expectations.

Figure 6. The share of general government gross debt held by domestic central banks, 2007-2020, % of total



Source: IMF Sovereign Debt Investor Base for Advanced Economies (version of 30 April 2021).

However, giving in to fiscal pressures would lead to higher inflation and undermine thus far stable inflationary expectations. Higher inflation could perhaps depreciate the real stock of public debt (if it had an unexpected character), but other economic and social consequences would be negative.

Adjusting to changing winds

For the last twenty years, monetary policy in advanced economies has been preoccupied with the fear of deflation, in a context in which deflationary forces were at work: savings surpluses in some emerging-market economies, disruption of financial intermediation after the GFC, consequences of financial regulation reforms, or, most recently, forced saving caused by COVID-19. These deflationary factors helped absorb, through decreasing V and φ, the effects of rapid expansion of central banks' balance sheets (Mh).

However, it is unlikely that these deflationary factors will continue working. Monetary authorities must be ready to react to an inflationary rather than a deflationary environment, even if it does not materialise immediately. Downplaying inflation risk and overconfidence that price increases in 2021 have only a temporary character can lead to a rise in inflation expectations and V. If that happens, fighting inflation will become more costly, economically and politically.

Governments and central banks must consider all of the relationships between monetary and fiscal policies, particularly the role of interest rates close to zero and massive QE in lowering public debt-service costs.

When the time comes for monetary policy tightening, either by increasing interest rates, downsizing central bank balance sheets, or both, government interest payments will increase substantially, putting debt sustainability at risk, especially in highly indebted countries.

Better would be to start a gradual fiscal adjustment soon while government bonds yields are still low. In addition, early fiscal adjustment will increase monetary policy's room for manoeuvre and help it fight potential inflationary pressures. ■

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International trade, global supply chains and monetary policy

Silvana Tenreyro says global supply chains can improve a country's productivity and income. But the benefits they bring are not evenly spread across sectors

I will talk about international trade, global supply chains and their implications for monetary policy in the UK. I will first discuss some of the reasons for international trade, and how the development of global supply chains has increased the scope for trade.

In the context of recent disruptions to global supply chains, I will then examine some past crises affecting trade volumes and compare these to the trade disruptions during the pandemic. I will finish by explaining what I think this means for monetary policy and setting out how I see the current economic outlook. I will make three key points:

- International trade brings benefits in the form of higher productivity and increased average incomes. The development of global supply chains has allowed further gains to be realised. While in the past there have been questions over whether trade and global supply chains also have costs by increasing income volatility, recent evidence suggests that trade can also reduce income volatility by allowing countries to diversify their risks. Trade and supply chains have also proved resilient in the face of crises.

- Recent disruption to global supply chains has arisen because of an unprecedented combination of a strong rotation in global demand towards some sectors – mostly goods, and away from others, mostly services – and a variety of reductions in supply, particularly affecting a few critical inputs. The rotation in demand reflects changes in consumption patterns brought on by the pandemic, which made some types of consumption less desirable, given the associated health risks.

  It has also been influenced by the large fiscal programs in place in a number of economies. Many of the reductions in supply have also been COVID-related, with lockdowns taking place across the world, while several other disruptions have been idiosyncratic.

- In the UK, the economy has not yet recovered to the employment and output trends we would have seen without the pandemic. At the same time, a range of temporary factors have been pushing CPI inflation above target, and will continue to do so over the coming months.

  Some of these, such as base effects and the direct impact of energy price rises, are short-lived, and monetary policy can do little to offset them: much of the effect of policy would not come until after their impact had faded; more important will be any indirect effects of energy prices on real incomes or production costs. The effects of supply chain disruption should also be temporary, and unwind as supply of some goods increases, and as demand rotates back towards pre-COVID consumption patterns.

The current supply chain disruption will also ultimately be temporary. For some products, disruption and its effect on inflation are likely to dissipate quickly as firms find new suppliers or current ones are able to expand

The speed of this rotation is a key uncertainty, and will be related to the evolution of the pandemic around the world. In the UK, domestic cost pressures will depend on the evolution of the labour market now that the furlough scheme has ended. My policy votes will aim to strike a balance between these different effects and risks while bringing inflation back to target sustainably.

Trade and global supply chains

Global supply chains have been dominating the news agenda. Just as the global financial crisis brought the financial system to the attention of the general public (as well as many economists), so too has the pandemic moved the workings of modern supply chains from the background to the front page. But while the focus on these complex production networks is new, many of the debates hark back to some of the oldest questions in economics: the benefits and potential costs of international trade.

International trade affects the daily lives of almost everyone in the world. In the UK, with around one-third of the consumer price index basket consisting of imported goods and services, our typical supermarket basket would look very different without it. Trade brings many benefits.

By allowing different countries to specialise in products they can produce more efficiently, it increases average productivity and incomes. We can also purchase more varieties of the same products: French and Italian cheeses to supplement British ones, for example.

And international trade integration can boost the productivity of UK firms – irrespective of whether they trade directly[1] – in several different ways: firms learn from best practices abroad and adopt new technologies developed elsewhere[2], and greater international competition favours more productive firms.

The development of global supply chains – production processes that use intermediate goods and services sourced from other countries – are a natural extension of this logic. A large share of trade has always consisted of inputs used in production, as opposed to imported final goods and services.

But in recent decades, global supply chains have continued to grow in importance. This reflected large reductions over time in the cost of transporting goods, initially through industrialisation.

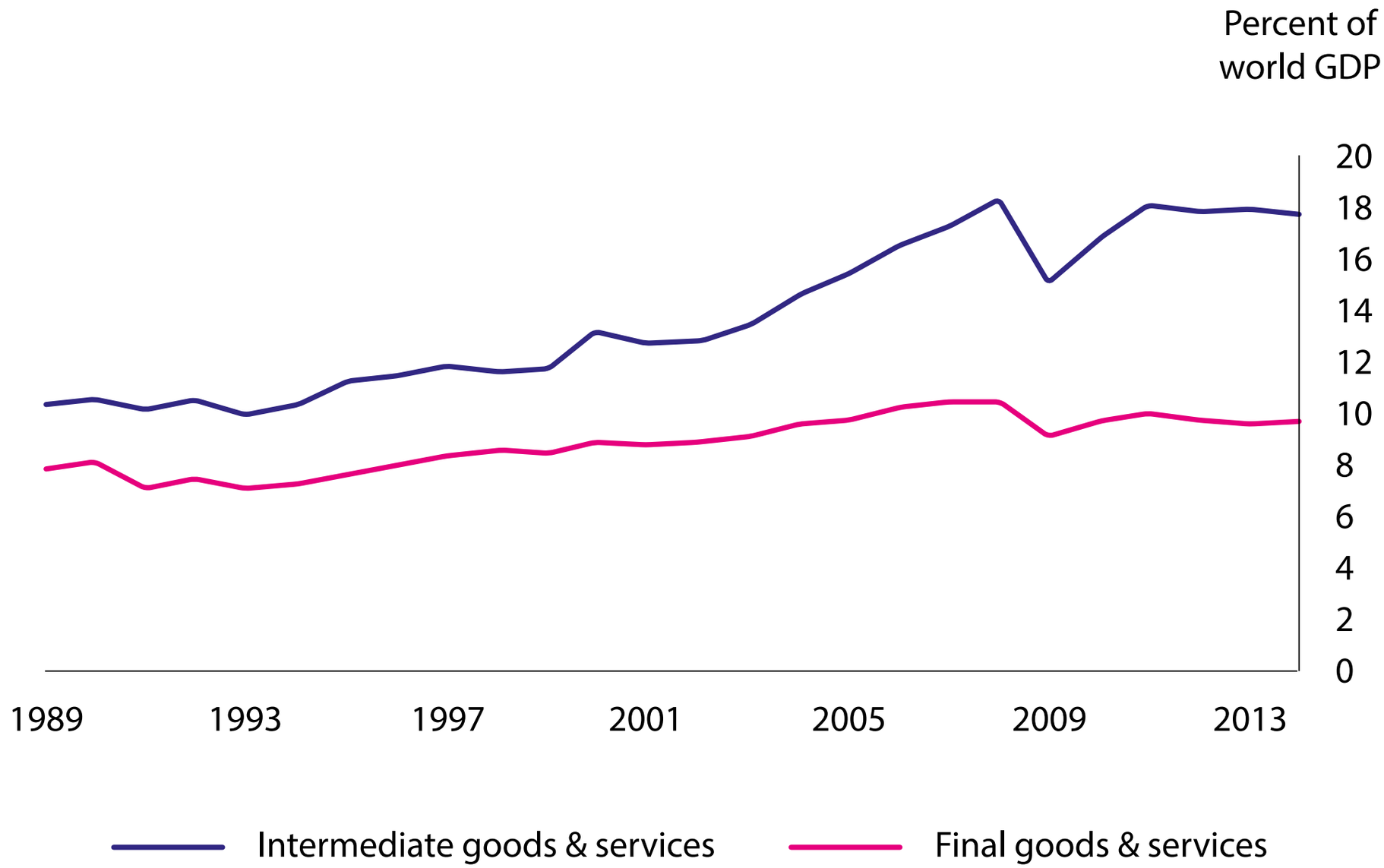
More recently, progress in information and communications technology has made it easier to transport ideas, thus enabling the coordination of work at a distance[3]. As a result, supply chains have also become longer and more complex, with stages of production offshored or unbundled across various firms located in different countries.

As a concrete example, all you have to do is look down at your smartphone; from design to delivery, our mobiles have been designed and constructed using the flow and exchange of know-how and parts and components produced and assembled across multiple borders.

To measure the increased importance of supply chains in international trade, there is a range of different metrics we might consider. Chart 1 shows that as a share of world GDP, intermediate input trade had increased far faster over the 20 years to 1990 than trade in final goods and services.

We might also want to know about how exposed different countries are to each other, either to measure risks and vulnerabilities, or to trace out how shocks in one region may transmit to others. These bilateral exposures are more complex to quantify.

Chart 1. Trade in intermediate and final goods and services



Source: Carney (2017), using data from Johnson and Noguera (2017), Powell (2016), World Input-Output Database (2016 release) and BIS.

For example, we might think of a British car, say a Mini, as being produced in Plant Oxford in the UK, because that is where final assembly happens. But by 2016, over half of the parts used in cars assembled in the UK are produced abroad[4].

Even taking these inputs into account would miss links in the network, however, since each input may be produced using sequences of inputs from elsewhere: the engine could contain cylinders from Germany, containing pistons from China, and so on.

To try to capture the indirect links in the network, in Caselli *et al* (2020), we build a quantitative model of trade with global supply chain networks for all countries using data from the 1970s to the 2000s. The model allows researchers to trace how economic shocks in one or more countries (or sectors) transmit across other countries and sectors in the network, and to study quantitatively how that transmission has evolved over time, as countries and supply chains became more integrated[5].

A more recent paper by Baldwin and Freeman (2021) proposes a measure of foreign input reliance based on gross, or cumulative trade[6]. This index gauges the total potential exposure to shocks emanating from abroad. Disruption to production or shipping from one country, due to a COVID lockdown, for example, is likely to affect the total value of goods produced or shipped, irrespective of the source of the inputs[7].

Both papers stress that the substitutability between different intermediate inputs as well as the possibility to diversify suppliers will influence how a shock in one country affects its trading partners, a point I will come to discuss below.

As global supply chains have expanded the scope for international trade, many of their benefits correspond closely to those from trade in general. Supply chains allow even more specialisation, again increasing productivity and average incomes. Lower cost or higher quality inputs, and a greater variety of inputs can do the same.

Supply chains also offer more possibilities for productivity gains from learning and technology spillovers: between importers or exporters and their suppliers or buyers, including via activities like the sharing of blueprints or managerial practices[8].

So trade and integrated global supply chains bring benefits in the form of higher national income. An important caveat is that these benefits may not be evenly distributed across societies, unless governments use the gains from trade to compensate any workers or consumers who lose out.

That said, if giving up globally integrated trade makes the overall level of aggregate income smaller, these losses often tend to fall on the lower part of the income distribution. From an aggregate perspective, given the disruption we have seen to supply chains in recent months, it is also important to assess whether there are other potential costs or risks.

One possibility is that while trade and supply chains raise the level of income in an economy, they could also make it more volatile. This was once a widely held view by economists, based on the idea that increased specialisation in one sector, which goes hand in hand with international trade, increases the exposure to shocks to that sector[9].

For example, the UK has long specialised in the export of financial services, which means that trade is likely to be disproportionately affected by shocks to the financial sector, as occurred during the 2007-08 global financial crisis.

My own research has highlighted that there is an offsetting effect, however, which means that trade can actually reduce income volatility, and typically has done so in the past. In Caselli *et al* (2020) we explain how higher trade integration allows countries to rely on a more diverse set of suppliers and buyers. This reduces the domestic economy's exposure to shocks to any single producer or country that they trade with.

If the supply of labour falls in the UK, for example, this has a smaller effect on our UK car manufacturer than it would for a firm with a less diverse supply chain, since the shock has no direct effect on the cost of its imported inputs. Other recent studies echo these conclusions.

For example, recent work by Bank of England economists[10] concludes that a blanket reduction in supply chain integration can be economically costly while not significantly reducing economic volatility; and that reshoring production would increase aggregate volatility by reducing source diversification[11].

This diversification channel also allows countries to pool technologies, as we saw in the recent example of vaccine development. Only a small number of countries witnessed the successful development of COVID vaccines, but a much larger number have been able to benefit from their discovery.

How do the recent supply chain disruptions, which have dominated news cycles, fit into this framework? We have seen widespread supply shortages, bottlenecks and transport disruptions over the past year.

Some of the causes have been idiosyncratic – such as the grounding of the Ever Given ship in the Suez Canal in March. Have these highlighted additional risks or fragilities in global supply chains that negate some of their benefits?[12]

While this is possible, as I will come on to discuss, many of the disruptions have been directly or indirectly related to COVID. As a shock that has been global in nature, it seems likely that there are limits to how easily its effects can be diversified away. To get some indication of how, and how quickly, such global shocks to supply chains might unwind, we may be able to learn from similar examples in the past.

Past supply chain crises

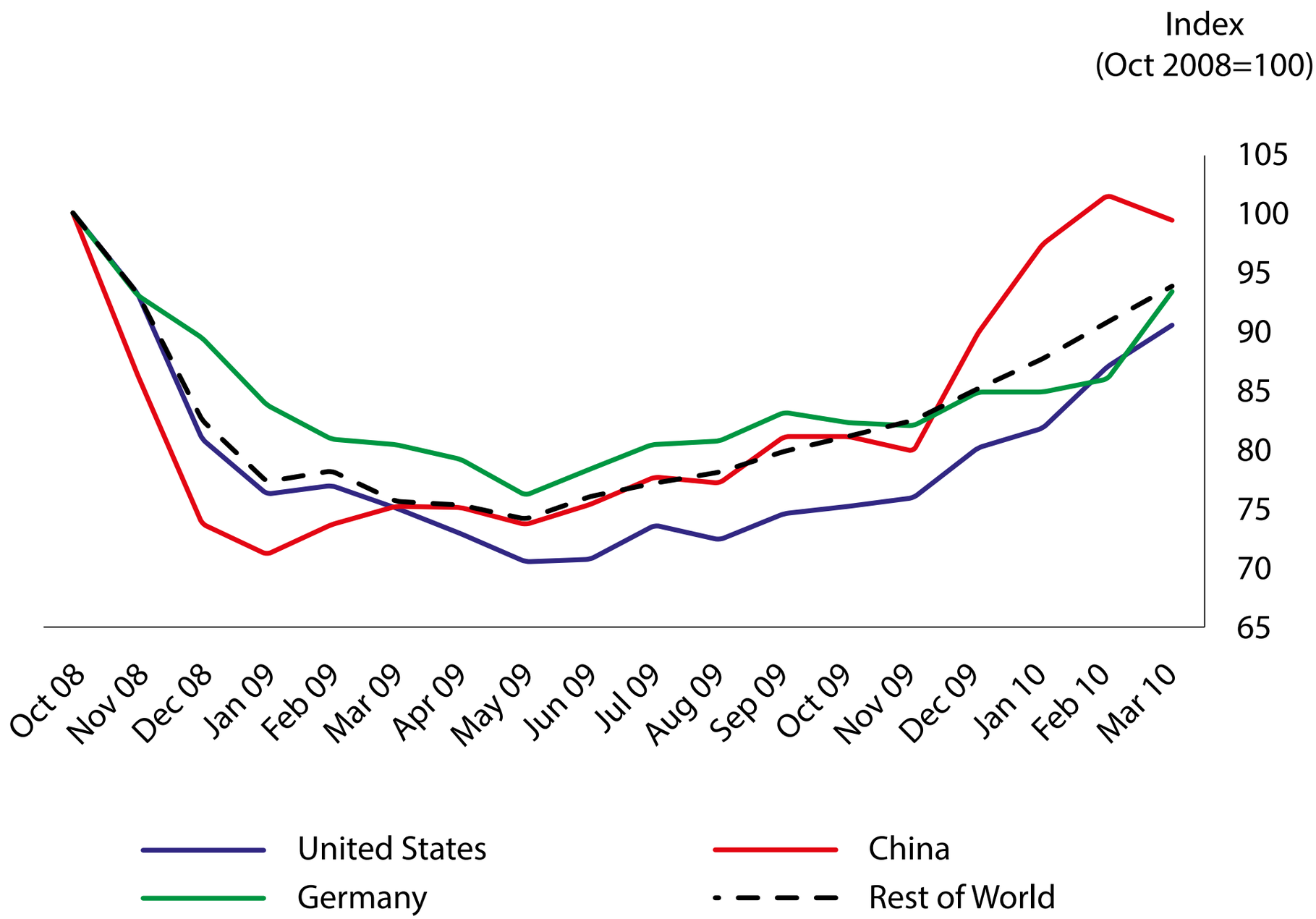
I will now turn to how supply chains have behaved during previous crises. Doing so suggests that supply chain trade can be resilient in the face of large, synchronised shocks. It can also help mitigate crises emanating from large supply disruptions in one region. However, there are no perfect parallels to the effects of COVID on the global economy, so there are limits to how far we can read across from previous examples.

The world experienced a similar global trade disruption following the 2007-08 global financial crisis. This has been termed the Great Trade Collapse, and as with the financial crisis itself, it simultaneously affected countries worldwide.

Chart 2 shows that the size of the collapse was on a massive scale – comparable to that seen over the past 18 months – and that it affected large GSC hubs (US, China, and Germany) similarly to the rest of the world. It was driven in large part by the fall in global demand following the financial crisis, which impaired demand for tradeable goods. In turn, this led to a reduction in supply chain volumes as intermediates demand also collapsed[13].

Perhaps encouragingly for the current situation, trade rebounded to its pre-crisis level quickly after the financial crisis (Chart 2). To the extent that there are similarities, this swift recovery might give us comfort that even when there is a global shock affecting supply chains, it can reverse relatively quickly.

Chart 2. World goods trade, sum of exports and imports



Source:.CBP World Trade Monitor.

At a macroeconomic level, large-scale policy stimulus after the financial crisis helped reverse the fall in demand for tradeable goods, with a consequent increase in supply chain trade.

Many studies even suggest that supply chains helped mitigate the scale and persistence of the overall trade collapse, as supply chain relationships tend to be highly resilient due to the fact that buyer-seller networks are hard to break. During the financial crisis, firms tended to maintain trading relationships (albeit at a much lower scale), allowing them to quickly rebuild volumes as demand recovered[14, 15].

Looking to other, more geographically-concentrated disruptions, such as the 2011 Tōhoku earthquake, reveals similar responses. Recent work by Freund *et al* (2021) zooms in on automotive and electronics sector trade after the earthquake, and provides evidence that intermediate imports were significantly less affected compared to final goods imports. As such, their analysis provides further evidence that global supply chain links are more difficult to untangle after a crisis than the import of final goods.

These past examples suggest there are some grounds for optimism about the resilience of supply chain relationships in the wake of the COVID pandemic, and about how quickly large global shocks can be reversed[16]. But although also global, the COVID shock has differed from the global financial crisis a decade ago.

The main difference is that although it had some supply elements, the financial crisis was primarily a large fall in demand below supply, including a reduction in the demand for tradeable goods.

In contrast, a connecting theme of recent supply disruption has been demand running ahead of supply for some products or sectors. This has had some demand-side causes: COVID has caused a material rotation of demand

towards goods, and away from services where health risks are higher, which has increased demand for tradeable goods above their pre-COVID levels, as illustrated by trends in global shipping volumes (Chart 3).

Goods demand has been further boosted by large fiscal policy stimuli in advanced economies, particularly in the US. It has also had some supply-side causes: lockdowns and other health restrictions have impeded production or transportation in some regions, while the spread of COVID has led to isolation or health-related reductions in labour supply in others.

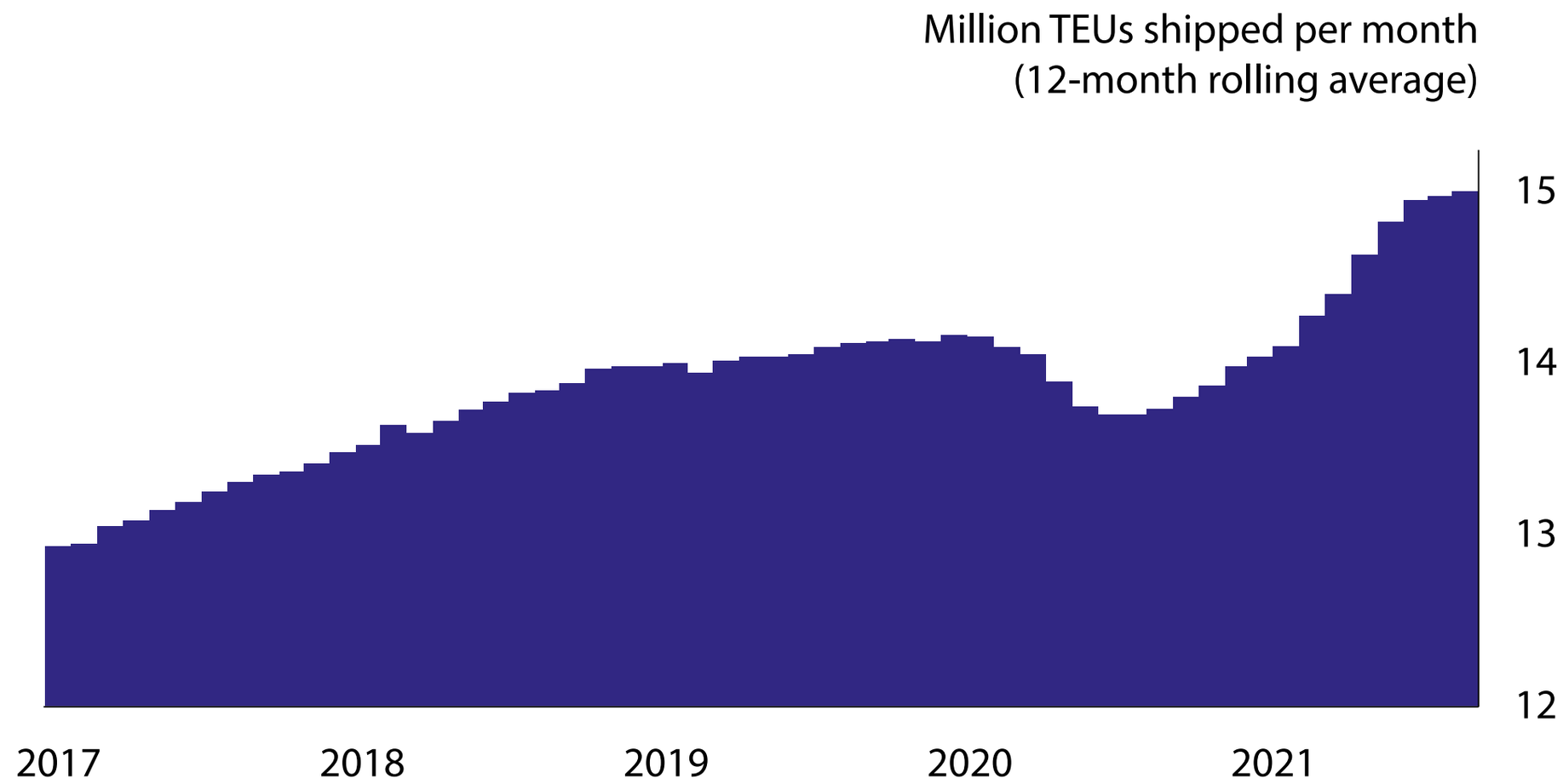
And adding to these factors, a number of idiosyncratic and unrelated shocks to goods supply (eg. multiple extreme weather events occurring during the pandemic, or the grounding of the Ever Given) have contributed further to global imbalances in the goods sector.

A second difference is that the effects of the financial crisis were felt simultaneously around the world, while the COVID shock has been less synchronous. The spread of the virus has waxed and waned at different rates in different regions (Chart 4).

Partly as a result, lockdowns and other public health interventions have also differed across locations across time. The relatively lower synchronicity during the pandemic has in all likelihood helped cushioning the impact of the COVID shock, as some countries were able to resort to imports from less affected regions abroad, and thus mitigate the impact of some products' shortages in their domestic economies.

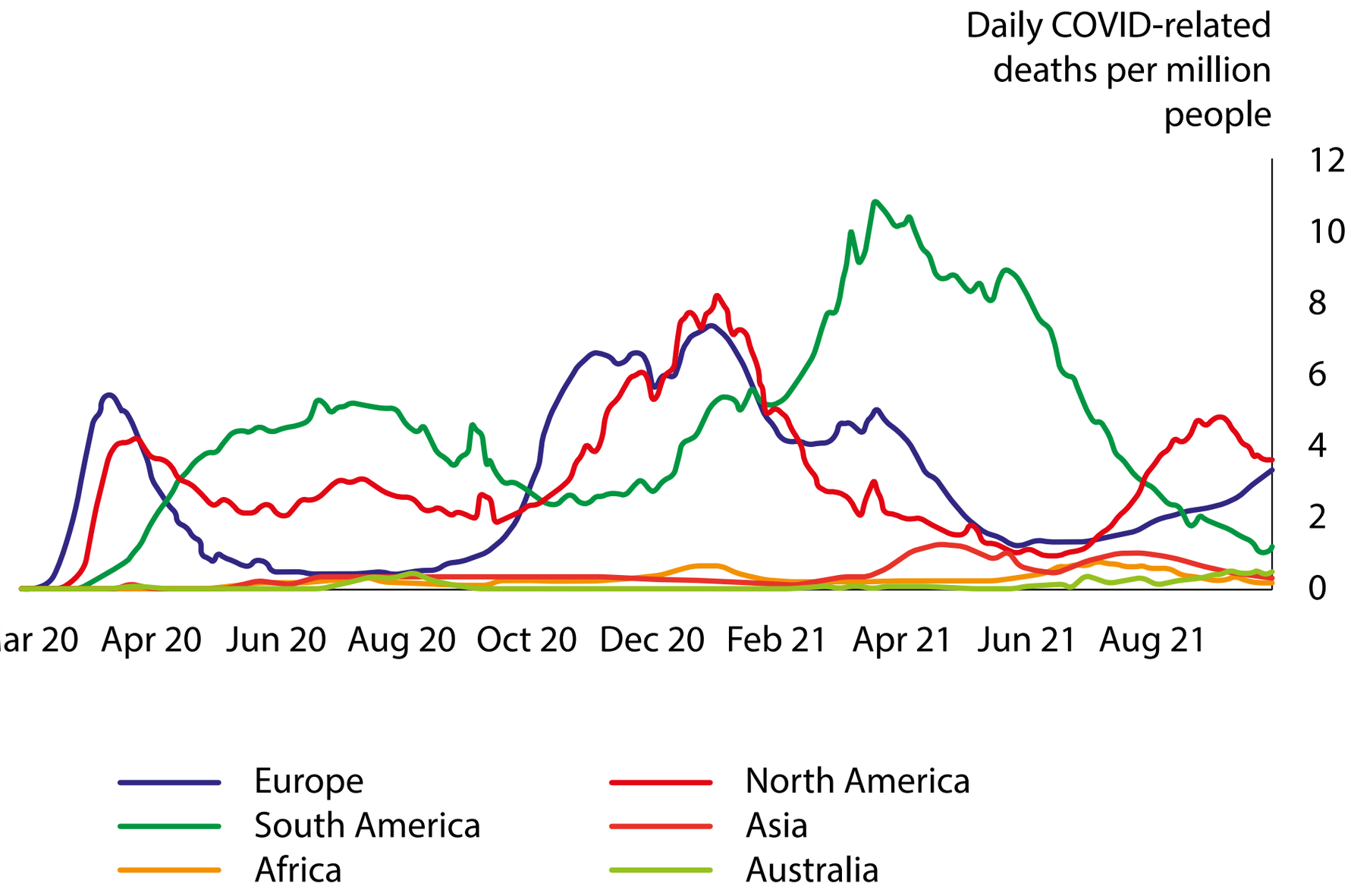
However, the nature of the shock and the disparities in timing may have posed challenges to some supply chains. It is typically easier to recover demand than it is to increase capacity, as has been required for some goods and

Chart 3. Global shipping container volumes



Source: Container Trades Statistics.

Chart 4. COVID deaths per million people



Source: Our World in Data.

inputs; furthermore, in long multinational supply chains, the way COVID has led to a series of regional supply and transportation disruptions may have had a somewhat more persistent impact than a single, large shock.

Supply chains during the pandemic

In light of the unique nature of the challenges during COVID and the recovery, with a battery of different shocks affecting supply chains at different times, it is tempting to ask whether it has been an exception to the usual benefits of trade.

The disruption has intensified calls for 'reshoring' production networks – aiming to reverse some of the supply chain integration we have seen in recent decades by increasing firms' reliance on domestic suppliers. The question these calls raise is whether countries would have been able to tackle the COVID shock better without trade and global supply chains.

If we were to imagine such a scenario, it seems unlikely that the absence of global supply chains would have been beneficial. Given the link between trade and the level of income, a more closed economy would have initially faced a far more difficult task, with fewer resources available to help maintain incomes of workers and businesses most affected.

Lockdowns abroad would not have affected production or supply chains domestically, but domestic lockdowns would have had a far larger effect[17]. So although the timing would have been different, it is not obvious that the overall shock would have been smaller. In fact, the volatility induced would likely have been larger, since the smaller scale of domestic production in a closed economy would have made it impossible to shift to substitute suppliers. Losing just a few workers due to an event like an outbreak in a given plant could mean losing the entire production line of certain inputs or foods.

Indeed, a number of the specific shocks and bottlenecks that are currently impacting output in the UK are at least partly domestic in nature, albeit we are seeing similar effects in many other economies. Shortages of truck drivers, for example, have been impacting logistics in the UK, most notably the supply of petrol. While this shortage has several discrete causes, it is difficult to see how any of them would be addressed with less international trade[18].

If anything, it seems plausible that by enabling more diversification, supply chain trade could have mitigated the overall impact of the shock. Where producers had substitute suppliers in different regions, the asynchronous nature of lockdowns and other impacts of the pandemic may have enabled them to continue production when a supplier in one region was unable to satisfy demand.

Clearly there are areas where diversification has been more difficult: we have seen a range of transport bottlenecks, reflected, for example, in increases in shipping costs. And, echoing the financial crisis, the opacity of many production networks means that beyond their direct suppliers, it is not always clear to firms how diversified supply chains for different products are.

Fundamentally, many of the current disruptions seem to simply reflect unusually large imbalances between supply and demand for some products and from some locations. COVID and its spread are the proximate cause of most of these imbalances.

While there may be limits to the benefits of supply chain-driven trade in the face of such shocks, reshoring production in response would be a risky strategy, which would almost certainly lower incomes on average, without necessarily providing any benefits in terms of lower volatility, or more resilience in response to supply shocks.

The debate is an important one to continue, however, and is linked to that on how policy can enhance the resilience of supply chains, for example by better understanding their associated risks[19]. With a higher risk of climate-related extreme weather events in future, it may be that shocks to supply chains become more frequent in the coming years[20].

Supply chains and monetary policy

So far I have described what global supply chains are and why they have come to be so important to international trade, as well as some of their benefits and potential costs. But in the capacity in which I am speaking today as an MPC member, the most pressing concern is the implications of global supply chains for monetary policy.

There are two different categories of effects. The first consists of the various long-run impacts supply chain integration may have had on the structure of the UK economy and the consequences for monetary policy.

These impacts, including on the slope of the Phillips curve, and the degree of output volatility, have been covered extensively by former Bank of England colleagues, so I will not focus on them today[21]. Instead, I would like to discuss the implications of global supply chain impacts on the near-term UK and global inflation outlooks.

In the near term, the persistence of current supply-chain disruptions is a key source of uncertainty for the inflation outlook. If the effects of supply-chain disruption on CPI inflation are short-lived, then attempting to use monetary policy to offset them would only serve to add additional volatility, since the effects would be fading by the time policy was having a major impact on inflation[22].

Where the temporary effect is on the level of prices, rather than its rate of change, inflation, then the disruption we are currently seeing would have a disinflationary impact as we progress later into our three-year forecast.

If, in contrast, supply-chain disruption were to have a more persistent impact, it would play a larger role in my assessment of appropriate monetary policy. By simultaneously pushing down on output while persistently increasing inflation, it would create a trade-off between the MPC's objectives, which policy would have to manage.

The MPC will be giving its collective assessment of the effects of supply chain disruption, alongside the other factors influencing its inflation forecast, in the November Monetary Policy Report. But for my own part, I would like to explore some of the factors that may determine how quickly disruptions will unwind for specific products.

I will do so by using, as case studies, two of the most prominent examples of goods subject to disruption over the past 18 months: semiconductors and personal protective equipment (PPE)[23].

Case-study A: semiconductors

Semiconductors are a crucial input to a large number of industries, including cars and consumer electronics[24]. Although the semiconductor industry accounts for a small share of GDP, many upstream buyers rely on semiconductors with no substitutable alternatives. As a result, a global shortage of semiconductors during the pandemic has had disproportionately large economy-wide effects[25].

The shortage has been due to both demand and supply factors. On the demand side, a range of goods have benefitted from a rotation away from some services, owing to higher COVID risks in the latter. But within that, demand for electronic devices has been particularly strong among individuals working or learning remotely.

When lockdowns ended, there was also a sharp recovery in the demand for motor vehicles, given both pent-up demand and a COVID-induced preference shift from public towards private transport, as well as a secular shift

towards electric vehicles, which use more chips. Both factors have boosted demand for semiconductor inputs, leading to sharp rises in sales (Chart 5).

On the supply side, global semiconductor production was hit by a number of idiosyncratic shocks. These included winter storms and power outages in manufacturing plants in Texas, a fire at one of the largest semiconductor factories in Japan and a drought in Taiwan[26]. Although semiconductors production increased over 2020, delivery times are higher than pre-COVID, while import prices have picked up (Chart 6).

The supply of semiconductors is typically slow to adjust to large shifts in demand. The manufacturing process is complex[27], and lead times – the wait between order and delivery – are long[28]. The industry operates at large scale, is capital intensive, and requires significant R&D expenditure.

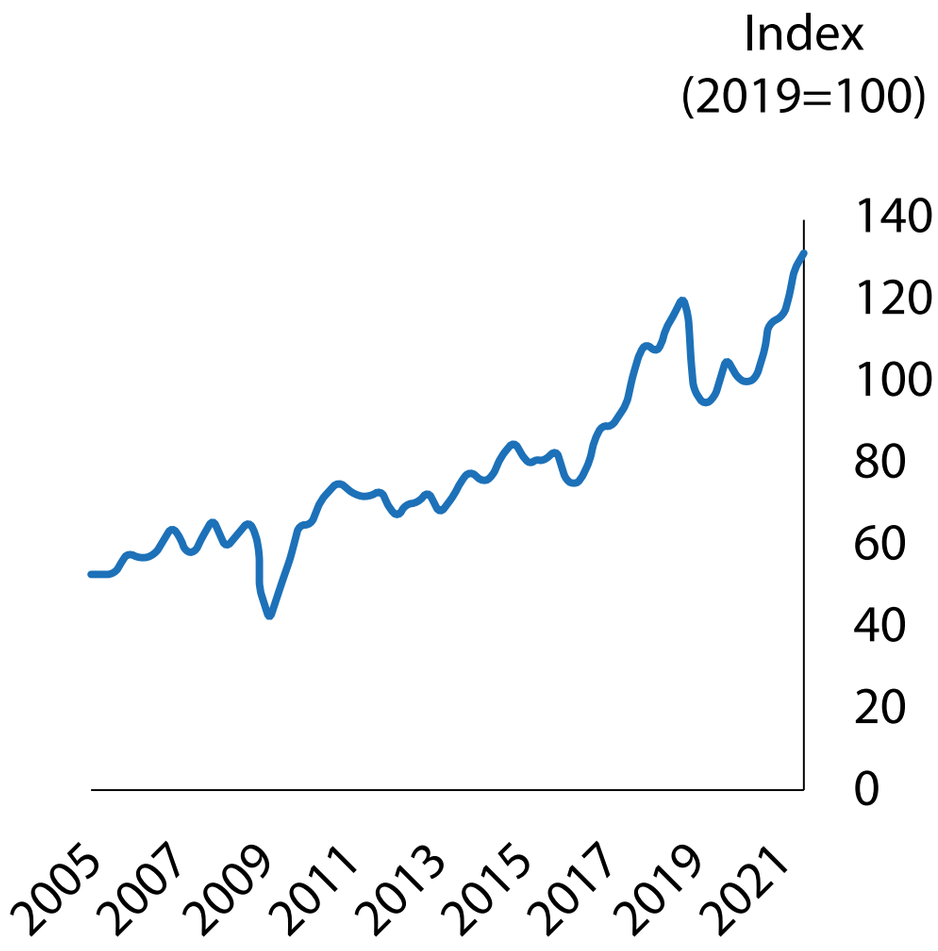
As a result, significant investment is required to increase capacity. Given the increase in demand, new manufacturing facilities are under construction, but will take some time to come online and to be scalable. Moreover, even with increased production capacity, it will likely take time to fulfil current backlogs which have accumulated during the shortages.

Case-study B: personal protective equipment (PPE)

PPE is a collective term used for wearable equipment and gear that protects users from hazards. As a key form of protection from COVID, the pandemic has led to an extraordinary increase in global demand for PPE, of which face masks have of course been the most visible type[29].

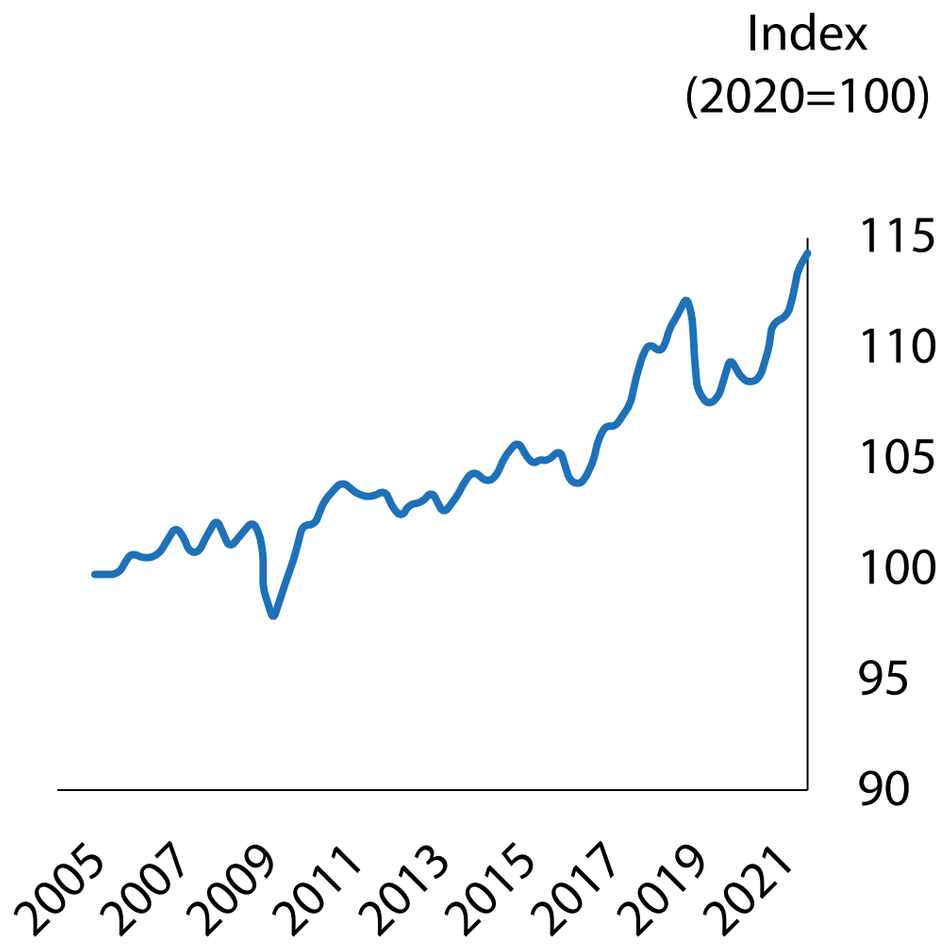
This steep increase is clear in Charts 7 and 8, which show the example of US imports of masks, respirators and medical gowns. This spike in demand was also present in the key supplier of PPE – China, reducing net exports to

Chart 5. World semiconductor manufacturers' sales, 3 month rolling average



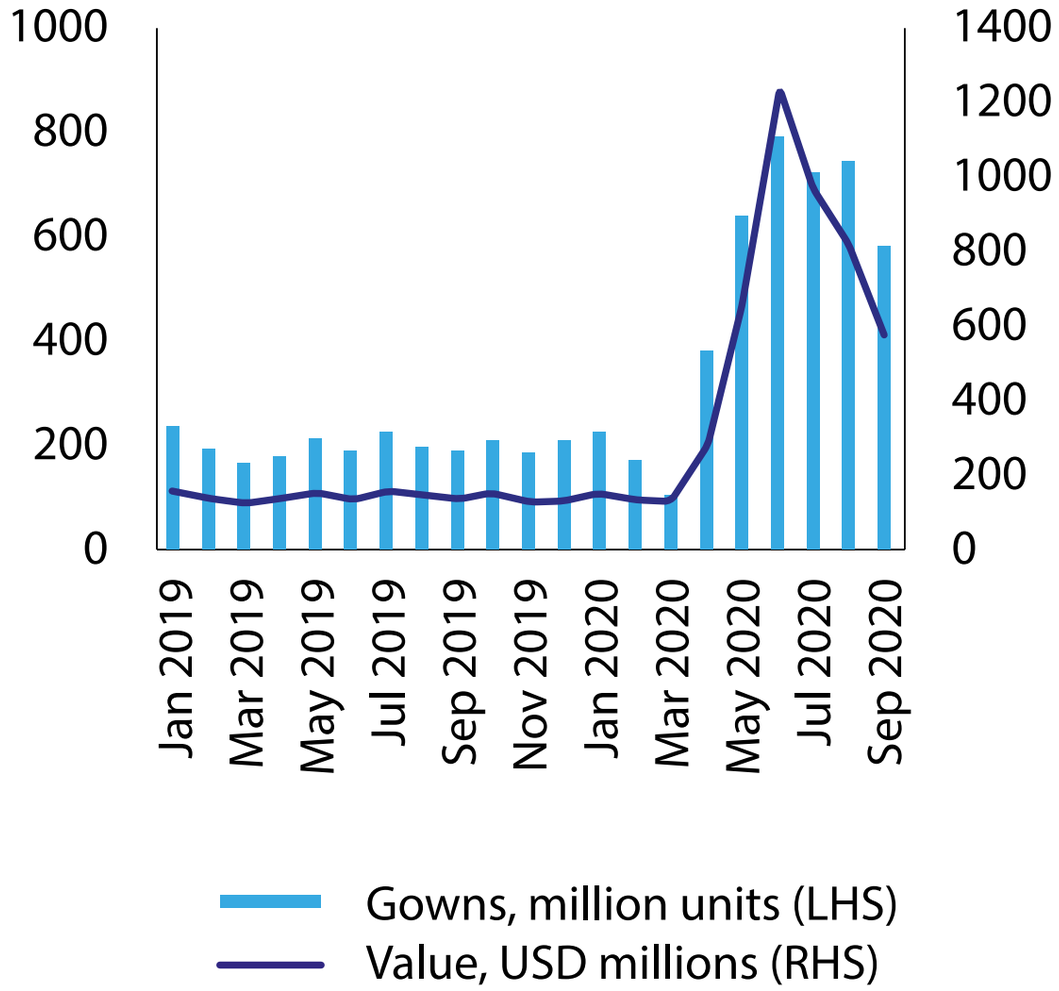
Source: Semiconductor Industry Association via Refinitiv Eikon.

Chart 6. US semiconductor import prices



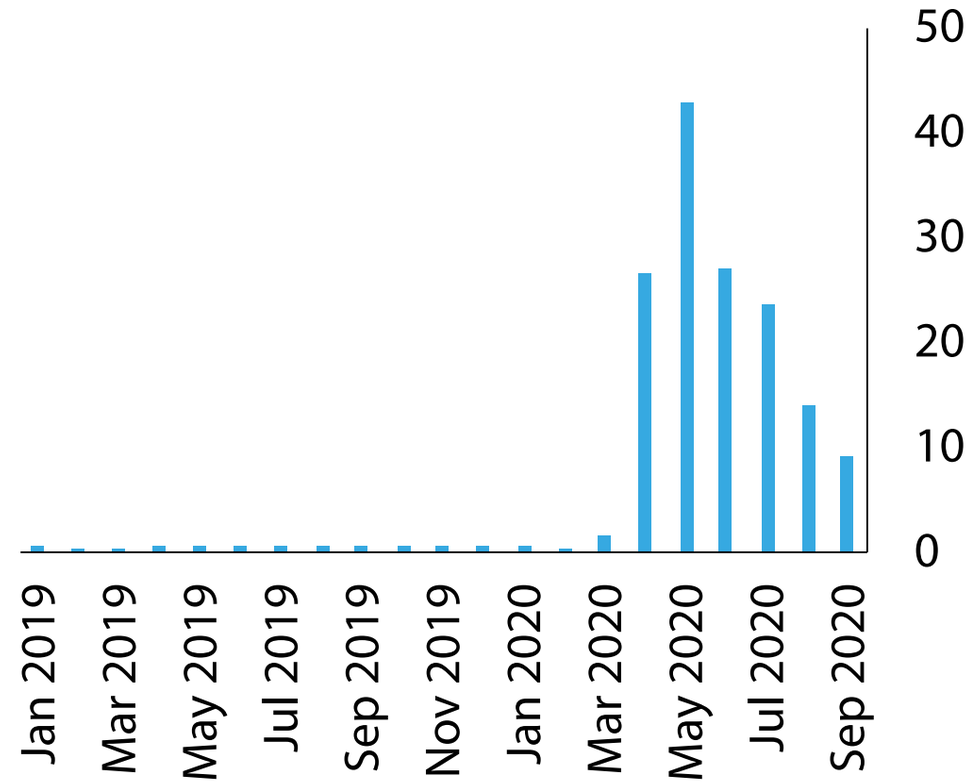
Source: Refinitiv Eikon.

Chart 7. US imports of medical gowns



Source: US International Trade Commission.

Chart 8. US imports of respirators and masks



Source: US International Trade Commission.

the rest of the world, while some countries also applied restrictions on PPE exports. At the same time, supply was disrupted by lockdowns and factory closures worldwide.

The combined effects of a rapid increase in demand alongside supply restrictions were amplified by the fact that the industry holds low inventories. So available stocks were drawn down quickly when demand outstripped supply.

Production of PPE is typically high volume, low value and low profit margin, in part because the main buyers are cost-sensitive healthcare facilities. To keep costs low, PPE suppliers tend to use 'just-in-time' inventory management, leaving supply vulnerable to shocks.

Although the acute phase of the pandemic saw shortages for many types of PPE, some of these supply-chain issues were solved fairly quickly as firms were able to increase production. As products with a relatively simple production process, it was also easier for firms to convert production or switch to substitute suppliers of some types of PPE than would be the case for semiconductors.

Nonetheless, issues with some types of PPE persisted longer due to difficulties in sourcing inputs and the time and cost of bringing new capacity to market[30]. An important consideration was that with much of the increase in PPE demand expected to be temporary, the return on any investment in capacity is uncertain.

Lessons

Extrapolating from the case studies back to the macroeconomy, one can infer that as supply disruptions feed through into price increases, supply can and will adjust in response. But the speed of that adjustment, and so the persistence of the price increases, is likely to vary across products.

For simpler, more homogenous goods such as PPE, where there are many suppliers and limited market power, supply may be able to adjust relatively quickly. For more complex goods such as semiconductors, some disruption may persist into 2022.

In determining the macroeconomic effect, the adjustment of relative demand for different products seems likely to be more crucial still. Even for goods such as PPE where supply can adjust more quickly, firms will be less inclined to do so if the increase in demand is expected to be temporary.

For items such as semiconductors, a fast rotation in demand back towards pre-COVID patterns has the potential to ease disruption more quickly than an expansion in supply. If so, there may even be the possibility of the price of semiconductors falling back, if a reduction in demand meets greater supply.

One source of the rotation will be as a response to price changes – as the global prices of goods subject to disruption rise relative to other goods and services, relative demand is likely to respond.

These demand patterns have also been closely tied to the evolution of COVID, both in the UK and around the world. When virus spread has increased, mandated or voluntary social distancing has led consumers to substitute away from riskier, high-contact services towards goods.

As a result, the prospects for a rapid rotation back towards services, and so the persistence of supply chain disruption, will also greatly depend on how the pandemic evolves over winter and beyond.

Current outlook

COVID initially had a disinflationary impact on the UK and the global economy, as weaker domestic and global

demand led to declines in wage and price pressures[31]. In contrast to the initial year of the pandemic, the uneven recovery is likely to create a temporary trade-off, which monetary policy will need to navigate.

Disinflationary pressures have given way to inflationary ones, while output remains a normal-sized recession below its pre-COVID level, and further still below its medium-run trend. As I have discussed, this tension stems partly from the various disruptions and bottlenecks currently affecting global supply chains, which are leading to temporary negative supply shocks in the UK.

These disruptions have been driven in large part by the effects of COVID and the subsequent recovery on both supply, and on the balance of demand between goods and services.

In the near-term, the inflation side of the trade-off will also be exaggerated by a number of temporary factors, which may not be informative about how prices are likely to change in future. In particular, base effects from weak prices a year ago have been pushing up on recent inflation outturns[32].

And while inflation is likely to increase further over the next few months, a large part of this increase will come from the direct impact of higher energy prices. Increases in the level of energy prices are not typically a sign of future energy price inflation, so these tend to only have one-off impacts on the level of CPI.

Monetary policy cannot offset these effects on inflation, which are driven mostly by global factors, because the level effects tend to drop out of the inflation calculation before policy can have much impact.

It will of course be important to remain vigilant in case of any second-round impacts of higher energy prices: these include the reduction in households' real income, which could weigh on demand and future inflation; and any

impact of higher energy prices on firms' production costs, which they may ultimately pass through to consumer prices.

The current supply chain disruption will also ultimately be temporary. For some products, disruption and its effect on inflation are likely to dissipate quickly as firms find new suppliers or current ones are able to expand.

For others, where supply is slower to adjust, the rotation of demand from goods back towards services should help ease pressure on supply chains. In either case, responding to short-lived effects on inflation would only be likely to impart additional volatility.

While my expectation is that the effects of supply chain disruption will be short-lived, a non-negligible risk is that the switch from goods back towards services is more protracted, leading to a longer period of supply disruption and inflationary pressure.

Given the close relationship between the composition of output and COVID risks and restrictions, it is likely that the epidemiology of the pandemic across the globe will be crucial in determining whether this risk crystallises.

The other major uncertainty for the UK inflation outlook at present is the evolution of the labour market, where there are two-sided risks. Given the near-term outlook for headline inflation, there is a possibility that higher inflation or higher inflation expectations begin to feed through into higher wage demands.

The effects of inflation expectations on wage bargaining can be difficult to gauge, so I will be paying particular attention to direct indicators of wage pressures, including our best assessment of underlying wage growth, settlements data, and information from the Bank's Agency network.

The opposing risk is that the end of the furlough scheme in September leads to a loosening in the labour market and a moderation in wage pressures. A large number of workers need to be reabsorbed into the labour market over the coming months, some of whom will flow into unemployment.

The literature on unemployment benefits, which are comparable in effect to the furlough scheme, would suggest that furlough has been boosting underlying wage growth. Its withdrawal could put this process into reverse.

Along with my colleagues on the MPC, I will be weighing up these different risks ahead of our November *Monetary Policy Report*. At the time of our August forecast, I expected that if the economy were to evolve as in our forecast, some modest tightening, broadly in line with our conditioning path, would be required to achieve the inflation target sustainably.

Since then, we have had large upside news for near-term inflation from energy prices, an effect which should fade quickly. We have also seen a moderation in recent GDP growth, which looks set to continue as we enter the winter months, affecting supply as well as demand.

Higher energy prices may reduce households' real incomes and depress spending, with additional risks stemming from the prevalence of COVID in the UK, and falls in income for any furloughed workers who move out of employment.

Overall, I judge that the balance of this set of news is unlikely to have a large effect on the amount of tightening required over the next few years. The August forecast was conditioned on market expectations of a gently rising path for Bank Rate, gradually unwinding the relatively small amount of monetary policy stimulus added since the onset of COVID[33].

They were also consistent with evidence that the medium-run equilibrium interest rate remains low, and is likely to be so for some time. The precise path policy takes towards that equilibrium rate will partly depend on how the risks I have highlighted evolve.

As always, my votes on any future policy changes will depend on incoming data and my assessment of the economy at the relevant MPC meetings. Uncertainty over the effects of the furlough scheme should be resolved over the coming months, which should help paint a clearer picture of the position of the labour market.

We will also continue to learn more about the persistence of disruptions to global and domestic supply chains and their impact on the UK inflation outlook. ■

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Endnotes

1. Specifically, firms which source from upstream industries that export, as well as supply to downstream industries that import, boosts the productivity of purely domestic firms through learning channels (Merlevede and Theodorakopoulos, 2021; Blalok and Veloso, 2007).

2. Caselli and Wilson (2004) show that imports of high-tech capital are a main source of TFP growth and technological development across countries.

3. Baldwin (2016).

4. SMMT (2016), quoted in Bailey, D and De Propris, L (2017).

5. The quantitative model can be used to carry out different scenario analyses, shocking different parts of the system; it is available on request from the authors.
6. This measure differs from more standard GVC measures, which focus on value added trade, and hence where work is carried out.
7. One finding from this metric is that all major manufacturing producers are highly dependent on China, with between 6% and 23% of their manufacturing output relying on Chinese inputs. See also Caselli et al (2020), which explores how much of the rise of China in the international trade scene has affected patterns of transmission and volatility across countries. While the Baldwin and Freeman (2021) metric is particularly relevant when thinking about shocks from the COVID pandemic, the authors also stress that the specific metric used to assess vulnerabilities should depend on the risk being evaluated.
8. See Halpern et al (2015), Topalova and Khandelwal (2011) and Taglioni and Winkler (2016) for more discussion of these channels.
9. See Newberry and Stiglitz (1989).
10. D'Aguanno et al (2021).
11. Similarly, academic work, which gained traction at the onset of the pandemic, examines the international transmission of supply chain shocks due to COVID-19. Using a large-scale general equilibrium model with many countries and sectors, the paper's authors ultimately conclude that reshoring production will not make countries more resilient to shocks – it would simply concentrate risk to the domestic economy. In addition, similar points are made by Koren and Tenreyro (2013) who examine diverse sources of energy as a volatility dampener, as well as Javorcik (2021) who underscores that the recent pandemic has highlighted firms' need to diversify their supplier base to protect against disruptions which may be concentrated to one supplier/geographic location.
12. For governments, there are a separate set of considerations about reshoring production on national security or critical infrastructure grounds, which I do not discuss here
13. See Baldwin (2009) or Domit and Shakir (2010) for detailed analyses.

14. See Antras (2020).
15. This is true in aggregate, but also at the firm level. For example, various academic studies that use detailed firm-level data on European customs transactions show that GSCs and production network structures indeed played a minor role in the collapse; rather it was trade volumes – rather than trade relationships surrounding individual product lines – which mostly adjusted (Bricogne et al 2012; Behrens et al 2013).
16. Indeed, while it is still too early to see these effects in disaggregated data, world goods trade mostly rebounded to pre-crisis levels in the 11 months following the lowest troughs in April 2020. This suggests that, by and large, global supply chains were agile and adaptable. However, there remain some specific bottlenecks in the more recent part of the pandemic.
17. This sentiment has been echoed in various academic studies, for example Bondio et al (2020) and Eppinger et al (2021).
18. See Bailey (2021) for a summary of these causes.
19. For further discussion, see D'Aguanno et al 2021.
20. A point made recently by Javorcik (2021).
21. See Carney (2017). Aquilante et al (forthcoming) looks at the impact of global supply chain integration on the UK Phillips Curve and finds that a higher imported-intermediate goods share from emerging market economies results in a flatter Phillips Curve for the period of 2000 to 2014.
22. Given empirical evidence that policy lags to inflation are faster than they were in the past, discussed in Tenreyro (2019), this may not be the case for slightly more persistent shocks.
23. See Bown (2021) for a discussion of the PPE supply chain during the pandemic.
24. Semiconductor-based components are used intensively in communications, computing, healthcare, military systems, transportation, clean energy, and countless other applications.
25. Semiconductors are materials that find widespread use in the electronics industry thanks to their useful electrical properties – such as showing variable resistance, passing current more easily in one direction than the other, and

reacting to light and heat. They could be described as critical inputs, as in the O-ring theory of Kremer (1993): they are key components in memory chips, microprocessors and integrated circuits.
26. Semiconductor producers use large volumes of ultra-pure water to remove impurities.
27. Manufacturing takes place in highly specialised fabrication plants called foundries. The process is highly automated, very energy-intensive and involves many steps.
28. Fabrication takes on average 11-13 weeks to complete.
29. Outside of the pandemic context, PPE includes a broad set of garments intended for industrial as well as healthcare applications. These range from head, eye and face protection to protective clothing and footwear, hand and arm protection, respiratory protection, hearing protection, fall protection, and others. PPE finds extensive application in industries where injuries can result from contact with physical, chemical, biological, mechanical and radioactive substances, such as the chemical industry, oil and gas, construction, pharmaceutical, healthcare and manufacturing.
30. Based on data from the Get US PPE initiative, N95 respirators, disinfecting wipes, surgical masks and face shields were the most requested types of PPE in the US between March 2020 and June 2021.
31. This was also in line with historical experience from past pandemics, as discussed in Tenreyro (2020).
32. Although the 12-month CPI inflation rate was 3.1% in September, part of this increase has reflected a recovery from low levels of prices a year ago. As a rough metric of the size of these effects, over a longer period, the 24-month CPI inflation rate is only 1.8% at an annualised rate, although this figure is likely to increase further over the next few months.
33. Fiscal policy played the major role in offsetting the economic effects of the pandemic, while monetary policy played a relatively smaller part. Bank Rate was cut by 65 basis points, which was smaller than the typical cut in past (smaller) recessions. The MPC also increased the stock of QE, but in my view, its primary effect was to prevent yields from rising in the face of market DYSFUNCTION, rather than providing additional net stimulus relative to pre-COVID. (The additional net stimulus vis-a-vis January 2020 imparted by QE, measured as the change in long yields relative to January 2020, was more limited and hence so was the net boost to activity or inflation relative to January 2020.) Despite the much larger size

of the fall in activity, the overall monetary stimulus was therefore relatively small when compared to shallower recessions in the past.

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