Committee on the
Global Financial System

◆ BIS

CGFS Papers

No 67

Private sector debt and financial stability

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May 2022

This publication is available on the BIS website (www.bis.org).

Contents

Abbreviations

Country codes

AR	Argentina	IS	Iceland
AT	Austria	IT	Italy
AU	Australia	JP	Japan
BE	Belgium	KR	Korea
BR	Brazil	LT	Lithuania
CA	Canada	LU	Luxembourg
CH	Switzerland	LV	Latvia
CL	Chile	MX	Mexico
CN	China	MY	Malaysia
CO	Colombia	NL	Netherlands
CZ	Czech Republic	NO	Norway
DE	Germany	PE	Peru
DK	Denmark	PH	Philippines
EA	euro area	PL	Poland
EE	Estonia	PT	Portugal
ES	Spain	RU	Russia
FI	Finland	SA	Saudi Arabia
FR	France	SE	Sweden
GB	United Kingdom	SG	Singapore
GR	Greece	SK	Slovakia
HK	Hong Kong SAR	TH	Thailand
HU	Hungary	TR	Turkey
ID	Indonesia	US	United States
IE	Ireland	VN	Vietnam
IL	Israel	ZA	South Africa
IN	India		

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

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

Executive summary

Debt financing fosters economic growth but can also pose risks to financial stability and macroeconomic performance. The Covid-19 pandemic put the spotlight firmly on the role of household and non-financial corporate (NFC) debt in supporting economic activity as well as the risks associated with high or increasing debt levels. This report identifies vulnerabilities arising from private sector debt and takes stock of central bank frameworks for monitoring these vulnerabilities. It also discusses ways that policymakers can mitigate private sector debt vulnerabilities in the uncertain macroeconomic environment that followed the Covid-19 pandemic and start of the war in Ukraine.

High household and NFC debt can affect financial stability as well as macroeconomic performance. Debt directly affects financial stability by making borrowers more vulnerable to shocks. When debt is high, shocks might increase repayment difficulties, and the impact on financial stability can be amplified by falling asset prices and losses at financial intermediaries. High or rapidly rising levels of debt among riskier borrowers – especially in the household, property and non-tradeable sectors – are associated with a higher likelihood of financial stress and economic downturns. The resilience of the financial system plays a key role in mitigating shocks and limiting adverse spillovers to the real economy. High private sector debt might also indirectly affect financial stability by hampering resource allocation, weakening aggregate demand or reducing the effectiveness of countercyclical policies.

The combined gross debt of the household and NFC sectors rose significantly during the Covid-19 crisis. While this borrowing helped moderate the economic downturn in 2020, it pushed non-financial private sector debt to an historical high relative to global GDP. Yet debt vulnerabilities were not uniform across countries or sectors. Debt vulnerabilities were mitigated by prudential reforms following the Great Financial Crisis (GFC) of 2007–09 as well as households' and businesses' accumulation of buffers during the pandemic, at least in aggregate. Aggregate trends and the tails of the distribution suggest that in the immediate wake of the pandemic vulnerabilities in the NFC sector were more elevated than those of households. However, booming residential real estate markets present an emerging risk.

Central bank frameworks for monitoring debt vulnerabilities were enhanced in the years prior to the Covid-19 crisis and helped inform the multi-pronged policy response to the crisis. Central banks refer to many of the same indicators and aggregation methods but their frameworks also incorporate differences tied to their mandates, the structure of their financial systems, historical sources of vulnerability and data availability. Central banks have increasingly used sectoral and entity-level data to look beneath aggregate figures, which might conceal vulnerabilities; the tail of the distribution often provides a better signal of debt vulnerabilities than the middle. In particular, greater use of granular household debt data has been a major development since the GFC. However, gathering such data is challenging, not least in terms of cost and privacy.

To manage potential macro-financial risks arising from private sector debt, policymakers face three interrelated challenges. The first is assessing the materiality of private sector debt vulnerabilities. This assessment is complicated by significant uncertainties in the macroeconomic environment including the rise of inflation to multi-decade highs. The second challenge is deciding the appropriate policy mix to mitigate private sector debt vulnerabilities. Where vulnerabilities are building, targeted borrower-based macroprudential measures, such as debt service-to-income limits, can help to stem the build up. Where vulnerabilities are already high, or might be exposed by the macroeconomic environment, it is especially important to ensure that loss absorbing capital remains sufficient to maintain the resilience of the financial system. The third and final challenge for policymakers is to guard against misperceptions about the prospects for exceptional support that might cause lenders to underprice risks in the future, such as occurred before the GFC when implicit guarantees led to the too-big-to-fail problem and excessive risk-taking by banks.

1.   Introduction

Debt financing has a fundamental influence on welfare and economic growth, and managing the associated risks is a key determinant of financial stability. In extreme circumstances, debt vulnerabilities can affect financial stability by precipitating significant disruptions and impairment to the functioning of the financial system. But even outside such extreme events, higher debt might affect macro stability by amplifying business cycle fluctuations. Prior to the outbreak of the Covid-19 pandemic, debt levels of households and non-financial corporates (NFCs) were already at record highs relative to world GDP. The response to the pandemic's economic and financial fallout pushed them higher still. This put monitoring and mitigating debt vulnerabilities firmly under the spotlight at central banks.
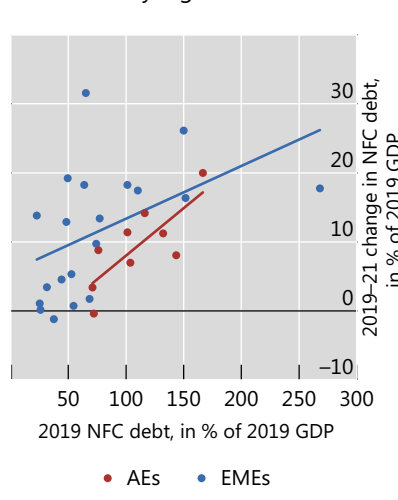

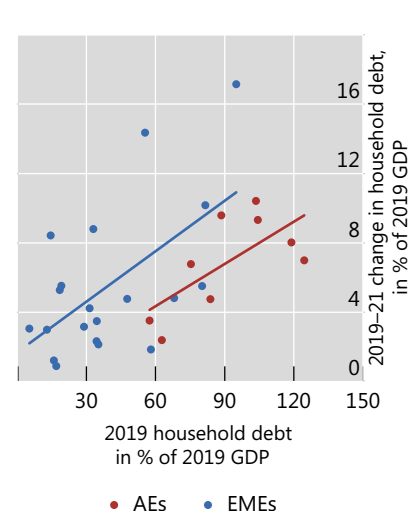Corporate and household debt soared during the Covid-19 pandemic   Graph 1

Global debt to GDP rose to a record high in 2020[1]
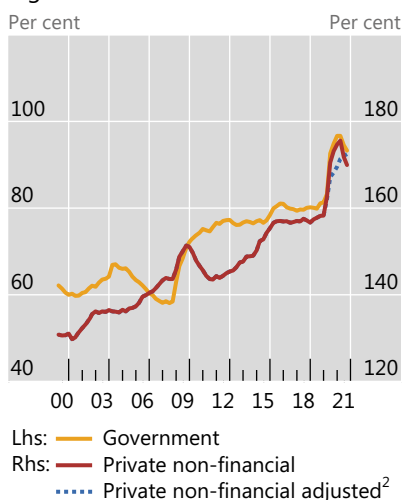
Corporate debt rose the most where it was already high ...[3]

... as did household debt[3]

Lhs: ——— Government
Rhs: ——— Private non-financial
       ····· Private non-financial adjusted[2]

2019–21 change in NFC debt, in % of 2019 GDP

2019 NFC debt, in % of 2019 GDP

● AEs   ● EMEs

2019–21 change in household debt, in % of 2019 GDP

2019 household debt in % of 2019 GDP

● AEs   ● EMEs

[1] Aggregate across 11 advanced economies and 21 emerging market economies. Annual GDP calculated as moving sum of the last four quarterly GDP figures.   [2] From Q1 2020 onwards, end-of-year 2019 GDP adjusted for inflation.   [3] AEs = AU, CA, CH, EA, GB, JP, NO SE and US; EMEs = AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PL, RU, SA, SG, TH, TR and ZA.

Sources: Bloomberg; national data; BIS credit statistics; CGFS Working Group calculations.

Private non-financial sector debt increased to an all-time high of around 170% of world GDP in 2020 (Graph 1, left-hand panel, red line). With the exception of a few years after the Great Financial Crisis (GFC) of 2007–09, debt increased steadily from about 130% of world GDP in 2000 to nearly 160% in 2015, where it stabilised until the Covid-19 pandemic. Private sector debt then jumped sharply in 2020 and remained near its peak in 2021. Both NFC and household debt tended to increase the most in economies where it was already high, as shown by the upward sloping lines in the centre and right-hand panels of Graph 1.

Private sector borrowing during the Covid-19 pandemic played an important role in meeting households' and businesses' liquidity needs and supporting economic activity. At the same time, it potentially created new vulnerabilities in economies where debt was low prior to the crisis and may have exacerbated existing vulnerabilities where debt was already high.

From a longer-term perspective, cyclical factors were not necessarily the most important driver of higher private sector debt levels; structural factors might account for a significant fraction of the increase even in recent years. Some structural factors are relatively benign, such as financial deepening driven by

better risk sharing arrangements or financing for investments that expand an economy's productive capacity. Other structural factors, however, such as certain drivers of lower equilibrium real interest rates, may instead raise debt vulnerabilities.
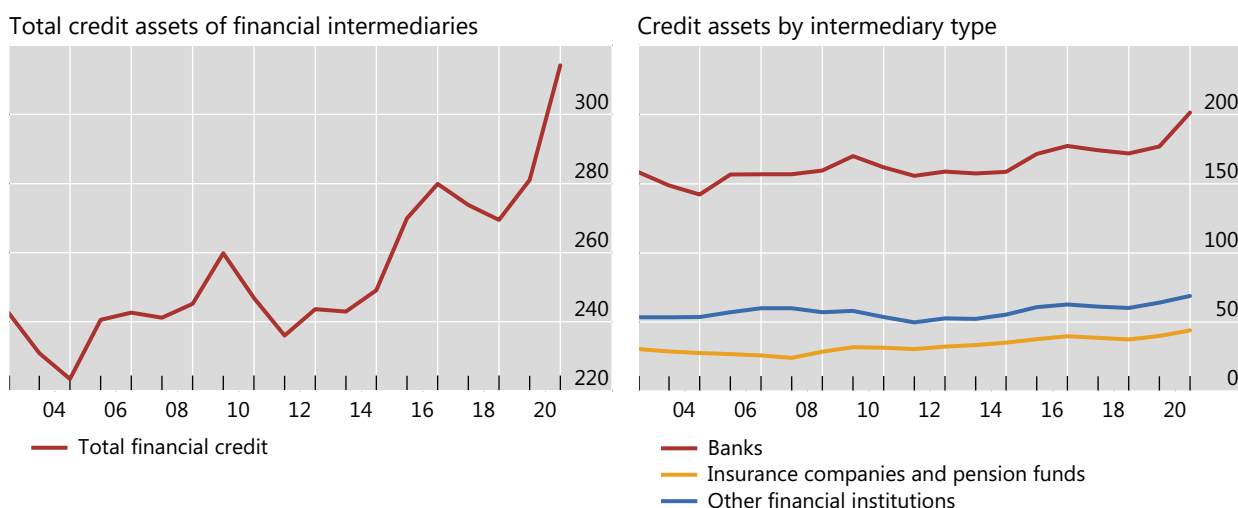
Government debt also increased substantially during the Covid-19 pandemic (left-hand panel, yellow line) as a result of large fiscal stimulus packages and weak growth. Government and private sector debt are intertwined; for example, exceptional government support for households and businesses during the pandemic boosted government debt and at the same time reduced private sector demand for credit. However, the channels through which government debt impacts financial stability and macroeconomic outcomes are somewhat different from those for private sector debt.

Financial sector debt constitutes a large share of private sector debt. Indeed, lending by financial intermediaries has gone hand with the rise in private non-financial sector debt. Banks remain the largest financial intermediaries, but credit granted by non-bank financial intermediaries (NBFIs) has been growing fast (Graph 2). Nevertheless, this report focuses on the non-financial component of private sector debt – borrowing by households and NFCs – because financial sector debt gives rise to different vulnerabilities and requires different policy tools. Moreover, unlike the GFC, the Covid-19 crisis did not originate in the financial sector. Indeed, strengthened by prudential reforms since the GFC and bolstered by stimulative fiscal and monetary policies, the banking sector helped to meet liquidity needs and absorb rather than amplify the initial impact of the pandemic on the real economy. The crisis underscored the need to strengthen the resilience of the NBFI sector, which the Financial Stability Board is coordinating efforts to address.

Credit intermediation by the financial sector[1]

In per cent of GDP   Graph 2

Total credit assets of financial intermediaries

Credit assets by intermediary type

— Total financial credit

— Banks
— Insurance companies and pension funds
— Other financial institutions

[1] AR, AU, BR, CA, CH, CL, CN,EA, HK, ID, IN ,JP, KR, MX, RU, SA, SG, TR, GB,US and ZA

Sources: FSB; IMF; CGFS Working Group calculations.

The rest of the report is structured in four sections. Section 2 reviews the empirical evidence on the relationship between private sector debt and financial stability, and articulates the underlying channels. Section 3 examines trends in aggregate debt since the GFC. Section 4 takes stock of the frameworks that central banks use to analyse private sector debt vulnerabilities. Section 5 sets out policy considerations in light of the debt vulnerabilities that arose from the Covid-19 pandemic and the uncertain macroeconomic environment. Table 1 summarises the report's main findings about the channels, implications for monitoring frameworks and recent trends.

Private sector debt and financial stability: summary of the report's main findings
Table 1

Stylised facts about debt vulnerabilities (Section 2)	Implications for monitoring (Section 4)	Debt trends in 2020–21 (Section 3)
High or rapidly rising debt increases the vulnerability of households and NFCs to adverse shocks and is a clear warning sign of upcoming financial stress.	Monitor aggregate private non-financial sector debt levels and credit growth. Assess borrowers' debt repayment capacity in addition to their leverage.	Debt of households and NFCs rose to a historical high relative to global GDP. Economies that were more leveraged in 2019 borrowed more during the Covid-19 pandemic.
Not all credit booms end in financial crises. Those that do tend to be associated with rapid asset price growth, easier lending standards and a fragile financial sector.	Analyse the allocation of credit and other metrics to distinguish between "good booms" and "bad booms", eg is the debt supporting productivity-enhancing investments?	Lending standards initially tightened but since Q2 2020 have eased. Asset prices rose rapidly, and lending spreads compressed.
Lending to households is more likely to be associated with financial stress and economic downturns than lending to the NFC sector.	Consider the sectoral allocation of credit. Focus on household debt, especially that related to residential property.	For residential property, price-to-rent ratios were high by historical standards in many economies.
Lending to riskier borrowers exacerbates vulnerability to shocks.	Monitor the allocation of debt across borrowers using granular data. Pay particular attention to borrowing by vulnerable borrowers, allocation of buffers and uses of debt.	Vulnerability of NFCs in the tails has increased relative to the median firm. Vulnerability of households in the tails was mixed depending on the indicator.
Short term and foreign currency (FX) denominated debt can increase borrowers' vulnerability to shocks. Floating rate debt may increase borrower vulnerabilities but may lower it in financial intermediaries.	Monitor trends in debt maturities, rollover needs as well as the currency and interest rate composition of debt. Assess borrowers' ability to absorb shocks.	Maturities have lengthened but repayment obligations have also increased due to the large rise in borrowing. FX and cross-border shares of aggregate debt remained stable.
Collateralised debt can increase the procyclicality of lending standards and amplify deleveraging.	Monitor collateralised lending, including valuations and signs of exuberance in residential and commercial property and other asset-backed debt markets.	For residential mortgages, share of loan-to-value ratios greater than 80% have trended upward but those greater than 100% were flat. Spreads on mortgages compressed.
Financial intermediaries can amplify adverse shocks.	Monitor the soundness of financial intermediaries, especially banks but also nonbank financial institutions (NBFIs) where they are systemically important.	Post-GFC prudential reforms strengthened bank capitalisation and liquidity. Banks accounted for a declining share of financing to NFCs. Markets and NBFIs accounted for a rising share.
High debt levels and the misallocation of credit can reduce the supply potential of an economy. They can also result in persistent weakness in aggregate demand and limit the effectiveness of countercyclical policies.	Consider the allocation of credit across sectors and borrowers and the contribution of debt overhangs to investment. Assess creditors' ability and willingness to recognise non-performing loans. Assess the possibility of debt-driven low interest rate liquidity traps.	Vulnerable businesses accounted for a rising share of NFCs' debt. Bankruptcies were much lower than expected based on their historical relationship with economic activity.

2.   Relationship between private sector debt and financial stability

This section reviews the empirical evidence about the relationship between private non-financial sector debt and financial and macroeconomic stability. It then articulates how private sector debt vulnerabilities affect financial stability. Private sector debt gives rise to direct and indirect vulnerabilities. As shown in Graph 3, direct debt vulnerabilities make households and businesses more vulnerable to shocks which result in repayment diffuclties that impact the financial system. The indirect vulnerabilities instead arise because high debt levels may drag down economic growth which may in turn compromise financial stability. This section also discusses factors that can amplify the negative effects of household and NFC debt, thereby further weakening aggregate demand and exacerbating financial instability. To reinforce financial stability, macroprudential policy can mitigate debt vulnerabilities either by targeting riskier borrowing or strengthening the resilience of the financial system.[1]

Relationship between private sector debt vulnerabilities and financial stability   Graph 3
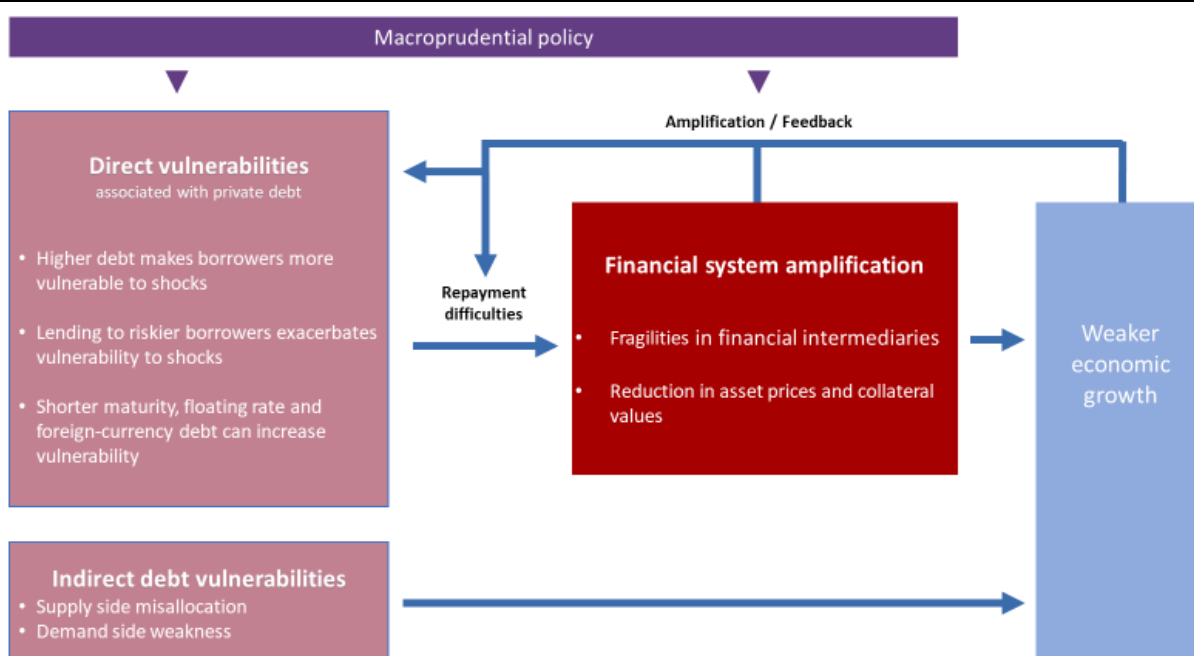
2.1   Empirical regularities

A large literature in economics, dating back at least to the work of Minsky (1977, 1986) and Kindleberger (1978), views rapid credit expansion as a prelude to financial crises. A large and growing body of empirical work finds that high levels and/or rapid increases in aggregate private non-financial sector debt are key predictors of the likelihood, severity and duration of future of financial crises and subsequent economic downturns (Claessens et al (2012), Drehmann et al (2012), Schularick and Taylor (2012)).[2] A number of

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[1]   See section 5.

[2]   See also, among others, Kaminsky and Reinhart (1999), Borio and Lowe (2002), Borio and Drehmann (2009), Gourinchas and Obstfeld (2012), BIS (2014), Dell'Ariccia et al (2016), IMF (2017, 2018), Gilchrist et al (2018), and Gertler and Gilchrist (2018).
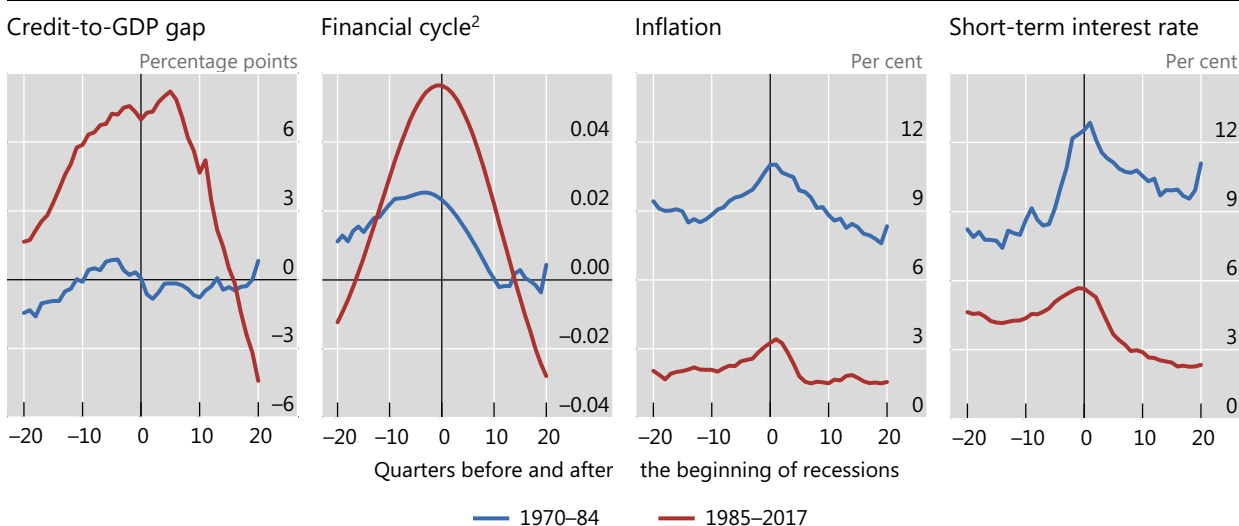
studies find that recessions preceded by large credit expansions are on average worse and last longer than recessions with no credit expansions (Jorda et al (2013), Sufi and Taylor (2021)).

A related literature documents how private sector debt influences the cyclicality of the economy. High private sector debt levels are associated with greater macroeconomic cyclicality as households expenditures become more sensitive to shocks when debt is high (Mian et al (2013), Bunn and Rostom (2015), Ji et al (2019), Zhang (2019)). Relatedly, some studies highlight how credit growth has become more cyclical in recent decades (Borio et al (2018)). To illustrate these changes, Graph 4 shows that since the mid-1980s credit relative to GDP and a broader measure of the financial cycle, which incorporates asset prices, have displayed significantly greater amplitudes (red lines). By contrast, in the period 1970–84, private credit to GDP and the financial cycle remained relatively stable. In addition to higher debt levels, better anchored inflation expectations and as a consequence more stable interest rates may also contribute to greater debt cyclicality (Graph 4, third and fourth panels).

Private sector debt and the changing nature of the business cycle[1]

Median across 10 advanced economies   Graph 4

Credit-to-GDP gap | Financial cycle[2] | Inflation | Short-term interest rate

Quarters before and after   the beginning of recessions

— 1970–84   — 1985–2017

[1] Based on a bandpass filter of the log-levels of real (inflation-adjusted) credit, the credit-to-GDP ratio and real property prices.

Source: Borio et al (2018).

While most financial crises are preceded by a ramp-up in credit to the private non-financial sector, not all episodes of rapid credit growth are associated with economic downturns or financial crises.[3] Several empirical studies try to distinguish between "good" and "bad" credit booms (Gorton and Ordoñez (2020), Richter et al (2020)). Most credit booms tend to be triggered by an initial increase in productivity. This higher productivity fades away in bad booms but is sustained in good booms, suggesting that credit allocation plays a key role in determining the ultimate effects of credit booms.[4] In a similar vein, Verner

[3] See, among many others, Mendoza and Terrones (2008), Dell'Ariccia et al (2012), Schularick and Taylor (2012), and Herrera et al (2014).

[4] Providing a complementary perspective to disentangling "good" and "bad" booms, several papers have found evidence that credit booms tend to be followed by economic downturns or financial crises when they are associated with rapid asset price growth (Jorda et al (2015), Greenwood et al (2020)); lower lending standards (Kirti (2018)); deteriorations in banking sector liquidity (Richter et al (2020)); and tighter credit spreads, particularly for risky debt (López-Salido, Stein, and Zakrajšek (2017), Krishnamurthy and Muir (2020)).

(2019) distinguishes between beneficial episodes of credit deepening and more disruptive episodes of credit booms, which lead to macroeconomic imbalances and precede growth slowdowns.

Theoretical research distinguishes between credit booms that allocate the productive capacity efficiently of the economy and those that increase consumption. These studies conclude that booms that fuel the demand for non-tradable consumption goods tend to have negative effects, including real exchange rate appreciation, lower productivity growth due to a misallocation of resources, high house price growth and increased financial fragility (Kalantzis (2015), Mian et al (2020)). Consistent with these arguments, empirical research shows that rapid expansions in lending to households (Mian et al (2014)), non-tradable sectors (Müller and Verner (2021)) and construction (Dell'Ariccia et al (2020)) are more likely to be associated with financial stress and economic downturns.

The empirical evidence shows a strong association between mortgage credit and recession severity, with both higher levels and faster growth of household debt associated with larger consumption decreases during downturns and more severe recessions (Dynan (2012), Anderson et al (2016), Bunn and Rostom (2015), Kovacs et al (2018)). Jorda et al (2014) find that, although mortgage lending booms were only loosely associated with financial crises before the Second World War, mortgage lending was a significant predictor of financial crises in the second half of the 20th century.

There is less consensus on the relationship between NFC credit and financial crises. Jorda et al (2020) find that while household credit booms predict deeper recessions, neither the growth nor the level of corporate debt are related to the likelihood, severity, or duration of future economic downturns and financial crises.[5] In contrast to these findings, Greenwood et al (2020) find that corporate and household credit booms are both key predictors of financial crises when accompanied with rapid asset price growth.

The literature points towards important policy trade-offs when dealing with rapid private non-financial sector credit growth. Rapid credit expansion can increase risks to macroeconomic and financial stability, as suggested by the evidence reviewed above, but can also support economic growth in the near term.[6] Moreover, deeper credit markets might contribute to long-term economic growth (Levine (2005)).[7] Thus, countercyclical macroprudential policies and other policies that curb debt growth might spare the economy a recession or a financial crisis but could also reduce average long-term economic growth (Svensson (2017), Adrian and Liang (2018)). Hence, policymakers might face a trade-off between growth and financial stability with different net effects depending on country circumstances (Rancière et al (2008)).

This highlights the need to understand the circumstances and channels through which high levels of and/or rapid increases in private non-financial sector debt can adversely affect macroeconomic and financial stability in the short, medium and long term, which is the focus of the next sections.

2.2   Direct debt vulnerabilities

Higher private sector debt levels can directly affect macroeconomic and financial stability by making borrowers more vulnerable to macroeconomic shocks. We consider three main direct vulnerabilities. First, high levels of debt, wherein existing borrowers take on more debt. Second, the allocation of debt when lending to riskier borrowers increases. Third, the characteristics of debt.

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[5]   Other studies find that rapid growth in corporate credit has a more negative impact on economic activity in the first year of a downturn, but household credit growth is more important in subsequent years (Bridges et al (2017), Aikman et al (2019)).

[6]   IMF (2021) presents empirical evidence consistent with this intertemporal trade-off, finding that rapid increases in aggregate credit to the private non-financial sector tend to reduce downside risks to economic activity in the near-term but increase them in the medium run.

[7]   Recent research has pointed to significant nonlinearities in the finance-growth relationship, with financial depth having a positive effect on growth only up to a certain threshold; beyond this threshold, a larger financial system is associated with lower economic growth (Arcand et al (2015), Cecchetti and Kharroubi (2012), Law and Singh (2014)). Zingales (2015) argues that without proper rules, finance can grow excessively, degenerating into zero-sum or rent-seeking activities.

Debt levels – high leverage increases the vulnerability of households and businesses to adverse shocks

The accumulation of debt by households and businesses can increase their vulnerability to economic and financial shocks. With higher indebtedness, borrowers' ability to repay becomes more sensitive to changes in their income and the cost of their debt. In other words, ceteris paribus, the probability of default increases with the level of debt. Even in the event of a comparably mild shock, borrowers with high debt burdens might suddenly be unable to repay.

Consistent with these arguments, empirical evidence shows that leverage increases the vulnerability of businesses and households to shocks. Leverage is a significant predictor of corporate defaults (Altman (1993), Shumway (2001), Campbell et al (2008)), especially during economic downturns and periods of financial stress (Molina (2005), Carling et al (2007), Bonfim (2009), Loffler and Maurer (2011), Bonaccorsi di Patti et al (2015)).[8] Similarly, high indebtedness is a key driver of a household's financial fragility (Japelli et al (2013), Ampudia et al (2016)).

Debt allocation – lending to riskier borrowers exacerbates vulnerability to shocks

For a given level of debt, riskier borrowers (ie those with lower or more unstable repayment capacities) are more vulnerable to shocks. Thus, which businesses and households receive credit matters from a financial stability perspective. Consistent with this idea, the empirical evidence suggests that the distribution of credit across borrowers is associated with GDP growth, downside risks to economic activity, the probability of financial crises and excess bond returns (Greenwood and Hanson (2013), Lopez-Salido et al (2016) Gomes et al (2018), Brandao-Marques et al (2019)).

A range of empirical studies have documented that lending standards typically weaken during periods of rapid credit growth and economic upswings (Asea and Brock (1998), Jimenez and Saurina (2006), Becker et al (2020), Kirti (2018)). The literature provides various explanations for this. During economic expansions, individual banks might lower their lending standards and expand credit supply if they perceive that good quality new loan applicants have become more common relative to bad quality applicants (Dell'Ariccia and Marquez (2006)). This can be rational for individual banks and can occur without any increase in risk appetite. But if all lenders behave similarly, then the non-financial sector will be more indebted and bank lending portfolios across the economy will be of lower quality.

Collateral can also play an important role in driving procyclicality in lending standards. The availability of credit to high-risk firms might depend on their net worth, and thus higher collateral values during economic booms can expand the credit access for these firms (Bernanke and Gertler (1989), Kiyotaki and Moore (1997)). The relationship between credit, economic activity and collateral can be self-reinforcing if higher credit growth and stronger economic activity lead to higher collateral values. High collateral values can incentivise lenders to reduce costly screening in good times (Asriyan et al (2019)). Lenders might not invest in producing information about the quality of assets used as collateral when the probability of default is low, reducing the information available in credit markets and allowing some borrowers with lower quality collateral to borrow (Gorton and Ordoñez (2014, 2020)). Reduced asset price volatility during economic upswings can encourage lenders to grant more credit for a given amount of collateral (ie a higher loan-to-value ratio) and innovate to increase the available collateral, ie lend against lower quality collateral (Geanakoplos (2009), Fostel and Geanakoplos (2014)).

During economic upswings, lenders might also be more likely to pursue innovations that enhance their ability to extend credit to riskier borrowers. For example, strong credit demand and novel

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[8]   The evidence also shows that, when faced with tighter credit conditions and reductions in demand, highly levered firms reduce their investment, employment and productivity growth more than firms with lower leverage (Duchin et al (2010), Giroud and Müller (2016), Duval et al (2017), Kalemli-Ozcan et al (2020)). Consistent with this evidence, recent studies on the effects of the Covid-19 pandemic find that firms with lower leverage experienced smaller stock price declines after the sudden and unexpected revenue shortfall caused by the pandemic (Ding et al (2020), Fahlenbrach et al (2020)).

securitisation practices led to a sharp deterioration in screening incentives in the lead up to the GFC (Keys et al (2010), Dell'Ariccia et al (2012)). In addition, bank lending to higher risk borrowers can expand during economic upswings because the ability of loan officers to distinguish between good and bad borrowers deteriorates as time passes since the last significant experience with problem loans (Berger and Udell (2004)) and also because banks might expand into market segments that they are less experienced in servicing (Doerr (2018)).

Competition between financial intermediaries can also weaken lending standards and increase financial vulnerabilities in a range of circumstances. Banks' shareholders face large upside potential and limited downside, due to limited liability and high use of leverage by banks, as well as deposit insurance and implicit guarantees (Keeley (1990), Allen and Gale (2004)). When competition is intense, this can lead banks to take on more risk rather than accept lower expected returns (Allen and Gale (2000)) and banks are less likely to realise the existence of an externality associated with higher level of debt.[9] In addition, in markets composed of many small banks, lending standards might be lower because each small bank has less information about the market than a large bank would (Marquez (2002)). Moreover, increased competition from new lenders could incentivise incumbent banks to concentrate their lending on riskier borrowers (Dell'Ariccia and Marquez (2004)). Banks can also become riskier if increased competition reduces profitability, even if they do not lower lending standards, because profits act as a buffer against unexpected losses (Martinez-Miera and Repullo (2010)).

However, greater competition between financial intermediaries might not necessarily result in lower lending standards and higher risk taking. For example, banks will not necessarily take on more risk to increase short-term expected returns if they are concerned about insolvency risk (Perotti and Suarez (2002)). Competition can even lead to lower risks if it results in lower lending rates which incentivise borrowers to invest in less risky projects (Boyd and de Niccolo (2005)).

A large literature, harkening back to Kindleberger (1978), emphasizes the role of beliefs in driving rapid credit growth, lower lending standards, and higher risk-taking during expansions. Empirical evidence suggests that beliefs about credit risk and economic growth are overoptimistic during credit booms (Bordalo, Gennaioli and Shleifer (2016), Mian, Sufi and Verner (2017), Baron and Xiong (2017)). This has spurred theoretical research modelling the evolution of beliefs departing from rational expectations (eg Bordalo, Gennaioli and Shleifer (2018), Greenwood, Hanson and Jin (2016), Krishnamurthy and Li (2020), Maxted (2020)). According to these models, during economic upswings, good news shocks make agents overoptimistic about economic prospects and borrower credit quality. This leads to credit expansions, high asset values, higher output and low credit losses – reinforcing the overoptimistic beliefs. However, the resulting deterioration in credit quality ultimately leads to credit losses and a sharp reversal in beliefs.

Debt characteristics – _shorter maturity, floating rate and foreign-currency debt can increase vulnerability to shocks_

The vulnerability of households and firms to different shocks depends not only on their riskiness and overall indebtedness, but also on the contractual characteristics and structure of their debt.

Borrowers relying more on short-term debt are more vulnerable, as they are exposed to rollover risk, that is, the risk that the terms or availability of financing might suddenly change to their detriment.[10]

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[9]   From this perspective, financial liberalisation that increases competition can increase the risk of a financial crisis, even where there are net positive long-run benefits to the economy from liberalisation (Demirguc-Kunt and Detragiache (1998), Ranciere et al (2006)).

[10]   The literature suggests that debt maturity can help overcome information asymmetries and agency problems, as it can signal positive inside information (Flannery (1986, 1994), Diamond (1991)) and can act as a disciplining device (Calomiris and Kahn (1991), Diamond and Rajan (2001)). From a different perspective, Broner et al (2013) and Krishnamurthy and Vissing-Jorgensen (2015) argue that, because lenders prefer liquid and safe assets, short-term debt is cheaper than longer-term debt and thus borrowers might choose to use short-term debt, even if this increases their rollover risk. For a review of the literature on debt maturity, see Chen et al (2019).

As a result, the maturity structure of debt can have effects on the real economy if it results in rapid deleveraging and excessive liquidation of assets. For instance, firms that had a larger share of their debt maturing in the short run during the GFC reduced their investment significantly more than firms that did not need to roll over debt in the short run (Duchin et al (2010), Almeida et al (2012), Duval et al (2017)).[11]

Floating rate debt can increase the financial vulnerability of borrowers, as it exposes them to interest rate risk: when interest rates rise, the debt servicing costs of floating rate debt increase, creating cash flow shocks that can reduce the debt repayment capacity of households and firms. From an aggregate perspective, while fixed rate debt might reduce the interest rate risk faced by borrowers, it transfers this risk to financial intermediaries. Floating rate debt, in turn, reduces the interest rate risk faced by financial intermediaries, but can increase their exposure to credit risk: if most loans are contracted at floating rates, a large proportion of borrowers might be unable to repay in the event of an interest rate increase (Hellwig (1994)).

To gauge the overall financial stability implications of the rate structure of debt, it is important to understand where interest rate risks ultimately reside and assess whether these sectors or entities are able to absorb the impact of changes in interest rates (Hoffman et al (2018, 2020)). Financial intermediaries, and to a lesser extent firms, might hedge their interest rate risk in derivatives markets, thereby reallocating this risk to other financial market participants who might be more willing or able to bear it. Households, on the other hand, are unlikely to have access to instruments to hedge interest rate risk. Financial intermediaries and borrowers might try to match the characteristics of their cash flows and liabilities. Consistent with this argument, Vickery (2008) finds that credit-constrained firms are more likely to rely on fixed rate debt, and that fixed rate debt is less prevalent in sectors in which industry output moves with interest rates. Moreover, savings banks and commercial banks, which are more sensitive to rising interest rates, originate a higher proportion of floating rate loans. Similarly, Kirti (2020) finds that banks with more floating rate liabilities make more flexible rate loans and charge lower rates on these loans.

Foreign currency denominated debt can increase the financial vulnerability of borrowers by exposing them to currency risk if they are not perfectly hedged: a currency depreciation will increase the value of their foreign currency denominated liabilities in terms of domestic currency, having a negative effect on their net worth and increasing their debt servicing costs. Several firm-level studies find that currency depreciations have a negative impact on firms that have foreign currency denominated debt: reducing investment, increasing firm exit rates and decreasing repayment capacity (Aguiar (2005), Kim et al (2015), Du and Schreger (2015), Niepmann and Schmidt-Eisenlohr (2019)).[12] Foreign currency denominated household debt can also increase vulnerabilities, as households might not be able to hedge the exchange rate risk, or even fully grasp the nature and extent of the risk they are effectively exposed to (Hake et al (2014)). Verner and Gyongyosi (2020) find that a currency depreciation in Hungary led to a significant increase in the burden of foreign currency denominated household debt, resulting in increased default rates and a collapse in spending. This worsened local recessions by lowering aggregate demand and had negative spillover effects on other borrowers whose debt was not in foreign currency.

2.3   Amplification through the financial system

When adverse shocks materialise, debt repayment difficulties can trigger a deleveraging process and lead to a reduction in aggregate demand. This can generate pernicious nonlinearities and interactions, where

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[11]   From a different perspective, a large literature shows that high levels of short-term debt among financial intermediaries (Brunnermeier (2009), Raddatz (2010)) and sovereigns (Eichengreen and Hausmann (1999), Rodrik and Velasco (2000), Jeanne (2009), Gourinchas and Obstfeld (2012)) are associated with a higher incidence of crises.

[12]   However, other studies find little effect of foreign currency denominated debt on firm outcomes following depreciations, suggesting that firms might naturally hedge the currency denomination of their assets or cash flows and their liabilities (Bleakley and Cowan (2008)).

deleveraging contributes to tighter financial conditions and lower asset prices, which in turn increase deleveraging pressures.

Financial frictions, asset prices and collateral

A broad set of macroeconomic models show that financial frictions can amplify adverse shocks when leverage is high.[13] The seminal contributions of Bernanke and Gertler (1989), Kiyotaki and Moore (1997), and Bernanke et al (1999) show that the interaction between credit constraints and asset prices is a powerful amplification mechanism by which small and temporary shocks can generate large and persistent fluctuations in aggregate economic activity.

Several papers go further and highlight how financial frictions can lead to asymmetric effects and non-linearities because financial constraints are more likely to become binding following adverse shocks when leverage is high (Fisher (1933), Maffezzoli and Monacelli (2015), Guerrieri and Iacoviello (2017), Couallier and Scalone (2020)). Brunnermeier and Sannikov (2014) show that due to highly nonlinear amplification effects the economy can enter volatile crisis episodes, and that endogenous leverage determines the distance to the crisis. Some models highlight how adverse shocks that trigger deleveraging pressures can lead to fluctuations in aggregate demand and output (Tobin (1980), Eggertsson and Krugman (2012), Korinek and Simsek (2016), Guerrieri and Lorenzoni (2017)). In the presence of borrowing constraints, an adverse shock can induce highly indebted households to deleverage and reduce their consumption. If this reduction in demand is not fully compensated by increased demand by those households that are less indebted, aggregate demand can fall, which might lead to a recession. In this type of model, households might borrow too much from a social perspective because they do not internalise the potential impact of their decisions on aggregate demand and on other households.[14]

The relationship between credit, economic activity and collateral values during credit booms described in Section 2.2 can amplify adverse shocks by generating negative feedback loops. If lenders reduce screening during economic upswings, more risky projects will be funded, and therefore there will be larger losses during the bust. In addition, a lack of screening means that lenders cannot easily distinguish between good and bad loans in their loan book. As a result, lenders will tighten financial conditions more than otherwise during a bust, and the economic downturn will be more severe (Asriyan et al (2019)). If lenders reduce their investment in producing information about the quality of the collateral backing debt instruments during good times, even a small reduction in the value of collateral can lead to a loss of confidence which triggers a sharp contraction in lending (Gorton and Ordoñez, (2014, 2020)).

Financial intermediaries

A large literature shows that financial intermediaries play an important role in amplifying adverse shocks to borrowers and that fragilities among intermediaries can cause economic shocks to become systemic financial events or crises.[15] Deleveraging and defaults can have negative effects on the financial intermediaries that hold the debt incurred by firms and households. This can trigger second round effects, as intermediaries that face capital and/or liquidity constraints might reduce their credit provision, further depressing economic activity and asset values. Any effects are likely to be larger the higher the leverage of financial intermediaries, the more involved in maturity/liquidity transformation they are and the riskier their exposures are.

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[13]   For a review of this literature, see Brunnermeier et al (2012).

[14]   A different strand of the literature has argued that private debt levels might be excessive due to expectations that the public sector will bail out private firms in case of a major downturn or crisis (Farhi and Tirole (2009, 2012, 2018), Brunnermeier (2016)).

[15]   For macroeconomic models where frictions in financial intermediation amplify shocks and business cycle fluctuations, see, among others, Gertler and Kiyotaki (2010), He and Krishnamurthy (2013, 2019), Brunnermeier and Sannikov (2014, 2016), and Li (2019).

Financial intermediaries interact with each other in many markets and in payments and settlements systems, generating a broad network of contractual obligations that can help propagate distress in one intermediary to other intermediaries.[16] Common asset holdings across financial intermediaries can also help propagate shocks, as intermediaries that face a negative shock might sell some of the commonly held assets, causing their prices to drop and imposing losses on other financial intermediaries. In addition, some financial intermediaries provide services and infrastructures that are essential to the real economy, such as payments and settlement systems, for which there are no readily available substitutes. Therefore, adverse shocks that affect these systemically important financial intermediaries are likely to spread to the broader financial system and to the real economy.

The nature of financial intermediaries might affect the extent to which they amplify adverse shocks to borrowers. One important factor in this regard could be differences in the way financial intermediaries intermediate between savers and borrowers. Some market-based financial intermediaries, such as corporate bond funds, directly channel resources between savers and borrowers, passing any credit losses onto savers. Other financial intermediaries, such as banks, conduct financial intermediation mostly on their own balance sheets, funding risky loans with deposits and short-term borrowings. The high leverage of banks and their large asset-liability mismatches can make them more vulnerable to shocks and, in the extreme, to runs.

Consistent with these arguments, Bats and Houben (2020) find that bank-based financial systems are associated with higher systemic risk than market-based systems. Gambacorta et al (2014) find that financial crises in countries with bank-based financial systems are more severe than in countries with market-based financial systems. Similarly, Langfield and Pagano (2016) find that housing market crises have a particularly large impact in bank-based systems. They argue that this is due to an amplification mechanism, by which banks overextend and misallocate credit when asset prices rise and ration it when they drop. Market financing might work as a "spare tire," substituting for bank credit when bank financing tightens and thus contributing to a reduction in the amplification of shocks and systemic risk (Greenspan (1999), Levine et al (2016)).[17] In contrast, Crouzet (2018) argues that banks provide more flexible forms of financing to firms during periods of stress.

2.4   Indirect debt vulnerabilities

High debt may create vulnerabilities that indirectly affect financial stability via its influence on economic growth. As discussed in section 2.3, debt can interact with financial frictions to amplify fluctuations in aggregate economic activity. In addition, high private sector debt levels may also drag down economic growth through a variety of supply and demand channels.

Supply-side effects

High levels of and/or rapid increases in aggregate private non-financial sector debt could potentially drag economic growth down through a variety of supply-side vulnerabilities. Rapid credit expansions might be associated with increased lending to sectors that tend to have lower productivity growth, such as construction and non-tradables (Reis (2013), Benigno and Fornaro (2014), Dias et al (2016)). This can result in resource misallocation, reducing the economy's growth potential (Gopinath et al (2017)).

Easier access to credit might allow inefficient incumbent firms to remain in the market longer, discouraging entry of potentially more efficient firms and dragging down productivity and growth (Aghion et al (2018)). High corporate indebtedness could also lead to the emergence of so-called zombie firms (ie

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[16]   For studies of how interconnectedness helps spread solvency and liquidity shocks throughout the financial system, see, among others, Acemoglu et al (2012), Allen and Gale (2000), Allen et al (2010), Cifuentes et al (2005), Dasgupta (2004), Eisenberg and Noe (2001), Freixas et al (2000), Gai et al (2011), Glasserman and Babus (2009), Rochet and Tirole (1996) and Rotemberg (2008).

[17]   Consistent with this view, research shows that U.S. firms substituted corporate bonds for bank loans during the global financial crisis (Adrian et al. 2012, Becker and Ivashina, 2014).

firms that are unable to cover debt servicing costs from current profits over an extended period). This could weaken economic performance and slow down recoveries after recessions as these firms tend to be less productive and their survival crowds out investment and employment in healthy firms (Caballero et al (2008), McGowan et al (2018)). Banerjee and Hofmann (2018, 2020) document an increase in the share of zombie firms since the late 1980s and link it to reduced financial pressures, in part reflecting lower interest rates. Corporate indebtedness could also interact with the health of financial intermediaries because undercapitalised banks might have incentives to keep weaker firms alive to avoid recognising losses, reducing credit to healthier borrowers and leading to capital misallocation (Peek and Rosengreen (2005), Caballero et al (2008), Acharya et al (2019), Schivardi et al (2017), Storz et al (2017)).

High corporate indebtedness could also reduce investment due to debt overhang problems.[18] Default risk acts like a tax that discourages new investment by firms because some of the benefits of investing will be reaped by creditors (Myers (1977)). Moreover, an increased risk of default might lead management to focus on the short-term survival of the firm, rather than on longer-term value creation and innovation. Debt overhang can reduce longer-term growth and amplify and prolong the effects of adverse business cycle shocks (Lamont (1995), Occhino and Pescatori (2015), Daher and Kneer (2022)).

The cost of dealing with default – eg through bankruptcy – is a major factor determining both deleveraging pressures and whether high debt loads remain on the balance sheets of firms and financial intermediaries and drag down medium-term growth. Even in the most efficient insolvency frameworks there will be losses; how these losses are allocated has important economic and distributional consequences. The empirical evidence suggests that in countries where reorganisation and restructuring is inefficient and costly, debt overhang problems are more likely to slow down the recovery after recessions and zombie firms are more likely to emerge, as banks have more incentives to evergreen loans instead of liquidating (Andrews and Petroulakis (2017), Jorda et al (2020)).

Demand-side effects

High private sector debt levels might persistently weigh on aggregate demand because savers and financial investors tend to have lower marginal consumption rates than borrowers and households without significant financial assets.[19] Mian et al (2020a) show that this can lead the economy to get stuck in a debt-driven low interest rate liquidity trap, or debt trap. In this context, standard expansionary macroeconomic policies, such as deficit financed fiscal policy, can have temporary effects, but if they result in shifts of resources from borrowers (lower-income households) to savers (higher-income households), they will reduce aggregate demand and interest rates in the long run (Mian et al (2020b)).

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[18] While contributing to a dampening of the demand side by depressing business investment, the "lost investment" may have an even greater long-term impact on the supply side if associated with less innovation and lower/unrealised productivity gains.

[19] This argument is closely related to the discussion in Section 2.1 about how adverse shocks that trigger deleveraging pressures can lead to fluctuations in aggregate demand and output. However, a key distinction is that even without adverse shocks and deleveraging, debt could reduce aggregate demand and output in the medium and long run.

3. Trends in private sector debt

Aggressive and timely policy action during the Covid-19 pandemic has so far prevented a materialisation of the direct channels through which debt impairs financial stability. Not least by shielding the financial system from losses that could have precipitated a credit crunch. This, however, has unavoidably contributed to a further increase in private sector debt. Elevated debt vulnerabilities could yet lead to losses and, through indirect channels, propagate resource misallocations or result in persistent demand weakness that eventually holds back growth.

That said, debt vulnerabilities differ significantly across economies, sectors, firms and households. Some economies have leveraged up over the past decade resulting in aggregate debt service-to-income ratios that now stand significantly above those at the time of the GFC despite significantly lower interest rates. For others, deleveraging in the wake of the GFC and European sovereign debt crisis of 2010–12 has helped hold down aggregate debt servicing costs. Aggregate trends as well as the tails of the distribution suggest that immediate debt vulnerabilities in the NFC sector are more elevated than those of households. Going forward, elevated asset prices – especially in residential property markets – and potentially over-optimistic expectations of further price rises present emerging risks. This is particularly the case if there is a consequent deterioration in credit quality.

Some trends over the past decade are likely to have mitigated debt vulnerabilities in a number of economies. Although gross debt levels increased significantly during the pandemic, the concurrent increase in aggregate household saving rates and cash buffers in the corporate sector in many economies indicate that, at least in aggregate, the household and corporate sectors have accumulated buffers. Over the past decade, debt maturities have lengthened and prudential reforms that have boosted the resilience of the financial system. Historical sources of vulnerabilities such as cross-border and foreign currency debt have largely grown in line with aggregate private sector debt.

This section first examines trends in aggregate debt since the GFC. It then analyses trends in debt allocation, with a focus on the riskier borrowers and lending standards as well as trends in the characteristics of debt that can raise vulnerabilities. The section then examines if amplification channels either via asset prices and collateral or financial intermediaries might have raised or mitigated debt vulnerabilities. It concludes by examining indirect channels in light of the Covid-19 pandemic.

3.1 Debt levels

As discussed in Section 2, private sector debt can have direct effects on financial stability by making households and firms more vulnerable to shocks. This section analyses the level of debt worldwide and the change since the GFC, with a focus on the impact of the Covid-19 pandemic.

Even prior to the Covid-19 shock, the overall level of gross debt (the sum of private non-financial sector debt and government debt) relative to GDP was higher in almost every country relative to that prevailing before the GFC (Graph 5, left-hand panel). Across regions, debt-to-GDP increased by around 40 percentage points in the major AEs and by over 60 percentage points in emerging Asia.

By 2021, private non-financial sector debt constituted just under two thirds of non-financial debt globally, with government debt making up the remaining third. Within private non-financial sector debt, around 60% are claims on the NFC sector with the remaining 40% on the household sector.

Until the Covid pandemic struck, debt trends had largely been shaped by the long shadow of the GFC. Private non-financial sector debt-to-GDP increased in economies that experienced more moderate debt increases in the decade before the GFC (Graph 5, centre panel). By contrast, economies that experienced strong pre-GFC private sector debt booms and financial crises deleveraged over the following

decade. However, these economies also tended to experience stronger government debt increases, at least within advanced economies (Graph 5, right-hand panel).
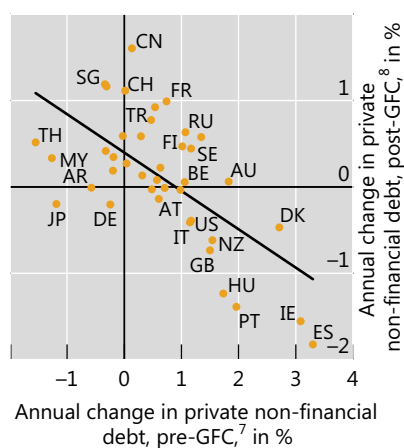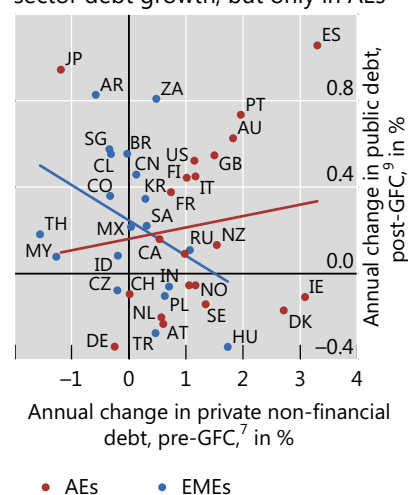
Changes in debt relative to GDP

Debt has increased since the GFC, but with important differences
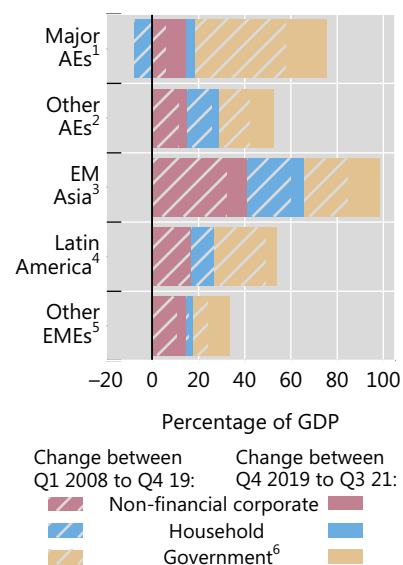
Private sector debt growth negatively correlated with pre-GFC experience

Government debt growth positively correlated with pre-GFC private sector debt growth, but only in AEs

Change between Q1 2008 to Q4 19:   Change between Q4 2019 to Q3 21:

Non-financial corporate
Household
Government[6]

[1] Euro area, JP and US.   [2] AU, CA, CH, DK, GB, NO, NZ and SE.   [3] CN, HK, ID, IN, KR, MY, SG and TH.   [4] AR, BR, CL, CO and MX.   [5] CZ, HU, PL, RU, SA, TR and ZA.   [6] Nominal value.   [7] Average annual change for the period between 2000-2007, as a percentage of GDP.   [8] Average annual change for the period between 2010–2019, as a percentage of GDP.   [9] Average annual change in public debt for the period between 2010–19, as a percentage of GDP.

Sources: BIS; CGFS Working Group calculations.

Relative to GDP, debt of the private non-financial sector (households and NFCs) rose worldwide between 2008 and 2019 (Graph 5, left-hand panel). The increase totalled about 50 percentage points in emerging Asia and around 25 percentage points in Latin America. In advanced economies, the situation has been more heterogeneous. Although non-financial corporate debt increased in the major AEs, the household sector deleveraged. In other advanced economies, by contrast, households also contributed strongly to the increase in private sector debt.

Private sector debt levels ratcheted up during the Covid-19 pandemic. The increase in NFC debt was particularly strong. Economies that were ex ante more leveraged, borrowed more during the pandemic. NFC debt did not, however, increase in all economies. Notably a number of EMEs experienced far weaker debt growth during the pandemic. One potential driver of this weaker debt growth was less extensive use of policies to expand lending capacity or incentivise lending.[20]

3.2   Direct debt vulnerabilities

As emphasised in Section 2, for a given level of debt, riskier borrowers (ie those with lower or more unstable repayment capacities) are more vulnerable to shocks. Thus, the composition of the firms and households that borrow matters from a financial stability perspective. In this subsection, we first analyse trends in aggregate measures of debt vulnerability. Then we investigate if the trends for the most

[20]   See for example Casanova et al (2021) and ESRB (2021).

vulnerable households and NFCs are consistent with aggregate measures of debt vulnerabilities. Finally, we study the evolution of lending standards – as financial instability has often followed a period of loose lending standards and compressed lending spreads.

Aggregate vulnerabilities

As described in Section 2, the credit-to-GDP gap (the difference between the credit-to-GDP ratio and its long-term trend) has gained prominence as an indicator of aggregate debt vulnerabilities and is used in many countries to guide the setting of the countercyclical capital buffer (CCyB). Just prior to the Covid-19 pandemic, credit-to-GDP gaps were higher than those preceding the GFC in around half of the economies sampled. By 2021 this had increased to just under 60% (Table 2).[21] Credit-to-GDP gaps highlight pockets of concern in Asian economies as well as France, Germany and Switzerland, where household and NFC sectors have experienced strong credit growth.

Change in credit-to-GDP gap between Q1 2006 and Q3 2021 — Table 2

	Major advanced[1]			Other advanced								EM Asia[2]								Lat AM					Other EME							Euro area						
	JP	US	EA	AU	CA	NZ	NO	SE	CH	DK	GB	CN	HK	IN	ID	KR	MY	SG	TH	AR	BR	CL	CO	MX	CZ	HU	PL	RU	SA	ZA	TR	BE	FR	DE	IT	LU	NL	ES
HH	↑	↓	↓	↓	↓	↓	↓	↓	↑	↓	↓	-	↑	-	-	↑	-	↑	↑	↓	↓	-	↓	↓	↓	↓	↓	↑	↑	-	↓	↓	↓	↑	↓	↓	↓	↓
NFCs	↑	↑	↑	↓	↑	↓	↓	↑	↑	↓	↓	-	↓	↓	-	↑	-	↑	↑	↑	↓	-	↑	↓	↓	↓	↑	↓	↑	-	↓	↓	↑	↑	↑	↓	↓	↓
PNFS	↑	↓	↓	↓	↑	↓	↓	↑	↑	↓	↓	↓	↑	↓	↑	↑	↑	↑	↑	↑	↓	↑	-	↑	↓	↓	↓	↑	↑	↓	↓	↓	↑	↑	↓	↓	↓	↓

↑ indicates a rise in the credit-to-GDP gap; ↓ indicates a decrease. HH: Household sector, NFCs: non-financial corporates, PNFS: private non-financial sector (HH+NFC). National credit-to-GDP ratios should be interpreted and compared across economies with care, taking into account jurisdiction specific considerations.

[1] For PNFS in EA, change since Q1 2009.   [2] For NFCs in IN, change since Q2 2012.

Sources: BIS credit statistics; National data; CGFS Working Group calculations.

While strong credit growth might signal rising vulnerabilities, the risks often materialise when households and firms struggle to service their debts. Indeed, the aggregate debt service ratio is an accurate early warning indicator of systemic banking crises (Drehmann et al (2017)). In the face of rising debt levels, falling interest rates globally have helped contain debt servicing costs over the past decade. Nevertheless, aggregate debt service ratios of the private sector have still increased in many economies (Graph 6, left-hand panel). In general, debt service ratios for the NFC sector have deteriorated by more than those in the household sector (see Appendix A).
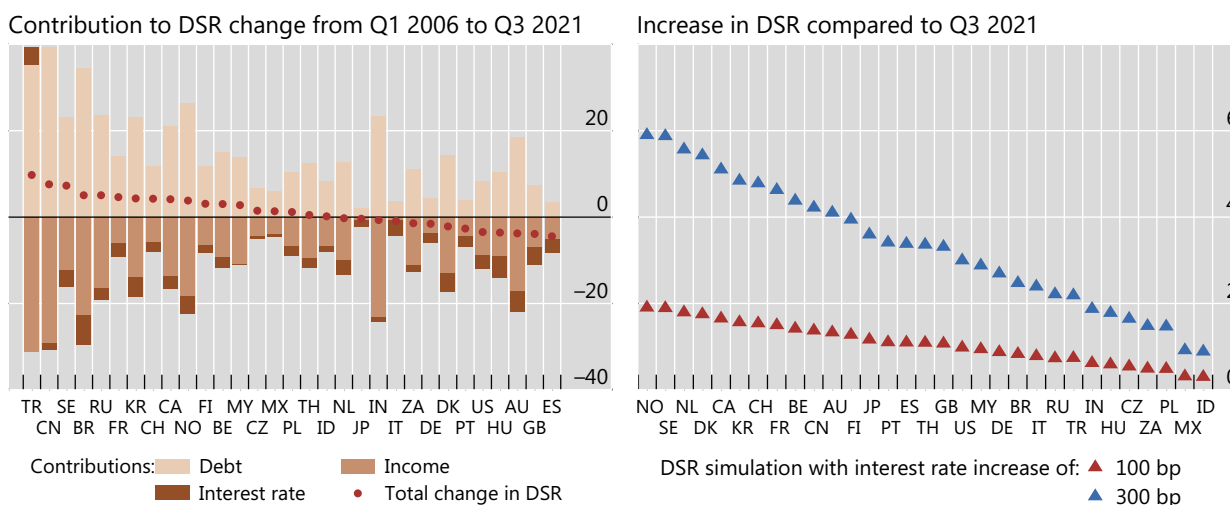
Going forward, higher debt levels expose the private sector to greater interest rate risk. A 100-basis point increase in borrowing costs would raise the aggregate household debt servicing cost by around 1 percentage point of income in the average economy (Graph 6, right-hand panel, red triangles). However, due to the non-linear relationship, a 300-basis point rise would increase debt service by around 4 percentage points of income (blue triangles). Although such an increase in debt service costs is still modest, vulnerabilities could be amplified if rising interest rates have negative effects on collateral and asset prices which in turn result in debt rollover difficulties for borrowers.

[21]   Credit-to-GDP gaps in recent years might still be affected by very strong pre-GFC credit booms in certain countries due to the persistence of the credit-to-GDP gap. Thus, the change relative to 2006 might underestimate risks arising from the recent debt build-up in some economies. Conversely, the unprecedented decline in GDP during the Covid-19 pandemic might also overestimate the recent credit-to-GDP gap, though this effect is less present in 2021 following the sharp rebound in activity.

Drivers of debt service ratios (DSR) of the private non-financial sector

In percentage points
Graph 6

Contribution to DSR change from Q1 2006 to Q3 2021

Increase in DSR compared to Q3 2021

Contributions: ▨ Debt ▨ Income
▨ Interest rate ● Total change in DSR

DSR simulation with interest rate increase of: ▲ 100 bp
▲ 300 bp

Sources: BIS credit statistics; CGFS Working Group calculations.

Distribution of vulnerabilities

Aggregate debt statistics can be misleading because they might mask underlying debt vulnerabilities. For example, a stable aggregate debt-to-income ratio might mask an accumulation of debt among households or firms with lower incomes. Moreover, as highlighted in Section 2, lending to riskier borrowers exacerbates the vulnerability of the economy to shocks. Thus, data on the distribution of debt vulnerabilities can provide useful information on debt vulnerabilities among borrowers at most risk of experiencing repayment difficulties. Analysis of distributions requires micro data, which are often not available from public sources. The Working Group collected data from central banks to analyse the distribution of debt vulnerabilities.

The Working Group analysed trends in lending to the risky tail of borrowers and compared how that differed from lending to borrowers at the centre of the distribution. Specifically, the Working Group focused on changes over time in debt vulnerabilities at the centre of the distribution and compared it to changes in the dispersion between the vulnerabilities of borrowers in the risky tail and the centre of the distribution (Graph 7). Appendix B provides a fuller explanation of the metrics analysed by the Working Group.
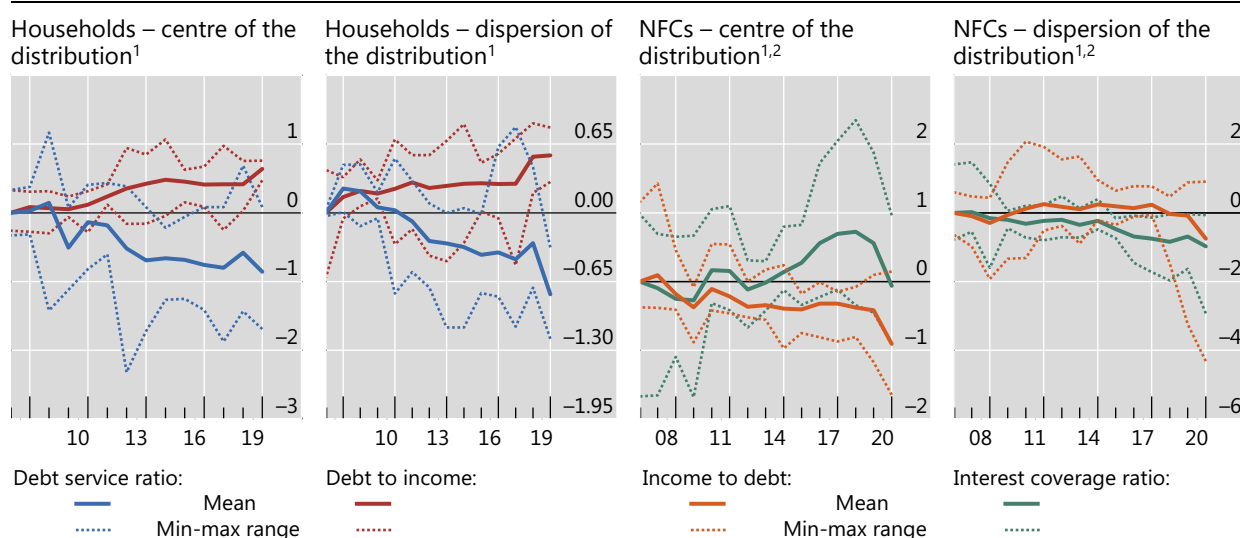
Trends in debt vulnerabilities in the risky tail of households were more pronounced that those at the centre of the distribution. The directional change in the trend, however, depends on the vulnerability indicator. Since the GFC, there has been a clear upward trend in both the centre and the dispersion of household debt to income. This points to an increase in vulnerabilities in the centre and an even larger increase in the risky tail of the distribution (Graph 7, first and second panels, red lines). By contrast, the distribution of debt service ratios has trended in the opposite direction, suggesting a decline in debt vulnerabilities (blue lines).

For non-financial corporates, the distributional analysis shows that movements in the tails do not necessary go hand in hand with movements in the centre of the distribution. Interest-coverage ratios improved in the centre of the distribution between 2008 and 2018 (Graph 7, third panel, green line). By contrast, the relative situation of borrowers in the risky tail deteriorated, as shown by the trend decline in the dispersion of the distribution (fourth panel, green line). For the income-to-debt ratio, the centre of the distribution deteriorated over much of the post GFC period, while the dispersion was little changed until the Covid-19 crisis, when it declined sharply (third and fourth panels, orange lines).

Trends in the distribution of debt vulnerabilities

Indexed to 0 in 2006 Graph 7

Households – centre of the distribution[1]	Households – dispersion of the distribution[1]	NFCs – centre of the distribution[1,2]	NFCs – dispersion of the distribution[1,2]

Debt service ratio:
— Mean
...... Min-max range

Debt to income:
— Mean
...... Min-max range

Income to debt:
— Mean
...... Min-max range

Interest coverage ratio:
— Mean
...... Min-max range

[1] The centre corresponds to the median of the distribution. The dispersion refers to the difference between the 90th percentile and the median. Average of demeaned country levels of the distribution. For a fuller explanation of the metrics, see Appendix B.   [2] For NFCs, the income-to-debt ratio is used instead of the more common debt-to-income ratio because the latter is not monotonic across the distribution when some firms make losses (negative income). This creates problems when analysing debt-to-income for the entire distribution of firms.

Sources: CGFS Working Group; CGFS Working Group calculations.

Moreover, the Working Group found that the tails of the debt vulnerability distribution co-moved more closely with aggregate vulnerability measures than the centre. For the household sector, movements of the credit-to-GDP gap were positively correlated with those in the tails of the debt distribution, whereas the centre was not (see Appendix B). However, the same was not true for NFCs. A potentially intriguing implication of this finding is that credit booms might have different effects on the distribution of vulnerabilities in the tails of debt distribution in the household and NFC sectors. This might complement other explanations regarding the reasons why household credit booms are more often associated with financial crisis compared with corporate ones, as described in Section 2.
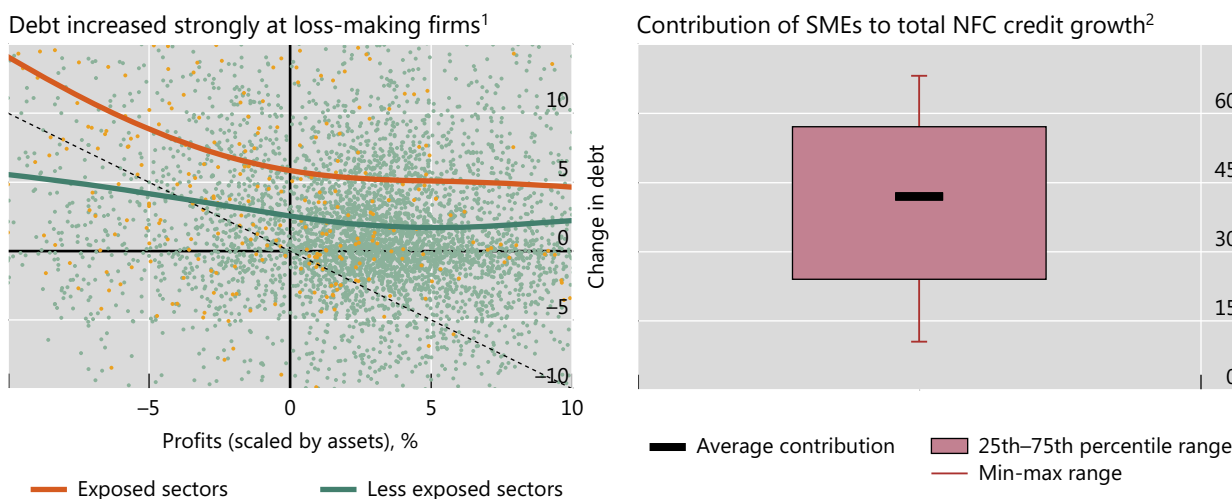
The Covid-19 pandemic also impacted the distribution of debt in other dimensions. More vulnerable households might have been affected more strongly as lower skilled customer-facing jobs were cut as a result of Covid-19 pandemic. Loss making firms borrowed heavily during the pandemic, plugging the gap left by negative cash flows (Graph 8, left-hand panel). Debt grew particularly strongly in sectors most exposed to the Covid shock. Another distributional impact has been heavy borrowing by small and medium-sized enterprises (SMEs), ranging from 20 to over 60% of total NFC loan growth since the start of the pandemic (Graph 8, right-hand panel). Elevated SME debt might present a particular challenge as smaller firms are more likely to be liquidated rather than restructured (Greenwood et al (2020)).

However, the total increase in gross debt might overstate the rise in debt vulnerabilities. The rise in aggregate household saving rates during the Covid-19 pandemic suggests that household may have accumulated buffers that could offset higher debt levels. Similarly, net debt in the corporate sector increased by less than gross debt due to a combination of large fiscal transfers and firms borrowing for liquidity purposes. Indeed, the increase in gross debt often exceeded operating losses in loss making firms shown by the orange line being above the dotted 45-degree line in the left-hand panel of Graph 8. This enabled many loss-making firms to build cash buffers. Finally, the sectors most exposed to the Covid-19 shock had relatively low debt levels leading into the pandemic, potentially mitigating financial stability risks (Mojon et al (2020)). These factors further highlight the importance of granular data on households and firms to effectively evaluate the overall change in debt vulnerabilities.

Credit provision during the Covid-19 pandemic

In percentage points

Graph 8

Debt increased strongly at loss-making firms[1]

Contribution of SMEs to total NFC credit growth[2]

Exposed sectors — Less exposed sectors

Average contribution — 25th–75th percentile range — Min-max range

NFC = non-financial corporate; SMEs = small and medium-sized enterprises.

[1] The smooth line is estimated using a generalised additive model, which fits a penalised cubic spline through the individual firm-level observations. Based on public and private companies in AU, CA, DE, ES, FR, GB, IT, JP and US. Covid-19 exposed sectors: airlines, hotel, restaurants and leisure, entertainment, textiles, apparel and luxury goods.   [2] Based on data from AU, BE, CH, DE, ES, GB, MX and RU.

Sources: S&P Capital IQ; CGFS Working Group; CGFS Working Group calculations.

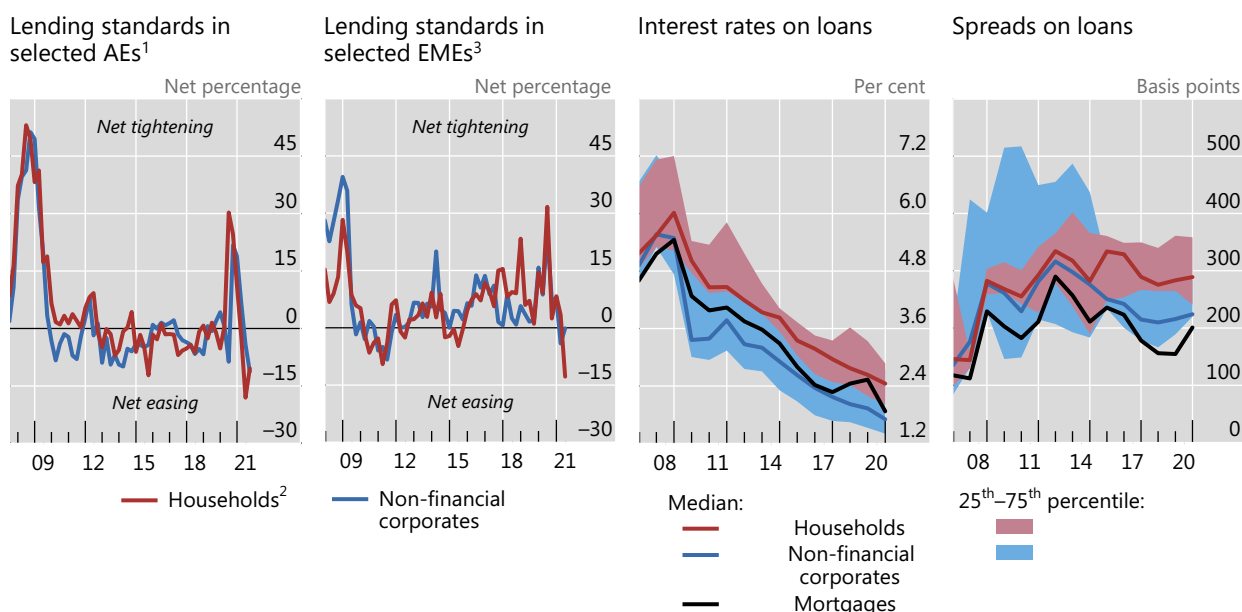### *Pricing of private sector debt*

As discussed in Section 2, debt vulnerabilities and financial instability have often followed a period of weak lending standards and compressed lending spreads. In AEs, lending conditions eased in the years after the GFC, particularly for non-financial corporates (Graph 9, first and second panels). By contrast, EME lending standards have been tightening for some time.

Lending spreads, another metric related to lending standards, have compressed in recent years which could go hand in hand with greater debt vulnerabilities. Although it took time, the strong and steady decline in the interest rate on loans (Graph 9, third panel), has been accompanied by declining spreads on loans to NFCs and household mortgages (fourth panel). Bond market metrics also suggest that credit quality may have deteriorated. Compressed bond spreads could also suggest greater debt vulnerabilities outside the banking system (Graph 10, first panel).

As the Covid-19 pandemic hit, lending standards initially tightened but have since eased. Policy action has been instrumental with standards easing more strongly in economies with larger credit guarantee schemes (Graph 10, second panel). Similarly, in corporate bond markets, spreads initially spiked as the pandemic hit but then compressed strongly in response to official interventions, particularly for more risky borrowers (Gilchrist et al (2020)).

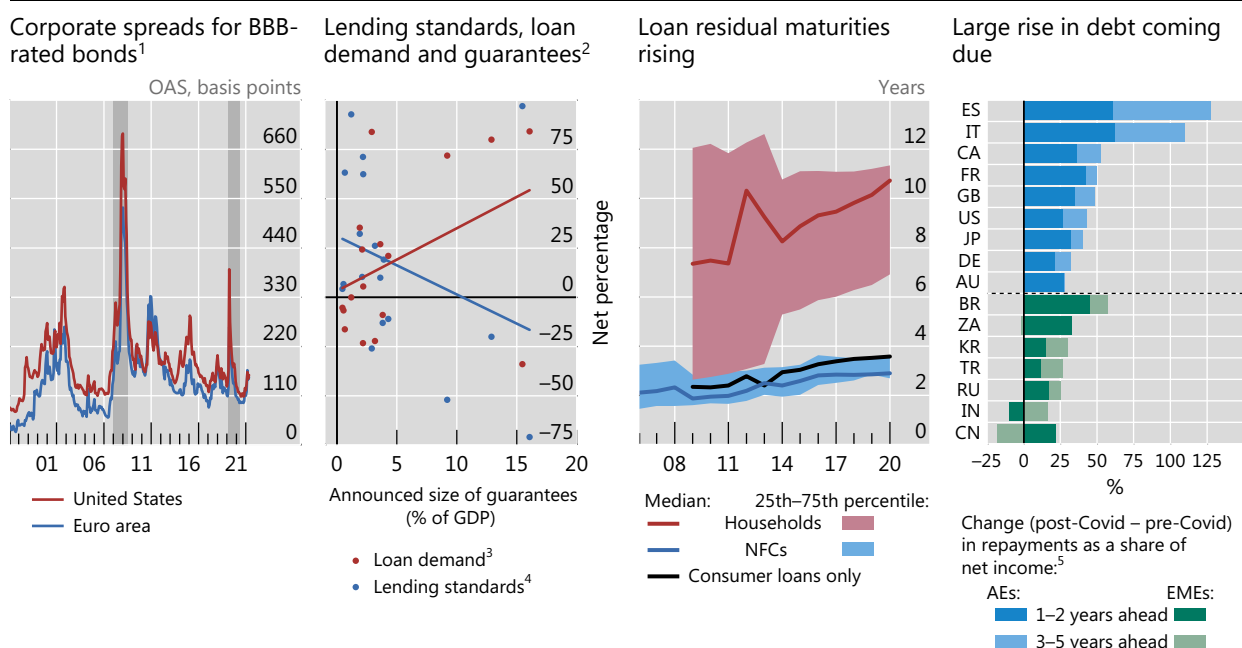## Loan lending standards, interest rates and spreads

Graph 9

Lending standards in selected AEs[1]

Net percentage

Lending standards in selected EMEs[3]

Net percentage

— Households[2] — Non-financial corporates

Interest rates on loans

Per cent

Median:
— Households
— Non-financial corporates
— Mortgages

Spreads on loans

Basis points

25th–75th percentile:

[1] Simple average across GB, euro area and US.   [2] Household mortgages.   [3] Simple average across KR, MX and TH. Data for MX starts Q1 2015.

Sources: US Federal Reserve; Datastream; CGFS Working group; BIS; CGFS Working Group calculations.

Bond spreads, lending standards and guarantees, debt maturity and rollover needs

Graph 10

Corporate spreads for BBB-rated bonds[1]

OAS, basis points

— United States
— Euro area

Lending standards, loan demand and guarantees[2]

Announced size of guarantees (% of GDP)

• Loan demand[3]
• Lending standards[4]

Loan residual maturities rising

Years

Median: 25th–75th percentile:
— Households
— NFCs
— Consumer loans only

Large rise in debt coming due

Change (post-Covid – pre-Covid) in repayments as a share of net income:[5]

AEs: EMEs:
■ 1–2 years ahead   ■ 1–2 years ahead
■ 3–5 years ahead   ■ 3–5 years ahead

[1] For the non-financial corporate sector.   [2] DE and IT are excluded as outliers. Their inclusion would not change the direction of the fitted lines.   [3] Based on banks' responses to surveys on NFCs' demand for loans in Q2 2020. Smaller values indicate weaker (net) demand.   [4] Based on banks' responses to surveys on lending standards for loans to NFCs in Q2 2020. Negative values indicate a loosening and positive values a tightening.   [5] Average yearly repayments for the stated period, as a share of 2019 net income, keeping a balanced sample of firms across time periods. "Post-Covid" includes amount outstanding for the latest stocks of debt securities and bank loans reported, whereas "pre-Covid" includes similar amounts outstanding up to and including Q4 2019.

Sources: IMF *Lending Surveys Monitor*; ICE BoAML Indices; S&P Capital IQ; CGFS Working Group; CGFS Working Group calculations.

Debt characteristics

Certain characteristics of debt such the maturity or whether it is in foreign currency or linked to currency mismatches can increase the vulnerability of borrowers to shocks.

Debt vulnerabilities arising from short maturities appear to have diminished somewhat in recent years. Data from the Working Group's survey suggest that there has been a broad increase in the residual maturity of debt that has followed the decline in long-term interest rates (Graph 10, third panel).

Even though maturities have lengthened, firms have to contend with increased repayment obligations due to the large rise in pandemic borrowing. The value of debt repayments due in the next two years has increased significantly since the start of the pandemic in many advanced economies and some large EMEs. In some countries it exceeds 50% of firms' net income (Graph 10, fourth panel).

Although the nature of capital flows has changed in important dimensions (CGFS (2021)), the dependence on cross-border debt relative to domestic credit has remained relatively stable over the past decade (Graph 11, left-hand panel). Among AEs, cross-border debt is more important in Europe. Within EMEs, the share of cross-border debt is very heterogeneous, ranging from over 20% in Mexico and Argentina to less than 5% in China, Korea and Thailand.

EMEs' foreign currency debt vulnerabilities still appear greater than those in AEs. For some EMEs, it is driven by higher foreign currency debt shares, constituting over 50% of non-financial corporate borrowings in some economies (Graph 11, right-hand panel). For others with lower foreign currency debt shares, vulnerabilities may instead arise from greater dependence on bank intermediated debt which tends to have shorter maturities.
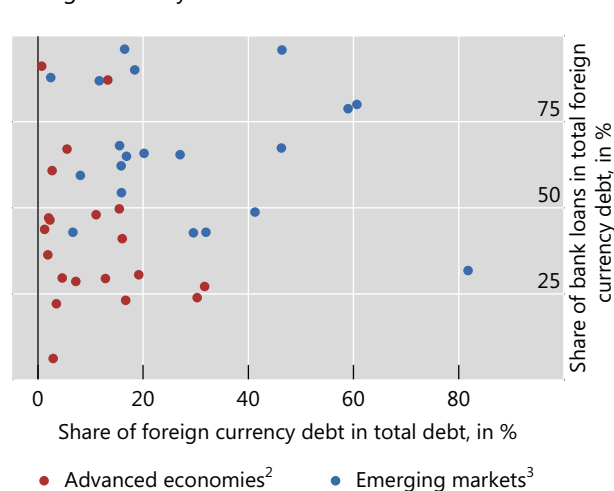
Cross-border and foreign currency debt   Graph 11

Share of cross-border debt[1]
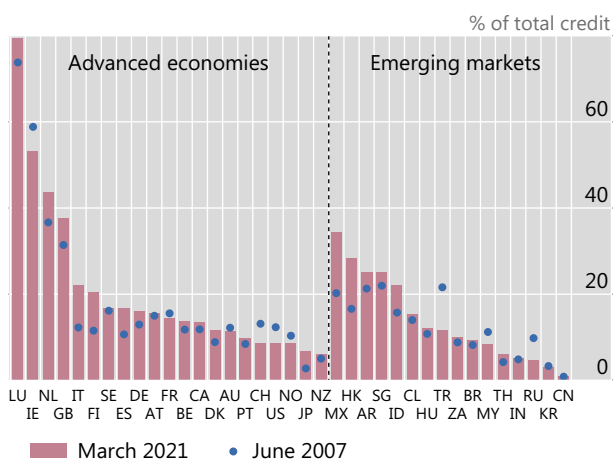
Foreign currency debt in March 2021

[1] Sum of international private non-bank financial loans and debt securities divided by the sum of international private non-financial loans, debt securities and total credit to the private non-financial sector. Cross-border and foreign currency debt numbers should be interpreted and compared across economies with care, taking into account jurisdiction specifics factors.   [2] AT, AU, BE, CA, CH, DE, DK, ES, FI, FR. GB, IE, IT, JP, NL, NO, NZ, PT, SE and US.   [3] AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PL, RU, SA, SG, TH, TR and ZA.

Sources: Dealogic; Euroclear; Thomson Reuters; TRAX; BIS locational banking statistics; BIS credit statistics; CGFS Working Group calculations.

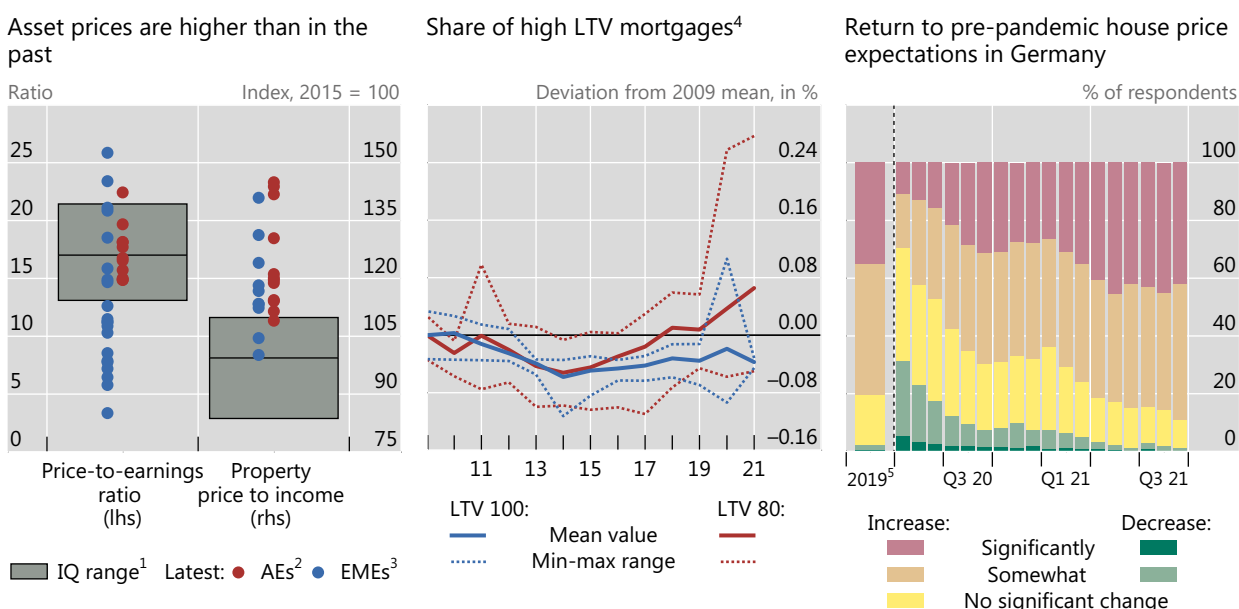## 3.3   Amplification through the financial system

When adverse shocks materialise, debt repayment difficulties can trigger deleveraging processes that result in falling asset prices or expose fragilities in financial intermediaries. These factors can generate pernicious nonlinearities and interactions that strongly amplify the original shock.

Asset prices and collateral

A number of international organisations have recently highlighted the risk that stretched corporate equity and debt valuations could amplify debt vulnerabilities (BIS (2021), FSB (2021), IMF (2021b)). Relative to their historical distributions, property prices appear particularly stretched in many economies, while metrics of equity price stretch appear more heterogeneous (Graph 12, left-hand panel). Negative asset price amplification channels can be particularly severe for household debt as mortgages make up around 75% of household debt compared to around 20% for NFCs, though there is significant heterogeneity across economies.

Asset price valuations, high LTV mortgages and house price expectations   Graph 12

Asset prices are higher than in the past

Share of high LTV mortgages[4]

Return to pre-pandemic house price expectations in Germany

LTV = loan-to-value.

[1] Interquartile range: reference period from 1985 to the latest data as of April 2022 for the price-to-earnings ratio and as of Q4 2021 for the property price to income ratio.   [2] Advanced economies: AU, CA, CH, DK, EA, GB, JP, NO, NZ, SE and US, or fewer countries depending on data availability.   [3] Emerging market economies: sample differs across indicators.   [4] Average of demeaned country level share of new issued mortgages above 80% and 100%.   [5] Average of values in April, May and June 2019.

Sources: Deutsche Bundesbank; OECD; Bloomberg; CGFS Working Group; CGFS Working Group calculations.

The loan-to-value (LTV) ratio for residential mortgages is often used as an indicator of potential amplification through the collateral price channel. In the aftermath of the GFC the share of high LTV mortgages initially decreased across a broad swath of economies (Graph 12, centre panel). However, since 2014 this trend has reversed. For LTVs greater than 80%, the share has been on a rising trend and now exceeds that in 2009, but the share of LTVs above 100% remains below 2009 levels in most economies sampled.

In the current environment, strong expectations of further house price increases may amplify the current upswing in household credit. For example, in Germany, almost 90% of households expected house
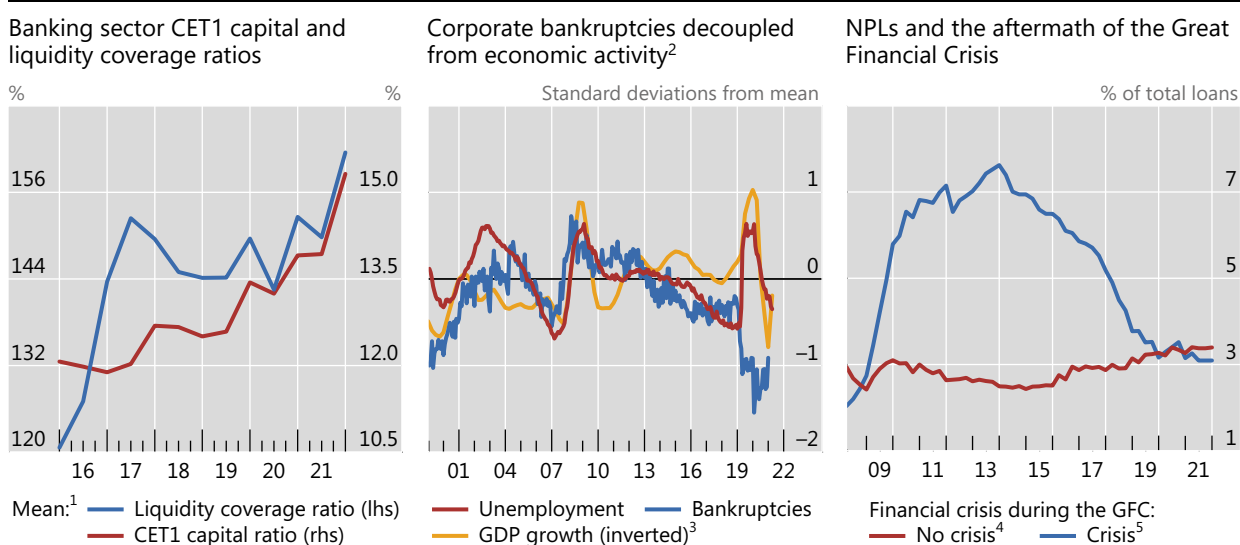
price increases and 40% expected significant increases in late 2021, which is more than in 2019 (Graph 12, right-hand panel).

Financial intermediaries

Risks stemming from private non-financial debt also depend on the resilience of the financial sector to absorb any shocks if borrowers face repayment difficulties. High leverage and maturity mismatches in financial intermediaries were significant amplifiers of deleveraging pressures during the GFC. Over the past decade, reforms to banking regulation and supervision have boosted bank capitalisation and reduced liquidity mismatches (Graph 13, left-hand panel). These reforms together with enhanced restructuring and resolution frameworks are likely to have substantially dampened the risk of amplification by banks both domestically and globally.

Bank capitalisation, low bankruptcies and NPLs   Graph 13

Banking sector CET1 capital and liquidity coverage ratios

Corporate bankruptcies decoupled from economic activity[2]

NPLs and the aftermath of the Great Financial Crisis

Mean:[1] Liquidity coverage ratio (lhs)
CET1 capital ratio (rhs)

Unemployment   Bankruptcies
GDP growth (inverted)[3]

Financial crisis during the GFC:
No crisis[4]   Crisis[5]

CET1 = Common Equity Tier 1; NPLs = non-performing loans.

[1] Banking data covering 38 countries, realigned for fiscal year and other date misalignments.   [2] Data covering 24 economies.   [3] GDP growth values are multiplied by –1.   [4] AR, BR, CA, CL, CN, CZ, FI, HK, ID, IL, IN, JP, MX, MY, PE, PH, PL, SA, SG, TH, TR, VN and ZA.   [5] DK, ES, FR, GB, IE, IT, NL, NO, RU, SE and US.

Sources: American Bankruptcy Institute; Cerved; Datastream; FitchConnect; SNL Financial; national data; CGFS Working Group calculations.

Since the start of the pandemic, debt moratoriums, ample credit supply and temporary changes to insolvency proceedings have resulted in a decoupling of bankruptcies from economic activity (Graph 13, middle-hand panel). As a consequence, non-performing loans rates have been low (Graph 13, right-hand panel). Although the share of non-performing debt is low, it has started to increase somewhat. For example, in India, there has been a significant migration of loans to impaired status since the second half of 2020 (RBI (2021)). In the UK, around 5.5% of all SMEs were in distress in January 2021, up from 3.6% in January 2020 (Bank of England (2021)). In the UK there has also been a rise in households with unsecured debt reporting financial difficulties as a result of Covid. This is consistent with these borrowers being more likely to face a fall in incomes compared with mortgage borrowers (Franklin et al (2021)). While low today, non-performing loans (NPLs) stemming from the GFC and European sovereign debt crisis took nearly a decade to work out, which is a prescient reminder of the long shadow they can cast on the economy.
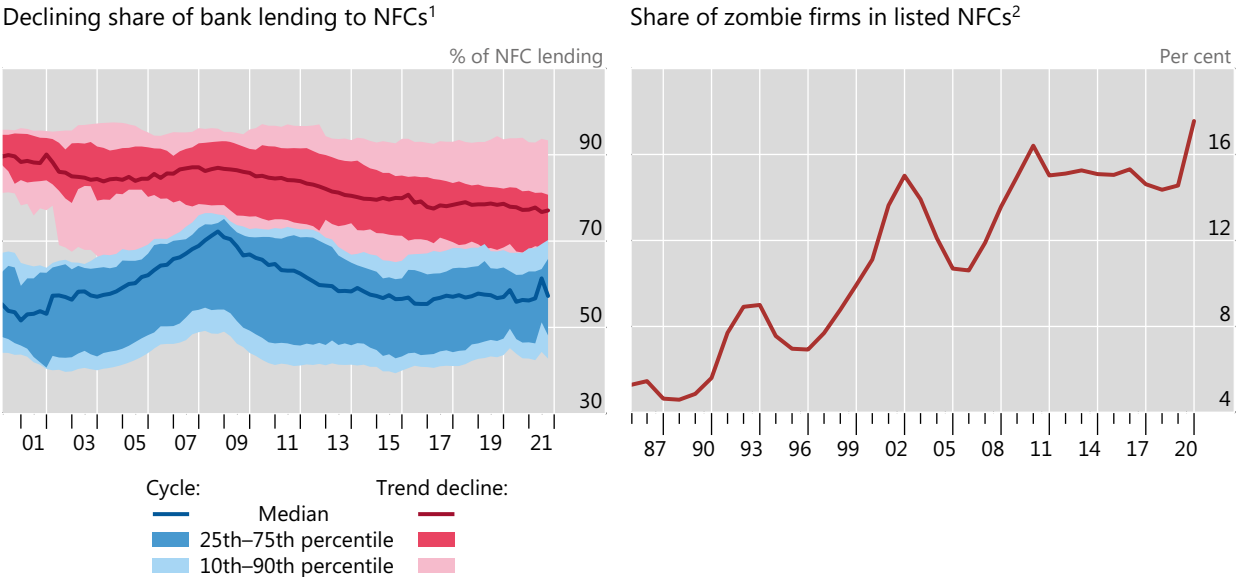
Although banks still intermediate the vast majority of household credit, as businesses have turned to capital markets for credit, there has been a broad-based decline in the importance of bank lending to the non-financial corporate sector since the GFC (Graph 14, left-hand panel). The growth of non-bank

credit intermediation may, on the one hand, help diversify concentration risks and provide a "spare tire" for the economy (Greenspan (1999)). It does, however, create new challenges for monitoring and regulating debt vulnerabilities, particularly for economies experiencing a structural trend of decline in the share of bank lending. Overall, the Covid-19 pandemic has not altered this trend significantly. Beyond bank loans and debt securities, intercompany debt constitutes a significant proportion of total NFC debt in some economies. For example, this can be the case when foreign-owned subsidiaries borrow from their parent company. As such credit does not originate from the domestic financial system, the impact of defaults on intercompany debt on the domestic financial system is usually limited.

3.4   Indirect debt vulnerabilities

Section 2 discussed how high private sector debt could indirectly affect financial stability by dragging down economic growth. In the post-pandemic landscape, a potential risk is that credit support policies perpetuate resource misallocation. One source of misallocation is zombification in the corporate sector that may pose a risk for medium-term growth. Similar to previous economic cycles, the share of public firms classified as zombies spiked in 2020 (Graph 14, right-hand panel). One risk is that – as seen in previous cycles – the share does not completely reverse, leaving a subset of less productive firms that hold back the growth of more productive and dynamic firms (Banerjee and Hofmann (2021)). Another risk is that debt overhang problems may weaken investment and lead to a decline in the economy's productive capacity.

Bank share of lending to NFCs and rising share of zombie firms   Graph 14

Declining share of bank lending to NFCs[1]   Share of zombie firms in listed NFCs[2]

Cycle: Trend decline:
—— Median   ——
■   25th–75th percentile   ■
■   10th–90th percentile   ■

[1] Bank loans to non-financial corporations (NFCs) as a share of the sum of bank loans to NFCs and debt securities issued by NFCs. If bank loans are not available, bank credit to NFCs (BR, CO and MY) or bank claims on NFCs (CN) are used. Debt securities issued by NFCs measured as total debt securities; if not available, sum of domestic and international debt securities. Cycle country sample: AU, CA, FR, GB, NO, US. Trend decline jurisdiction sample: BE, BR, CH, CL, CN, CO, CZ, DE, DK, ES, HK, HU, ID, IT, JP, KR, MX, MY, NL, PL, SE, SG, TH, TR, ZA.   [2] Across 14 advanced economies, zombie firms defined as firms with both an interest coverage ratio of less than 1 and a Tobin's q below the median firm in the sector over two years. To be declassified as a zombie firm, an ICR larger than one or a Tobin's q above the sector median over two years is required. Zombie share is the ratio of zombie firms to all firms.

Sources: Datastream; national data; BIS; CGFS Working Group calculations.

Finally, higher inequality might worsen potential problems related to indebted demand (Mian et al (2020)). In many economies the Covid-19 pandemic might have worsened inequality as lower skilled

customer-facing jobs were cut. Although economic activity has recovered across many sectors, activity in the most heavily affected sectors, such as hotels and restaurants, remains weak.

4. Central bank frameworks for analysing debt vulnerabilities

In the years following the Great Financial Crisis, central banks invested significant resources in enhancing their frameworks for monitoring debt vulnerabilities. This section takes stock of the tools and frameworks that central banks use to evaluate private sector debt vulnerabilities.

Section 2 highlighted a number of empirical regularities that central bank debt monitoring frameworks should capture. Yet, central banks face numerous practical challenges when moving from stylised facts to debt monitoring frameworks. What should be monitored? And which particular metrics should be used? Which decompositions and what level of granularity are sufficient? How should information from multiple indicators and sectors be combined to obtain a comprehensive overview of vulnerabilities? What thresholds or techniques should be used to assess the potential severity of systemic risk?

Moreover, in terms of the policy objectives, central banks face a trade-off: the need to prevent the emergence of systemic risk while at the same time ensuring that the beneficial effects of debt are not unduly impaired. This policy trade-off is complicated by the absence of accurate quantitative techniques for predicting financial crises as well as by financial innovation and changing macroeconomic circumstances. Central banks are thus required to use judgment in addition to quantitative techniques when assessing potential systemic risks. This, together with differences in prudential policy mandates across central banks, suggests that one might expect to observe heterogeneity across debt monitoring frameworks with respect to what is monitored and how the information is used to assess systemic risk. Additional sources of heterogeneity arise from structural differences in financial systems, historical sources of vulnerability and data availability.

To take stock of central bank debt monitoring frameworks, the Working Group surveyed 23 central banks. The survey requested information along several dimensions. It included questions relating to indicators of aggregate debt as well as separate sections for households and non-financial corporations. It also included a section on real estate markets. The survey also requested information on the breakdown of indicators, eg maturity, sector, currency or type of lender. A section of the survey on dashboards and heatmaps focused on how individual indicators are brought together to identify emerging systemic risks. The survey also included questions regarding the use of threshold values for indicators, statistical techniques for purposes such as estimating crisis probabilities as well as the use of macroprudential stress tests. Additional survey sections related to the monitoring of financial intermediaries and to the use of the debt monitoring frameworks in the design and choice of macroprudential policies. Finally, the survey included questions on the relative importance of various indicators and on perceived data gaps.

The responses offer a detailed view of the choices central banks make with respect to the questions of what to monitor, how to aggregate information to obtain a systemic view, how to measure systemic risk and what data gaps exist in the monitoring frameworks. The remaining sections present a stocktake of practices based on the survey responses, treating each of these questions in turn.

4.1 What to monitor and which metrics to use

Not all credit booms end in financial crises. As discussed in Section 2, those that do tend to be associated with lower lending standards, mispricing, rapid asset price growth and increased fragility within the financial sector.

All central banks responding to the survey reported that in addition to indicators of aggregate debt, indicators of debt to households and debt to NFCs are included separately in the monitoring frameworks. Multiple indicators are typically monitored for each of these sectors due to the various channels through which debt developments may translate into financial vulnerabilities. Indicators can be grouped into four categories: (1) level/growth of debt; (2) lending standards; (3) credit quality; and (4) borrower vulnerabilities.

In addition, booms in household debt, particularly mortgage credit, are more likely to be associated with eventual financial stress and economic downturns. Thus, real estate markets are often monitored separately in central banks' frameworks. Finally, given that fragility within the financial sector is an inherent feature of financial crises, monitoring frameworks include indicators of the health and characteristics of financial intermediaries.

Household debt

Types of indicators. Table 3 summarises the indicators of household debt that central banks include in their monitoring frameworks. Indicators measuring either the level of aggregate household credit or the growth rate are monitored by virtually all central banks surveyed. Often these indicators are broken down by loan category (eg mortgage, consumer credit and other liabilities). A few central banks noted that household credit growth is also monitored by maturity and currency composition.

Use of household debt vulnerability indicators		Central banks using indicator (max 23)	Central banks using threshold (max 23)
	Indicator		Table 3
Level / growth	Household credit to GDP	23	11
	Household credit growth	23	7
	Household credit-to-GDP gap	20	6
Credit standards	Bank lending standards	21	5
	Credit spreads (or interest rates on household credit)	21	4
	Qualitative information on credit demand/supply	19	3
	Distribution of credit scores	6	2
Credit quality	Loan to value (LTV) of mortgage loans	23	9
	Non-performing loans ratio	21	5
	Impairment ratio for household loans	19	2
Household vulnerability	Gross debt to income (DTI)	22	11
	Debt service-to-income ratio (DSTI)	21	9
	Mortgage payment to income ratio	17	3
	Gross interest payments to disposable income	12	3
	Household net worth to liabilities	12	3
	Household liquid assets to liabilities	11	3
	Net debt to income (debt net of financial assets)	6	1
	Composite indicator of household vulnerabilities	5	1

Source: CGFS Working Group Survey based on responses from 23 central banks.

The vast majority of central banks track all of the listed indicators of lending standards and credit quality, with the exception of credit scores, which are monitored by only a small number of central banks.

Indicators of household vulnerability are monitored somewhat less frequently than those of credit growth or quality, with the exception of gross debt to income (DTI) and debt service to income (DSTI), which are followed by most central banks. Only eleven countries monitor at least two of the following indicators: net debt to income; net worth to liabilities; liquid assets to liabilities; or gross interest payments to disposable income. Six central banks monitor none of these indicators. More than half of central banks nevertheless indicate that they monitor vulnerable households, using indicators such as DTI or DSTI to define this group. A few central banks also monitor the share of riskier households and loans.

Importance of certain indicators. While a few central banks reported using a holistic approach in their assessment of the household debt indicators, more than half indicated that they judge some indicators to be more important than others. Commonly cited indicators were aggregate credit growth/level (household credit growth, credit-to-GDP gap and debt-to-GDP ratio) and indicators of debt servicing ability (DTI, DSTI).

Differences across central banks. The survey responses suggest that EME central banks focus more on mortgages and make less use than advanced economies of general household vulnerability indicators. Some countries also reported decomposing indicators according to the distinction between owner-occupied and income-earning properties. Around half of the respondents also noted the use of micro data to gauge household balance sheet strength.

In this regard, greater use of granular household debt data has been a major development since the GFC, helping to shine light on those vulnerabilities most associated with macroeconomic stability. Central banks have been innovative in sourcing such data, collecting it from credit bureaus and banks as well as data collected in the course of other central bank operations (see Appendix C). However, there are often specific challenges related to gathering such data, not least with respect to cost and privacy.

Non-financial corporate debt

Types of indicators. Central bank monitoring of NFC debt-related vulnerabilities involves using a broader set of indicators and more decompositions of aggregate indicators than for households. This is because of the diversity in types of firms, sectors of activity and types of debt (eg bank loans versus bonds). Table 4 summarises the aggregate NFC debt indicators used by central banks. Table 5 provides information on further NFC vulnerability indicators that are typically calculated at firm, industry or sector level.

Similar to households, the vast majority of central banks monitor the level and growth of aggregate NFC credit (Table 4). The vast majority also monitor credit quality indicators. Most of the lending standards indicators – with the exception of credit scores – are also monitored by most banks. The NFC vulnerability indicators measured in the aggregate are monitored less frequently than indicators in the other categories; however, most central banks monitor vulnerability indicators at the firm, sector or industry levels using metrics such as the interest coverage or debt-to-EBITDA ratios to define this group (Table 5).

Most central banks compute several NFC vulnerability indicators at the firm or sector level, although for some the indicators are calculated for listed firms only (Table 5). The majority of central banks monitor interest coverage, leverage and debt-to-earnings ratios. Around 50% of respondents also compute the short-term debt ratio or issuer rating downgrade ratios at the firm and/or sector level.

Given the more frequent use of granular vulnerability indicators for NFCs compared with households, Appendix D provides some examples about how central banks monitor NFC debt vulnerabilities with micro data. Analysis by the Deutsche Bundesbank illustrates the importance of looking underneath aggregate figures as these might conceal the true extent of debt vulnerabilities. Analysis by the Bank of Italy, Bank of Japan, Bank of Spain and ECB illustrates how granular information enabled the evaluation of debt risks during the Covid-19 pandemic and the ability of government measures to contain the economic fallout from the across the distribution of firms.

Use of aggregate non-financial corporate (NFC) debt vulnerability indicators

Table 4

	Indicator	Central banks using indicator (max 23)	Central banks monitoring separately for bonds (max 23)	Central banks using threshold (max 23)
Level / growth	NFC credit to GDP	23	11	6
	NFC credit growth	21	15	6
	NFC credit-to-GDP gap	19	7	4
Credit standards	Bank lending standards	19	2	2
	Interest rates for NFC debt	19	8	4
	Credit spreads	18	9	2
	Qualitative info on credit demand/supply	17	3	1
	Distribution of credit scores	12	5	0
Credit quality	Non-performing loans ratio	21	6	3
	Impairment ratio	20	5	3
NFC vulnerability	Number of insolvencies/bankruptcies	20	1	1
	Number of vulnerable firms	14	2	0
	Composite indicator of non-financial corporate vulnerabilities	6	0	1
	NFC interest payment to GDP ratio	4	0	0

Source: CGFS Working Group Survey based on responses from 23 central banks.

Additional non-financial corporate (NFC) vulnerability indicators computed at firm, sector or industry level

Table 5

Indicator	Central banks using indicator
Interest coverage ratio (eg EBITDA over interest expense)	19
Leverage ratio	18
Debt to earnings (eg EBITDA)	17
Short term debt ratio	14
Issuer rating downgrades	14
Debt service ratio	12

Source: CGFS Working Group Survey based on responses from 23 central banks.

With respect to the monitoring of bonds and loans, Table 4 shows that apart from the indicators of NFC credit to GDP and NFC credit growth, relatively few central banks monitor NFC debt indicators separately for bonds. On the other hand, survey responses suggest that most monitor overall bond issuance by risk class, as well as corporate bond spreads. However, only a few monitor excess bond premia.

Table 6 indicates that all central banks use sectoral breakdowns of NFC debt, and most also decompose debt by maturity and by firm size. More than half distinguish between types of lenders (bank versus non-bank) and by currency. A few central banks also monitor the origin of the financing source.

Importance of certain indicators. As was the case for the indicators of household debt, most central banks consider certain NFC indicators to be more important than others. Among the most commonly cited are indicators related to aggregate credit growth, followed by indicators of credit quality and interest coverage ratios.

Differences across central banks. Central banks in EMEs appear more likely than those in advanced economies to use decompositions of aggregate debt by maturity and currency (Table 6). EMEs appear to make less use than AEs of qualitative information on bank lending standards or demand and supply dynamics, perhaps due to the absence of well-established survey reporting frameworks by banks and firms.

Decompositions of aggregate indicators			Table 6
Type of decomposition	Central banks using decomposition	% EMEs using decomposition	% AEs using decomposition
Sector	23	100	100
Firm size	19	78	86
Debt maturity structure	18	89	71
Types of lenders	15	67	64
Currency denomination	13	78	43
Types of debt instrument	11	44	50
Sources of financing by land of origin	8	22	43
Types of borrowers (eg leveraged loans or bonds)	7	22	36

Source: CGFS Working Group Survey based on responses from 23 central banks.

Real estate

Damaging credit booms have historically been associated with exuberance in real estate markets. As discussed in Section 2, during booms, real estate collateral values can result in weaker monitoring by lenders, while in the bust phase collapsing real estate values can amplify deleveraging pressures. In light of these regularities, it is unsurprising that central bank frameworks include the specific monitoring of real estate markets. All central bank respondents monitor residential property prices and new mortgage loans, and virtually all monitor price-to-income ratios and overall transaction volumes (Table 7). Residential real estate indicators are more widely monitored than commercial real estate indicators, consistent with stronger regularities between residential real estate booms and debt risks. It may also reflect greater heterogeneity in commercial real estate that complicates monitoring of vulnerabilities.

Almost all central banks report monitoring the evolution of house prices indicators in order to detect overheating, with the most common indicators being price-to-rent and price-to-income ratios. Some countries use econometric models to compare house prices to values predicted by fundamentals. Fewer central banks monitor other indicators of overvaluations such as indicators of speculative activity, such as flipping trades.

Indicators to monitor residential real estate (RRE) and commercial real estate (CRE)			Table 7
	RRE and CRE monitored separately	RRE only	CRE only	Central banks using indicator
Property prices	19	4	0	23
New mortgage loans	10	12	0	22
Price to income	3	18	0	20
Transaction volumes	15	4	0	19
Market sentiment	9	7	0	16
Price to rent	8	9	0	17
Foreign participation	5	2	4	11
Speculative activities	3	2	0	6

Source: CGFS Working Group Survey based on responses from 23 central banks.

Financial intermediaries

Central banks were asked in the survey if their debt monitoring framework takes into account the risks to lenders and, if so, what are considered key indicators. Data on non-performing loans and loan-loss provisions are the most widely cited metrics for evaluating the asset quality of financial institutions. Other indicators mentioned by respondents include data on credit growth, arrears, provisions and coverage ratios for non-performing loans, and internal ratings. More than half of central banks, across both advanced and emerging economies, report tracking the foreign exposures of domestic banks in terms of performance and currency composition.

With respect to the types of financial institutions monitored, almost all central banks indicate that they monitor non-banks as well as banks. Among the specific types of non-bank financial institutions mentioned are finance companies, credit unions and cooperatives, as well as insurance companies, pension funds and asset managers.

Almost all central banks mention the use of macroprudential stress tests that incorporate credit risk simulations. These tests have become a key instrument to assess the impact of debt risks, not only on banking sector resilience but also to gauge potential wider impacts on the economy. Appendix E discusses two recent innovative uses of stress tests that evaluated the banks' capacities to continue lending during the Covid-19 pandemic and the ability of the financial system to absorb climate-related debt vulnerabilities.

4.2   Aggregating information to obtain a comprehensive overview

A natural question that arises in relation to debt monitoring frameworks is how to aggregate the information from multiple indicators. Adequately aggregating information from multiple indicators to form an overall view on the degree of systemic vulnerability is an ongoing challenge for central banks. Dashboards and composite indicators are two tools used by central banks to combine information to obtain a comprehensive overview of debt vulnerabilities.

Dashboards

More than three quarters of central bank respondents report the use of indicator dashboards. These dashboards bring together multiple indicators (often between 50 and 100) covering several specific sectors or types of risk, with the aim of providing an overview of the main vulnerabilities in the financial system.

Whereas the sectors and types of indicators included in dashboards tend to be common across central banks, the structure of dashboards – the conceptual organisation of the indicator categories – varies. The main difference is between risk-oriented and sector-oriented structures.

One example of a risk-oriented structure is the National Bank of Belgium's dashboard indicator organised into categories of the credit cycle, household and NFC leverage, financial sector leverage, financial and asset markets, and indicators used to trigger release of macroprudential measures during stress periods. Another example is the Bank of Spain's, which is organised into categories focusing on credit intensity (eg level or excess), real estate markets, borrower stretch and concentration. Sector-oriented structures are used by other central banks as macroprudential instruments are often applied at a sectoral level.

Irrespective of the structure, most central bank dashboards include indicators related to aggregate debt (eg the overall credit-to-GDP ratio), and also with splits by sector for households, NFCs, real estate and financial intermediaries (Graph 15, left-hand panel). Overall, advanced economies appear to put more emphasis on real estate-related indicators in comparison to EMEs, whereas EMEs place more emphasis on external position-related indicators (centre and right panels).

Sectors with indicators included in dashboards

As a percentage of central bank respondents   Graph 15
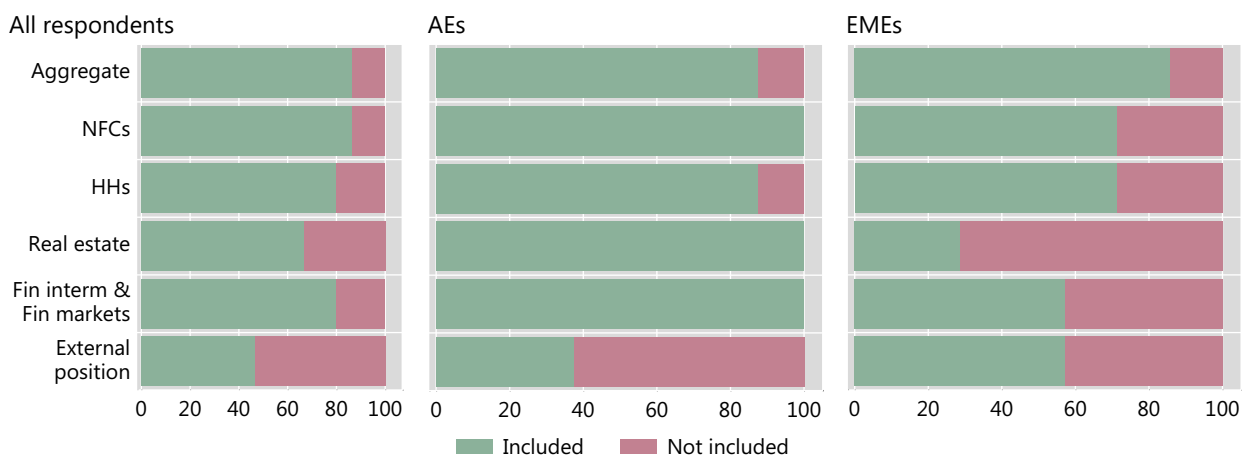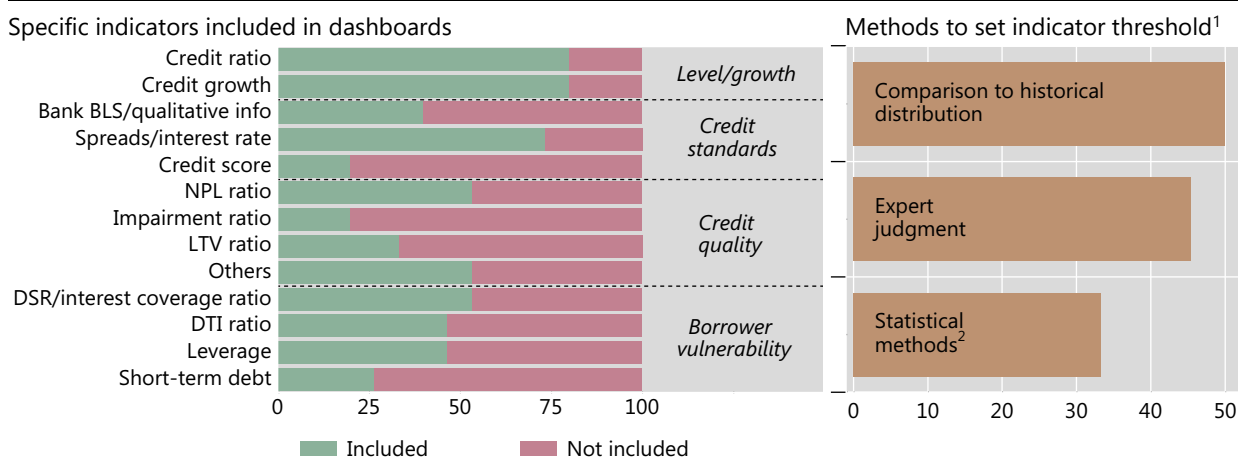

NFCs = non-financial corporates; HHs = households; fin interm = financial intermediaries; fin markets = financial markets.

Source: CGFS Working Group Survey based on responses from 23 central banks.

Dashboard indicators and vulnerability threshold methods

As a percentage of central bank respondents

Graph 16

BLS = bank lending standards; credit ratio = credit-to-GDP ratio or credit-to-GDP gap; DSR/interest coverage ratio = debt service ratio or interest rate coverage ratio; DTI ratio = debt-to-income ratio; LTV = loan-to-value; NPL = non-performing loans.

[1] As a percentage of central banks that set thresholds in the dashboard. [2] Statistical methods excluding those related to comparison to historical distribution, such as the calculation of historical percentiles.

Source: CGFS Working Group Survey based on responses from 23 central banks.

Among the types of indicators included in central banks' dashboards, metrics based on the level or growth of debt are the most frequently included, followed by credit standards (Graph 16, left-hand panel). Indicators based on short-term debt, credit scores and impairment ratios are less likely to be included. With respect to the relative importance of the dashboard indicators, most central banks adopt a holistic approach. Others explicitly give more weight to indicators with greater power in predicting financial crisis and tail risk of GDP.

Composite indicators

More than half of the central bank respondents use composite indicators to assess overall debt vulnerabilities. Composite indicators can take several forms. Examples cited by central banks include:

- *Systemic risk and vulnerability*. These indices typically include indicators of debt and vulnerability of households and NFCs. NFC indices include indicators such as leverage, profitability and debt burden. Most indices also include real estate indicators and indicators for the banking sector.

- *Early warning*. These indicators use metrics that have some power in predicting financial crises or recessions. An early warning indicator aims to be a leading – rather than a coincident indicator – of financial stress, which typically implies that it excludes a broad range of market price variables. Instead, they include slow moving variables that signal when the financial system is becoming more fragile.

- *Financial conditions*. These indices include data on equity, bond, foreign exchange and money markets, such as prices, volatilities and spreads. Appendix F provides some examples of the different types of composite indicators used in central banks. The number of series which feed into composite indicators varies widely, ranging from three to around 100.

4.3   From vulnerabilities to systemic risk

While dashboards and composite indicators allow information from several potential areas to be combined, it is important to assess the degree to which identified vulnerabilities translate into systemic risks. In this respect, thresholds for composite indicators or individual dashboard indicators are often used to signal areas of emerging or increasing risk. Growth-at-risk models provide estimates of the severity of potential systemic risk in terms of downside risks to GDP growth.

Virtually all central banks that use dashboards establish thresholds for indicator categories in the dashboards. The thresholds are used to assign colour codes to indicators or groups of indicators within the dashboard in order to signal areas of vulnerability. The colour codes may derive from thresholds defined either at the level of individual indicators or at the level of indicator groups or categories.

Central banks set thresholds in dashboards using three main methods: historical distributions, statistical methods and expert judgment (Graph 16, right-hand panel). The majority of respondent central banks use comparisons to historical distributions or statistical methods. Almost half (45%) of the respondents set indicator thresholds based on expert judgment, of which more than half (60%) employed the method in combination with statistical methods or comparison to historical distributions. Appendix G provides examples of how central banks set thresholds in practice. One statistical method is based on crisis prediction models where the indicators and corresponding thresholds are chosen to minimise the risk of false positives or false negatives when predicting historical banking crises. Another method combines statistical methods with expert judgment by utilising graphical analysis to identify points of non-linearity at which debt vulnerabilities often turn into actual debt distress. Appendix G also discusses efforts to better align thresholds to actionable responses.

Growth-at-risk (GaR) is a statistical method to measure systemic risk. It is used by two-thirds of the responding central banks. GaR models use macroeconomic and financial variables to estimate a probability distribution of future real GDP growth. One important advantage is that GaR models map the effects of different vulnerabilities into one easy-to-understand measure: potential GDP losses. GaR models can also illustrate how current debt vulnerabilities affect downside GDP growth risk at various horizons. Thus, they have the potential to shed light on some of the debt related intertemporal trade-offs discussed in Section 2. However, more research is needed to identify the relationship with certain policy levers.

Financial conditions indices are the most common indicator for capturing growth risks in GaR models. Half of the central bank respondents that make use of a GaR framework include a global financial conditions index. Other indicators cited by central banks include composite financial cycle indicators, composite financial stress indicators, credit-to-GDP gaps, economic activity and vulnerability indexes, and system risk indicators. Most central banks tend to focus on both the near term (one month or one quarter) and medium-to-long term (one to three years) GDP risks. Medium-to-long horizon models may be more useful to guide policy actions to manage the build-up of debt vulnerabilities. However, central banks highlight a trade-off between model performance and the need to capture the lags in the transmission from an initial shock to an increase in vulnerabilities. Appendix H provides an example of how central bank GaR models capture downside GDP growth risks. It also showcases central bank research that estimates the influence of domestic and foreign debt growth on downside GDP risks, finding that a period of strong credit growth results in downside GDP growth risks that peak around one to two years later.

Beyond debt monitoring frameworks, central banks also use statistical methods in the context of the CCyB framework. The methods include: quantile regressions that provide estimates of future NPLs; statistical filters to identify excessive credit growth; stress tests to review the adequacy of the CCyB; and models measuring the long-term trade-off between efficiency and stability. Crisis probability models also utilise statistical methods to assess systemic risks.

4.4   Uses of debt monitoring frameworks

The responding central banks were asked how they use their debt monitoring frameworks and the extent to which these frameworks influence policy decisions.[22] Virtually all central banks cite that they use debt monitoring frameworks in external communications, with financial stability reviews being mentioned by most. Around half of the central banks report feeding indicators from household debt monitoring – eg loan-to-value and loan-to-income ratios – into macroprudential stress test models (Table 8). Considerably fewer central banks do the same with indicators from NFC debt monitoring.

The use of indicators from household debt monitoring as inputs into macroprudential stress tests	Table 8

Indicator(s)	Number of central banks using indicator
Loan to value and/or loan to income ratios	4
NPL ratio	3
Household balance sheet and/or credit composition	3
Household credit growth and/or household debt level	1
Bank lending standards	1
Payment-to-income ratios	1

Note: A total of 11 central banks noted that they use household debt monitoring as input into macroprudential stress tests. Some central banks may not list all of the indicators from household debt monitoring that are used as inputs into macroprudential stress test. The list as captured by the table is therefore not exhaustive.

Source: CGFS Working Group Survey

With respect to policy decisions, virtually all central banks make use of indicators from the household and NFC debt monitoring frameworks in the context of their CCyB framework. The monitoring by virtually all central banks of indicators such as household credit to GDP and NFC credit to GDP, together with credit-to-GDP gaps may well be an outcome of the inclusion of the CCyB in the Basel III framework.

Seventeen of the 23 central banks that responded to the survey have implemented policy measures since 2010 to address debt vulnerabilities. Measures related to mortgages and real estate markets were implemented by 15 jurisdictions, while the CCyB was triggered by eight jurisdictions. Fourteen indicated that the central banks' debt monitoring framework had been influential in these decisions.

The policy measures have been largely devoted to limiting the build-up of risks from household debt related to housing markets. Respondents said that triggers to act were largely based on the pace of credit creation (credit-to-GDP gap) and real estate prices. Only a limited number of measures were put in place to restrain the commercial real estate market. The real estate measures typically relied on changing bank standards for the LTV metrics for mortgages. Often, the LTV standards were made increasingly dependent on the type of mortgages, with more stringent standards set for second mortgages, income-earning properties and unusually large loans. Many jurisdictions also acted by requiring faster minimum paydowns of mortgages.

There was little mention of policy measures tied to NFC debt, although one jurisdiction required risk weight add-ons for loans in foreign currency, depending on the borrower's foreign currency revenue as a share of total revenue or of the total amount of loan payments.

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[22]   The role of central bank within their domestic macroprudential frameworks is likely to influence the use of debt monitoring frameworks. See CGFS (2016a) and (2016b) for an overview of central banks' role within macroprudential frameworks.

4.5　Enhancing capabilities to monitor debt vulnerabilities

In the years prior to the Covid-19 pandemic, central banks enhanced their frameworks for monitoring debt vulnerabilities and use them to inform macroprudential policy decisions. Even though these frameworks were developed for financial stability purposes, they also helped inform the multi-pronged policy response to the crisis. Yet, they remain work in progress. A comparison of the channels and mechanisms discussed in Section 2 with central bank frameworks suggests a number of areas where enhancements could be helpful in policy deliberations.

- *Forward looking*. Further enhancements in this direction can support effective policy interventions that rely on the informative assessment of the future evolution of debt vulnerabilities under various scenarios, as well as the potential severity if risks were to crystallise.

- *Intertemporal trade-offs*. Enhancements to frameworks that assess intertemporal trade-offs created by debt would enhance the ability to determine costs and benefits from activating policies earlier or later. Such frameworks would be particularly valuable at the current juncture as central banks evaluate the trade-offs between building up buffers against potential side effects that this might have on the nascent pandemic recovery.

- *Heterogeneity*. The increasing use of disaggregated data and examination of heterogeneity across the economy has facilitated the identification of risk pockets. However, existing frameworks struggle to evaluate when pockets of risk are sufficiently large to pose systemic risks.

- *Data gaps* present a continuing problem in central banks' monitoring frameworks. Timely collection of firm- and household-level micro data can be a challenge. Many of the surveyed central banks also expressed concerns about the lack of data on credit provided by NBFIs and by some large NFCs. Growing lending by fintech companies or platforms is another potential area in which to strengthen monitoring and data coverage.

- *Indirect channels*. So far, central banks have largely focused on the frameworks to assess the direct channels through which debt affects financial stability. However, frameworks to evaluate the indirect channels highlighted in Section 2.4 remain in their infancy. As research identifies new channels through which debt creates vulnerabilities, central bank frameworks could be enhanced by incorporating these dimensions.

5. Policies to mitigate debt vulnerabilities in the wake of the Covid-19 pandemic

Gross debt levels of the non-financial private sector were substantially higher almost everywhere in the immediate wake of the Covid-19 pandemic, yet debt vulnerabilities were not uniform across countries or sectors. In many countries, vulnerabilities were mitigated by prudential reforms following the GFC that boosted the resilience of the financial system. Furthermore, in some cases household and corporate sector buffers were higher than on the eve of the pandemic, and in economies that experienced strong recoveries incomes were rising.

However, in economies where the recovery was slower, debt vulnerabilities were more sensitive to the unwinding of exceptional policy support. Even in those with strong recoveries, an upswing in the financial cycle, strong mortgage growth and elevated asset prices may create new vulnerabilities. Moreover, the cyclical upturn in interest rates could aggravate economy-wide debt vulnerabilities, while the war in Ukraine and related surge in commodity prices added to uncertainty about the growth and inflation outlook. Also, public debt levels were much higher in the wake of the pandemic, which might compound private sector debt vulnerabilities or constrain policymakers' scope to absorb future shocks.

In light of these developments, policymakers face three interrelated challenges. The first is assessing the materiality of debt vulnerabilities. The second challenge is deciding whether a macroprudential response is warranted and if so, what the appropriate policy mix would be to mitigate vulnerabilities. Greater use of macroprudential measures, particularly in the housing sector, might help contain vulnerabilities and reduce the severity of amplification channels arising from ongoing real estate booms. Finally, if misperceptions about the prospects of exceptional support were to develop, policymakers might need to manage expectations to safeguard against lenders underpricing risks.

5.1 Assessing debt vulnerabilities

The first challenge for macroprudential authorities is assessing debt vulnerabilities in light of significant uncertainty about the macroeconomic environment. During and after the Covid-19 pandemic the global economy has been subjected to a series of macroeconomic developments that are likely to shape debt vulnerabilities.

One important issue is the potential consequences of unwinding policies that supported debt during the Covid-19 pandemic. As described in section 2, other things equal, high leverage, post pandemic, might have increased the vulnerability of households and businesses to adverse shocks and may have made the economy more cyclical. Some economies, however, experienced strong recoveries. This often facilitated an endogenous unwind of policies that supported debt during the pandemic. Where the recovery is weak and buffers small, policymakers face an uncertain trade-off between scaling back support and thereby potentially pulling down the growth in the short term or continuing support and exacerbating debt vulnerabilities.[23]

The surge in inflation in 2021-22 to multi-decade highs in many countries added to uncertainty about debt vulnerabilities. Inflation was propelled by the combination of strong recoveries, shifts in demand, supply side disruptions and rising commodity prices. Several of these factors are likely to be exacerbated by surging energy, food and other commodity prices arising from the war in Ukraine. On the one hand, higher inflation could erode debt burdens if it is broad based and accompanied by higher nominal incomes. On the other hand, higher inflation has pushed down real interest rates, which might further stoke financial cycle upswings and so exacerbate or create debt vulnerabilities in the future. Higher

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[23]   See IMF (2021a) and IMF (2022) for a discussion on these trade-offs.

and volatile inflation might also raise inflation risk premia resulting in higher borrowing costs especially for longer-term borrowing.

To tackle inflationary pressures, the stance of monetary policy is becoming less supportive of debt in many economies. Higher interest rates could exacerbate vulnerabilities arising from the existing stock of debt as they feed through into higher debt servicing costs (Drehmann et al (2017)). Higher real rates could also activate amplification channels via their effects on asset prices. The extent of interest rate increases necessary to address inflationary pressures will depend on the evolution of inflation expectations. The surge in commodity prices as a result of the war in Ukraine as well as fiscal responses to mitigate the macroeconomic and distributional consequences complicate the challenge of controlling inflationary pressures and inflation expectations.

While higher interest rates might weigh on existing debt vulnerabilities, going forward tighter monetary policy could, however, limit the net flow of new debt vulnerabilities, for example by influencing risk-taking incentives (Altavilla et al (2020)). This in turn could help dampen financial cycle upswings and reduce the build-up of debt vulnerabilities in the future.

In light of these rapidly evolving circumstances, close monitoring of debt vulnerabilities, loan loss recognition and NPLs is vital. Analysis of granular data, facilitated by enhancements to central bank monitoring frameworks, appears particularly important to assess any impacts on debt vulnerabilities.

5.2   Macroprudential policy to mitigate debt vulnerabilities

The second challenge is deciding whether a macroprudential response is warranted and if so, the appropriate policy mix to mitigate debt vulnerabilities. Some types of macroprudential instruments target lending to riskier borrowers or build buffers against specific risks to ensure risks remain appropriately priced. Other types focus on building broad resilience, which would dampen amplification if risks were to materialise.

In economies where debt-related risks are mounting, borrower-based macroprudential instruments can help to stem the build-up. The emerging evidence on the effectiveness of macroprudential instruments suggests that measures such as debt-to-income or debt-service to income limits can have a relatively rapid effect on holding back the emergence of debt vulnerabilities and with it the probability of financial crises (Cerutti et al (2017), Behncke (2020), Budnik (2020), Galán (2021)).[24]

Where vulnerabilities are limited to only one or a small number of sectors, targeted instruments might be used. Their use is facilitated by increasingly detailed analysis of borrower vulnerabilities. Given the important historical role of mortgage and house price booms in generating financial crises, many countries have gravitated to instruments that target real estate vulnerabilities. These include policies that directly limit borrower vulnerabilities as well as sectoral CCyBs that build buffers against specific real estate lending risks.[25] Appendix I summarises recent examples of housing sector macroprudential measures and shows that borrower-based measures have been used more frequently than capital requirements linked to the riskiness of mortgages. In contrast to the household sector, macroprudential authorities have few if any borrower-based macroprudential instruments to address corporate sector vulnerabilities.

When risks materialise, the emerging evidence on macroprudential instruments suggests that capital building measures are better at ensuring resilience. For example, measures such as dynamic provisioning and the CCyB have been found to boost resilience in downturns and have a significant effect on new lending and growth (Jimenez et al (2017), Sivec et al (2019)) while easing of borrower-based

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[24]   These instruments, however, do not appear to have a discernible effect in dampening house price amplification channels (Vandenbussche et al (2012), Kuttner and Shim (2016)). Kuttner and Shim (2016) do, however, find that housing-related taxes do have a discernible impact on house price appreciation.

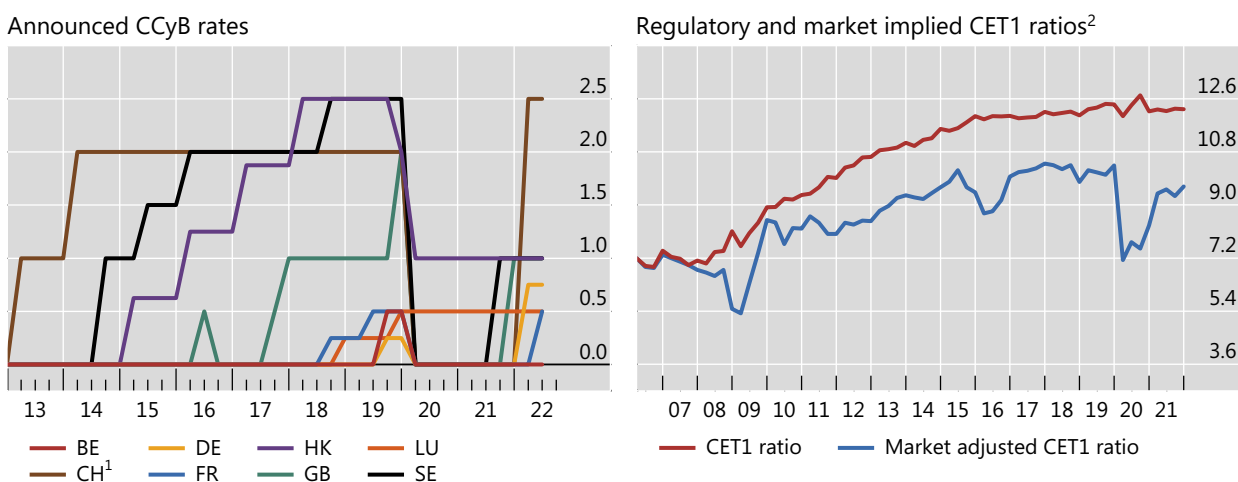[25]   See BCBS (2018), BCBS (2019) and European Banking Authority (2020).

measures are less effective in these situations (Galán (2021)). Thus, in economies where debt-related risks are already high, it appears prudent to assess through bank stress tests and other methods, that the financial system has sufficient capacity to absorb unexpected losses even though expected losses remain contained (Juselius and Tarashev (2021)).

At the current juncture, one challenge is to rebuild regulatory buffers in the financial system. The CCyB and other regulatory buffers were released to expand bank lending during the pandemic liquidity shock (Graph 17, left-hand panel). Regulatory capital buffers were lowered in all of the advanced economies sampled (Graph 18, left-hand panel), but only in half of the EMEs (right-hand panel). While the release of regulatory buffers helped meet liquidity needs during the height of the Covid-19 pandemic, their restoration would reinforce financial sector resilience.

Bank buffers

In per cent of risk-weighted assets   Graph 17

Announced CCyB rates

BE   DE   HK   LU
CH[1] FR   GB   SE

Regulatory and market implied CET1 ratios[2]

CET1 ratio   Market adjusted CET1 ratio

CET1 = Common Equity Tier 1.

[1] For Switzerland, sectoral RWA.   [2] Median value based on a sample of 360 banks among the top 500 global banks by total assets for which data to calculate the market adjusted CET1 ratio were available. Assets of US banks have been adjusted for derivatives netting. For periods where CET1 capital is not available, changes in the CET1 capital are proxied by changes in common equity. For the market adjusted CET1 ratio, CET1 capital is multiplied by the bank's price-to-book ratio if the ratio is below unity.

Sources: Ikeda et al (2021); national data.

In some economies, returning to the pre-pandemic macroprudential stance might not entail significant costs. Policies such as limits on dividend distributions have resulted in an accumulation of capital (Graph 18, right-hand panel). Moreover, in several economies including Germany and the United Kingdom, banks barely used their capital buffers despite the easing of regulatory buffers because fiscal support met many firms' liquidity needs and limited the deterioration in the credit quality of banks' portfolios. In addition, in economies experiencing a robust rebound, such as the United States, firms' strong cash flows might mitigate the cost of raising regulatory buffers, as demand for additional credit might be lower. In light of these circumstances, macroprudential authorities in Bulgaria, the Czech Republic, Denmark, France, Germany, Iceland, Romania, Sweden, Switzerland and the United Kingdom have already announced plans or decided to raise countercyclical capital buffers in 2022. In some economies where the financial cycle upswing was not interrupted by the pandemic, including Germany and Switzerland, the macroprudential policy stance has tightened beyond that prior to the pandemic.

Policy measures implemented during the Covid crisis to support bank lending[1]

Percentage of countries implementing within each region   Graph 18
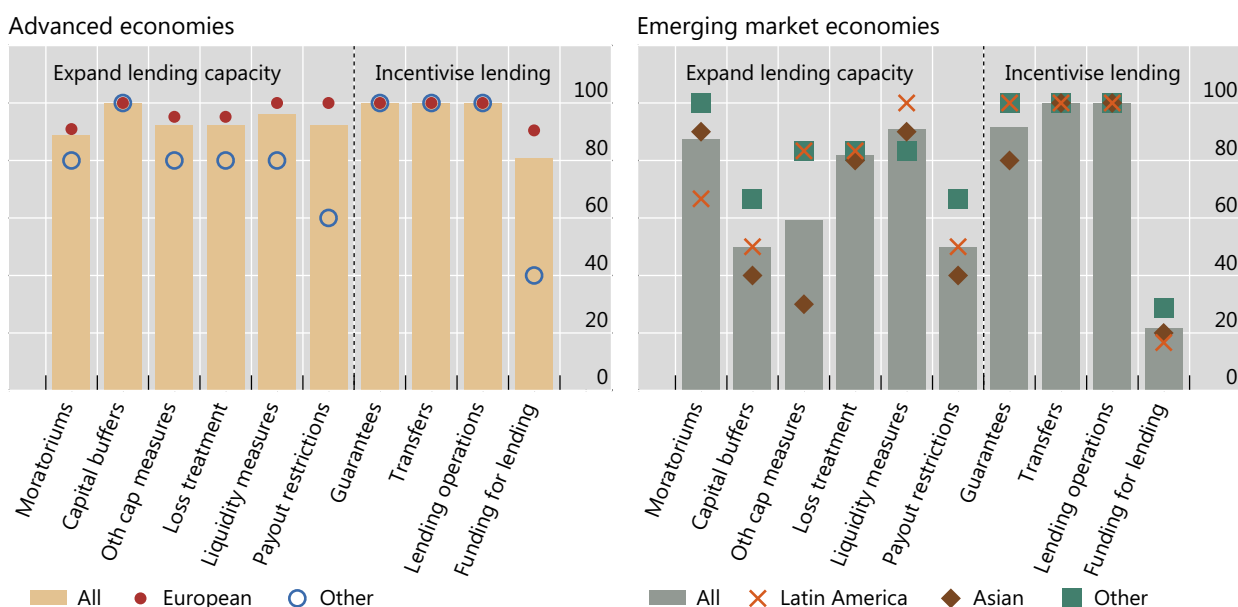
European advanced economies = AT, BE, CH, DE, DK, EE, ES, FI, FR, GB, GR, IE, IS, IT, LT, LU, LV, NL, NO, PT, SE, and SK; other advanced economies = AU, CA, NZ, JP and US; Latin America = AR, BR, CL, CO, MX and PE; Asian EMEs = CN, HK, ID, IN, KR, MY, PH, SG, TH and VN; other EMEs = CZ, HU, IL, PL, RU, SA, TR and ZA.

[1] The sample covers 48 countries for prudential policies, 49 countries for monetary policies and 51 countries for fiscal or other policies. For prudential and monetary policies, European Union and euro area-level measures are also counted in individual countries. For instance, the ECB's TLTRO III programme is attributed to each country within the euro area, under funding for lending. The ECB's measures typically apply to the largest banks in the euro area. See Casanova et al (2021) for details on the groupings of measures.

Sources: Cantú et al (2021); Asian Development Bank; FSB; IMF; OECD (2020); EBA; ESRB; national data; CGFS Working Group calculations.

In economies where the recovery is less entrenched, banks might come under pressure, especially in economies where fiscal policy bore less of the burden through transfers or guaranteed loans. Banks might also come under pressure in economies where debt moratoriums continue to be important in shielding borrowers or where bank profitability is low. In this environment, a tension may arise between short-term demand effects and longer-term financial stability risks. If unexpected losses are elevated, microprudential considerations and the need to counteract longer-term financial stability risks would indicate a need to raise capital levels to ensure banks remain sound. However, from a macro perspective, raising capital buffers might result in a contraction of bank lending which could weaken economic activity in the short run.

If this tension is resolved in favour of raising capital levels to ensure banks remain sound, it might place a greater burden on monetary and fiscal policies to stabilise economic activity in the short-run, unless there are strong offsetting confidence effects. The ability of these policies to offset potential contractionary effects depend, in turn, on monetary and fiscal space. EMEs have been less active in releasing capital buffers compared with AEs (Graph 18) which could reflect microprudential considerations taking precedent over macroprudential ones, possibly because of lower expectations of fiscal support if capital is eventually exhausted.

Microprudential policies that ensure financial institutions hold sufficient liquidity and limit systemic risk associated with large concentrations of debt, common exposures or interlinkages between institutions can also boost resilience of the financial system and thus reduce systemic risks. Policies that help reduce the use of debt contracts with risky characteristics or balance sheet mismatches provide

another policy lever to contain debt vulnerabilities. These include measures to minimise risks related to maturity, liquidity, foreign currency or other unhedged mismatches in borrower and intermediary balance sheets. A number of recent CGFS reports discuss these policies in more detail. [26]

More generally, a case can be made for the proactive use of macroprudential policies to address cyclical vulnerabilities. A proactive use of macroprudential measures may help dampen financial cycles, which have displayed greater amplitudes in recent decades (Borio et al (2018)). By reducing vulnerabilities and helping economies recover once risks materialise, borrower-based and capital building instruments can in turn create space for monetary and fiscal policies to pursue their core objectives. The proactive use of macroprudential policy may be facilitated by communication and ex ante approval of macroprudential policies, such as agreement on the objective against which policy impacts are judged, the types of instruments best placed to target specific types of vulnerabilities and the timing and calibration of instrument use (CGFS (2016a) and CGFS (2016b)).

Leakages of debt vulnerabilities may, however, undermine the effectiveness of macroprudential policy. As macroprudential policies mainly target vulnerabilities in the regulated banking sector, this can result in leakages of debt vulnerabilities from the banking sector to non-bank financial intermediaries (NBFIs) or even certain non-financial corporations that are not subject to the same macroprudential policies. Indeed, the growth of non-bank intermediation has been identified as a key vulnerability in the global financial system (FSB (2020)). Leakages might not translate into higher overall risk in the financial system if NBFIs operate with higher capital levels. However, their growth might create challenges when such entities, such as private credit funds, do not fall under remit of macroprudential authorities, or are subject to run risk, like open-ended bond funds. Thus, macroprudential authorities together with capital market regulators may need to develop appropriate macroprudential instruments for these non-bank financial intermediaries (Carstens (2021)). Cross-border leakages present another challenge. Such leakages can, at least for the regulated banking sector, be mitigated through consistent implementation of international standards as well as through reciprocity arrangements with relevant foreign supervisory authorities. [27]

5.3   Pricing of debt

The third challenge is ensuring that policy-related distortions do not lead to an underpricing of risky debt by lenders, as occurred in the lead-up to the GFC. Potential debt biases arising from taxation may also result in debt levels that render households or firms more vulnerable to shocks. Finally, if debt burdens become unsustainable, early loss recognition and efficient insolvency and bankruptcy regimes facilitate swift and efficient debt restructuring.

During the Covid-19 crisis, unprecedented policy support prevented the materialisation of debt risks. If misperceptions about the prospects for such support were to lead to lenders underpricing risks in the future, the consequences could be observationally similar to the excessive risk taking by banks before the GFC caused by implicit guarantees and the too-big-to-fail problem. Thus, policymakers need to ensure that policies and policy communications do not cause debt to be underpriced.

In light of biases arising from taxation, several economies have taken significant steps to address factors that raise the cost of equity relative to debt. In the corporate sector, studies have found that the introduction of the Notional Interest Deduction in Belgium and the Allowance for Corporate Equity in Italy, both of which aim to equalise the tax treatment of debt and equity, had significant effects on reducing

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[26]   For policies that enhance the availability of safer debt contracts, which better allocate risk and support financial stability, see CGFS (2019). For policies related to reducing vulnerabilities arising from global dollar funding, see CGFS (2020). For policies to reduce vulnerabilities related to capital flows, see CGFS (2021).

[27]   For instance, the Basel Committee on Banking Supervision has established a jurisdictional reciprocity mechanism for the CCyB in order to maintain a level playing field between domestic and cross-border banks.

corporate sector leverage (Panier et al (2012), Schepens (2018), Branzoli and Caiumi (2018)) helping to reduce the vulnerability of the corporate sector. In order to reduce corporate sector leverage, some economies have also instituted policies to facilitate equity raising, particularly for SMEs.[28] For SMEs which are too small for such initiatives, incentivising the use of retained earnings through tax incentives could help reduce leverage in vulnerable firms. In the household sector, a number of economies have also removed mortgage interest tax relief which may also influence potential debt biases.

Early loss recognition by creditors is an important factor facilitating swift and efficient debt restructuring. Past experiences from Japan and Scandinavia in the 1990s and from Europe during the sovereign debt crisis, suggest that effective regulation and strict supervisory attention can meaningfully reduce forbearance lending practices and incentivise swift debt workouts by banks (Mori et al (2001), Nakaso (2001), Bank of Japan (2002), Bonfim et al (2020)). In addition, high levels of bank capital have been shown to facilitate early loan loss recognition and reduce zombie lending incentives (Nakaso (2001), Achaya et al (2019), Andrews and Petroulakis (2019)).

Experience from past private sector debt workouts suggests that the associated costs of restructuring borrowers' operations and debts can be lowered when insolvency and bankruptcy regimes, as well as legal systems, are efficient (Nakaso (2001), Adalet McGowan and Andrews (2018), Jordà et al (2020), Schularick (2021)). Out-of-court procedures and simplified and standardised insolvency frameworks might reduce congestion in courts if the large increase in SME debt sours. Scope to enhance these areas appears greatest in EMEs where bankruptcy and resolution frameworks are often, though not always, less efficient and predictable that in advanced economies (CGFS (2019)). Enhanced insolvency and debt workout regimes may also help to mitigate the need for ex post policy support when debt related risks materialise.

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[28]   A recent example of the latter is Borsa Italiana's Elite programme which coaches SMEs on corporate governance and capital raising, making it easier to raise capital before seeking a stock market listing. Furthermore, SMEs' listing on the stock exchange has been simplified by establishing a dedicated market (Alternative Investment Market, AIM Italia), with minimum entry requirements. Indeed, Italy is one of the few developed markets which have seen a rise in the number of listed corporations in recent years. See CGFS (2019) for a broader discussion on developing equity markets.
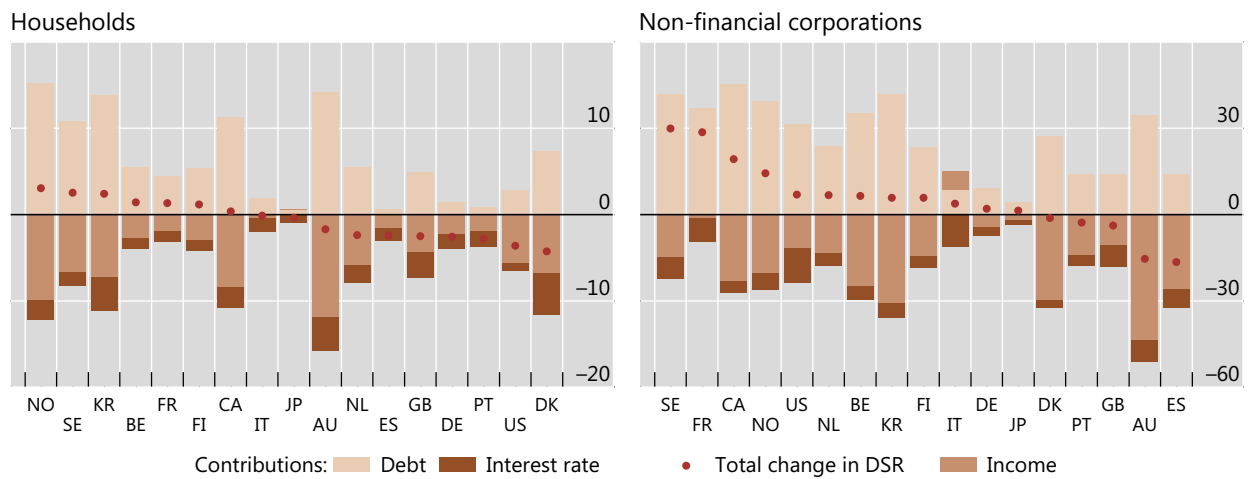
Appendices

A.   Supplementary graphs on debt service ratios

Contributions to the change in drivers of debt service ratios (DSRs) between
Q1 2006 and Q1 2021

In percentage points   Graph A.1

Sources: National data; BIS credit statistics; CGFS Working Group calculations.

B.   Distribution of debt vulnerabilities

Lending to riskier borrowers exacerbates the vulnerability of the economy to shocks. Thus, data on the distribution of debt vulnerabilities can provide useful information on debt vulnerabilities among borrowers at most risk of experiencing repayment difficulties. However, in many instances, the short history of granular microeconomic data on debt vulnerabilities is a significant drawback for policy setting. The lack of historical data makes it hard to judge when and which measures of tail vulnerabilities indicate heightened financial stability risks as few if any financial crisis events exist in the history of the data to calibrate such indicators.

Conversely, with its long history, researchers have successfully shown that strong aggregate credit growth is an early warning indicator of financial crises. In a loose sense high credit-to-GDP gaps may capture financial exuberance and this might relate to growing debt vulnerabilities of borrowers in the risky tail of the distribution. However, the blunt and black box nature of the indicator makes it hard to pinpoint the source of the financial stability risk and thus differentiate good from bad credit booms.

To investigate whether strong aggregate credit growth is associated with lending to riskier borrowers, the Working Group collected data on the debt distributions for 11 countries. By exploiting cross-country information, the analysis overcomes some of the difficulties associated with the short time series of such data in one country alone.

The analysis summarises the distribution with three characteristics: the level, scale and shape. The *level* describes the centre of the distribution, the *scale* captures the dispersion of the risky tail relative to the level, and the *shape* captures disproportionate movements in the risky tail compared with the core of the distribution. For indicators where larger values point to higher debt vulnerabilities (eg debt service-to-income ratio): the level corresponds to the median; the scale to the difference between the 90th percentile and the median; and the shape to the ratio of the difference between 90th and 75th percentiles to that between 75th percentile and the median. For indicators where higher values point to lower vulnerabilities, the 25th and 10th percentiles are used instead to compute the scale and shape. For our 11-country sample, the level and scale are shown in Graph 5 in Section 3, and the shape in Graph B.1.

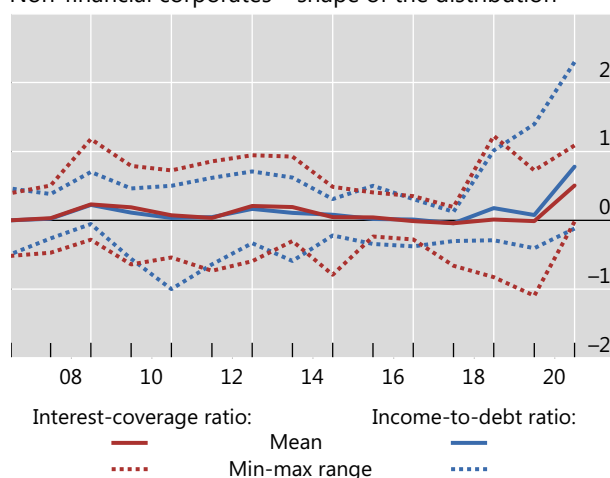Trends in the distribution of debt vulnerabilities

Indexed to 0 in 2006   Graph B.1
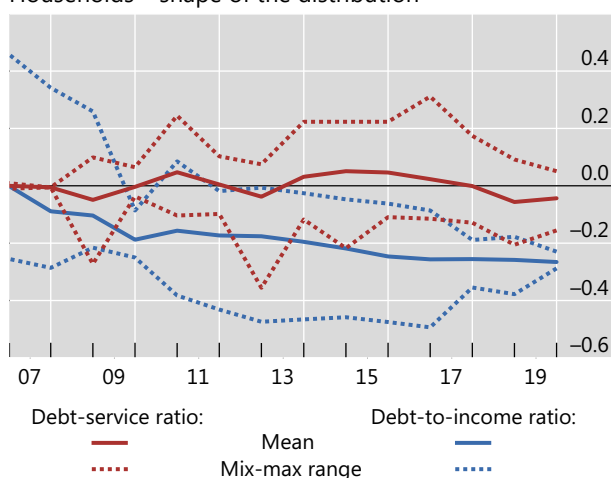
Sources: CGFS Working Group; CGFS Working Group calculations.

To examine the association between aggregate credit and the distribution of debt, the following simple panel regression was estimated:

$$Characteristics\ of\ distribution_{i,t}\ =\ \beta Credit\ to\ GDP\ gap_{i,t}\ +\ \alpha_i\ +\ \varepsilon_{i,t}$$

where *characteristics of distribution*$_{i,t}$ are the level, scale and shape of the vulnerability metrics (household debt service ratio, household debt-to-income ratio, NFC interest coverage ratio and the NFC income-to-debt ratio) in country i in year t. The *credit to GDP gap*$_{i,t}$ is the credit-to-GDP gap in country i in year t, α_i is a country fixed effect and $\varepsilon_{i,t}$ is a residual.

These regressions show that in the household sector, vulnerabilities in the tails of the distribution are correlated with rapid aggregate credit growth, while those in the centre are not (Table B.1). For example, the *scale* of household debt service ratio (ie the dispersion of risk) is higher when credit-to-GDP gaps are higher. By contrast, the *level* of the distribution is uncorrelated the credit-to-GDP gap (Graph B.I, left-hand panel). Similarly, the *shape* of household debt-to income ratios is positively correlated with the credit-to-GDP gap while the *level* is not (Graph B.I, right-hand panel). This means that when aggregate debt growth is high, it is associated with a disproportionate worsening in the tail of households that is not evident in the centre of the distribution.

Credit-to-GDP gap is correlated with the risky tail of the household debt distribution but not the centre

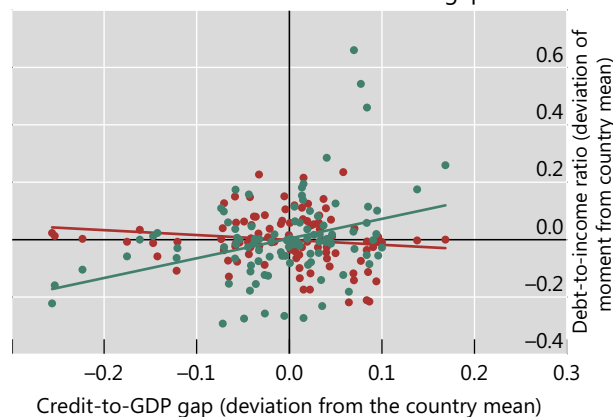Correlation between characteristics of the distribution and credit-to-GDP gap   Graph B.2

Jurisdiction sample: AU, BE, CH, DE, ES, GB, HK, IN, IT, JP, KR, LU, MX, NL, RU, SA and TH. Reference period: 2006–2019.

[1] Median of the debt service ratio.   [2] Difference between the 90th percentile and the median of the debt service ratio.   [3] Median of the debt-to-income ratio.   [4] Ratio of the difference between 90th and 75th percentile and the difference between 75th percentile and the median of debt-to-income ratio.

Sources: CGFS Working Group; CGFS Working Group calculations.

Vulnerabilities in the tails of NFC debt appear less correlated with rapid credit growth. For example, a higher credit-to-GDP gap is significantly correlated with a deterioration in the *level* of interest-coverage ratios, but insignificantly correlated with changes to the scale and shape (Table B.1). A similar result holds for the distribution of NFC income-to-debt ratio.

These results shed some preliminary light on why the credit-to-GDP gap provides an early warning signal of financial crisis. They also suggest an additional reason that could explain why household debt is more strongly associated with financial crises compared with NFC debt. In particular, the results

indicate that high credit-to-GDP gaps are associated with rising vulnerabilities in the risky tail of households but with shifts only in the entire distribution of NFC corporates. This finding may complement other explanations about the reasons why household credit booms are more often associated with financial crisis compared with corporate ones, as described in Section 2.

Association between credit-to-GDP gaps and characteristics of the debt distribution[1]   Table B.1

	Household debt-to-income			Household debt service ratio			NFC interest coverage ratio			NFC income-to-debt ratio		
	Level	Scale	Shape	Level	Scale	Shape	Level	Scale	Shape	Level	Scale	Shape
Credit-to-GDP gap	-0.224	-0.688	0.902***	0.0182	0.0888**	0.0788	-7.126***	12.64	1.092	-1.636**	-0.0974	1.570**
	(0.144)	(0.425)	(0.220)	(0.0158)	(0.0340)	(0.176)	(2.015)	(15.07))	(0.702)	(0.729)	(2.179)	(0.713)
Observations	100	100	100	112	98	98	185	170	170	185	170	170
R^2	0.026	0.029	0.159	0.013	0.075	0.002	0.068	0.004	0.015	0.029	0.000	0.030

[1] See text for details on the data and regression specifications.

C. Improving micro data to monitor household debt vulnerabilities

To enhance their monitoring of debt vulnerabilities, central banks have improved the representativeness and granularity of available data, especially data on household debt vulnerabilities. Some central banks have used information collected by credit bureaus. Others have leveraged information collected by banks. Another novel source is data collected by central banks in the course of their liquidity operations.

Federal Reserve Bank of New York. The large increases in consumer debt and defaults, of mortgage debt in particular, during the GFC highlighted the importance of understanding household liabilities. To that end, the New York Fed Consumer Credit Panel (CCP) was created to provide a nationally representative sample of consumer debt. The CCP is a longitudinal database with detailed information on consumer debt constructed from a nationally representative sample of Equifax credit report data. The CCP tracks individuals over time for signs of any stress developing in their mortgages, home equity loans, credit cards, auto loans and student loans, along with information on delinquencies, foreclosures, bankruptcies and credit scores.

Although the dataset did not exist at the time, it would have shown rising vulnerabilities before the GFC, in particular the importance of speculative activity and concentration of debt vulnerabilities. For example, one third of all home purchases in 2006 were being made to people who already owned at least one house. In the four states with the most pronounced housing cycles, the investor share of mortgages was close to half, a doubling from 2000 to 2006. At the peak, investors owning three or more properties were responsible for nearly 20 percent of mortgage originations in these states.

More recently, CCP data have shown how economic policies targeting distressed households have kept consumer delinquency rates low, with forbearance initiatives yielding cash flow relief to households and business owners. These data document the sharp contrast to the experience of the GFC when ever-rising consumer delinquencies and foreclosures fostered a steep recession and a slow recovery.

Bank of Thailand. A collaboration between the National Credit Bureau (NCB) and Puey Ungphakorn Institute for Economic Research (PIER) at the Bank of Thailand, provides anonymised loan-level data from the NCB to analyse household debt in Thailand. The data cover approximately 20 million retail borrowers of commercial banks, special financial institutions (SFIs), and some non-bank financial institutions. Due to the granularity of the NCB data, the dataset enables the tracking of each borrower over time to understand their borrowing/repayment behaviour and identify who are (or likely to be) struggling to repay debt in order to assess vulnerability in the household sector.

In light of the Covid-19 pandemic, the Bank of Thailand used the NCB data to track the borrowers' participation in support measures such as debt payment holidays, debt restructuring, conversion of term loans, all of which provided information that informed policy formulation. In addition, to assess vulnerabilities in a forward-looking manner, the loan-level data from the NCB was used as an input in a simulation to estimate household vulnerabilities under various macro scenarios. To further improve the monitoring of debt vulnerabilities, the Bank of Thailand is in the process of collecting loan-level data on new loans extended by SFIs and regulated non-bank financial institutions to better understand borrower profiles and underwriting standards of financial intermediaries outside the banking system.

Hong Kong Monetary Authority. The HKMA launched a pilot project on Granular Data Reporting (GDR) in 2019 to collect structured financial transactions data on residential mortgage loans and corporate loans. Following the success of the pilot project, GDR has become an ongoing initiative and has expanded to cover interbank loans and debt securities holdings, as well as more participating banks. Banks are required to report their outstanding transactions on a monthly basis, covering a wide range of data fields including loan amount, tenor, pricing, counterparty, collateral, etc. In the future, the GDR initiative may be expanded to include additional data areas. Over time, the GDR initiative has the potential of replacing a number of template-based regulatory reports, thereby lessening the reporting burden on banks. The collection of granular data is aimed at enhancing the effectiveness of surveillance and

supervision by better understanding interconnectedness, concentration, and risks more generally in the banking system. The data collected have been used in several areas of analysis, such as assessing the impact of macro-prudential housing measures, income distribution of mortgage borrowers, pricing behaviour of corporate loans, banks' exposures to vulnerable borrowers, and interconnectedness between banks and non-banks.

Reserve Bank of Australia. The Reserve Bank of Australia's (RBA) Securitisation Dataset contains timely and detailed data on all mortgages underlying a broad set of Australian residential mortgage-backed securities. Since June 2015, the RBA has required that this information be made available in order for the mortgage-backed security to be eligible as collateral in the RBA's market operations.[29] The RBA receives monthly data (with a one-month lag) on around 2.4 million mortgages with a value of around AUD 620 billion, representing roughly one third of the total value of housing loans in Australia (as of March 2021). The coverage is large because the dataset includes "self-securitisations" – comprising 85% of the loans by value – which are not sold to investors, but are instead retained by the issuing bank for use as collateral in the RBA's market operations. The primary purpose of the data is to enable the RBA to manage its actual and contingent exposure to these securities. The data also allow the RBA to gain valuable loan-level insights into risks associated with housing debt. For instance, these data are used to examine the share of bank lending to at-risk borrowers, such as those with both high loan-to-value and debt-to-income ratios, the share of loans in negative equity and the distribution of vulnerabilities by geographic location and borrower type.

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[29]   See Fernandes and Jones (2018) for a description of the database; more detail on permitted users and data access can be found on www.rba.gov.au/securitisations/ and www.securitisation.com.au/standards

D.   Insights on NFC debt vulnerabilities from micro data

While aggregate NFC debt metrics are often used to predict the risk of financial instability, important details can be hidden under the surface. In particular, stable levels of aggregate debt might mask debt allocated to more risky borrowers. As a consequence, central banks have worked to improve their frameworks to assess debt vulnerabilities across the distribution of firms. During the Covid-19 crisis these enhancements enabled central banks to gauge the size of corporate liquidity squeeze and debt vulnerabilities among NFCs.

Deutsche Bundesbank. Recent analysis highlighted a growing allocation risk as the composition of bank loans shifted to relatively risky corporates (Graph D.1, left-hand panel). This analysis showed that the share of bank lending to relatively risky firms had risen steadily over the past decade, even though the aggregate level of non-financial corporate debt in Germany is moderate by global and European standards. By 2019, more than half of banks' credit portfolios were comprised of loans to enterprises whose debt to EBITDA was in the worst 30th percentile of firms. More stark was the growing share of loans to enterprises with interest coverage ratios in the worst 30th percentile of firms. As more indebted enterprises tend to be more at risk of being unable to service their loans in an economic downturn, this asymmetry in banks' credit portfolios could give rise to higher loss allowances in the future. This analysis required matching detailed information about firms to bank loans using credit registry information.

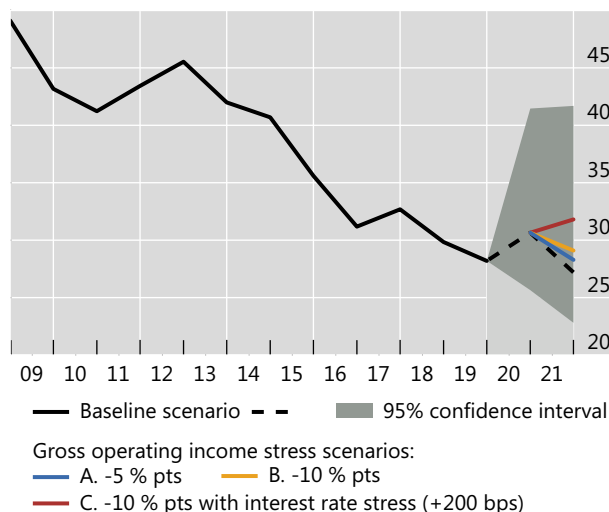Insights on the evolution of debt vulnerabilities from micro data

In percent   Graph D.1

Allocation risk in the domestic loan portfolio of German banks[1]
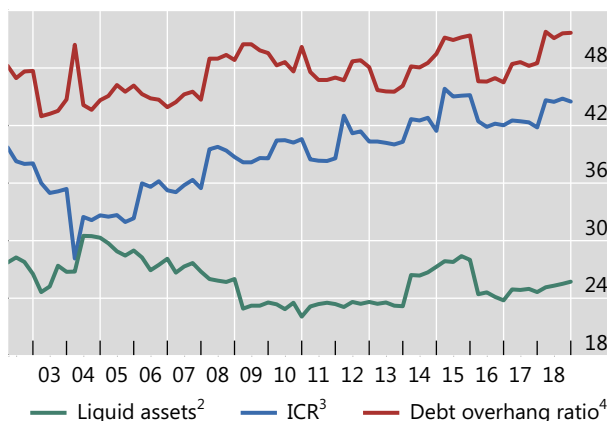
Share of debt in vulnerable Italian firms[5]

— Liquid assets[2]   — ICR[3]   — Debt overhang ratio[4]

— Baseline scenario   - - - Baseline scenario   ▨ 95% confidence interval

Gross operating income stress scenarios:
— A. -5 % pts   — B. -10 % pts
— C. -10 % pts with interest rate stress (+200 bps)

[1] Credit claims on relatively risky non-financial corporations as a percentage of total credit claims. Non-financial corporations are enterprises whose risk measure is in the worst 30th percentile.   [2] Balance sheet item "cash and bank balances" in relation to the sum of "staff costs", "interest expenditures" and "other expenses".   [3] ICR = interest coverage ratio measured as the ratio of EBITDA to interest expenditures.   [4] Ratio of total debt to EBITDA (earnings before interest, taxation, depreciation and amortisation).   [5] Vulnerable firms are those whose gross operating income is negative or whose ratio of net interest expense to gross operating income exceeds 50%, excluding firms with bad loans. Compared to the baseline scenario, the assumptions for 2021 are that: (A) the growth rate of nominal gross operating income is five percentage points lower; (B) the growth rate of nominal gross operating income is ten percentage points lower; and (C) the interest rate is 100 basis points higher and the growth rate of nominal gross operating income is ten percentage points lower.

Sources: Deutsche Bundesbank; Bank of Italy; CGFS Working Group calculations..

Bank of Italy. Analyses based on microsimulation models combine individual level information together with macroeconomic data to provide timely and forward-looking estimates of the share of debt

held by firms at a higher risk of default. Such exercises are particularly useful because changes in the share of debt held by vulnerable firms tend to anticipate movements in banks' credit quality indicators. In the case of Italy, the micro data approach directly shows the improvements in terms of debt sustainability achieved since the European debt crisis (Graph D.1, right-hand panel). Moreover, by incorporating macroeconomic forecasts, microsimulation models provide projections on future debt vulnerabilities, which can be used for risk assessment and policy calibration. For instance, microsimulation models showed that thanks to the higher resilience achieved in the years before the outbreak of the pandemic, the Covid-19 pandemic would probably only cause a moderate increase in the share of debt held by vulnerable financial firms in Italy.

The **ECB** developed a composite indicator of corporate vulnerabilities (Gardó et al (2020)). Using aggregate sectoral accounts data, this measure combines indicators along five dimensions: debt service capacity, leverage/indebtedness, financing/rollover, profitability and activity. During 2020, the indicator shows that corporate vulnerabilities have increased sharply in the wake of the pandemic, but monetary, fiscal and prudential policy measures have helped to limit this increase. To analyse the risks related to corporate zombification, the ECB also took a comprehensive approach based on firm-level, loan-level and supervisory data (Helmersson et al (2021)). The analysis suggests that zombie firms in the euro area might have temporarily benefited from loan schemes and accommodative credit conditions – but likely only to a modest degree. These firms might face tighter eligibility criteria for schemes and more recognition of credit risk in debt and loan pricing in the future.
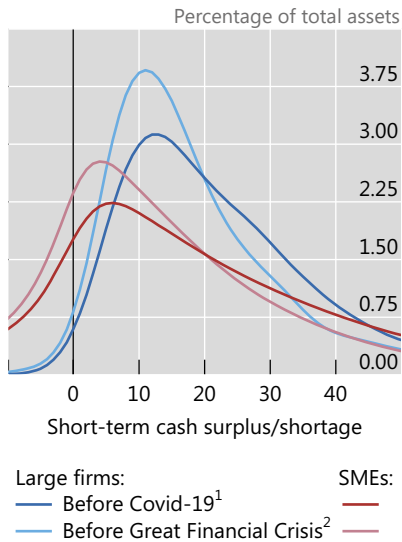
The **Bank of Japan** conducted a simulation analysis that quantified the impact of the Covid-19 pandemic on firms' balance sheets and earnings, and compared it to the impact of the GFC (Bank of Japan (2020)). The analysis used firm-level data, which covered about 2,400 large firms and about 730,000 SMEs. This simulation was conducted under a set of assumptions about the firms' cash reserves and the magnitude of the decline in firms' sales and costs. The simulation results showed that both large firms and SMEs had become more resilient to cash flow stress relative to the GFC (Graph D.2, left-hand panel).

Using the same framework, the BOJ also conducted another simulation to examine the effects of the government measures to support corporate financing (Bank of Japan (2021)). The analysis showed that these measures would contain a rise in the probability of defaults (PD) in the short term, substantially reducing PDs over the next two years. However, they would be accompanied by a future rise in PDs driven by the face-to-face services sector (Graph D.2, centre panel).
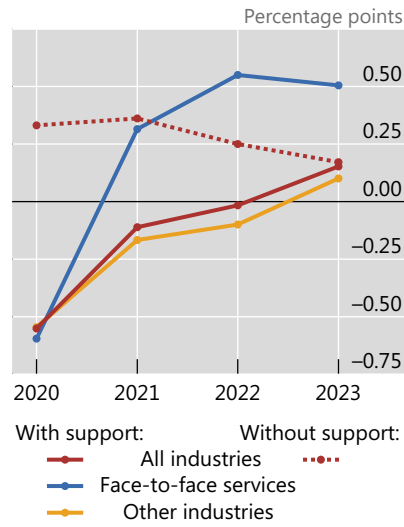
The **Bank of Spain** conducted a simulation exercise to estimate Spanish non-financial corporations' liquidity needs caused by the pandemic (Blanco et al (2021)). According to the results, the liquidity needs, between April and December of 2020, might have exceeded €230 billion, around €67 billion higher than under a counterfactual scenario of no pandemic (Graph D.2, right-hand panel). More than half of this liquidity shortfall could not be covered using internal buffers such as deposits and undrawn credit facilities. It is estimated that, as a whole, Spanish non-financial corporations covered close to half of their liquidity needs through bank loans, of which one third was attributable to loans under the public guarantee schemes.

Using the Bank of Spain's March 2021 baseline macroeconomic scenario, a projection of debt vulnerabilities showed that indebtedness would rise, particularly in the SME segment and especially among the firms in the sectors most affected by the pandemic. From 2021 onwards, however, the pick-up in activity should see a significant reduction in the proportion of vulnerable firms defined as having a net debt-to-ordinary earnings ratio above 10 or making losses. By 2023, the percentage of vulnerable firms would be close to pre-pandemic levels, except in the sectors severely affected by the crisis, where they would remain higher.
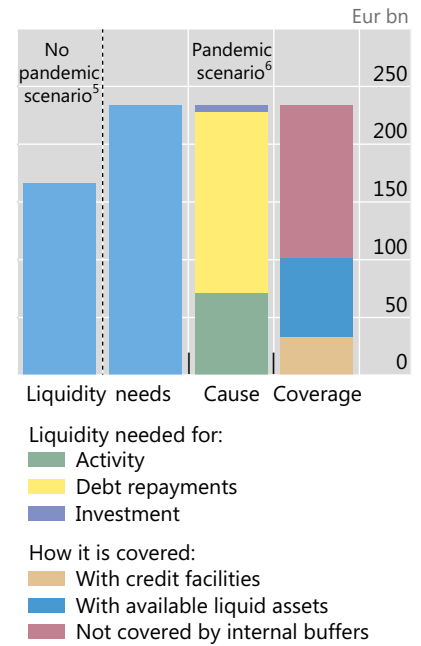
How central banks determined Covid-19 debt risks in the corporate sector

Graph D.2

Distribution of simulated short-term cash surplus/shortage

Percentage of total assets

Short-term cash surplus/shortage

Large firms:
— Before Covid-19[1]
— Before Great Financial Crisis[2]

SMEs:

Decomposition of the deviation of PD[3]

Percentage points

With support: Without support:
— All industries   ·•·•·
— Face-to-face services
— Other industries

Liquidity needs and coverage capacity in Spain[4]

Eur bn

Liquidity needs   Cause   Coverage

Liquidity needed for:
- Activity
- Debt repayments
- Investment

How it is covered:
- With credit facilities
- With available liquid assets
- Not covered by internal buffers

[1] Simulations based on the financial conditions as at fiscal year 2018 reflecting the period before the Covid-19.   [2] Simulations based on the financial conditions as at fiscal year 2007 reflecting the period before the Great Financial Crisis.   [3] The charts indicate the deviation of PD from the simulation without the Covid-19 outbreak (firms' profits are unchanged and precautionary loans are not obtained).   [4] Between April and December 2020. Excludes holding companies and financial services sector firms.   [5] Counterfactual scenario under which GDP growth is in line with the scenario published by the Bank of Spain in December 2019.   [6] Median of 100 microsimulations in which each firm is randomly allocated a variation in 2020 sales such that the distribution of sales for each sector and firm size is replicated.

Sources: Bank of Japan; Bank of Spain; CGFS Working Group calculations.

E.   Innovative uses of bank stress tests

Macroprudential stress tests have become a key instrument that central banks use to assess the ability of the financial system to cope with a materialisation of debt risks. Stress tests have been used to examine consequences from an increasingly diverse range of debt vulnerabilities.

Bank of England. In light of the extreme uncertainty surrounding the Covid-19 shock to the economy, the Bank of England (BoE) carried out a "reverse stress test" on banks. This took the results from previous stress tests conducted in 2019 and examined what sort of Covid-related stress might cause a similar drop in capital. Essentially it analysed how much worse than the central projection the economic outcome would need to be to deplete regulatory capital buffers by as much as previous stress tests.

There were a range of scenarios that could generate that level of loss but in general, the cumulative loss of economic output associated with the outbreak of Covid-19 would need to be around twice as big as the Monetary Policy Committee's central projection in Q1 2020 and accompanied by a significant rise in unemployment. The exercise used two illustrative reverse stress test paths for the UK and global economies that could generate £120 billion of credit losses and deplete banks' capital ratios by around 5 percentage points: a very slow recovery from the H1 2020 shock and a double-dip recession later in 2020. Because banks had buffers of capital larger than required by past stress tests, the reverse stress test would have used up only 60% of aggregate excess capital buffers. In aggregate, they would be left with the ability to absorb a further £80 billion of losses before breaching minimum requirements. The BoE judged that banks had the capacity, and it was in the collective interest of the banking system, to continue to support businesses and households through this shock.

Netherlands Bank. In recent years climate change and its potential impact on the financial system through debt revaluations has become an important concern in policy discussions. The Netherlands Bank ran an energy transition stress test in 2018, using granular data on €2.3 trillion in assets, mostly debt-related, for more than 80 Dutch financial institutions covering banks, pension funds and insurers. The exercise required granular data to enable classification of exposures based on the carbon intensity of the financed projects. The stress test examined four disruptive scenarios that capture crucial uncertainties regarding climate policy and energy technology and considered the transition vulnerability for industries. In the most severe case, a "double shock" scenario, in which both climate policy and energy technology undergo abrupt changes, losses on asset positions were has high as 11%. The stress test calculations indicated that financial stability risks could be sizeable, which underlines the importance of avoiding energy transition paths that come too late and would therefore be too sudden.

F. Examples of composite indicators used by central banks

Composite indicators are used by central banks to combine information from multiple indicators to obtain an aggregate view about the current state of debt vulnerabilities. Composite indicators can take several forms with indicators often grouped so as to provide information on longer- or near-term debt vulnerabilities.

Systemic risk and vulnerability

The Bank of Thailand calculates an entity-based composite risk measure using 80 economic and financial variables, with sub-indices for eight sectors (NFCs, SMEs, households, banks, financial markets, real estate, cooperatives and the external sector). In addition, an issue-based composite risk measure is calculated, covering six key financial stability risks (leverage, debt serviceability, financial market spillovers, interconnectedness, financial institutions' balance sheets and inadequacy of buffers). Values from 0 to 1 are assigned to each grouping on the basis of historical distributions, with 1 representing the greatest vulnerability. A composite risk measure is then calculated as the average of the scores for the indicators in each grouping.

The Central Bank of Brazil makes use of an NFC vulnerability index for listed firms, comprised of the indicators return on equity, interest coverage ratio and the ratio net debt/EBITDA. The threshold for the composite indicator is determined as a function of threshold values for the individual indicators.

Early warning

Sveriges Riksbank's Early Warning Indicator (EWI) is a weighted average of three series covering the evolution of credit, house prices and bank funding in Sweden (Giordani et al (2017)). More specifically, credit is measured as the deviation from trend of log credit-to-GDP, house prices as the deviation from trend of log of house prices-to-consumer prices and the funding gap as the deviation from trend of the log of the ratio of unstable to stable funding. The three series are aggregated to make the EWI. However, the credit series is given twice the weight of the other two variables as it is viewed as the leading indicator.

Financial conditions

The ECB's Composite Indicator of Systemic Stress (CISS) uses 15 mostly market-based financial stress measures equally split into five categories. These categories are: the financial intermediaries sector, money markets, equity markets, bond markets and foreign exchange markets (Holló et al (2012)). A separate financial stress subindex is computed for each of these five market segments, with the subindices then aggregated into the composite indicator based on the cross-correlations between the subindices. The key feature is that the CISS is designed to put relatively more weight on situations in which stress prevails in several market segments at the same time to capture the idea that systemic risk is higher if financial instability is widely spread.

The Federal Reserve Bank of Chicago's National Financial Conditions Index (NFCI) is a weighted average of 100 mixed-frequency financial indicators. Weights are based on cross-sectional and time-series information to determine how well each indicator has tracked past financial crises. There are three subindexes – risk, credit and leverage – with each constructed to have an average value of zero and a standard deviation of one over a sample period. The risk subindex captures volatility and funding risk, the credit subindex measures credit conditions, and the leverage subindex consists of debt and equity measures.

G.   Examples of threshold setting in debt monitoring frameworks

A key challenge in debt monitoring frameworks is assessing when vulnerability indicators indicate systemic risks. In this respect, determining thresholds at which indicators signal heightened vulnerabilities is an important element of debt monitoring frameworks. Central banks use three main methods to set thresholds based on statistical methods, expert judgment and historical distributions.

Bank of Japan. The BOJ uses a statistical approach to determine indicators and thresholds in its heat map (Ito et al (2014), Hirano et al (2021)). The approach is a round robin process which examines combinations of: (i) 159 candidate variables; (ii) 2 to 3 detrending methods; and (iii) 5 alternative types of thresholds. The thresholds are based on the root mean square of the sum of deviations between actual and trend values, and the five cases are: 100% of the root mean square, 125%, 150%, 175% and 200%. The choice is based on whether the combination of the indicator and its threshold minimise risks of false positives or false negatives for banking crises.

Bank of England. Staff analysis suggests that the proportion of borrowers in arrears increases markedly for borrowers with consumer credit debt service ratios (DSR) in excess of 20% and for borrowers with mortgage DSRs in excess of 40%. Non-linearities are evident from simple plots of the share of borrowers in arrears in different DSR buckets (see for example chart 2.B in the Bank of England's August 2020 Financial Stability Report). For the corporate sector, staff find that firms with interest coverage ratios (ICR) below 2.5 are more likely to experience repayment difficulties and hence distress. This threshold is based on a graphical mapping of default rates and ICRs for large corporates and is supported by regression analysis.

The Bank of England uses internal "Risk and Resilience Tables" to monitor around 70 macroeconomic and financial indicators. Around 20 of these enter a heat map where colours indicate risk levels based on the historical distributions of the indicators. Values in the top decile of the distribution are assigned the highest level of vulnerability. Alongside this, the Bank of England uses a swathe chart to visualise the proportion of indicators that are above the 50th and 75th percentiles of the historical distribution

Bank of Thailand. The Bank of Thailand's financial stability dashboard consists of 80 macroeconomic and financial indicators from 8 key sectors. To signal the degree of risk in the dashboard, the Bank of Thailand assigns risk scores, on a scale of 0 (lowest risk) to 1 (highest risk), to each indicator based on: (1) the indicator's historical percentile value; and (2) the change of direction from the previous period that indicates heightened vulnerability. Currently, the Bank of Thailand is in the process of revisiting the threshold setting methodology to align it more closely to an actionable response to address risk build-up in an up or down cycle of the economy.

Bank of Spain. The risk map associates a level of alert with each value of the indicator. The indicators may be in a normal range of values (green colour coding), which does not pose a threat to the system. As an indicator departs from the normal range, the level of alert increases from a low level (yellow) to medium (orange) and finally the maximum level of alert (red). The thresholds are calculated from the historical percentiles of the distribution of each indicator. Two types of indicators are distinguished: some indicators are one-tailed, since an increase in their value always signals greater vulnerability; other indicators are two-tailed, since both very high and very low values signal a risk to the system. An example of the first type of indicator is the non-performing loans ratio, while an example of the second type is the rate of change of credit. A red reading – the maximum level of alert – is earned for the 0–10 and 90–100 percentile bands for two-tailed indicators; and the 90–100 percentile band for one-tailed indicators.

## H. Debt vulnerabilities through the lens of growth at risk models

Growth at risk (GaR) models quantify the effects of different financial vulnerabilities in one easy to understand measure; potential GDP losses. Financial conditions indices are the most common vulnerability indicator used in these models, however, central banks also make use of other debt vulnerability metrics to assess the size of systemic risks.

The left-hand panel of Graph H.1, produced by the Federal Reserve Bank of New York, illustrates the GaR results by using the ECB's financial stress index (CISS) for the United States and current GDP growth in order to track how the distribution of expected future GDP changed when the pandemic hit financial markets (Adams et al (2020)). The conditional distribution for four quarter ahead GDP growth is derived by running quantile regressions for the 5th, 25th, 75th and 95th quantiles and then fitting a distribution with those four data points. GDP growth at the 5th percentile of the distribution provides an indicator of downside GDP growth risks conditional on current financial conditions and GDP growth.
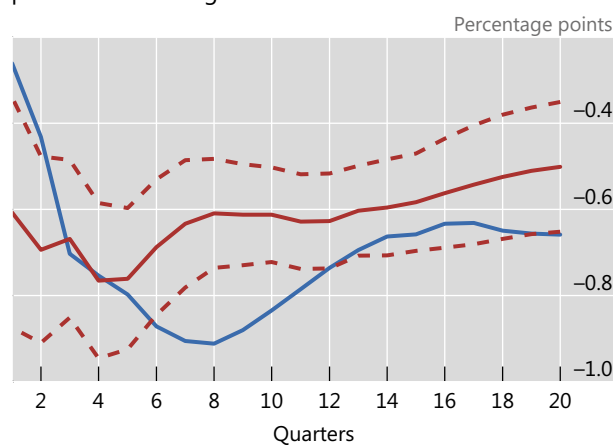
Growth at risk   Graph H.1

Tightening financial conditions widen left tail before economic conditions deteriorate

Impact of domestic and foreign credit growth on the 5th percentile of GDP growth at different horizons[1]
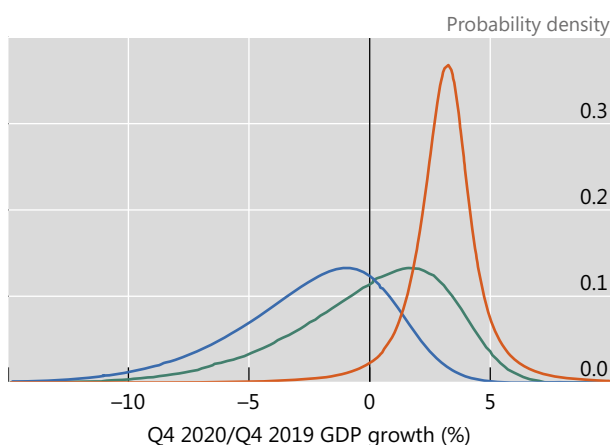
Growth at risk distribution:
— 31 December 2019   — 31 March 2020
— 6 March 2020 (using Q4 2019 GDP)

— Domestic credit–to–GDP   - - 68% confidence interval[2]
— Foreign–weighted credit–to–GDP

[1] Estimated association between one standard deviation change in domestic and foreign-weighted credit-to-GDP at time t with 5th percentile of annual average domestic real GDP growth at each quarterly horizon.   [2] From block bootstrap procedure.

Sources: Adams et al (2020); Lloyd et al (2021).

At the end of 2019, financial conditions were loose and the 5th percentile of the four quarter ahead GDP distribution stood at 0.4% (orange line). That was in the range of possible poor outcomes and the model put a 5% probability on low but still positive growth. Financial conditions subsequently deteriorated with news from China and Europe on the Covid pandemic, and the GaR estimated a much flatter distribution using the CISS data for 6 March (green line), with the 5th percentile estimate dropping to -4.3%. The results for 31 March (blue line) included both the further deterioration in financial conditions over the rest of March and the first estimate of faltering output in Q1, resulting in an addition flattening of the distribution and the 5th percentile of the growth forecast distribution shifting down to -8.7%.

While financial conditions are often used in GaR models, from a policy perspective, leverage indicators with leading indicator properties such as credit growth might prove a useful predictor of downside growth risks arising from debt vulnerabilities. Bank of England research shows that both stronger

domestic and foreign credit growth increases downside GDP risks at relatively long horizons compared with more concurrent financial conditions (Lloyd et al (2021)). The negative impact on GDP from a one standard deviation increase in credit growth over the previous three years peaks between one to two years later, pulling down the conditional GDP growth risk at the 5th percentile by close to one percentage point (Graph H.1, right-hand panel).
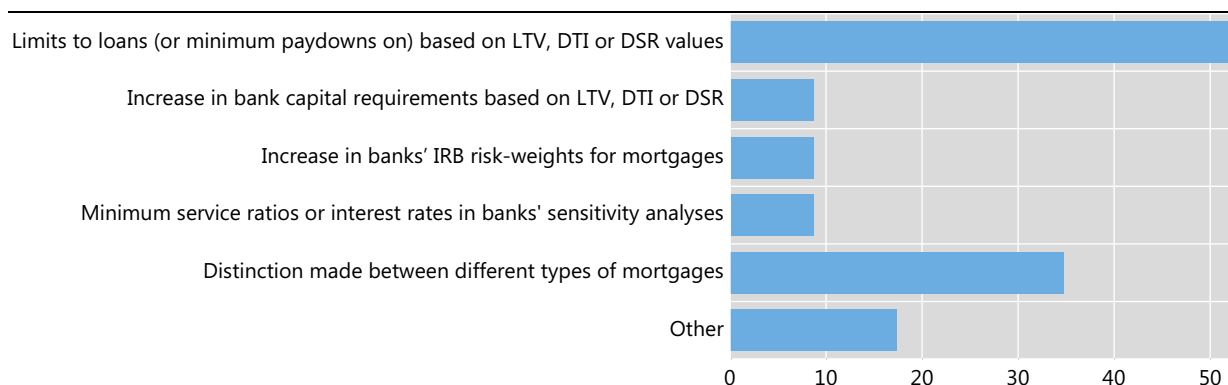
I. Real estate sector macroprudential measures

Macroprudential real estate measures vary considerably in their characteristics and may include one or more of the following features: (1) the imposition of limits (or minimum paydowns) on new lending based upon metrics such as loan-to-value (LTV), borrower debt-to-income (DTI), or borrower debt service ratio (DSR); (2) an increase in bank capital requirements on loans as a function of LTV, DTI, or DSR values; (3) an increase in banks' internal risk based risk weights on mortgages; or (4) the application of different measures for varying types of mortgages. Graph I.1 reports the share of jurisdictions responding to the Working Group's survey whose macroprudential real estate measures contain these features.

Use of macroprudential real estate measures[1]

In per cent   Graph I.1

IRB = internal ratings-based;

[1] Only 16 jurisdictions had measures in place.

Source: CGFS Working Group Survey based on responses from 23 jurisdictions.

Three quarters of the jurisdictions that have implemented macroprudential real estate measures impose borrower-based measures. These either limit or require minimum paydowns on mortgages exceeding certain LTV, DTI, or DSR thresholds. Two additional jurisdictions raised bank capital requirements for mortgages with LTV, DTI or DSR values above certain thresholds.

Four jurisdictions' real estate measures include other characteristics, such as imposing the use of minimum interest rates or debt service ratios in banks' borrower assessments, imposing limits on the share of mortgages on banks' balance sheets or requiring banks to increase provisions for loans with high LTV values.

Half of the jurisdictions applying real estate measures made a distinction between types of mortgages. Five of these applied specific rules for rental properties. Four applied different rules for first-time buyers. Two jurisdictions single out large-value mortgages and three made a distinction between domestic and foreign buyers.

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[30] The Working Group submitted the report to the CGFS in January 2022, before the access of the Central Bank of the Russian Federation to all BIS services, meetings and other BIS activities was suspended.