

The COVID-19 crisis and banking system resilience

Simulation of losses on non-performing
loans and policy implications



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Foreword

Over the previous twelve months the world has worked to contain the unprecedented health and economic crises brought on by the COVID-19 pandemic. At the time of this report's release, the outlook for the pandemic and the path to economic recovery remain highly uncertain.

In this context, the ongoing health of the banking sector remains a primary concern for economic policy makers. Banks' lending is critical to see businesses and households through the crisis, and finance investment as we move into economic recovery.

However, COVID-19's economic impacts have contributed to a sharp rise in defaults of corporate and household debt that is eroding the asset quality of banks across OECD countries. As the pandemic continues into 2021, banks could face a substantial increase in non-performing loans (NPLs) due to the rise in household and company defaults and will be forced to increase their loan loss provisions and allowances. Such a deterioration in bank asset quality and earning performance could limit banks' capacities to absorb higher loan losses over time, flowing through to their ability to intermediate credit and support the recovery.

It is thus critical for banking supervisors and monetary and fiscal authorities, in planning ongoing response and the eventual unwinding of support, to have a clear picture of bank asset performance under different scenarios. This paper supports these considerations with a simulation analysis that assesses the extent of the potential rise in bank NPLs, under different assumptions: a scenario of extensive monetary and fiscal support; versus a scenario without continued support measures, in line with conditions that prevailed in 2008-2009 Global Financial Crisis. The paper also investigates the subsequent implications for bank capital and discusses whether policy responses may be needed to address the declining asset quality and reduced capital buffers.

At the first glance, this analysis suggests that aggregate capital ratios would remain above regulatory minimums – however, a modest number of banks are likely to see respective capital adequacies being challenged, especially if existing stimulus policies are abruptly diminished. At the same time, a weaker than expected economic recovery or premature end to monetary and fiscal support measures, coupled with growing vulnerabilities in the non-financial private sector may give rise to higher bank NPLs. Therefore, financial authorities in several countries should consider additional policy steps to enhance supervisory assessments of loan quality and improve resolution and recovery regimes to address the potential challenges associated with elevated NPLs.

Strengthening bank resilience requires international cooperation to limit regulatory arbitrage and harmonise regulatory standards. The OECD will continue to pursue this goal through its financial policy communities, and its wider work supporting an international policy environment to provide relevant policy recommendations for banking institutions and markets.



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This paper contributes to the work of the OECD Committee on Financial Markets which seeks to promote the contribution of financial institutions, including institutional investors, and capital markets to savings and investment, to finance sustainable and inclusive economic growth. It contributes to the enhancement of policy approaches in the financial sector; such as the promotion of efficient and transparent public debt markets. For more information, visit www.oecd.org/finance/financial-markets/.

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Executive summary

The impact of the COVID-19 pandemic has already brought major economic disruptions globally, which in turn have contributed to weaken credit conditions and certain asset valuations in the financial system. Delinquency rates of home and commercial mortgages have risen substantially in certain jurisdictions with potentially detrimental implications for the asset quality of bank loan portfolios. As the situation persists in 2021, banks could face a substantial increase in non-performing loans (NPLs) due to the rise in household and company defaults and will be forced to increase their loan loss provisions (LLPs) and allowances. Nevertheless, the continued deterioration in bank asset quality and earning performance could limit banks' capacities to absorb higher loan losses over time, which could undermine their ability to intermediate credit and support an economic recovery.

This paper outlines the findings of a simulation analysis aimed at assessing the extent of the potential rise in NPLs depending on the severity of the COVID-19 crisis on the global economic environment, and taking into consideration assumptions under extensive monetary and fiscal support versus a scenario without continued support measures in keeping with conditions that prevailed in the past crisis. The paper also investigates the subsequent implications for bank capital and discusses whether policy responses may be needed to clean balance sheets.

Results of the analysis indicate that:

Bank NPL ratios would increase under a single-hit scenario in both advanced and emerging market economies, and culminate under a double-hit scenario. Nevertheless, extensive monetary and fiscal support measures would reduce the severity of the impact of the COVID-19 crisis on bank NPL ratio in all regions. Notably, projected peaks would stand below previous crises levels in most jurisdictions. In contrast, without monetary and fiscal support measures, the increase in NPL ratios would be more substantial under the two scenarios and projected peaks would surpass previous crises levels in a number of jurisdictions.

Banks would face reductions in their common equity Tier 1 (CET1) capital ratios in both advanced and emerging market economies despite extensive monetary and fiscal support measures that have been implemented to address the crisis resulting from the COVID-19 pandemic. Nevertheless, government loan guarantees would help reduce the decline in CET1 capital for banks in all regions. Notably, the capital reduction due to the deterioration in bank asset quality is particularly concerning for the higher number of banks that face a capital shortfall under the double-hit scenario.

The likelihood that CET1 capital deterioration could trigger contingent convertible bond (CoCo) conversion into loss absorbing equity largely depends on a bank's starting CET1 capital buffer. Therefore, CET1 capital deterioration is expected to be limited, which would cause the Cocos of only a small portion of banks to be triggered to help them strengthening their capital during crisis. If conditions further deteriorate, the increased capital depletion across a higher number of banks would lead more CoCos to be converted into loss absorbing equity.

Policies adopted by governments and central banks have undoubtedly helped to ease challenges faced by banks' as a result of the COVID-19 crisis and induced stress, in turn reducing the impact on bank asset

quality. Nevertheless, while aggregate capital ratios remain above regulatory minimums within each region, there is a weak tail of banks that could see their capital adequacy challenged should existing stimulus policies be abruptly diminished. The banks that are the most at risk include those that entered the crisis with existing idiosyncratic problems or those heavily exposed to the sectors most affected by the COVID-19 crisis, and whose capital ratios might not suffice to weather the upcoming challenges. In this respect, a weaker than expected economic recovery or premature end to monetary and fiscal support measures to mitigate the negative consequences of the pandemic waves, coupled with growing vulnerabilities in the non-financial private sector may give rise to higher bank NPLs. In certain jurisdictions, financial authorities would have to address NPL problems and implement or revive NPL disposal schemes to ensure that banks continue to intermediate credit and support economic recovery.

1 Introduction

The COVID-19 pandemic has caused an unprecedented health and economic crisis. According to the OECD 2020 Economic Outlook, both the outlook for the pandemic and the path to economic recovery remain highly uncertain. The OECD warns that the global recession is expected to be the deepest since the Great Depression with some differences across countries depending on the measures taken to limit contagion, prevent second or further waves of the virus and support the national economy (OECD, 2020c). Persisting uncertainty surrounding the severity of the crisis and prospects for an economic recovery raise questions on the potential consequences for the banking sector.

Banking systems entered into the COVID-19 crisis with stronger capitalisation and liquidity than in prior crises (EBA, 2020b; FED, 2020a). However, vulnerabilities are evident in several areas. A number of banks, particularly in some parts of the world, still suffer from low valuations, low profitability, and high levels of non-performing assets (IMF, 2020a; ECB, 2020a). Irrespective of the crisis, weaknesses such as low interest margins might be exacerbated by the low interest rate environment and flat yield curves (Patalano and Roulet, 2020), which will likely now continue in many jurisdictions. Furthermore, a prolonged and severe disruption could bring about a substantial increase in non-performing loans (NPLs) due to a rise in household and company defaults, with banks being forced to increase their loan loss provisions (LLPs) and allowances. Notably, the deterioration in bank asset quality and earning prospects may impact banks' capacities to absorb higher loan losses.

NPL build-ups are a recurrent feature of financial crises and financial stress episodes. Recent examples include several European countries, as well as the United States (EBA, 2016; IMF, 2015; ECB, 2017), following the Global Financial Crisis. Earlier examples include several Asian economies in the late 1990s, (Fung et al, 2004), the Nordic countries in the 1990s (Borio et al., 2010), and the US savings and loan (S&L) crisis in the 1980s (FDIC, 1997). The potential of a vicious circle of low asset quality, low bank profitability, pressure on capital levels and constrained lending, with negative effects on growth can worsen the initial NPL problem, thus pointing to the macroeconomic and financial stability significance of NPLs. In many instances significant realised losses by banks on NPLs, coupled with high leverage and weak economic conditions could precipitate the need for resolution instruments and possibly government-backed solutions. Notably, solutions to repair balance sheets related to high levels of NPLs have been implemented in several European jurisdictions following the Global Financial crisis. In Europe, EUR 700 billion of NPLs have been sold over the period 2014-2019 to a host of major distressed asset managers and investment banks (Deloitte, 2019). For these reasons, understanding the potential losses from NPLs under different economic and policy stimulus scenarios would be important.

Therefore, this paper seeks to assess the extent of the potential rise in NPLs following the COVID-19 pandemic, subsequent implications for bank capital, and whether policy responses may be needed to repair balance sheets. Concerns have emerged that as banks accumulate higher levels of non-performing loans on their balance sheets, this will undermine their ability to intermediate credit and support economic recovery. These concerns may urge financial authorities in at least some OECD jurisdictions to address NPL problems in the banking sector and have them take actions to restore banks' financial soundness and strengthen their resilience.

The second section proceeds to analyse how the increase in NPLs may vary depending on the severity of the COVID-19 crisis on the global economic environment. The section outlines simulation analysis of bank

NPL ratios under a single-hit versus a double-hit scenario informed by the OECD 2020 Economic Outlook forecast, and taking into consideration assumptions under extensive monetary and fiscal support versus a scenario without continued support measures in keeping with conditions that prevailed in the past crisis. The purpose of this analysis is to evaluate the extent to which banking systems may be impacted across OECD economies.

The third section focuses on the deterioration in bank asset quality that is likely to impact banks' capacity to absorb higher loan losses. A simulation analysis is performed to consider how much capital banks would need to absorb higher levels of loan losses and estimate regulatory capital erosion (and even potential shortfalls) due to remaining loan losses that may not be covered by loan loss reserves.

The fourth section analyses the possible consequences of the erosion of bank regulatory capital due to the deterioration in asset quality. Further analysis is intended to assess the amount of contingent convertible bonds (CoCos) that may be triggered due to substantial loan losses not covered by reserves. The objective is to investigate whether CoCos may be an additional source of bank equity to absorb losses on NPL write-offs.

Section five includes an assessment of the key findings and high level policy considerations.

2 Assessment of bank non-performing loans following the COVID-19 crisis

2.1. Stylised facts: banking sector strengths and vulnerabilities prior to the COVID-19 crisis

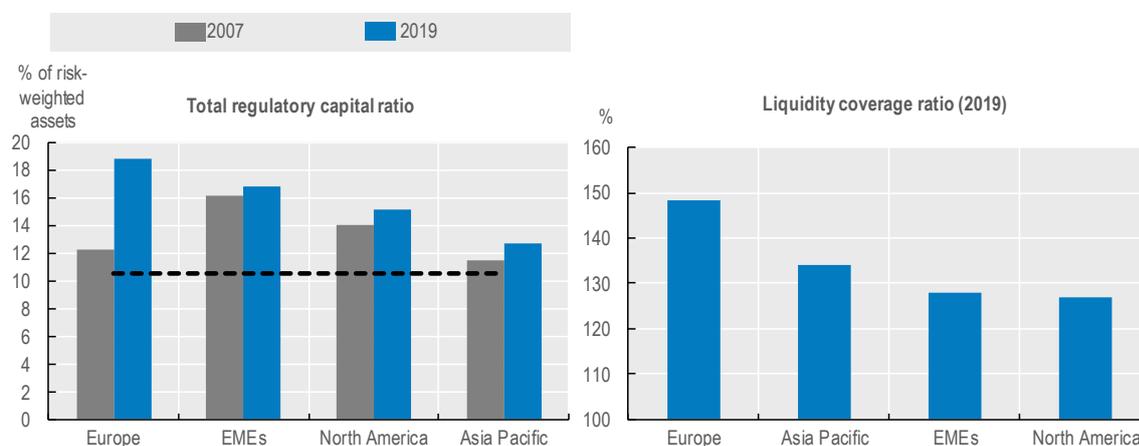
The resilience of banking systems in many OECD countries has been strengthened following the implementation of the Basel III accords with higher minimum capital and liquidity requirements.¹ In contrast to the situation prior to the Global Financial Crisis (GFC) in 2008-2009, banks' regulatory capital and liquidity ratios stood at historically high levels globally at the end of 2019 (Figure 1). The total regulatory capital ratio in 2019 ranged from 2 to 8 percentage points above the minimum regulatory requirement. The highest increase has been recorded by European banks with a rise in the total regulatory capital ratio to nearly 19% in 2019. Also, the liquidity coverage ratio in 2019 exceeded 100% in all banking systems assessed. This suggests that banks may rely on their strong loss-absorbing capacities to face increased credit provisions and draws on committed credit lines to corporate borrowers associated with the onset of the COVID-19 pandemic (FED, 2020a and 2020d; IMF, 2020a and 2020b).

Nevertheless, the COVID-19 crisis raises challenges to the capital of certain banks, even though they entered the crisis with higher capital ratios than before the GFC and despite the large monetary and fiscal policy interventions aimed at containing the economic fallout from the current crisis (IMF, 2020b). In particular, for the banks with a regulatory capital ratio that is slightly above the minimum regulatory requirement, the erosion of the capital base due to rising loan losses not covered by reserves may require the capital buffer to be replenished. For the banks with remaining capital buffers available, it is crucial to address any impediments for using such buffers in order to avoid the risk of bank deleveraging which could constrain credit intermediation to the real economy during the recovery (ECB, 2020g).

Vulnerabilities remain in several areas. Profitability has deteriorated substantially since the GFC and remains subdued (Figure 2). Banks in Europe, emerging market economies and the Asia Pacific region have recorded the sharpest decline of their return on equity (ROE) in 2019 compared to 2007. Furthermore, the ROE of banks in the Asia Pacific is the lowest in 2019, standing at about half the ratio of banks in other advanced economies. Such low levels of bank profitability suggests that banks have entered into the crisis with less income available to offset losses than in the past (IMF, 2020a). Low interest margins may also be exacerbated by the low interest rate environment, which is likely to persist following the unprecedented monetary policy actions by major central banks since the beginning of 2020 (EBA, 2020b). In addition, income generation from new businesses is likely to be impaired, and credit losses are set to increase, as banks are increasingly confronted with delayed or missed payments on mortgages and a growing number of corporate defaults (ECB, 2020a and 2020g; IMF, 2020a and 2020b). A weaker than expected economic recovery or premature end to monetary and fiscal support measures, coupled with growing vulnerabilities in the non-

financial private sector may complicate the path for banks with higher than expected loan loss provisioning needs, further exacerbating the negative impact of the COVID-19 on their profitability (EBC, 2020g).

Figure 1. Average bank total regulatory capital and liquidity coverage ratios by region, 2007 versus 2019



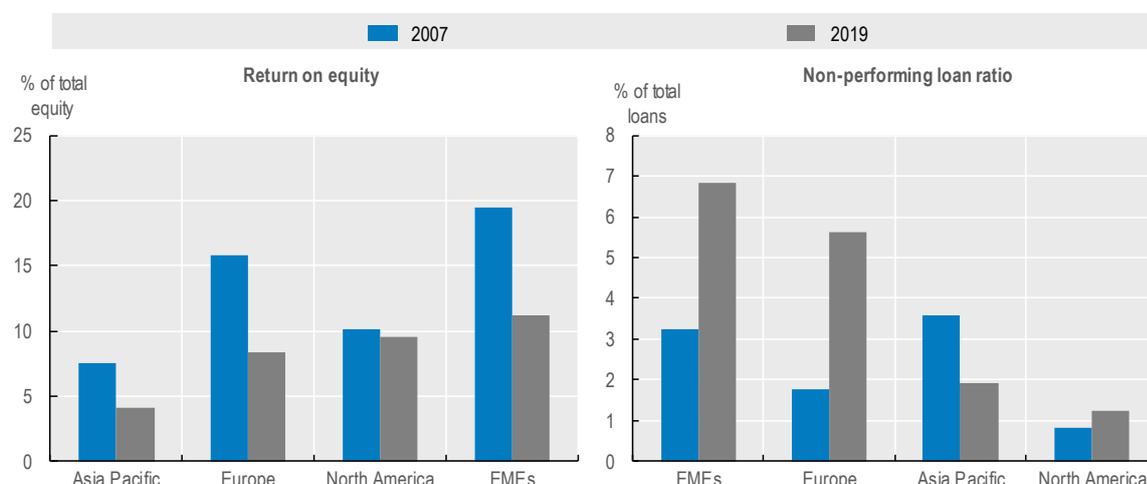
Note: This figure shows simple averages of regulatory capital and liquidity coverage ratios using a sample of 798 publicly listed banks in 46 major advanced and emerging market economies for which financial statement data are available in Refinitiv since 2007. Under Basel III regulatory framework, minimum requirement for the total regulatory capital ratios has been raised from 8% to 10.5% of risk-weighted assets because banks should hold buffers of capital above the regulatory minimum outside of periods of stress (BIS, 2011). Additional surcharges may be deployed by national jurisdictions when excess aggregate credit growth is judged to be associated with a build-up of system-wide risk. A liquidity coverage ratio minimum requirement of 100% has been also introduced. EMEs stands for emerging market economies.

Source: Refinitiv, OECD calculations.

Also, despite continuous efforts to improve bank asset quality and the implementation of GFC-related NPL resolution schemes in many jurisdictions, the NPL ratio of banks in emerging market economies and certain European economies² have reached high levels well above pre-GFC levels. Such high levels of bank NPLs suggest that banks in some jurisdictions are entering the crisis weighted by a burden of bad quality loans that could generate even greater challenges. A prolonged severe disruption could bring about high and problematic levels of NPLs that may impair bank balance sheets, depress credit growth, and delay economic recovery (Aiyar et al., 2015, Kalemli-Ozcan et al., 2015). Persistently high NPL ratios were a concern in several European economies after the GFC, and the COVID-19 pandemic could cause a re-emergence of the NPL issue (Ari et al., 2020).

In addition to cyclical challenges, persisting structural problems are likely to further hinder banks' prospects. Low cost-efficiency, limited revenue diversification and overcapacity continue to weigh on many banks' profitability prospects (ECB, 2020a). While on one hand the COVID-19 pandemic could help accelerate changes in the banking sector, it could also increase uncertainty and lower profit expectations which may delay transformation plans. In addition, new challenges will need to be addressed, for example digitalisation and remote working solutions are exposing banks to new forms of cyber risks, and banks will need to increasingly manage the implications of the transition towards a greener economy.

Figure 2. Average bank return on equity and non-performing loan ratio by region, 2007 versus 2019

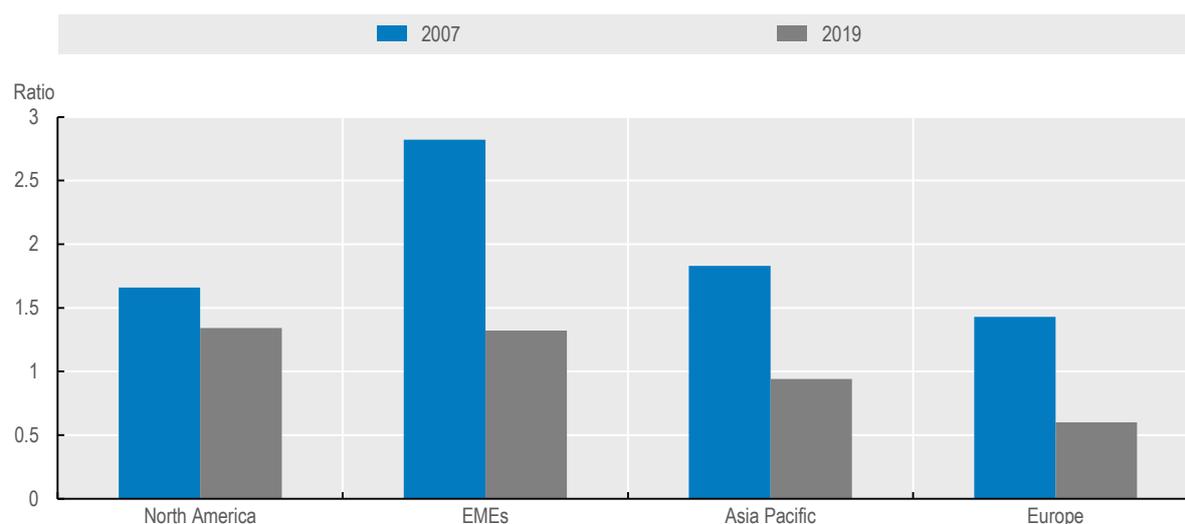


Note: This figure shows simple averages of return on equity and non-performing loan ratio using a sample of 798 publicly listed banks in 46 major advanced and emerging market economies for which financial statement data are available in Refinitiv since 2007. EMEs stands for emerging market economies.

Source: Refinitiv, OECD calculations.

Poor profitability and high levels of NPLs in certain jurisdictions have also driven down banks' valuations over the last decade (Detragiache et al., 2018; ECB, 2020g). While banks' price-to-book value ratios have recovered from a sharp fall during the GFC, they have flattened to low levels (Figure 3). This suggests that rising vulnerabilities in a number of real sectors, potential legacy structural problems and the increasing need to address climate risk could test some banks in the future (ECB, 2020g). Depending on the severity of the impact of the COVID-19 crisis on asset quality and stock prices, some banks are likely to face more adverse conditions to raise external capital and a substantial increase in their cost of equity (IMF, 2020a).

Figure 3. Average bank price-to-book value ratio by region, 2007 versus 2019



Note: This figure shows price-to-book value index calculated using Refinitiv bank regional indices. EMEs stands for emerging market economies.

Source: Refinitiv, OECD calculations.

2.2. Methodology and simulation results of bank non-performing loans throughout the COVID-19 crisis

This subsection will assess the impact of the COVID-19 pandemic on bank asset quality. For this purpose, a simulation analysis of bank NPL ratio has been performed under a single-hit versus a double-hit scenario informed by the OECD 2020 Economic Outlook and assuming extensive monetary and fiscal support versus no support measures consistent with conditions that prevailed during the past crisis. This subsection will explain the empirical methodology of the simulation analysis and discuss the results obtained. The main objective of this is to evaluate the extent to which OECD member countries' banking systems may be impacted.

2.2.1. Empirical methodology of the non-performing loan simulation analysis following the COVID-19 pandemic

The OECD warns that the potential global recession would be the deepest since the Great Depression with some differences across countries, and would have material consequences for credit conditions. To elaborate on this, the OECD 2020 Economic Outlook focused on two equally probable scenarios to reflect the possible evolution of the global economy.³ These macro scenarios implicitly incorporate the effects of broad macroeconomic and monetary policy measures that have been implemented in many jurisdictions since the onset of the COVID-19 pandemic in 2020. By improving the liquidity of borrowers, these policies indirectly affect the conditions of banks. As such, these two scenarios provide useful guideposts of the potential paths of the pandemic and its impact on the real economy.

Under the *single-hit scenario*, it is assumed that containment measures successfully overcome the outbreak with no expected resurgence in infections. Global economic activity is expected to fall by 6% in 2020 and OECD unemployment is expected to climb to 9.2%. This scenario has already proven to be optimistic for some economies. While prospects for an eventual path out of the crisis have improved, with encouraging news about progress in vaccine deployment, renewed virus outbreaks in many economies, and the reintroduction of containment measures are slowing the pace of the rebound from the output collapse in the first half of 2020, with renewed output declines in some economies.

Under the *double-hit scenario*, an easing of containment measures is assumed to be followed by a second, but less intensive, virus outbreak taking place in late 2020. World economic output is expected to plummet 7.6% in 2020, before climbing back 2.8% in 2021. The OECD unemployment rate is expected to nearly double to 10% with little recovery in jobs by 2021. These assumptions are supported by economic developments as the aggregate economic impact of renewed restrictions appears lower than during the first wave of the virus, but job-rich service activities with high levels of social interactions are being hard-hit once again, raising risks of bankruptcies, higher unemployment in the absence of extended policy support (OECD, 2020d). Already, given that numerous OECD countries have experienced a second wave of infections since October 2020, the consideration of further deterioration of credit conditions is warranted.

Downside risks to bank asset quality arise from the detrimental impact of such a massive economic shock on corporate and household insolvencies. The non-financial corporate sector was the first to be impacted, with credit quality deteriorating sharply and suddenly as the global economy ground to a halt (OECD, 2020a). According to the S&P baseline scenario (S&P Global Ratings, 2021), speculative-grade corporate default rates for the trailing 12 months are expected to rise to 9% by September 2021 from 6.3% in September 2020 in the United States and to 8% by September 2021 from 4.3% in September 2020 in Europe.⁴ Unprecedented monetary actions by major central banks and extensive fiscal support in many advanced and emerging market economies could temper defaults in the near term. However, the surge in corporate debt issuance in 2020 is adding to already-high leverage (Patalano and Roulet, 2020) at a time when revenues are shrinking, costs are rising, and a recovery is uncertain which could lead to a prolonged period of high defaults, rather than to a more typical turn in the credit cycle.⁵ Faced with these shortfalls,

businesses have little choice but to reduce costs and employment to withstand insolvency pressures. Consequently, rising unemployment rates are affecting household revenues with negative consequences on consumption and loan repayment capacity. According to Core Logic's loan performance insights report (2020), the overall delinquency rate of US home mortgages rose to 6.3% in September 2020, marking its highest level since January 2016. Extensive public support measures in many countries, like payment holidays, may dampen and delay the impact of the economic shock on the increase in unemployment and on households' fall in revenues. Nevertheless, rising defaults on household and business debt will inevitably trigger substantial increase in bank NPLs.

In light on these dynamics, it is relevant to assess the potential rise in bank NPLs depending on the possible evolution of the global economy following the COVID-19 crisis. The empirical framework underpinning the analysis is inspired by several papers in the recent literature (IMF, 2014; Staehr and Uusküla, 2017; Bonaccorsi di Patti and Cascarino, 2020; Heppe, 2020). A macroeconomic panel data for 37 major advanced and emerging market economies is used to estimate a parsimonious projection model. The bank NPL ratio is regressed against a set of indicators that capture the impact of macroeconomic and macrofinancial conditions that may influence the ability of borrowers from the private sector (i.e. corporates and households) to repay their loans and respond to economic shocks. Projected NPL ratios are calculated using OECD forecasts under a single-hit versus a double-hit scenario for these macroeconomic variables.⁶ In quantifying the impact of monetary and fiscal support measures, average OECD projected rates on 2020 and 2021 are used to reflect the effectiveness of extensive monetary and fiscal support measures implemented to mitigate the impact of the COVID-19 crisis on economic conditions. Alternately, expected minimum or maximum rates in 2020 or 2021 depending on the indicator considered are used to reflect the overall negative impact of the COVID-19 pandemic for corporates and households, i.e. both facing lower earnings prospects due to deteriorated economic conditions and rising unemployment. The measure of bank NPL ratio used in this analysis encompasses the credit risk of different sectors, namely corporates, households and other sectors. Nevertheless, the COVID-19 pandemic is exerting abrupt effects with major disruptions that may differ in nature and intensity across the several real sectors.⁷ In fact, the extensive direct fiscal support provided to households would help to mitigate the negative consequences of the COVID-19 crisis on their revenues. By contrast, corporates do not benefit from the same direct government support, therefore the impact of deteriorating economic conditions tends to materialise in a shorter period and leads actual earnings to reduce. Therefore, the credit risk profile of each sector may be explained by different macroeconomic and financial variables. To assess these different effects, considering a breakdown of NPLs by loan type would also be relevant. Unfortunately, these data are not publicly available for many countries included in this study.

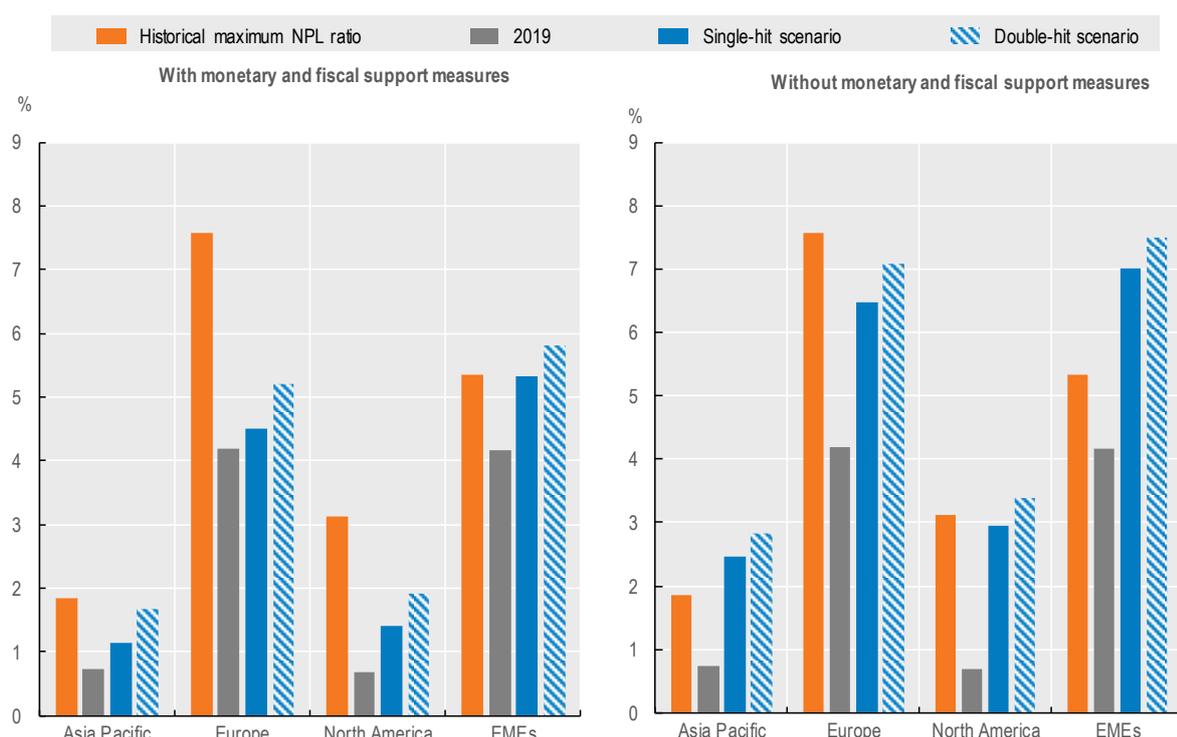
The main purpose of this simulation analysis is to compare the predicted NPL ratios with those observed at the end of 2019 and also during the GFC to identify the regions which are likely to be most severely impacted. Given the unprecedented nature of the shock and persisting uncertainty surrounding the severity of the crisis and the prospects of an economic recovery, this analysis is designed to assess the magnitude of the potential rise in bad quality assets based on hypothetical scenarios rather than forecast estimates. Also, banks in many countries benefit from direct government support such as moratoria and credit guarantees that may also help to avoid defaults on a select amount of performing and non-performing loan exposures, or at least delay loan defaults. Nevertheless, downside risks are rising for banks given the uncertainty surrounding the performance of these loans once these temporary measures would expire.

2.2.2. Results of the analysis

Projected NPL ratios by region under a single-hit versus a double-hit scenario, along with the latest NPL ratios, are shown in Figure 4. Results also take into consideration the assumption of extensive monetary and fiscal support versus no support measures in keeping with conditions that prevailed in the past crisis.

The simulation results suggest that bank NPL ratios would increase under a single-hit scenario in both advanced and emerging market economies, and culminate under a double-hit scenario. Nevertheless, extensive monetary and fiscal support measures help to mitigate the increase in bank NPLs in all regions due to the massive economic shock following the COVID-19 outbreak. Notably, with this assumption projected peaks would still stand below previous crises levels in most jurisdictions. Whereas, without monetary and fiscal support measures, the increase in NPLs ratios would be more substantial under the two scenarios and projected peaks would surpass previous crises levels in certain jurisdictions.

Figure 4. Average historical and projected non-performing loan ratios by region, calculated under OECD single-hit versus double-hit scenario



Note: This figure shows latest (i.e., as of end 2019), peak NPL ratios during the GFC or the European sovereign debt crisis and projected non-performing loan ratios for banks in selected advanced and emerging market economies. Simple average ratios are calculated under single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook. Non-performing loan projection model and data used to perform this analysis are detailed in Annex A. EMEs and NPL stand for emerging market economies and non-performing loans respectively.

Source: IMF Financial Soundness Indicators Database, BIS Credit to the non-financial sector database, OECD National Account Database, Refinitiv, OECD calculations.

With monetary and fiscal support measures, estimates suggest that projected NPL ratios would still increase in all regions; and at least double for banks in Asia Pacific and North America. Nevertheless, there is a high heterogeneity across countries as reflected by ranging NPL ratios between 0.6% and 37% in selected advanced and emerging market economies under the most adverse scenario. Also, banks in North America and emerging market economies would face the highest increase in NPL ratios under both the single-hit and double-hit scenarios. In these regions, expected increases in NPL ratios range between 0.7 and 1.6 percentage points depending on the scenario considered. The increase in NPL ratios under the single-hit scenario for banks in emerging market economies is mainly driven by two factors, elevated long-term interest rates and leverage of non-financial firms relative to other regions (Table 1). Under the double-hit scenario, the fall in the real GDP growth rate and remaining elevated interest rates would drive the further increase in bank NPL ratios. Besides, the substantial gap between projected and actual NPL

ratios recorded under the single-hit scenario for banks in North America is largely driven by high bank credit growth, moderate household disposable income growth and relatively high long-term interest rates compared to other regions. Under the double-hit scenario, the additional increase in bank NPL ratios in North America mainly relates to the sharpest deterioration in real GDP growth and household disposable income growth compared to other regions. In the Asia Pacific region, high leverage of non-financial firms and low growth in household disposable income compared to other regions are the dominant factors that determine the magnitude of the gap between projected and actual NPL ratios. Under the double-hit scenario, the fall in the real GDP growth rate and remaining high interest rates drive the increase in bank NPL ratios. European banks mainly face a combination of relatively high leverage among non-financial firms, high long-term interest rates and moderate household disposable income growth. Under the double-hit scenario, the increase in NPL ratios is largely driven by the deterioration in real GDP growth and to a lesser extent by the decline in household disposable income growth compared to North American banks.

Table 1. Actual versus average non-performing loan ratios and other explanatory macroeconomic variables under the OECD single-hit scenario with policy mitigation

	Single-hit scenario						Change from single-hit to double-hit scenario			
	Projected minus end-2019 NPL ratio	Real GDP growth rate forecast	Household disposable income growth forecast	Long-term interest rate forecast	Leverage of non-financial firms	Annual percent change in aggregate bank loans	NPL ratio	Real GDP growth rate	Household disposable income growth	Long-term interest rate
Asia Pacific	0.4	-1.2	1.2	0.5	63	-1.4	0.5	-2.0	-0.5	0.00
Europe	0.5	-1.0	2.2	1.6	62	-0.7	0.6	-2.3	-1.0	-0.02
North America	0.7	-1.0	2.2	1.4	53	0.2	0.7	-2.4	-1.7	0.00
Emerging market economies	0.9	-1.1	5.5	4.8	62	-5.9	0.6	-2.0	-0.5	0.01

Note: This table shows the gap between projected and actual non-performing loan ratios along with average macroeconomic explanatory variables under OECD single-hit scenario by region. Statistics for non-financial firm leverage and bank loan growth are shown only under the single-hit scenario because 2019 values of non-financial firm leverage and bank loan growth have been used since OECD forecasts are not available for these indicators. The difference between projected ratios under OECD double-hit and single-hit scenarios for NPL ratio and other macroeconomic explanatory variables are also shown in the right side of the table. All data are expressed in percentage. Non-performing loan (NPL) projection model and data used to perform this analysis are detailed in Annex A.

Source: IMF Financial Soundness Indicators Database, BIS Credit to the non-financial sector database, OECD National Account Database, Refinitiv, OECD calculations.

Without monetary and fiscal support measure, estimates suggest that projected NPL ratios would increase substantially for banks in all regions; and more than triple for banks in Asia Pacific and North America. Projected NPL ratios are expected to vary between 1.3% and 39% in selected advanced and emerging market economies under the most adverse scenario. Nonetheless, banks in Europe, North America and emerging market economies would face the highest increase in NPL ratios under the two scenarios. In these regions, increases in projected NPL ratios range between 2.3 and 3.3 percentage points depending on the scenario considered. Without monetary and fiscal support measure, GDP growth rates are expected to fall and become substantially negative in all regions. Also, household disposable income growth rates are expected to decrease and remain slightly positive or become negative in certain regions (Table 2). These collective factors can in part explain the sharp increase in projected bank NPL ratios compared to a context in which monetary and fiscal support measures have been implemented.

Table 2. Actual versus average non-performing loan ratio and other explanatory macroeconomic variables under the OECD single-hit scenario without policy mitigation

	Single-hit scenario				Change from single-hit to double-hit scenario			
	Projected minus end-2019 NPL ratio	Real GDP growth rate forecast	Change in disposable income of households forecast	Long-term rates forecast	NPL ratio	Real GDP growth rate	Change in disposable income of households	Long-term rates
Asia Pacific	2.0	-7.0	-1.4	0.5	0.4	-1.6	0.2	0.00
Europe	2.3	-7.1	-0.6	1.6	0.5	-1.8	-1.0	-0.01
North America	2.3	-6.7	0.8	1.5	0.5	-1.8	-1.4	0.00
Emerging market economies	2.8	-7.4	0.8	4.9	0.6	-2.0	-0.4	0.02

Note: This table shows the gap between projected and actual non-performing loan ratios along with average macroeconomic explanatory variables under OECD single-hit scenario by region. The difference between projected ratios under OECD double-hit and single-hit scenarios for NPL ratio and other macroeconomic explanatory variables are also shown in the right side of the table. All data are expressed in percentage. Non-performing loan (NPL) projection model and data used to perform this analysis are detailed in Annex A.

Source: IMF Financial Soundness Indicators Database, OECD National Account Database, OECD calculations

Overall, the results of the simulation analysis suggest that policies adopted by governments and central banks have helped ease banks' challenges amid the COVID-19 crisis and mitigate the increase in bank NPLs in both advanced and emerging market economies. Nevertheless, high heterogeneous projected NPL ratios across countries reflect that some economies are expected to be more negatively impacted than others. In these jurisdictions, banks are likely to be hit particularly hard, reflected in the strong expected rise in their NPL ratios. These results indicate the potential for material tail risk (ECB, 2020e). With or without widespread second outbreaks (which are already materialising in a number of jurisdictions), the consequences will be severe for many banking sectors across the globe and bank NPL ratios are likely to increase substantially in certain jurisdictions. A weaker than expected economic recovery, premature end or insufficient monetary and fiscal support measures to mitigate negative consequences of the several waves of the pandemic along with growing vulnerabilities in the non-financial private sector may entail higher bank NPLs. Importantly, guarantees and moratoria appear to have lengthened the time it takes for weak economic performance to translate into credit losses and NPLs for banks (ECB, 2020g). Despite this, following the COVID-19 crisis, financial authorities in many countries will need to address NPL problems in the banking sector and implement or revive NPL resolution schemes. Therefore, proactively identifying distressed borrowers and managing deteriorating assets at an early stage could help contain the potential impact of the COVID-19 crisis on bank NPL ratios (ECB, 2020f).

2.3. Consequences of rising non-performing loans and subsequent loan loss provisions for bank earnings and valuations

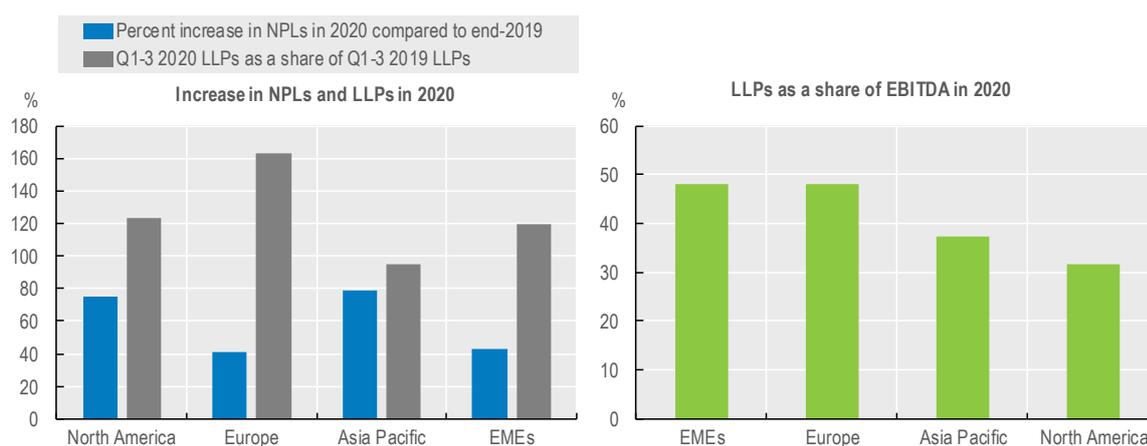
The combination of credit losses, increase in LLPs and weaker revenues could gradually reduce bank earnings and weaken bank ability to increase capital stock using profits generated internally.⁸ These challenges could prevail in particular for the banks located in countries with the highest expected rise in NPLs that are likely to face the most acute deterioration in their asset quality. Therefore, bank capital ratios are susceptible to deterioration unless banks take steps to reduce risk-weighted assets through deleveraging⁹ or strengthening their capital base using profits generated internally or by issuing equity shares, which would be challenging under current conditions in which bank equity valuations are historically low. The Federal Reserve (2020b and 2020d), the European Banking Authority (2020), the

European Central Bank (2020c and 2020h) and the IMF (2020b) have performed stress tests, including credit losses, provisions, pre-tax net income, to assess the sensitivity of bank capital ratios under adverse conditions. Findings from stress test analyses suggests that the banks that are the most at risk include those that entered the crisis with existing idiosyncratic problems or those heavily exposed to the sectors most affected by the COVID-19 crisis, and whose capital ratios might not suffice to weather the upcoming challenges. The deterioration in asset quality and rising loan losses following the COVID-19 pandemic is therefore likely to further weaken banks' capabilities to absorb higher loan losses and possibly their lending supply.

There are several factors that contribute to the rise in NPLs across banking systems. NPLs and, most noticeably, LLPs have already risen sharply in the first three quarters of 2020, and are eroding bank profitability (Figure 5). Notably, LLPs growth during the first three quarters of 2020 is exceeded 2019 provisions during the same quarters.¹⁰ The abrupt increase in LLPs may be attributed to the fact that loan loss provisioning has been made more cyclical in the United States and under IFRS 9 accounting standards to address shortcomings observed during the GFC (Oliver Wyman, 2020). Nevertheless, more flexibility has been attributed to banks in the Euro Area when determining the amount of provisions in an exceptional situation such as the COVID-19 crisis (European Commission, 2020).

It is worth noting that complex models and bank judgment to remove very short-term effects of macroeconomic developments on expected credit loss may create distortions in the calculation methodology of forecasted LLPs possibly leading to less accurate comparisons across banks. Also, LLPs in 2020 account for about half of bank operating incomes. Rising LLPs tremendously help in strengthening reserve buffers, loan loss absorption capacities, and the resilience of individual banks and the overall banking system to withstand loss. Given the continued uncertainty, banks' ability to forecast LLPs under evolving scenarios will be critical to support a prompt response and overall resilience. Nevertheless, LLPs would lead to erode a substantial share of profits that may be used to strengthen the capital base. Therefore, depending on the evolution of the pandemic and the occurrence of possibly several future waves, this could give way to serious concerns for bank capitalisation and their ability to intermediate, in particular for the banks located in countries with the highest expected increase in NPLs.

Figure 5. Average increase in non-performing loans and loan loss provisions for banks that experienced a rise in non-performing loans, 2019-2020

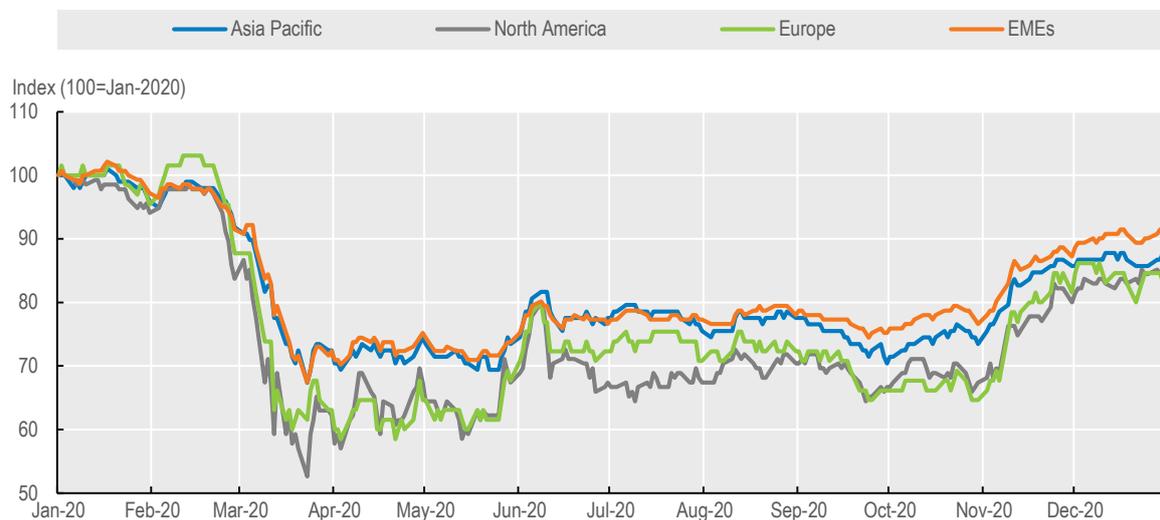


Note: The left panel figure shows average percent increase of non-performing loans (NPLs) in 2020 compared to end-2019 levels along with the average ratio of loan loss provisions (LLPs) in 2020 to total loan loss provisions during the first three quarters of 2019. Simple average calculations have been performed by including only the banks with a positive percent change in non-performing loans (i.e. 432 banks in a total of 788 publicly listed banks in 37 major advanced and emerging market economies). The right panel figure shows simple average ratio of LLPs and EBITDA (i.e., the sum of operating income, loan loss provisions, depreciation and amortization) in 2020 for banks located in major advanced and emerging market economies. EMEs stands for emerging market economies.

Source: Refinitiv, OECD calculations.

Despite depressed bank valuations due to profitability concerns, asset quality and resilience, the positive news on the COVID-19 vaccine in November 2020 and more optimistic economic outlook for 2021 are beginning to restore bank valuations from very low levels (Figure 6). These trends reflect global investors' positive sentiment about the effect of an expected rebound in economic activity in 2021 to mitigate defaults in the non-financial sector and further deterioration of bank asset quality (IMF, 2020b). Therefore, some banks could be expected to accumulate lower than anticipated levels of non-performing loans on their balance sheet and would be more able to support an economic recovery, in particular in economies largely dependent on bank financing and with a large share of small and medium-size enterprises (SMEs) that are not sufficiently able to tap capital markets. Also, expected additional fiscal stimulus in 2021 following the Biden Administration's plans to pursue a substantial stimulus plan, and growing inflation expectations upon recovery. In the near term, long-term interest rates are expected to rise, which may boost banks' profitability in the United States.

Figure 6. Evolution of bank price-to-book ratio in 2020



Note: This figure shows price-to-book value index calculated using Refinitiv bank regional indices. EMEs stands for emerging market economies.
Source: Refinitiv, OECD calculations.

3 Implications of rising bank loan losses for bank resilience and solvency

This section will assess the extent to which the potential deterioration in bank asset quality could impact banks' capacities to absorb higher loan losses. It identifies the banks that are the most exposed to credit default risk from their loan portfolio, the extent of their safety buffer that helps strengthen their resilience, and conditions in which additional policy responses may be needed.

3.1. Impact of simulated bank loan losses on capital levels

To examine the sensitivity of banks' capacity to absorb higher loan losses due the deterioration in their asset quality and a substantial rise in NPLs, analysis is performed to simulate the shock of the COVID-19 crisis. In doing this, this section assesses how much bank capital would be needed to absorb higher loan losses and the subsequent erosion of banks' regulatory capital ratios should risks in the scenario materialise.

The magnitude of potential capital erosion due to a rise in non-performing loans is assessed under a single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook, which reflects the extensive monetary and fiscal supports that has been implemented in most jurisdictions to combat the effects of the COVID-19 crisis. In this manner, the analysis identifies the banks that face the highest reduction in regulatory capital from the credit default risk exposure of their loan portfolio relative to their safety buffer that strengthens their resilience. The amount of bank losses that can be absorbed by loan loss reserves is compared to the actual common equity Tier 1 (CET1) capital. Since the onset of the COVID-19 crisis, government loan guarantees have been implemented in many jurisdictions. Therefore, the effect of bank-specific policies is considered in this analysis in addition to extensive monetary and fiscal support measures. Simulations under each scenario are first performed adjusting for how the bank-specific mitigation policies may reduce the potential losses that a bank may face from assets exposed at potential risk of losses. Estimates have also been generated to reflect a scenario without government loan guarantees consistent with the conditions that prevailed during the past crisis. The purpose of this exercise is to assess the amount of CET1 capital buffers that may be eroded by loan losses not covered by reserves and the extent of a potential CET1 capital shortfall depending on the gradual severity in adverse scenarios, including the consequences of extensive monetary and fiscal support measures and the possible implementation of bank-specific mitigation policies.¹¹

Overall, this analysis is intended to support a greater understanding of how bank asset quality would deteriorate under hypothetical adverse economic conditions and the impact on bank resilience.¹² Under the Basel III regulatory framework, the Tier 1 capital ratio should be at least 4.5% of CET1 capital. CET1 capital represents the bank's core capital and is a measure of a bank's ability to withstand financial distress. Under prolonged severe disruption, the CET1 capital ratio may deteriorate and banks may enter in what may be called "caution" and "danger" zones (McKinsey, 2020a). In this analysis, banks may enter a

“caution” zone if the CET1 capital ratio falls between 7% to 5.5%. In fact, such decline would imply that banks must start to rebuild their capital cushions and comply with minimum capital conservation ratios. Also, banks may enter a “danger” zone if their CET1 capital ratio falls to 5.5% or below.¹³

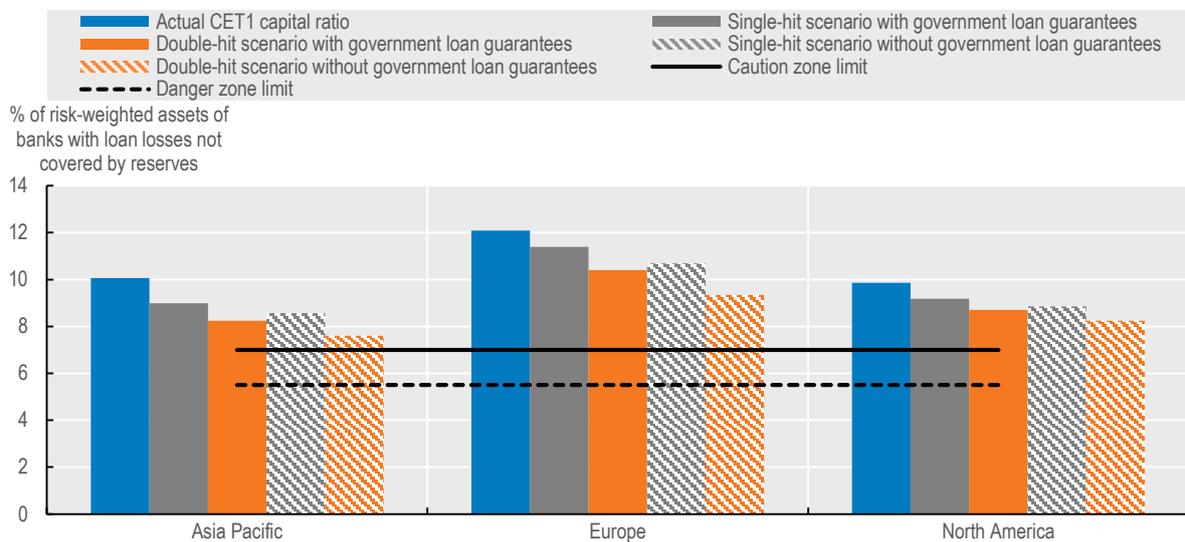
3.2. Results

The results of the simulation under a single-hit and double-hit scenarios show a decline in CET1 capital ratios in all regions (Figure 7) despite the extensive monetary and fiscal support measures implemented to combat the effects of the COVID-19 crisis. The magnitude of the deterioration in CET1 capital ratios indicated significant heterogeneity across regions and scenarios. Nevertheless, government loan guarantees could be expected to help reduce the decline of CET1 for banks in all regions.

Under the single-hit scenario, CET1 capital ratios could be expected to decrease by 0.7 to 1.1 percentage points depending on the region adjusting for bank-specific mitigation policies. Without government loan guarantees, the fall in CET1 capital ratios could be more substantial with declines ranging between 1 and 1.5 percentage points depending on the region. Nevertheless, CET1 capital ratio of banks in all regions would remain above the “caution” zone limit.

Under the double-hit scenario, CET1 capital ratios could be expected to decrease by 1.2 to 1.8 percentage points depending on the region adjusting for bank-specific mitigation policies. Under the most severe adverse scenario, CET1 capital ratios could fall by 1.6 to 2.7 percentage points depending on the region. CET1 capital ratios of banks in the Asia Pacific region in the simulation could be the lowest standing at 7.6%, a level that is slightly above the “caution” zone limit. CET1 capital ratios of banks in Europe or North America would remain more elevated at 9.3% and 8.2% respectively.

Figure 7. CET1 capital ratio under single-hit and double-hit scenarios and policy mitigation

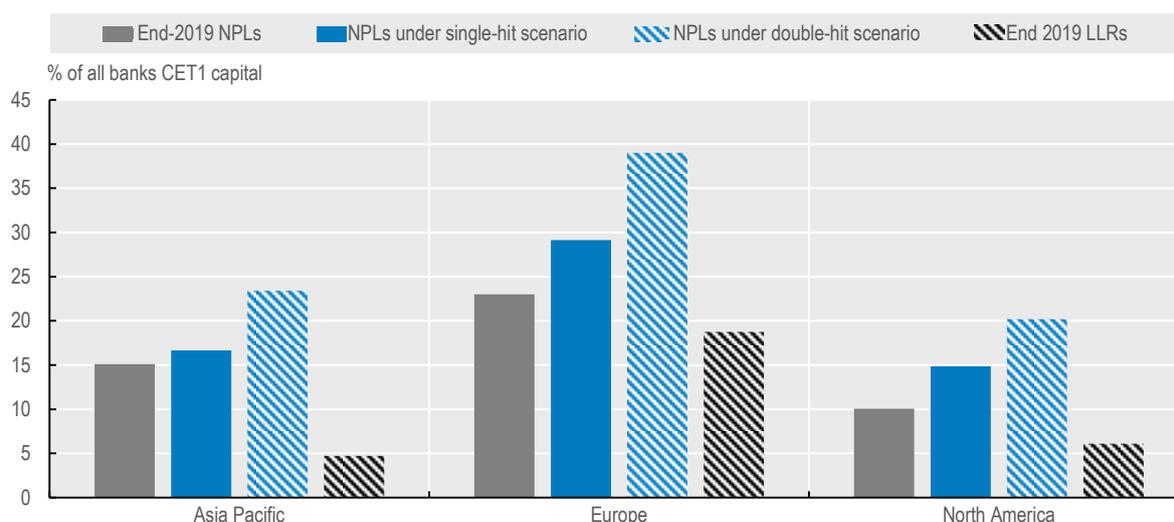


Note: This figure shows actual versus CET1 ratios calculated including loan losses not covered by reserves under single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook reflecting extensive monetary and fiscal supports that have been implemented following the COVID-19 crisis. Simulations under each scenario are performed with and without adjusting for the impact government loan guarantees. Further details about the methodology and underlying bank sample are provided in Annex B.

Source: Refinitiv, OECD calculations.

These results may be further complemented by examining the simulated NPLs in each region relative to existing loan loss reserves (Figure 8). For example, while banks in the Asia Pacific region hold similar levels of CET1 capital buffers to North American banks, the increase in NPLs would be offset to a lesser extent by actual loan loss reserves for banks in Asia Pacific compared to North American banks. While European banks are facing a substantial increase of their projected NPLs under the two scenarios, they benefit from higher CET1 capital buffers and loan loss reserves to mitigate the effect of deteriorating asset quality on their CET1 capital ratios.

Figure 8. Non-performing loans and loan loss reserves under single-hit and double-hit scenarios as a share of actual CET1 capital without government loan guarantees



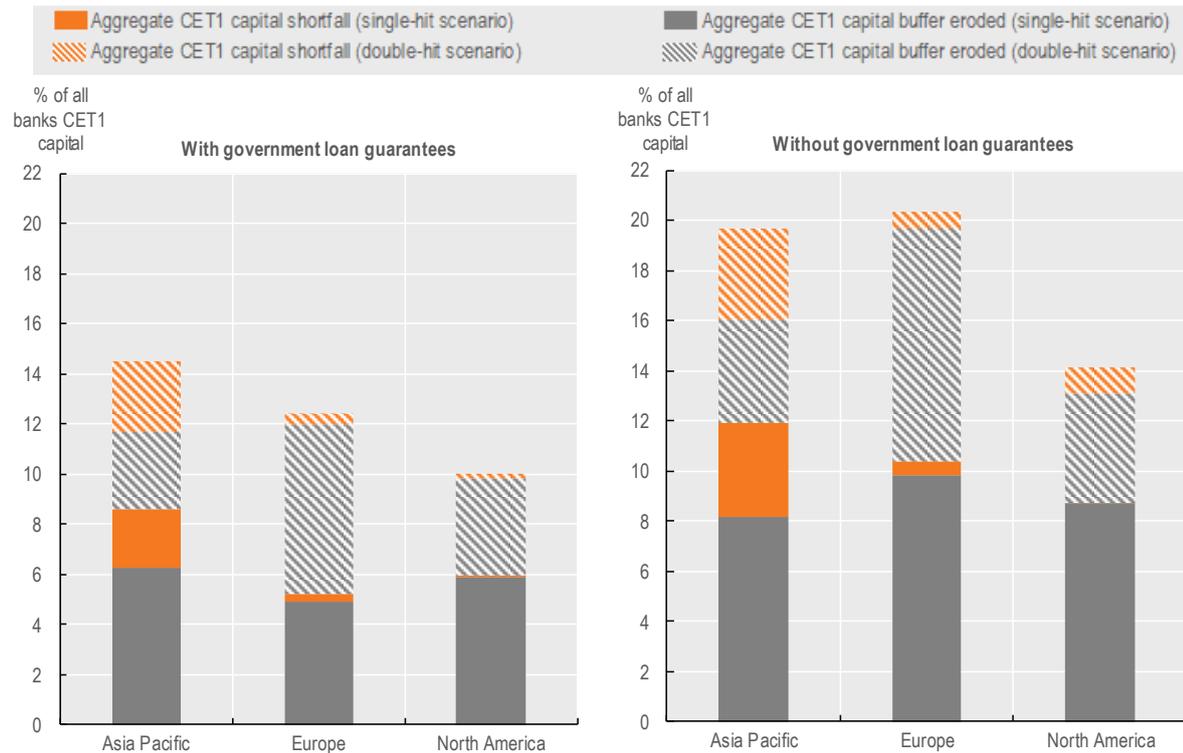
Note: This figure shows bank non-performing loans (NPLs) as a share of CET1 capital. NPL simulation analysis is performed considering single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook reflecting extensive monetary and fiscal supports that have been implemented following the COVID-19 crisis but not government loan guarantees. LLRs stand for loan loss reserves. Further details about the methodology and underlying bank sample are provided in Annex B.

Source: Refinitiv, OECD calculations.

Asset quality deterioration of banks in all regions would mostly result in CET1 capital buffer erosion under the two scenarios (Figure 9). Nevertheless, some banks would face substantial CET1 capital shortfalls.¹⁴ Estimates further show that government loan guarantees are effective to mitigate the negative impact of loan losses on capital for banks in all regions.¹⁵

These results suggest that among the banks that would face a capital reduction, for most banks their capital ratios would remain above regulatory minimums. However, within each region there would be a number of banks that could see their capital adequacy challenged. While the size of this tail depends on the severity of the crisis, and despite the policies that have been adopted by governments and central banks to dampen the negative impact of the COVID-19 crisis on real sectors, bank-specific policies in the form of loan guarantees have provided a second line of defence to ease pressure. The capital reduction due to the deterioration in bank asset quality is particularly concerning for the higher number of banks that are facing a capital shortfalls under the double-hit scenario.¹⁶ The banks that could get uncomfortably close to minimum capital levels in scenarios is tied to the effect COVID-19 pandemic on asset quality, therefore indicating a need to improve their financial soundness, starting with rebuilding at least part of their capital cushion (McKinsey, 2020a and 2020b).

Figure 9. Reduction in CET1 capital under single-hit and double-hit scenarios and policy mitigation



Note: This figure shows reduction in CET1 capital related to the erosion of the capital buffer versus the capital shortfall, expressed as a share of CET1 capital of all banks included in the sample by region. Calculations have been performed under single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook reflecting extensive monetary and fiscal supports that have been implemented following the COVID-19 crisis. Simulations under each scenario are performed with and without adjusting for the impact government loan guarantees. Further details about the methodology and underlying bank sample are provided in Annex B.

Source: Refinitiv, OECD calculations.

A strong capitalisation base is particularly important as markets have become increasingly aware of the importance of a capital cushion to withstand external shocks following the GFC. Banks are likely to struggle with capital formation due to falling revenues and profits following the COVID-19 crisis (ECB, 2020g). Given the scarcity of available capital, banks will most likely need to reduce their dividend payouts and stock buybacks and introduce compensation caps. After stress tests found that several banks could get uncomfortably close to minimum capital levels in scenarios tied to the COVID-19 pandemic, the Federal Reserve has put restrictions on US banks regarding share buybacks and dividend payments in 2020 (FED, 2020c and 2020d). The ECB has called banks not to pay dividends and to suspend share buy backs until January 2021. In addition, the ECB expects banks to exercise extreme moderation on variable remuneration to conserve capital in crisis (ECB, 2020d).¹⁷ Higher solvency risk may also complicate equity issuance to restore regulatory capital ratios. Therefore, financial authorities may need to help the most vulnerable banks in strengthening their capital base to mitigate a potential increase in systemic risk triggered by the financial distress of a single or a couple of vulnerable banks. This could prevail in banking systems already facing high NPLs before the COVID-19 crisis and that are likely to be severely impacted by the economic shock with a high expected increase in NPLs.

Overall, these simulations show that aggregate capital ratios of the banking systems analysed would remain above regulatory minimums even if the capital buffers accumulated as a result of the regulatory reforms introduced after the GFC may be substantially eroded due to the deterioration in bank asset quality. Nonetheless, results vary considerably across individual banks. In fact, while aggregate capital ratios

remain above regulatory minimums within regions, there is a weak tail of banks that could see their capital adequacy challenged. The results of this analysis suggest that bank-specific measures in the form of government loan guarantees combined with monetary and fiscal support measures help ease banks' challenges amid the COVID-19 crisis. Therefore, the extent to which the announced guarantee programs are used could be an important driver of bank solvency positions and resilience, in particular for the higher number of banks that are facing a capital shortfall under adverse conditions. Looking ahead, the benefits of monetary and fiscal support measures and government loan guarantees in easing banks' capital constraints to maintain the flow of credit to the real economy should be carefully balanced against their potential medium-term risks (IMF, 2020b). In fact, phasing out support measures, including government loan guarantees too quickly would lead to a delay in economic recovery. However, phasing it out too late could also risk damaging public finances and unduly support credit conditions for already distressed highly leveraged borrowers. These decisions that will need to be taken by policy makers will have major implications for bank asset quality and resilience. It is thus important that some of these measures be carefully phased out as the economy recovers.

Policy makers should pay particular attention to their communication strategy and the quality of the information released to strengthen confidence in the banking system and ensure overall stability (FSB, 2020). The banking sector would benefit from clarity and stability on the time horizon afforded to them by authorities to make use of temporary monetary and fiscal support measures and government loan guarantees. For example, this would enable banks to carry out better capital planning that may also improve in turn buffer usability at the current juncture.

4 Potential impact of rising bank loan losses for the conversion of contingent convertible bonds

This section will assess to which the erosion of bank CET1 capital due to the deterioration in asset quality may lead to the conversion of contingent convertible bonds (CoCos). This analysis is intended to assess the amount of CoCos that may be triggered due to substantial loan losses not covered by reserves. The objective is to investigate the effectiveness of CoCos to provide banks an additional source of equity following the deterioration of the capital base due rising NPLs.

4.1. Background and historical trends in bank contingent convertible bond issuance

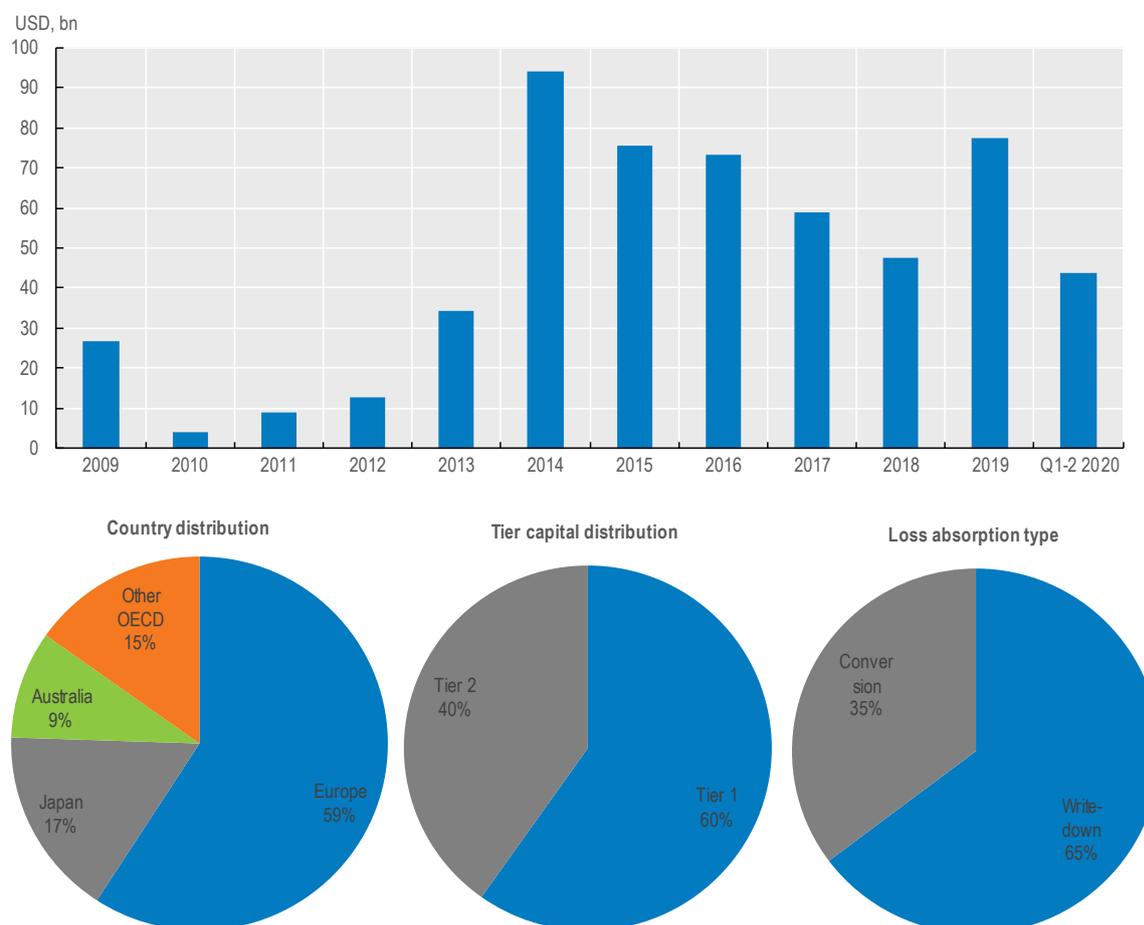
During the GFC, many banks experienced capital shortfalls to the extent that regulators had to accept bailout resolutions as the only possible stabilizing form of intervention.¹⁸ In addition to more stringent bank capital and liquidity requirements, regulators have also created new instruments to facilitate the write-down of the debt of distressed institutions.¹⁹ One tool to achieve this objective is through the issuance of contingent convertible capital securities (CoCos) to meet part of their regulatory capital requirements. CoCos are similar to equity capital in that they can strengthen banks' capital positions under stressed conditions,²⁰ i.e. when issuing equity may be difficult.²¹ The Basel III regulatory framework includes specific contingent capital elements that have brought some homogeneity in CoCo design across jurisdictions.

Following gradual implementation of the Basel III accords, banks in a number of jurisdictions responded by raising a substantial amount of capital in the form of CoCo issuance. Between 2009 and second quarter of 2020, banks in OECD economies issued a total of USD 450 billion in CoCos (Figure 10), with European banks representing nearly 60% of total issuance. Also, 60% of CoCos issued could qualify as Additional Tier 1. Therefore, CoCo conversion would help strengthening bank's ability to withstand financial distress by increasing the core capitalisation base that is formed of Tier 1 capital. Besides, 63% of CoCos issued allow banks to raise equity by incurring a write-down instead of converting into equity.²² In fact, loss absorption mechanisms of CoCos are made up of two types. A conversion to equity CoCo increases CET1 capital by converting into equity at a pre-defined conversion rate. By contrast, a principal writedown CoCo raises equity by incurring a write-down.

4.2. Assessment of contingent convertible bonds that may be triggered due to the deterioration in bank asset quality

The capacity of banks to absorb higher loan losses is likely to deteriorate depending on the severity of the COVID-19 crisis and the magnitude of the rise in NPLs. Therefore, regulatory capital ratios may be eroded by loan losses not covered by reserves and may cause the conversion of CoCos into loss-absorbing equity.

Figure 10. Contingent convertible bond issuance of banks in OECD economies, 2009-2020



Note: The top panel figure shows contingent convertible bond (CoCo) issuance by banks in OECD economies since January 2009 until the end of second quarter 2020. Assessment of bank CoCo issuance has been performed using CoCo bond data issued by individual banks in OECD countries since 2009 from Refinitiv. CoCos qualified as either Additional Tier 1 or Tier 2 capital are included regardless of their loss absorption mechanism (i.e., conversion to equity or principal write-downs). However, CoCos that are classified as preferred shares are excluded. Detailed about the data and the methodology are provided in Annex C.

Source: Refinitiv, OECD calculations.

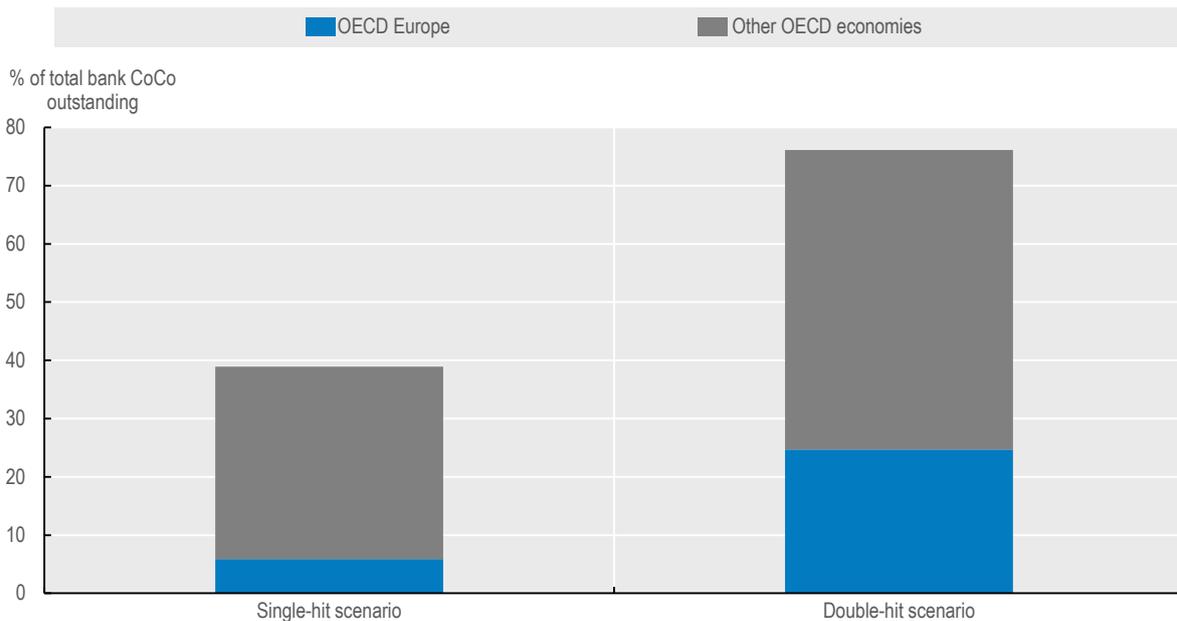
To assess the effectiveness of CoCos in providing banks an additional source of equity following the deterioration of the capital base due to rising non-performing assets, an analysis is performed to determine the extent of CoCos that would be triggered under stressed conditions. This analysis questions, among the banks that are issuing CoCos, what extent of CoCos would likely be converted into loss absorbing equity.²³ To assess the maximum amount of CoCos that may be converted into equity, estimates are performed under most adverse conditions in the absence of government loan guarantees. Overall, this analysis is intended to provide a greater understanding of how banks facing an erosion of their capital base may rely on their CoCos to strengthen their resilience and potentially address capital adequacy issues. It should be noted that CoCos are not the only instrument that help addressing bank capital depletion. Notably, the European resolution framework introduced by the Bank Recovery and Resolution Directive (Official Journal of the European Union, 2014) allows the conversion of a much larger class of liabilities

than additional Tier 1 and Tier 2 capital (including non-preferred senior debt and even uninsured deposits) under conditions (i.e., “likely to fail”) which could be triggered prior to the CoCos conversion threshold.

4.3. Results of the analysis

Figure 11 offers an overview of the extent of CoCos conversion under a single-hit versus double-hit scenario. The share of CoCos converted into loss absorbing equity in total outstanding would be lower for European banks than for banks in other OECD economies. Notably, the amount of CoCos converted into loss absorbing equity for European banks ranges between 6% and 25% of total CoCos outstanding under a single-hit versus double-hit scenario while it varies between 33% and 51% for banks in other OECD economies. These findings suggest that European banks benefit from their substantial CET1 capital buffer in line with the discussion in the previous sections. Therefore, the reduction in their CET1 capital due to the deterioration of their asset quality leads to a limited number of CoCos to be converted into loss absorbing equity. Also, the capital depletion of banks in other OECD economies would result in a higher number of CoCos converted into equity that could help them strengthening their capital base as their actual CET1 capital buffers are lower than those of European banks.

Figure 11. Share of contingent convertible bonds converted into loss absorbing equity following the deterioration in bank capital in total outstanding under single-hit and double-hit scenarios



Note: This figure shows the amount of CoCos that maybe triggered following a deterioration of CET1 capital ratio due to the rise in NPLs under single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook. Only the banks in OECD economies (excluding the United States) are included in this sub-sample (i.e., 130 banks). Asset quality simulation analysis framework is detailed in Annex B. Assessment of bank Coco outstanding has been performed using Coco bond data issued by individual banks in OECD countries since 2009 from Refinitiv. Detailed about the data and the methodology are provided in Annex C.

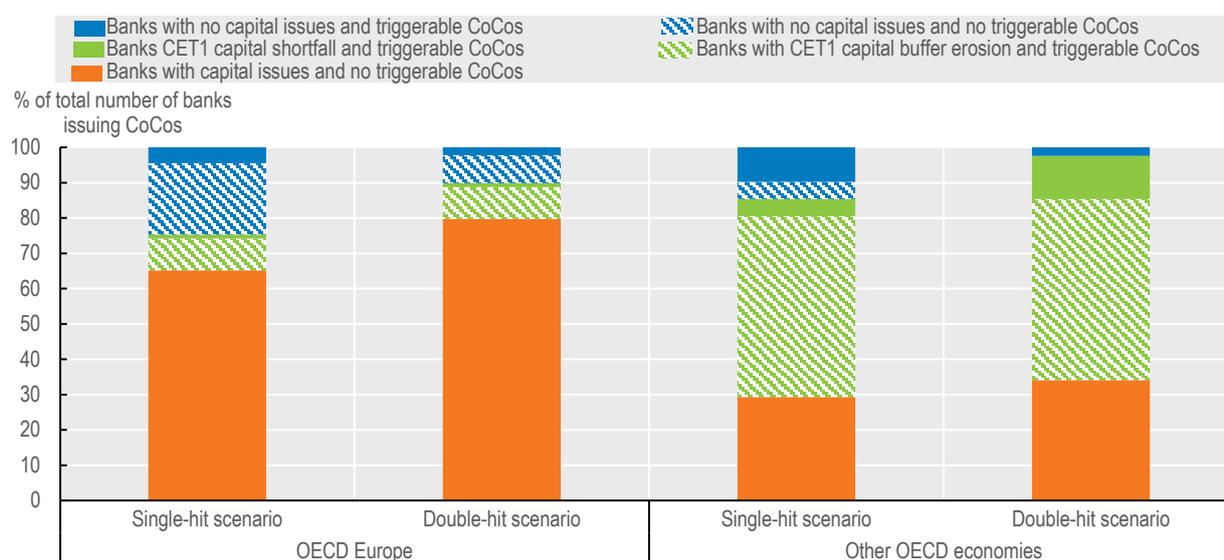
Source: Refinitiv, OECD calculations.

Deeper investigation shows that only a small portion of banks that face a CET1 capital shortfall in OECD economies would be able to trigger their CoCos (Figure 12). Also, a large portion of European banks facing reduction in their CET1 capital would not need to convert their CoCos into loss absorbing equity compared to banks in other OECD economies. These results may be explained by the fact that European banks hold

substantial CET1 capital buffers and capital depletion remains too small to trigger CoCos conversion. These findings suggest that the impact of CET1 capital deterioration is expected to be limited for European banks, which would cause the CoCos of only a small portion of banks to be triggered to help them strengthening their capital base during a crisis. Therefore, the combined negative impact of the deterioration in bank asset quality and limited effectiveness of CoCos to help certain banks strengthen their capital base would require regulators to facilitate the resolution of high NPLs. Nevertheless, a much higher share of banks that may face an erosion of their CET1 capital buffers in other OECD economies would be able to trigger their CoCos compared to European banks. Therefore, CoCos conversion would help these banks in other OECD economies to strengthen their CET1 capital buffer and resilience throughout a crisis.

If conditions deteriorate further, capital depletion of a higher number of banks would increase in the scenario analysis, leading more CoCos to be converted into loss absorbing equity. Nevertheless, the conversion of CoCos into loss absorbing equity may be associated with notable downside risks (Glasserman and Perotti, 2017). CoCos issuers may face liquidity risk following a partial principal write-down. In fact, bondholders would lose a certain amount of the face value and the issuer would have to fund the remaining cash pay-out while in distress. Also, CoCos issuers may experience substantial dilution of existing equity holders with a conversion-to-equity loss absorption mechanism that is based on the market price of the stock at the time the trigger is breached, a pre-specified price (often the stock price at the time of issuance) or a combination of the two options.²⁴ Rising contagion risk in the case that CoCos would need to be triggered following negative bank capital impacts of the COVID-19 crisis is weakening banks' incentives to use CoCos to strengthen resilience. In practice, CoCos introduce considerable complexity with potential destabilising consequences on financial markets in the case of conversion (i.e., Goodhart 2010, Admati et al. 2013, Allen 2012) and could contribute to financial stability risks in the event of cross-market contagion (Bologna et al., 2018; Patalano and Roulet, 2020). The market turbulence around Deutsche Bank's CoCos in early 2016 illustrates this issue.

Figure 12. Distribution of banks according to the state of deteriorated capital base and the conversion of contingent convertible bonds



Note: This figure shows the share of banks according to the state of deteriorated capital base and their ability to trigger their CoCos under single-hit versus double-hit scenario informed by in the OECD 2020 Economic Outlook. Only the banks in OECD economies (excluding the United States) are included in this sub-sample (i.e., 130 banks). Asset quality simulation analysis framework is detailed in Annex B. Assessment of bank Coco outstanding has been performed using Coco bond data issued by individual banks in OECD countries since 2009 from Refinitiv. Detailed about the data and the methodology are provided in Annex C.

Source: Refinitiv, OECD calculations.

5 Assessment and high level policy considerations

The impact of the COVID-19 pandemic has already brought major economic disruptions globally and the economic consequences are now having unprecedented effects. If this situation persists, solvency risk of corporates and households would rise substantially with detrimental effects on bank NPLs. Empirical evidence suggests that policies adopted by governments and central banks have helped ease banks' challenges amid the COVID-19 crisis and mitigate the increase in bank NPLs in both advanced and emerging market economies. Nevertheless, high heterogeneous projected NPL ratios across countries reflect that some economies are expected to be more negatively impacted than others. A weaker than expected economic recovery, premature end or insufficient monetary and fiscal support measures to mitigate negative consequences of the several waves of the pandemic along with growing vulnerabilities in the non-financial private sector may also entail higher bank NPLs.

Guarantees and moratoria appear to have lengthened the time it takes for weak economic performance to translate into credit losses and NPLs for banks (ECB, 2020g). Notably, loan forbearance measures aimed at easing financial constraints on debtors and banks have been implemented in the United States under the Coronavirus Aid, Relief, and Economic Security (CARES) Act and in the European Union (EBA, 2020c) following the COVID-19 crisis.²⁵ In some jurisdictions, mortgage payments have completely paused for a period of time or even the terms and conditions of the loan contract may be modified (i.e. loan restructuring) to avoid the debtor to default.²⁶ Nevertheless, under the new terms of the loan contract or at the end of the loan payment suspension period, the debtor would not be able to meet his commitments and the exposure will be considered as non-performing resulting in loan losses for the lender. These measures will help to avoid defaults on certain amounts of performing and non-performing loan exposures, or at least delay loan defaults. More defaults are likely to be avoided if loans under forbearance are performing exposure. The effectiveness of these measures would depend on the evolution of economic conditions and the extent to which future waves materialise eroding further the credit quality of debtors.

The combination of worsening economic conditions and rising NPLs are likely to weaken banks' loss absorption capacities. Despite the mitigating effect of government policies, the capital reduction due to the deterioration in bank asset quality would be particularly concerning for the larger number of banks that are facing a capital shortfall under the double-hit scenario. Measures taken by financial authorities would help the most vulnerable banks strengthen their capitalisation to mitigate a potential increase in systemic risk triggered by the financial distress of a single or a couple of vulnerable banks. Particularly, in banking systems already facing high NPLs before the COVID-19 crisis and that are likely to be severely impacted by the economic shock with high expected increase in NPLs.

In the aftermath of the GFC, NPLs have been a major concern for supervisors, policymakers and market participants particularly in the European Union (EBA, 2019). In July 2017 the Council of the European Union published a comprehensive action plan to address legacy assets in the region (European Council, 2019). Several approaches may be considered for bank NPL resolution (ECB, 2017; BIS, 2017a, 2020a) that consist either of internal recovery options (i.e., loan write-offs, decentralised asset management company, asset protection schemes) or market-based solutions (i.e., direct sales, securitisation, centralised asset management companies). Despite substantial improvements, legacy assets remain

material in a few countries (EBA, 2019). In light of weakening economic conditions following the COVID-19 pandemic, the problem of bank NPLs is likely to worsen in countries that were already facing high NPLs before the COVID-19 crisis and to become more acute otherwise. In this context, banks should closely monitor their asset quality to identify any possible deterioration, especially in riskier segments, and to continue to actively manage NPLs from their balance sheets. Ultimately, efficient solutions for dealing with NPLs would help originating banks to focus on supporting the future productive output of the real economy.

Banks appear to have started to address some challenges as a result of the COVID-19 pandemic. Notably, many banks have strengthened their cost-cutting efforts further reducing the number of staff and branches, but low profitability may hinder the meeting of digital transformation needs (ECB, 2020g). Consolidation via mergers and acquisitions could be one potential avenue for reducing overcapacity in the sector. Planned domestic and across border mergers in addition to a number of already completed deals in some countries in 2020 provide an encouraging sign (Financial Times, 2020). In parallel, banks face increasing urgency to manage the implications of environmental challenges and the transition to a greener economy. Therefore, in this case medium-term risks may arise particularly for the banks heavily exposed to sectors with high carbon emissions.

The lack of efficient solutions to deal with the erosion of bank capital may trigger balance sheet adjustments due to deleveraging with negative consequences for the real economy. Banks experiencing capital shortfalls are likely to decrease lending relatively more (ECB, 2019; BIS, 2020b). Substantial contraction in credit supply may lead to a lack of funding sources in particular for corporates and low credit quality households, which typically represent the riskiest segment of a bank's loan portfolio. All this may contribute to depress consumption, investment and economic growth. It may also boost alternative sources of lending that are subject to less regulatory scrutiny possibly resulting in higher financial stability risk. Lastly, many of the COVID-19 programmes supported by the government rely on banks to grant the loans (OECD, 2020b). If banks are facing greater challenges and become risk adverse, reducing their credit supply, it could further constrain government efforts to channel crisis lending to the real economy.

Looking ahead, the benefits of monetary and fiscal support measures and government loan guarantees in easing banks' challenges amid the COVID-19 crisis should be carefully balanced against their potential medium-term risks. Establishing effective exit strategies from COVID-19 financing support programmes is an imperative for policymakers and will be important to ensure that when borrowing conditions normalise it does not result in a significant increase in NPLs. Including through loan foreclosure incentives for banks as the termination of guarantees approach, which would reduce collateral values for loans, thus increasing banks' risk of holding NPLs. Therefore governments may want to closely monitor measures to support insolvent but viable companies that benefited from direct lending from the government (or from guaranteed lending) in restructuring their debt going forward. In addition measures such as implementing extensions to repayment, or thresholds for debt repayment depending on the annual turnover and growth of companies, allowing them to repay debt at a lesser burden, and strengthen corporate solvency and mitigate a significant increase in bank NPLs (OECD, 2020e). The decisions that will need be taken by policy makers will have major implications for bank asset quality and resilience. Therefore, policy makers should pay particular attention to their communication strategy and the quality of the information released to strengthen confidence in the banking system and ensure overall stability.

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Annex A. Non-performing loan projection model following the COVID-19 crisis

The COVID-19 pandemic has caused an unprecedented health and humanitarian crisis and the outlook is uncertain (OECD, 2020c; OECD, 2020d). A prolonged severe disruption, characterised by a continuation of weaker earnings and poorer corporate and household debt performance, could negatively affect bank asset quality. Therefore, banks are likely to face a substantial increase in non-performing loans due to the rise in household and corporate defaults.

Predicting NPL ratios under a single-hit versus a double-hit scenario informed by the OECD 2020 Economic Outlook (OECD, 2020c) would be relevant to evaluate the extent to which banks will be impacted, and how this may impact banking systems across OECD economies. Macro scenarios implicitly incorporate the effects of broad macroeconomic and monetary policy interventions that have been implemented in many jurisdictions since the onset of the pandemic in 2020, including interest rate cuts, unconventional monetary policies, fiscal measures, social safety net packages, and other policies that support the real economy. By improving the liquidity of borrowers, these policies indirectly affect the condition of banks. While these two scenarios provide a broad assessment of the potential paths of the pandemic and its impact on the real economy, uncertainty remains given the unprecedented nature of the shock.

Considering major advanced and emerging market economies, the projected NPL ratio is compared to latest NPL ratio (i.e., at end-2019) and observed ratios during the GFC or the European sovereign debt crisis. This annex will describe the OECD single-hit versus double-hit scenarios and outline the empirical simulation model.

OECD single-hit and double-hit scenarios

Given such level of uncertainty, two scenarios have been postulated in the OECD 2020 Economic Outlook for 2020 and 2021:

Under *the single-hit scenario*, containment measures are assumed to successfully overcome the outbreak with no expected resurgence in infections and intensive cases later in 2020 (and until a vaccine becomes available). This scenario has already proven to be optimistic for some economies as the resurgence of COVID-19 cases and renewed lockdowns occurred since October 2020 in some parts of the world.

Under *the double-hit scenario*, easing of containment measures is assumed to be followed by a second, but less intensive, virus outbreak taking place in October or November 2020. Further outbreaks in 2021 are assumed to be avoided due to pharmaceutical breakthroughs, but these remain a significant downside risk. These assumptions are supported by economic developments as the aggregate economic impact of renewed restrictions appears lower than during the first wave of the virus, but job-rich service activities with high levels of social interactions are being hard-hit once again, raising risks of bankruptcies, higher unemployment in the absence of extended policy support (OECD, 2020d).

In June 2020, the OECD warned that the global recession would be the deepest since the Great Depression with some differences across countries.²⁷

Under the single-hit scenario, average declines of 8% and 6% in real GDP growth are expected in 2020 in major advanced and emerging market economies respectively. Also, unemployment is expected to reach 8.5% and 11% on average in 2021.

Under the double-hit scenario, average declines of 10% and 8% are expected in 2020 in major advanced and emerging market economies respectively. Also, unemployment is expected to reach 9.1% and 13% on average in 2021.

The model

Using macroeconomic panel data for a global sample of 37 countries,²⁸ a parsimonious model has been used including indicators that capture the impact of macroeconomic and macrofinancial conditions that may influence the ability of borrowers from the private sector (i.e. corporates and households) to repay their loans and respond to economic shocks (IMF, 2014; Staehr and Uusküla, 2017; Bonaccorsi di Patti and Cascarino, 2020; Heppe, 2020). The dependent variable is the ratio of non-performing loans to total loans.²⁹ Equation (1) shows the estimated linear panel regression model:

$$NPL_{i,t} = v_i + \beta_1 RGDP_{i,t} + \beta_2 DisplIncome_{i,t-1} + \beta_3 Leverage_{i,t-1} + \beta_4 LoansGrowth_{i,t-1} + \beta_5 InterestRate_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

NPL is the ratio of non-performing loans to total loans. The change in the ratio is used in the regressions to revolve non-stationarity of the dependent variable. In fact, the dynamics of the NPL ratio is affected by NPL flows and by the time required for loans to exit the NPLs stock following a shock (Bonaccorsi di Patti and Cascarino, 2020). The NPL ratio tends therefore to still be relatively low at the beginning of a crisis, while remaining high for some time after the economy starts to recover. Country-level annual data for NPL ratios are from the IMF Financial Soundness Database. For most countries included, NPL ratios series start in 2005. Therefore, estimations are run over the period of 2005-2019 for the panel to be balanced to provide estimates based on historical information related to an extensive sample of countries.

RGDP is the annual growth rate of real GDP. GDP growth depicts the dynamics of borrowers' income and is expected to be negatively related to default rates and bank NPL ratio. In the context of the COVID-19 crisis, it is expected to be a good proxy for corporate income growth as corporates do not benefit from direct government support and the impact of deteriorating economic conditions tends to materialise shortly on their actual earnings.

The one year lagged value of household disposable income growth (*DisplIncome*)³⁰ is used because unemployment benefit programmes and crisis measures (i.e., like payment holidays) are delaying the impact of deteriorating earnings of households on banks' reported NPLs. This indicator is calculated as the annual percent change in household disposable income and should anticipate the NPL ratio with a negative coefficient.

The one year lagged values of non-financial firms' leverage, the annual percent change in aggregate bank lending and long-term interest rate, reflect the impact of past firm's financial fragilities and credit conditions on banks' reported NPLs. The aggregate leverage of non-financial firms (*Leverage*) is the ratio of total debt to total assets calculated using Refinitiv country equity benchmarks including non-financial listed firms only. A highly leveraged corporate sector implies that corporates are more vulnerable to macroeconomic shocks that could precipitate defaults, aggravating the bad loan problem in banks. Therefore, a positive sign is expected for the related coefficient of this variable in the determination of bank NPL ratio.

The annual percent change in aggregate bank loans (*LoansGrowth*) is calculated using aggregate country data of bank credit to the private non-financial sector (i.e., including corporates and households) from the Bank for International Settlements. As shown by several studies focusing on credit cycles (Chavan and

Gambacorta, 2016; Jiménez and Saurina 2006), fast credit growth may lead to an adverse selection and be associated with an increase in credit risk. Therefore, a positive sign is expected for the related coefficient of this variable in the determination of bank NPL ratio.

The impact of long-term interest rate (*InterestRate*)³¹ is introduced in the model. In fact, banks adjust rates in response to changes in credit risk and an increase in interest rates on new loans could anticipate future changes in loan defaults. Also, interest rates incorporate bank funding conditions; to the extent that rising rates capture tightening credit supply, they could be anticipating a negative credit supply shock, which in turn increases the insolvency of borrowers that need to refinance their loans. Therefore, a positive sign is expected for the related coefficient of the long-term interest rate in the determination of bank NPL ratio. Real GDP, household disposable income and long-term interest rate data are from the OECD National Account Database.

A pooled model is estimated for advanced and emerging market economies including country fixed effects. v_i are country-specific fixed effects (i.e., intercepts). The β are regression coefficients, t indicates the year, i the country and ε is the error term. Therefore, estimates provide the average effect of macroeconomic factors on NPLs by country. The introduction of a broad set of macroeconomic indicators helps to mitigate possible omitted variable biases when estimating a common relationship across countries, and better control for country specificities.³² In addition, the variety of macroeconomic indicators helps to account for the fact that the response to economic shocks is not constant over time and better control for the impact of structural shocks over the period 2005-2019. A static panel model is used to account for the fact that economic shocks are felt sooner and stronger compared to a dynamic panel model. Staehr and Uusküla (2017) reference a number of other studies of the NPL ratio which are more focused on inference than forecasting.

Descriptive statistics of the variables included in the model and regression results are shown in tables A1.1 and A1.2. Regression results are consistent with findings from previous literature. All indicators are significant and the sign of their related coefficients are as expected.

Table A A.1. Descriptive statistics of variables included in the model, 2005–2020

	Mean	Median	Maximum	Minimum	Standard deviation
NPL	3.94	2.68	45.57	0.08	5.35
RGDP	2.65	2.32	15.12	-3.76	2.59
DisplIncome	6.00	4.75	38.49	-8.56	6.02
Leverage	60.49	60.45	82.29	31.71	9.05
LoansGrowth	6.46	4.48	62.04	-33.76	14.61
InterestRate	4.68	4.09	16.81	-0.36	3.23

Note: All variables are computed using aggregate country data and are expressed in percentage. NPL: bank non-performing loan ratio; RGDP: annual real GDP growth rate; DisplIncome: annual growth rate of household disposable income; Leverage: non-financial firms' debt to total assets ratio; LoansGrowth: annual percent change in bank loans to the private non-financial sector.

Source: IMF Financial Soundness Indicators Database, BIS Credit to the non-financial sector database, OECD National Account Database, Refinitiv, OECD calculations.

Table A A.2. Determinants of a bank's NPL ratio, 2005–2020

	[1]
RGDP	-0.26*** (-8.39)
DisplIncome	-0.05*** (-2.75)
Leverage	0.03* (1.86)
LoansGrowth	0.003* (1.77)
InterestRate	0.22*** (5.84)
C	-1.63* (-1.83)
N	440
R-square	0.33
F-statistic	4.80
Prob(F-statistic)	0.00

Note: This table shows the results of estimating Equation (1) using standard OLS global sample of 37 countries over the period 2005–2020. Country-specific fixed effects are included in the regression and the one-year lagged value of all explanatory variables is used, except for the annual real GDP growth rate. See Table A1.1 for the definitions of the variables included in the regression framework. Standard errors are robust from heteroskedasticity. * Indicate statistical significance at the 10 percent level. ** Indicate statistical significance at the 5 percent level. *** Indicate statistical significance at the 1 percent level. Student-t statistics are reported in parentheses.
Source: OECD calculations.

The objective of this analysis is to perform a simulation analysis of bank NPL ratio applying the shock of the COVID-19 crisis to assess the potential rise in bank NPLs depending on the possible evolution of the global economy. Simulations are performed under the single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook assuming extensive monetary and fiscal support measures that have been implemented following the COVID-19 crisis versus without support measures consistently with conditions that prevailed during past crisis. Projections of NPL ratios are calculated using OECD forecasts for real GDP, household disposable income growth and long-term interest rate under the single-hit versus double-hit scenario. Also, 2019 values of non-financial firm leverage and bank loan growth have been used because OECD forecasts are not available for these indicators.³³ Without extensive monetary and fiscal support, expected minimum rates in 2020 or 2021 of real GDP growth, household disposable income growth and maximum long-term rate are considered to reflect the overall negative impact of the COVID-19 pandemic for corporates and households, i.e. both facing lower earnings prospects due to deteriorated economic conditions and rising unemployment. Alternately, average OECD projected rates on 2020 and 2021 are used to reflect the effectiveness of extensive monetary and fiscal support measures implemented to mitigate the impact of the COVID-19 crisis on economic conditions.

At a time of great uncertainty, achieving accurate macroeconomic forecasts and models is even more challenging than usual (Heppe, 2020). In any scenario, several factors could influence the impact (Mc Kinsey, 2020a). In fact, economic conditions and the effective default rates of companies could be worse than those currently expected, given the unprecedented nature of this crisis. Also, banks in many countries benefit from direct government support such as moratoria and credit guarantees that may help to avoid defaults on certain amounts of performing and non-performing loan exposures, or at least delay loan defaults. Other indirect support measures from governments and supranational institutions may also help to further alleviate the extent of the shock on the real economy. Nevertheless, these factors are difficult to measure empirically and therefore this model does not include the impact of such factors. Therefore, this analysis is designed to assess the magnitude of the potential rise in bad quality assets based on hypothetical scenarios rather than forecast estimates.

Annex B. Simulation analysis of non-performing loans and impact on banks' ability to absorb loan losses

The sensitivity of banks' capacity to absorb higher loan losses due the deterioration of their asset quality and a substantial rise in NPLs is examined by performing a simulation analysis applying the shock of the COVID-19 crisis. A four-step analysis is performed to calculate the amount of the regulatory capital buffer that may be eroded by loan losses not covered by loan loss reserves and the extent of a potential regulatory capital shortfall.

In the first step, the magnitude of the increase in NPLs is defined under the single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook reflecting extensive monetary and fiscal supports that have been implemented following the COVID-19 crisis. Bank NPLs are expected to rise by the NPL multiple of the bank's country of incorporation.³⁴ This approach enables to consider the magnitude of the impact of the COVID-19 outbreak that differs across countries. This means that depending on their location, banks are not facing similar risk of increase in their NPLs.

A second step consists in converting NPLs into loan losses³⁵, by adjusting the amount of NPLs for loss given default (LGD). Since the onset of the COVID-19 crisis, government loan guarantees have been implemented in many jurisdictions. While government loan guarantees are not impacting the amount of assets exposed at potential risk of losses, they may influence the potential losses that a bank may face from assets exposed at potential risk of losses. In fact, government loan guarantees are affecting the loss given default (LGD) by reducing the loss that a bank experiences when a borrower defaults. As suggested and consistently with the IMF approach (IMF, 2020b), when such guarantees are implemented, an LGD that prevails in normal times is used. Unfortunately, cross-country data on LGD are limited. In the existing literature, estimates suggest that for the United States, average LGD for unsecured bank loans over the period 1970–2009 was about 60% in normal times (Schuermann 2004; Altman et al., 2006; Shibut and Singer, 2014; Johnston Ross et al., 2015). Alternately in the absence of government loan guarantees, an LGD during crisis times is used. Consistently with Dagher et al. (2020), an LGD of 75% is used in this study.

In the third step, the amount of bank losses that can be absorbed by actual loan loss reserves are calculated. The aim is to assess the extent of gross amount of bad assets that may be absorbed by the safety buffer a bank holds to mitigate the consequences of losses following a wave of defaults. The formula that converts loan losses during a crisis period into capital needed to absorb them is:³⁶

$$\text{Capital needed} = (\text{Non performing loans} * \text{Multiple increase}_{NPL} * \text{LGD}) - \text{Reserves for loan losses}$$

Under the Basel III accords, banks must comply with capital standards through minimum requirements (BIS, 2011, 2017c). The GFC demonstrated that credit losses and writedowns come out of retained earnings, which is part of banks' tangible common equity base. Therefore, it is critical that banks' risk exposures are backed by a high quality capital base. The Basel III accords introduced a regulation that requires banks to maintain minimum total regulatory capital ratio of 8% (of risk-weighted assets) and Tier 1 capital ratio of 6%. The Tier 1 capital ratio should comprise at least 4.5% of common equity Tier 1 (CET1) capital. CET1 capital represents the bank's core capital³⁷ and is a measure of a bank's ability to withstand financial distress. A capital conservation buffer of 2.5%, comprised of CET1 capital, is established above the regulatory minimum CET1 capital requirement (BIS, 2019). Capital distribution constraints will be imposed on a bank when capital levels fall between 7% to 4.5% that consist for the bank to conserve

minimum retained earnings ratio in the subsequent payment period (i.e., pay out no more than a given share of earnings in terms of dividends, share buybacks and discretionary bonus payments). Most banks hold an amount of capital that exceeds the minimum imposed by regulation.

Following the COVID-19 crisis, bank-specific capital measures have been implemented in many jurisdictions. Within the risk-based capital framework, the countercyclical capital buffer (CCyB) for Tier 1 capital has been reduced in many jurisdictions to alleviate regulatory capital constraints of bank credit supply and to support further lending to businesses and households for a prompt economic recovery (BIS, 2020c; ESRB, 2020; IMF, 2020b). Nevertheless, requirements for the capital conservation buffer (CCoB) for CET1 capital have not been modified following the COVID-19 crisis (RBA, 2020; Kleinnijenhuis et al., 2020). This implies that banks have some flexibility toward the fluctuation of their Tier 1 capital, at least if standing above the 8% regulatory minimum requirement of RWA. However, banks should comply with minimum conservation buffer if CET1 capital ratio is falling below 7%. Under prolonged severe disruption, CET1 capital ratio may deteriorate and banks may enter in what may be called “caution” and “danger” zones (Mc Kinsey, 2020a). In this analysis, banks may enter a “caution” zone if CET1 capital ratio would fall between 7% to 5.5%. In fact, such decline would imply that banks must start to rebuild their capital cushions and have to comply with minimum capital conservation ratios.³⁸ Also, banks may enter a “danger” zone if their CET1 capital ratio is falling at 5.5% and below.³⁹ Therefore, the fourth step consists in comparing capital needed and actual CET1 regulatory capital to assess the amount of CET1 capital buffer that may be eroded by loan losses not covered by reserves and the extent of a potential CET1 capital shortfall. The amount of eroded CET1 capital buffer is calculated as the difference between actual CET1 capital buffer and capital needed to absorb loan losses not covered by reserves. The formulas that convert capital needed during crisis into CET1 capital buffer that may be eroded by loan losses not covered by reserves and potential CET1 capital shortfall are:

$$\begin{aligned} & \text{CET1 capital buffer eroded} \\ & = \text{Capital needed}_{\text{of banks with capital needed} < \text{CET1 capital buffer}} \\ & + \text{CET1 capital buffer}_{\text{of banks with capital needed} > \text{CET1 capital buffer}} \end{aligned}$$

$$\begin{aligned} & \text{CET1 capital shortfall} \\ & = (\text{CET1 capital buffer} - \text{Capital needed})_{\text{of banks with capital needed} > \text{CET1 capital buffer}} \end{aligned}$$

Overall, this approach implies that resulting “capital needed” and “regulatory capital eroded” or “shortfall” are better discussed in terms of ranges rather than point estimates. Consistently with the stress testing approaches of major central banks (Fed, 2020b; EBA, 2020; ECB, 2020c) and the IMF (2020b), the gradual severity in adverse scenarios does not provide forecast estimates but rather hypothetical scenarios are designed to assess the magnitude of potential capital erosion and the implications for bank resilience. Also, results for the value of eroded CET1 capital buffer and CET1 capital shortfall are shown as a share of CET1 capital of all banks by region. This approach helps to assess the importance of such losses for the overall banking system.

Annex C. How bank loan losses may trigger the conversion of contingent convertible bonds?

The capacity of banks to absorb higher loan losses is likely to deteriorate depending on the magnitude of the rise in NPLs following the COVID-19 pandemic. Therefore, regulatory capital ratios may be eroded by loan losses not covered by reserves and may enable the conversion of contingent convertible bonds (CoCos). This analysis is intended to assess the effectiveness of CoCos in providing banks with an additional source of equity following the deterioration of the capital base due rising bad quality assets. This will be measured by the share of banks facing CET1 capital erosion or shortfall but with CoCos that maybe be converted into loss absorbing equity.⁴⁰ The amount of CoCos that may be triggered due to substantial loan losses not covered by reserves is calculated in two steps.

The first step consists in calculating an eroded CET1 capital ratio by deducting capital needed from actual CET1 capital. To assess the maximum amount of CoCos that may be converted into equity, these calculations are performed under most adverse conditions (i.e. under the double-hit scenario) in the absence of government loan guarantees; i.e. considering estimates of capital needed calculated using an LGD of 75%.

In the second step, the estimated value of eroded a CET1 capital ratio is compared to minimum trigger limit to determine if CoCos can be triggered.⁴¹ All CoCos (either additional Tier 1 or Tier 2) must include a discretionary trigger, also known as a point of non-viability (PONV) trigger. Under the Basel III regulatory framework, additional Tier 1 CoCos classified as liabilities must have a mechanical trigger, with a minimum trigger level of 5.125% in terms of CET1 capital ratio (BIS, 2013; BIS, 2017c). This means that if a CET1 capital ratio falls below the capital trigger level, an additional Tier 1 capital CoCo bond may either be converted into equity on a permanent basis or the nominal amount of the additional Tier 1 capital written down. Nevertheless, the preventive effect of CoCos is effective only if CoCos are triggered well before a bank faces financial distress and potential resolution would be implemented. Hence, trigger levels should be high enough to automatically reduce the leverage of the issuing bank to avoid any operational disruption. A trigger of 5.125% is relatively 'low', given that the Basel III regulatory framework includes a 4.5% CET1 capital and a 6% Tier 1 capital requirements along with capital conservation buffers. Thus, given that banks usually hold an additional voluntary buffer on top of the minimum requirements, it is very likely that banks would experience deleveraging pressure when their CET1 and Tier 1 capital ratios are higher than minimum requirements or well before any CoCo trigger would be reached (Goncharenko et al., 2019). By the time the Tier 1 capital ratio has fallen below 6%, banks have already incurred so much loss that a bank resolution is imminent. Because information of trigger and equity conversion rate are not available by security in Refinitiv, it is assumed that trigger limits apply if a CET1 capital ratio falls below 6%. Also, Tier 2 CoCos with a mechanical trigger of any level are considered as convertible into loss absorbing equity (BIS, 2017b). These assumptions imply that more banks, that would experience financial distress following the COVID-19 pandemic, will be able to trigger all their issued CoCos. Also, it is assumed that additional Tier 1 CoCos have a mechanical trigger at the book value of CET1 capital and that all CoCos have an equity conversion rate of 100%. CoCos that have been called over the period 2009-2020 are excluded from these calculations.

Notes

¹ Under Basel III regulatory framework, minimum requirement for the total regulatory capital ratios has been raised from 8% to 10.5% of risk-weighted assets because banks should hold buffers of capital above the regulatory minimum outside of periods of stress (BIS, 2011). Also, when additional surcharges are activated, such as countercyclical buffer and Global Systemically Important Banks (G-SIB) surcharge, minimum requirement may increase up to 15.5%. These two additional surcharges are deployed by national jurisdictions when excess aggregate credit growth is judged to be associated with a build-up of system-wide risk. A liquidity coverage ratio minimum requirement of 100% has been also introduced.

² Figure 2 shows the simple average of non-performing loan ratios by region. Nevertheless, it should be noted that the weighted average by total assets would lead to lower ratios for European banks in line with estimates reported in the EBA Risk Dashboard which shows data as of the fourth quarter of 2019 (EBA, 2020a).

³ Further details about OECD scenarios are provided in Annex A.

⁴ Downside risks are exacerbated because one-third of corporate ratings in the United States and one-quarter in Europe entered the crisis at 'B' or below, a level that indicates high vulnerability to shifts in economic and business cycles.

⁵ Businesses, particularly those with high debt, are finding it difficult to meet short-term cash need for debt repayments, taxes, and significant operational expenses. Nevertheless, the degree of severity is varying tremendously by industry (S&P Global Ratings, 2020). Energy, labour-intensive sectors most exposed to social distancing (i.e., construction, travel and leisure, transportation) and those most dependent on large discretionary consumer purchases have suffered the most.

⁶ Detailed information about the model and the data are provided in Annex A.

⁷ Despite origins of the GFC or the European sovereign debt crises are different from those of the COVID-19 crisis, effects on the real economy have been detrimental. The GFC started in 2008 with disruption to the US real estate and financial markets and only spread to financial and real economy in the rest of the world after a certain time delay. Many economies have been hit by recession in 2008-2009. However, the COVID-19 pandemic is exerting a more abrupt effect with major disruptions in the real sectors. Major international organisations have forecasted sharp reduction in GDP growth rate and rise in unemployment both in advanced and emerging market economies in 2020 and 2021 (OECD, 2020c; IMF, 2020a). During recession, both corporates and households are facing substantial reductions in revenues or earnings. Therefore, banks are likely to face a substantial increase in NPLs and will be forced to increase their LLPs and allowances following defaults on their retail and commercial loans. During the GFC, banks started to record losses following rising defaults on their mortgages, and afterwards on other loans granted to households and corporates that were affected by a fall in their revenues under deteriorated economic

conditions. During both crises, the effect on bank NPLs has been similar but not driven by defaults on same type of loans.

⁸ High NPLs reduce profitability because banks have to increase their LLPs. Also, rising NPLs tends to lower interest income, generate higher expenses associated with their monitoring and management and lead to an increase in funding costs, as risk adverse investors are less willing to lend to institutions with a low credit quality. In addition, NPLs feature higher risk weights that is eroding bank regulatory capital ratio.

⁹ It is worth noting that deleveraging performed by selling NPLs to a third party investor or through securitization may have some negative implications for the bank, and for at least two main reasons (Angelini, 2018). Notably, NPLs are usually sold at a discounted value compared to their actual book value. This transaction may generate a loss that is likely to more than offset the positive effect on capital ratios generated by the reduction of risk-weighted assets. Also, outsourcing NPLs may result in the closing of distressed but solvent firms because the status of a non-negligible share of NPLs may become performing again after some time.

¹⁰ In particular, European banks witnessed the highest increase in their LLPs in 2020 totalling 163% of provisions during the first three quarters of 2019 followed by banks in North America, emerging market economies and Asia Pacific that have at least doubled their LLPs. ECB estimates further show that much of the increase in LLPs in the first half of 2020 was driven by the migration of non-financial corporate loans to Stage 2, while the Stage 3 loan ratio remained broadly unchanged (ECB, 2020g).

¹¹ This vulnerability analysis would provide valuable insights into banks' risks under adverse economic conditions. Nevertheless, when conducted by regulators or supervisors, this type of assessment would rely on more granular data than used in this global exercise, and thus would provide additional richness.

¹² The several steps and assumptions used in the empirical framework are detailed in Annex B. This analysis has been performed using a sample of 633 publicly listed banks in 23 major advanced economies for which financial statement data are available in Refinitiv at end 2019. Emerging market economies are excluded from the scope of this analysis because OECD forecasts under single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook are not available for several major emerging market economies (i.e., for further details, see Annex A).

¹³ The “danger” zone threshold of 5.5% is considered instead of the Basel III minimum CET1 capital ratio requirement to reflect the fact that banks are facing solvency distress well before regulatory minimum threshold are reach and they should take prompt steps to rebuild their capital cushion.

¹⁴ Banks in the Asia Pacific are likely to record the highest share of loan losses not covered by reserves that are implying a CET1 capital shortfall compared to European or North American banks. Under the most adverse scenario, loan losses not covered by reserves that are implying a CET1 capital shortfall account for 8% of total CET1 capital of banks in the Asia Pacific, compared to 0.6% and 0.5% for European and North American banks respectively. CET1 capital shortfall prevails for 3% of the total number of banks in the Asia Pacific included in the sample, compared to 7.9% for European banks and 1.6% for North American banks.

¹⁵ Loan losses not covered by reserves that are implying a CET1 capital shortfall are decreasing to 5% of total CET1 capital of banks in the Asia Pacific, compared to 0.4% and 0.1% for European and North American banks respectively. CET1 capital shortfall still prevails for 3% of the total number of banks in the Asia Pacific included in the sample. This is due to the fact that capital shortfall prevails for only one bank in the Asia Pacific. Nevertheless, these shares are falling to 5.6% and 1.3% for European banks and North American banks respectively.

¹⁶ The banks facing an erosion of their capital buffer are likely to experience further reduction in their valuations and therefore stronger pressure on their funding conditions.

¹⁷ The ECB also provided temporary capital and operational relief in reaction to the COVID-19 crisis to ensure that its directly supervised banks can continue to fulfil their role in funding the real economy (ECB, 2020a). Notably, the ECB allowed banks to operate temporarily below the level of capital defined by the Pillar 2 Guidance (P2G), the capital conservation buffer (CCB) and the liquidity coverage ratio (LCR).

¹⁸ These actions contributed to deteriorate public finances in certain countries, i.e. leading to substantial increase in sovereign debt and debt accumulation. Therefore, the major priority of regulators following the GFC was ensuring that a bank's critical functions were preserved while the costs of restructuring and resolving failing banks fell upon the bank's owners and creditors and not on taxpayers.

¹⁹ The main objective is to ensure that in the event of another crisis, bail-in resolution would be a credible alternative to bailout.

²⁰ Bail-in resolution would consist in the conversion of CoCos previously issued (BIS, 2017b). CoCos may act as a buffer to make banks more resilient in times of crisis (Boermans et al., 2014). Tax-deductible coupon payments, whereas dividend payments are not, make CoCos cost-effective for banks to strengthen their capital.

²¹ It is worth noting that the ability of banks to issue CoCos and other capital instruments at a reasonable price may differ depending on the diverse NPL situation across countries.

²² Detailed information about the CoCo database used in this analysis are provided in Annex C.

²³ CoCos have two main defining characteristics that are the loss absorption mechanism and the trigger that activates that mechanism. CoCos are converted into loss absorbing equity when the trigger is breached under stressed conditions. In this analysis, because information of trigger and equity conversion rate are not available by security in Refinitiv, it is assumed that trigger limits apply if CET1 capital ratio is falling below 6%. Also, Tier 2 CoCos with a mechanical trigger of any level are considered as convertible into loss absorbing equity (BIS, 2017b). The several steps and assumptions used in the empirical framework are detailed in Annex C.

²⁴ The first option could lead to a substantial dilution of existing equity holders because the stock price is likely to be very low at the time the loss absorption mechanism is activated. Also, existing equity holders would prefer avoiding a breach of the trigger to prevent this potential for dilution. The second option would limit the dilution of existing shareholders, but also probably decrease their incentives to avoid the trigger being breached. The combination of these two options would prevent unlimited equity dilution but the incentives for existing equity holders to avoid a breach of the trigger are likely to persist.

²⁵ Forbearance is a concession granted to a counterparty for reasons of financial difficulty that would not be otherwise considered by the lender. Forborne exposures can be included within the performing or non-performing category. The appropriate categorisation depends on: (i) the status of the exposure at the time when forbearance is granted; and (ii) the counterparty's payment history or creditworthiness after the extension of forbearance (BIS, 2016).

²⁶ A forborne exposure can cease being categorised as such when both an objective criterion, such as a probation period for which a minimum duration is set, and a solvency criterion are met.

²⁷ OECD expected fall in real GDP growth rate are consistent with expected evolution of the economy after the COVID-19 outbreak considered by the Federal Reserve (2020b and 2020d), the ECB (2020b) for their supervisory stress tests. Nevertheless, IMF (2020b) estimates are relatively dovish compared to estimates from major central banks and the OECD. This reflects the differences in capturing the extent of the prompt and extensive fiscal support provided to households in many countries in the several forecasting scenarios of major central banks and international organisations.

The Federal Reserve has revised estimates of expected rise in unemployment and fall in real GDP growth rate in December compared to June 2020 stress test. Under severely adverse scenario, US unemployment rate is expected to peak at 12.5% in the fourth quarter of 2021. Real GDP growth rate is expected to decline by 3.25% from the end of the third quarter of 2020 to its trough in the fourth quarter of 2021. In June, US unemployment rate was expected to peak at 10% in the third quarter of 2021. Real GDP growth rate was expected to decline by 8.5% from its pre-recession peak, reaching a trough in the third quarter of 2021.

Under baseline scenario, real GDP growth rate in the Eurozone is expected to decline by 8.7% and unemployment to peak at almost 3%. However, under adverse scenario, real GDP growth rate is expected to decline by 12.6% and unemployment to peak at about 5%.

Under baseline scenario, IMF estimates show that real GDP growth rate in advanced economies is expected to decline by 5.5% and unemployment to peak at almost 6.5%. However, under adverse scenario, real GDP growth rate is expected to decline by 6% and unemployment to peak at about 8.5%. In emerging market economies, under baseline scenario, real GDP growth rate is expected to decline by 8% and unemployment to peak at almost 8. However, under adverse scenario, real GDP growth rate is expected to decline by 9% and unemployment to remain stable at about 8%.

²⁸ This analysis has been performed including the following countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China (People's Republic of), Colombia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. The countries included in this study are the ones for which OECD, BIS and IMF historical data are available. Nevertheless, OECD forecasts for long-term interest rate under single-hit versus double-hit scenario are not available for Argentina, Brazil, China, Indonesia and Russia. IMF forecasts have been used using same values under single-hit and double-hit scenarios. Therefore, this may lead to a slight underestimation of the rise in NPL ratio under the double-hit scenario for emerging market economies.

²⁹ The dependent variable therefore captures non-performing exposure. Consistently with IMF Financial Soundness Indicators and EBA definitions of forbearance and non-performing exposures definitions, two criterion are considered to classify a loan as non-performing when: (1) payment of principal and or interest past due by 90 days or more, or interest payments equals to 90 days interest or more have been capitalised (i.e. reinvested into the principal amount, refinanced or rolled-over); (2) the bank considers that the obligor is unlikely to meet its remaining credit obligations to the bank, the parent undertaking or any of its subsidiaries in full, without recourse by the bank to actions such as realising security.

³⁰ In the existing literature, the unemployment rate is used to capture the financial soundness of the household sector. However in the context of the COVID-19 crisis, it is more relevant to consider household income given the extensive direct fiscal support provided to households to mitigate the negative consequences of the COVID-19 crisis on their revenues. To avoid collinearity issues, only the annual percent change in household disposable income is introduced in the model.

³¹ Long-term interest in the OECD database are reflected by 10-year sovereign bond yields with forecasts available under the single and double-hit scenarios.

³² While some macroeconomic variables depend on a number of country-level factors that are mostly unrelated to the state of the economy and not necessarily fixed over time, these factors are difficult to measure empirically and therefore this model does not include the impact of such factors.

³³ While satellite models maybe estimated to calculate projections, the remaining uncertainty given the unprecedented nature of the shock and the challenges to adequately reflect extensive monetary and fiscal supports in these models may lead to inaccurate estimates. Furthermore, data limitations to calculate forecasts from potential satellite models is an other obstacle to engage in this empirical strategy. Regarding, the leverage of non-financial corporates, it could be further argued that leverage was already very high before the COVID-19 crisis both in major advanced and emerging market economies (Patalano and Roulet, 2020). While, non-financial corporate leverage is expected to rise following the COVID-19 crisis, such increase will have a marginal contribution to the overall ratios that are already very very high. Also, monetary and fiscal support measures and government loan guarantees are intended to ease banks' capital constraints to maintain the flow of credit to the real economy. Therefore, aggregate bank lending growth is not expected to fall dramatically during the current crisis compared to substantial credit crunch that occurred during previous crisis episodes.

³⁴ Anticipating future levels of NPLs is key for formulating NPL resolution strategies. Multiple increase in nominal NPLs after a crisis compared to pre-crisis levels would be a good indicator of the post-crisis NPL problems (Ari et al., 2020). Therefore, NPL multiple is calculated as the ratio of nominal projected NPLs to end-2019 value. Methodology and data to calculate NPL ratio by country under single-hit versus double-hit scenario are detailed in Annex A. Estimates show that with extensive monetary and fiscal support measures implemented following the COVID-19 crisis, nominal NPLs are expected to increase between 1 and 2.8 times their 2019 values under the single-hit scenario depending on the country considered. Under the double-hit scenario, NPL multiple is expected to increase between 1 and 3.6.

³⁵ In this analysis, loan losses by country are attributed to banks depending on the location of their headquarters, and not according to the location of their exposures. While this may be relevant to consider, it is difficult to incorporate in the model due to the lack of data for the distribution of bank loan portfolio exposure and losses by location for a large sample of banks. Also, consolidated data are used in this analysis. Therefore, losses are compared to the overall capital of the group and not across subsidiaries in different countries.

³⁶ Estimates have been performed using bank financial statement data as of end-2019 for a sample of 633 banks in 23 advanced economies. Emerging market economies are excluded from the scope of this analysis because OECD forecasts under single-hit versus double-hit scenario informed by the OECD 2020 Economic Outlook are not available for several major emerging market economies (i.e., for further details, see Annex A). Also, Chinese banks are excluded from this sample because state ownership involves different issues than the ones discussed in this study (Sarin and Summers, 2016).

³⁷ It includes ordinary shares, retained earnings, stock surpluses from the issue of common shares and common shares held by the subsidiaries of the company.

³⁸ More precisely, banks must conserve minimum retained earnings ratio in the subsequent payment period to strengthen their capital cushion.

³⁹ Actual CET1 capital buffer is calculated as the difference between actual CET1 capital ratio and the 5.5% threshold. The "danger" zone threshold of 5.5% is considered instead of the Basel III minimum CET1

capital ratio requirement to reflect the fact that banks are facing solvency distress well before regulatory minimum threshold are reach and they should take prompt steps to rebuild their capital cushion.

⁴⁰ In all economies where Basel III regulatory framework has been implemented, banks are issuing CoCos, except in the United States. In the United States, requirements for total loss-absorbing capital (TLAC) rely on bail-in debt and equity. Therefore, no banks in the United States have issued contingent convertible capital securities to date (Glasserman and Perotti, 2017). Although the Dodd Frank Wall Street Reform and Consumer Protection Act commissioned a study (FSOC, 2012), the Federal Reserve has not introduced contingent capital requirements.

The analysis is performed using a sample of 130 publicly listed banks for which CoCo issuance data and financial statement data are available in Refinitiv at end 2019. These banks are located in the following 21 OECD economies (excluding the United States): Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

⁴¹ Assessment of bank Coco issuance has been performed using Coco bond data issued by individual banks in OECD countries since 2009 from Refinitiv. CoCos qualified as either Additional Tier 1 (AT1) or Tier 2 (T2) capital are included regardless of their loss absorption mechanism (i.e., conversion to equity or principal write-downs; BIS, 2013). However, CoCos that are classified as preferred shares are excluded. Such CoCos are exempt from the requirement to have a mechanical trigger with a minimum level of 5.125% in order to be eligible to qualify as AT1 capital. Therefore, they are considerably different from AT1 CoCos classified as liabilities. It is worth noting that CoCos classified as preferred shares are concentrated in a very small number of jurisdictions (BIS, 2017b).

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