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Annual Economic
Report

June 2019

*Promoting global monetary
and financial stability*

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This Report went to press on 19–21 June 2019 using data available up to 31 May 2019.

Conventions used in the Annual Economic Report

$	US dollar unless specified otherwise
mn	million
bn	billion (thousand million)
trn	trillion (thousand billion)
% pts	percentage points
bp	basis points
lhs, rhs	left-hand scale, right-hand scale
sa	seasonally adjusted
yoy	year on year
qoq	quarter on quarter
...	not available
.	not applicable
–	nil or negligible

Components may not sum to totals because of rounding.

The term "country" as used in this publication also covers territorial entities that are not states as understood by international law and practice but for which data are separately and independently maintained.

Country codes

AE	United Arab Emirates	GB	United Kingdom	NZ	New Zealand
AR	Argentina	GR	Greece	PA	Panama
AT	Austria	HK	Hong Kong SAR	PE	Peru
AU	Australia	HR	Croatia	PH	Philippines
BA	Bosnia and	HU	Hungary	PK	Pakistan
	Herzegovina	ID	Indonesia	PL	Poland
BE	Belgium	IE	Ireland	PT	Portugal
BG	Bulgaria	IL	Israel	QA	Qatar
BR	Brazil	IN	India	RO	Romania
CA	Canada	IS	Iceland	RU	Russia
CH	Switzerland	IT	Italy	RS	Republic of Serbia
CL	Chile	JP	Japan	SA	Saudi Arabia
CN	China	KR	Korea	SE	Sweden
CO	Colombia	KW	Kuwait	SG	Singapore
CY	Republic of Cyprus	KZ	Kazakhstan	SI	Slovenia
CZ	Czech Republic	LT	Lithuania	SK	Slovakia
DE	Germany	LU	Luxembourg	TH	Thailand
DK	Denmark	LV	Latvia	TR	Turkey
DO	Dominican Republic	LY	Libya	TW	Chinese Taipei
DZ	Algeria	MK	North Macedonia	US	United States
EA	euro area	MT	Malta	UY	Uruguay
EE	Estonia	MX	Mexico	VE	Venezuela
ES	Spain	MY	Malaysia	VN	Vietnam
EU	European Union	NG	Nigeria	ZA	South Africa
FI	Finland	NL	Netherlands		
FR	France	NO	Norway		

Currency codes

AUD	Australian dollar	KRW	Korean won
BRL	Brazilian real	MXN	Mexican peso
CAD	Canadian dollar	NOK	Norwegian krone
CHF	Swiss franc	NZD	New Zealand dollar
CLP	Chilean peso	PEN	Peruvian sol
CNY (RMB)	Chinese yuan (renminbi)	PHP	Philippine peso
COP	Colombian peso	PLN	Polish zloty
CZK	Czech koruna	RUB	Russian rouble
EUR	euro	SEK	Swedish krona
GBP	pound sterling	THB	Thai baht
HUF	Hungarian forint	TRY	Turkish lira
IDR	Indonesian rupiah	USD	US dollar
INR	Indian rupee	ZAR	South African rand
JPY	Japanese yen		

Advanced economies (AEs): Australia, Canada, Denmark, the euro area, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States.

Major AEs (G3): The euro area, Japan and the United States.

Other AEs: Australia, Canada, Denmark, New Zealand, Norway, Sweden, Switzerland and the United Kingdom.

Emerging market economies (EMEs): Argentina, Brazil, Chile, China, Chinese Taipei, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand and Turkey.

Global: All AEs and EMEs, as listed.

Commodity exporters (countries whose average share of commodities in export revenues in 2005–14 exceeded 40%): Argentina, Australia, Brazil, Canada, Chile, Colombia, Indonesia, New Zealand, Norway, Peru, Russia, Saudi Arabia and South Africa.

Country aggregates used in graphs and tables may not cover all the countries listed, depending on data availability.

Annual Economic Report 2019: Editorial

The year in review

It was perhaps too good to be true. In 2017, it was unusual to see a synchronised global expansion at rates above estimates of potential so late in the upswing and, moreover, to project it to continue well into the future. Some deceleration was on the cards. But when it came, in the second half of 2018, it appeared much stronger than expected. It caused tremors in financial markets and anxiety about a possible impending recession. Faced with the prospect of a weaker economy and with an abrupt tightening of financial conditions, the major central banks put the very gradual monetary policy tightening on pause. The recession has not materialised. Still, as always, the question everyone is asking is: "What next?"

Looking back, decomposing global output into its components – a purely accounting exercise – provides some insight into the factors behind the slowdown. In the second half of the year, global trade came to a halt, manufacturing decelerated and investment lost pace. By comparison, services and consumption held up relatively well, propping up the expansion.

But while it is straightforward to identify the accounting categories behind the slowdown, it is much harder to identify the underlying forces at work. That said, it is possible to point to a number of cross-currents.

Multiple forces exerted downward pressure on growth. First, quite prominently, political factors left their imprint on the economy and weighed on the minds of economic decision-makers. Besides some country-specific political factors, trade tensions loomed large. Doubtless, related uncertainty and concerns inhibited activity, especially investment. Second, China slowed as the authorities sought to bring about the much needed deleveraging of the economy to make growth more sustainable. Given China's heft and tight interconnections in the global economy, the slowdown quickly spread around the world. Global value chains acted as a powerful transmission channel. Third, financial conditions tightened somewhat in parts of the world as US monetary policy continued to normalise until late 2018 and the US dollar strengthened. While holding up remarkably well by past standards, emerging market economies (EMEs) came under some pressure, given the heavy reliance of their firms on dollar financing. Finally, in several advanced small open economies and a number of EMEs, financial cycles – best captured by the joint behaviour of credit and property prices – appeared to shift from expansion to contraction, weighing down on expenditures.

The slowdown would have been sharper without resilience elsewhere that served to buffer weakness from manufacturing and trade. One supporting factor was the continued strength of labour markets, accompanied by a modest pickup in wage growth. Employment expanded further, pushing unemployment rates to multi-decade lows in several economies. Other than in economies where the housing market began to falter, consumption was thus a relative strength. Another factor, at work in some of the large economies at the heart of the Great Financial Crisis (GFC), was the financial cycle upswings, most notably in the United States. In those cases, the post-crisis household deleveraging provided room for the corporate sector to re-leverage, to the point of creating some vulnerabilities (see below).

At the time of writing (late May), financial markets have become jittery again, especially owing to an intensification of trade tensions. Nevertheless, consensus forecasts, while noting downside risks, continue to see a global economy in a soft patch. The forces supporting the expansion are expected to prevail.

What, then, about the outlook and risks beyond the next few quarters? In order to assess how the global economy might evolve over that horizon, it is useful to identify the more systematic forces at work behind the business fluctuations we have been seeing more generally – forces which were in evidence in the period under review. These deeper forces can influence business fluctuations either directly or indirectly, by affecting policy. After considering these forces, we evaluate possible risks to the outlook before turning to policy considerations.

The longer-term forces at work

Four such key forces have arguably been at work, providing the backdrop for recent developments.

The first force is the inflation process, which has been pivotal in determining the monetary policy stance. Inflation has remained very subdued despite many economies operating close to, or above, standard estimates of economic potential and with record low unemployment. Much ink has been spilt over this surprising development. Some, like us, have for a long time stressed globalisation and technological advances. In addition, demographics-induced changes in the labour force may have led to underestimates of economic slack. What is clear is that labour has been struggling to regain the bargaining power lost over the past decades. And while wages have finally been responding more clearly to tighter labour markets, firms have shown little sign of reacquiring pricing power. For instance, even as wages have been rising faster than productivity in many countries, prices have not kept up.

Less appreciated is the fact that ever since inflation has been low and stable, starting some three decades ago, the nature of business fluctuations has changed. Until then, it was sharply rising inflation, and the subsequent monetary policy tightening, that ushered in downturns. Since then, financial expansions and contractions have played a more prominent role.

Which brings us to the second force: finance and its role in the economy. The GFC was just the most spectacular instance of this role. This justifies the greater attention policymakers now pay to financial markets, credit developments and real estate prices. Moreover, in a financially highly integrated world, capital flows across borders hold sway. And smaller economies are generally at the receiving end; hence the high sensitivity of EMEs to global financial conditions.

The third force is productivity growth, or rather the lack thereof. Growth accelerations of the type experienced in 2017 could only lead to sustained growth at a new, higher pace if a level shift in productivity growth takes place. Productivity growth has been on a marked downward trend in advanced economies as a group for a long time. And the slowdown became more marked following the GFC. The impaired financial system is likely to have played a role in impeding the allocation of resources to their best use. And it is surely no coincidence that trade has lagged behind output and that investment has been correspondingly weak. Whatever the actual reasons, lower productivity growth is constraining sustainable expansions, at least in the advanced economies, where the frontier for the rest of the world is set.

The fourth force, of more recent vintage, is the political and social backlash against the open international economic order that has grabbed all the news

headlines recently. The trade and political tensions in the period under review are just the most glaring manifestation. By no means all of the recent slowdown can be ascribed to trade conflicts and protectionism – the slowdown in trade and productivity predates the retreat into protectionism in the last two years. However, the sound and the fury of trade conflict and the associated uncertainty have imparted a downward twist to the slowdown. Nor should we take the longer-term challenges lightly. From a historical perspective, it is not unusual to see such surges of sentiment in the wake of major economic shockwaves: the Great Depression marked the end of the previous globalisation era. It is too early to tell how this surge will evolve; but it will clearly be a force to contend with in the years to come.

From the short-term to the medium-term outlook

If the four listed above are the deeper forces at work, then they should hold clues to charting the future. Of these forces, political factors, in particular those related to trade policies, will continue to cast a long if unpredictable shadow over the world economy. In addition, the factors underlying productivity growth are slow-moving, providing the backdrop to business fluctuations. Therefore, perhaps the forces that can be explored in more depth are finance and the inflation process. And as one would expect of this institution, we focus on assessing possible financial vulnerabilities and how they might play out under different conditions – our comparative advantage.

It has been a long journey since the GFC for the global financial system. Yet the imprint of the crisis is still discernible in how financial developments will be influencing the evolution of the economy in the years ahead.

In many of the countries less affected by the GFC, financial expansions have reached an inflexion point. As a group, these economies account for around one third of global GDP. Private sector credit growth has slowed relative to GDP and, in a number of cases, property prices have started to fall. After the strong credit expansion, these countries are now saddled with historically high household debt levels, and some with high corporate debt as well. A specific feature of EMEs has been the rapid growth of FX debt, mostly in the corporate sector – although it has not quite reached previous peaks in relation to GDP. Size-wise, the only systemic economy in this group is China, where the authorities are engaged in the delicate balance of deleveraging the economy without slowing down growth, adapting policy as circumstances, including the trade tensions, evolve. If past experience is anything to go by, the contraction phase of the financial cycles in this group of countries is likely to continue, acting as a drag on growth.

Countries that were at the heart of the GFC, such as the United States and a number of European economies, have tended to see marked differences at the sectoral level. Household debt in relation to incomes has declined after a long phase of balance sheet repair and is on a stronger footing. By contrast, the corporate sector in some countries has shown clear signs of overheating. In these, the overall financial expansion will remain a source of strength for the economy for now.

Perhaps the most visible symptom of potential overheating is the remarkable growth of the leveraged loan market, which has reached some $3 trillion. While firms in the United States – and, to a lesser extent, the United Kingdom – have accounted for the bulk of the issuance, holdings are spread out more widely. For quite some time, credit standards have been deteriorating, supported by buoyant demand as investors have searched for yield. Structured products such as

collateralised loan obligations (CLOs) have surged – reminiscent of the steep rise in collateralised debt obligations that amplified the subprime crisis. Should the leveraged loan sector deteriorate, the economic impact would depend on the potential amplification mechanisms. These can run right through the banking system, linked to unstable wholesale funding, and other parts of the financial system that hold leveraged loans and CLOs, via price adjustments. The probability of these factors taking effect is best assessed against the backdrop of the longer-term deterioration in credit quality of the corporate sector in some advanced economies, visible in the concentration of the outstanding stock of securities in the triple-B segment – just above non-investment grade ("junk" status).

The condition of the banking sector is, in some respects, paradoxical. Country differences aside, it is much better capitalised thanks to the post-crisis regulatory reforms. However, asset growth among the major banks has slowed sharply since the GFC. Book equity growth has been similarly lacklustre. The slow growth of book equity reflects, in part, banks' chronically low profitability, particularly in many euro area countries. This matters. Profits are the first line of defence against losses and, as by far the primary source of capital, they are the foundation for banks' ability to lend and support the economy. Some of the reasons for low profitability can be traced to legacies from the GFC and the macroeconomic environment, most notably persistently and unusually low nominal interest rates. Others reflect more structural factors, especially excess capacity in a number of key banking systems.

Looking ahead, a looming competitive threat to banks comes in the form of the big techs. In this Annual Economic Report, we devote a special chapter to these huge companies that have started making inroads in financial services, leveraging the vast customer bases they have secured through their activities (eg social media, e-commerce and search engines). Payments, retail lending, asset management and even insurance have already seen deep incursions by these behemoths, whose market capitalisation far exceeds that of banks. Drawing on their unique combination of vast amounts of data, the power of networks and their diversified activities (their "DNA"), these companies have the potential to make further thrusts into financial services and bring about large efficiency gains. They represent a wake-up call for banks, which need to raise their game in order to compete effectively. But at the same time, the presence of big techs is giving rise to major policy issues (see below).

The overall landscape is one of a global economy that has been unable to jettison its debt-dependent growth model. Indeed, aggregate debt (public plus private) in relation to GDP, while it plateaued in the past year, is much higher than pre-crisis. At the same time, interest rates – nominal and real – remain historically low, even as economies hover around estimates of potential. And financial conditions in advanced economies, notably in the largest among them, remain accommodative from a longer-term perspective. As a result, should the global economy slow down at some point, it is hard not to imagine that the debt burden would increase further.

Against this backdrop, the evolution of inflation plays a key role. Should inflation start to rise significantly at some point, it would induce central banks to tighten more. This could cause tensions in financial markets and put heavily indebted borrowers – private and public – under pressure. Should inflation remain subdued and below central banks' objectives, despite their forceful attempts to push it up, current economic conditions could continue. But this would also extend risk-taking, increasing vulnerabilities.

Policymakers can successfully negotiate this terrain. But as the pause in the monetary policy normalisation process indicates, the narrow path we described last year has proved to be a winding one.

Policy considerations

A number of policy implications flow from this diagnosis. For clearer skies to appear, the policy mix needs to be rebalanced. Higher sustainable growth can only be achieved by reducing the reliance on debt and reinvigorating productive strength. In the process, this would relieve some of the burden monetary policy has been bearing since the GFC and avoid the expectation that this policy can be the engine for sustainable growth. Its more appropriate role is that of a backstop, given that its main focus is delivering price stability while supporting financial stability.

Indeed, since the GFC, monetary policy has found itself in a complex position. After fighting the fires of the crisis, it took over – successfully – much of the burden of supporting the recovery. But given the persistence of economic weakness and, even later on, an inflation rate stubbornly below objectives, interest rates have been kept unusually low for unusually long, and central bank balance sheets have ballooned. As a result, the room for policy manoeuvre has narrowed considerably. Moreover, the very low rates, which prevail even as economies are hovering around potential, have contributed, in part, to some of the financial vulnerabilities we now see.

As we discuss in more detail in the body of the Report, this points to the possibility of some delicate intertemporal trade-offs. Depending on circumstances, it is possible that actions that yield clear benefits in the near term may risk generating costs in the longer term. One such example is the relationship between low interest rates and short-term economic activity, on the one hand, and risk-taking and debt accumulation over the longer run, on the other. Another is the high sensitivity of financial markets to policy tightening once they have grown dependent on prolonged monetary policy accommodation. In turn, both of these factors can potentially reduce the future room for manoeuvre and complicate normalisation. Central banks are fully aware of these delicate and complex trade-offs. Central banks and other authorities have implemented policies to reduce the possibility of adverse future outcomes. Notably, they have adopted far-reaching financial sector reforms. So far, adverse outcomes have been avoided, but this does not give licence for complacency, including with regard to monetary policy.

EME central banks have been contending for some time with a complex environment, which is why we devote a special chapter to the evolution of monetary policy frameworks in the emerging world. The specific challenge in this instance results from the high sensitivity of these economies to global financial conditions: waves of capital flows and exchange rate pressures can put a strain on these countries' balance sheets. As a result, much as when a number of advanced small open economies pioneered inflation targeting, monetary policy practice in EMEs has moved ahead of theory. Rather than strictly sticking to inflation targeting with freely floating exchange rates, the vast majority have combined it to varying degrees with foreign exchange intervention. And all of them have complemented it with the active use of macroprudential measures. That way, they have gained a measure of freedom to better reconcile price and financial stability over the medium term. Questions remain about how to deploy and coordinate the various instruments, adapting them to country-specific circumstances and avoiding some of the pitfalls involved. At a more structural level, the key challenge is to develop domestic financial systems so as to reduce the sensitivity to global financial conditions in the first place.

The experience of EMEs showcases one way to achieve a more balanced policy mix. This is having a strong prudential framework, with respect to both micro- and macroprudential dimensions: dealing with individual institutions and the financial system as a whole, respectively. With primary reference to the microprudential

dimension: now that most of the post-crisis financial reforms are in place, the key challenge is their full, timely and consistent implementation. In the process, regulators and supervisors should resist unwarranted pressures to backslide and weaken standards. Just as there is a business cycle and a financial cycle, there is also a regulatory cycle. As the memories of the GFC fade, those pressures will intensify. As regards the macroprudential dimension, a lot has been done to put in place full-fledged frameworks and to deploy and activate the tools. As discussed in detail in last year's Report, this is a very welcome development.

Appropriate fiscal policies can also help achieve a more balanced policy mix. In countries where sustainability is in danger, the objective should be to bring public finances under control, to avoid fiscal dominance and limit risks to the financial system. But where fiscal space is available, it should be used judiciously to boost sustainable growth and, if the need arises, to support aggregate demand. Suitable measures include, in particular, making the tax system and expenditures more growth-friendly, not least through well chosen infrastructural investments where productive opportunities exist. Reducing the bias of the tax system in favour of debt is an obvious example. In doing all this, it is important to avoid the trap of carrying out procyclical policies. One reason why public sector debt-to-GDP ratios have been increasing at the global level is precisely the asymmetrical use of fiscal policy, increasing deficits during contractions but failing to consolidate during expansions. Hence the reduced room for policy manoeuvre compared with pre-crisis.

But the most important set of policies is structural. Hard as it is politically, it is essential to revive the flagging efforts to implement policies designed to boost growth. We have already discussed in previous Reports what those policies could look like. In this year's Report, the analysis of the regulatory response to big techs' inroads in finance offers rich material to examine more closely and concretely some of the challenges involved. The objective is to ensure that one can reap the potentially large benefits that such technological innovations can bring about while managing the potential risks. This requires tackling delicate issues that range from financial stability to competition and data privacy. At the core of this triangle is the treatment of data, which the digital revolution has brought to the fore. Ensuring a level playing field that promotes competition under an adequate regulatory umbrella is key. Whatever the precise answer, it will require more than ever the close cooperation of different authorities, both nationally and internationally.

The skies are not clear yet. The path is narrow and winding. But the means to negotiate it exist. They should be deployed.

I. No clear skies yet

Key takeaways

- *Although global growth appears to have hit a soft patch late last year, the resilience of services and buoyant labour markets bode well for the near term.*

- *Risks remain on the horizon. Trade and manufacturing may slow further, especially if trade tensions escalate. Deleveraging in some major emerging market economies, weak bank profits in advanced economies and high corporate debt may all act as a drag on growth.*

- *Normalising policy against this backdrop involves potential trade-offs: what is good for today need not necessarily be good for tomorrow. More fundamentally, monetary policy cannot be the engine of growth. A greater role for fiscal, structural and prudential policy would contribute more effectively to sustainable growth.*

Over the past 12 months, the global economy slowed down. After a robust upturn that pushed global growth well above potential in 2017, growth was set to moderate somewhat. As the year progressed, however, the slowdown exceeded expectations. In late 2018, world trade growth weakened substantially and financial markets dived. In response, the Federal Reserve and other major central banks put the very gradual and anticipated tightening of monetary policy on pause. Financial markets quickly rebounded and were supported by subsequent signs that economic activity had firmed. The outlook, though, remained uncertain as a further escalation of trade tensions unnerved financial markets in May.

The signs of resilience augur well for the near-term outlook. Services have held up better than manufacturing and trade, while employment growth and solid wage increases have underpinned consumption. Moreover, except in some, relatively small economies, credit and financial conditions are still acting as tailwinds for economic activity. Yet significant near-term risks remain. Notably, the trade and political uncertainty that contributed to the global slowdown over the past year can flare up again. And China's much needed deleveraging could resume, again causing its economy to slow with global implications. Looking further ahead, high levels of private and public debt in many economies represent a macroeconomic vulnerability.

The room for policy manoeuvre to address these risks has narrowed since the Great Financial Crisis (GFC) of 2007–09, and regaining it has proved harder than originally thought. One example is monetary policy. After shoring up the economy during the GFC, with other policies taking a back seat, central banks were instrumental in supporting the subsequent recovery. While central banks succeeded, an inflation rate stubbornly below objectives even with economies seemingly operating close to potential has made it harder to proceed along the normalisation path. In addition, after the prolonged period of plentiful accommodation, financial markets have proved very sensitive to signs of policy tightening while some financial vulnerabilities have emerged. As a result, intertemporal trade-offs have come to the fore. The continuation of easy monetary conditions can support the economy, but make normalisation more difficult, in particular through the impact on debt and the financial system. The narrow normalisation path has become narrower.

To ensure sustainable growth, a more balanced policy mix is in order. Hard as it is politically, the only way to promote sustainable growth is to redouble efforts to implement structural reforms. These have been lagging in the last few years except for the financial system, where prudential regulation and supervision have been strengthened. Within sensible fiscal frameworks, using resources to boost sagging public investment and making spending and taxation more efficient should also help. And, needless to say, in a global economy tightly knitted together through both the production (global value chains) and financial channels, the reduction of trade tensions would provide a widespread and sustained boost to growth and jobs.

The chapter first describes the key economic and financial developments over the past year. It then discusses the main drivers of growth and financial vulnerabilities. Finally, it elaborates on the difficult challenges monetary policy is facing.

The year under review

The global economy loses momentum

Overall, the past year was a good one for the world economy. Global growth (in purchasing power parity terms) is estimated to have edged down to 3.7% in 2018, from a cyclical high of 3.9% in 2017, slightly below expectations at the start of the review period (Graph I.1, first panel).

Some slowdown was to be expected. Amid continuing very easy financial conditions globally, growth in 2017 had been surprisingly strong and above potential in an unusually large number of countries. Using conventional measures of slack, several economies appeared to carry far more momentum into the future than had been the case in previous business cycle expansions (see Box I.A in last year's Annual Economic Report). Indeed, unemployment rates in several advanced economies had reached multi-decade lows, helping to cement a recovery in private consumption. Fiscal policy had turned expansionary in many countries. And, boosted by above-average business confidence, fixed capital investment had finally accelerated, especially in advanced economies. As a result, global trade and manufacturing output had rebounded sharply from the lows reached in 2016 (Graph I.1, second panel).[1]

As 2018 progressed, however, indications emerged that the slowdown was deeper than private and official forecasters had projected. New export orders continued to decline, and world trade growth came to a sudden stop towards year-end. Capital goods investment disappointed, especially in Europe, China and other Asian emerging market economies (EMEs). Purchasing managers' indices (PMIs) for manufacturing moved lower – even pointing to a contraction in several economies in early 2019 (Graph I.1, third panel). Consumption also slowed, but generally proved considerably more resilient, helping to support services. In the second quarter, there were some signs that activity had firmed somewhat in advanced economies and that fiscal easing and other measures put in place by China's authorities had started to bear fruit. Unfortunately, at the time of writing (end of May), sentiment was again hit by renewed trade tensions.

The timing and extent of the slowdown differed across major economies and regions. In the United States, growth actually rose for 2018 as a whole, to an estimated 2.9%, from 2.2% in 2017, not least owing to a strong tax-driven procyclical fiscal expansion. It then weakened slightly towards year-end, broadly in line with projections. In China, growth is estimated to have edged down from 6.7% in 2017 to 6.6% in 2018. This outturn went hand in hand with a large unexpected

Global slowdown deeper than expected

Graph I.1

GDP growth relative to expectations[1]	World trade	Broad decline in manufacturing PMIs	GDP growth and potential[1]

Legend (first panel): 2018[2] ◆ 2019[3]

Legend (second panel): — Global trade growth (lhs)[4] — New export orders, global PMI (rhs)[5]

Legend (third panel): — US dollar index (lhs)[6] PMIs (rhs):[5] — US — AEs excl US[7] — EMEs[7]

Legend (fourth panel): ○ 2017 ● 2018 ◆ 2019[8] — Potential[9]

[1] For regions, weighted averages based on GDP and PPP exchange rates. For GDP growth in IN, based on fiscal years (starting in April). [2] Actual growth less forecasts made in May 2018. [3] Forecasts made in May 2019 less those made in May 2018. [4] Three-month moving average of the simple average of volume indices for merchandise exports and imports; year-on-year changes, seasonally adjusted. [5] Based on manufacturing PMI. A value of 50 indicates that the number of firms reporting business expansion and contraction is equal; a value above 50 indicates expansion of economic activity. [6] Federal Reserve Board trade-weighted nominal dollar index, other important trading partners; year-on-year changes. [7] Weighted averages based on GDP and PPP exchange rates. For HK, SA and SG, based on PMIs for the whole economy. [8] Forecasts made in May 2019. [9] Potential GDP growth proxied by Consensus GDP growth forecasts for six to 10 years; if not available, five-year-ahead IMF WEO forecasts.

Sources: Federal Reserve Bank of St Louis (FRED); IMF, *World Economic Outlook*; Consensus Economics; CPB Netherlands Bureau for Economic Policy Analysis; Datastream; IHS Markit; national data; BIS calculations.

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drop in fixed investment and a sizeable contraction in import growth. Given the size of Chinese imports, these developments made a noticeable contribution to the drop in world trade and growth.

The slowdown was deeper in the euro area, Japan and most EMEs than elsewhere (Graph I.1, first and fourth panels). In the euro area, growth is estimated to have fallen to 1.8% in 2018, around half a percentage point below the forecast at the start of the review period, but still above potential. While the drops in world trade and exports were a major force, a variety of country-specific factors weighed on domestic demand. In Japan, declining exports and natural disasters pushed growth down to 0.8%, despite the partial offset of stronger than expected investment.

Driven by slumping exports and lower investment, growth in EMEs outside China also disappointed (Graph I.1, first panel). As the dollar reversed course and started appreciating in early 2018, financial conditions tightened somewhat in EMEs – a development that may have further weakened manufacturing activity and trade (third panel). The sharpest tightening occurred in the most vulnerable EMEs, typically those with larger current account deficits and greater reliance on foreign funding. Turkey and Argentina suffered a currency crisis and sharp output contractions. Yet contagion to other EMEs remained limited.

As the outlook deteriorated and uncertainty rose, growth projections were marked down significantly, pushing them closer to or slightly below estimates of

potential (Graph I.1, fourth panel). Global growth was expected to slow to 3.4% in 2019, half a percentage point lower than forecast at the start of the review period. The largest revision concerned EMEs excluding China. Elsewhere, including the United States and China, revisions were smaller (first panel). Most revisions, even small ones, were accompanied by statements highlighting an unusual concentration of downside risks.

Financial markets go through large swings

As global trade growth slowed and downside risks grew, equity and corporate bond markets experienced sharp losses, initially in October and then again in December. Until then, financial conditions in the United States had remained easy by historical standards, notably as reflected in a long rally in the stock market and narrowing risk spreads against the backdrop of unusually low interest rates (Graph I.2). This had occurred despite the continued tightening by the Federal Reserve. By contrast, in the first half of 2018, financial conditions had actually tightened in EMEs (first panel).

The causes of the market slump, while not entirely clear, can be traced to a number of factors. Evidence based on stock returns indicates that earnings expectations fell while uncertainty surrounding them rose substantially; and that the future course of monetary policy and high corporate debt may also have played a role (see Box I.A for further details). In the euro area, the deterioration of the growth outlook was more evident, and so was its adverse impact on an already fragile banking sector. Price-to-book ratios fell further from already depressed levels, reflecting increasing concerns about banks' health (Graph I.2, fourth panel).

Financial conditions undergo large shifts   Graph I.2
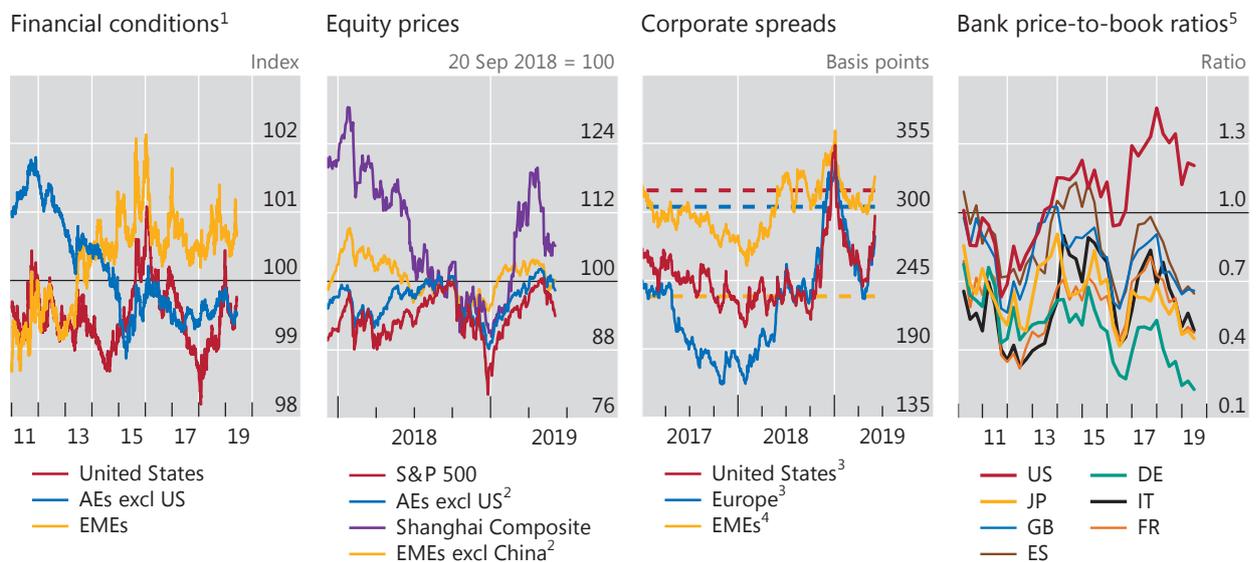
The dashed lines in the third panel indicate simple averages over the period 2002–06.

[1] Goldman Sachs Financial Conditions Index. 100 indicates country-specific long-term averages; each unit above (below) 100 denotes financial conditions that are one standard deviation tighter (looser) than the average. Weighted averages based on GDP and PPP exchange rates for eight AEs and 16 EMEs.   [2] Simple average across country stock indices in local currency terms.   [3] Simple average between investment grade and high-yield option-adjusted spreads.   [4] JPMorgan CEMBI index; stripped spread.   [5] Asset-weighted averages.

Sources: IMF, *World Economic Outlook*; Bloomberg; Datastream; Datastream Worldscope; Goldman Sachs; ICE BofAML indices; JPMorgan Chase; BIS calculations.

Monetary policy eases around year-end amid subdued inflation

In per cent
Graph I.3

China	Forward rates[3]	Policy rates[4]	Inflation[5]

Reserve requirement ratio (lhs)[1]
Seven-day repo rate (rhs)[2]

Lhs: / Rhs:
US / EA / JP
- - - / - - - / - - - 19 Jun 2018
——— / ——— / ——— 31 May 2019

AEs
Asian EMEs excl CN
Latin America excl AR

Headline: Core:
AEs ....
EMEs ....
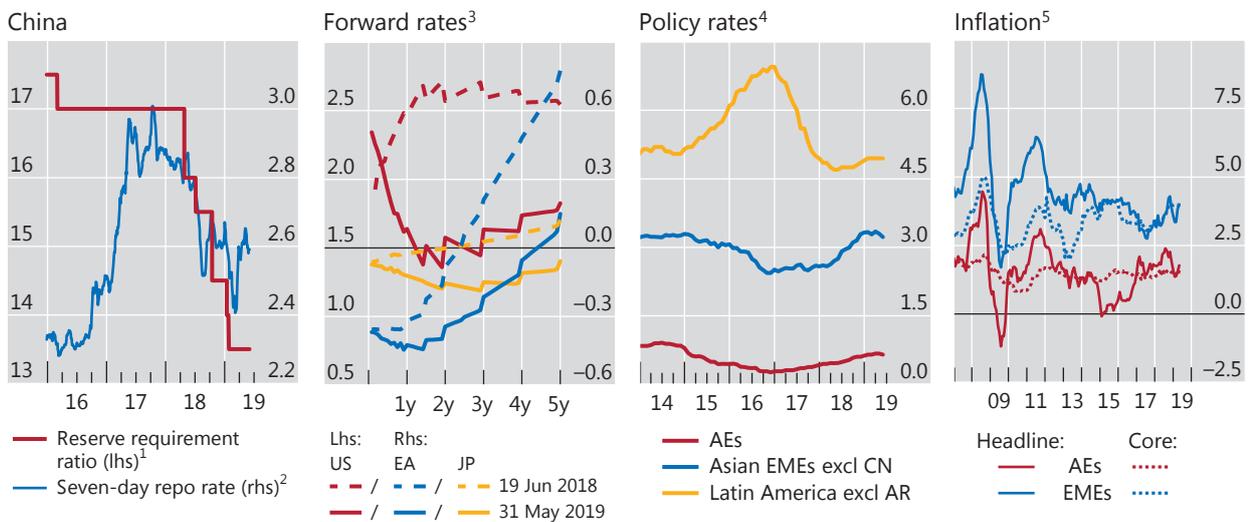
[1] For large banks. [2] Twenty-two-day moving average of the interbank bond collateral repo rate (depository institutions, weighted average). [3] Based on one-month US dollar, euro and yen overnight index swap (OIS) forward rates. [4] Simple average across country policy rates. [5] Weighted averages based on GDP and PPP exchange rates, year-on-year changes. Definitions vary across countries. For JP, adjusted for the consumption tax hike.

Sources: IMF, *World Economic Outlook*; Bloomberg; CEIC; Datastream; Wind; national data; BIS policy rate statistics; BIS calculations.

Major central banks reacted to a deteriorating outlook and tighter financial conditions by easing their stance. The People's Bank of China moved first by cutting reserve requirements several times as of mid-2018 (Graph I.3, first panel) and introducing measures to help banks refinance and support small and medium-sized enterprises (SMEs). After hiking the policy rate three times from March and having its balance sheet run off at a predetermined pace, the Federal Reserve eventually moved late in the year, signalling that its tightening cycle was nearer the end than previously expected. Initially, in December, it gave indications about the policy rate and, following the sharp tightening of financial conditions, about its balance sheet in January and finally March. The ECB announced in March 2019 that it would keep reference rates unchanged at least until the end of the year – a six-month extension – and that it would renew its long-term refinancing operations (LTROs) for banks, albeit on potentially less generous terms than previously. The Bank of Japan further eased its very accommodative stance. In response to these shifts in monetary policy, forward interest rates in major economies moved down (Graph I.3, second panel).

Several other economies also adopted a more accommodative stance. As external conditions weakened, central banks in advanced small open economies and EMEs put planned policy rate increases on hold or even cut rates (Graph I.3, third panel).

Monetary policy easing was facilitated by the rather surprising continued absence of significant inflationary pressures in most economies. As oil prices fell from mid-2018 to early 2019, headline inflation in both advanced and emerging market economies declined towards core inflation. In advanced economies, core inflation continued to hover at or below inflation targets (Graph I.3, fourth panel). Its stability partly reflected the persistent lack of strong unit labour cost pressures: tighter labour markets did boost real wage growth, but this hardly exceeded

Box I.A

What drove US financial market volatility in late 2018?

In October and, after a brief respite, again in December 2018, US equity prices fell sharply and corporate bond spreads decompressed. Moreover, corporate issuance declined and bond and loan funds experienced outflows, unusually large ones in December. What were the causes of market volatility? Were external developments more important than domestic ones? How important were expectations of monetary policy? To answer these questions, the analysis in this box follows three distinct approaches: it compares the dynamics of US equity valuations with those of its possible drivers; it examines differences in stock returns on firms with high exposures to major countries to illustrate the importance of global connections; and it evaluates whether the co-movement between stock returns and either growth expectations or funding costs was unusually high in January, especially for riskier and more leveraged firms.

The decline in the US stock market in October and December can be traced primarily to a downgrade in growth expectations and a rise in earnings uncertainty (Graph I.A, left-hand panel).[①] The fall in US growth expectations was particularly large by historical standards in October. The rise in earnings uncertainty was also sizeable, especially in December. Expectations of further monetary policy tightening played a key role late in the year, but had a more limited impact on stocks in October, as suggested by the muted response of equity prices to policy announcements. For example, on 3 October when, in addition to positive macroeconomic data releases, the

Drivers of financial market valuations in late 2018 and early 2019

Graph I.A

Drivers of valuations in October and December[1]
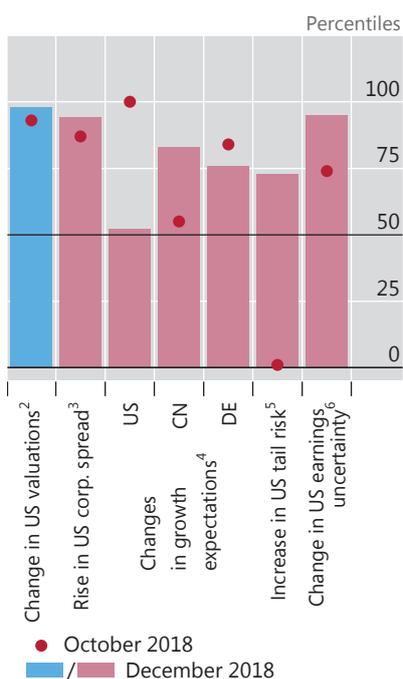
Impact of international exposures on equity returns

Relevance of growth expectations and funding costs in January[8]

Extra return for:[7]
— US stocks exposed to Germany
— US stocks exposed to China
-- German stocks exposed to China

Change in sensitivity to:
▪ Funding costs[9]   ▪ Growth spread[10]

● October 2018
▪/▪ December 2018
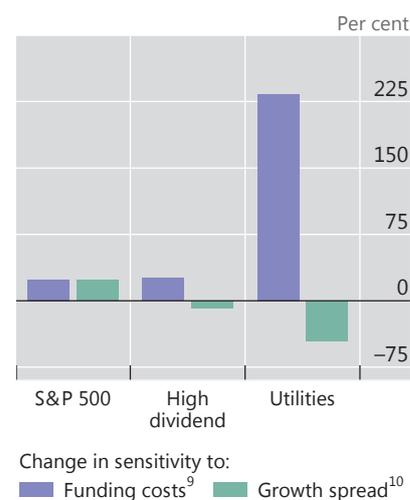
[1] Relative to a distribution of monthly changes starting in 2005.   [2] Shiller US CAPE ratio; inverted scale.   [3] Simple average of US high-yield and investment grade corporate bond index option-adjusted spreads.   [4] Country-level growth expectations are the difference in returns between Growth and Consumer Staples indices; inverted scale.   [5] Chicago Board Options Exchange Skew index.   [6] Earnings uncertainty is based on the standard deviation of earnings-per-share estimates divided by the average estimate for the S&P 500 index.   [7] Extra return is the difference between returns on stocks with high exposure to the country indicated (top 10%) and other stocks in the index (S&P 500 for the US and HDAX for DE), with sensitivities calculated with regressions.   [8] Sensitivities are regression coefficients of daily returns on growth spread and on funding costs. The bars show the coefficient changes in January 2019 relative to the January 2016–September 2018 average. Returns are on the Vanguard S&P 500 ETF, on the Vanguard High Dividend Yield ETF and on the Vanguard Utilities ETF.   [9] Average return on Vanguard Intermediate Term Corporate Bond ETF and on the Vanguard High Yield Corporate Fund, minus the return on the Vanguard Intermediate Term Treasury ETF.   [10] Difference in returns between Vanguard Growth ETF and Vanguard Consumer Staples ETF.

Sources: Barclays; Bloomberg; Datastream; ICE BofAML indices; BIS calculations.

Fed signalled that policy rates were still some distance away from a neutral level, 10-year sovereign yields rose by 10 basis points on the day but equity prices did not budge.

The weakening global economy and its potential impact on US growth seem to have been a key factor behind declining growth expectations and rising earnings uncertainty. Indeed, firms with large direct and indirect exposures to China lost more than their peers (Graph I.A, centre panel). Indirect links appear to have been particularly important: US firms exposed to Germany lost about the same as German firms exposed to China. Concerns about Germany were, in turn, likely to have been amplified by weakness in other German export markets, including Turkey. Coinciding with persistent growth risks overseas, the rise in US earnings uncertainty in December was quite large relative to historical patterns (left-hand panel).

In addition, concerns intensified that monetary policy might be insufficiently flexible in responding to the deteriorating corporate and growth outlook. Bond spreads for US high-yield companies rose much more in December than in October (roughly 100 versus 60 basis points), with outflows from bond and loan funds and a sizeable rise in overall spreads by historical standards (Graph I.A, bars in left-hand panel). Moreover, a measure of tail risk for US equities advanced quickly in the week leading to the December Federal Open Market Committee meeting, before retreating shortly afterwards. This contrasts with muted equity tail risks in October, when actual volatility rose (dots in left-hand panel). At the same time, unease about the economic outlook rose in December, as reflected in the elevated volatility of growth-sensitive equities prior to important macroeconomic data announcements.[2]

The rally in risky assets in early 2019, after the shift in US monetary policy outlook, seems to have owed to both improved growth expectations and lower funding costs. The response of the broader stock market to these factors was roughly in line with historical patterns (Graph I.A, right-hand panel). However, for utilities firms, which tend to be highly leveraged, lower funding costs proved the key driver of returns. By the end of May, the S&P was 6% short of its mid-September 2018 peak, and corporate spreads had retraced about one third of their increase between early October and end-2018.

[1] Growth expectations are measured as the difference between returns on stocks whose value responds more strongly to the economic outlook (growth stocks), eg electronics, and returns on stocks that remain more stable through the business cycle (consumer staple stocks), eg household goods. Similarly, country-specific growth expectations are measured with the return difference between growth and consumer staple stock indices that include local companies.   [2] The two measures quantify risk in different ways. The Chicago Board Options Exchange Skew index uses prices of options on the S&P 500 that insure against tail risk. Preannouncement volatility reflects uncertainty about the economic data that are about to be released. When economic uncertainty is high, stocks more sensitive to the economic outlook (growth stocks) tend to be relatively more volatile before macroeconomic announcements.

productivity growth. Moreover, firms appear to have absorbed increases in unit labour costs by accepting smaller profit margins or by cutting other costs (see Box I.B for further details).

Following the easier policy stance, financial markets rebounded in early 2019. Stock markets initially recouped most of their previous losses, but retreated somewhat in May as trade tensions again intensified (Graph I.2). On the back of lower expected policy rates, yield curves continued to flatten in major economies (Graph I.4, first panel). Investment grade corporate spreads, especially in the United States, narrowed closer to pre-crisis benchmarks. And after end-2018, high-yield spreads dropped again below pre-crisis averages. Following an initial depreciation around the turn of the year, the US dollar strengthened, approaching levels prevailing in early 2017 (second panel). In EMEs, foreign currency spreads fell to levels seen in mid-2018 (third panel) and capital flows briefly resumed (fourth panel).

At the time of writing (end of May), financial markets were jittery about escalating trade and geopolitical tensions. With investors' risk appetite diminishing, yield curves in advanced economies flattened further at the end of May and portfolio flows into EMEs again showed signs of weakening. That said, looking through short-term market volatility, financial conditions remained easy by historical standards, especially in the United States and other advanced economies.

Financial markets rebound in early 2019

Graph I.4

Term spread[1]	USD exchange rates[2]	EME spreads[4]	Flows into EME portfolio funds[5]
Basis points	2 Jan 2017 = 100	Basis points	USD bn

United States — Germany — Japan

EUR — EMEs[3] — JPY

Local currency — Foreign currency

Bond — Equity
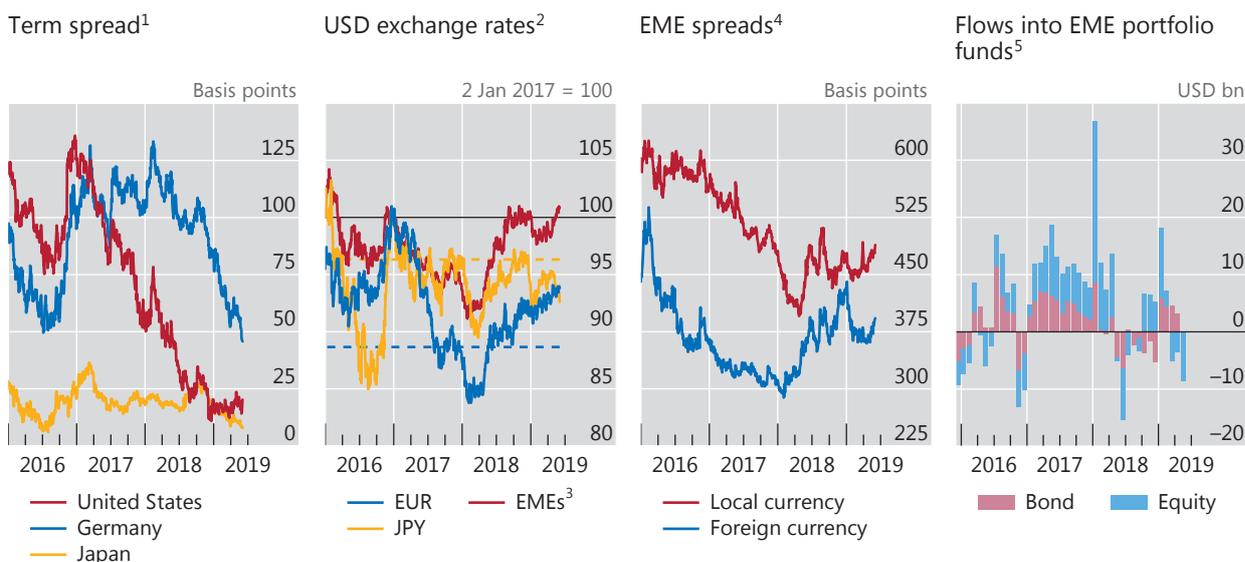
The dashed lines in the second panel indicate simple averages since 1987 (JPY) and 1999 (EUR).

[1] Difference between 10-year and two-year government bond yields. [2] An increase indicates an appreciation against the cited currency. [3] Simple average across EMEs, excluding AR, TR and TW. [4] For local currency, JPMorgan Government Bond Index-Emerging Markets (GBI-EM), spread over five-year US Treasury securities; for foreign currency, JPMorgan Emerging Markets Bond Index (EMBI) Global, stripped spread. [5] Monthly sums of weekly data across major EMEs up to 29 May 2019. Data cover net portfolio flows (adjusted for exchange rate changes) to dedicated funds for individual EMEs and to EME funds with country/regional decomposition.

Sources: Bloomberg; EPFR; JPMorgan Chase; national data; BIS calculations.

Drivers of growth

Recent developments raise several important questions. Why did growth slow more than expected? What forces were at work? How likely is it that growth could slow further? Answering these questions is inevitably hard.[2] Even so, it is possible to identify a number of factors that have been at play in the past year and some vulnerabilities that could at some point contribute to a future slowdown.

Outcomes in the year under review appear to have reflected the interaction of contrasting forces. Some forces – which obviously prevailed – slowed the expansion. One such force was growing economic and political uncertainty and downside risks linked primarily to trade tensions and country-specific developments. Another, temporary force was the weakness in the global demand for electronics. Yet, a more important one was Chinese authorities' much needed efforts to contain leverage and to pursue a structural rebalancing of the economy towards consumption-driven growth – efforts whose near-term effects on economic activity were compounded by rising trade-related concerns. Given China's size and tight links with the rest of the world, weakness in that country quickly spread around the globe. Global value chains played a key role, possibly also through a tightening of financial conditions associated with the further appreciation of the dollar – a tightening that no doubt weighed on EMEs more generally. Besides China, some smaller economies that had been less affected by the GFC began to feel the drag of turning financial cycles, but given their size the impact should have had contained global repercussions.

Other forces helped buttress global demand. In particular, the relative resilience of consumption drew strength from buoyant labour markets as employment increased further and wage growth picked up. Moreover, in some of the larger

Box I.B

Why has inflation remained low despite rising wages?

Over the past year, wage growth has finally gained some strength, especially in the United States, Japan and Germany where the cycle is now mature and official unemployment rates close to record lows. Albeit timidly, wage inflation is responding to tighter slack in the economy, suggesting that conventional wage Phillips curves are still a valid benchmark.① That said, current wage inflation has yet to translate into higher consumer price inflation. Why has the transmission been so muted thus far?

The evolution of real wage growth relative to productivity gains holds part of the answer. In the recent years, growth in labour compensation came mostly on the back of productivity gains (Graph I.B, left-hand panel); once these are accounted for, real (inflation-adjusted) compensation per unit of product has hardly increased. Recent developments seem unlikely to reverse this trend. The share of income that accrues to labour has been on a declining path in many countries, reflecting to a large extent a continued erosion of workers' bargaining power.② This phenomenon, which may have contributed to the flattening of the wage Phillips curve, owes to structural factors that are unlikely to change in the near term. First, globalisation and the integration in the global economy of China, India and the former Soviet bloc have increased the effective supply of labour and made labour markets contestable, exposing workers to the threat of production relocation. Second, unionisation has steadily declined, making it more difficult for workers to capture a larger share of productivity gains. Third, technological change continues to shape the demand for labour. Automation of manufacturing processes has enabled firms to substitute labour with capital and may now threaten even "high-quality" blue-collar jobs. Going forward, progress in the application of artificial intelligence, advanced data analytics, cloud computing and other technological advances is likely to also weaken the bargaining power of white-collar workers who have been spared so far. Fourth, a large share of recent job creation has occurred in certain low productivity growth services sectors. This trend may continue in the near term as economies become increasingly service-oriented. Finally, a higher retirement age has led in recent years to an increase in the participation rate of older workers, whose wages are generally less sensitive to slack than those of younger workers.③

Another part of the answer reflects how firms adjust their profit margins or other costs. While strong in the 1970s and 1980s, the correlation between the growth in unit labour costs (ULCs) and contemporaneous and subsequent price inflation has weakened considerably in the most recent period (Graph I.B, centre panel).④ This disconnect is also visible in another well documented finding – the flattening of the price Phillips curve – and

Wages, prices and margins

Graph I.B

Labour compensation has hardly exceeded inflation and productivity[1]
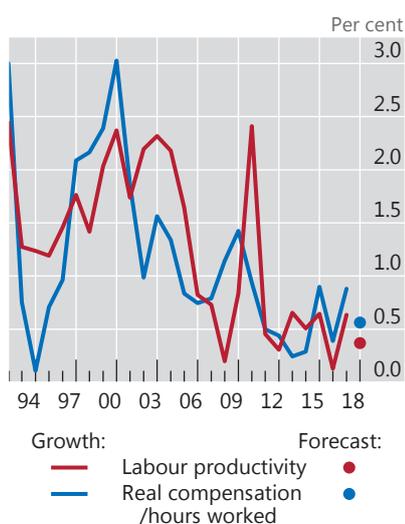
The transmission of ULC to prices has weakened[2]
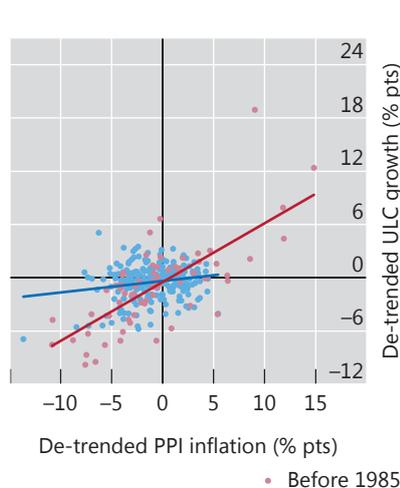
Profit margins do not seem to follow the business cycle[2]

Growth:
— Labour productivity ● (dot)
— Real compensation ● (dot)
  /hours worked

Forecast:

● Before 1985   ● After 1985
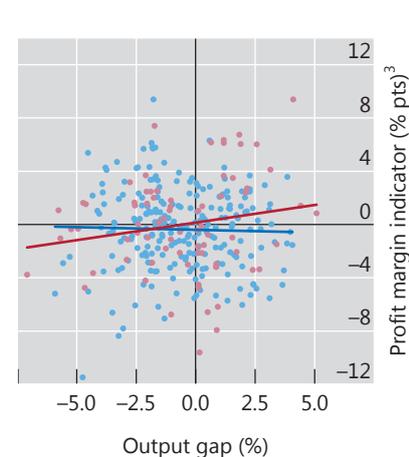
[1] Weighted averages of G7 economies based on GDP and PPP exchange rates; forecasts after 2017.   [2] G7 economies; annual data from 1970 to 2018.   [3] PPI inflation minus unit labour cost (ULC) growth.

Sources: IMF, *World Economic Outlook*; OECD, *Economic Outlook*; Datastream; national data; BIS calculations.

mirrors the increase in the profit share (the counterpart of a lower labour share).⑤ With larger margins, firms should have more room than in the past to absorb fluctuations in ULCs.

However, from a theoretical perspective it is unclear whether profit margins should necessarily decrease in response to demand pressures, hence making the price Phillips curve flatter than its wage counterpart. Indeed, if wages are "stickier" than prices – as it is normally the case – profit margins should increase when demand grows. Yet firms may also decide to reduce their margins in an upswing to gain market share.⑥ For highly indebted firms or firms with difficult access to credit, financial factors may also play a role: in a downturn, such firms may be reluctant to lower prices to avoid losing the cash needed to meet their financial obligations or new spending. This may explain, for example, why inflation fell less than forecast during the GFC.⑦ Similarly in an upswing, firms may take advantage of easy credit conditions to moderate price increases and hence strengthen their customer base. Empirical evidence on the cyclicality of profit margins tends to be inconclusive (Graph I.B, right-hand panel).⑧

Accepting a reduction in margins is not the only way firms may respond to rising ULCs. Firms can alternatively change the quality and composition of their products or cut other costs. For example, in certain sectors such as the retail fashion industry, firms are increasingly using "quantum pricing". They design their products to match a small number of prices. And when production costs change, they may choose to redesign their product lines (eg adjust the quality or composition of their products) rather than changing their quantum prices.⑨ This illustrates how the pricing (and marketing) policies of part of the corporate sector may have become far more complex than what is assumed by mainstream macroeconomic models.

All in all, there remains considerable uncertainty as to when and how far current labour market tightness will translate into price inflation. But it is clear that muted inflation pressures from increasingly tight labour markets are no boon for monetary policy. Weaker cyclical pressures can enable idiosyncratic factors to drag inflation rates below target, which may eventually lead long-term expectations to drift down. Counteracting this would require the continuation or even a further strengthening of the accommodative stance. But this would put a stop to normalisation, preventing the rebuilding of policy space to face the next downturn and potentially raising significant intertemporal trade-offs (see below).

① See eg BIS, *87th Annual Report*, June 2017, Box IV.A.   ② For an overview, see eg BIS, *87th Annual Report*, June 2017, Chapter IV; A Stansbury and L Summers, "Productivity and pay: is the link broken?", *PIIE Working Papers*, no 18-5, June 2018, document that compensation and productivity growth are still connected, although the strength of the relationship may have diminished since the 2000s.   ③ See B Mojon and X Ragot, "Can an ageing workforce explain low inflation?", *BIS Working Papers*, no 776, March 2019.   ④ This result has been well documented in the literature, especially in the United States; see eg E Peneva and J Rudd, "The passthrough of labor costs to price inflation", *Journal of Money, Credit and Banking*, vol 49, no 8, November 2017, pp 1777–1802, and references therein; however, recent results based on euro area data in E Bobieca, M Ciccarelli and I Vansteenkiste, "The link between labor cost and price inflation in the euro area", *ECB Working Papers*, no 2235, February 2019, point in the opposite direction.   ⑤ See eg L Ellis and K Smith, "The global upward trend in the profit share", *BIS Working Papers*, no 231, July 2007; S Barkai, "Declining labor and capital shares", *London Business School Working Papers*, 2017; and S Calligaris, C Criscuolo and L Marcolin, "Mark-ups in the digital era", *OECD Science, Technology and Industry Working Papers*, no 2018/10.   ⑥ This is the "customer market" model described in E Phelps, *Structural slumps: a modern equilibrium theory of unemployment, interest and assets*, Harvard University Press, 1994.   ⑦ See eg S Gilchrist, R Schoenle, J Sim and E Zakrajšek, "Inflation dynamics during the financial crisis", *American Economic Review*, vol 107, no 3, March 2017, pp 785–823.   ⑧ J Rotemberg and M Woodford, "The cyclical behaviour of prices and costs", *Handbook of Macroeconomics*, Chapter 16, 1999, hint at countercyclical markups; by contrast, C Nekarda and V Ramey, "The cyclical behaviour of the price-cost markup", *NBER Working Papers*, no 19099, November 2013, find either procyclical or acyclical markups; C Macallan, S Millard and M Parker, "The cyclicality of mark-ups and profit margins for the United Kingdom: some new evidence", Bank of England, *Working Papers*, no 351, August 2008, also find that the profit margin moves procyclically in the United Kingdom.   ⑨ Not only do quantum prices make prices stickier, but they also have important implications for the computation of consumer price indices and may lead to the mismeasurement of inflation. See D Aparicio and R Rigobon, "Quantum prices", *MIT Working Papers*, forthcoming; and R Rigobon, "What can online prices teach us about exchange rate pass-through and the law of one price?", keynote lecture at the final conference of the BIS Consultative Council for the Americas Research Network on "Exchange rates: key drivers and effects on inflation and trade", August 2018.

economies that had been hard hit by the GFC, the subsequent deleveraging of the household sector meant that, in aggregate, financial cycle expansions remained a source of strength.

These contrasting forces go a long way towards explaining the patterns that characterised the slowdown. The trade-intensive manufacturing sector weakened more than services, investment suffered more than consumption, and the United States held up better than China, the euro area and a number of EMEs.

Looking ahead, the balance of these forces could help sustain the expansion further. Still, some risks remain. The factors that slowed growth have not gone away

and might intensify. And a number of financial vulnerabilities could act as a drag if the economy weakened. These relate primarily to corporate balance sheets, household balance sheets in some of the smaller economies, and weak bank profitability in a number of advanced economies. Underlying several of these vulnerabilities is the continued overdependence of the economic expansion on very accommodative monetary conditions and higher debt, globally, compared with pre-crisis.

Confidence and uncertainty

Over the past year, business and consumer confidence retreated steadily from their cyclical highs (Graph I.5, first panel). Lingering trade tensions, especially between China and the United States, dampened business sentiment, in part due to concerns about a possible escalation of tariff hikes (second panel). In addition to clouding future demand and fixed investment prospects, the trade tensions raised questions about the viability of existing supply chain structures and, more generally, about the future of the global trading system.

But trade tensions were not the only factor sapping confidence. In Europe, fiscal stress in Italy, problems with auto emission testing in Germany, street protests in France and the possibility of a disruptive Brexit also contributed. These factors are likely to have dampened growth expectations and made future growth more uncertain – hence, for instance, the increased dispersion of growth forecasts around the turn of the year (Graph I.5, third panel). A more vulnerable global economy, in turn, increased corporate earnings uncertainty in the United States and other major economies (Box I.A). Existing measures suggest that higher uncertainty and lower

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Confidence falls and economic uncertainty rises   Graph I.5

Business and consumer confidence[1] — US imports from China affected by tariffs[2] — Real GDP growth forecast dispersion[4] — Effect of weaker economic sentiment on investment[5]

- Business confidence
- Consumer confidence

Affected   Unaffected

- Germany (lhs)
- Italy (rhs)

Horizon (quarters)
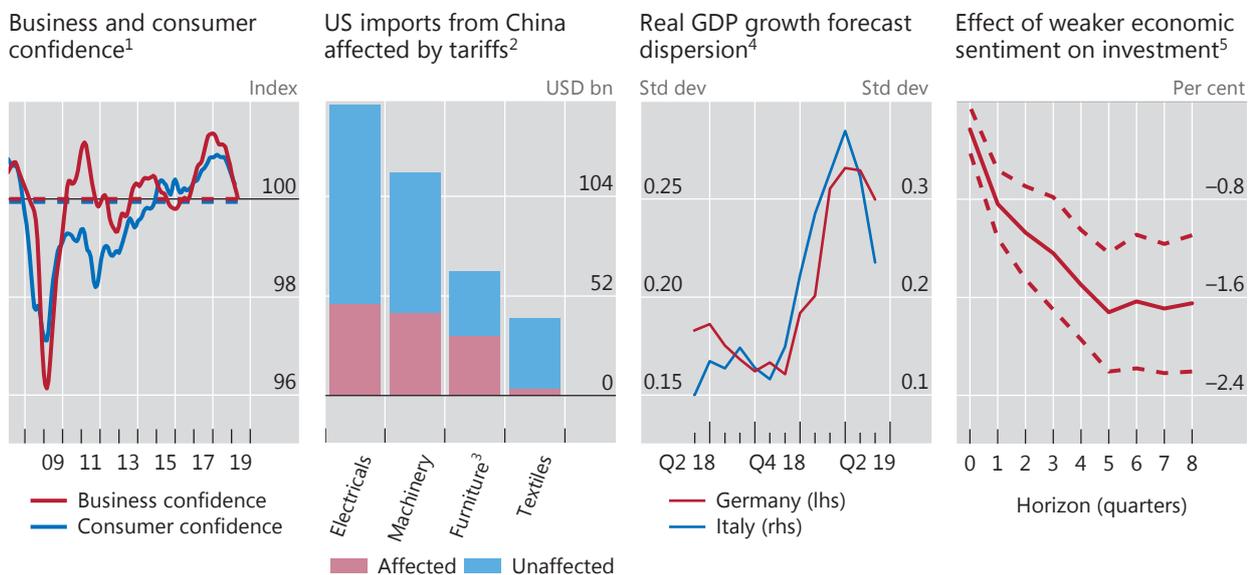
[1] OECD aggregate. 100 = long-term average since 1976; dashed lines indicate average since 2000.   [2] Includes two rounds of tariffs announced in 2018. General customs value of imports in 2018; based on two-digit harmonised tariff schedule (HTS) code. Only the four largest sectors are shown.   [3] Including toys.   [4] Cross-sectional standard deviation of Consensus Economics forecasts of full-year real GDP growth, computed on a monthly basis. The series are weighted averages of current and next-year forecasts, with weights shifting as the year progresses to proxy a 12-month-ahead forecast.   [5] Effect on investment of a deterioration in economic sentiment in quarter zero, by one standard deviation, based on linear regressions for a sample of 13 AEs and EMEs. The measure of sentiment is the first principal component of business confidence (inverse), actual share price volatility and GDP growth forecast disagreement. The dashed lines indicate +/− one standard error.

Sources: OECD; US International Trade Commission; US Trade Representative; Consensus Economics; Datastream; national data; BIS calculations.

business confidence have historically coincided with reduced investment activity (Graph I.5, fourth panel).

China's deleveraging

As the review period confirmed, China continues to face a deleveraging challenge. The authorities are engaged in a delicate, in fact unprecedented, balancing act. They are seeking to ensure a smooth transition to a service-based economy and to reduce the serious macroeconomic risks linked to an outsize financial boom while maintaining overall economic growth on a satisfactory path.

Over the past year, the authorities took further measures designed to restrict shadow banking and, more generally, to deleverage the economy. These measures constrained, in particular, local government spending and the activity of SMEs, which over the past decade had largely relied on shadow banking finance. Partly as a result, SMEs saw their working capital and profitability decline sharply (Box I.C). Policymakers also took further measures to restrict bank lending to highly polluting and excess capacity industries. These decisions, while much needed from a longer-term perspective, no doubt depressed investment and economic activity in the near term, adding to the woes from large debt overhangs. Firm-level data suggest that, beyond a certain threshold, firms that have accumulated more debt tend to be relatively less productive, reflecting past credit misallocation (Graph I.6, left-hand panel). Naturally, trade tensions exacerbated these problems, especially for the export-oriented sectors.

The decline in credit growth to non-financial businesses was offset by a further increase in household and on-budget government debt. As a result, the non-financial sector debt-to-GDP ratio – a measure of leverage – was broadly unchanged (Graph I.6, centre panel). That said, the shift in the composition of debt may, on

Shifting funding of the real economy in China   Graph I.6

Firm labour productivity and leverage[1]

Debt to GDP ratios

Effect of increase in credit on future GDP[2]
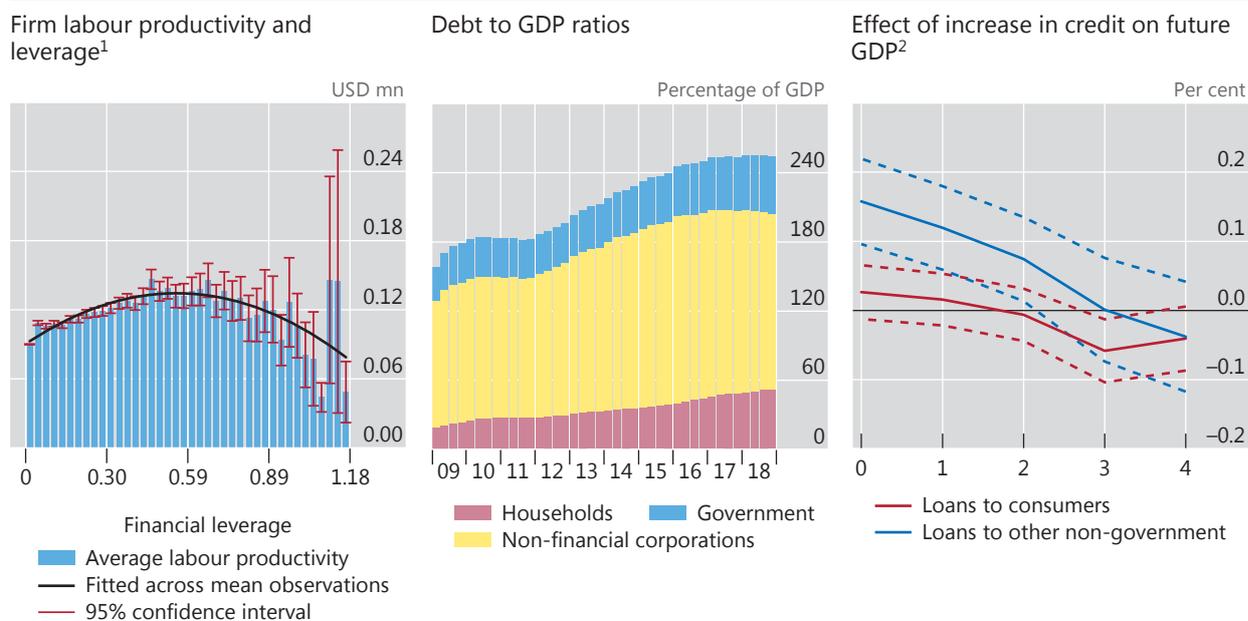
[1] Firm labour productivity as a function of leverage, 2007–15. Labour productivity is calculated as sales per employee and is shown as the average across firms at different levels of financial leverage; financial leverage is calculated as total financial debt scaled by total assets at the end of the previous year.   [2] Change in GDP in the year indicated on the horizontal axis, as a response to a 1% increase in credit in year zero. The dashed lines indicate 95% confidence bands.

Sources: Orbis; national data; BIS total credit statistics; BIS calculations.

Box I.C

Deleveraging and SME financing in China

A key objective of Chinese regulatory authorities has been to reduce corporate leverage and, by extension, the size of the shadow banking sector. This sector's rapid expansion between 2009 and 2016 was mainly bank-funded. Small and medium-sized banks such as joint-stock and city commercial banks played a key role, as they tried to circumvent regulations and extend credit through special off-balance sheet vehicles, trust funds and brokers. During this period, growth in the liabilities of these banks, which account for around one third of total banking system assets, consistently outpaced that of aggregate financing for the real economy (Graph I.C, left-hand panel).

Measures taken by authorities have stabilised growth in the shadow banking sector, but at the cost of tightening financial conditions. Privately owned small and medium-sized enterprises (SMEs) were particularly affected. The reduction in shadow bank lending has stretched smaller banks' lending capacity, as many previously off-balance sheet risky assets have been brought back onto balance sheets. These banks primarily serve SMEs, while the larger ones provide credit to large state-owned firms (Graph I.C, centre panel).

The economic slowdown and rising trade tensions exacerbated the plight of SMEs, including a large number of manufacturing firms. Detailed data on SME performance are not available. However, the latest financial data for listed firms show that while the proportion of non-financial firms reporting losses in 2018 increased across the board, it was small-cap companies and manufacturers that suffered most (Graph I.C, right-hand panel). The effect is macroeconomically significant: the fall in profits for the smallest category of firms erased 0.2 percentage points of GDP growth. Further, this group saw close to a 40% fall in market cap in 2018, one and a half times that of the market as a whole. This reflected growing concerns about future profitability and, by extension, firms' financial health, given high debt.

Chinese authorities have responded to these developments by encouraging banks to increase their lending to SMEs. Measures adopted by the People's Bank of China since June 2018 include increasing the central bank's quota of refinancing and rediscounted loans to smaller banks. Moreover, the authorities have incentivised lending to SMEs by using the level of such lending as the basis for lowering reserve requirements and providing access to a new central bank facility for loans of up to three years. In April 2019, the government also cut the value added tax rate that applies to sales of goods in the manufacturing sector from 16% to 13%. The effects of these measures started to show in Q1 2019, as total outstanding bank loans to small and micro enterprises rose by 19% year on year, more than 5 percentage points above the growth rate of other loans.

Bank loans, liabilities and aggregate financing   Graph I.C
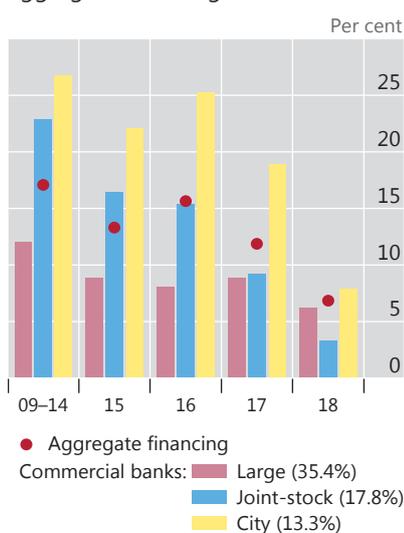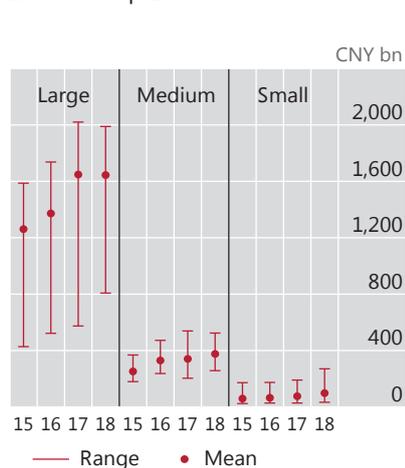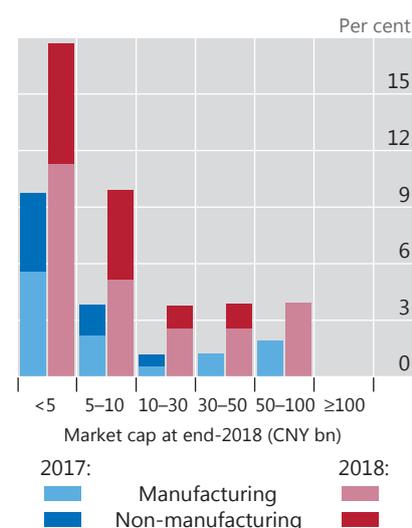
[1] Average of year-on-year changes. Numbers in parentheses indicate the share of assets in the banking system for each group as of end-2018.   [2] For "large", five large state-owned commercial banks; for "medium", seven joint-stock commercial banks; for "small", 12 city and rural commercial banks.   [3] Based on listed non-financial companies that have filed April 2019 financial reports.

Sources: People's Bank of China; China Banking and Insurance Regulatory Commission; Wind; national data; BIS calculations.

balance, have slowed growth. Estimates using provincial-level data suggest that, unlike business loans, consumer loans do not have a discernible impact on GDP in the first year, and reduce it after three years (right-hand panel). This is probably because consumers use credit mainly to purchase residential property, whereas firms use it for fixed investment.

Trade and global value chains

As China slowed, partly contributing to the slowdown in the euro area – another major trading powerhouse – global trade took a hit. Countries that trade more intensively with both economies tended to experience a larger drop in manufacturing activity and new export orders (Graph I.7, left-hand and centre panels). To some extent, the fall reflected a decline in intermediate goods transacted within global value chains (right-hand panel). For example, for Chinese Taipei and Korea, intermediate goods account for 76–81% of all exports to China.

The effects of the slowdown on trade were probably amplified by tighter financial conditions in EMEs, in part owing to the US dollar's tendency to appreciate in 2018. Around 80% of global bank trade financing is denominated in dollars. In several countries, not only are firms highly indebted (see below), but a large share of their debt is denominated in dollars (Chapter II). Furthermore, long value chains are highly dependent on external finance for working capital. For all these reasons, activity in the value chains and trade is likely to be sensitive to a dollar appreciation.[3] Such sensitivity is one factor that can help explain why the dollar and global trade in manufacturing moved in sync during the review period (Graph I.1, second and third panels).

Consumption and the services sector

Even as trade and manufacturing activity decelerated, global consumption remained relatively robust on the back of sustained employment and wage growth

Trade exposures affect economic activity   Graph I.7

Manufacturing PMI[1]

New export orders sub-index[1]

Exports to China[3]

3m on 3m, per cent

$y = 0.92 - 0.10x$ where $R^2 = 0.24$

$y = 0.94 - 0.12x$ where $R^2 = 0.35$

Sum of exports to CN and EA, (% of total exports, 2018 average)[2]

Sum of exports to CN and EA, (% of total exports, 2018 average)[2]

— Chinese Taipei and Korea
— Germany and Japan
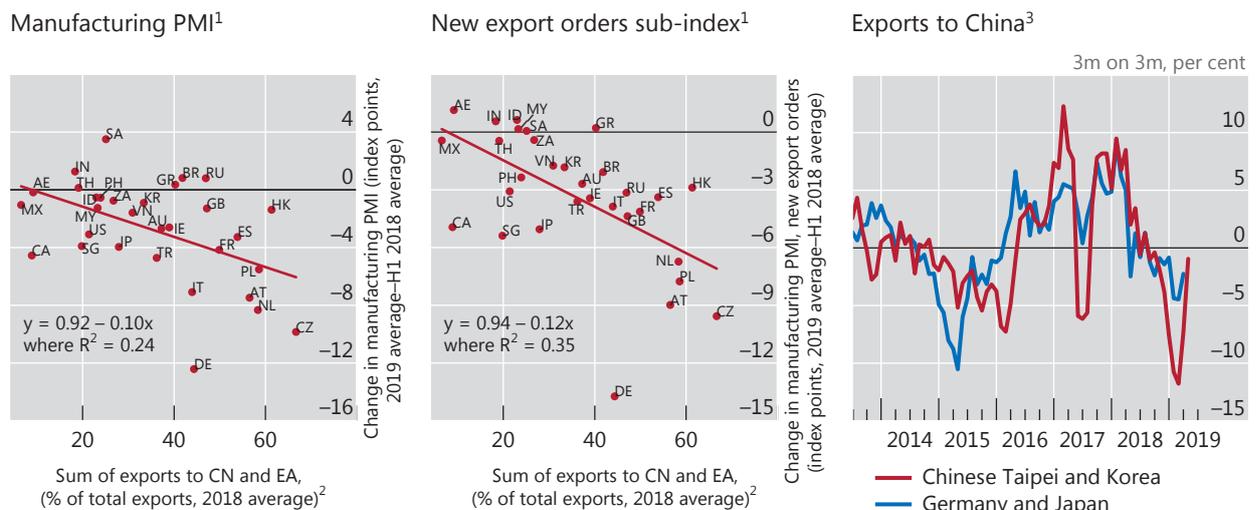
[1] A positive change in the PMI indicates improvement in economic activity. For AE, HK, SA, SG and ZA, whole economy PMI.   [2] Including intra-euro area exports for the euro area members.   [3] In US dollar terms, seasonally adjusted.

Sources: IMF, *Direction of Trade Statistics*; CEIC; IHS Markit; national data; BIS calculations.

Consumption, services and employment prove resilient

Graph I.8

Consumption and wage growth

Changes in consumption share[3]

Changes in employment share[4]

Legend (centre panel): Services (grey), Goods (purple), Housing (orange)

Legend (right-hand panel):
- Agriculture and mining
- Manufacturing, trade and transport
- Construction
- Services
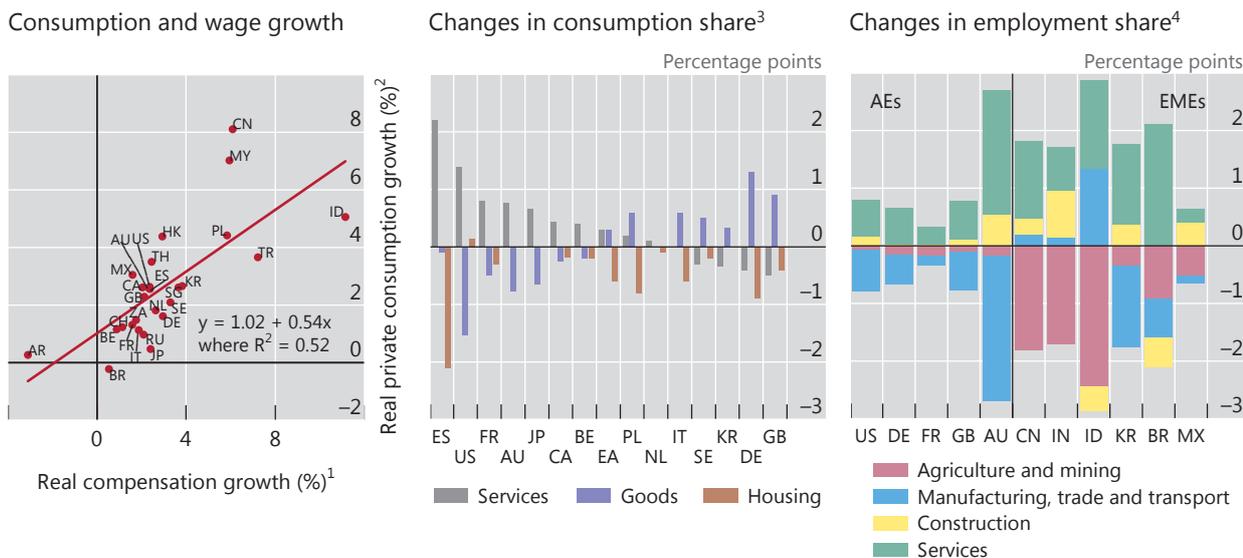
[1] 2016–18 average of year-on-year growth in real compensation of employees (compensation deflated by private consumption expenditure deflator). For CN, HK, MY and TH, changes in 2016–17; for AR, BR, CN and ID, total wages or earnings. [2] 2016–18 average of year-on-year growth in private final consumption. For CN, estimated. [3] Changes in private consumption expenditure share from 2014 to 2017. For JP and KR, housing is subsumed into goods and services. [4] Changes from 2015 to 2018.

Sources: Inter-Agency Group on Economic and Financial Statistics; International Labour Organization; OECD, *Economic Outlook* and *National Accounts*; Eurostat; US Bureau of Economic Analysis; CEIC; Datastream; national data; BIS calculations.

(Graph I.8, left-hand panel). The resilience of consumption may also partly explain why the services sector outperformed manufacturing. But structural factors have probably also contributed: the composition of consumption has generally been shifting towards services, albeit not uniformly across countries (centre panel).

In turn, these trends have supported job creation, given that the services sector is labour-intensive. At the same time, digital technology has increasingly enabled the provision of more services across borders. As a result, over the past four years, employment shares in services have risen in both advanced and emerging market economies (Graph I.8, right-hand panel). By contrast, the employment shares in manufacturing have generally declined.

Financial cycles

The dilemma Chinese policymakers have been facing is just an instance of a broader phenomenon. Since the mid-1980s, medium-term fluctuations in credit and property prices – in short, financial cycles – have grown in duration and amplitude and have become a more important determinant of business fluctuations (see Box I.B in last year's Annual Economic Report). To be sure, such cycles differ in intensity across countries and over time. And they depend fundamentally on policy. For instance, the post-crisis financial reforms, by strengthening financial systems, have no doubt muted their costs. But they all share some key dynamics. New credit and rising asset prices tend to support aggregate demand and economic activity. But, over time, the accumulation of debt raises debt service commitments, which can weigh down persistently on the expenditures of indebted households and firms. Hence, once the financial cycle turns, the positive effects of new credit give way to the negative effects of debt servicing and declining asset prices on spending. As a result, measures of financial cycle expansions have proved useful leading indicators of

The financial cycle and dynamics around business cycle recessions

Graph I.9

Financial variables around the start of recessions[1]
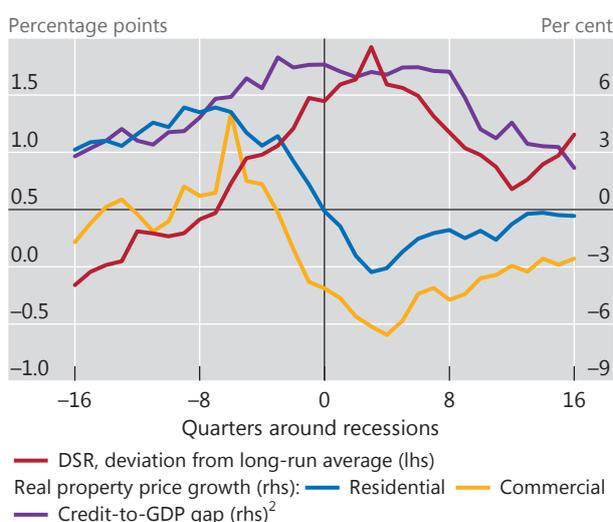
Aggregate measure of the financial cycle[3]
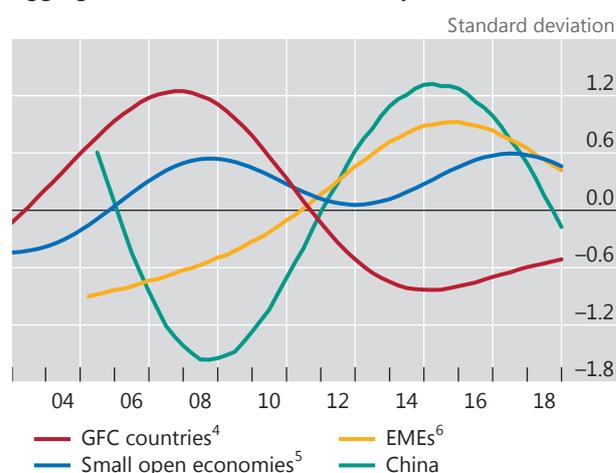
[1] The horizontal axis indicates quarters around recessions (since 1985) in the business cycles, with the peak date set at zero (vertical line). The lines plotted show the median evolution across 16 AEs. [2] Difference of the credit-to-GDP ratio from its long-run, real-time trend calculated with a one-sided Hodrick-Prescott filter using a smoothing factor of 400,000, in percentage points. [3] Financial cycles are measured by frequency-based (bandpass) filters capturing medium-term cycles in real credit, the credit-to-GDP ratio and real house prices. Financial cycles are normalised by country-specific means and standard deviations before simple averages are taken for country groupings. [4] ES, FR, GB, IT and US. [5] AU, CA, CH, FI, NO and SE. [6] BR, CL, CO, HK, ID, KR, MX, MY, SG and TH.

Sources: OECD, *Main Economic Indicators*; Bloomberg; Economic Cycle Research Institute; national data; BIS debt service ratio (DSR) statistics, property price statistics and total credit statistics; BIS calculations.

subsequent economic downturns (Graph I.9, left-hand panel). Indeed, such measures have been found to outperform yield curve variables as indicators of recession risk.[4]

Financial cycles need not be synchronised around the world. In fact, countries currently find themselves in different phases. This can be illustrated with a simple composite measure that combines the behaviour of credit and property prices. In countries less affected by the GFC, where recessions had largely been imported via trade, financial cycles continued to expand and now appear to have turned. This is true not only of China but also of many EMEs and advanced small open economies (Graph I.9, right-hand panel). All else equal, this suggests weaker demand in these economies going forward and may already have been a factor behind their slowdown over the past year. As a group, including China, these economies account for around one third of global GDP. By contrast, in crisis-hit countries such as the United States and some European countries, which had already seen a financial bust at the time, the financial expansion is less mature, suggesting some support to global growth.

At the same time, sectoral differences are also apparent, in line with the features of the pre-crisis financial expansion. In countries that were not at the heart of the GFC, both household and corporate debt have continued to rise. In the others, the household sector has deleveraged and resumed building up debt only recently. But the corporate sector has generally leveraged further, in some cases to the point of generating vulnerabilities.

Household debt and house prices

Household debt has reached new historical peaks in a number of economies that were not at the heart of the GFC, and house price growth has in many cases stalled.

For a group of advanced small open economies, average household debt amounted to 101% of GDP in late 2018, over 20 percentage points above the pre-crisis level (Graph I.10, left-hand panel). Moreover, household debt service ratios (DSRs), capturing households' principal and interest payments in relation to income, remained above historical averages despite very low interest rates. In selected Asian EMEs, household debt climbed to 69% of GDP, compared with 46% pre-crisis. Some advanced economies, in particular Australia and to a lesser extent Sweden, have already seen downward corrections in residential property prices (centre panel).

High household debt and anaemic or negative house price growth may already have begun to weigh on private consumption in some of these countries. For example, for the advanced small open economies that began to see a decline in house prices, private consumption growth slowed on average by around half a percentage point in 2018, including by over 1 percentage point in Canada and Sweden. This is consistent with experience in recent years, which have seen a relatively close correlation between growth in private consumption and residential property prices in a broad sample of AEs and EMEs (Graph I.10, right-hand panel).

While in Asian EMEs private consumption has so far mostly proved resilient, debt dynamics raise concerns about future debt servicing burdens and, by extension, consumption. In Korea, where data on household debt servicing costs are available, the household DSR has evolved similarly to that in advanced small open economies (Graph I.10, red lines in the left-hand panel).

By contrast, following the post-crisis deleveraging, household balance sheets proved to be a source of strength in the economies that had been at the core of the crisis. Household debt-to-GDP ratios there generally remained below pre-crisis levels. Thus, rising house prices combined with strong labour markets supported

Household indebtedness, property prices and consumption

Graph I.10

Household debt and DSRs[1]

DSR (lhs):[2]
— Small open AEs
- - Korea

Debt (rhs):
— Small open AEs
- - Selected Asian EMEs

Recent growth in real property prices[3]

yoy changes, per cent

▬ Residential[4]   ◆ Commercial[5]

House prices and consumption[6]

$y = 2.45 + 0.24x$
where $R^2 = 0.19$

Real private consumption growth (%)[7]

Real residential property price growth (%)
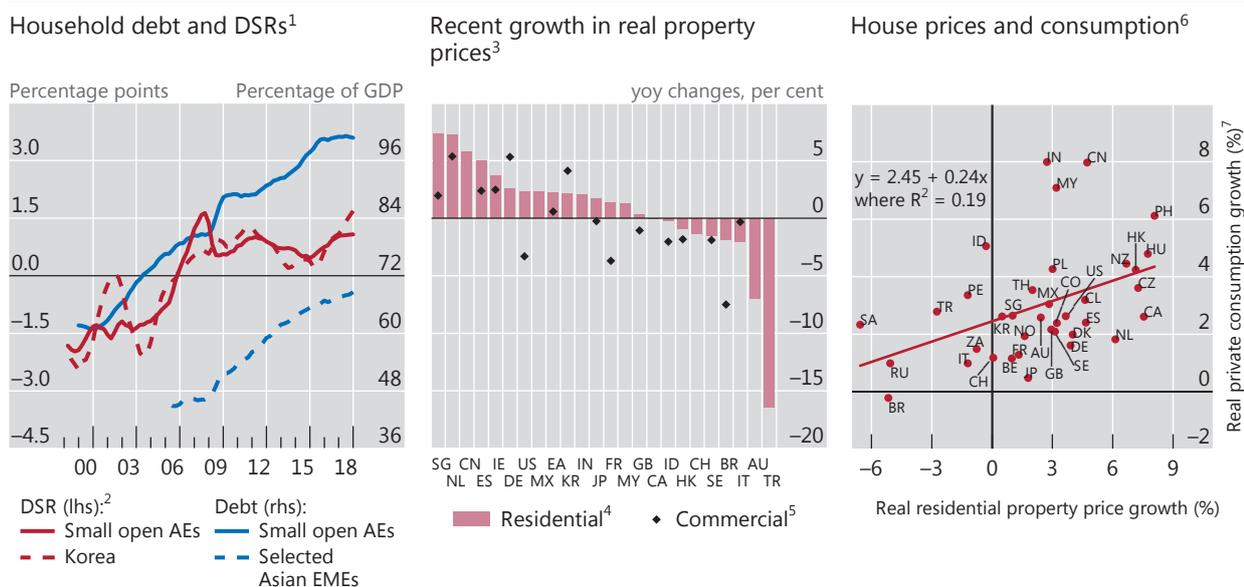
[1] Simple averages for regions. Small open AEs = AU, CA, CH, FI, NO and SE; selected Asian EMEs = CN, HK, KR, MY, SG and TH.   [2] Difference of the debt service ratio (DSR) from country-specific average.   [3] Change from Q4 2017 to Q4 2018, deflated by consumer price inflation.   [4] For BR, CH, CN, HK, IE, KR and TR, change from Q1 2018 to Q1 2019.   [5] Definitions vary across countries. For EA, ES, FR, GB, IE, IT, NL and SE, ECB experimental indicators of commercial property prices; total, headline. For BR, DE, HK, ID, JP and KR, change from Q1 2018 to Q1 2019.   [6] Average year-on-year growth over the last 12 quarters.   [7] For CN, estimated.

Sources: ECB; CEIC; Datastream; national data; BIS debt service ratio statistics, property price statistics and total credit statistics; BIS calculations.

consumption and growth (Graph I.10, centre panel). Given the size of these economies, developments there go a long way in explaining why global consumption growth held up relatively well. That said, private consumption did show signs of slowing towards late 2018 even in some core economies in the euro area.

Vulnerabilities from high corporate debt

Even after retreating somewhat, corporate leverage remained close to historical highs in many regions. In the United States in particular, the ratio of debt to earnings in listed firms was above the previous peak in the early 2000s (Graph I.11, first panel). Leverage in emerging Asia was still higher, albeit below the level immediately preceding the 1990s crisis. Moreover, lending to leveraged firms – ie those borrowing in either high-yield bond or leveraged loan markets – has become sizeable. In 2018, leveraged loan issuance amounted to more than half of global publicly disclosed loan issuance (loans excluding credit lines).

High indebtedness makes firms more vulnerable to a possible tightening of financial conditions, regardless of the source. Even in an environment of continuing very low interest rates, financial conditions could tighten substantially if earnings faltered. The strong outflows from bonds and loan funds and the sharp widening of AE and EME spreads in late 2018 illustrate how fast markets can shift (Box I.A).

Market characteristics can influence the extent to which financial conditions respond to a deteriorating business environment. In particular, following a long-term decline in credit quality since 2000, the share of issuers with the lowest investment grade rating (including financial firms) has risen from around 14% to

High-yield finance macro exposure and economic amplification   Graph I.11

Gross leverage[1] | Rising BBB bond holdings[2] | Sensitivity of firms to growth slowdown[3] | Growth slowdown and debt service burdens[4]

US EA
Asian EMEs Other AEs
Other EMEs

US: Europe:
A
BBB

Investment Employees Margins Cash ratio
Average effect
Effect on high-yield financed firms

Baseline impact on output
Impact on output with high debt service ratio
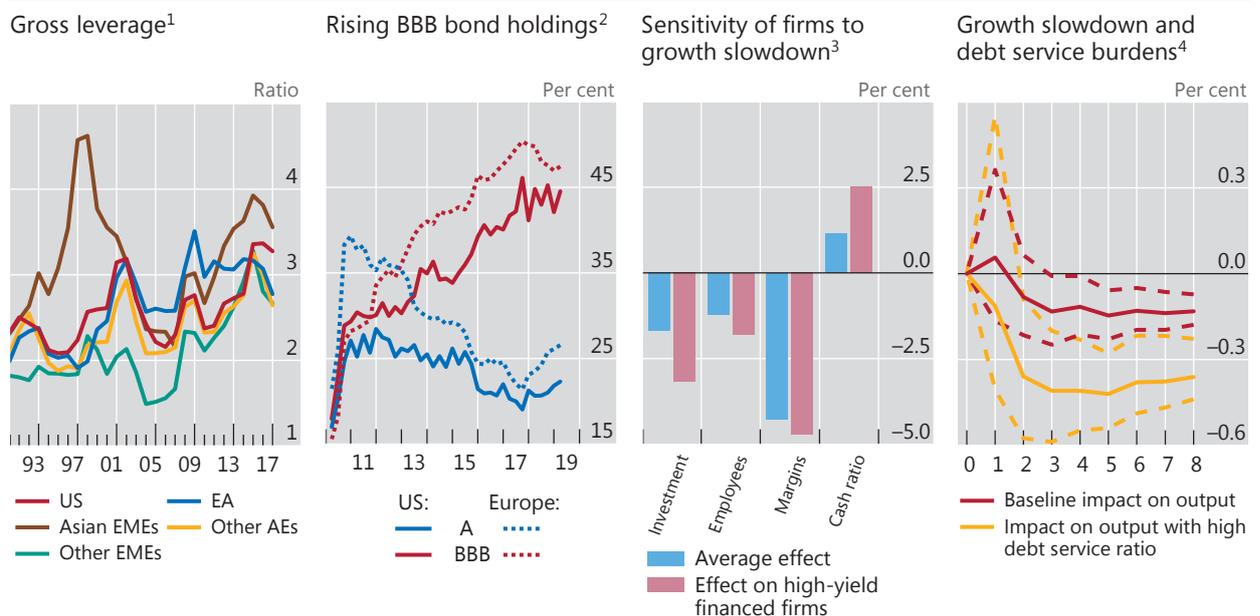
[1] Gross debt of listed firms to EBITDA.   [2] Average percentage of investment grade corporate bond mutual fund portfolios invested in bonds with the indicated rating.   [3] Impact after one year following a 1 percentage point surprise slowdown in GDP growth. Based on impulse responses from local projection regressions with firm-level data for listed firms. High-yield financed firms defined as those that have issued at least one high-yield bond or leveraged loan in the past three years.   [4] The solid red (yellow) line represents the quarterly average output loss following a 1 percentage point drop in annual GDP growth when the corporate debt service ratio is at (25% above) the sample median. Based on impulse responses from local projection regressions. The sample comprises 16 AEs.

Sources: Consensus Economics; Datastream Worldscope; Lipper; Refinitiv Eikon; national data; BIS debt service ratio statistics; BIS calculations.

45% in Europe and from 29% to 36% in the United States.[5] Given widespread investment grade mandates, a further drop in ratings during an economic slowdown could lead investors to shed large amounts of bonds quickly. As mutual funds and other institutional investors have increased their holdings of lower-rated debt, mark-to-market losses could result in fire sales and reduce credit availability. The share of bonds with the lowest investment grade rating in investment grade corporate bond mutual fund portfolios has risen, from 22% in Europe and 25% in the United States in 2010 to around 45% in each region (Graph I.11, second panel).
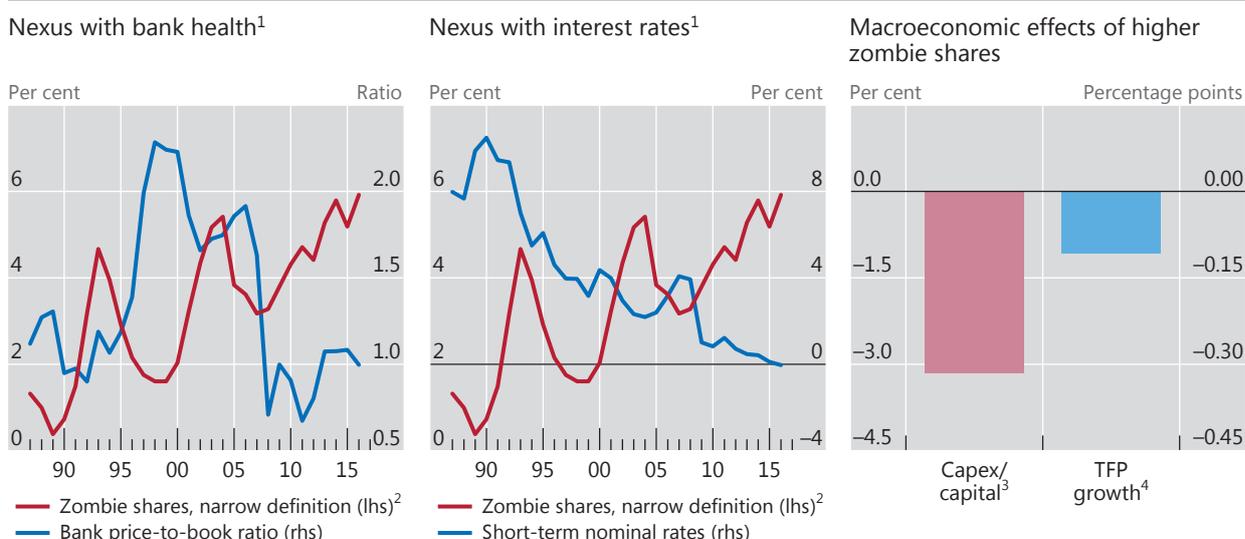
How financial conditions might respond depends also on how exposed banks are to collateralised loan obligations (CLOs). Banks originate more than half of leveraged loans and hold a significant share of the least risky tranches of CLOs. Of these holdings, US, Japanese and European banks account for around 60%, 30% and 10%, respectively. In general, banks are likely to face lower losses from direct securitisation exposures and should be in a better position to manage them than in the 2006–07 subprime crisis, given the reform-induced stronger capital and liquidity cushions. That said, the concentration of exposures in a small number of banks may result in pockets of vulnerability. CLO-related losses could reveal that the search-for-yield environment has led to an underpricing and mismanagement of risks. In turn, this could generate dynamics that would bring banks' direct and indirect exposures to the fore. All else equal, more vulnerable would be banks that have extended credit lines to leveraged borrowers, have links with asset managers active in the CLO market, find it hard to accumulate loss-absorbing capital (eg because of profitability issues), and/or depend on short-term (eg FX swap) funding markets.

Tighter financial conditions could dampen investment, amplifying any slowdown. The effect would tend to be larger in countries where firms are more leveraged, play a larger role in investment, are more exposed to commercial property price (and hence collateral-value) declines, and borrow in foreign currency. Econometric evidence suggests that, following a slowdown, investment by high-yield financed firms drops by twice as much as that of other firms (Graph I.11, third panel). In the United States, during 2015–17, as much as 40% of capital expenditures took place in high-yield financed firms.[6] Among economies with relatively high corporate debt, commercial property prices have declined over the past year in France, Sweden and the United States (Graph I.10, centre panel). And after years of strong issuance in international markets, outstanding FX-denominated debt securities issued by non-financial corporates amounted to $4 trillion at end-March 2019; of that total, around $850 billion is set to mature in the next two years.

Firms would be more vulnerable if inflation eventually rose and monetary policy tightened substantially in response. While debt service ratios have been kept at bay by low interest rates, rising debt has raised their sensitivity to policy rates. Estimates for a panel of advanced economies suggest that high corporate debt service ratios amplify any slowdown in output growth (Graph I.11, yellow line in fourth panel).

The continued increase in corporate debt has consequences also for the aggregate productive potential of the economy. Firms that are unable to cover debt servicing costs from operating profits over an extended period and that have muted growth prospects – so-called zombie firms – have been on average 40% more leveraged than their profitable counterparts.[7] Since the 1980s their share has risen, alongside the deterioration in banks' perceived health, as reflected in price-to-book ratios (Graph I.12, left-hand panel), and with declining interest rates (centre panel).[8] Zombie firms currently make up around 6% of non-financial listed firms and account for 2.5% of their capital stock.[9] They sap economy-wide productivity growth not only by being less productive themselves, but also because they crowd out resources available to more productive firms. Evidence suggests that their increase over time has had an economically significant macroeconomic impact (right-hand panel).[10]

Causes and consequences of rising zombie shares

Graph I.12

Nexus with bank health[1]

Nexus with interest rates[1]

Macroeconomic effects of higher zombie shares

Legend left panel:
— Zombie shares, narrow definition (lhs)[2]
— Bank price-to-book ratio (rhs)

Legend centre panel:
— Zombie shares, narrow definition (lhs)[2]
— Short-term nominal rates (rhs)

Right panel categories: Capex/capital[3], TFP growth[4]

[1] Simple averages for AU, BE, CA, CH, DE, DK, ES, FR, GB, IT, JP, NL, SE and US.   [2] Firms with an interest coverage ratio less than one for three consecutive years, over 10 years old and with a Tobin's q below the median firm in the sector in a given year.   [3] Impact on non-zombie firms of a 1 percentage point increase in the share of zombie firms in the same sector.   [4] Impact on economy-wide annual total factor productivity (TFP) growth of a 1 percentage point increase in the share of zombies in the economy.

Sources: R Banerjee and B Hofmann, "The rise of zombie firms: causes and consequences", *BIS Quarterly Review*, September 2018, pp 67–78; Datastream; Datastream Worldscope; national data; BIS calculations.

Banks' condition

Banks' ability to support the economy, especially in a downturn, depends on how well capitalised and profitable they are. Thanks to the Basel III reforms, bank capitalisation has increased substantially (Graph I.13, left-hand panel).[11] As a large body of evidence indicates, not only does a stronger capital base improve bank stability,[12] it also supports more lending.[13] Moreover, as capital is significantly above regulatory requirements, banks are also less likely to curtail lending to avoid breaching them. Estimates suggest that capital buffers increased significantly from the mid-2000s (right-hand panel). For the median large bank, the buffer rose from some 3 to 5 percentage points between 2006 and 2017 (vertical lines).[14]

However, in order to support the economy, banks also need to be profitable. In general, profits are the main source of capital increases, help raise external funding at lower cost, and represent the first line of defence against losses. Hence, sustainable profitability underpins resilient lending. Moreover, low profitability may also lead to credit misallocation. Less profitable banks are more likely to evergreen loans or lend to zombie firms, thereby crowding out funding for new, more productive ones. In turn, over time, credit misallocation may depress bank profits further, thus setting in motion a vicious cycle.

Unfortunately, bank profitability has been lacklustre. In fact, as measured, for instance, by return-on-assets, average profitability across banks in a number of advanced economies is substantially lower than in the early 2000s (Graph I.14, left-hand panel). Within this group, US banks have performed considerably better than those in the euro area, the United Kingdom and Japan (centre panel). Looking ahead, depressed market valuations, as reflected for instance in lower price-to-book ratios, suggest lingering concerns about long-term profitability. Furthermore, the increase in capitalisation has occurred to a large degree owing to slower asset

Bank capitalisation increased compared with the mid-2000s[1]

In per cent
Graph I.13

Bank capitalisation of major international banks

Bank capital distance from regulatory minimum[2]

Sources: SNL; Financial Stability Board; BIS calculations.
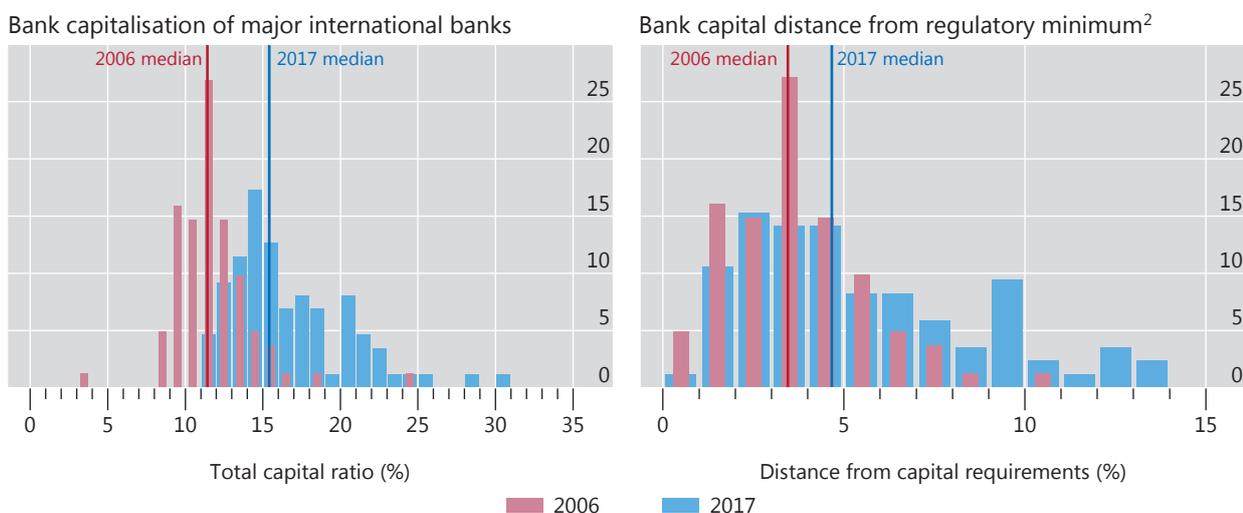
[1] Eighty-seven banks that reported their total capital ratio in 2006 and 2017.   [2] Difference between the total capital adequacy ratio and the regulatory requirements in the form of the 8% capital ratio, the capital conservation buffer (2.5%, assuming full implementation) and the bank-specific capital surcharge on global systemically important banks. Other capital requirements, such as the (implicit) capital requirements stemming from countercyclical capital buffers, Pillar II and stress tests are not included here.

growth (right-hand panel). Hence, going forward, weak profitability could potentially constrain credit growth through slower equity accumulation.

Both macroeconomic and banking-specific factors have sapped bank profitability. On the macro side, persistently low interest rates and low growth reduce profits. Compressed term premia depress banks' interest rate margins from maturity transformation.[15] Low growth curtails new loans and increases the share of non-performing ones. Therefore, should growth decline and interest rates continue to remain low following the pause in monetary policy normalisation, banks' profitability could come under further pressure.[16]

To improve profitability, banks face challenges. Costs remain stubbornly high relative to income. Business models have yet to be restructured on a sustainable basis – in particular, adapting to a lower and flatter yield curve. Banks are also facing increasing competition from non-traditional players, such as big techs, which are taking advantage of digital innovation (Chapter III). Those banks saddled with antiquated legacy IT systems are more vulnerable. Furthermore, overcapacity lingers, as bank exit is much harder than in other sectors.

The public sector can play a useful role in boosting bank profitability. Authorities can demand tighter provisioning policies (eg via asset quality reviews). Such policies may facilitate the task of addressing enduring non-performing loans,[17] which weigh on bank valuations, especially in some euro area jurisdictions.[18] The authorities can also improve the resolution mechanism to facilitate orderly exit. Removing obstacles from cross-border mergers could similarly help consolidation. Finally, the public sector could implement much needed growth-boosting structural reforms and, in economies with limited fiscal space, could maintain fiscal discipline so as to avoid putting the banking system at risk.

Similar questions about the resilience of bank lending arise in the context of FX funding. International banks intermediate substantial foreign currency funds. Most

Lower profitability and slower growth of equity   Graph I.14

Return-on-assets[1]   By country   Low equity growth globally[3]

| Per cent | | Per cent | | Per cent | Log, USD bn |

Left panel (Return-on-assets):
Per cent axis: 1.00, 0.75, 0.50, 0.25, 0.00, −0.25, −0.50
X-axis: 98 01 04 07 10 13 16 19

Percentiles:
25th–75th   — Average
10th–90th

Middle panel (By country):
Per cent axis: 1.00, 0.75, 0.50, 0.25, 0.00, −0.25, −0.50
X-axis: 11 13 15 17 19

United States   Japan
Euro area   Other AEs[2]
United Kingdom

Right panel (Low equity growth globally):
Per cent axis: 6.5, 6.0, 5.5, 5.0, 4.5, 4.0, 3.5
Log, USD bn axis: 11, 10, 9, 8, 7, 6, 5
X-axis: 97 00 03 06 09 12 15 18

$\beta_{post} = -0.01$
$\beta_{pre} = 0.15$
$\beta_{post} = 0.02$
$\beta_{pre} = 0.15$

Lhs: Book equity to total assets ratio
Rhs: Total assets   Book equity

[1] Asset-weighted average of AU, CA, CH, DK, EA, GB, JP, NO, SE and US.   [2] Asset-weighted average of AU, CA, CH, DK, NO and SE.   [3] Sample of 75 banks. The beta coefficient shows the trend growth rate in natural logarithms. For instance, a 0.15 value corresponds to an approximately 15% growth rate per annum.

Sources: Datastream; BIS calculations.

of these are denominated in US dollars, and a sizeable portion in euros. In addition, a large share of FX funding takes place through FX swaps and is not captured on balance sheets.[19] Given the dominant role of the US dollar in the international banking system, as the GFC showed, dollar funding can easily come under pressure at times of stress.[20] This puts a premium on appropriate backstop mechanisms.

Monetary policy challenges

The challenges monetary policy is facing today are best understood against the backdrop of the GFC's long shadow. Not only did central banks prevent the economy from falling into a tailspin as the crisis broke out, they also took the lead in establishing the basis for the subsequent recovery, as other policies did not provide sufficient support. And they did so successfully, supporting the economy's return to potential. In the process, inflation rates have for years remained below target for the main advanced economies, even when economies have been operating with limited spare capacity. Faced with these conditions and the puzzling behaviour of inflation, central banks could keep policy accommodative for some time, both in terms of interest rates and in terms of the size and composition of their balance sheets. Policy rates had previously never been negative in nominal terms in major economies, and they have now been negative in real (inflation-adjusted) terms for even longer than during the Great Inflation era. And balance sheets have seen an unprecedented expansion.

Central banks have been responsive in the rapidly evolving context. In the year under review, the uncertainties in the global economy, notably related to the trade tensions, and the sensitivity of financial markets have induced a pause in the monetary policy normalisation process in advanced economies. Nevertheless, central banks find themselves in a predicament, as the path ahead has narrowed. On the one hand, the room for policy manoeuvre has shrunk substantially since the

GFC. Tackling a downturn or a further downward slide in inflation would stretch monetary policy further. This puts a premium on regaining policy space by proceeding along a tightening path. On the other hand, with subdued inflation, signs of weakening economic activity have made it hard for central banks to continue along that path, not least as it may risk de-anchoring inflation expectations. While ideally inflation convergence on the back of sustained growth would open the way to tightening policy gradually and steadily, in practice persistently low inflation and doubts about the resilience of economic growth have delayed it. And, as the GFC has receded in time, financial vulnerabilities have built up.

Potential intertemporal trade-offs

All this has brought to prominence some delicate potential intertemporal policy trade-offs. These would arise in those situations where policy actions have welcome effects in the short run but raise the risk of unwelcome ones in the longer run. Under normal conditions, this is not an issue. Reducing interest rates when inflation is below target and output is depressed pushes them towards desirable levels. But if inflation remains unresponsive and interest rates have to be kept low for long, then financial vulnerabilities can build up and the room for policy manoeuvre can be consumed. This takes policymakers outside their comfort zone and requires extra care. Deciding the extent and pace of policy normalisation today exemplifies these potential challenges. Central banks are fully aware of such trade-offs. Inevitably, a good degree of judgment is needed. That is why decisions may differ across countries and circumstances.

In such conditions, adopting a more gradual approach is justified on several grounds.

First, the price stability mandate sets the stage. This naturally induces central banks to maintain policy accommodation, or to ease further, when inflation is below target, even when the economy appears to be close to estimates of potential. And it constrains the policy options when such a policy could have unwelcome effects on the financial side of the economy longer-term, such as by encouraging excessive risk-taking.

Second, and closely related, such an approach can help bring inflation and inflation expectations back towards target. This is especially relevant if the central bank's credibility is at stake. Succeeding in raising inflation would boost that credibility and help preserve future policy space if it prevents expectations from drifting downwards. Stabilising inflation around the target is seen as especially important when policymakers consider that the equilibrium, or so-called "natural", interest rate has fallen for reasons that have little to do with their decisions.[21]

Finally, such an approach is quite compelling if financial markets or segments of the financial system appear fragile. As suggested by the year under review, markets can sometimes be quite sensitive to signs of higher rates or smaller central bank balance sheets. Even in the context of benign market conditions, there is evidence that changes in balance sheet policy can have non-negligible effects on term premia (Box I.D). A sharp market reaction, and consequent outsize tightening of financial conditions, could impact the economy adversely. Furthermore, in economies with a relatively weak banking sector, the approach may reduce the risk of banks running into funding problems and curtailing credit. And if it succeeds in boosting output without raising debt burdens, it can support financial stability. The higher the uncertainty about conditions in the financial system, and the macro economy, the stronger the case for such a strategy.

At the same time, the gains from such a strategy could be associated with costs in terms of risks to longer-term macroeconomic resilience and stability and the

Box I.D

The run-off of the Federal Reserve's balance sheet

In late 2017, almost two years after the first post-crisis hike in the federal funds rate, the Federal Reserve began to reduce its balance sheet, which had grown to $4.5 trillion or 23% of GDP. To minimise the risk of disruptions to bond markets and facilitate communication on the use of multiple instruments, the reduction has been carried out in a gradual and preannounced manner.

A key question concerns its impact on interest rates and real activity. One view, shared by some economists and policymakers, is that the impact should be small, unlike the documented sizeable effects of large-scale asset purchase programmes (referred to as quantitative easing or QE).[1] This conclusion relies on some key hypotheses. First, changes in central bank reserves have no effect when financial markets are functioning properly and banks have easy access to funding – that is, under these circumstances, portfolio rebalancing effects are small or negligible.[2] Second, the signalling effects of changes in the balance sheet also fade away once the policy rate is above its zero lower bound and rising. The signalling channel works when the policy rate is at its zero lower bound by strengthening the central bank's commitment to keeping policy rates at the lower bound for longer than otherwise expected.[3] An opposite view is that portfolio balance effects remain economically significant even in the context of benign financial market conditions. Indeed, several studies find support for this view based on data from the pre-crisis period,[4] when the maturity structure of public debt and hence the amount of duration risk absorbed by the market were influenced by the fiscal authority's debt management decisions.[5] According to this view, long-term interest rates should be affected post-crisis not only by the central bank's balance sheet policies but also by the US Treasury's issuance.

Against this backdrop, the analysis here examines the effects of changes in the balance sheet policy on term premia using both event-study and regression analysis. The focus of the event study is on the period of quantitative tightening (QT; defined here as December 2015 to March 2019). The exercise measures the impact of Federal Open Market Committee (FOMC) announcements regarding its balance sheet policy on term premia within a two-day window.[6] The announcements are limited to windows in which there was no change in the fed funds rate. The impact is then compared with the average effect observed over FOMC announcements when neither changes in interest rate nor those in balance sheet policies were communicated. The differential impact can therefore be attributed to balance sheet policy. The first event is September 2017, when the FOMC announced that the run-off would start in October (Graph I.D, left-hand panel). The reaction of the term premia (blue bar) was mildly positive, as a fraction of market participants were expecting a later start of the run-off.[7] Afterwards, the FOMC communicated changes in balance sheet policy in January (yellow bar) and March (purple bar) 2019. Both announcements positively surprised the market in terms of the larger size of System Open Market Account (SOMA) holdings or earlier end of the run-off, decreasing the term premia. In absolute value, these last two announcements induced statistically significant, larger changes in the term premia relative to the average impact of announcements of no change in either policy rates or the balance sheet (red bars). These results suggest that balance sheet policy can move financial markets also in periods of QT.
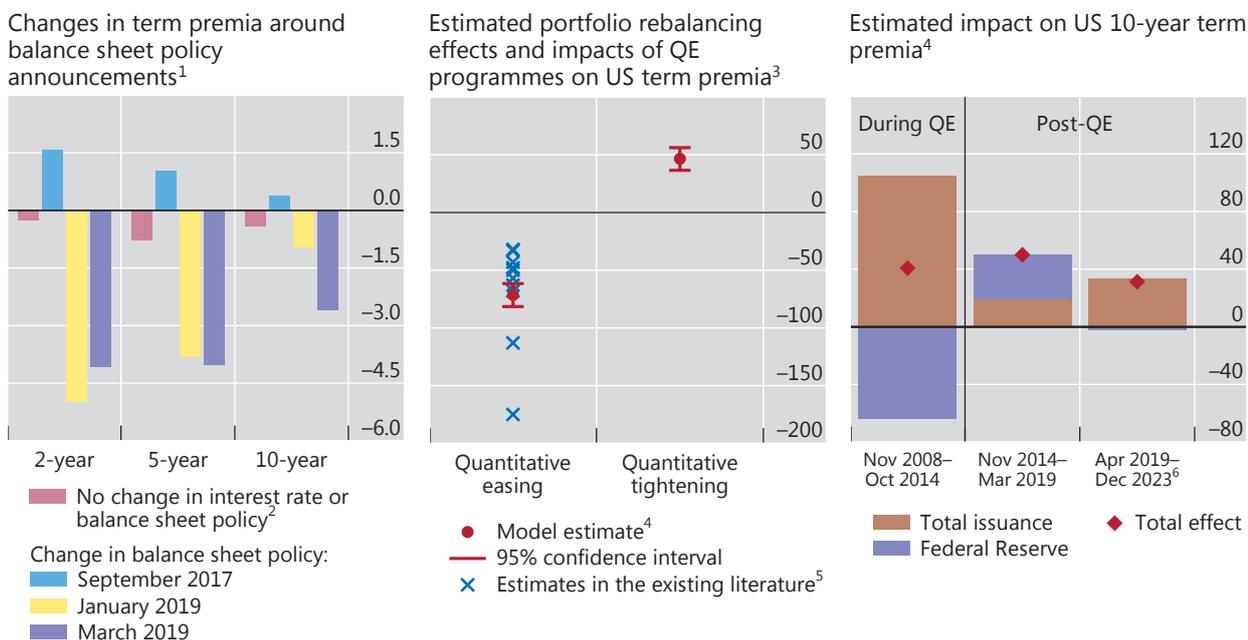
A regression analysis offers additional evidence pointing to sizeable effects of changes in balance sheet policy (alongside changes in debt management policy). It first converts the maturity structure of outstanding US Treasury securities held in the market (outside the Federal Reserve) into a figure labelled the ten-year equivalent (TYE) – a summary measure of the exposure of market participants to interest rate risk. The US 10-year term premium is regressed on the TYE supply measure over the period March 1994–September 2017, using a number of controls. The supply variable is interacted with a dummy indicator, which distinguishes QT periods from QE periods (the latter defined here as November 2008–November 2015) and also pre-crisis periods.[8] As shown in the centre panel, the estimated impact of a reduction in the TYE supply of 10 percentage points of GDP is about 70 basis points during periods of QE and 50 basis points in periods of QT. The difference between the effects is statistically significant. This indicates an asymmetry in the impact of QT relative to QE, although a quantitatively small one.

Going forward, Treasury issuance should be expected to have a significant impact on long-term yields alongside the reduction of the central bank's balance sheet. During QT, the Federal Reserve's reinvestment policy tended to raise the amount of Treasuries the market had to absorb, thereby actually adding to the effect of the planned increase in US Treasury issuance. Over the period from April 2019 to December 2023, the expected increase in total issuance and a relatively stable Federal Reserve balance sheet are expected to lead to a 30 basis point increase in term premia (Graph I.D, right-hand panel). The future composition of the Federal Reserve's portfolio is under discussion. The Fed plans to invest most of the principal payments from agency mortgage-backed securities in Treasury securities with a maturity structure consistent with that of the outstanding stock. The regression result shows that the choice of reinvestment maturities is of second-order importance. Full reinvestment in two-year Treasuries would add only 6 basis points to term premia.

Balance sheet policy and debt issuance have significant effects on term premia

In basis points   Graph I.D

Changes in term premia around balance sheet policy announcements[1]

Estimated portfolio rebalancing effects and impacts of QE programmes on US term premia[3]

Estimated impact on US 10-year term premia[4]

No change in interest rate or balance sheet policy[2]

Change in balance sheet policy:
- September 2017
- January 2019
- March 2019

- ● Model estimate[4]
- — 95% confidence interval
- ✕ Estimates in the existing literature[5]

- Total issuance
- Federal Reserve
- ◆ Total effect

[1] Two-day changes in term premia around the announcements.   [2] Average across announcements from December 2015 to December 2018.   [3] Standardised to changes, in the Federal Reserve's balance sheet, of 10% US GDP.   [4] Impacts of portfolio rebalancing effect on US 10-year term premia (10-year yield less 10-year OIS-implied expected rate). The sensitivity of the term premia is obtained by regressing the term premia on the TYE outstanding US Treasury securities held in the market (outside the Federal Reserve). The control variables include a bond-implied volatility measure, the VIX, a macroeconomic uncertainty measure, capacity utilisation and the SOMA holdings of privately held mortgage-backed securities. March 1994–September 2017 monthly sample.   [5] Each cross indicates the estimate from the existing literature, obtained from Table 1 in Andrade et al (2016).   [6] Total issuance based on the CBO forecast. The maturity structure of total issuance is assumed to remain the same as in March 2019.

Sources: P Andrade, J Breckenfelder, F De Fiore, P Karadi and O Tristani, "The ECB's asset purchase programme: an early assessment", *ECB Working Papers*, no 1956, September 2016; Federal Reserve Bank of New York; US Congressional Budget Office (CBO); US Department of the Treasury; Bloomberg; BIS calculations.

[1] See eg J Bullard, "When quantitative tightening is not quantitative tightening", speech at the US Monetary Policy Forum, 22 February 2019.   [2] See V Cúrdia and M Woodford, "Conventional and unconventional monetary policy", Federal Reserve Bank of St Louis, *Review*, July/August 2010, pp 229–64.   [3] One argument for its effectiveness is that large holdings of long-duration assets expose the central bank to the risk of capital losses if short-term rates rise rapidly. See eg S Bhattarai, G Eggertsson and B Gafarov, "Time consistency and the duration of government debt: a signalling theory of quantitative easing", *NBER Working Papers*, no 21336, July 2015. For empirical evidence on the signalling channel, see eg M Bauer and G Rudebusch, "The signaling channel for Federal Reserve bond purchases", *International Journal of Central Banking*, vol 10, September 2014, pp 233–89.   [4] See eg R Greenwood and D Vayanos, "Price pressure in the government bond market", *American Economic Review*, vol 100, no 2, May 2010, pp 585–90. For a survey, see J Gagnon, "Quantitative easing: an underappreciated success", Peterson Institute for International Economics, *Policy Brief* 16-4, April 2016.   [5] Some studies even suggest that public debt and its maturity composition matter for financial stability. By issuing more short-term debt, the government can lower the premium on short-term money-like debt, reducing the private sector's incentives to issue it and curbing the amount of liquidity transformation in the financial system. See eg R Greenwood, S Hanson and J Stein, "A comparative-advantage approach to government debt maturity", *Journal of Finance*, vol 70, issue 4, August 2015, pp 1683–722.   [6] An analysis based on high-frequency data with a window of 20 minutes around the FOMC announcement shows similar effects on two- and 10-year Treasury yields.   [7] Source: Federal Reserve Bank of New York Primary Dealers Survey.   [8] The pre-crisis dummy indicators distinguish the months in which the Federal Reserve cut (increased) the policy rates and then possibly kept them constant, which correspond to an easing (tightening) period.

erosion of the future room for policy manoeuvre operating mainly through financial channels.

As regards macroeconomic resilience, one such possibility is through the negative impact that historically low-for-long interest rates may have on financial intermediation and credit supply. As discussed above, and to an extent that

depends on country characteristics, over the longer term low rates tend to sap interest margins, profits and hence banks' ability to build up capital, which is essential for their lending to the productive economy.

A second possibility works through the impact of very easy and prolonged financial conditions on economic activity. There is increasing evidence that such conditions may boost growth in the near term but, depending on circumstances, could do so at the cost of higher downside risks in the longer term. For instance, they can become a drag in the future, as they raise debt service burdens and generate financial vulnerabilities, typically in the form of weaker balance sheets.[22]

A third possibility is that, over a longer horizon, persistently low rates may undermine efficient resource allocation and productivity. The effects can be present in the upswing, when low rates may induce resources to shift into lower productivity growth sectors during credit booms, and may also work in the downswing, when very low interest rates for prolonged periods, possibly combined with weak bank balance sheets, may delay the release of resources from less productive sectors into more productive ones.[23] As noted above, the rise of zombie firms is one such example.

As regards the room for policy manoeuvre, the potential intertemporal trade-offs may materialise in two ways. First, and most directly, unless normalisation weakens growth or inflation beyond what is desirable or acceptable, it creates room to cut interest rates when needed to cushion future adverse developments. Second, and more subtly, the side effects of very accommodative policies may themselves reduce the future room for manoeuvre. They may do so by weakening the economy's ability to withstand higher rates, making any normalisation harder; and by generating financial headwinds that potentially limit policy effectiveness.[24] In particular, raising rates becomes harder if debt burdens have increased and financial markets are more sensitive to monetary policy tightening after prolonged support is withdrawn.

Not only do these considerations underline how difficult a balancing act central banks face, they also raise a broader question concerning the role of monetary policy. As the GFC broke out, central banks prevented it from spiralling out of control and then successfully supported the recovery. At the same time, as discussed in last year's Annual Economic Report, following serious financially induced downturns and given stubbornly subdued inflation, there are diminishing returns and costs in relying too much on monetary policy. Such an overburdening can contribute to the re-emergence of financial vulnerabilities and reduce the room for policy manoeuvre. It becomes natural to ask where the limits to this approach are. Ostensibly, monetary policy cannot be the engine of higher sustainable economic growth. More realistically, it may be better regarded as a backstop.

Towards a more balanced policy mix

Looking ahead, these considerations suggest that a more balanced policy mix can contribute more effectively to sustainable growth and financial stability. It can also help steer the economy towards the clearer skies that can be discerned after such a prolonged and at times uncertain recovery. And it would facilitate a shift away from the debt-fuelled growth model on which the global economy appears to have relied for so long.

The only way to raise long-term growth on a sustainable basis is to implement structural reforms. Indeed, productivity growth has been on a long-term downward trend in advanced economies (Graph I.15).[25] Rather disappointing growth at a time when economies are hovering around estimates of potential and experiencing unemployment at multi-decade lows underlines this point.

Unfortunately, over the past decade, the momentum in structural reforms has been lost, as the sense of urgency associated with the GFC has faded. Most ominously,

Labour productivity growth has been declining in advanced economies[1]

In per cent
Graph I.15

Advanced economies

Emerging market economies

Asian EMEs — Latin America
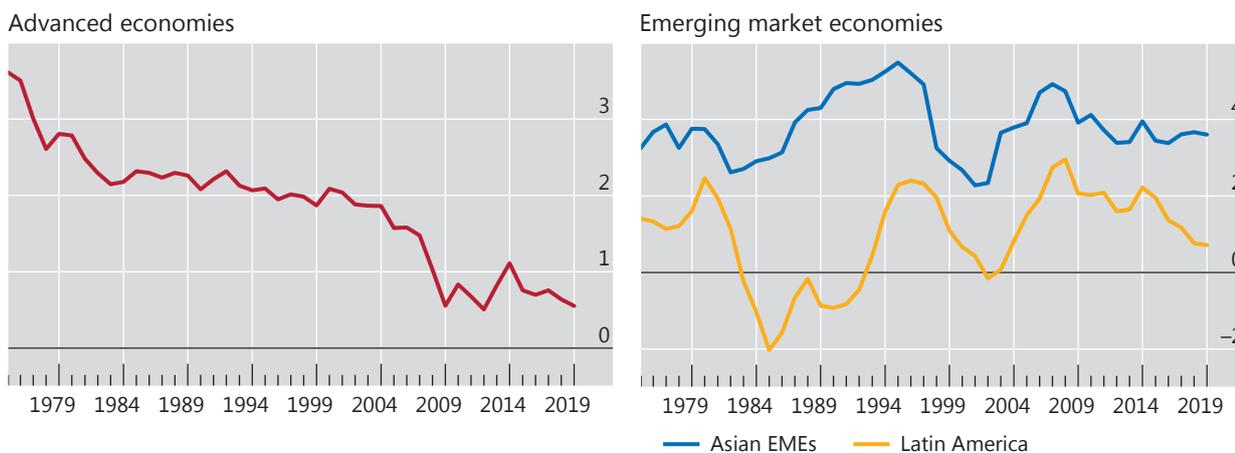
[1] Five-year moving average of growth in labour productivity per hours worked; simple averages across countries.

Sources: The Conference Board Total Economy Database™, April 2019; BIS calculations.

the emergence of trade tensions has cast a dark cloud over the multilateral trading system that has underpinned global growth and productivity for decades. The important area in which structural efforts have proceeded apace is in the financial sector, where (micro) prudential regulation and supervision have been upgraded, not least through the implementation of Basel III. But beyond that, is there a role for macroprudential measures and fiscal policy at more cyclical frequencies?

Macroprudential measures can help alleviate trade-offs.[26] Post-crisis, most countries have made considerable progress in implementing macroprudential frameworks, with tools ranging from system-wide stress tests and countercyclical capital requirements to maximum loan-to-value and debt-to-income ratios. The measures can be usefully activated to limit the build-up of financial vulnerabilities or cushion the blow when financial cycles turn. Thus, in current circumstances, and more generally, they provide an extra degree of freedom to monetary policy. They have the advantage that they can be more targeted, addressing specific risks and vulnerabilities, such as those arising in the corporate or mortgage sector. Of course, they are no panacea. Their activation is typically subject to significant political economy constraints and, given the limited regulatory perimeter – in most countries mainly confined to banks – they are vulnerable to regulatory arbitrage. Moreover, they cannot be expected, on their own, to tame financial cycles, especially where they work at cross purposes with monetary policy.

Fiscal authorities, too, can help in various dimensions. Provided sufficient fiscal space is available, targeted fiscal expansions may usefully support the economy if the need arises. The desirability of policy action will also depend on other country-specific circumstances, including their external balance position. In general, the most effective fiscal measures are of a *structural* nature, such as making the tax system and – where productive opportunities exist – the composition of spending more growth-friendly, especially by boosting well chosen infrastructure investments. In the process, it is important to avoid the risk of once more behaving asymmetrically – easing during downturns, or even pre-emptively, while not consolidating during expansions. This is one reason why the room for fiscal policy manoeuvre has been diminishing over time.

Endnotes

1   World trade grew by 4.7% in 2017, well above its post-GFC average of around 3%. According to the World Trade Organization (WTO), three factors account for this outcome: (i) the low base from which trade increased; (ii) the acceleration of fixed capital investment, which is trade-intensive; and (iii) an unexpected large pickup in consumption in Japan. See WTO, *World Trade Statistical Review 2018*.

2   Data are generally patchy, and analytical models that could help disentangle the relevant mechanisms are generally too abstract or incomplete, especially in describing the financial side of the economy, to reach precise conclusions. In particular, they generally do not incorporate the intertemporal trade-offs implied by macro-financial links and may therefore underestimate the negative medium-term effects of short-run easier financial conditions. See eg T Adrian, F Grinberg, N Liang and S Malik, "The term structure of growth-at-risk", *IMF Working Papers*, no WP/18/180, July 2018.

3   See V Bruno, S-J Kim and H S Shin, "Exchange rates and the working capital channel of trade fluctuations", *AEA Papers and Proceedings*, vol 108, May 2018, pp 531–36; and V Bruno and H S Shin, "Dollar exchange rate as a credit supply factor: evidence from firm-level exports", 2019, mimeo.

4   See C Borio, M Drehmann and D Xia, "The financial cycle and recession risk", *BIS Quarterly Review*, December 2018, pp 59–71.

5   Excluding financial firms, the shares have increased from 21% to 48% in Europe and from 30% to 34% in the United States.

6   The shares are lower elsewhere, at around 20% in Latin America and smaller advanced economies, and 16% in the euro area.

7   This figure is based on net leverage ratios, which take into account firms' cash holdings. To account for the limited expected profitability of zombie firms, the definition of zombie firms considers only firms whose Tobin's q is lower than the median within their sector in any given year. For an analysis of zombie firms, see also M Adalet McGowan, D Andrews and V Millot, "The walking dead? Zombie firms and productivity performance in OECD countries", *Economic Policy*, vol 33, issue 96, October 2018, pp 685–736; and R Banerjee and B Hofmann, "The rise of zombie firms: causes and consequences", *BIS Quarterly Review*, September 2018, pp 67–78.

8   See also F Schivardi, E Sette and G Tabellini, "Credit misallocation during the European financial crisis", *BIS Working Papers*, no 669, December, 2017; M Storz, M Koetter, R Setzer and A Westphal, "Do we want these two to tango? On zombie firms and stressed banks in Europe", *ECB Working Papers*, no 2104, October 2017; C Borio and B Hofmann, "Is monetary policy less effective when interest rates are persistently low?", *BIS Working Papers*, no 628, April 2017; and D Andrews and F Petroulakis, "Breaking the shackles: zombie firms, weak banks and depressed restructuring in Europe", *ECB Working Papers*, no 2240, February 2019.

9   Using data for both listed and non-listed firms, Adalet McGowan et al (2018), op cit, report higher capital-weighted zombie shares.

10 The macroeconomic effects of zombie firms are found to be economically large in some euro area countries. See V Acharya, T Eisert, C Eufinger and C Hirsch, "Whatever it takes: the real effects of unconventional monetary policy", *The Review of Financial Studies*, forthcoming.

11 See also BIS, "The financial sector: post-crisis adjustment and pressure points", *Annual Economic Report*, June 2018, Chapter III.

12 See eg I Fender and U Lewrick, "Adding it all up: the macroeconomic impact of Basel III and outstanding reform issues", *BIS Working Papers*, no 591, November 2016.

13 See eg L Gambacorta and H S Shin, "Why bank capital matters for monetary policy", *BIS Working Papers*, no 558, April 2016.

14 The countercyclical capital buffer was omitted from the capital requirements because regulators can release it in downturns. The release after the Brexit vote in the United Kingdom is an example.

Furthermore, banks face additional capital requirements (through Pillar 2 in Europe and stress tests in the United States) which might impose higher effective capital adequacy standards than Pillar 1 requirements. These additional requirements could lower the observed distance from Pillar 1 regulatory minima.

[15] See C Borio, L Gambacorta and B Hofmann, "The influence of monetary policy on bank profitability", *BIS Working Papers*, no 514, October 2015; also published in *International Finance*, vol 20, issue 1, spring 2017.

[16] To the extent that monetary easing can boost economic activity, it also supports bank profitability. But, unlike structural reforms, monetary policy cannot lift output on a sustainable basis.

[17] See eg C Borio, B Vale and G von Peter, "Resolving the financial crisis: are we heeding the lessons from the Nordics?", *BIS Working Papers*, no 311, June 2010.

[18] See eg B Bogdanova, I Fender and E Takáts, "The ABCs of bank PBRs", *BIS Quarterly Review*, March 2018, pp 81–95.

[19] See C Borio, R McCauley and P McGuire, "FX swaps and forwards: missing global debt?", *BIS Quarterly Review*, September 2017, pp 37–54.

[20] See eg P McGuire and G von Peter, "The US dollar shortage in global banking and the international policy response", *BIS Working Papers*, no 291, October 2009.

[21] This is the predominant view; see eg R Caballero, E Farhi and P Gourinchas, "The safe assets shortage conundrum", *Journal of Economic Perspectives*, vol 31, no 3, Summer 2017, pp 29–46; C Carvalho, A Ferrero and F Nechio, "Demographics and real interest rates: inspecting the mechanism", *European Economic Review*, vol 88, September 2016, pp 208–26; L Rachel and T Smith, "Are low real interest rates here to stay?", *International Journal of Central Banking*, vol 13, September 2017, pp 1–42; and L Summers, "Low real rates, secular stagnation & the future of stabilization policy", speech at the Bank of Chile Research Conference, 20 November 2015. In contrast to the predominant view, a number of studies find a tenuous or no relationship with real variables, suggesting a role for monetary policy in the determination of long-run real interest rates. See eg J Hamilton, E Harris, J Hatzius and K West, "The equilibrium real funds rate: past, present, and future," *IMF Economic Review*, vol 64, November 2016, pp 660–707; K Lunsford and K West, "Some evidence on secular drivers of safe real rates", 2017, mimeo; and C Borio, P Disyatat, M Juselius and P Rungcharoenkitkul, "Why so low for so long? A long-term view of real interest rates", *BIS Working Papers*, no 685, December 2017.

[22] See eg T Adrian, N Boyarchenko and D Giannone, "Vulnerable growth", *American Economic Review*, vol 109, no 4, April 2019, pp 1263–89; Borio, Drehmann and Xia (2018), op cit; M Juselius, C Borio, P Disyatat and M Drehmann, "Monetary policy, the financial cycle, and ultra-low interest rates", *International Journal of Central Banking*, vol 13, September 2017, pp 55–89; and M Drehmann, M Juselius and A Korinek, "Accounting for debt service: the painful legacy of credit booms", *BIS Working Papers*, no 645, June 2017.

[23] For the evidence on credit booms and their aftermath, see eg G Gopinath, S Kalemli-Ozcan, L Karabarbounis and C Villegas-Sanchez, "Capital allocation and productivity in South Europe", *Quarterly Journal of Economics*, vol 132, no 4, November 2017, pp 1915–67; G Gorton and G Ordoñez, "Good booms, bad booms", *Journal of European Economic Association*, January 2019; B Richter, M Schularick and P Wachtel, "When to lean against the wind", *CEPR Discussion Papers*, no 12188, July 2017; V Asriyan, L Laeven and A Martin, "Collateral booms and information depletion", *ECB Working Papers*, no 2266, April 2019; S Doerr, "Collateral, reallocation and aggregate productivity: evidence from the US housing boom", University of Zurich Open Repository and Archive, June 2018; and C Borio, E Kharroubi, C Upper and F Zampolli, "Labour reallocation and productivity dynamics: financial causes, real consequences", *BIS Working Papers*, no 534, January 2016. For the impact of low rates on reallocations, especially during phases of needed balance sheet repair, see above.

[24] There is increasing evidence that the effectiveness of policy depends on the state of the financial cycle. Persistently low rates, for example, can reduce the amount of remaining mortgages for which there would be an incentive to refinance when rates are cut again down the road; see D Berger, K Milbradt, F Tourre and J Vavra, "Mortgage prepayment and path-dependent effects of monetary policy," *NBER Working Papers*, no 25157, December 2018. The authors illustrate this

mechanism in the case of the United States, showing that monetary policy stimulus depends on both current and past rates, with easing being less effective if previous rates were low. D Aikman, A Lehnert, N Liang and M Modugno, "Credit, financial conditions and monetary policy transmission", *Hutchins Center Working Papers*, no 39, November 2017, also show that the impact of policy easing is muted when the debt-to-GDP ratio is above trend. For a review of the empirical evidence, see Borio and Hofmann (2017), op cit.

[25]   The decline in productivity growth is a long-term phenomenon that predates the GFC. Due to structural impediments and slower innovation diffusion, productivity has declined faster and remained stagnant in a number of countries. See eg G Cette, J Fernald and B Mojon, "The pre-Great Recession slowdown in productivity", *European Economic Review*, vol 88, September 2016, pp 3–20.

[26]   See BIS, "Moving forward with macroprudential frameworks", *Annual Economic Report*, June 2018, Chapter IV.

II. Monetary policy frameworks in EMEs: inflation targeting, the exchange rate and financial stability

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Key takeaways

- *Inflation targeting frameworks in emerging market economies (EMEs) have generally been successful. These frameworks have been combined with varying degrees of FX intervention, together with the active use of macroprudential tools.*

- *This approach reflects EMEs' response to capital flow and associated exchange rate volatility as policymakers seek to design and implement a monetary policy framework for both price and financial stability.*

- *In this way, practice has moved ahead of theory, much as it did when inflation targeting was adopted in the early 1990s by some advanced economies.*

After high inflation and crises in the 1990s, many emerging market economies (EMEs) adopted inflation targeting as their monetary policy framework, catching up with the trend set by advanced economies. The transition has been supported by policies to strengthen economic fundamentals, notably reforms to overcome fiscal dominance, to bolster banking system soundness and to develop domestic financial markets. This regime change has coincided with a widespread reduction of inflation to lower and more stable levels, smoother growth and more stable financial systems.

These achievements have helped EMEs to better integrate themselves into the global financial system and to reap the benefits of financial globalisation. But integration has brought new challenges. EMEs have been exposed to large swings in capital flows and exchange rates, increasingly so since the Great Financial Crisis (GFC) of 2007–09. Near zero policy rates and large-scale asset purchases in the major advanced economies have gone hand in hand with strong capital inflows and exchange rate appreciation in EMEs. In the wake of steps towards monetary policy normalisation by some major advanced economy central banks, phases of significant inflows have alternated with phases of strong capital outflows, reflecting risk-on and risk-off swings in global market sentiment.

To cope with these challenges, most EME inflation targeters have pursued a controlled floating exchange rate regime, using FX intervention to deal with the challenges from excessive capital flow and associated exchange rate volatility. This contrasts with standard textbook prescriptions for inflation targeters, which advocate free floating without recourse to FX intervention. Moreover, in part due to the transmission of easy global financial conditions to domestic financial cycles, policymakers have added macroprudential and, in some cases, capital flow management measures to their monetary policy toolkit. In this light, the practices of EME inflation targeters have moved ahead of theory – as was seen in the advanced open economies when they initially adopted inflation targeting in the early 1990s.

This chapter reviews the challenges that capital flows and the associated exchange rate fluctuations have raised for EME monetary policy frameworks. The first section outlines how EME monetary policy frameworks have evolved over the past two decades. The second discusses how capital flows and exchange rates affect

EMEs. The third section looks at how EME monetary policy frameworks have adjusted to cope with these challenges, especially through FX intervention, and at the role of complementary tools, notably macroprudential measures. The chapter concludes by exploring some implications for the design of EMEs' monetary policy frameworks and of their wider macro-financial stability frameworks.
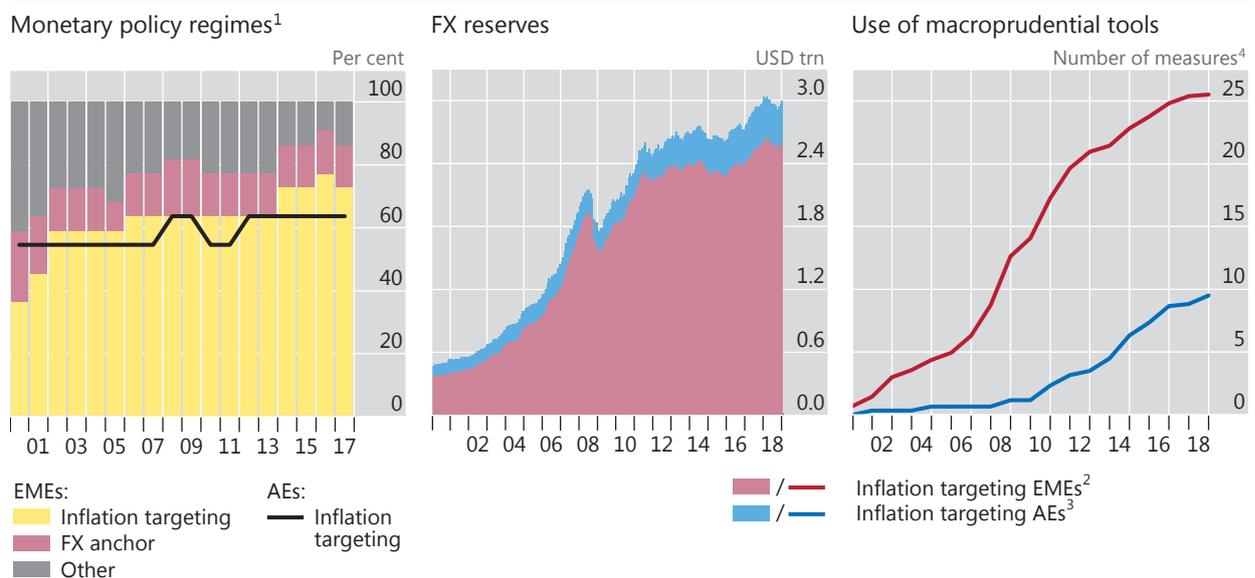
EME monetary policy frameworks: state of play

Over the past two decades, EME monetary policy frameworks have increasingly focused on maintaining domestic price stability (Graph II.1, left-hand panel). The number of major EME central banks operating an explicit inflation targeting regime has increased considerably, while the number using an explicit exchange rate anchor has declined.[1] Inflation targeting is now the most common framework in major EMEs, catching up with the prevailing practice in advanced economies (black line). This evolution accords with the consensus in the mainstream open economy literature, which has coalesced around the superiority of a monetary policy framework that focuses on domestic inflation while keeping the exchange rate flexible.[2]

That said, EME inflation targeters have put significant weight on exchange rate considerations, as reflected in the more than sevenfold increase in their foreign exchange reserves over the past two decades, to about $2.6 trillion (Graph II.1, centre panel).[3] In relation to GDP, the reserves of inflation targeting EMEs are more than three times larger than those of their advanced economy peers.[4] In building up these buffers, mainly after the currency crises of the 1990s, EMEs have sought to self-insure

Inflation targeting, FX reserves and macroprudential tools

Graph II.1

Monetary policy regimes[1]   Per cent

FX reserves   USD trn

Use of macroprudential tools   Number of measures[4]

EMEs:
- Inflation targeting
- FX anchor
- Other

AEs:
- Inflation targeting

- / ▬ Inflation targeting EMEs[2]
- / ▬ Inflation targeting AEs[3]

[1] EMEs = AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SA, SG, TH, TR and ZA; AEs = AU, CA, CH, DK, EA, GB, JP, NO, NZ, SE and US.   [2] BR, CL, CO, CZ, HU, ID, IN, KR, MX, PE, PH, PL, RU, TH, TR and ZA.   [3] AU, CA, GB, NO, NZ and SE.   [4] Cumulative sum of the average number of measures per country.

Sources: K Budnik and J Kleibl, "Macroprudential regulation in the European Union in 1995–2014: introducing a new data set on policy actions of a macroprudential nature", *ECB Working Papers*, no 2123, January 2018; D Reinhardt and R Sowerbutts, "Macroprudential policies: a granular database", Bank of England, *Working Papers*, no 632, December 2016; I Shim, B Bogdanova, J Shek and A Subelyte, "Database for policy actions on housing markets", *BIS Quarterly Review*, September 2013, pp 83–95; IMF, *Annual Reports on Exchange Arrangements and Exchange Restrictions* and *International Financial Statistics*; national data; BIS calculations.

Inflation, growth and credit in inflation targeting economies

Year-on-year changes, in per cent   Graph II.2

Inflation   Real GDP growth   Real credit growth[3]

01 03 05 07 09 11 13 15 17 19   01 03 05 07 09 11 13 15 17 19   02 04 06 08 10 12 14 16 18

██ EMEs[1]   ██ AEs[2]
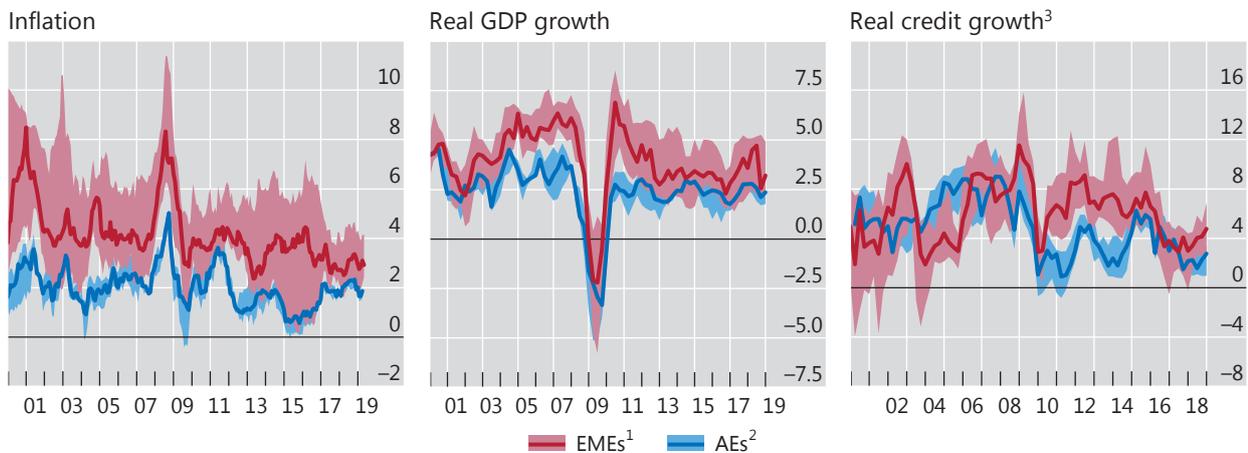
The panels show median values with interquartile ranges.

[1] BR, CL, CO, CZ, HU, ID, IN, KR, MX, PE, PH, PL, RU, TH, TR and ZA.   [2] AU, CA, GB, NO, NZ and SE.   [3] Total credit to the non-financial sectors, deflated by consumer price indices.

Sources: National data; BIS total credit statistics; BIS calculations.

against the risk of sudden outflows and large devaluations. At the same time, changes in FX reserves have often tended to correlate positively with the value of the countries' currencies, suggesting that they have been absorbing exchange rate pressures.[5]

In addition, EME inflation targeters have resorted to macroprudential measures in order to address financial stability objectives (Graph II.1, right-hand panel). In using such tools, which include reserve requirements, loan-to-value caps and countercyclical capital buffers, they have been considerably more assiduous over the past two decades than inflation targeting advanced economies. While the design and governance structure of macroprudential frameworks varies considerably between countries, many of these tools are at the disposal of the central bank, or the central bank is part of the decision-making process, eg as a member of a financial stability council or committee. Macroprudential tools can thus be considered as part of the wider macro-financial stability framework in which the central bank plays a key role.

So far, the combination of inflation targeting with FX intervention, complemented by macroprudential policies, has produced favourable macroeconomic outcomes. Inflation rates have fallen (Graph II.2, left-hand panel), notwithstanding some significant differences across countries (Appendix Graph II.1). At the same time, output growth has been relatively solid and stable (centre panel). Specifically, the growth rebound after the GFC was stronger than in advanced economies, not least as EMEs did not experience a financial crisis. However, many EMEs have seen rapid credit growth (right-hand panel), reflecting at least in part the very accommodative financial conditions prevailing globally, and potentially raising risks for financial stability.
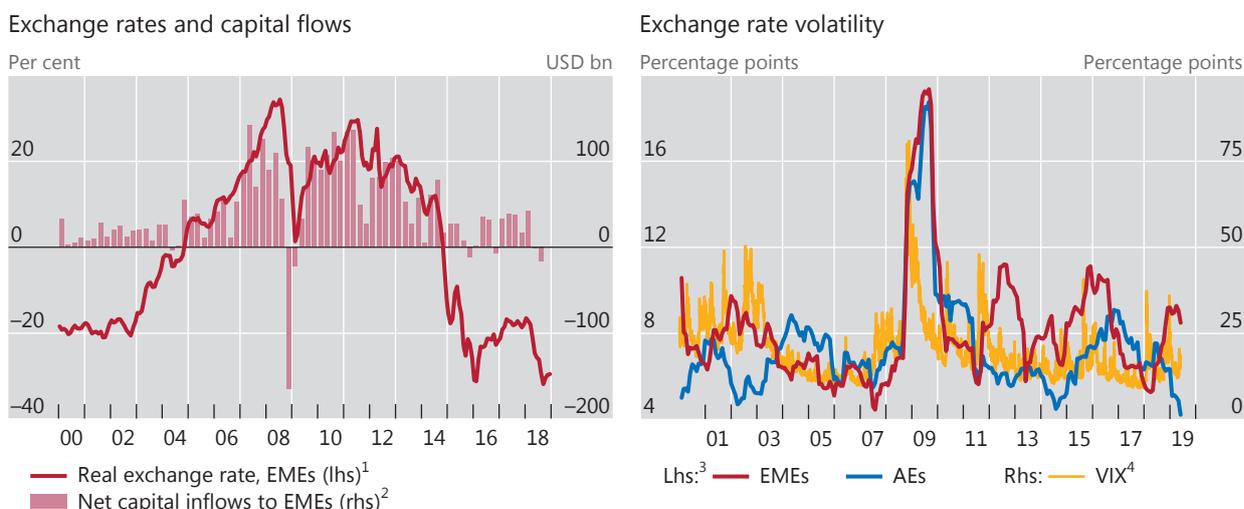
Challenges from capital flow and exchange rate swings

The nature of EME inflation targeting frameworks reflects to a significant extent the challenges posed by large swings in capital flows and exchange rates. Over the past

Global financial factors and EME exchange rates

In inflation targeting economies
Graph II.3

Exchange rates and capital flows

Per cent	USD bn

Exchange rate volatility

Percentage points	Percentage points

Real exchange rate, EMEs (lhs)[1]
Net capital inflows to EMEs (rhs)[2]

Lhs:[3] — EMEs — AEs   Rhs: — VIX[4]

EMEs = BR, CL, CO, CZ, HU, ID, IN, KR, MX, PE, PH, PL, RU, TH, TR and ZA; AEs = AU, CA, GB, NO, NZ and SE.

[1] Weighted average of bilateral US dollar exchange rates, based on GDP and PPP exchange rates; deviation from the long-term linear trend. An increase indicates appreciation of the domestic currencies.   [2] Sum of direct, portfolio and other investments, excluding reserves and related items.   [3] Annualised moving standard deviations of the monthly changes in the bilateral USD exchange rates over the past year. Weighted averages based on GDP and PPP exchange rates.   [4] Chicago Board Options Exchange S&P 500 implied volatility index.

Sources: IMF, *Balance of Payments Statistics* and *International Financial Statistics*; Bloomberg; national data; BIS calculations.

two decades, EMEs have integrated themselves more closely into the global financial system, dismantling barriers to free movements of capital.[6] As a result, capital inflows increased significantly after the mid-2000s, particularly in the wake of the GFC, although they have slowed markedly since 2013. These fluctuations were driven largely by cross-border credit flows, primarily bank loans before the GFC and increasingly securities thereafter.[7] The flows, in turn, reflected global financial conditions. For instance, they first surged after the GFC when short- and long-term interest rates in major advanced economies fell to unprecedentedly low levels and then slowed in the wake of the gradual withdrawal of US monetary accommodation.[8]

The evolution of capital flows over the past two decades has gone hand in hand with major swings in EME exchange rates, visible in large and persistent movements around their long-run trends (Graph II.3, left-hand panel). Sizeable inflows during the second half of the first decade of the 2000s and in the wake of the GFC coincided with persistent appreciations relative to trend, while the slowdown in inflows since 2013 has proceeded alongside persistent depreciations. At the same time, EME currencies have experienced larger spikes in exchange rate volatility around periods of financial stress that emanated from the advanced economies (Graph II.3, right-hand panel). This has occurred on several occasions over the past two decades, especially since the GFC, reflecting the vulnerability of EMEs to alternating risk-on/risk-off sentiment in global financial markets.

Capital flows and associated exchange rate fluctuations affect macroeconomic and financial stability in EMEs through three main channels: (i) exchange rate pass-through to inflation; (ii) export competitiveness; and (iii) domestic financial conditions. The impact is more significant in EMEs than in advanced economies owing to their economic and financial structures.

Exchange rate pass-through to inflation

Exchange rate swings directly impact domestic inflation through their effect on import prices. This effect is generally larger in EMEs than in advanced economies due to the larger share of tradable goods, in particular food, in the consumption baskets, owing to lower income levels.[9]

The propagation of exchange rate changes to non-tradable prices and inflation more generally depends on the characteristics of the domestic inflation process. Here the strength of second-round effects through wages is key. The extent of such second-round effects depends in particular on how well inflation expectations are anchored. The anchoring of inflation expectations is, in turn, influenced by the credibility of the monetary policy framework, which also hinges on its ability to mitigate destabilising exchange rate swings.[10]
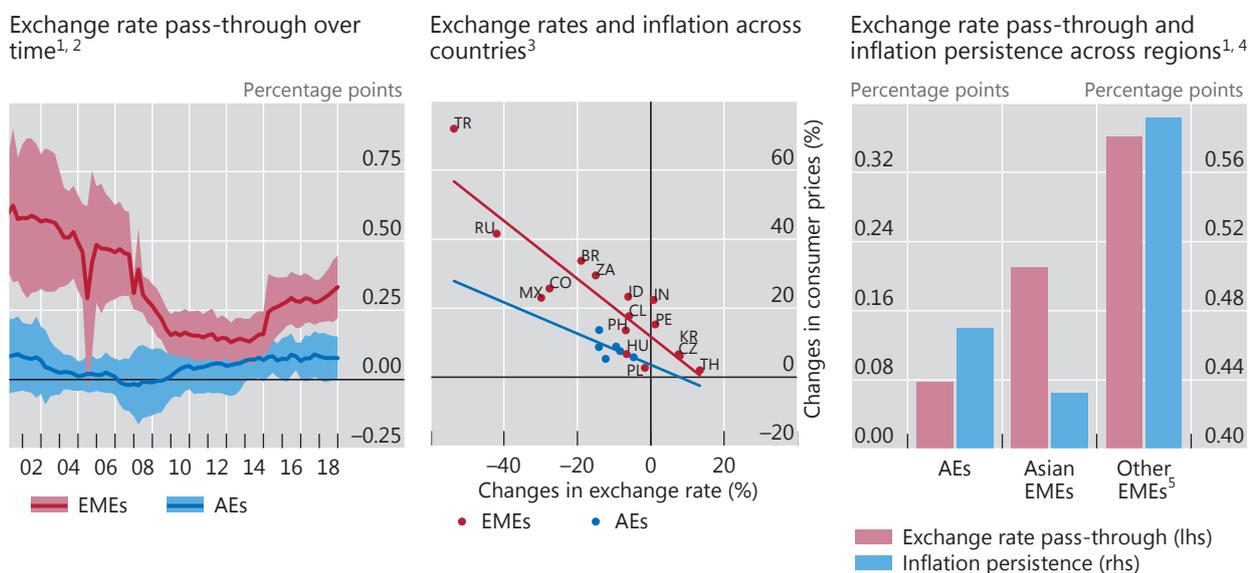
Exchange rate pass-through to inflation in inflation targeting EMEs has on average come down over the past two decades (Graph II.4, left-hand panel). While a sustained 1% depreciation pushed up inflation by 0.6 percentage points in the early 2000s, the long-run effect was just 0.3 percentage points more recently. Yet the effect remains, on average, larger than in inflation targeting advanced economies. The uptick in pass-through over the past few years reflects the impact of large depreciations in a few countries, notably Russia and Turkey (centre panel).

The aggregate evolution of the pass-through conceals important regional differences. In particular, it is lower in Asia than elsewhere (Graph II.4, right-hand panel). Estimates using data over the last six years reveal that a sustained 1% currency

Exchange rates have a larger impact on inflation in EMEs

In inflation targeting economies

Graph II.4

Exchange rate pass-through over time[1,2]

Exchange rates and inflation across countries[3]

Exchange rate pass-through and inflation persistence across regions[1,4]

EMEs = BR, CL, CO, CZ, HU, ID, IN, KR, MX, PE, PH, PL, RU, TH, TR and ZA; AEs = AU, CA, GB, NO, NZ and SE.

[1] Coefficients are six-year rolling window long-run multipliers from the equation $Inflation_{it} = \alpha_i + \beta_t + \delta\, Inflation_{it-1} - \sum_{j=0}^{3}\gamma_j \Delta NEER_{it-j} + \phi Outputgap_{it} + \varepsilon_{it}$. Sample starts in Q1 1995. For details, see M Jašová, R Moessner and E Takáts, "Exchange rate pass-through: what has changed since the crisis?", *International Journal of Central Banking*, forthcoming, 2019. Also published as *BIS Working Papers*, no 583.   [2] The ranges indicate the 90% confidence intervals.   [3] Cumulative changes between end-2018 and end-2013 based on nominal effective exchange rates and headline CPI. A positive value in the nominal effective exchange rate indicates appreciation of the domestic currency.   [4] As of Q4 2018.   [5] BR, CL, CO, MX, PE, RU, TR and ZA.

Sources: Datastream; national data; BIS calculations.

depreciation leads to a long-run increase in the inflation rate by 0.2 percentage points in Asian inflation targeting EMEs, still more than double the pass-through estimates for their advanced economy peers. In other inflation targeting EMEs, the same depreciation raises inflation by 0.35 percentage points.

These differences are in part linked to the strength of second-round effects (Graph II.4, right-hand panel). Specifically, inflation persistence, ie the influence of past inflation on current inflation – a rough indicator of the intensity of second-round effects – is relatively low in inflation targeting emerging Asia, even lower than in advanced economies. By contrast, it is considerably higher in other inflation targeting EMEs.

To sum up, exchange rate pass-through in inflation targeting EMEs is lower today than in the past, no doubt in part reflecting better anchored inflation expectations and the more credible anti-inflation credentials of their frameworks. Yet, in many EMEs, inflation dynamics are still less well anchored than in advanced economies.[11] In those cases, price stability remains more vulnerable to large currency depreciations.
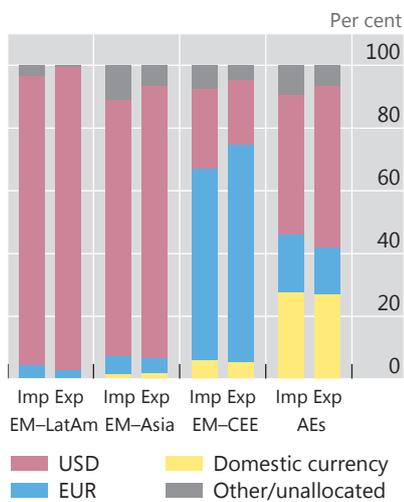
Exchange rates and export volumes

Exchange rate swings also affect trade and aggregate demand. Many EMEs are highly export-dependent, which amplifies the potential relevance of this channel. From the perspective of the conventional trade channel, a depreciation of the currency improves the exporters' international competitiveness. As a result, exports rise, boosting output, possibly above potential, a level that would create inflationary pressures on top of those from exchange rate pass-through.

The conventional trade channel rests on the assumption that export prices adjust in response to a change in the country's exchange rate. Over short horizons, however, this may not be the case. This is particularly so in EMEs because their trade is almost entirely invoiced in foreign currency, primarily in US dollars (Graph II.5, left-hand panel). If the invoice price is sticky in US dollar terms, swings in a country's exchange rate against the US dollar would impact imports, but would in the short term have little effect on export competitiveness.[12] Instead, export volumes would be affected by changes in import demand from other countries. Thus, a broad-based depreciation of currencies against the US dollar could even reduce EME export volumes, as demand would contract.
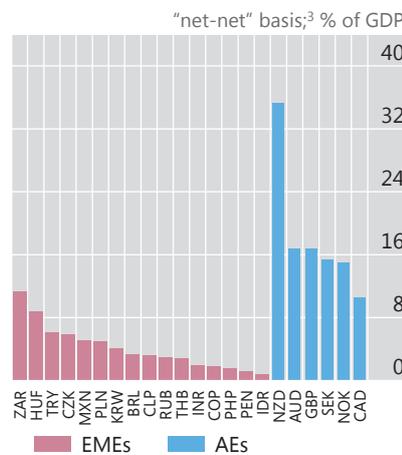
That said, exchange rate swings would still have macroeconomic effects by influencing export firms' profits and, through this channel, employment and investment. If export prices are fixed in US dollar terms, a depreciation of the currency would increase the value of exports in domestic currency, boosting firms' profits. This channel is likely to be more pronounced in EMEs, as scope for hedging exchange rate risk through financial derivatives is much more limited. This is illustrated by the much smaller FX derivatives markets in EME currencies, as compared with those of inflation targeting advanced economies (Graph II.5, centre panel).[13] As a consequence, EME exporters tend to be largely unhedged against currency fluctuations.[14]

Widespread US dollar trade invoicing underpins the dominance of the US dollar in global trade financing.[15] This, in turn, may influence the effect of exchange rate swings on EME exports in the same direction as that of sticky prices in dollar terms. The role of trade finance has increased as global value chains (GVCs) have lengthened, requiring greater resources to finance them. A stronger US dollar pushes up the value of trade credit in local currency terms, often in parallel with a general tightening of financial conditions in EMEs. This financial dimension weakens the expansionary effect of a currency depreciation on a country's export volumes.

Graph II.5

Trade invoicing currencies in inflation targeting countries[1]

Average daily turnover in FX derivatives markets[2]

US dollar and global trade volume

Per cent

"net-net" basis;[3] % of GDP

Q1 2000 = 100   Q1 2000 = 100

Imp Exp   Imp Exp   Imp Exp   Imp Exp
EM–LatAm EM–Asia   EM–CEE   AEs

USD   Domestic currency
EUR   Other/unallocated

ZAR HUF TRY CZK MXN PLN KRW BRL CLP RUB THB INR COP PHP PEN IDR NZD AUD GBP SEK NOK CAD

EMEs   AEs

00 02 04 06 08 10 12 14 16 18

Trade-weighted USD index (lhs)[4]
World goods exports/GDP (rhs)

[1] Simple averages across the countries within each region; based on 15 inflation targeting economies with available data. LatAm = Latin America; CEE = central and eastern Europe.   [2] Volume is defined as the gross value of all new deals entered into during a given period, and is measured in terms of the nominal or notional amount of the contracts; based on the Triennial Central Bank Survey of Foreign Exchange and OTC Derivatives Markets in April 2016. For CLP, COP, CZK, IDR, PEN, PHP and THB, turnover may be underestimated due to incomplete reporting of offshore trading.   [3] Over-the-counter (excluding spot transactions) and exchange-traded foreign exchange derivatives adjusted for inter-dealer double-counting within and across economies.   [4] Federal Reserve Board trade-weighted nominal dollar index, broad group of major US trading partners, based only on trade in goods. An increase indicates appreciation of the US dollar.

Sources: G Gopinath, "The international price system", in proceedings of the Federal Reserve Bank of Kansas City Jackson Hole symposium, August 2015; Board of Governors of the Federal Reserve System; IMF, *World Economic Outlook*; World Trade Organization; Datastream; national data; BIS derivatives statistics; BIS calculations.

In the extreme, currency depreciation could even have a contractionary effect on exports in the short run if GVCs are curtailed due to tighter credit conditions.[16]

To summarise, the US dollar's dominance in trade invoicing and trade financing weakens the impact of exchange rate changes on export volumes, at least in the short term. Instead, phases of broad US dollar strength would coincide with a broad-based weakness in global trade. This conclusion is consistent with the strong negative correlation between the broad US dollar exchange rate and global export volumes (Graph II.5, right-hand panel).

Capital flows and domestic financial conditions

Capital flows and associated exchange rate fluctuations influence macroeconomic and financial stability in EMEs through domestic financial conditions. Capital flows exert a direct quantity effect on credit and asset markets. In addition, asset prices can move substantially even without significant transactions and, conversely, quantities may change and affect asset prices and the exchange rate without involving capital flows.[17] Reflecting such tight links and the associated global arbitrage, asset returns and the yields of bonds denominated in the respective EME currencies have moved closely together with those in advanced economies, despite at times divergent macroeconomic conditions.[18]

Two structural features make EMEs especially vulnerable. First, EME borrowers rely heavily on foreign currency borrowing, often unhedged. Second, foreign investors have large holdings of EME assets, particularly bonds, on a similar basis.

This means that the exchange rate can amplify the impact of capital flows via the so-called financial channel of the exchange rate.
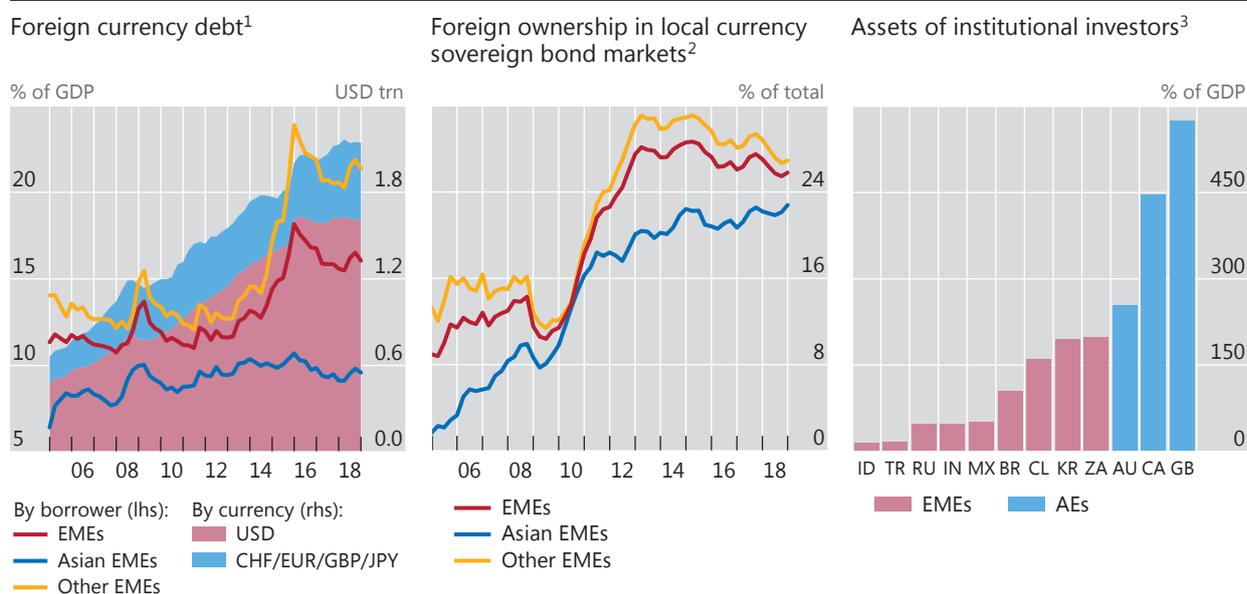
The strong expansion of EMEs' foreign currency debt over the past decade or so makes the financial channel of the exchange rate especially relevant (Graph II.6, left-hand panel). Since 2005, the FX debt of major inflation targeting EMEs has almost tripled, to more than $2 trillion or more than 16% of GDP (up from less than 12% in 2005), mainly driven by corporate sector borrowing in US dollars.[19] The incidence of foreign currency borrowing is smaller in Asian EMEs, where it stood at around 10% of GDP in 2018, compared with more than 20% in other EMEs.

Borrowers incur currency mismatches whenever the foreign currency debt is left unhedged by means of FX revenues and assets or derivatives. While widespread US dollar invoicing in trade means that foreign currency debt servicing costs are often matched by export revenues, the private sector's stock of foreign currency debt is, in many EMEs, much larger than that of foreign assets.[20] In addition, and as mentioned above, scope for hedging often remains limited. This suggests that currency mismatches are widespread, more so than in advanced economies. As a result, an appreciation, say, of the domestic currency against the funding currency would reduce debt servicing costs and debt burdens, lowering EME borrowers' credit risk, attracting more capital inflows and loosening financial conditions. These mechanisms work in reverse when the currency depreciates, and are then potentially amplified through the higher foreign currency debt burdens accumulated in the appreciation phase.

Foreign currency debt and foreign ownership raise vulnerabilities in EMEs

In inflation targeting economies   Graph II.6

Foreign currency debt[1]   Foreign ownership in local currency   Assets of institutional investors[3]
                                  sovereign bond markets[2]

By borrower (lhs):   By currency (rhs):
— EMEs   ▬ USD
— Asian EMEs   ▬ CHF/EUR/GBP/JPY
— Other EMEs

— EMEs
— Asian EMEs
— Other EMEs

▬ EMEs   ▬ AEs

EMEs = BR, CL, CO, CZ, HU, ID, IN, KR, MX, PE, PH, PL, RU, TH, TR and ZA.

[1] Cross-border and local bank loans extended by LBS-reporting banks to EME non-bank borrowers and international debt securities issued by non-banks residing in EMEs. Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations.   [2] Simple averages, excluding CL, CZ, IN, PH and RU due to data availability.   [3] Sum of assets of insurance corporations, pension funds and other financial intermediaries. Financial assets when available, otherwise total assets; 2017 data.

Sources: Financial Stability Board, *Global Monitoring Report on Non-Bank Financial Intermediation 2018*; International Institute of Finance; IMF, *World Economic Outlook;* Datastream; Dealogic; Euroclear; Refinitiv; Xtrakter Ltd; national data; BIS locational banking statistics (LBS); BIS calculations.
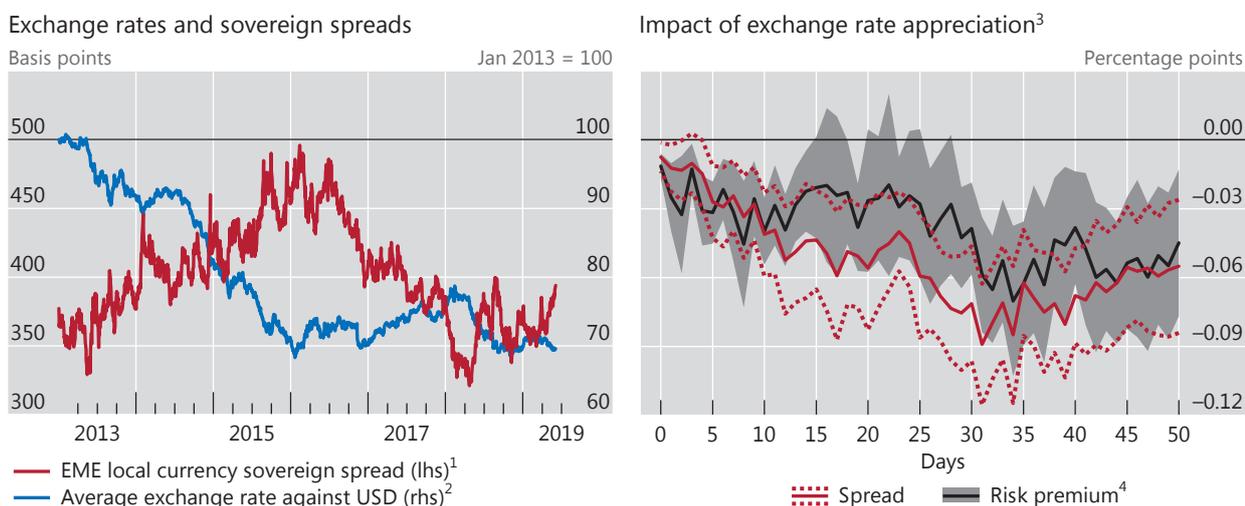
Just as for borrowers, the strong expansion of foreign investment in local currency securities heightens the relevance of the financial channel of the exchange rate. Foreign investors often hold a large share of EME local currency debt securities. Specifically, in the group of EME inflation targeters, non-residents held, on average, an estimated 26% of local currency sovereign bonds in 2018, up from 11% in 2005 (Graph II.6, centre panel). Here too, emerging Asian inflation targeters are somewhat less exposed. To be sure, local currency securities markets are more developed in EMEs compared with the times when they could only borrow in foreign currency ("original sin"). Even so, the development has not eliminated the vulnerability entirely, not least as EME bond markets have a less developed base of domestic institutional investors (Graph II.6, right-hand panel).[21]

Investors incur currency mismatches whenever they do not hedge the corresponding local currency exposures. In this case, a currency appreciation, say, increases the value of local currency assets in foreign investors' home currency terms, relaxing their value-at-risk constraints. This encourages further investment, pushing down bond yields by compressing the credit risk premium. The same mechanism plays out in reverse when the exchange rate depreciates.[22] This mechanism is one reason why EME sovereign spreads move inversely with the exchange rate (Graph II.7, left-hand panel). Indeed, formal empirical analysis for a group of major EMEs finds that exchange rate appreciation leads to lower local currency bond spreads in EMEs, and that this reduction turns out to be driven by lower credit risk premia. This is consistent with the financial channel at work, operating through the risk-taking of global investors (right-hand panel).

Over longer horizons, the impact of capital flow and associated exchange rate swings is greater still. This is because external borrowing, be it through banks or

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Exchange rates co-move with bond yields in EMEs

Graph II.7

Exchange rates and sovereign spreads

Impact of exchange rate appreciation[3]

EME local currency sovereign spread (lhs)[1]
Average exchange rate against USD (rhs)[2]

Spread   Risk premium[4]

[1] JPMorgan GBI-EM Broad diversified index spread over the 10-year US Treasury yield.   [2] Weighted average using the country weights (excluding DO, RO and UY) of the JPMorgan GBI-EM Broad diversified index as of 31 May 2019.   [3] Impact of a 1% appreciation shock to the bilateral USD exchange rate (log exchange rate changes on days of US and euro area monetary policy news) on EME local currency bond spreads and risk premium over a 50-day horizon. Control variables are the log change in the VIX index and the change in the domestic three-month money market rates. The 90% confidence bands are based on cross-sectional and period cluster robust standard errors.   [4] Spread between the five-year local currency government bond yield and a synthetic local currency five-year yield given by the sum of the five-year US Treasury yield and the five-year cross-currency swap rate. See W Du and J Schreger, "Local currency sovereign risk", *Journal of Finance*, vol 71, no 3, June 2016, pp 1027–69.

Sources: B Hofmann, I Shim and H S Shin, "Bond risk premia and the exchange rate", *BIS Working Papers*, no 775, March 2019; Bloomberg; Datastream; JPMorgan Chase; BIS calculations.

capital markets, interacts with domestic borrowing. There is ample evidence that external borrowing increases relative to domestic borrowing during credit booms,[23] and that strong credit expansion coupled with strong exchange rate appreciation has preceded financial crises.[24] This way, capital flows, exchange rate swings and domestic financial cycles reinforce each other.

Capital flows, exchange rates and monetary policy in EMEs

The specific ways in which capital flows and associated exchange rate swings affect EMEs give rise to a number of important challenges and trade-offs for monetary policy.

First, while exchange rate pass-through has declined, the inflationary consequences of exchange rate swings have not been vanquished. In many EMEs, exchange rate pass-through to inflation remains significant, although its decline over time is no doubt in part a consequence of central banks' success in containing inflation in the first place. Large swings in the exchange rate, and especially large depreciations, still have the potential to de-anchor inflation.

Second, the effects of global financial conditions transmitted through capital flows tend to weaken the transmission of monetary policy, reducing the central bank's ability to steer the economy through adjustments of its policy rate. If domestic capital market rates and asset prices are tied to swings in global markets, this weakens the effect of changes in domestic monetary policy.[25] The strength of these effects depends in part on the economy's financial structure, such as the relevance of long-term rates relative to short-term rates in credit markets, as bank short-term rates tend to be more closely related to the domestic policy rate.

The financial channel of the exchange rate adds to this effect. Under the conventional trade channel, the exchange rate would reinforce monetary transmission. A monetary policy tightening would lead to exchange rate appreciation, lowering inflation through exchange rate pass-through and dampening output through its effect on net exports. But the output effects of the financial channel work in the opposite direction. An appreciation of the exchange rate would tend to ease domestic financial conditions, counteracting the tightening effects of higher policy rates. Thus, the stronger the financial channel is relative to the trade channel, the weaker is monetary transmission through aggregate demand.

Third, the potential weakening of the classical trade channel through US dollar trade invoicing and financing, as well as the significance of capital flows and associated exchange rate swings in shaping domestic financial conditions, may worsen the short-term trade-off between inflation and output stability. A capital outflow accompanied by a depreciation of the domestic currency would push up inflation through exchange rate pass-through, but might have little effect on domestic output through traditional trade channels, at least in the near term. At the same time, domestic financial conditions would tighten, exerting a contractionary effect on the domestic economy. As a result, the central bank may face the combination of rising inflation and a weak economy. The opposite dilemma would emerge when capital flows in and the exchange rate appreciates.

Fourth, the effects of capital flows and concomitant exchange rate fluctuations may give rise to an intertemporal trade-off between stabilising inflation today and the risk of instability tomorrow. This trade-off is best described in the context of persistent capital inflows coupled with an appreciating currency. The appreciation would dampen inflation while loose financial conditions could fuel a domestic financial boom, boosting both credit expansion and increases in asset prices, not least those of real estate, and hence economic activity. However, the corresponding

build-up of vulnerabilities, notably through debt accumulation, could result in future economic weakness, a currency depreciation and a probable rise in inflation once the boom turns to bust. That way, lower inflation and stronger economic activity in the short run can give way to higher inflation and depressed activity in the longer run.

Inflation targeting EMEs have met these challenges and trade-offs by augmenting interest rate policy with FX intervention and, in some cases, balance sheet policies in domestic assets. Moreover, macroprudential policies, often with the involvement or even under the lead of the central bank, have complemented monetary policy frameworks.
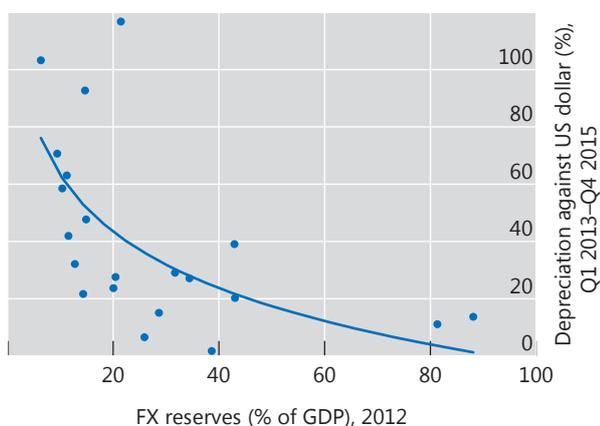
FX intervention

Intervention in foreign exchange markets can be used to build buffers against future sudden outflows and depreciations, as well as to lean against the domestic consequences of capital flow and exchange rate fluctuations.[26] Intervention strategies, tactics and instruments have varied considerably over time and across countries (Box II.A). The most common form remains intervention in spot markets.

Whether such FX intervention, unaccompanied by policy rate changes, can affect exchange rates at all has long been questioned.[27] But recent theoretical contributions have shown it can be effective under realistic assumptions about the functioning of financial markets.[28] Empirical evidence is consistent with these results. For instance, Graph II.8 (right-hand panel) reports evidence from a quarterly panel of EMEs. FX purchases depreciate the currency in a way that is statistically and economically significant.[29] Quantitatively, the effect is very similar to the appreciating effect of a capital inflow of the same size, suggesting that FX intervention can counterbalance the effects of capital flows on the exchange rate.
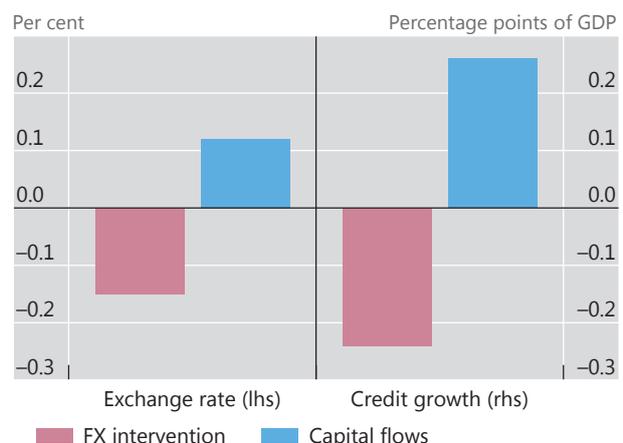
FX intervention enhances resilience in EMEs

Graph II.8

FX reserves cushion the impact of major shocks[1]

Stabilising effects of FX intervention[2]

[1] Based on 21 EMEs. [2] Coefficients from a panel regression analysis for 20 EMEs from 2000 to 2017. The dependent variable is the percentage change in the bilateral exchange rate against the US dollar (increase denotes an appreciation) and the change in the ratio of domestic credit to GDP, respectively. The regressors are the accumulation of FX reserves as well as net capital inflows, respectively, as a ratio to GDP. The control variables comprise the lagged dependent variable, the short-term interest rate spread against the United States, the log change in the VIX, the log change in the CRB commodity price index and country fixed effects.

Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; Bloomberg; Datastream; national data; BIS calculations.

FX intervention helps tackle the challenges from exchange rate swings in two main ways. First, through its effect on the exchange rate, it can directly counteract exchange rate swings that would have undesired effects on the inflation rate and on the economy. In doing so, it takes some of the burden off interest rate policy, adding a degree of freedom.

Second, the accumulation of reserves has quasi-macroprudential features. For one, it provides self-insurance against potential large future devaluations, thereby serving as an integral part of a country's financial safety net. Indeed, there are indications that FX reserve buffers helped mitigate the impact of recent episodes of global financial stress on EME exchange rates. For instance, in the wake of the taper tantrum, between 2013 and 2015, EMEs with larger reserve buffers experienced smaller currency depreciations (Graph II.8, left-hand panel).[30] For this purpose, the reserve accumulation itself does not even need to influence the exchange rate. In fact, when building up reserves with this objective in mind, central banks often seek to have as little impact as possible on the external value of the currency.

In addition, FX intervention can counteract the impact of exchange rate swings on domestic financial conditions. Working through the financial channel of the exchange rate, FX intervention can break the mutually reinforcing feedback loop between exchange rate appreciation and capital inflows that fuels domestic credit creation. In addition, the sterilisation leg of an FX intervention may help mute domestic credit expansion, to the extent that banks cannot rebalance their asset portfolios so that the sterilisation instruments on their balance sheets "crowd out" other lending.[31] In line with these notions, evidence across major EMEs suggests that FX purchases, in addition to slowing exchange rate appreciation, also dampen domestic credit expansion in a way that quantitatively matches the expansionary impact coming from capital inflows (Graph II.8, right-hand panel).[32] In other words, FX reserve buffers do not just help to "clean up the mess", once capital flows reverse and stress arises, but their accumulation also "leans" against the build-up of financial imbalances in the first place, reducing the risk, or at least the amplitude, of a possible reversal.

However, central banks also face difficult trade-offs in the use of FX intervention. The fiscal cost of carrying reserves can be considerable. This is especially true when interest rates are very low in reserve currencies, and for countries with high domestic interest rates. Moreover, to the extent that FX intervention reduces exchange rate volatility and possibly even the sense of two-way risk, it may induce further carry trades. And in the longer run, it may encourage currency mismatches, raising the relevance of the financial channel and making economies more vulnerable.[33] How far precautionary reserves are accumulated and intervention is used as a stabilisation tool will depend on a cost-benefit analysis, which will vary across countries and over time.

Thus, while FX reserves are an important element of countries' financial safety net, they are quite costly and, also for that reason, will always be limited. In times of large stock adjustments by global investors, outsize capital outflows can overstretch the central bank's FX reserve buffer. In order to mitigate this risk, sound policy frameworks and FX reserve buffers need to be complemented by regional arrangements for financial assistance, such as FX swap lines, and adequate global lending facilities at the IMF.

In addition to intervening in the FX market, EME central banks may also address capital flow and associated exchange rate volatility by using their balance sheet for operations in domestic rather than foreign currency assets. One such policy, implemented by several EME central banks, is to offer foreign exchange protection to investors without affecting the level of international reserves (Box II.A). This is achieved by auctioning non-deliverable forwards (NDFs) that settle in domestic currency. The central bank has a natural hedge for this derivative exposure,

Box II.A

FX intervention in EMEs: instruments and tactics

Although spot market interventions remain the most common instrument, the EME FX intervention toolkit has continued to expand. In particular, derivatives are gaining ground (Table A), as they are becoming the most liquid segment of the FX market, and play an increasingly important role in determining prices, even for the spot exchange rate.[1] Two other reasons may be relevant. First is the growing importance of financial stability considerations. With rising FX debt levels and increased foreign asset holdings, the vulnerability to large FX moves has increased. By providing market participants with instruments to self-insure, derivatives may be better suited to mitigating these tail risks. Second, operating in derivatives settled in local currency reduces the risk of having to report unwelcome changes in FX reserves, which might trigger undesirable market dynamics.[2]

FX intervention and related instruments in EMEs

Table A

Instrument	Mechanism	Effects			Examples
		Provide hedge for FX exposure	Support FX market liquidity	Economise on use of FX reserves	
FX spot transaction	Central bank buys or sells FX spot	Yes	Yes	No	
FX swap or FX repo	Central bank sells (buys) FX spot, and purchases (sells) FX forward	Yes, against market risk, or FX maturity mismatch	Possibly	Yes; only temporary supply of FX	Hungary, India, Korea (FX swap), Mexico, Peru, the Philippines, Russia (FX repo)
FX forwards (including NDFs, settled in local currency), FX index certificate	Central bank pays/ receives domestic currency related to change in FX value	Domestic currency payment offsetting FX valuation losses	Possibly, if FX demand declines	Yes; no foreign currency payment	Brazil,[1] India, Indonesia, Mexico, Peru, the Philippines, Turkey
FX options	Central bank sells (buys) put (call) options to buy (sell) FX reserves if exchange rate appreciation (depreciation) exceeds threshold	Yes	No. Withdraws FX when foreign currency is under depreciation trend	Build-up of reserves when domestic currency is on an appreciation trend	Colombia, Mexico

[1] In Brazil, this is known as an FX swap.

Sources: D Domanski, E Kohlscheen and R Moreno, "Foreign exchange market intervention in EMEs: what has changed?", *BIS Quarterly Review*, September 2016, pp 65–79; E Kohlscheen and S Andrade, "Official FX interventions through derivatives", *Journal of International Money and Finance*, vol 47, October 2014, pp 202–16; national authorities.

With regard to timing, central banks generally intervene reactively, once the initial bout of market pressure has subsided. This lets them maximise the effectiveness of intervention, instead of falling victim to market forces and depleting reserves significantly without having much impact. Such an approach can also be more flexible. For example, if the pressure on the currency reflects proxy hedging, it is more likely to be self-correcting and may not warrant intervention.

A comprehensive understanding of the functioning of global FX markets is especially valuable. It helps underpin central banks' decision-making on the best timing and place to intervene. For example, if the objective is to influence the exchange rate, operating in locations where and time zones when market liquidity is thin would enhance the impact. On the other hand, if the objective is to adjust the stock of reserves with minimal impact on the exchange rate, intervening in highly liquid markets and during hours when there is a large turnover would be desirable.

Discretionary interventions are the norm in EMEs, and very few central banks have experimented successfully with formal rules-based interventions. Discretion allows central banks to intervene flexibly, limit detection risk, and

maximise effectiveness on account of the surprise factor. It also makes it harder for market participants to trade against the central bank, as in the case of precommitted intervention rules.

On communication and transparency, there is a marked difference across regions.③ Central banks in Latin America have typically opted for more transparency, both in terms of preannouncing their interventions and providing more detailed information after the fact. Central banks in Asian EMEs have been less transparent.

Central banks have increasingly relied on market-based instruments to sterilise their interventions. As a result, central bank securities have become the most common instrument and reserve requirements have lost ground markedly. While market-based instruments can be more costly, they are instrumental in developing deep and liquid domestic bond markets and a local currency yield curve. Derivatives are quite prominent, and FX swaps in particular have long been used for sterilisation.

① See eg T Ehlers and F Packer, "FX and derivatives markets in emerging market economies and the internationalisation of their currencies", *BIS Quarterly Review*, December 2013, pp 55–67. In particular, they document that the ratio of derivatives to spot market turnover in EMEs increased from 1.6 in 2007 to 2.3 in 2013.   ② As per the IMF's special data dissemination standards (SDDS), only derivatives that are settled in foreign currency are recorded as reserves, while derivatives settled in local currency are reported only as "memo items". Market participants often tend to focus on headline reserve numbers excluding derivative positions.   ③ See P Cavallino and N Patel, "FX intervention: goals, strategies and tactics", *BIS Papers*, forthcoming, 2019.

ie its international reserves. Thus, offering such protection is equivalent to adjusting the currency composition of the central bank's balance sheet. As a result, such operations can be effective only when backed by a sufficiently large stock of foreign reserves.

Central banks could also address capital outflows, and thus exchange rate pressures, by facilitating the adjustment of investor portfolios in times of stress. Advanced economy central banks have provided monetary stimulus by taking duration out of the market through asset purchases, lowering long-term interest rates. EME central banks could follow a similar approach in times of stress. Specifically, when a large amount of foreign capital has been channelled into long-duration public debt and threatens to flow out quickly, the central bank may buy long-term government bonds and sell short-term instruments in order to stabilise bond markets.[34]

Macroprudential tools

Macroprudential policies complement monetary policy frameworks as an integral element of the wider macro-financial stability framework. They are targeted specifically at addressing risks to financial stability, which arise from domestic financial imbalances.

As discussed in detail in last year's Annual Economic Report,[35] such policies rely on a wide set of instruments. These range from tools such as system-wide stress tests, countercyclical capital buffers and dynamic provisions to maximum loan-to-value and debt-to-income ratios. Compared with FX intervention, they target financial vulnerabilities more directly. And, in doing so, they provide an additional degree of freedom for monetary policy too.

Overall, the experience of the past two decades indicates that macroprudential measures do help improve the trade-offs monetary policy faces, including those in connection with capital flow and associated exchange rate fluctuations. They do so by strengthening the resilience of the financial system and by leaning against the build-up of financial imbalances. There is increasing evidence that macroprudential tools can to some extent influence variables such as credit, asset prices and the amplitude of the financial cycle.[36] At the same time, because they are largely bank-based, they can leak. And they may be subject to a certain inaction bias,[37] because

of political economy pressures, among other factors. The evidence suggests that macroprudential measures alone cannot contain the build-up of financial imbalances and that they are best regarded as complements rather than substitutes for monetary policy in the pursuit of macro-financial stability.[38]

In addition, in some cases, authorities have also relied on capital flow management tools, as these have become less controversial over time.[39] That said, evidence for their effectiveness is mixed. For example, while recent empirical studies have generally found that these tools can slow down targeted flows, these effects are typically temporary.[40] Moreover, evidence in the post-GFC period suggests that tighter capital inflow restrictions generate spillovers to other countries.[41]

Sketching a framework

EME inflation targeting frameworks differ in significant respects from textbook inflation targeting frameworks, which prescribe pursuing price stability exclusively through adjustments in policy interest rates combined with freely floating exchange rates. EME central banks have addressed the challenges from capital flow and associated exchange rate swings through the use of complementary policy instruments. This practice has served EMEs well, as indicated by their macroeconomic performance over the past decades and the more specific empirical evidence supporting such a strategy. Yet important challenges remain.

As EME inflation targeters have moved ahead of theory, so the conceptual foundations of their frameworks have lagged behind. In particular, the different elements have been analysed largely in isolation. Box II.B provides a schematic framework that brings the different elements together and suggests how they can rationalise current policies. The analysis shows how the various channels through which capital flows and the exchange rate impact EMEs worsen trade-offs for central bank stabilisation policy and how FX intervention and macroprudential tools can ameliorate these trade-offs. Yet a full-fledged analytical framework that captures EME inflation targeters' full suite of policy practices remains to be developed.

On the practical side, the challenge is how best to design, implement and combine the various tools. Central banks need to decide how to develop and use their toolboxes. These include not only monetary tools proper, such as FX intervention, but also macroprudential tools, if these are under central bank control. The choice of instruments and their exact deployment will depend on country-specific factors, particularly economic and financial structures, as well as on the macro-financial background and policy objectives.

At the same time, authorities have to determine the policy horizon. Under inflation targeting regimes, monetary policy usually aims at stabilising inflation over horizons of up to two years, with policy decisions typically taken at less than a quarterly frequency. Macroprudential measures have a longer horizon, as they aim to mitigate longer-run financial stability risks. Given the slow-moving nature of such risks, these tools are adjusted less frequently, sometimes at yearly frequencies. By contrast, FX intervention often has a very short horizon, especially if it is aimed at stabilising exchange rate volatility, and operations may even be carried out at daily frequencies. However, both FX intervention and macroprudential measures shape the trade-offs involved in interest rate decisions (Box II.B).

This raises the question of the appropriate horizon for monetary policy. There is the enduring question of whether central banks may need to lengthen the horizon of their inflation targets in order to better address the intertemporal trade-off between short-term economic performance and longer-term financial and macroeconomic stability. One way of doing so is to enhance flexibility by lengthening

the horizon over which inflation targets are pursued. This would help address the longer-run risks financial imbalances pose to macroeconomic stability. Importantly, the need for flexibility to address this intertemporal trade-off arises only when inflation is below target. This is because the reversal of capital inflows would result in inflationary pressures through its impact on the exchange rate. By implication, a tighter policy during the capital flow surge when inflation is already above target would be called for in response to both short-term and medium-term considerations.

Managing macroeconomic and financial stability with multiple instruments also poses challenges in terms of instrument assignment and coordination, especially as the transmission channels of the different instruments overlap. A common approach for instrument assignment is separation: policy rates respond primarily to domestic price and output developments, FX intervention mainly to unwelcome exchange rate fluctuations, and macroprudential measures to financial stability risks. Instruments are set in sequence, each taking the previous ones as given, and with different policy horizons. A rationale for instrument separation is clarity in the allocation of responsibilities, which could bolster the framework's credibility. The drawback is that each instrument is calibrated in isolation, rather than in a coordinated way, which could in theory yield better results.[42]

There are major communication challenges as well. Clear communication about policy objectives, frameworks, rules and decisions is generally seen as a key factor boosting the credibility and accountability of monetary policy regimes. This basic insight also applies to frameworks operated with multiple tools (interest rates and FX interventions, complemented by macroprudential tools) and multiple objectives (price, macroeconomic and financial stability). Yet outlining a communication strategy with multiple tools and objectives is particularly challenging. In such cases, authorities could benefit from frequent cross-referencing of decisions and rationalising the context, scope and objective behind each so as to minimise the risk of sending mixed signals. This is especially important in cases where different tools are used to achieve objectives at different horizons, so that they may not always move in the same direction.

In addition to boosting credibility and accountability, clear and active communication about policy rationales and intentions also matters for the effectiveness of specific measures and strategies. The transmission of policy rates to longer-term rates can be enhanced through transparency about the reaction function and the envisaged path of policy rates. For FX intervention, communication strategies will depend on the intermediate objective. If FX intervention serves to accumulate precautionary FX reserve buffers without any intended effect on exchange rates, the central bank might intervene discreetly or alternatively preannounce an intended fixed path for purchases. Rules-based FX intervention might help stabilise the exchange rate as market participants internalise the central bank's reaction to excess volatility, but it may also encourage position-taking against the central bank and reduce the surprise element of the intervention.

In future, EME central banks will need to further develop their toolboxes, frameworks and communications. At a time of large and internationally mobile financial capital and low interest rates, risk-taking and the search for yield acquire greater prominence and can expose EMEs to disruptive stock adjustments by global investors. Thus, central banks may need to reinforce and refine their FX intervention strategies and tactics. They may also need to consider further developing balance sheet policies in the domestic currency to help stabilise conditions in their capital markets at times of stress. In addition, in countries where inflation is low and well anchored, there could be scope for increasing the flexibility of inflation targeting frameworks to better take into account the longer-run risks to macroeconomic stability linked to the build-up of financial imbalances.

Box II.B

Monetary policy in EMEs: a simple analytical model

Capital flow fluctuations affect EMEs' macroeconomic stability through their impact on inflation, exports and domestic financial conditions via various channels. This box highlights the trade-offs that these effects may give rise to for EMEs, drawing on a stylised model. The trade-offs are both immediate, when inflation stabilisation comes at the cost of output stabilisation, and intertemporal, when stabilising inflation today raises macroeconomic vulnerabilities tomorrow. FX intervention and macroprudential tools can improve these trade-offs.

We develop a stylised simple model for the main channels through which capital flows affect EMEs, as discussed in the main text.① The model is simply a pedagogical device designed to provide a stylised framework for policy analysis – as a reference point for future research. In the model, a surge in capital inflows appreciates the exchange rate, which, in turn, reduces import prices (pass-through channel) and export competitiveness (trade channel). The impact of the exchange rate on exports depends on trade invoicing and trade financing. Foreign currency invoicing and greater integration in global value chains (GVCs) weaken the trade channel, so that a currency appreciation might not act as a drag on economic activity, at least in the short run. Furthermore, the exchange rate affects domestic expenditure through its impact on domestic financial conditions (financial channel). An exchange rate appreciation improves domestic credit conditions and thus boosts domestic demand.② Monetary policy affects the economy through the standard effects of the interest rate on domestic demand and on the exchange rate.③

The strength of these channels determines the ultimate impact of capital flows on economic activity and inflation, and therefore shapes the trade-offs faced by central banks. Consider, first, the case of a baseline open economy lacking a financial channel and featuring a moderate inflation pass-through and a strong trade channel. In this situation, the appreciation caused by a capital inflow surge reduces inflation and output. By cutting its policy

Short-term monetary policy trade-off and FX intervention

The output/inflation trade-off   Graph II.B.1
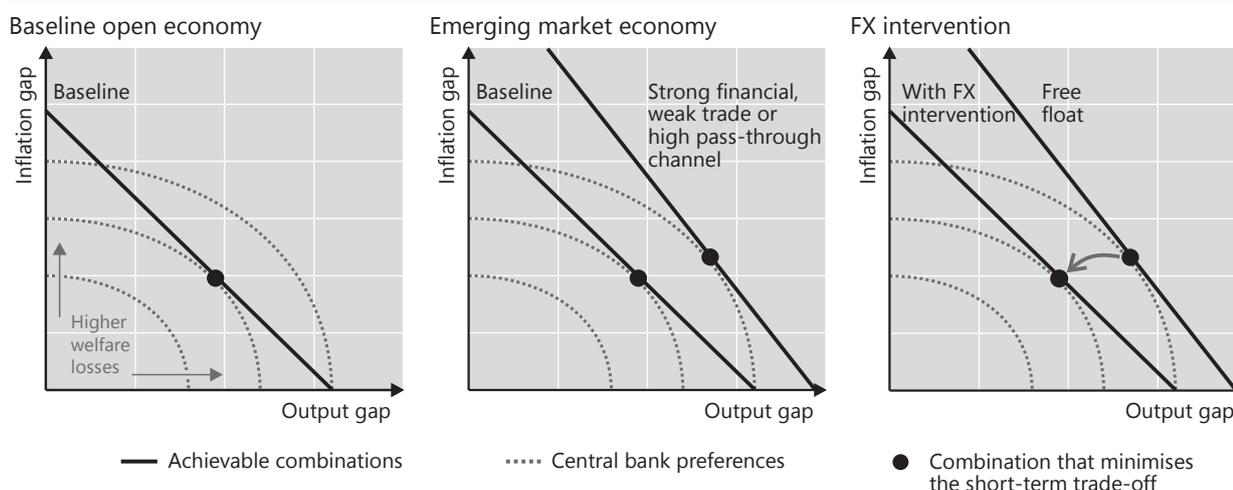
The equations of the model, expressed in percentage deviations from steady state, are: $y = \alpha_D(-i + \psi e) + \alpha_E(-i^* - \tau e)$, $\pi = \kappa y + \eta(\pi^* - \rho_I e)$ and $e = i - i^* + f - \gamma x$. The parameters α_D and α_E measure the elasticity of output to domestic and export expenditure, respectively, while $\psi > 0$ indexes financial linkages with the rest of the world and measures the strength of the financial channel of the exchange rate. The parameter $\tau = \rho_E - v$ indexes the trade channel, where $v > 0$ captures the impact of the exchange rate on GVCs and $\rho_E \in [0,1]$ measures pass-through to export prices. Similarly, $\rho_I \in [0,1]$ measures pass-through to import prices. The parameter κ measures the elasticity of inflation to output while η captures the impact of import prices, both direct and indirect through domestic marginal costs. In the modified UIP equation, f is a risk premium term that captures global financial conditions (low f means tighter financial conditions), x represents changes in foreign reserves and γ measures the effectiveness of foreign exchange intervention. The central bank follows the intervention rule $x = \delta e$. According to that rule, the central bank absorbs a fraction $\gamma\delta/(1 + \gamma\delta)$ of exchange market pressure as change in foreign exchange reserves (when $\delta = 0$, the central bank does not intervene). The central bank minimises the loss function $L = \phi\pi^2 + y^2$, where ϕ measures the weight attached to inflation stabilisation relative to output stabilisation. The equation of the set of feasible allocations is $|\pi| = -(\kappa + \Lambda)|y| + \Lambda\alpha_D|f|$, where $|\cdot|$ denotes the distance of the variable from its steady state level and $\Lambda = \frac{\eta\rho_I}{\alpha_D(1-\psi+\gamma\delta)+\tau\alpha_E}$ measures the impact of monetary policy on inflation relative to its impact on output.

Source: BIS.

rate, the central bank can counteract this contractionary effect, but it cannot fully stabilise output and inflation at the same time. This is because the exchange rate affects inflation not only through the output gap but also directly through import prices via the exchange rate.④ Hence, the central bank faces a trade-off between output and inflation stabilisation, as represented by the downward-sloping line in Graph II.B.1 (left-hand panel). Greater inflation stabilisation is achieved only at the cost of more output variability, and vice versa. By changing its policy rate, the central bank can move along the frontier and achieve different combinations of inflation and output stabilisation. The central bank will choose the combination it prefers. The dotted curves in the graph provide a conventional representation of the central bank preferences. Points on the same curve represent combinations that the central bank values equally (ie give rise to the same welfare loss), while higher curves are associated with worse outcomes. The origin of the graph represents the first best, ie the point where output is at potential and inflation is equal to its target. The central bank sets the interest rate to implement the feasible combination of output and inflation gaps that lies on the curve closest to the first best.
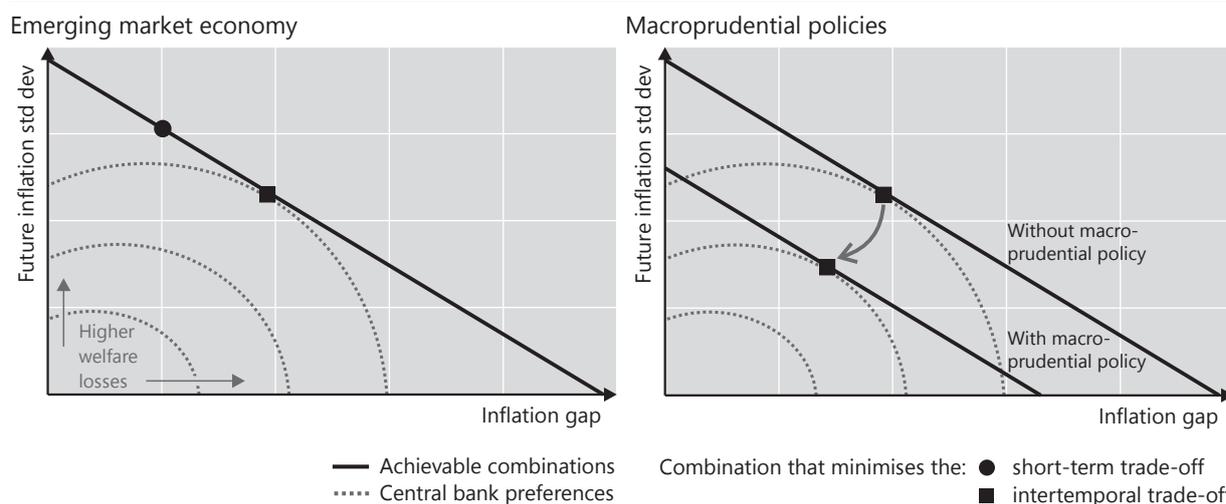
Trade-offs worsen in the case, more realistic for an EME, where the exchange rate also affects domestic financial conditions, its pass-through to inflation is high due to foreign currency trade invoicing, or the trade channel is weaker due to the combination of foreign currency trade invoicing and trade financing. A strong financial channel and a weak trade channel reduce the contractionary effect of capital inflows on output, while a high degree of pass-through raises the negative impact of exchange rate appreciation on inflation. As a result, output and inflation move in a less synchronised way. Thus, the combinations of output and inflation gaps the central bank can achieve through interest rate policy shift outwards, further away from the origin (Graph II.B.1, centre panel). The central bank can attain the same level of inflation only by boosting output further beyond its potential. If the financial channel is particularly strong, dominating the trade channel, then output actually rises in response to an exchange rate appreciation. In this case, the trade-off between output and inflation is even worse, as the two variables move in opposite directions.

FX intervention is assumed to affect the exchange rate independently of conventional interest rate policy and can thus help to improve policy trade-offs. Specifically, to the extent that FX intervention can limit exchange rate movements by absorbing part of the capital flows, it makes it easier to stabilise the economy in response to shifts in global financial conditions (Graph II.B.1, right-hand panel). The feasible combinations of output and inflation gaps attainable with changes in interest rates shift back inwards towards the origin, improving outcomes.⑤

Intertemporal monetary policy trade-off and macroprudential tools

The current inflation/future inflation volatility trade-off   Graph II.B.2

Emerging market economy

Macroprudential policies

― Achievable combinations   Combination that minimises the: ● short-term trade-off
····· Central bank preferences   ■ intertemporal trade-off

The law of motion of the strength of the financial channel is $\psi' = (\varrho - \mu)\psi - \omega[\xi(-i^* + ve - e) - \iota(-i + \psi e)]$, where ψ' represents the strength of the channel in the future and ϱ measures its persistence. The term in square brackets is the country's current account balance, with ξ and ι being the elasticity of export and import expenditures, respectively, and ω its contribution to financial vulnerabilities. The parameter μ captures the effect of macroprudential policies. The central bank minimises the intertemporal loss function $L + \beta E[L']$, where E is the expectation operator and $\beta \in (0,1)$ is the central bank's discount factor. The equation of the set of feasible allocations is $\sigma_{\pi'} = \frac{\Lambda'\alpha_D}{1+\phi(\kappa+\Lambda')^2}\sigma_{f'}$.

Source: BIS.

In addition to these immediate trade-offs, there are also intertemporal ones. Capital inflows lead to an increase in foreign debt, weakening the country's foreign asset position and possibly translating into a wider build-up of financial imbalances. This increases the economy's sensitivity to capital flow swings over time, as debt accumulates. Hence an intertemporal trade-off arises between inflation stability today and inflation volatility tomorrow. Specifically, the larger the cumulated capital inflows, the stronger the risks and impact of their potential future reversal. For example, in the face of a capital inflow surge and associated exchange rate appreciation, the central bank may cut its policy rate to mitigate the downward pressure on inflation. But to the extent that policy easing boosts imports and worsens the current account, the resulting increase in foreign debt raises the economy's exposure to capital flow reversals down the road, increasing future macroeconomic volatility.⑥ Taking this into consideration would mean tempering policy easing, and tolerating larger inflation deviations from target today in order to have more stability in the future (moving from the dot to the square in Graph II.B.2, left-hand panel).⑦

Macroprudential measures can ameliorate this intertemporal trade-off by mitigating the build-up of financial vulnerabilities and hence reducing the economy's sensitivity to capital flow and associated exchange rate swings. This would shift the trade-off frontier towards the origin (Graph II.B.2, right-hand panel).⑧ Foreign exchange intervention can have a similar effect. However, while macroprudential measures improve the economy's resilience, foreign exchange intervention directly limits foreign debt accumulation by leaning against exchange rate appreciation, further improving the trade-off.

① See footnote in Graph II.B.1 for a short summary of the model's key elements and the online appendix for a more detailed exposition. ② As discussed in the main text, capital flows can also impact domestic financial conditions directly, not only through the exchange rate. The analysis developed in this box would not change in the presence of such a direct link.   ③ Monetary policy might also affect capital flows through its impact on the carry trade. This channel can weaken and even reverse the transmission of monetary policy to the domestic economy. See P Cavallino and D Sandri, "The expansionary lower bound: contractionary monetary easing and the trilemma", *BIS Working Papers*, no 770, February 2019.   ④ The "divine coincidence", ie the possibility that interest rate policy could alone close both inflation and output gaps simultaneously, generically fails when the policy rate affects inflation in ways other than through the output gap, eg through the prices of imported goods via the exchange rate.   ⑤ As discussed in the main text, there are many reasons not included in the model that make it suboptimal to completely stabilise the exchange rate through intervention. For the case of the quasi-fiscal cost of intervention, see P Cavallino, "Capital flows and foreign exchange intervention", *American Economic Journal: Macroeconomics*, vol 11, no 2, April 2019, pp 127–70.   ⑥ To simplify the analysis, we assume that the country's exposure is proportional to its net foreign asset position. Hence, a reduction in the domestic policy rate increases financial vulnerabilities if it worsens the current account. However, this condition might be too restrictive, given that a country's exposure is a function of its gross, rather than just net, asset position. See eg C Borio and P Disyatat, "Global imbalances and the financial crisis: link or no link?", *BIS Working Papers*, no 346, May 2011.   ⑦ In our model, foreign debt amplifies the impact of capital flow and associated exchange rate swings and raises macroeconomic volatility. In reality, the build-up of financial vulnerabilities affects not only the exposure to but also the likelihood of a capital flow reversal. This channel worsens the intertemporal trade-off. More generally, if one also took into account the impact of monetary easing on domestic credit growth, the intertemporal trade-off would be even worse. See T Adrian and N Liang, "Monetary policy, financial conditions, and financial stability", *International Journal of Central Banking*, vol 14, no 1, January 2018, pp 73–132. ⑧ As for foreign exchange intervention, we abstract from any cost of macroprudential measures. For example, countercyclical regulatory rules might induce volatility in capital requirements that can translate into volatility in other macroeconomic variables, including the exchange rate. See P-R Agénor, K Alper and L Pereira da Silva, "Sudden floods, macroprudential regulation and stability in an open economy", *Journal of International Money and Finance*, vol 48, November 2014, pp 68–100.

From a broader perspective, sound monetary policy frameworks need to be complemented by sound structural, fiscal and regulatory policies at the national level. One especially relevant element is the development of a stronger domestic base of institutional investors, reducing the dependence on foreign funding. At the same time, sound policy frameworks at the national level need to be complemented by a credible and effective global financial safety net that would mitigate risks of speculative attacks and reduce the need for self-insurance through large-scale FX reserve accumulation.

Endnotes

[1] The classification is based on self-classification of the individual countries as well as the information provided in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.

[2] See eg R Clarida, J Gali and M Gertler, "Monetary policy rules and macroeconomic stability: evidence and some theory", *The Quarterly Journal of Economics*, vol 115, no 1, February 2000, pp 147–80; J Gali and T Monacelli, "Monetary policy and exchange rate volatility in a small open economy", *Review of Economic Studies*, vol 72, 2005, pp 707–34; and M Woodford, *Interest and prices: foundations of a theory of monetary policy*, Princeton University Press, 2003.

[3] According to de facto classifications of exchange rate regimes proposed by academic researchers and which are based on the actual behaviour of exchange rates rather than official labels, EME inflation targeters are commonly characterised as managed floaters or as having crawling bands or pegs, while in advanced economies free floating is quite common. See E Ilzetzki, C Reinhart and K Rogoff, "Exchange arrangements entering the 21st century: which anchor will hold?", *Quarterly Journal of Economics*, vol 134, no 2, May 2019.

[4] The reference group of inflation targeting advanced economies comprises the countries that have operated inflation targeting regimes throughout the past two decades. This includes Australia, Canada, New Zealand, Norway, Sweden and the United Kingdom.

[5] See J Frankel, "Systemic managed floating", *Open Economies Review*, vol 30, no 2, April 2019, pp 255–95.

[6] See BIS, "Understanding globalisation", *87th Annual Report*, June 2017, Chapter VI.

[7] See eg H S Shin, "The second phase of global liquidity and its impact on emerging economies", in K Chung, S Kim, H Park, C Choi and H S Shin (eds), *Volatile capital flows in Korea*, Palgrave Macmillan.

[8] For evidence for the link between global financial conditions and capital flows to EMEs, see eg S Ahmed and A Zlate, "Capital flows to emerging market economies: a brave new world?", *Journal of International Money and Finance*, vol 48, November 2014, pp 221–48; F Bräuning and V Ivashina, "US monetary policy and emerging market credit cycles", *Journal of Monetary Economics*, forthcoming; and S Avdjiev, L Gambacorta, L Goldberg and S Schiaffi, "The shifting drivers of global liquidity", *NBER Working Papers*, no 23565, June 2017.

[9] According to Engel's law: as income rises, the proportion of income spent on food falls. Since EMEs have lower incomes on average than advanced economies, their consumption baskets tend to have a higher weight on food. For a more detailed discussion, see C Ho and R McCauley, "Living with flexible exchange rates: issues and recent experience in inflation targeting emerging market economies", *BIS Working Papers*, no 130, February 2003.

[10] For more detailed analyses on the evolution and drivers of inflation in EMEs, see J Ha, A Kose and F Ohnsorge, "Inflation in emerging and developing economies", *World Bank Publications*, March 2019.

[11] See IMF, *World Economic Outlook*, October 2018, for a more detailed analysis of the anchoring of inflation expectations in emerging market and advanced economies.

[12] See G Gopinath, E Boz, C Casas, F Díez, P-O Gourinchas and M Plagborg-Møller, "Dominant currency paradigm", *NBER Working Papers*, no 22943, March 2019.

[13] See C Upper and M Valli, "Emerging derivatives markets", *BIS Quarterly Review*, December 2016, pp 67–80.

[14] See eg F Liriano, "The use of foreign exchange derivatives by exporters and importers: the Chilean experience", paper presented at the Eighth IFC Conference on *Statistical implications of the new financial landscape*, Basel, September 2016; and T Chuaprapaisilp, N Rujiravanich and B Saengsith, "FX hedging behaviour among Thai exporters: a micro-level evidence", Puey Ungphakorn Institute for Economic Research, *PIER Discussion Papers*, no 81, February 2018.

[15] For more details of global trade financing, see Committee on the Global Financial System, "Trade finance: developments and issues", *CGFS Papers*, no 50, 2014.

[16] See V Bruno, S-J Kim and H S Shin, "Exchange rates and the working capital channel of trade fluctuations", *AEA Papers and Proceedings*, May 2018, vol 108, pp 531–36.

[17] See J Caruana, "Monetary policy for financial stability", keynote speech at the 52nd SEACEN Governors' conference, Naypyidaw, Myanmar, 2016.

[18] For formal evidence of the link between global and emerging market equity returns and interest rates, see H Rey, "Dilemma not trilemma: the global financial cycle and monetary policy independence", in *Global dimensions of unconventional monetary policy*, proceedings of the Federal Reserve Bank of Kansas City Jackson Hole symposium, August 2014; M Obstfeld, "Trilemmas and trade-offs: living with financial globalisation", *BIS Working Papers*, no 480, January 2015; and B Hofmann, and E Takáts, "International monetary spillovers", *BIS Quarterly Review*, September 2015, pp 105–18.

[19] See M Chui, E Kuruc and P Turner, "A new dimension to currency mismatches in the emerging markets: non-financial companies", *BIS Working Papers*, no 550, March 2016, for a more detailed analysis of foreign currency borrowing and currency mismatches in EMEs.

[20] See Chui et al (2016), op cit.

[21] See A Carstens and H S Shin, "Emerging markets aren't out of the woods yet", *Foreign Affairs*, 15 March 2019. Committee on the Global Financial System, "Establishing viable capital markets", *CGFS Papers*, no 62, 2019, provides a detailed analysis of the strength of institutional investor bases in advanced and emerging market economies.

[22] This mechanism can be described as an exchange rate risk-taking channel, as exchange rate swings influence the lending capacity of global investors through their risk constraints; see B Hofmann, I Shim and H S Shin, "Bond risk premia and the exchange rate", *BIS Working Papers*, no 775, March 2019.

[23] See C Borio, P McGuire and R McCauley, "Global credit and domestic credit booms", *BIS Quarterly Review*, September 2011, pp 42–57; and S Avdjiev, P McGuire and R McCauley, "Rapid credit growth and international credit: challenges for Asia", *BIS Working Papers*, no 377, April 2012.

[24] See C Borio and P Lowe, "Assessing the risks of banking crises", *BIS Quarterly Review*, December 2002, pp 43–54; and P-O Gourinchas and M Obstfeld, "Stories of the twentieth century for the twenty-first", *American Economic Journal: Macroeconomics*, January 2012, vol 4, no 1, pp 226–65.

[25] For more detailed discussions of this point, see Rey (2014), op cit; and Obstfeld (2015), op cit.

[26] See eg BIS, *74th Annual Report*, June 2004, particularly Box IV.B.

[27] Throughout this chapter, the term "FX intervention" is used to refer exclusively to sterilised FX intervention. "Non-sterilised" interventions alter the level of bank reserves and, all else equal, go hand in hand with a change in the policy rate. The exception is when central banks operate with a floor (excess reserves) system, so that the policy rate is set equal to the deposit facility. But, in that case, bank reserves are effectively perfect substitutes for short-term government paper, making the distinction dubious at best. For a more detailed discussion, see P Disyatat, "Monetary policy implementation: misconceptions and their consequences", *BIS Working Papers*, no 269, December 2008.

[28] The literature identifies two channels through which interventions can affect the exchange rate. The first is the signalling channel, which changes market participants' expectations about macroeconomic conditions or future policy. The second is a portfolio balance channel, which operates whenever assets denominated in different currencies are imperfect substitutes. For a survey of the early literature, see L Sarno and M Taylor, "Official intervention in the foreign exchange market: is it effective and, if so, how does it work?", *Journal of Economic Literature*, vol 39, no 3, September 2001, pp 839–68. For recent theoretical contributions on the portfolio balance channel, see X Gabaix and M Maggiori, "International liquidity and exchange rate dynamics", *Quarterly Journal of Economics*, vol 130, no 3, August 2015, pp 1369–420; and P Cavallino, "Capital flows and foreign exchange intervention", *American Economic Journal: Macroeconomics*, vol 11, no 2, April 2019, pp 127–70.

[29] For an overview of the evidence, see A Ghosh, J Ostry and M Qureshi, *Taming the tide of capital flows: a policy guide*, MIT Press, 2018; and L Menkhoff, "Foreign exchange intervention in emerging

markets: a survey of empirical studies", *The World Economy*, vol 36, no 9, September 2013, pp 1187–2008. See also recent high-frequency evidence for Israel in I Caspi, A Friedman and S Ribon, "The immediate impact and persistent effect of FX purchases on the exchange rate", Bank of Israel, *Discussion Papers*, no 2018.04, June 2018; and for Colombia, B Hofmann, H S Shin and M Villamizar-Villegas, "FX intervention and domestic credit: evidence from high-frequency micro data", *BIS Working Papers*, no 774, March 2019.

[30]   See also J Davis, D Crowley and M Morris, "Reserve adequacy explains emerging-market sensitivity to US monetary policy", Federal Reserve Bank of Dallas, *Economic Letter*, vol 13, no 9, December 2018, pp 1–4; P García and C Soto, "Large hoardings of international reserves: are they worth it?", Central Bank of Chile, *Working Papers,* no 299, 2004; R Llaudes, F Salman and M Chivakul, "The impact of the great recession on emerging markets", *IMF Working Papers*, no WP/10/237, October 2010; and A Silva, "The self-insurance role of international reserves and the 2008–2010 crisis", Central Bank of Brazil, *Working Paper Series*, no 256, November 2011. More generally, O Blanchard and G Adler, "Can foreign exchange intervention stem exchange rate pressures from global capital flow shocks?", *NBER Working Papers*, no 21427, July 2015, find that FX intervention mitigates the impact of shifts in global capital flows on the economy.

[31]   See Ghosh et al (2018), op cit; and R Chang, "FX intervention redux", *NBER Working Papers*, no 24463, March 2018.

[32]   High-frequency evidence for Colombia paints a similar picture; see Hofmann et al (2019), op cit.

[33]   See eg A Barajas and A Morales, "Dollarization of liabilities: beyond the usual suspects", *IMF Working Papers*, no WP/03/11, 2003; and J Berrospide, "Exchange rates, optimal debt composition, and hedging in small open economies", Board of Governors of the Federal Reserve System, *Finance and Economics Discussion Series*, no 2008-18, January 2008.

[34]   For example, in 2008 and 2009 the Bank of Mexico swapped long-term securities for short-term securities via auctions in order to address stock adjustment by global investors. This policy stabilised conditions in peso-denominated bond markets.

[35]   See BIS, "Moving forward with macroprudential frameworks", *Annual Economic Report*, June 2018, Chapter IV; and C Borio, "Macroprudential frameworks: experience, prospects and a way forward", speech on the occasion of the Annual General Meeting of the Bank for International Settlements, Basel, 24 June 2018.

[36]   For recent reviews of the effectiveness of macroprudential instruments, see G Galati and R Moessner, "What do we know about the effects of macroprudential policy?", *Economica*, vol 85, no 340, October 2018, pp 735–70; and S Claessens, "An overview of macroprudential policy tools", *Annual Review of Financial Economics*, vol 7, no 1, December 2015, pp 397–422.

[37]   See S Ingves, "It takes all sorts – macroprudential oversight in the EU", keynote address at the First ESRB Annual Conference, September 2016.

[38]   See eg V Bruno, I Shim and H S Shin, "Comparative assessment of macroprudential policies", *Journal of Financial Stability*, vol 28, February 2017, pp 183–202; and L Gambacorta and A Murcia, "The impact of macroprudential policies and their interaction with monetary policy: an empirical analysis using credit registry data", *BIS Working Papers*, no 636, April 2017.

[39]   See, in particular, the IMF's explicit endorsement of the use of capital controls to calm volatile cross-border capital flows under its institutional view: IMF, *The liberalization and management of capital flows: an institutional view*, November 2012.

[40]   BIS (2018), op cit.

[41]   See eg G Pasricha, M Falagiarda, M Bijsterbosch and J Aizenman, "Domestic and multilateral effects of capital controls in emerging markets", *Journal of International Economics*, vol 115, November 2018, pp 48–58.

[42]   See P-R Agénor and L Pereira da Silva, *Integrated inflation targeting: another perspective from the developing world*, BIS-CEMLA, February 2019, for a detailed discussion of the benefits and challenges in the use and calibration of policy rates, FX intervention and macroprudential tools in an integrated macro-financial stability framework.

Inflation in inflation targeting EMEs

In per cent

Inflation: — Core — Headline ▬ Target/target range
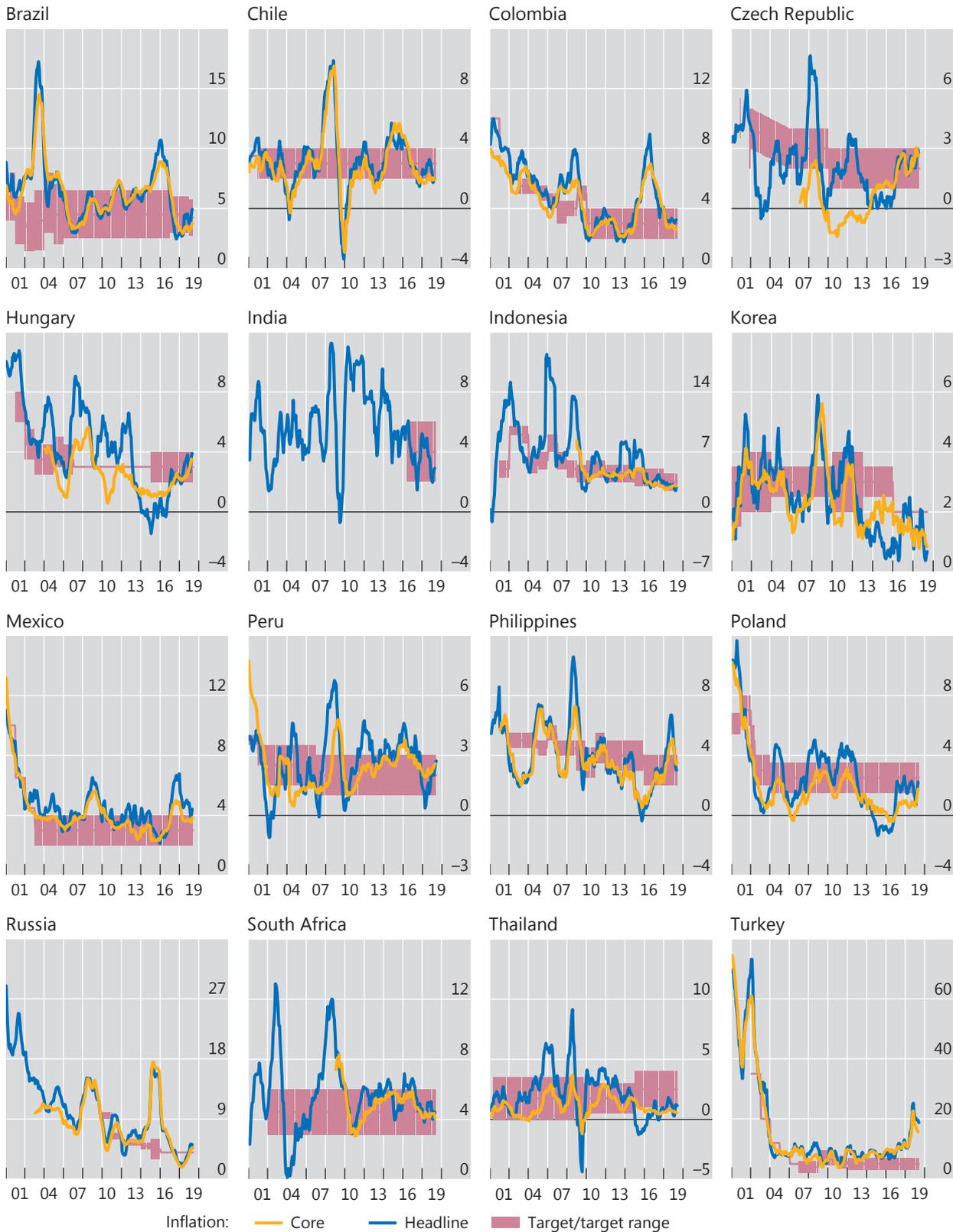
Sources: Central bank websites; Datastream; national data.

III. Big tech in finance: opportunities and risks

> *Key takeaways*
>
> - *The entry of large technology firms ("big techs") into financial services holds the promise of efficiency gains and can enhance financial inclusion.*
>
> - *Regulators need to ensure a level playing field between big techs and banks, taking into account big techs' wide customer base, access to information and broad-ranging business models.*
>
> - *Big techs' entry presents new and complex trade-offs between financial stability, competition and data protection.*

Technology firms such as Alibaba, Amazon, Facebook, Google and Tencent have grown rapidly over the last two decades. The business model of these "big techs" rests on enabling direct interactions among a large number of users. An essential by-product of their business is the large stock of user data which are utilised as input to offer a range of services that exploit natural network effects, generating further user activity. Increased user activity then completes the circle, as it generates yet more data.

Building on the advantages of the reinforcing nature of the data-network-activities loop, some big techs have ventured into financial services, including payments, money management, insurance and lending. As yet, financial services are only a small part of their business globally. But given their size and customer reach, big techs' entry into finance has the potential to spark rapid change in the industry. It offers many potential benefits. Big techs' low-cost structure business can easily be scaled up to provide basic financial services, especially in places where a large part of the population remains unbanked. Using big data and analysis of the network structure in their established platforms, big techs can assess the riskiness of borrowers, reducing the need for collateral to assure repayment. As such, big techs stand to enhance the efficiency of financial services provision, promote financial inclusion and allow associated gains in economic activity.

At the same time, big techs' entry into finance introduces new elements in the risk-benefit balance. Some are old issues of financial stability and consumer protection in new settings. In some settings, such as the payment system, big techs have the potential to loom large very quickly as systemically relevant financial institutions. Given the importance of the financial system as an essential public infrastructure, the activities of big techs are a matter of broader public interest that goes beyond the immediate circle of their users and stakeholders.

There are also important new and unfamiliar challenges that extend beyond the realm of financial regulation as traditionally conceived. Big techs have the potential to become dominant through the advantages afforded by the data-network-activities loop, raising competition and data privacy issues. Public policy needs to build on a more comprehensive approach that draws on financial regulation, competition policy and data privacy regulation. The aim should be to respond to big techs' entry into financial services so as to benefit from the gains while limiting the risks. As the operations of big techs straddle regulatory perimeters and

geographical borders, coordination among authorities – national and international – is crucial.

This chapter begins with a description of big techs' inroads into finance. The second section analyses the reasons for this entry and how big techs' business models can create competitive advantages over banks. The third section analyses the potential effects of big techs on financial intermediation and the final one discusses possible implications for public policy.

Big techs in finance

The activities of big techs in finance are a special case of broader fintech innovation. Fintech refers to technology-enabled innovation in financial services, including the resulting new business models, applications, processes and products.[1] While fintech companies are set up to operate primarily in financial services, big tech firms offer financial services as part of a much wider set of activities.

Big techs' core businesses are in information technology and consulting (eg cloud computing and data analysis), which account for around 46% of their revenues (Graph III.1, left-hand panel). Financial services represent about 11%. While big techs serve users globally, their operations are mainly located in Asia and the Pacific and North America (right-hand panel). Their move into financial services has been most extensive in China, but they have also been expanding rapidly in other emerging market economies (EMEs), notably in Southeast Asia, East Africa and Latin America.

In offering financial services, big techs both compete and cooperate with banks (Table III.1).[2] Thus far, they have focused on providing basic financial services to their large network of customers and have acted as a distribution channel for third-party providers, eg by offering wealth management or insurance products.
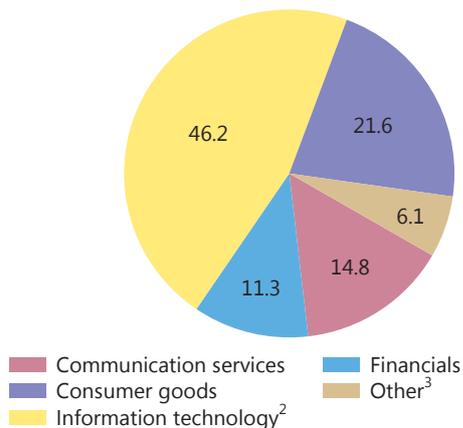

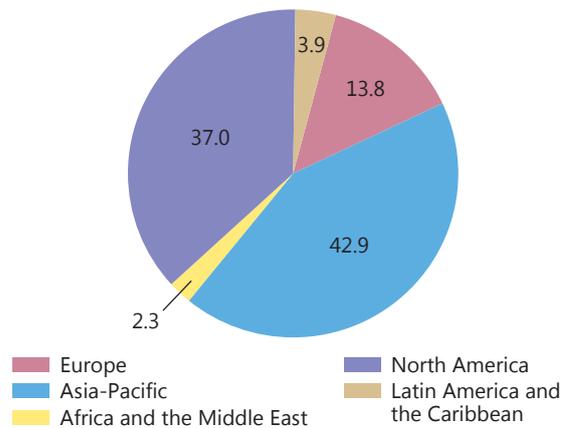
Financial services are a small part of big tech business

In per cent   Graph III.1

Big techs' revenues by sector of activity[1]   Regional distribution of big techs' subsidiaries[4]

Communication services   Financials   Europe   North America
Consumer goods   Other[3]   Asia-Pacific   Latin America and
Information technology[2]   Africa and the Middle East   the Caribbean

The sample includes Alibaba, Alphabet, Amazon, Apple, Baidu, Facebook, Grab, Kakao, Mercado Libre, Rakuten, Samsung and Tencent.

[1] Shares based on 2018 total revenues, where available, as provided by S&P Capital IQ; where not available, data for 2017.   [2] Information technology can include some financial-related business.   [3] Includes health care, real estate, utilities and industrials.   [4] Shares are calculated on the number of subsidiaries as classified by S&P Capital IQ.

Sources: S&P Capital IQ; BIS calculations.

Financial activities of selected big tech firms Table III.1

	Main geographical area of activity	Payments	Money market funds and insurance	Credit
Emerging market economies				
Alibaba/Alipay, Tencent	China	Δ	Δ/√	Δ
Baidu	China	Δ	Δ/√	√
Vodafone M-Pesa	East Africa, Egypt and India	Δ		√
Mercado Libre	Argentina, Brazil and Mexico	Δ		Δ
Samsung	Korea	√		
GO-Jek, Ola Cabs	Southeast Asia	Δ		
Grab	Southeast Asia	Δ	√	Δ
KT	Korea	√	Δ	Δ/√
Kakao	Korea	Δ/√		Δ/√
Advanced economies				
Google	Worldwide	√		Δ/√
Amazon, eBay/PayPal	Worldwide	√		√
Apple, Facebook, Microsoft	Worldwide	√		
Orange	France	√		√
Groupon	Worldwide	Δ		
Line, Rakuten	Japan	Δ	Δ	Δ
NTT Docomo	Japan	Δ	Δ	√

Δ indicates new entities and operations introduced outside the traditional financial and banking network. √ indicates the provision of services as overlays on top of, or in collaboration with, existing financial institutions (especially banks and credit card providers).

Sources: Financial Stability Board; S&P Capital IQ; public sources; BIS.

Payment services

Payments were the first financial service big techs offered, mainly to help overcome the lack of trust between buyers and sellers on e-commerce platforms. Buyers want delivery of goods, but sellers are only willing to deliver after being assured of payment. Payment services like those provided by Alipay (owned by Alibaba) or PayPal (owned by eBay) allow guaranteed settlement at delivery and/or reclaims by buyers and are fully integrated into e-commerce platforms. In some regions with less developed retail payment systems, new payment services emerged through mobile network operators (eg M-Pesa in several African countries). Over time, big techs' payment services have become more widely used as an alternative to other electronic payment means such as credit and debit cards.

Big techs' payment platforms currently are of two distinct types. In the first type, the "overlay" system, users rely on existing third-party infrastructures, such as credit card or retail payment systems, to process and settle payments (eg Apple

Pay, Google Pay, PayPal). In the second, users can make payments which are processed and settled on a system proprietary to the big tech (eg Alipay, M-Pesa, WePay).

While big techs' payment platforms compete with those provided by banks, they still largely depend on banks. In the first type, directly so; in the second, users require a bank account or a credit/debit card to channel money into and out of the network. Big techs then hold the money they receive in their own regular bank accounts and transfer it back to users' bank accounts when users request repayment. To settle between banks, big techs have to again use banks, since they do not participate in regular interbank payment systems for the settlement in central bank money.

Overlay systems are used more commonly in the United States and other advanced economies since there credit cards were already ubiquitous by the time e-commerce firms such as Amazon and eBay came to prominence. Proprietary payment systems are more prevalent in jurisdictions where the penetration of other cashless means of payment, including credit cards, is low. This helps explain the large volume of big tech payment services in China: 16% of GDP, dwarfing that elsewhere (Graph III.2, left-hand panel).

More generally, big techs have made greater inroads where the provision of payments is limited and mobile phone penetration high. For instance, as a large fraction of the population in EMEs remains unbanked (Graph III.2, right-hand panel), the high mobile phone ownership rate has allowed digital delivery of essential financial services, including cashless payments, to previously unbanked households and small and medium-sized enterprises (SMEs).
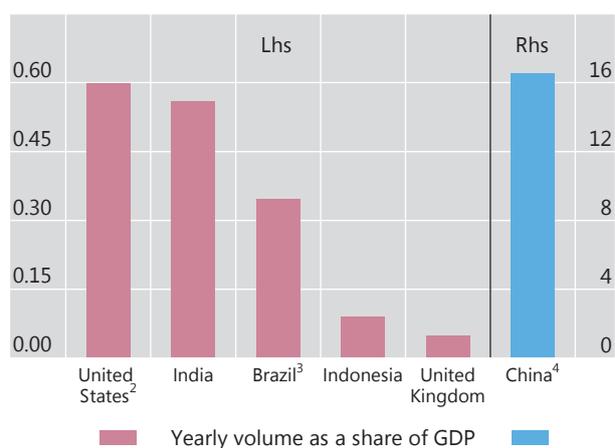
Remittance services, and cross-border retail payments more broadly, are another activity ripe for entry. Current services are often costly and slow, and it is
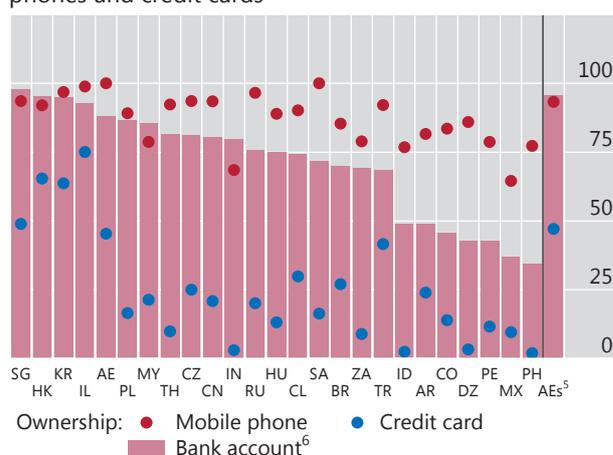
Mobile payments and bank accounts[1]

In per cent

Graph III.2

Big tech mobile payment services

Fraction of population with bank accounts, mobile phones and credit cards

Legend:
Yearly volume as a share of GDP

Ownership: ● Mobile phone ● Credit card
Bank account[6]

[1] 2017 data. [2] 2016 data. [3] Estimate based on the public data for Mercado Libre. [4] Only mobile payments for consumption data (ie excluding mobile payments for money transfer, credit card payments and mobile finance). [5] Advanced economy (AE) average. [6] Respondents who report having an account at a bank or another type of financial institution or report personally using a mobile money service in the past 12 months.

Sources: J Frost, L Gambacorta, Y Huang, H S Shin and P Zbinden, "BigTech and the changing structure of financial intermediation", *BIS Working Papers*, no 779, April 2019; World Bank; Forrester Research; GlobalData; iResearch; Mercado Libre; Nikkei; Worldpay; national data; BIS calculations.

difficult for senders to verify receipt of funds. Some big techs have started to offer (near) real-time transfers at relatively low cost. Examples include the remittance service between Hong Kong SAR and the Philippines offered by Alipay HK (a joint venture of Ant Financial and CK Hutchison) and GCash (operated by Globe Telecom). These cross-border transactions, however, still rely on a correspondent banking network and require collaboration with banks. Other big techs (eg Facebook) are reportedly considering offering payment services for their customers on a global basis.[3]

Money market funds and insurance products

Big techs use their wide customer network and brand name recognition to offer money market funds and insurance products on their platforms. This business line capitalises on big techs' payment services. Big techs' one-stop shops aim to be more accessible, faster and more user-friendly than those offered by banks and other financial institutions.
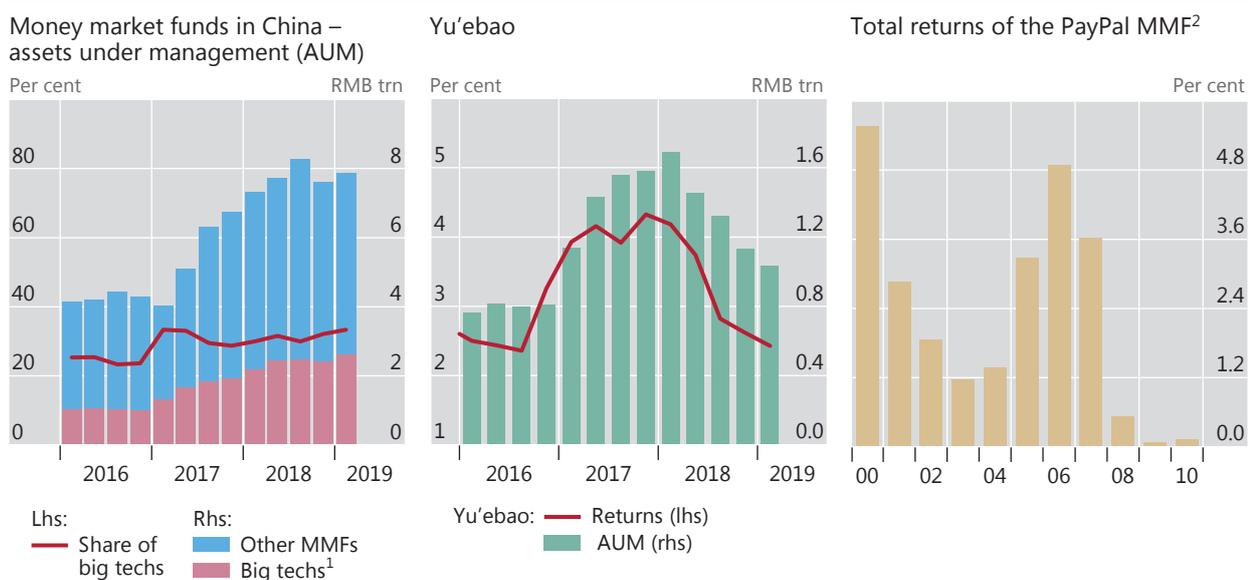
On big tech payment platforms, customers often maintain a balance in their accounts.[4] To put these funds to use, big techs offer money market funds (MMFs) as short-term investments. The MMF products offered are either managed by companies affiliated with the big tech firm or by third parties. By analysing their customers' investment and withdrawal patterns, big techs can closely manage the MMFs' liquidity. This allows them to offer users the possibility to invest (and withdraw) their funds almost instantaneously.

In China, MMFs offered through big tech platforms have grown substantially since their inception (Graph III.3, left-hand panel). Within five years, the Yu'ebao money market fund offered to Alipay users grew into the world's largest MMF, with assets over CNY 1 trillion (USD 150 billion) and around 350 million customers.

Despite their rapid growth, MMFs affiliated with big techs in China are still relatively small compared with other savings vehicles. At end-2018, total MMF

The rise of big tech money market funds and their sensitivity to returns   Graph III.3

Money market funds in China –
assets under management (AUM)

Yu'ebao

Total returns of the PayPal MMF[2]

Lhs:
— Share of big techs

Rhs:
▇ Other MMFs
▇ Big techs[1]

Yu'ebao: — Returns (lhs)
▇ AUM (rhs)

[1] Ant Financial, Tencent, Baidu and JD.   [2] Quarterly average of annualised weekly returns.

Sources: Wind; company reports.

balances related to big techs amounted to CNY 2.4 trillion (USD 360 billion), only about 1% of bank customer deposits or 8% of outstanding wealth management products.

The expansion of big tech MMFs in China and in other countries has benefited from favourable market conditions. For example, the launch of Yu'ebao coincided with interbank interest rates exceeding deposit rates, allowing big techs to offer higher rates. As rates declined recently, Yu'ebao's assets stopped growing and even saw reductions (Graph III.3, centre panel). Similarly, PayPal closed its MMF in 2011, after interest rates in the United States fell to close to zero (right-hand panel).

Some big techs have started to offer insurance products. Again, they use their platforms mainly as a distribution channel for third-party products, including auto, household liability and health insurance. In the process, they collect customer data, which they can combine with other data to help insurers improve their marketing and pricing strategies.

Credit provision

Building on their e-commerce platforms, some big techs have ventured into lending, mainly to SMEs and consumers. Loans offered are typically credit lines, or small loans with short maturity (up to one year). The (relative) size of big tech credit varies greatly across countries. While total fintech (including big tech) credit per capita is relatively high in China, Korea, the United Kingdom and the United States, big techs account for most fintech credit in Argentina and Korea (Graph III.4).

The uneven expansion of total fintech credit appears to reflect differences in economic growth and financial market structure. Specifically, the higher a country's per capita income and the less competitive its banking system, the larger total fintech credit activity.[5] The big tech credit component has expanded more strongly than other fintech credit in those jurisdictions with lighter financial regulation and higher banking sector concentration.

Despite its substantial recent growth, total fintech credit still constitutes a very small proportion of overall credit. Even in China, with the highest amount of fintech

Big tech and other fintech credit in selected jurisdictions[1]

Graph III.4

Lhs: ■ Big tech credit   ■ Other fintech credit   Rhs (logarithmic): ● Total fintech credit per capita
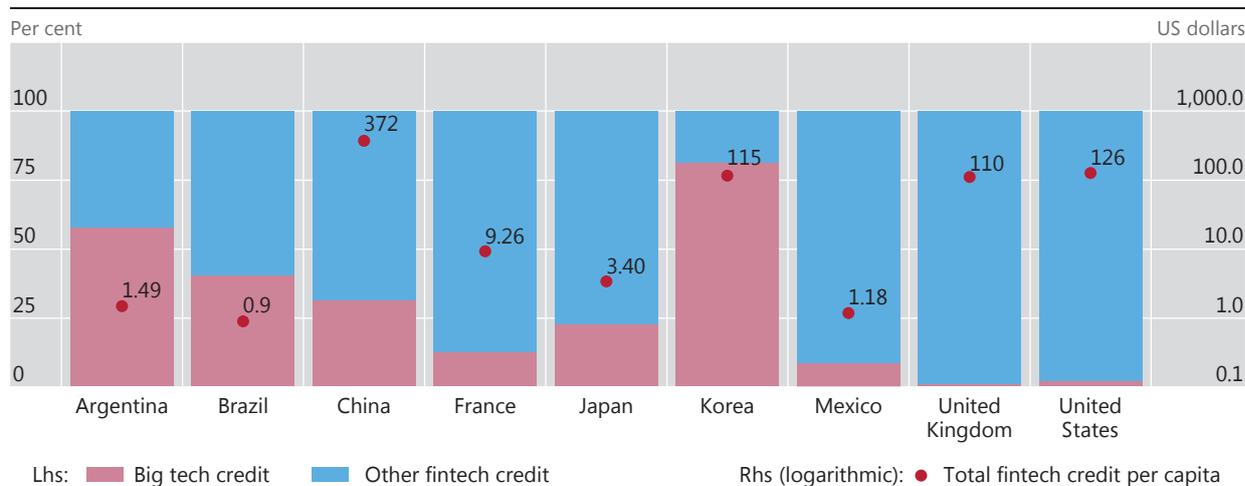
[1] The bars show the share of big tech and other fintech credit in selected jurisdictions in 2017, while the dots show total fintech credit per capita.

Source: J Frost, L Gambacorta, Y Huang, H S Shin and P Zbinden, "BigTech and the changing structure of financial intermediation", *BIS Working Papers*, no 779, April 2019.

credit per capita, the total flow of fintech credit amounted to less than 3% of total credit outstanding to the non-bank sector in 2017.

Big techs' relatively small lending footprint so far has reflected their limited ability to fund themselves through retail deposits. Big techs have some options to overcome this constraint.

One is to establish an online bank. But in some countries, regulatory authorities restrict the opening of remote (online) bank accounts. One example is China, where the two Chinese big tech banks (MYbank and WeBank) rely mostly on the interbank market funding and certificates of deposit (Graph III.5, left-hand panel) rather than on traditional deposits. More recently, however, these banks have started to issue "smart deposits" that offer significantly higher interest rates than other time deposits and the possibility of early withdrawal at a reduced rate.

A second option is to partner with a bank. Big techs can provide the customer interface and allow for quick loan approval using advanced data analytics; if approved, the bank is left to raise funds and manage the loan. This option can be attractive to big techs as their platforms are easily scalable at low cost and they interface directly with the client. It may also be profitable for banks, as they can gain an extra return – despite providing lower value added services.

A third option is to obtain funds through loan syndication or securitisation – already a common strategy among fintech firms. For instance, Ant Financial's gross issuance of exchange-traded asset-backed securities (ABS) accounted for almost one third of the total securitisation in China in 2017 (Graph III.5, right-hand panel).

## Why do big techs expand into financial services?

Big techs have typically entered financial services once they have secured an established customer base and brand recognition. Their entry into finance reflects strong complementarities between financial services and their core non-financial activities, and the associated economies of scope and scale.

Big tech banks in China rely more on non-core deposit funding

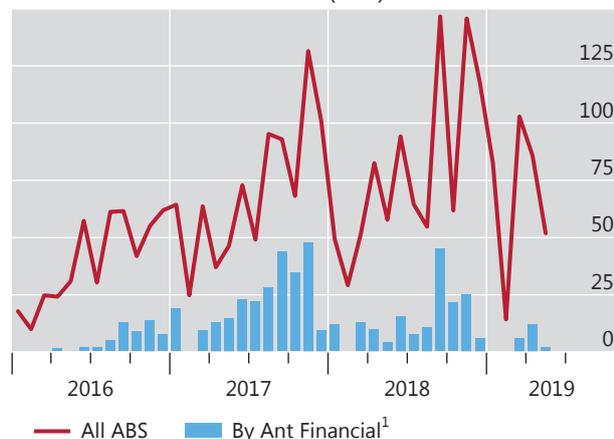In billions of renminbi   Graph III.5

Gross certificate of deposit issuance
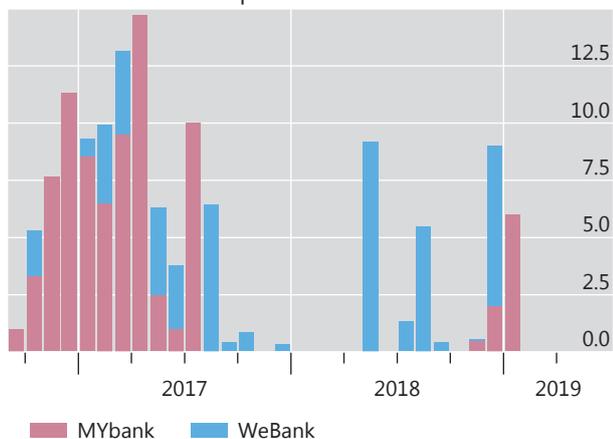
Gross asset-backed securities (ABS) issuance in China

MYbank   WeBank   All ABS   By Ant Financial[1]

[1] The figures refer to the transactions conducted via exchanges and do not include interbank transactions.

Sources: Wind; company reports.

The DNA of big techs

Data analytics, **n**etwork externalities and interwoven **a**ctivities ("DNA") constitute the key features of big techs' business models. These three elements reinforce each other. The "network externalities" of a big tech's platform relate to the fact that a user's benefit from participating on one side of a platform (eg as a seller on an e-commerce platform) increases with the number of users on the other side (eg buyers). Network externalities beget more users and more value for users. They allow the big tech to generate more data, the key input into data analytics. The analysis of large troves of data enhances existing services and attracts further users. More users, in turn, provide the critical mass of customers to offer a wider range of activities, which yield even more data. Accordingly, network externalities are stronger on platforms that offer a broader range of services, and represent an essential element in big techs' life cycle (Box III.A).

Financial services both benefit from and fuel the DNA feedback loop. Offering financial services can complement and reinforce big techs' commercial activities. The typical example is payment services, which facilitate secure transactions on e-commerce platforms, or make it possible to send money to other users on social media platforms. Payment transactions also generate data detailing the network of links between fund senders and recipients. These data can be used both to enhance existing (eg targeted advertising) and other financial services, such as credit scoring.

The source and type of data and the related DNA synergies vary across big tech platforms. Those with a dominant presence in e-commerce collect data from vendors, such as sales and profits, combining financial and consumer habit information. Big techs with a focus on social media have data on individuals and their preferences, as well as their network of connections. Big techs with search engines do not observe connections directly, but typically have a broad base of users and can infer their preferences from their online searches.

The type of synergies varies with the nature of the data collected. Data from e-commerce platforms can be a valuable input into credit scoring models, especially for SME and consumer loans. Big techs with a large user base in social media or internet search can use the information on users' preferences to market, distribute and price third-party financial services (eg insurance).

Although large banks have many customers and offer a wide range of services too (eg distribution of wealth management or insurance products, mortgages), so far they have not been as effective as big techs at harnessing the DNA feedback loop. Payments aside, banks have not exploited activities with strong network externalities. One reason is the required separation of banking and commerce in most jurisdictions.[6] As a result, banks have access mostly to account transaction data only. Moreover, legacy IT systems are not easily linked to various other services through, for instance, application programming interfaces (APIs).[7] Combining their advanced technology with richer data and a stronger customer focus, big techs have been adept at developing and marketing new products and services. The main competitive advantages and disadvantages of large banks versus big techs are summarised in Table III.2.

Big techs' impact on financial services

Big techs' DNA can lower the barriers to provision of financial services by reducing information and transaction costs, and thereby enhance financial inclusion. However, these gains vary by financial service and could come with new risks and market failures.

Box III.A

Big techs' life cycle

Big techs primarily create value as online multi-sided platforms (MSPs), by enabling and catalysing direct interactions between two or more groups of users (eg buyers and sellers). The three main types of online platforms are social networks, e-commerce platforms and search engines.

In contrast to traditional bilateral exchanges, users on each side transact with each other through the platform – not with the platform. Social platforms, for example, allow people to connect to each other, and each member benefits from a larger community. Online shopping websites enable their users to buy and sell a wide variety of goods and services worldwide. A larger number of sellers reduces buyers' search costs, and a larger number of buyers expands sellers' business opportunities. A typical feature of MSPs is the presence of network externalities: the very fact that users participate on one side of the platform (eg buyers) increases users' benefits on the other side (eg sellers). One challenge is to attract users on both sides at the same time – a chicken-and-egg problem. Successful platforms solve this problem by using specific price structures, which essentially consist in charging a lower fee to the side that creates the most network externalities – and letting the side that benefits the most from the network subsidise the other.

Big techs have so far followed a rather traditional corporate life cycle with three phases: birth, growth and maturity (Graph III.A, left-hand panel). What makes them unique is the coincidence of several factors (ie the collection of personal data on a large scale, network effects and a large number of activities) and the high speed at which they reach maturity. Indeed, big techs, albeit young, have attracted – often in less than a decade – many more customers than even the largest banks.

Once an MSP has attracted a sufficient mass of users on both sides, the emphasis is on increasing the number of users further, and reaching the tipping point at which adoption rates accelerate and network effects kick in. Beyond this point, growth can be very fast (Graph III.A, right-hand panel). More buyers bring more sellers – and vice versa – and the MSP enjoys increasing returns to scale. The average cost of serving a user declines with the total number of users. And users are willing to pay more for access to a bigger network. As a result, the platform's margins improve.

Big techs' life cycle: theory and practice

Graph III.A

From big techs' birth to maturity[1]
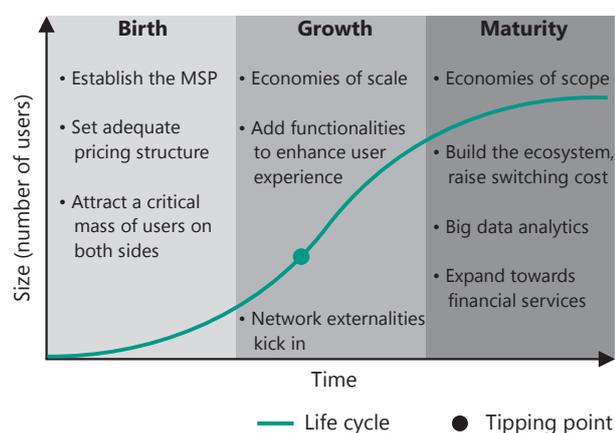
Big techs' monthly active users
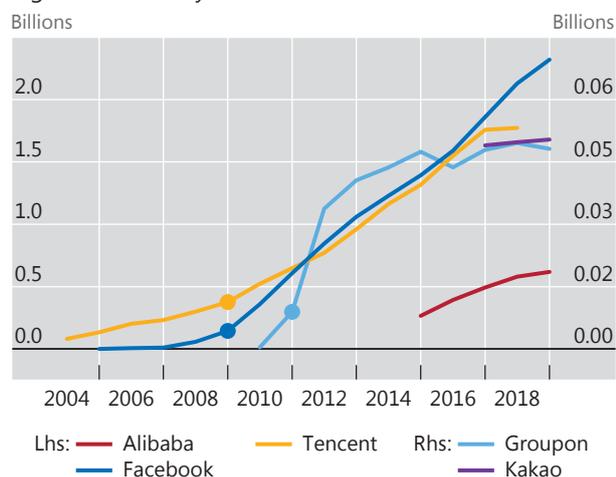
[1] The firm's life cycle described in the left-hand panel borrows from the synthesis of the literature by Miller and Friesen (1984). Given that big techs are still new and rising firms, we purposely ignore the usual "decline" phase. MSP = multi-sided platform.

Sources: D Miller and P Friesen, "A longitudinal study of corporate life cycle", *Management Science*, vol 30, no 10, 1984; company reports; BIS calculations; BIS.

Banks versus big techs – competitive advantages (+) and disadvantages (−)

<div align="right">Table III.2</div>

	Large banks	Big techs
Data	+ Verified/reliable customer data with a long history; "soft" information from personal interactions with customers; high importance of data privacy to support customer trust.	− Mixture of verifiable and potentially less reliable data; shorter history of customer data; lower priority placed on data privacy and protection.
	− Small number of customers and limited range of non-financial activities to collect data from; transactional data often "one-sided" (eg counterparty of transactions with another bank); legacy technology limits data processing capabilities.	+ Data on a very large number of customers; technology and business model built to collect and merge data; network of customer interactions is a key data dimension.
Network	+ Large number of financial activities and services already provided.	− Need to reach a large customer base to exploit network externalities.
	− Strict regulatory limits on activities and use of data; higher marginal costs of serving additional customers.	+ Significant network externalities due to wide range of non-financial activities; captive ecosystem with potential high exit costs.
Activities	+ Advantages in high margin and complex products requiring personal interaction (eg corporate finance, investment banking); wider range of financial services; access to large and relatively cheap funding sources; experience in risk management.	− Thus far limited or no footprint in key financial services (eg mortgages, loans to medium and large firms, insurance); funding limitations; lack of regulatory and risk management experience and expertise.
	− Legacy IT systems are a barrier to using existing data to offer new services (low economies of scope); activities limited to financial services.	+ Commoditisable services can be provided at near zero marginal costs; pre-existing commercial activities yield data that can be used to support new services (high economies of scope).

Source: BIS.

Big techs' potential benefits in lending activities

Besides the cost of raising funds, the cost of lending is closely tied to the ex ante evaluation of credit risk and the ex post enforcement of loan repayments. To price loans, banks must assess the riskiness of their borrowers, typically by gathering information from various sources and building close relationships. To incentivise borrowers to repay their loans and limit losses in case of default, banks monitor borrowers or require collateral. As all this is costly and time-consuming, banks require a compensation in the form of fees or interest rate spreads.[8] Big techs' access to and use of big data for screening and monitoring borrowers' activity reduce such costs, which can improve efficiency and broaden access to financing.

Screening and financial inclusion

The information cost may sometimes be so prohibitive that banks refrain from serving borrowers – or do so only at very high spreads. This is true regardless of whether the information is soft (communicated but difficult to quantify) or hard (quantitative data that can be easily processed). Most at risk from exclusion are borrowers who lack basic documentation or are difficult to reach, eg because they are too remote geographically. For instance, many SMEs in developing economies

do not meet the minimum requirements for a formal bank loan application, as they often do not have audited financial statements.

As a result, big techs can have a competitive advantage over banks and serve firms and households that otherwise would remain unbanked (Graph III.6, left-hand panel). They do so by tapping different but relevant information through their digital platforms.[9] For example, Ant Financial and Mercado Libre claim that their credit quality assessment and granting of loans typically involve more than 1,000 data series per loan applicant.

Recent BIS empirical research also suggests that big techs' credit scoring applied to small vendors outperforms models based on credit bureau ratings and traditional borrower characteristics (Box III.B). All this could represent a significant advance in financial inclusion and help improve firms' performance.[10] Although the preliminary evidence is encouraging, it is still early to draw definitive conclusions on the quality of those risk assessments. Most have been applied to very specific forms of credit (eg small business credit lines), the comparisons do not include the soft information available to banks and performance has not been tested through full business and financial cycles. [11]
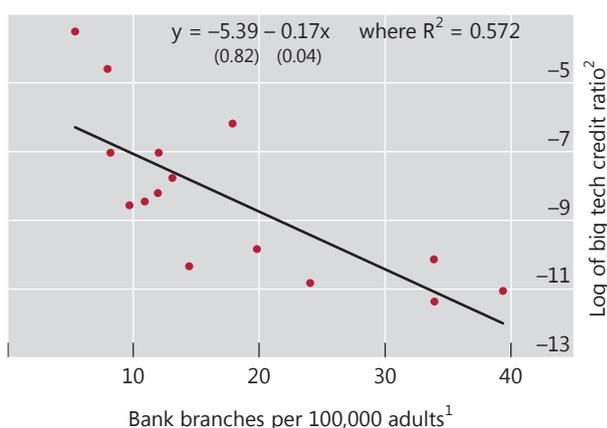
Monitoring and collateral

The cost of enforcing loan repayments is an important component of total financial intermediation cost. To reduce enforcement problems banks usually require borrowers to pledge tangible assets, such as real estate, as collateral to increase recovery rates in the case of default. Another mean is monitoring. Banks spend time and resources monitoring their clients' projects to limit the risk that borrowers implement them differently from what was agreed initially. Through monitoring, firms and financial intermediaries also develop long-term relationships and build mutual trust, which makes defaulting less attractive for borrowers.

Big tech credit, asset prices and bank development   Graph III.6

Big tech credit and banking sector development

$$y = -5.39 - 0.17x \quad \text{where } R^2 = 0.572$$
$$(0.82) \quad (0.04)$$

Log of big tech credit ratio[2]

Bank branches per 100,000 adults[1]

Elasticity of credit with respect to house prices in China

0.905** — Bank lending to firms with collateral[3]
0.498** — Bank lending to small firms[3]
0.238 — MYbank credit to small firms[4]
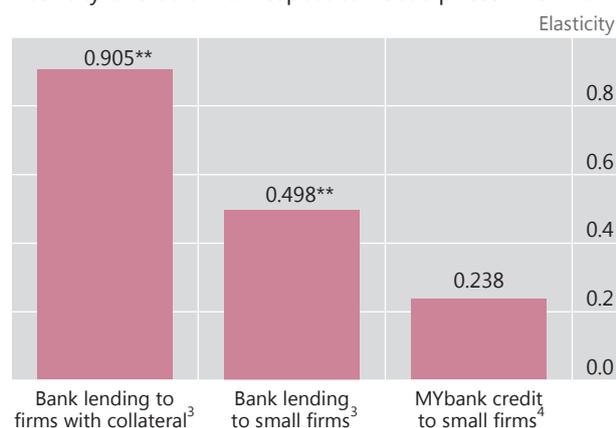
Robust standard error in parentheses. ** indicates significance at the 5% level.

[1] Average over the period 2010–15.   [2] The ratio is calculated for 2017 and is defined as big tech credit divided by total credit to the private non-financial sector (including total fintech credit).   [3] Period of estimation: 2005–13.   [4] Period of estimation: 2011–17.

Sources: J Frost, L Gambacorta, Y Huang, H S Shin and P Zbinden, "BigTech and the changing structure of financial intermediation", *BIS Working Papers*, no 779, April 2019; L Gambacorta, Y Huang, H Qiu and J Wang, "How do machine learning and non-traditional data affect credit scoring? Evidence from a Chinese fintech firm", mimeo, 2019; World Bank; Cambridge Centre for Alternative Finance and research partners; company reports; BIS calculations.

Box III.B

Big tech credit assessment: big data and artificial intelligence
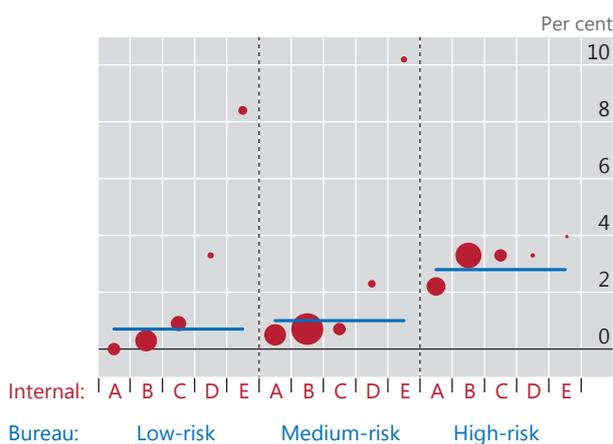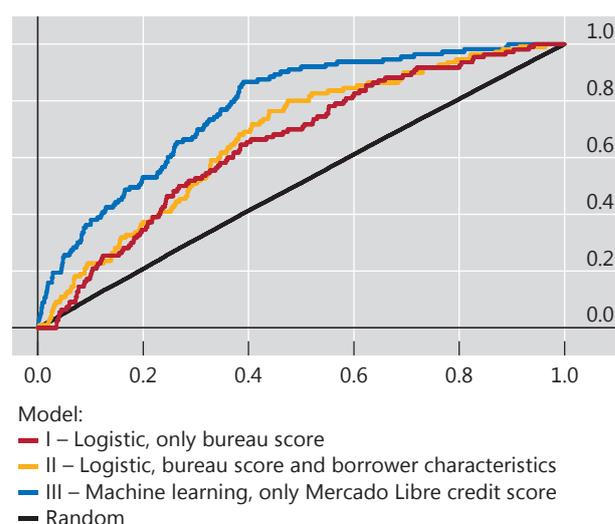
Big techs' lending decisions are linked to the processing of large quantities of information (big data) using advanced analytical methods such as machine learning and network analysis (artificial intelligence). Big data relevant for financial services obtained directly from big tech platforms include: (i) transactions (sales volumes and average selling prices); (ii) reputation-related information (claim ratio, handling time, reviews and complaints); and (iii) industry-specific characteristics (sales seasonality, demand trend and macroeconomic sensitivity). This can be also enriched by using non-traditional data obtained via social media and other channels.[①]

The predictive power of the big techs' scoring systems arises in large part from exploiting the network structure. For instance, MYbank (Ant Financial group) uses network analysis of transactions to evaluate whether an entrepreneur separates personal funds from business funds, which is one of the basic principles of good business conduct.[②]

Preliminary evidence suggests that the use of more and more granular data with machine learning can help to improve the predictive power of prepayment prospects, especially for small merchants that are typically not served by banks. In the case of Mercado Libre, internal ratings are more granular (A to E) than those of the credit bureaus in Argentina (low-risk to high-risk), which banks rely on but augment with other borrower characteristics and soft information (Graph III.B, left-hand panel). However, as most of Mercado Libre's clients are unbanked, the analysis below is more specific to cases in which traditional soft information collected by banks is not available.

Credit assessment and big data analytics

Graph III.B

Loss rate[1]

Internal: A B C D E A B C D E A B C D E
Bureau: Low-risk Medium-risk High-risk

Receiver operating characteristics (ROC) curve[2]

Model:
— I – Logistic, only bureau score
— II – Logistic, bureau score and borrower characteristics
— III – Machine learning, only Mercado Libre credit score
— Random

[1] The loss rate is the volume of loans more than 30 days past due relative to the origination volume. In its use to date, the internal rating of Mercado Libre is better able to predict such losses. It segments the originations into five different risk groups versus the three clusters identified by the credit bureau. The size of the dots is proportional to the share of the firms in the rating distribution. The horizontal blue lines indicate the average loss rates for each credit bureau cluster.   [2] True positive rates versus false positive rates for borrowers at different thresholds for a logistic model with only the credit bureau score (I), a logistic model with the bureau score and borrowers' characteristics (II), and a machine learning model with the Mercado Libre credit score (III). A random model is included for comparison purposes. The ROC curve shows that the machine learning model has superior predictive power to both the credit bureau score only and the credit bureau score with borrower characteristics.

Source: J Frost, L Gambacorta, Y Huang, H S Shin and P Zbinden, "BigTech and the changing structure of financial intermediation", *BIS Working Papers*, no 779, April 2019.

For a given bureau rating (eg low-risk), the expected loss rate is strictly monotonic with the internal rating (ie the patterns of the dots show that the internal rating increases with expected loss). Conversely, for a given internal rating (eg C, D or E), the loss rate is not strictly monotonic with the credit bureau risk. For example, the dot associated with internal rating D in the low-risk bureau category indicates a higher risk than the internal rating D in the medium-risk bureau category. Moreover, the internal rating has a broader range, covering losses from 0.0 to 10.2%; the bureau rating ranges from 0.7 to 2.8%.

Most importantly, by using the internal scoring model, Mercado Libre is able to provide credit to the profiles assessed as high-risk by the bureau. The size of the dots in the left-hand panel of Graph III.B is proportional to the share of the firms in the rating distribution; a substantial number of clients are in the credit bureau high-risk category. Because banks use a mix of credit bureau information, hard information from financial statements and soft information from loan officers, this segment may have much less access to traditional banking services. With its more granular scoring model, Mercado Libre offers 30% of its credit to this category.

Further, the internal rating system based on machine learning techniques and data obtained from the e-commerce platform can outperform simple models based on bureau score and borrower characteristics in predicting defaults (Graph III.B, right-hand panel). That said, there are open questions as to whether this performance is superior to bank models that use also soft information and can be sustained over full business and financial cycles.

① However, empirical evidence suggests that data from social networks may not have the same informational value for credit scoring models. See S Freedman and G Z Jin, "The information value of online social networks: lessons from peer-to-peer lending", *NBER Working Papers*, no 19820, 2018.   ② See www.smefinanceforum.org/post/how-is-ant-financial-closing-the-sme-finance-gap-in-china.

Big techs can address these issues differently. When a borrower is closely integrated in an e-commerce platform, for example, it may be relatively easy for a big tech to deduct the (monthly) payments on a credit line from the borrower's revenues that transit through its payment account. In contrast, banks may not be in the position to do so as the borrower can have accounts with other banks. Given network effects and high switching costs, big techs could also enforce loan repayments by the simple threat of a downgrade or an exclusion from their ecosystem if in default. Anecdotal evidence from Argentina and China suggests that the combination of massive amounts of data and network effects may allow big techs to mitigate information and incentive problems traditionally addressed through the posting of collateral. This could explain why, unlike banks', big techs' supply of corporate loans does not closely correlate with asset prices (Graph III.6, right-hand panel).

Big techs' potential costs: market power and misuse of data

Big techs' role in financial services brings efficiency gains and lowers barriers to the provision of financial services, but the very features that bring benefits also have the potential to generate new risks and costs associated with market power. Once a captive ecosystem is established, potential competitors have little scope to build rival platforms. Dominant platforms can consolidate their position by raising entry barriers. They can exploit their market power and network externalities to increase user switching costs or exclude potential competitors.[12] Indeed, over time big techs have positioned their platforms as "bottlenecks" for a host of services. Platforms now often serve as essential selling infrastructures for financial service providers, while at the same time big techs compete with these providers. Big techs could favour their own products and try to obtain higher margins by making financial institutions' access to prospective clients via their platforms more costly. Other anticompetitive practices could include "product bundling" and cross-subsidising activities.[13] Given their business model, these practices could reach a larger scale for big techs.

Another, newer type of risk is the anticompetitive use of data. Given their scale and technology, big techs have the ability to collect massive amounts of data at near zero cost. This gives rise to "digital monopolies" or "data-opolies".[14] Once their dominant position in data is established, big techs can engage in price discrimination and extract rents. They may use their data not only to assess a potential borrower's creditworthiness, but also to identify the highest rate the borrower would be willing to pay for a loan or the highest premium a client would pay for insurance.[15] Price

discrimination does not just have distributional effects, ie raising big techs' profits at customers' expense without changing the overall amounts produced and consumed. It could also have adverse economic and welfare effects. The use of personal data could lead to the exclusion of high-risk groups from socially desirable insurance markets. There are also some signs that big techs' sophisticated algorithms used to process personal data could develop biases towards minorities.[16]

The idea that people's preferences are malleable and are subject to influence for commercial gain is not new.[17] But the scope for such actions may be greater in the case of big techs, due to their command over much richer customer information and their integration into their customers' everyday life. Anecdotal evidence indeed suggests that big techs may be able to influence users' sentiment without the users themselves being aware of it.[18]
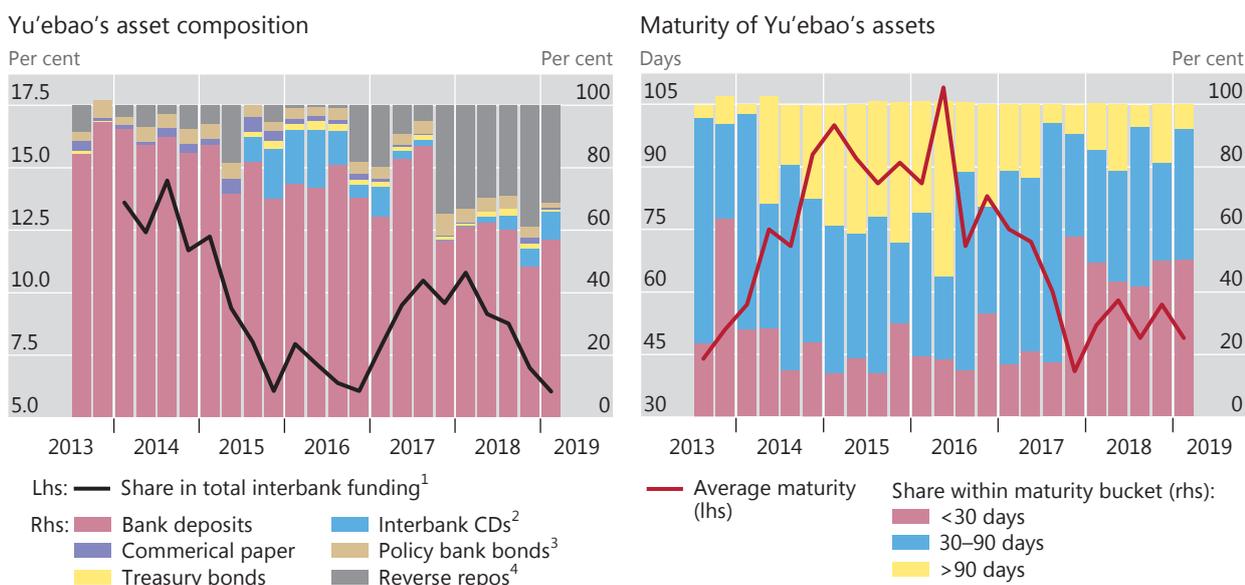
Public policy towards big techs in finance

Traditionally, financial regulation is aimed at ensuring the solvency of individual financial institutions and the soundness of the financial system as a whole. It also incorporates consumer protection goals. The policy instruments used to achieve these goals are well understood, ranging from capital and liquidity requirements in the case of banks to the regulation of conduct for consumer protection. When big techs' activity falls squarely within the scope of traditional financial regulation, the same principles should apply to them.

However, two additional features make the formulation of the policy response more challenging for big techs. First, big techs' activity in finance may warrant a more comprehensive approach that encompasses not only financial regulation but also competition and data privacy objectives. Second, even when the policy goals are well articulated, the specific policy tools should actually be shown to promote those objectives. This link between ends and means should not be taken for granted. This is because the mapping between policy tools and the ultimate welfare outcomes is more complex in the case of big techs. In particular, the policy tools that are aimed at traditional financial regulation objectives may also impinge on competition and data privacy objectives, and vice versa. These interactions introduce potentially complex trade-offs that do not figure in traditional financial regulation. Each of these issues is explored in turn.

"Same activity, same regulation"

A well functioning financial system is a critical public infrastructure, and banks occupy a central place in that system through their role in the payment system and in credit intermediation. Banks' soundness is a matter of broader public interest beyond the narrow group of direct stakeholders (their owners and creditors). For this reason, banks are subject to regulations that govern their activities, and market entry is subject to strict licensing requirements. Likewise, when big techs engage in banking activities, they are rightfully subject to the same regulations that apply to banks. The aim is to close the regulatory gaps between big techs and regulated financial institutions so as to limit the scope for regulatory arbitrage through shadow banking activities. Accordingly, regulators have extended existing banking regulations to big techs. Examples include the extension of know-your-customer (KYC) rules – designed to prevent money laundering and other financial crimes – to big techs' operations in payments.[19] The basic principle is "same activity, same regulation".[20] If big techs engage in activities that are effectively identical to those performed by banks, then such activities should be subject to banking rules.

Yu'ebao's importance for bank funding

Graph III.7

Yu'ebao's asset composition
Per cent   Per cent

Maturity of Yu'ebao's assets
Days   Per cent

Lhs: ■■■ Share in total interbank funding[1]

Rhs: Bank deposits   Interbank CDs[2]
     Commerical paper   Policy bank bonds[3]
     Treasury bonds   Reverse repos[4]

Average maturity (lhs)

Share within maturity bucket (rhs):
  <30 days
  30–90 days
  >90 days

[1] Share of Yu'ebao's assets (excluding treasury bonds) as a fraction of total interbank funding. Total interbank funding is calculated as the sum of outstanding amounts in the interbank CD, repo collateral, outright repo and interbank loan markets.   [2] Interbank certificates of deposit.   [3] Bonds issued by policy banks including Agricultural Development Bank of China, Export-Import Bank of China and China Development Bank.   [4] Financial assets held under resale agreements.

Sources: CEIC; Wind; BIS calculations.

In addition to existing rules being extended to big techs, new rules may be warranted in those cases where big techs have wrought structural changes that take them outside the scope of existing financial regulation. Prudential regulators have turned their attention to specific market segments, notably in the payment system, where big techs may have already become relevant from a systemic perspective. Where rapid structural change has outrun the existing letter of the regulations, a revamp of those regulations will be necessary. The general guide is to follow the risk-based principle and adapt the regulatory toolkit in a proportionate way. In China, for instance, big techs' sizeable MMF businesses play an important role for interbank funding. These MMFs mainly invest in unsecured bank deposits and reverse repos with banks (see Graph III.7 for the case of Yu'ebao). The rapid structural change has introduced new linkages in the financial system. Around half of MMFs' assets are bank deposits and interbank loans with a maturity of less than 30 days. A risk is thus that a redemption shock to big techs' MMF platforms quickly transmits to the banking system through deposit withdrawals. Another concern is the systemic nature of the payment links when banks are reliant on funding from payment firms. To address these risks, the authorities in China have introduced new rules requiring settlement on a common, public platform for all payment firms, as well as on redemptions and the use of customer balances (Box III.C).

A new regulatory compass

When the objectives of policy extend beyond the goals of traditional financial regulation into competition and data privacy, new challenges present themselves. Even when the objectives are clear and uncontroversial, selecting the policy tools to secure the objectives – the means towards the ends – requires taking account of potentially complex interactions.

Box III.C

Recent regulatory changes in China

Large MMFs may pose systemic risks, as they are intertwined with the banking system and could be subject to investor runs in the event of credit losses, creating fire sale and funding risks for the broader financial system. To reduce potential risks of runs on MMFs, the People's Bank of China (PBC), together with the China Securities Regulatory Commission, introduced in June 2018 a cap on instant redemptions of RMB 10,000 (USD 1,560) for all MMFs. At the same time, it prohibited big techs from financing instant redemptions with their own cash to provide de facto same-day redemption. Only qualified banks became eligible to provide financing services to facilitate immediate redemptions. Additional measures included increased disclosure obligations in the promotion of MMFs.

The PBC has also recently adopted reforms for non-bank payment institutions active in payments. First, it imposed a reserve requirement on customer balances in big techs' payment accounts ("float"). From January 2019, big techs must keep 100% of customer balances in a reserve account with the PBC.① In this way, the float is segregated and shielded as in a narrow bank. This is intended to strictly limit potential risks from big techs investing these funds into interest-bearing assets in the banking system or venturing into shadow banking by extending credit to customers on their credit platforms.

Second, since June 2018 big techs are required to clear payments on a newly created state-owned clearing house, NetsUnion Clearing.② Clearing is also possible via China Union Pay, a state-owned clearing network for bank card payments. Clearing of payments through a common, public platform enhances transparency by replacing the complex and opaque bilateral relationships between third-party payment platforms and banks (Graph III.C). The new regulation also redresses the disparity in competitive advantage between big and small third-party payment platforms.

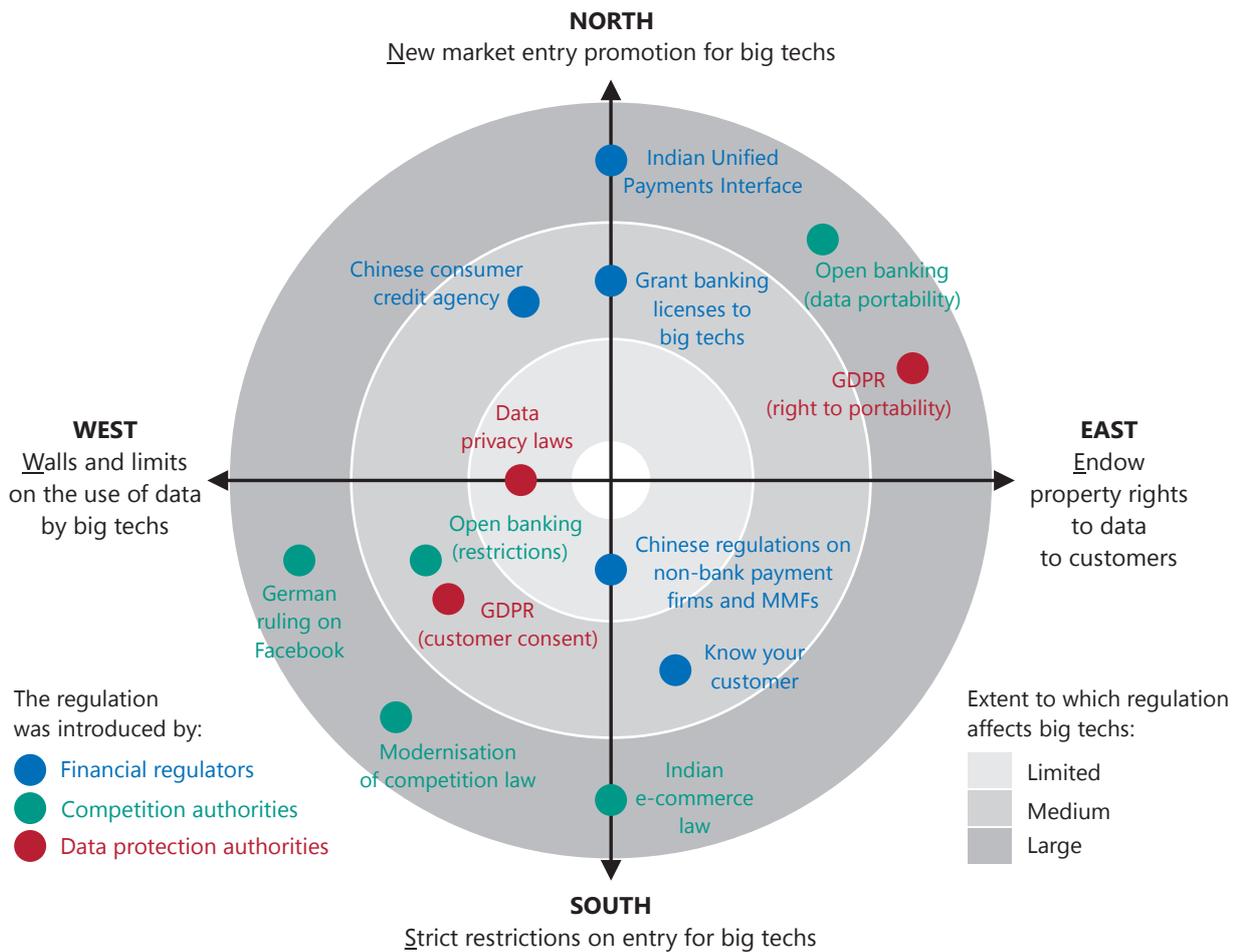
Introduction of central clearing requirement in China
Graph III.C
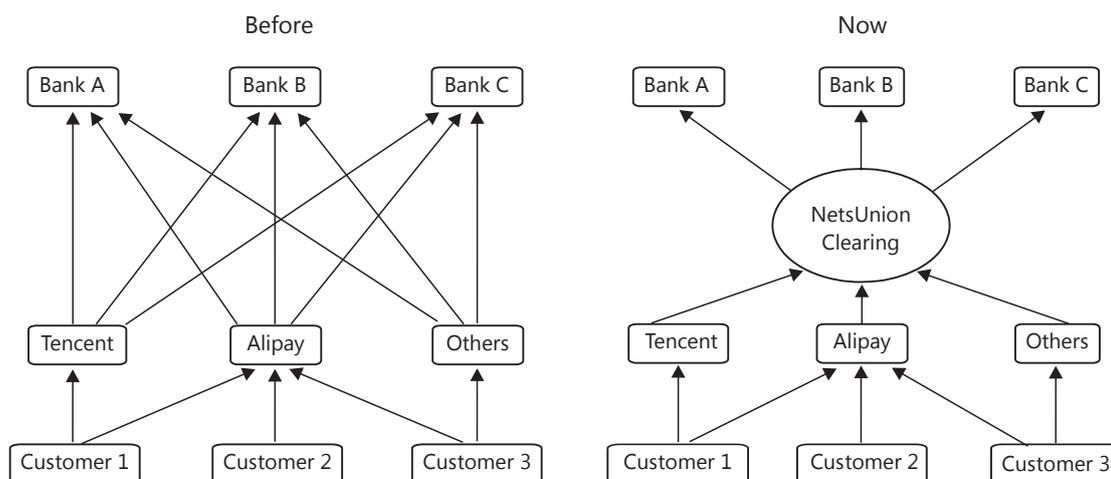
Source: BIS.

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① This change is part of a process started in January 2017, when the PBC required third-party payment groups to keep 20% of customer deposits in a single, dedicated custodial account at a commercial bank and specified that this account would pay no interest. In April 2018, the ratio was increased to 50%. The increase of reserves to 100% is effective as from January 2019. Payment firms will earn zero interest on customer funds. See www.gov.cn/xinwen/2018-06/05/content_5296169.htm. ② The major stakeholders of NetsUnion Clearing are the PBC and associated governmental institutes (40%), Tencent (9.6%), Alipay (9.6%) and other third-party payment platforms (40.8%).

To navigate the new, uncharted waters, regulators need a compass that can orient the choice of potential policy tools. These tools can be organised along the two dimensions, or axes, of a "regulatory compass" (Graph III.8). The north-south axis of the compass spans the range of choices over how much new entry of big techs into finance is encouraged or permitted. North indicates encouragement of **n**ew entry, while south indicates **s**trict restrictions on entry. The second dimension in

NORTH
New market entry promotion for big techs

Indian Unified Payments Interface

Open banking (data portability)

Chinese consumer credit agency

Grant banking licenses to big techs

GDPR (right to portability)

WEST
Walls and limits on the use of data by big techs

Data privacy laws

EAST
Endow property rights to data to customers

Open banking (restrictions)

Chinese regulations on non-bank payment firms and MMFs

German ruling on Facebook

GDPR (customer consent)

Know your customer

The regulation was introduced by:

● Financial regulators
● Competition authorities
● Data protection authorities

Modernisation of competition law

Indian e-commerce law

Extent to which regulation affects big techs:

Limited
Medium
Large

SOUTH
Strict restrictions on entry for big techs

Each dot refers to a public policy affecting big techs to some degree. Each policy is described in Table III.3. The placement of a policy on the compass reflects the choice of a policymaker (financial regulator, competition authority or data protection authority) in terms of: (i) promoting/restricting big techs' entry into finance (north-south axis); or (ii) endowing customers with data property rights/restricting big techs' use of customer data (east-west axis).

For example, in some jurisdictions, competition authorities have been promoting new entry into finance – including by big techs – (north direction) by enabling individuals (eg borrowers) to share their financial transaction data among multiple financial institutions (east direction). This policy choice is reflected by the placement of the green dot "open banking (data portability)" in the northeast quadrant of the compass.

Source: BIS.

the compass spans choices over how data are treated in the regulatory approach. It ranges from a decentralised approach that **e**ndows property rights over data to customers (east), to a restrictive approach that places **w**alls and limits on big techs' use of such data (west).

Current practices cover a broad territory spanned by the two axes. These practices are represented as dots in this space. The placement of the dots reflects the multifaceted nature of the policy choices in that components of the approaches can be placed in different places on the compass. The choices also involve decisions by three types of official actors: financial regulators (blue dots), competition authorities (green dots) and data protection authorities (red dots). As can be seen in Graph III.8, the choice of policy tools has been quite heterogeneous across jurisdictions (Table III.3).

The regulatory compass reflects the menu of policy choices, not the outcomes as measured against the ultimate goals. The evaluation of the policy choices

Description of the selected policy initiatives included in Graph III.8

Table III.3

Type of policy intervention	Countries/jurisdictions	Content
● Unified Payments Interface (UPI)	India	The UPI was established by the Reserve Bank of India in April 2016. It is an instant real-time payment system that facilitates transfers of funds between two bank accounts on a mobile platform, to which all payment service providers have access.
● Granting banking licence to big techs	Hong Kong SAR, Korea, Luxembourg	Promotes competition across a wide range of (or all) banking services, while subjecting new entrants to strict regulations.
● Regulations on non-bank payment firms and MMFs	China	This set of regulations includes reserve requirements on customer balances in big techs' payment accounts ("float"), a requirement to channel payments through a state-owned clearing house (NetsUnion Clearing) and a cap on instant redemptions for all MMFs (Box III.C).
● Chinese consumer credit reporting agency (Baihang)	China	Baihang is a licensed consumer credit reporting platform which collects and stores personal credit information from its members, and provides credit reports and ratings. It promotes competition by giving members access to relevant data, but also restricts the type and use of the collected data. It received its licence from the People's Bank of China in January 2018.
● Know-your-customer (KYC) regulations	Various	Impose the same strict requirements on payment service providers as on banks. These include the collection of detailed information on customers regarding their identity and possible criminal intentions.
● Open banking	Australia (open banking), European Union (PSD2), United Kingdom (open banking), Mexico (fintech law)	The first open banking regulations came into force in 2018. This type of regulation requires financial firms to make their customers' financial transaction (or equivalent) data portable, ie directly transferable to third parties or competitors, typically through open APIs (Graph III.8, east axis). The conditions under which data shall be shared are nonetheless restricted (west axis). Restrictions may be related to the type of data and participating institutions, customer consent or reciprocity.
● German ruling on Facebook	Germany	In February 2019, the German competition authority (Bundeskartellamt) prohibited Facebook from systematically combining user data from different sources (such as its other services WhatsApp and Instagram).
● Indian e-commerce law	India	In February 2019, a new e-commerce rule took effect that prohibits foreign e-commerce platforms from selling products supplied by affiliated companies on their Indian shopping sites.
● Modernisation of competition law	European Union, Germany, United Kingdom, United States	In March and April 2019, the German, EU and UK competition authorities received commissioned expert recommendations on how to sharpen their existing practices and methodologies for assessing anticompetitive conduct in digital markets. In the US, the Federal Trade Commission has recently been reported to examine potential anticompetitive conduct by several big techs.
● Data privacy laws	Australia, California, China, European Union, India, Japan, Singapore, Switzerland	Data privacy laws (or adaptations thereof) typically require digital firms with access to personal data to inform their customers about the usage of their personal data. They started to be enacted in 2018.
● General Data Protection Regulation (GDPR)	European Union	The GDPR came into force in May 2018 and is one of the most comprehensive – and a precursor of – new data privacy laws being implemented. The regulation provides that customers have the right to receive their personal digital data in a structured and transferable way without hindrance ("right to portability"; Graph III.8, east axis). It also requires data holders to obtain their customers' active consent prior to using or sharing their personal data (west axis).

Source: BIS.

according to their effectiveness in achieving the ultimate objectives would require the further step of analysing the mapping from the policy tools to the ultimate outcomes. This final step is far from simple given the complex interactions between the objectives of solvency, competition and data privacy. Nevertheless, the regulatory compass helps to organise thinking and sheds light on this mapping between means and ends.

Revisiting the competition–financial stability nexus

Take the concrete example of the interplay between competition objectives and financial stability objectives. Traditionally, public policy on entry into the banking industry has been influenced by two divergent schools of thought on the desirability of competition in banking. One view is that the entry of new firms in the banking sector is desirable as it fosters competition and reduces incumbents' market power. The associated policy prescription is to foster new firms' entry in the banking industry by operating a liberal policy on issuing banking licences. Regulators may also lower entry costs in some specific market segments, especially where the scope for technological progress is the greatest. In India, for instance, they have favoured the development of the Unified Payments Interface (UPI), which gives authorised mobile payment providers, including big techs, access to the interbank payment system.[21]

On the other side of the debate is the school of thought emphasising that a concentrated – or less competitive – banking sector is desirable because it is conducive to financial stability. Incumbents are more profitable – and thus more able to accumulate a strong equity base – and have a higher franchise value – and are thus more likely to act prudently. Moreover, they may have access to more stable (insured) funding bases. The associated policy approach is to restrict new entry by maintaining strict licensing requirements for new entrants. In the regulatory compass, the degree of stringency in allowing big techs' entry is spanned by the north-south axis, with north being the policy of being permissive towards new entry while south is the policy of restricting entry.

However, the relationship between entry and effective competition is far from obvious when the DNA feedback loop is taken into account. New entry may not increase market contestability – and competition – when big techs are envisaged as the new entrants. This is because big techs can establish and entrench their market power through their control of key digital platforms, eg e-commerce, search or social networking. On the one hand, such control may generate outright conflicts of interest and reduce competition when both big techs and their competitors (eg banks) rely on these platforms for their financial services. On the other hand, a big tech could be small in financial services and yet rapidly establish a dominant position by leveraging its vast network of users and associated network effects. In this way, the rule of thumb that encouraging new entry is conducive to greater competition can be turned on its head.

The traditional focus of competition authorities on a single market, firm size, pricing and concentration as indicators of contestability is not well suited to the case of big techs in finance.[22] Just as the mapping between policy choices to outcomes can be complex for financial regulators, competition authorities may also need to adapt their paradigms. As part of this effort, some jurisdictions (eg the European Union, Germany, India, the United Kingdom and the United States) have recently been upgrading their rules and methodologies for assessing anticompetitive conduct.[23] In India, for example, the main e-commerce platforms are prohibited from selling products supplied by affiliated companies on their websites to avoid potential conflicts of interest.

The new competition–data nexus

By tying market power to the extensive use of customer data, big techs' DNA feedback loop creates a new nexus between competition and data.

Abstracting from privacy concerns, wide access to data can in principle be beneficial. Digital data are a non-rival good – ie they can be used by many, including competitors, without loss of content. Moreover, since data are obtained at zero marginal cost as a by-product of big techs' services, it would be socially desirable to share them freely.[24] Provided that markets are competitive, open access to data can help to lower the switching costs for customers, alleviate hold-up problems and generally foster competition and financial inclusion.

The issue, therefore, is how to promote data-sharing. Currently, data ownership is rarely clearly assigned. For practical purposes, the default outcome is that big techs have de facto ownership of customer data, and customers cannot (easily) grant competitors access to their relevant information. This uneven playing field between customers and service providers can be remedied somewhat by assigning data property rights to the customers. Customers could then decide with which providers to share or sell data. In effect, this attempts to resolve inefficiencies through the allocation of property rights and the creation of a competitive market for data – the decentralised or "Coasian" solution.[25] The east-west axis of the regulatory compass maps out the range of choices according to the degree to which authorities rely on allocating property rights to data versus outright restrictions on the data's use. The further east one travels, the greater the emphasis on the decentralised solution based on data portability and data property rights.

However, the mapping between the policy tools and the ultimate outcomes is more complex in the case of big techs. The DNA feedback loop challenges a smooth application of the Coasian approach. The reason is twofold. First, big techs can obtain additional data from their own ecosystems (social networking, search, e-commerce, etc), outside the financial services they operate. Second, data have increasing returns to scope and scale[26] – a single additional piece of data (eg a credit score) has more value when combined with an existing large stock of data – and economies of scope – eg when used in the supply of a broader range of services. For both reasons, data have more value to big techs. In a bidding market for data, big techs would most likely outbid their competitors. Letting market forces freely run their course could not be guaranteed to result in the desired (competitive) outcomes. Concretely, if banks' customers were to grant (or sell) big techs unrestricted access to their banking data, this could reinforce the DNA feedback loop and paradoxically increase big techs' competitive advantage over banks, as opposed to keeping it in check.

Given the network effects underlying competition, the competitive playing field may be levelled out more effectively by placing well designed limits on the use of data.[27] Introducing some additional rules regarding privacy – while at the same time allowing selectively for the sharing of some types of data – could increase effective competition, because the addition of such limitations on the use of data could curb big techs' exploitation of network externalities.

This policy choice along the data usage dimension – as represented by the east-west axis of the regulatory compass in Graph III.8 – has taken centre stage in the debate on big techs.[28] The underlying arguments that bear on the available choices are reflected in the policies recently adopted in a number of jurisdictions. Two particular examples are the various forms of open banking regulations that have been adopted around the world, and the EU's General Data Protection Regulation (GDPR). Open banking regulations give authorised third-party financial service providers direct access to bank customer data and – in some cases – banks

reciprocal access to third parties' equivalent data. They also set common technical standards for APIs, but do not give customers as much control over their personal data as the GDPR. To the extent that they entail the transfer of data ownership from big techs to customers, both regulations can be seen as measures intended to facilitate greater effective market contestability. For this reason, they are positioned in the northeast quadrant in Graph III.8. Data portability allows customers to transfer personal data easily across different services and for their own purposes. As such, it is an important step towards defining the terms of competition in the financial sector.

At the same time, some of the new regulations also limit the scope of data-sharing. Regulations that circumscribe the use of data are positioned in the western half of the compass. The rationale for limiting the use of data rests on a number of considerations. For one, not all types of data are relevant for the provision of financial services. To assess a borrower's creditworthiness, for example, a lender may not necessarily need to know their social habits or travel plans. Moreover, not all types of service providers should be given access to their customers' financial data. In any case, there are more fundamental considerations from privacy for limits on the use of personal data. Accordingly, open banking regulations selectively restrict the range of data that can be transmitted (eg financial transaction data), as well as the type of institutions among which such data can be shared (eg accredited deposit-taking institutions). Similarly, the GDPR requires customers' active consent before a firm can use their personal data.[29] Both types of restrictions can be seen as barriers to big techs' entry into finance. For this reason, they are positioned in the southwest quadrant of the compass. More drastic approaches involve outright restrictions on the processing of user data. One example of a policy initiative that aims at levelling the competitive playing field by limiting the use of data is the recent rule by Germany's competition authority that prohibits a prominent social network from combining its user data with those it collects from its affiliated websites and applications. Where to draw the line is an issue that involves not just economics, but also society's privacy preferences.

The regulatory compass is a useful device to classify the range of policy initiatives that impinge on the use of data and market entry. However, it remains to be seen how far these policy initiatives will lead to the desired outcomes in terms of effective competition, efficiency and soundness of the financial system. A broadening of perspectives will be essential to make considered policy choices in this area.

Policy coordination and need for learning

In the face of the rapid and global digitisation of the economy, policymakers need institutional mechanisms to stay abreast of developments and to learn from and coordinate with each other.

Some countries have set up innovation facilitators. These can take a number of forms, including hubs and accelerators, which provide a forum for knowledge-sharing, and may involve active collaboration or even funding for new players. Regulatory sandboxes (eg in Hong Kong, Singapore and the United Kingdom) let innovators test their products under regulatory oversight. Hubs, accelerators and sandboxes can help to ensure a dynamic financial landscape – one that is not necessarily dominated by just a few players. At the same time, their setup requires careful design and implementation, to avoid regulatory arbitrage and to not provide signs of support for new but still speculative projects.

Coordination among authorities is crucial, at both the national and the international level. First, there is a need for coordination of national public policies.

The mandates and practices of the three different national authorities – competition authorities, financial regulators and data protection supervisors – may not always be compatible. Financial regulators focus on the specifics of the financial sector, whereas competition and data privacy laws often impose general standards that apply to a wide range of businesses. Second, as the digital economy expands across borders, there is a need for international coordination of rules and standards (eg for data exchange).[30] To prevent those differences from leading to conflicting actions, policymakers not only need a new compass but also need to find the right balance of public policy tools.

Endnotes

1   See Financial Stability Board, *Financial stability implications from fintech: regulatory and supervisory issues that merit authorities' attention*, June 2017.

2   See L Hornuf, M Klus, T Lohwasser and A Schwienbacher, "How do banks interact with Fintechs? Forms of alliances and their impact on bank value", *CESifo Working Papers*, no 7170, July 2018.

3   For example, the Libra Association, whose members include a number of big techs and payment service providers, recently outlined plans for a new cryptocurrency backed by a reserve of assets. See Libra Association, *An introduction to Libra*, 18 June 2019, https://libra.org/en-US/white-paper/.

4   Technically, these unused balances are liabilities of big techs which are held as deposits in their bank accounts. A major difference across countries is whether the interest earned from these unused balances accrues to the customers or to the payment service provider.

5   See S Claessens, J Frost, G Turner and F Zhu, "Fintech credit markets around the world: size, drivers and policy issues", *BIS Quarterly Review*, September 2018, pp 29–49; and J Frost, L Gambacorta, Y Huang, H S Shin and P Zbinden, "BigTech and the changing structure of financial intermediation", *BIS Working Papers*, no 779, April 2019.

6   See C Borio and R Filosa, "The changing borders of banking: trends and implications", *BIS Economic Papers*, no 43, December 1994.

7   APIs are the typical way to share information with third parties securely and efficiently in the digital economy. They are pieces of software designed to allow different programs to communicate with each other and transfer information.

8   The cost of financial intermediation is typically measured as the income received by financial intermediaries as compensation for providing services such as the production of information, risk-sharing, maturity transformation and underwriting. Measures based on a panel of 20 countries indicate that, in the last decade, the unit cost of financial intermediation has been around 1.5% of the intermediated assets. See G Bazot, "Financial intermediation cost, rents, and productivity: An international comparison", *European Historical Economics Society Working Papers*, no 141, November 2018.

9   See H Hau, Y Huang, H Shan and Z Sheng, "Fintech credit, financial inclusion and entrepreneurial growth", mimeo, 2018; and Y Huang, C Lin, Z Sheng and L Wei, "Fintech credit and service quality", mimeo, 2018.

10   Preliminary evidence suggests that small (and typically unbanked) firms in Argentina and China that received big tech credit expanded their product offerings more than those that did not. See J Frost et al (2019), op cit.

11   One risk is big techs' unknown impact on lending over the business cycle. Big techs do not build as strong long-term relationships with their customers – notably SMEs – as banks do. By having a lower opportunity cost of severing relationships, big techs could therefore more easily cut SME lending during downturns. The literature finds that banking systems based on relationships better protect firms in adverse conditions, especially if banks have sufficient capital, in comparison with systems characterised by financial intermediaries with transactional type loans. See P Bolton, X Freixas, L Gambacorta and P Mistrulli, "Relationship and transaction lending in a crisis", *The Review of Financial Studies*, vol 29, issue 10, 2016.

12   To date there is no evidence of big techs hindering their competitors' provision of financial services on their platforms. But examples of anticompetitive practices can be found in other sectors of activity, such as advertising. For example, in March 2019 the European Commission fined a big tech for imposing a number of restrictive clauses in contracts with third-party websites which prevented its rivals from placing their search adverts on those websites.

13   Product bundling is a marketing strategy by which a firm offering several products separately also gives a discount to those consumers purchasing the products as a single combined product (a "package"). Bundling practices can be seen as a particular form of price discrimination, and are most often found in multiproduct industries such as telecommunications, hardware and software.

Anticompetitive practices in the telecommunications sector gave rise to a significant overhaul of telecommunications laws in a number of countries in the 1990s (eg the US Telecommunications Act of 1996).

[14] See M Stucke, "Should we be concerned about data-opolies?", *Georgetown Law Technology Review*, vol 2, issue 2, 2018.

[15] See O Bar-Gill, "Algorithmic price discrimination when demand is a function of both preferences and (mis)perceptions", *University of Chicago Law Review*, vol 86, no 2, March 2019.

[16] Evidence of racial discrimination (for the US) by algorithms is provided in L Sweeney, "Discrimination in online ad delivery", *ACM Queue*, vol 11, issue 3, March 2013. There is also evidence (again for the US) that black and Hispanic borrowers are disproportionately less likely to gain from the introduction of machine learning in credit scoring models, suggesting that algorithms may develop their own biases (see A Fuster, P Goldsmith-Pinkham, T Ramadorai and A Walther, "Predictably unequal? The effects of machine learning on credit markets", mimeo, November 2018). The complex and opaque algorithms render biases particularly difficult to detect, and therefore to prevent. See C Sandvig, K Hamilton, K Karahalios and C Langbort, "Auditing algorithms: research methods for detecting discrimination in internet platforms", mimeo, 2014.

[17] The notion that firms may actively change preferences and create wants, eg through advertising and salesmanship, is already present in J Galbraith, *The affluent society*, 1958.

[18] See A Kamer, J Guillory and J Hancock, "Experimental evidence of massive-scale emotional contagion through social networks", *Proceedings of the National Academy of Sciences of the United States of America*, vol 111, no 24, March 2014.

[19] Other issues currently under discussion are whether bank deposit insurance and related rules to safeguard funds should be extended to non-bank payment companies, and whether new regulations for electronic money are required. Electronic money (e-money) is broadly defined as prepaid value stored electronically, which represents a liability of the e-money issuer (eg a bank, an e-money institution or any other entity authorised or allowed to issue e-money in the local jurisdiction) and is denominated in a currency backed by an authority.

[20] Many central banks and supervisors are also exploring ways of using big data analytics to improve their assessment of financial sector risks and to enhance banking supervision (suptech). Asia is leading by example. The Monetary Authority of Singapore, for example, is exploring different ways of using big data, including web scraping techniques. These techniques can come in handy precisely to disentangle and evaluate the financial stability risks inherent to big techs' typical bundling of commercial and financial activities, and to better understand the interplay of such activities from a risk assessment perspective.

[21] To varied degrees, other countries have given – or are planning to give – non-bank payment system providers access to their real-time gross settlement systems. In Switzerland, for example, the central bank has recently granted entities with a fintech licence access to the Swiss Interbank Clearing system (as well as to sight deposit accounts). See Swiss National Bank, "Swiss National Bank sets criteria for fintech companies' access to Swiss Interbank Clearing", press release, 11 January 2019.

[22] Traditional indicators of market dominance, such as excessively low or high prices, may not be indicative of predatory or monopoly pricing. Most big techs indeed start as digital MSPs, by having one side (eg sellers on an e-commerce platform) subsidise the other (eg buyers). Such pricing strategies are crucial for a big tech to solve the initial chicken-and-egg problem, reach a critical mass of users and build a digital network (Box III.A).

[23] For example, a competition authority that mechanically prohibits big techs' specific pricing strategies could forestall positive network externalities or destabilise established networks. Things are complicated by big techs' services not always being priced in monetary terms. For example, most social networks and search engines are free for users, at least at face value. The effective price that users pay takes the form of the personal data they provide. See J Cremer, Y-A de Montjoye and H Schweitzer, "Competition policy for the digital era", report to the European Commission, 2019.

[24] For example, a prospective borrower could significantly increase competition and obtain better deals if they could share relevant information selectively across multiple lenders. However, big techs have no incentive to share data because of the competitive advantage that their private usage confers. Note that the notion that information may not be produced ex ante if it is to be shared for free ex post – which would stifle innovation – is less of an issue in the case of raw digital data, to the extent that those data are collected at zero marginal cost and are a by-product of a big tech's activity, ie would be produced anyway.

[25] Named after Ronald Coase; see R Coase, "The problem of social cost", *Journal of Law and Economics*, vol 3, 1960.

[26] See M Farboodi, R Mihet, T Philippon and L Veldkamp, "Big data and firm dynamics", *NBER Working Papers*, no 25515, January 2019.

[27] The rationale is that when there are several departures from a frictionless market, removing just a subset of those frictions may not improve overall welfare if the remaining frictions are amplified. This "theory of the second best" is also the basic theoretical rationale for financial regulation itself. When there are incentive and spillover problems in the financial system, removing all restrictions on the activities of financial firms may result in a worse outcome from a welfare perspective due to financial instability and the broader impact on the economy.

[28] See L Wall, "Some financial regulatory implications of artificial intelligence", *Journal of Economics and Business*, vol 100, November–December 2018.

[29] In some jurisdictions, customer privacy laws may also protect digital customer data, and require customer consent prior to the sharing of data under open banking. This is, for instance, the case in Australia, the EU and the UK.

[30] For example, the Monetary Authority of Singapore has signed fintech cooperation agreements with authorities in different countries. These agreements include information exchanges with other regulators and regulated businesses, referrals of firms attempting to enter a regulatory partner's market and guidance for companies on the regulations of jurisdictions they wish to enter. More recently, an international group of financial regulators, including the UK Financial Conduct Authority, launched the Global Financial Innovation Network, which seeks to provide a more efficient way for innovative firms to interact with regulators.