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The regulatory and supervisory response to the COVID-19 crisis

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Abstract

The impact of COVID-19 represents an unprecedented international challenge and the most severe test of the resilience of the banking industry – and of the financial system as a whole – since the global financial crisis of 2008. The rapid and resolute response of international and European Union institutions and fora with financial regulatory and supervisory responsibilities has been aimed to coordinate the actions taken at national level and, thus, to help safeguard the orderly functioning and stability of the financial system, as well as the uninterrupted financing of the real economy. This response has spanned different areas, including microprudential, accounting and macroprudential policies. This article provides an overview of the standards, guidelines and measures promoted since March 2020 by different authorities. The wide-ranging regulatory and supervisory reaction to COVID-19 is emerging as a distinctive feature of the management of this crisis, which, far from over, has led to an environment of heightened uncertainty and risks for the financial system which warrants further monitoring and a continued policy response.

1 Introduction

With the outbreak of COVID-19, the global financial system faces an unprecedented crisis, with an as yet unknown macroeconomic impact.[1] **However, it is in a comparatively more robust position than in the 2008 global financial crisis, largely owing to the reforms promoted by the G20 over the last decade.** These measures have been developed and instrumented at global level through the Financial Stability Board (FSB), the different organisations responsible for international regulatory standards, including the Basel Committee on Banking Supervision (BCBS), and the organisations responsible for accounting standards [the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB)]. One notable example is the BCBS Basel III standards, which have led to an increase in the banking sector's capital and liquidity levels and have been key to guaranteeing that the sector acts as a mechanism for absorbing, rather than amplifying, the shocks triggered by the pandemic.

The action taken to date by various institutional authorities has addressed the different dimensions of the impact of the crisis. Governments and central banks

1 For example, in June, the International Monetary Fund (IMF) estimated a drop of 4.9% in global GDP in 2020 [International Monetary Fund (2020)]; in September, the Banco de España estimated a decrease of between 10.5% and 12.6% in Spanish GDP [Banco de España (2020c)].

in numerous jurisdictions have taken fiscal and monetary policy measures to tackle the various impacts on productive sectors, households and consumers and on the financial markets and access to liquidity. Meanwhile, market authorities have taken the required measures to try to prevent disruptions in the financial markets in the aftermath of the pandemic.

The banking regulatory and supervisory authorities remain watchful and continue to explore additional action within the remit of their competences, both at international level and in the European Union (EU). In the short term, the measures taken have centred on ensuring that banks continue lending to households and solvent firms, thereby trying to mitigate part of the economic impact. Efforts have also been made to reduce the operational burden both for supervisors and regulators and for banks, thus ensuring that the resources available are focused on the financial stability priorities arising from the pandemic crisis. The challenges facing the authorities in the medium and long term will revolve around continuing to monitor and assess the changes in the financial and operating risks to the banking system, with a view to ensuring the banking sector's resilience and financial stability.

This article focuses on describing the banking sector regulatory and supervisory response to date. Section 2 briefly explains the motivation for the authorities' response and the importance of international coordination. Section 3 describes, from a microprudential, accounting and macroprudential standpoint, the measures adopted with the aim of ensuring that the banking sector continues to play its role in mitigating the impact of the pandemic by lending to households and solvent firms. Section 4 briefly explains the measures aimed at alleviating the operational burden of both banks and authorities. Lastly, Section 5 draws some initial conclusions, within the existing climate of uncertainty following the early months of the pandemic's impact, and describes future areas of focus.

2 Why is a response needed from regulatory and supervisory authorities? The role of international coordination

The COVID-19 impact is an exogenous shock to the banking sector, yet its possible consequences could threaten the stability of the financial system as a whole and of the banking sector in particular. Despite the response from governments and central banks, regulatory and supervisory authorities play a very important role in coping with this crisis. There are at least three reasons for this: i) to alleviate the operational burden so that resources are correctly prioritised; ii) to ensure that the banking sector helps to absorb the fallout of the crisis; and iii) to guarantee the financial system's resilience.

One of the lessons of the 2008 global financial crisis is the importance of international coordination for safeguarding financial stability in an increasingly

interconnected world. The consequences of the pandemic are admittedly heterogeneous, depending on its incidence at national level (not only in health terms, but also on the basis of the productive structure and economic dependence of the most affected sectors) and national responses need to be suitably flexible. However, given the global dimension of the financial system in general and of the banking sector in particular, efforts must be made to guarantee cooperation so as to ensure a level playing field and avoid fragmentation at international level.

Some examples of this coordination can be found in the activities undertaken by the FSB and the BCBS since the initial phase of the pandemic. The FSB has monitored the situation and its impact on global financial stability on an ongoing basis and has also established principles underpinning the response from the authorities [Financial Stability Board (2020a)]. These principles state that the authorities recognise the flexibility built into standards to sustain the flow of financing to the real economy, to support smooth market functioning and to accommodate robust business continuity planning. However, they also emphasise that authorities' actions will be consistent with maintaining common international standards that guarantee the resilience needed of the financial system while preserving an international level playing field. The G20 has given its political backing to this report and requested that the measures adopted and their consistency with standards be monitored; this work has been undertaken by the FSB together with the various organisations responsible for international standards. As an initial conclusion, most of the measures adopted make use of the flexibility built into international standards and, where they go further, the changes have in general been temporary.[2] In turn, the BCBS, in appropriate coordination with different organisations and authorities, is adopting a series of response measures backing the measures taken at national level, in order to avoid international fragmentation.

3 Measures taken to encourage banks to continue lending to households and solvent firms

As explained above, given its causal nature, COVID-19 is an exogenous shock affecting both economic growth and the financial system. Nevertheless, the ultimate impact and severity are, in some way, endogenous vis-à-vis the behaviour of the banking sector, in particular as regards the provision of credit and other critical services to households and solvent firms. In this context, it is essential that the banking sector mitigates the crisis and that, to the extent possible, banks are prevented from adopting a defensive stance by deleveraging. This section describes the microprudential, macroprudential and accounting measures taken by regulators to date in this regard.

2 Financial Stability Board (2020b). One example in this regard would be the exclusion of central bank reserves and government bonds from the leverage ratio in the United States and Canada, where no adjustment or recalibration of the ratio in response to this exemption, as envisaged in the Basel III framework, has been introduced.

3.1 Prudential treatment of the extraordinary measures adopted by governments

Regulators have attempted to ensure that the reduction in risk derived from these extraordinary measures is fully recognised in the calculation of capital requirements. Governments and banks in multiple jurisdictions have launched extraordinary measures to soften the economic and financial impact of COVID-19, in particular to ease the temporary liquidity stress of firms and households owing to the sharp decline in activity. These measures include a range of payment moratoria (temporary suspension of loan payments covering just the principal or also interest) and public guarantees for corporate sector lending. In this connection, regulators have attempted to ensure that prudential regulations are neither a deterrent to adopting these measures nor detrimental to their positive effects.

At international level, the BCBS has published technical guidelines clarifying the prudential treatment of guarantees and moratoria. For example, banks will be able to apply sovereign risk weights to exposures with public guarantees. Banks may also exclude payment moratoria when classifying exposures as non-performing due to arrears[3] or as forborne.[4]

At European level, the treatment agreed by the European Banking Authority (EBA) for payment moratoria is particularly interesting. In line with the BCBS, the EBA advocated a pragmatic and flexible treatment of moratoria in its statement on 25 March 2020 [European Banking Authority (2020b)]. Moreover, it anticipated that it would draw up more detailed guidelines on this subject. The guidelines on moratoria [European Banking Authority (2020c)] were negotiated and developed with the swiftness and urgency demanded by the situation and were published just a few days later on 2 April 2020. In these guidelines, the EBA specifies the prudential treatment applicable to the moratoria and sets the criteria that they must fulfil in order to qualify for this treatment.

With regard to the prudential treatment of the moratoria, the EBA has appropriately combined flexibility with sound and prudent management of default recognition. These guidelines clarify the application of the prudential definitions[5] of "default" and "forbearance" to exposures subject to eligible moratoria.

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3 A credit transaction is classified as non-performing due to arrears when it has amounts more than 90 days past due.

4 Basel Committee on Banking Supervision (2020a). The Committee also gave indications on accounting standards; see Section 3.4.

5 The definition of default is given in Article 178 of Regulation (EU) No. 575/2013 on prudential requirements for credit institutions and investment firms [Capital Requirements Regulation (CRR)] and developed in the EBA Guidelines on the application of the definition of default (EBA/GL/2016/07). The definition of forbearance is detailed in Article 47b of the aforementioned Regulation.

Box 1

MORATORIUM ELIGIBILITY CRITERIA FOR THE PURPOSES OF THE EUROPEAN BANKING AUTHORITY GUIDELINES ON LEGISLATIVE AND NON-LEGISLATIVE MORATORIA ON LOAN REPAYMENTS APPLIED IN THE LIGHT OF THE COVID-19 CRISIS

1 The moratorium must be based on national law (legislative moratorium) or be a private initiative in which an institution adheres to an agreement reached by the banking sector, or a material part thereof (non-legislative or private moratorium). Therefore, neither private moratoria established individually by institutions nor those negotiated with clients on a case-by-case basis are eligible.

2 The moratorium has to apply to a broad range of clients, and any criteria for defining the moratorium should allow the borrower to take advantage of it without an ex ante assessment of their ability to pay.

3 The moratorium may only entail changes to the schedule of payments, namely by suspending, postponing or reducing the payments of principal amounts, interest or of full instalments, for a predefined period of time.

4 The moratorium must offer the same conditions to all the exposures subject to it. Acceptance is not obligatory for borrowers.

5 The moratorium does not apply to new loans granted after the date when the moratorium was announced.

6 The moratorium must have been launched in response to the COVID-19 crisis and applied before 30 June 2020. Subsequently, on 25 June 2020, the European Banking Authority extended this deadline to 30 September.

As regards the prudential definition of default, instalments subject to the moratoria are not considered past due. Classifying an exposure as defaulted generally entails an increase in capital requirements. This classification can be made for two reasons: automatically, when a borrower is past due more than 90 days on a material obligation; or at the bank's discretion, when it considers that there are reasonable doubts that the borrower will service their debts. This second criterion is known as 'unlikely to pay'.

The guidelines interpret that, when an exposure is subject to an eligible moratorium, the instalments in question will not be considered past due, and the counting of days past due will be based on the new schedule resulting from application of the moratorium. It is worth clarifying that, with this interpretation, the EBA merely extends a criterion for legislative moratoria, already set out in its guidelines on the definition of default, to all eligible moratoria.

However, for the duration of the moratorium, banks must continue to analyse their borrowers' creditworthiness and unlikeliness to pay in accordance with their relevant prevailing general policies. When banks conclude that borrowers are unlikely to pay, they will be classified as defaulted. It is therefore a matter of distinguishing between those borrowers with viable businesses that are experiencing one-off liquidity difficulties owing to government-imposed lockdowns and those with fundamental solvency problems. For the latter group, the guidelines on moratoria are clear: banks should not delay classification as defaulted or the recognition of losses.

As regards the definition of forbearance, transactions subject to an eligible moratorium should not automatically be reclassified as forborne. In accordance with prudential regulation, banks are obliged to inform the supervisor and the market of those exposures that have been subject to forbearance measures. The definition of a forbearance measure is a concession by a bank towards a borrower that is experiencing, or is likely to experience, difficulties in meeting its financial commitments. In other words, in order to be reclassified as forborne, a borrower has to be experiencing financial difficulties.

Following the guidelines, transactions subject to an eligible moratorium should not automatically be reclassified as forborne. This flexibility has been allowed – among others – because eligible moratoria are granted as part of a general scheme to borrowers meeting certain criteria, without said borrowers being subject to an individual ex ante assessment of their creditworthiness.

Moreover, as the transactions are not necessarily considered forborne, these exposures would also be exempt from the distressed restructuring test. This test is covered in the aforementioned guidelines on the definition of default and the exemption of these transactions is an important nuance, as otherwise many would possibly need to be reclassified as defaulted.

Finally, it should be noted that the original deadline of these guidelines was foreseen for 30 June 2020. However, the EBA decided to extend it for three additional months, until September. As this date approached, the EBA rejected a new extension, what means that moratoria granted after that date cannot be subject to the provisions of the guidelines.

3.2 Other microprudential measures adopted at European level

In addition to the measures aimed at clarifying the prudential treatment of the extraordinary measures, European authorities undertook an unprecedented urgent review of banking legislation on capital requirements, known as the 'CRR quick fix'. This reform responds to the aim of guaranteeing that the banking sector continues to support firms and households by lending. Details of some of these changes, together with the related rationale and expected impacts from a conceptual standpoint, are as follows:[6]

6 These measures also include a revision of the prudential treatment of provisions for expected losses (see Section 3.4) and other changes not detailed in this article. For example, a temporary favourable treatment has been reintroduced for exposures to central governments issued in the domestic currency of another Member State for the purpose of calculating risk-weighted assets and large exposures; this treatment was previously allowed under European regulation, before its term expired. The main objective is to enable European countries outside the euro area to address potential difficulties in local currency issuances, given the impact of COVID-19.

Prudential filter

Movement in the financial markets can trigger major changes in the fair value of assets, which in prudential terms may have a significant impact on capital levels.[7] In order to mitigate this sudden impact and help to absorb it gradually, a filter for gains/losses on certain financial instruments measured at fair value through other comprehensive income (FVOCI) has been reintroduced into European legislation. This filter will be applied to those assets on banks' balance sheets corresponding to central governments, regional governments or local authorities that are assigned a risk weight of 0% under the standardised approach.[8] It will be applied temporarily for a period of three years, with an initial percentage of 100% in 2020, declining to 70% in 2021 and 40% in 2022.

By temporarily filtering unrealised losses or gains arising from changes in the fair value of these assets, such changes would not automatically result in a consumption/increase of a bank's CET1. Nevertheless, as the changes allow banks to apply the filter and reverse this decision on one occasion, it could in fact mean that only capital decreases are removed and increases are admitted. Naturally, the impact will depend on the exposures to central governments recognised at FVOCI held by banks and on the intensity of the changes in their fair value.

Moreover, in order to guarantee that the market understands the effects of this filter and the transparency of the new requirements if it is applied, banks must disclose the capital ratios they would have had without its application.

Leverage ratio

When institutions use central bank liquidity facilities obtained by providing collateral, deposits at central banks are recognised within their assets, unless the funding is used for other purposes; the collateral also remains in their assets, resulting in an expansion of their balance sheet, which can tighten the leverage ratio.[9] Basel III already introduced the possibility of approving the exclusion of central bank reserves from the leverage ratio denominator in order to ease monetary policy implementation.[10] To apply this exemption, institutions are required to recalibrate the leverage ratio, in order to avoid releasing capital upon application of this exemption, and to disclose its impact on the leverage ratio to the market.

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7 Changes in the value of instruments measured at fair value through other comprehensive income directly affect a bank's Common Equity Tier 1 (CET1) capital. Consequently, unrealised losses reduce banks' CET1, introducing volatility into the capital ratios.

8 Treated as exposures to the central government under Articles 115(2) and 116(4), excluding Stage 3 exposures.

9 Conversely, it does not affect the solvency ratio, as such deposits at central banks have zero risk weight.

10 And, specifically, to deter banks from deleveraging in order to maintain the leverage ratio owing to the effect on this ratio of using such central bank liquidity assistance.

The possibility of introducing this exemption was already provided for in European regulation. However, it entailed an adjustment to the requirement, offsetting any benefit from the exemption, with the adjustment varying over time, based on the volume of reserves. Via the 'quick fix', a series of amendments has been introduced enabling application of the exemption by preventing the full offset of the benefits. The amendments also allow the decision taken by the competent authority, in consultation with the central bank, to refer to a date prior to such decision.[11]

Revision of the prudential backstop for non-performing loans

The prudential backstop at European level for non-performing loans introduces minimum loss coverage levels for such exposures, based on specific timetables. The 'quick fix' adjustments introduced a permanent favourable treatment for exposures guaranteed by the "public sector".[12] Specifically, for the part of the non-performing exposure guaranteed or insured by the "public sector", a provision of 0% is permitted for the first seven years following classification as non-performing. This thus avoids a negative impact on banks' solvency ratios in the event that exposures guaranteed by the public sector are classified as non-performing.

Early application of some 2021 measures

It is proposed to bring forward the date of application of the SME[13] and infrastructure[14] supporting factors and of the favourable treatment of loans to pensioners and employees with a permanent contract that are backed by the borrower's pension or salary, both already envisaged in European regulation. Early application of the new prudential treatment of software assets (developed by the EBA through an RTS published in October 2020) is also proposed, to bring it forward to immediately following publication of the final document, rather than 12 months later as envisaged

11 This aspect is especially relevant in order to give the authority scope for decision-making and to prevent the adjustment from being reset if a renewal of the exemption for a period of more than one year is envisaged. Moreover, the measure prevents the adjustment from being based on a specific value of central bank reserves (which can show volatility) on a concrete day.

12 Understood as: central governments and central banks, regional governments or local authorities, multilateral development banks, international organisations with a risk weight of 0% and public sector entities eligible for a risk weight of 0% under Part Three, Title II, Chapter 2 [Articles 115(2) and 116(4) of the CRR], in accordance with Article 201(1)(a) to (e) of the CRR on eligible collateral for purposes of credit risk.

13 In the case of SMEs, in accordance with the CRR, the capital requirements for credit risk on exposures to SMEs have until now been multiplied by a factor of 0.7619 (only for exposures of less than €1,500,000). A factor of 0.7619 is now established for exposures of less than €2,500,000, and a factor of 0.85 for those exceeding this amount.

14 In the case of infrastructure, the supporting factor for exposures to entities that operate or finance physical structures or installations, systems and networks that provide or support essential public services is 0.75 provided that the exposure fulfils certain criteria defined in the CCR.

in European regulation. Amendments enabling favourable treatments as regards the leverage ratio for transparency and reporting purposes are also included.[15]

The purpose of bringing these dates of application forward is to anticipate measures entailing reductions in capital requirements, in addition to incentivising funding for certain economic sectors.

Adjustments to market risk requirements

The extreme volatility in the financial markets arising from the COVID-19 impact could have a significant impact on banks' capital requirements for market risk.[16] The 'quick fix' adjustments are aimed at providing some supervisory discretion for adjusting capital requirements, in exceptional circumstances and for individual cases, so as to exclude possible deviations occurring between 1 January 2020 and 31 December 2021, provided they do not result from deficiencies in the internal model. This adjustment prevents an increase in market-risk weighted assets and, therefore, a decrease in the solvency ratio.

In this regard, the EBA had already recommended applying supervisory flexibility in the qualitative part of the market risk multiplier for these requirements. With this same objective (i.e. eliminating negative capital impacts of excessive volatility in the financial markets), the EBA temporarily amended its technical standards on prudent valuation.

Amendment to the securitisation framework

Besides the 'quick fix', on 24 July, the European Commission published a new raft of legislative measures with targeted changes for capital markets, as part of the post-COVID-19 strategy. From a prudential regulation standpoint, the proposed amendments to the **securitisation framework** are particularly significant.

Securitisation is a tool that allows illiquid bank assets to be transformed into tradable securities. Although not risk-free, this tool is very useful both for originator institutions (normally credit institutions) and for investors. It enables originators to obtain

15 Specifically, the exclusion of central bank reserves from the denominator and the specific adjustment enabling the netting of claims and payment obligations on transactions pending settlement in the leverage ratio, both of which are already envisaged in European regulation for when the leverage ratio requirement enters into force (June 2021).

16 Under the internal model approach, capital requirements for market risk are increased by a qualitative multiplier and a quantitative multiplier, which depends on the number of overshootings. Overshootings are the differences obtained in the comparison of the internal model output with the P&L (actual and hypothetical). With this change, overshootings in 2020 and 2021 would be excluded, preventing an increase in capital requirements for market risk; the CRR currently permits supervisors to only partially disregard overshootings, specifically those derived from a comparison with the actual P&L, not the hypothetical P&L.

financing and/or manage existing exposures on their balance sheet, freeing up capital that can be used to grant new loans. At the same time, market participants can access new investment opportunities, contributing to an appropriate risk-sharing across the financial system as a whole.

The amendments proposed by the European Commission are aimed at strengthening the role that securitisation can play in channelling credit to the economy, thereby contributing to the post-COVID-19 economic recovery. First, it is proposed to extend the simple, transparent and standardised (STS) framework in place for traditional securitisation[17] to balance-sheet synthetic securitisations,[18] achieving a beneficial prudential treatment for the senior tranche retained by the originator on its balance sheet. Second, and in line with the BCBS' recent consultative document, a series of measures aimed at removing the regulatory obstacles identified in non-performing exposure securitisations is proposed.

At the cut-off date for this article, all the securitisation amendments mentioned are pending discussion and approval by the European Parliament and by the Council before their entry into force.

3.3 Use of capital and liquidity buffers

The Basel III framework introduced capital buffers and, in addition, a short-term liquidity requirement that also functions as a buffer (this is not a minimum requirement, but rather can be used in situations of stress). However, as experience with this framework does not yet cover a full financial cycle, one of the issues under debate is the usability of these buffers and the obstacles which might limit such usability (see Box 2).

Against this backdrop, the authorities have issued recommendations on their use at national, European and international level. For example, the BCBS has reiterated in various statements the purpose of the capital and liquidity buffers and the possibility of using them adequately to support the economy and absorb the current shock. It has also clarified the expectation that supervisors should give banks sufficient time to restore their capital buffers, taking into account both economic and market conditions and each bank's individual circumstances.

At European level, on 12 March 2020 the EBA issued a statement encouraging supervisors and regulators to make use of the flexibility embedded in the European

17 A traditional securitisation is one in which securitised exposures are transferred to a securitisation special purpose entity (SSPE), transforming them into tradable securities.

18 An on-balance-sheet synthetic securitisation involves transferring the credit risk of a set of loans, typically large corporate loans or SME loans, by a credit protection agreement where the originator buys credit protection from the investor. The credit protection is achieved by the use of financial guarantees or credit derivatives while the ownership of the assets remains with the originator.

Box 2

USABILITY OF CAPITAL BUFFERS: ISSUES AND MEASURES ADOPTED

The objective sought by the Basel III buffers framework is two-fold:

— To provide banks with greater flexibility to absorb losses in times of stress, increasing their resilience and mitigating negative macroprudential externalities such as deleveraging.

— To prevent an imprudent reduction in capital by setting constraints on distributions.

Basel III requires using Common Equity Tier (CET1) for three buffers: a capital conservation buffer (2.5%), an additional buffer (between 1% and 3.5%) for global systemically important banks (G-SIBs) based on the degree of systemic importance, and a countercyclical capital buffer (CCyB) which the macroprudential authorities will activate and deactivate based on developments in the economic cycle. At European level, this is known as the combined buffer requirement, which includes the systemic risk buffer.[1]

It is established that failure to comply with this requirement will give rise to automatic restrictions on the distribution of profits (e.g. payment of dividends, payment of coupons on Additional Tier 1 (AT1) instruments, share buy-backs and payment of bonuses). Such restrictions will increase as greater use is made of the buffer.[2] This automatic mechanism is known in European Union (EU) regulations as the Maximum Distributable Amount (MDA), which determines the maximum amount to be distributed for each CET1 level if the capital buffers have not been met.

The ability to use buffers depends on their design, investor and supervisor expectations and banks' incentives and internal risk management [Borio and Restoy (2020)]. Against this background, it is essential to understand what obstacles there are to usability and how to address them:

1 One factor determining the possible use of capital buffers is banks' own internal risk management and prudence in anticipating future losses. In a setting of negative macro-financial prospects, banks might not wish to use buffers in view of the possibility of having to deal with losses or increases in capital requirements in response to greater risks materialising.

2 In connection with the foregoing, there is a potential stigma effect deriving from the market's pressure to maintain capital levels reflecting a specific strength of their solvency position, especially in situations of stress. Banks could also wish to avoid being "the first ones" to reduce their capital ratios if they perceive that the market might interpret this as a sign of weakness.

3 Another disincentive could occur where there is a lack of clarity about supervisory expectations relating to flexibility and time periods for capital restoration plans and their relationship with economic activity and the capital markets returning to normal. This factor is particularly important considering the expectations on the ability to restore capital in the future. Against a background of a negative economic outlook and downward pressures on profitability, compounded in some cases by the cancellation of shareholder remuneration, banks are facing potential constraints on their ability to restore capital, whether through profit generation or market issuances. In this connection, both at international level and certain authorities have stated that sufficient time will be provided for restoring capital based on the course of the pandemic and banks' specific circumstances [Basel Committee on Banking Supervision (2020)].

4 Finally, an area that might limit the usability of capital buffers is the possible stigma derived from the effect of automatic restrictions on distributions. These restrictions affect dividend payments, share buy-backs, coupons on AT1 instruments and variable remuneration. The stigma effect may be more pronounced in certain cases, such as the payment of dividends and of coupons on AT1 instruments. Variable remuneration may have a lower stigma effect in the market, but may have consequences on the ability to attract and retain senior management. As regards share buy-backs, although the economic effect is similar to that for dividend payments, there could be more flexibility as they are not perceived to be recurrent

1 The systemic risk buffer (SyRB) is a macroprudential instrument specific to EU regulations under which the designated authorities may impose a CET1 capital requirement to deal with non-cyclical systemic risks not covered by the CCyB or by systemically important institutions' buffers.

2 The conservation ratio depends on which quartile the CET1 ratio is in. The lower the quartile, the greater the conservation ratio and, therefore, the lower the distributable amount.

and, therefore, their cancellation can be expected to involve a smaller stigma effect, in relative terms. This practice is currently more common in the United States than in the EU.

As regards this last point, the Basel Committee on Banking Supervision has stated that using capital and liquidity resources to absorb the shock and support the real economy should take priority over discretionary distributions. The pattern of distributions in different countries is uneven internationally and different approaches have been adopted across jurisdictions.

In Europe, a general restriction on the payment of dividends and share buy-backs has been introduced. This helps in part to resolve the stigma arising from the automatic restriction on distributions. The European Banking Authority (EBA) urged banks not to pay dividends – whether in cash or in the form of shares –, or buy back shares, and to revise their remuneration policies, setting variable remuneration at a conservative level. This was a controversial decision, insofar as it could affect the market valuations of European banks, but it was necessary to preserve capital at banks and thus serve the economy's credit and liquidity needs. This EBA action was adopted in coordination with the European Central Bank (ECB). On 27 March 2020, the ECB recommended that banks under its supervision refrain from: i) paying out dividends for 2019 and 2020, at least until 1 October 2020, and ii) buying back shares to remunerate shareholders. There was no reference in the recommendation as to how variable remuneration was to be treated. However, on 28 July, when extending the previous recommendations until January 2021, the ECB also asked banks to be extremely moderate with regard to their variable remuneration policies.

Lastly, the obstacles identified in banks' use of capital buffers to absorb losses affect microprudential and macroprudential buffers in the same manner. From a macroprudential viewpoint, the countercyclical capital buffer is activated and deactivated by the authorities. Therefore, although failure to meet the requirement once the buffer has been activated gives rise to automatic constraints on distributions, if the authorities decide to reduce it (which, as explained in the previous section, was the case in most jurisdictions), the stigma associated with automatic distribution restrictions is resolved. This makes it more effective for the macroprudential authority to be able to reduce the calibration of a specific buffer rather than the alternative option of maintaining it, and encourages banks to consume it if necessary to absorb losses. The use of the conservation and systemic risk buffers is conditioned by the automatic distribution restriction mechanism.

regulatory framework to free up capital and thus mitigate the impact of COVID-19 on the banking sector. In particular, the EBA signalled P2G[19] as a countercyclical tool that could be used by supervisors to support lending.

In line with this recommendation, several supervisors provided their banks with the flexibility to operate temporarily below their P2G levels. In particular, on 12 March the European Central Bank (ECB) echoed this recommendation and asked banks to make use of the capital and liquidity buffers and, in particular, the capital conservation buffer, P2G and the liquidity coverage ratio (LCR) buffer. It argued that these instruments had been designed precisely to address situations such as the COVID-19 crisis. On 28 July the ECB committed to allow banks to operate below the P2G and the combined buffer requirement until at least end-2022, and below the LCR until end-2021.

19 In the EU the Pillar 2 requirements have two components: additional own funds requirements (P2R), covering risks or risk elements not covered by Pillar 1, and additional own funds guidance (P2G).

The issues relating to the use of buffers may affect both capital and liquidity. However, as a result of the stabilisation of activity in the financial markets, the possible tensions regarding the use of liquidity buffers are lower. The measures adopted by central banks provide banks with broad access to liquidity, making the use of the LCR less pressing.

3.4 Response within the scope of accounting standards

Following the declaration of the global pandemic by the World Health Organization (WHO) on 11 March 2020, numerous statements were made by accounting regulators and banking supervisors on the application of accounting standards.

These statements shared the goal of providing guidance on the application of the International Financial Reporting Standards adopted by the European Union (IFRS-EU).[20] More specifically, they focused on the application of IFRS9-EU criteria on financial instruments, on the classification of credit risk transactions for the purpose of estimating credit loss coverage (known as "provisions") and on how to carry out such estimates.

IFRS9-EU was first applied relatively recently (in January 2018). Among other important changes, this international standard introduced a new approach for estimating provisions, known as the "expected loss" approach. One of the main features of this approach is the need to consider information about future conditions in the estimate. The statements mentioned above sought to mitigate the risk of an inadequate application of the new expected loss approach having procyclical effects.

When a high-level summary is made of the content of such statements, it is generally noted that they guide banks to make use of the flexibility envisaged in the accounting standards. With this formula, the intended message is that the automatic application of some of the factors and assumptions that have been used to estimate expected losses since the initial application of IFRS9-EU has proved to be inadequate for the situation arising from COVID-19, and even going forward, and that there are alternative practices within the framework established in the international standard.

The situation deriving from COVID-19 gave rise to two basic problems for banks when applying the IFRS9-EU framework:

20 IFRS are also the accounting framework of reference at global level, with the exception of the United States, which has its own specific accounting rules. These standards are prepared by the IASB and they became binding for the EU through the adoption procedure established in Regulation (EC) No. 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards (IAS Regulation).

— **Difficulties in classifying loans by credit risk** (stages[21]): the measures to contain the spread of COVID-19 led, to a greater or lesser degree, to the confinement of the population and the shutdown of economic activity. In this situation, households and firms whose ability to pay had been adequate until then suffered a sudden reduction (or even disappearance) of their recurrent sources of income. Banks had to analyse the extent to which sudden and short-term changes in a borrower's situation gave rise to significant impacts on their creditworthiness over the life of the loan. Performing this analysis has been difficult in the situation deriving from COVID-19.

— **Difficulties in estimating credit loss provisions:** during 2020 H1 there was much uncertainty about the impact of both containment and support measures on economic activity. Although there was undoubtedly going to be a decline in economic activity, there was a high degree of uncertainty about its magnitude. To paraphrase Donald Rumsfeld, the negative impact of the coronavirus on economic activity was a "known unknown".[22] This has complicated the application of the expected loss approach.

At euro area level the ECB spearheaded the adoption of different prudential measures relating to credit institutions' capital and liquidity requirements, in addition to providing guidance on how to apply IFRS9-EU in the situation deriving from COVID-19. In the latter case, the aim was to mitigate the risk of inadequate practices in classifying loans and estimating provisions having procyclical effects in this setting. In the field of accounting, the first and most impactful communication was a press release on 20 March 2020 regarding further flexibility for banks in response to the coronavirus.

At EU level, on 25 March 2020 the European Securities and Markets Authority (ESMA) issued a public statement entitled "Accounting implications of the COVID-19 outbreak on the calculation of expected credit losses in accordance with IFRS 9". On that same date the EBA published a statement on the application of the prudential framework regarding default, forbearance and IFRS9 in light of COVID-19 measures.

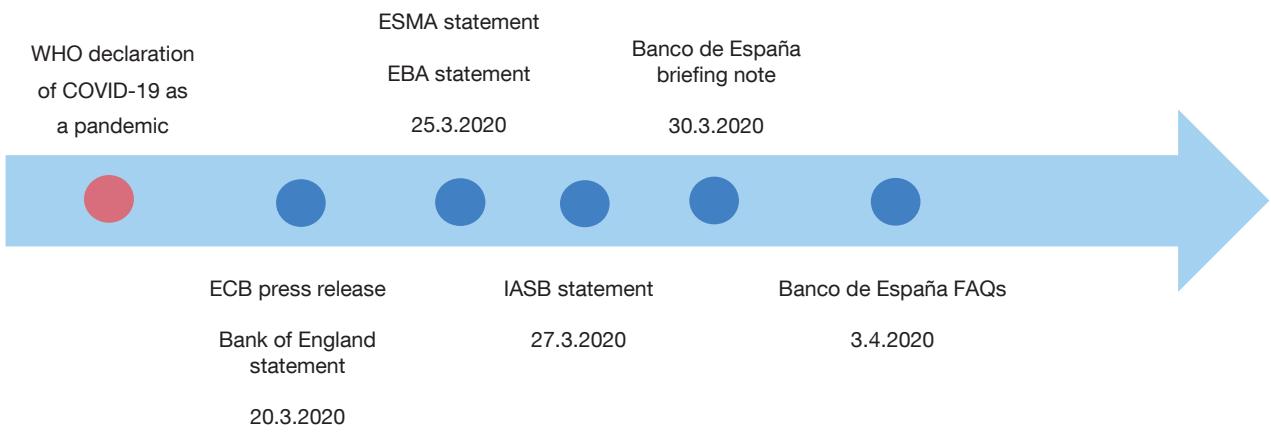
On 27 March 2020, the IASB published a statement entitled "IFRS 9 and COVID-19".[23] In it the IASB recalled that the application of IFRS9 requires expert judgement

21 To estimate expected losses under IFRS9 loans are classified into one of three categories: Stage 1, Stage 2 and Stage 3, with the highest credit quality relating to Stage 1. In general, as the classification of a specific loan worsens, the associated expected loss increases.

22 On 12 February 2002 the then United States Secretary of Defence Donald Rumsfeld stated the following in response to a question about Iraq and weapons of mass destruction: "There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know."

23 The full title is "IFRS 9 and COVID-19. Accounting for expected credit losses applying IFRS 9 Financial Instruments in the light of current uncertainty resulting from the COVID-19 pandemic".

Figure 1
MAIN ANNOUNCEMENTS RELATING TO ACCOUNTING ISSUES
2020 H1



SOURCE: Devised by authors (drawing on public information).

and that this standard allows and requires banks to adjust their practices in estimating credit loss provisions to different circumstances. Further, it stated that certain linkages and assumptions underlying the way these provisions had been estimated to date might no longer hold in the situation deriving from COVID-19 and that banks should not continue to apply their existing practices automatically.

Lastly, on 30 March 2020 the Banco de España, as the national accounting regulator for credit institutions, published a briefing note on the use of the flexibility envisaged in the accounting standards in view of the shock caused by COVID-19. On 3 April 2020 this briefing note was supplemented with the publication of an FAQs document, which was updated on 30 April 2020.

The main messages conveyed in the foregoing statements will be discussed below, starting with those relating to the classification for estimating provisions for loans due to credit risk and continuing with those relating to calculating provisions.

As stated previously, the containment measures adopted by governments to limit the spread of the coronavirus have had severe consequences on economic activity. However, the impact of the situation caused by COVID-19 on a firm's operating results or on household income while the containment measures are in force does not have to be permanent.

The liquidity difficulties of many borrowers will fully or partially disappear when such containment measures are lifted. Also, the exceptional and significant public support measures aimed at mitigating the temporary liquidity

difficulties of borrowers affected by the situation deriving from COVID-19 should be taken into account.

In its statement, ESMA recalls that the presumption that exposures with amounts past due more than 30 days should be reclassified from Stage 1 to Stage 2 (which generally involves an increase in the level of provisioning for the transaction) **can be rebutted.** ESMA's message is that, in the context of COVID-19, the fact that amounts may be past due should not be automatically applied when classifying exposures into stages.

ESMA also recalls that significant increases in credit risk since origination, which lead to classification in Stage 2, are identified by considering the entire expected life of the transaction. Consequently, banks must analyse the extent to which sudden and short-term changes in a borrower's situation give rise to impacts over the entire life of the transaction. It also emphasises that moratoria and other measures allowing payments to be postponed that are granted as a result of the situation generated by COVID-19 need not automatically lead to the identification of a significant increase in credit risk. In other words, a warning is issued against an automatic linkage between the change in the contractual conditions of a loan and its reclassification to Stage 2.

Along the same lines, in addition to the aforementioned briefing note, the Banco de España incorporated a change to Annex 9 of Circular 4/2017[24] by means of an urgent procedure. The purpose of this change was to break the automatic link that existed until then between a forborne transaction and its reclassification as other than performing (i.e. other than Stage 1).

Forbearance is the modification of the contractual conditions of a loan as a result of the borrower's financial difficulties. Prior to the change in Annex 9 of Circular 4/2017, it was assumed that forbearance automatically meant that there had been a significant increase in credit risk (leading to classification in Stage 2) or credit impairment (leading to Stage 3). The situation deriving from COVID-19 evidenced that this assumption did not necessarily hold true either in this exceptional situation or going forward.

The fact that the borrower is suddenly experiencing temporary financial difficulties does not necessarily mean that there has been a significant increase in credit risk considering the entire expected life of the transaction. Even in the event that there

24 This circular establishes the accounting regime applicable to Spanish credit institutions in their individual financial statements. Its full name is Banco de España Circular 4/2017 of 27 November 2017 to credit institutions on public and confidential financial information rules and formats. The criteria included in this circular on the accounting treatment of financial instruments are in line with those of IFRS9-EU (an international standard that is directly applicable to the consolidated financial statements of practically all banks). Annex IX of Circular 4/2017 on credit risk analysis, allowances and provisions implements the expected loss approach of IFRS9-EU.

has been such an increase, it may be reversed before the minimum period of two years during which forbearance must be identified as such has elapsed. Therefore, it should be possible to reclassify the loan as performing before the forbearance ceases to be flagged as such.

Following the change, under Annex 9 forbearance now works as a rebuttable presumption that there has been a significant increase in credit risk. A transaction may continue to be classified as performing if the bank justifies that no event evidencing a significant increase in credit risk has been identified at the time of forbearance.

Considering all the above, in their financial statements for 2020 Q1 and Q2, banks were not forced to automatically reclassify to a "worse" stage, in terms of credit quality, loans with amounts between 30 and 90 days past due, those granted to borrowers who had experienced a sudden decrease in income or those whose contractual conditions had been modified to facilitate payment by borrowers affected by the situation deriving from COVID-19. Banks thus had more headroom to compile and analyse information on lending transactions in order to identify those where liquidity constraints had been temporary and did not entail a significant decrease in credit quality.

In a situation such as that arising from COVID-19, general factors such as loans with amounts more than 30 days past due or whose conditions have been changed may not constitute sufficient evidence of a significant decrease in credit quality. Consequently, if a transaction is to be classified correctly it might be necessary to analyse additional risk factors in order to calculate the magnitude of the decrease in the debtor's recurrent income or determine whether such decrease will persist over time.

One of the phenomena to be contended with when the correct functioning of a system is being sought is that known as "tight coupling". This term makes reference to the need to complete many closely-linked processes in little time; in these cases, an anomalous functioning is likely to arise in situations of stress which would not occur if more time were available to carry them out. The aforementioned measures regarding classification by credit risk made it possible, in the COVID-19 crisis, for banks not to have to make decisions in haste, thus reducing the risk of adopting erroneous decisions, which is a key issue given the importance financing decisions have for households and firms.

As regards the aforementioned estimation of credit risk coverage (provisions) under the expected loss approach of IFRS9-EU, information about future conditions must be taken into account to determine whether and to what extent it is necessary to adjust the historical information on borrowers' payment behaviour and on losses observed on credit transactions. The information about future conditions taken into account by banks generally consists of forecasts of future macroeconomic variables.

Although the situation resulting from COVID-19 was undoubtedly going to lead to a decline in economic activity, there was a high degree of uncertainty about the magnitude of such impact during 2020 H1. In this situation of extreme uncertainty, it was immensely difficult to generate macroeconomic scenarios and assign probabilities to them.

In its statement, the IASB noted that banks would have to take into account the effects of the containment and support measures adopted when assessing future conditions. Given that in this context it would be very difficult to do this any other way, the IASB explained that banks would be able to make adjustments to the results obtained from their expected loss models in order to consider both effects. The idea was that after some time, when the situation began to stabilise, banks would be able to update their macroeconomic scenarios and associated probabilities. This message sought to promote a practical, rather than dogmatic and complex, approach to applying the standard.

Another feature of the IFRS9-EU expected loss approach is the use of the probability of default over the entire life of the transaction to estimate provisions for Stage 2 transactions.

Against this backdrop, the ECB recommended that banks give a greater weight to longer-term, more stable, forecasts, based on historical performance. The effects of the volatility generated in an environment subject to frequent changes as new information became available would thus be mitigated.

Lastly, together with moratoria, the other measure frequently resorted to was the granting of public guarantees for certain lending transactions; for example, the guarantee facilities of the Official Credit Institute (ICO) in Spain. In these cases, the ESMA statement highlights that the amount of the provision associated with the transaction may be reduced owing to the effect of these guarantees. Insofar as the public sector guarantee specifically covers the failure of a borrower to make payments, the amount of the expected loss associated with the transaction will be reduced.

3.5 Prudential treatment of provisions

With the first-time application of IFRS9-EU, the BCBS resolved to introduce at the international level the possibility of deferring the potential impact of provisions on banks' regulatory capital over time. Two components were distinguished: a static component, for the increase in provisions at the date of entry into force of IFRS9-EU, and a dynamic component, for the difference between the provisions for exposures classified in Stages 1 and 2 at each calculation date and those recorded as at 1 January 2018. These transitional arrangements allowed

adding, in decreasing percentages, a portion of these provisions to the highest-quality capital (CET1) over a period not exceeding five years. This adjustment to regulatory CET1 is called "add-back".

The effects of the pandemic may result in an increase in provisions for expected losses, with the consequent impact on capital. For this reason, the Basel Committee resolved to revise these transitional arrangements to provide flexibility and help such impact fade over time. Specifically, jurisdictions are allowed to incorporate these transitional arrangements into their regulation, even if they had not done so previously, and provide flexibility for banks to use the most favourable approach (dynamic or static). As regards the design, jurisdictions are allowed to increase the adjustment coefficient to 100% during 2020 and 2021 (although they may also maintain the existing percentage if they consider it appropriate), resetting the transitional period, which would therefore be extended once again to five years. Finally, the use of alternative methodologies for calculating the impact of the entry into force of expected loss accounting is allowed.

Adjustments introduced at European level with the "quick fix"

In line with the BCBS, within the European package commonly known as the "quick fix", the EU authorities revised the transitional arrangements for provisions for expected losses in the prudential framework. First, the arrangements for the dynamic component were revised, splitting it into two: i) increase in provisions between 1.1.2018 and 31.12.2019, which will continue to be subject to the existing transitional arrangements;[25] and ii) increase in provisions from 1.1.2020 (which could be associated with those deriving from the impact of COVID-19), for which the arrangements are revised. Specifically, the proposal consists of resetting the transitional period for the latter (extending it once again to five years) and revising the percentages of recognition in CET1, starting at 100% in the first two years, with a linear phase-in during the following three. This change will allow banks to continue recording the provisions required without consuming regulatory capital during the first two years – progressively increasing consumption over the following three years –, although they would be accounted for in the income statement and in the net book value.

The impact of this measure will largely depend on the classification of exposures in the different IFRS9-EU stages. If an exposure is reclassified to Stage 3 or derecognised owing to write-offs, these provisions cease to count for the transitional arrangements. The new dynamic component has a two-fold benefit for exposures classified in Stage 1 and Stage 2. First, the add-back applicable to the stock of provisions increases from 70% to 100% from 1.1.2020, lengthening the time frame.

25 70% in 2020, decreasing to 0% in 2023.

Second, banks are allowed to only take into account the change in the stock of provisions in 2018 and 2019 if they entail a benefit in the calculation of the dynamic component. In other words, their effect would only be taken into account if they increased, thus preventing potential falls in the stock in 2018 and 2019 from offsetting or reducing the benefits of the new transitional arrangements.

3.6 The macroprudential policy response

The aim of macroprudential policy is to mitigate preventively systemic risks that might affect financial stability. The authorities entrusted with macroprudential policy for the banking sector have a macroprudential toolkit that is provided for in domestic regulation. The tools are to be used on the basis of the financial system's cyclical and structural circumstances in each jurisdiction.

With the adoption of Basel III, the banking authorities of the world's main jurisdictions – including the EU and all its Member States – have had at their disposal since 2016 the countercyclical capital buffer (CCyB) and capital buffers for global systemically important institutions and other systemically important institutions (the G-SII and O-SII buffers). EU law provides for additional tools such as the systemic risk buffer and the possibility of setting higher risk weights for credit exposures owing to financial stability considerations. In turn, a significant number of EU and non-EU countries have, in their domestic legislation, conferred on their authorities a supplementary macroprudential toolkit with which to strengthen their ability to act. These tools include limits on and conditions for lending by credit institutions, such as the loan-to-value (LTV) ratio limits.

The CCyB is the macroprudential tool *par excellence* since its aim is to shore up banks' solvency, particularly where the macrofinancial situation is favourable, before systemic risks materialise. Credit institutions are required to build up the CCyB during expansionary periods so that it can be released during a subsequent contractionary phase. In this way, the CCyB strengthens the banking system's solvency during growth phases, which is when risks usually build up, and helps mitigate the decline in the flow of new lending to the economy when these risks materialise. Consequently, the CCyB helps increase credit institutions' capacity to withstand potential future losses. Releasing the CCyB in recessionary environments contributes to smoothing credit cycle fluctuations, which in turn could dampen the downswing during recessions. The national macroprudential authorities set the CCyB rate via a quarterly announcement of the buffer's required size, expressed as a percentage of risk-weighted assets of the credit exposures associated with the jurisdiction.[26]

26 The CCyB rate tends to be set between zero and 2.5% (calibrated in steps of 0.25 percentage points). A CCyB rate in excess of 2.5% should be acknowledged expressly by the macroprudential authorities of other jurisdictions

After COVID-19 was declared a pandemic on 11 March 2020, the national macroprudential authorities swiftly announced several measures. In tandem, European and global bodies issued statements calling for coordinated collective action. The national authorities' reactions were shaped by their respective pre-COVID-19 macroprudential requirements. Broadly speaking, these announcements highlighted the importance of communication and transparency when designing macroprudential policies and the extraordinary need to signal to all economic and social agents the macroprudential authorities' willingness to adopt measures that soften the adverse and uncertain impact of COVID-19.

Table 1 contains the CCyB-related macroprudential measures announced in response to COVID-19. Overall, 15 jurisdictions, most of which European (since Europe has been the most active user of this tool in recent years), have released the CCyB. In most cases, the CCyB has been released in full – reverting the rate to 0% – and, where applicable, the CCyB announcements made over the immediately preceding 12-month period which at that point had not yet become effective have been revoked. By contrast, a few jurisdictions have opted to either partially reduce the CCyB or release it in stages. To date, only one jurisdiction (Luxembourg) has decided not to change its positive CCyB rate. Spain has not cut the CCyB rate because it was already set at 0% at the onset of the crisis owing to the lack of obvious signs of a build-up of cyclical systemic risks pre-COVID-19.

Table 2 summarises the other macroprudential measures announced in response to COVID-19. A total of nine jurisdictions have adopted macroprudential measures adjusting the implementation of previously announced requirements. Six jurisdictions reduced their structural buffers (such as the systemic risk buffer or the O-SII buffer) completely or selectively on an institution-by-institution basis. While both buffers are designed for withstanding non-cyclical and/or structural risks, authorities have a high level of discretionality as regards their activation and deactivation. This has helped to facilitate their release. Notably, no jurisdiction has lowered the G-SII buffer.[27] In addition, the existence of a minimum positive O-SII buffer rate, decided by the ECB for application in the euro area [European Central Bank (2016)], appears to have curbed the adoption of further measures related to this tool, although two jurisdictions (Cyprus and Portugal) have decided to temporarily interrupt the gradual build-up of this buffer. During this time, Spain has required five systemically important institutions to build up macroprudential

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so that their institutions take it into account when calculating their institution-specific CCyBs. Based on the CCyB rates of each jurisdiction, banks must calculate the capital requirement applicable to them at the consolidated level based on the geographical diversification of their credit exposures stemming from their international business (the so-called institution-specific CCyB rate). Institutions have one year from an authority's announcement of an increase in the CCyB rate to comply with the requirement. CCyB rate reductions are effective immediately.

27 This appears to be because the regulation governing this tool does not include any contingency wherefore the requirement can be set at 0% or even below the level decided each year by the FSB upon a proposal from the BCBS.

Table 1
NATIONAL COUNTERCYCLICAL CAPITAL BUFFER MEASURES

Country	CCyB (%)			Announcement date (2020)	Responsible authority
	Effective in March 2020	Latest announcement pre-COVID-19	Announced after COVID-19		
DE Germany	0.00	0.25	0.00	18 March	German Financial Stability Committee
				31 March	BaFin
BE Belgium	0.00	0.50	0.00	11 March	Nationale Bank van België/Banque Nationale de Belgique
BG Bulgaria	0.50	1.50	0.50	19 March	Българска народна банка (Bulgarian National Bank)
DK Denmark	1.00	2.00	0.00	12 March	Government
SK Slovakia	1.50	2.00	1.50	28 April	Národná banka Slovenska
			1.00	14 July	
FR France	0.25	0.50	0.00	18 March	French High Council for Financial Stability (HCSF)
IE Ireland	1.00	1.00	0.00	18 March	Central Bank of Ireland
IS Iceland	2.00	2.00	0.00	18 March	Central Bank of Iceland
LT Lithuania	1.00	1.00	0.00	18 March	Lietuvos bankas
NO Norway	1.00	2.50	1.00	13 March	Norges Bank
				13 March	Government
UK United Kingdom	1.00	2.00	0.00	11 March	Bank of England (FPC)
CZ Czech Republic	1.75	2.00	1.75	19 March	Česká národní banka
			0.50	18 June	
SE Sweden	2.50	2.50	0.00	13-16 March	Finansinspektionen
CH Switzerland	2.00	2.00	0,00	25 March	Swiss National Bank
				27 March	Government
HK Hong Kong	2.00	2.00	1.00	16 March	Hong Kong Monetary Authority

SOURCE: Devised by authors (drawing on public information available as of 15 July 2020).
NOTE: The third column refers to the last CCyB rate announced prior to the spread of COVID-19, which would have become effective 12 months after the announcement. Releasing the CCyB is effective immediately. The countries in the table that have not changed the CCyB rate after COVID-19 appear without a figure in the columns for this tool. This table does not include the European countries that have not made any changes to macroprudential tools because of COVID-19.

capital buffers. The calibration of these buffers, consistent with the minimum levels established in the prevailing legislation and the ECB guidance, has not afforded the Banco de España any leeway to reduce them.

The general absence of macroprudential measures relating to limits on and conditions for lending (LTV, LTI, DTI and DSTI limits) is noteworthy. Except for Portugal – which has adopted a measure to prevent lending to households from being limited owing to temporary reductions in their income – a possible explanation could be that COVID-19 has clearly encouraged banks to implement more prudent lending standards and, in general, pay closer scrutiny to borrowers, in which case the existence of minimum regulatory limits becomes less important as it does not entail effective restrictions on lending by institutions.

Table 2

OTHER NATIONAL MACROPRUDENTIAL MEASURES

Country		Announcement date (2020)	Authority	Description
CY	Cyprus	10 April	Central Bank of Cyprus	Deferral by one year (to 2023) of the end of the phase-in period for the O-SII buffers
SI	Slovenia	8 April	Banka Slovenije	Temporary restriction on the distribution of profits by credit institutions
		22 May	Banka Slovenije	Amendment to DSTI ratio limits for households affected by COVID-19
EE	Estonia	25 March	Eesti Pank	Full reduction of the SyRB
FI	Finland	18 March	Finanssivalvonta (FIN-FSA)	Full reduction of the SyRB and selective reduction of the O-SII buffers
HU	Hungary	1 April	Magyar Nemzeti Bank	Full reduction of the O-SII buffers
NL	The Netherlands	17 March	De Nederlandsche Bank	Partial and selective reduction of the SyRB and of the O-SII buffers
				Deferral of the introduction of minimum floors for for mortgage loan risk weighting calculated for institutions using internal models (measure under Article 458 of the CRR)
PL	Poland	16 March	Polish Financial Stability Committee (KSF)	Full reduction of the SyRB (from 3% to 0%)
		20 March	Government	
PT	Portugal	25 March	Banco de Portugal	Amendment to a recommendation applicable to banks on credit limits and standards to exempt certain loans granted to households
		8 May	Banco de Portugal	Postponement by one year (to 2022) of the end of the O-SII buffer phase-in period
CA	Canada	13 March	Office of the Superintendent of Financial Institutions (OSFI)	Reduction (from 2.25% to 1%) of the domestic stability buffer (applicable to domestic systemically important banks)

SOURCE: Devised by authors (drawing on public information available as of 25 June 2020).
NOTE: CCyB and SyRB refer to the countercyclical capital buffer and the systemic risk buffer, respectively. O-SIIs are other systemically important institutions. The third column refers to the last CCyB rate announced prior to the spread of COVID-19, which would have become effective 12 months after the announcement. Releasing the CCyB is effective immediately. The countries in the table that have not changed the CCyB rate after COVID-19 appear without a figure in the columns for this tool. This table does not include the European countries that have not made any changes to macroprudential tools because of COVID-19.

In tandem with the announcements of these national measures, various EU and global bodies issued statements in March urging the national authorities to provide a coordinated macroprudential response. The proposed response was to ease requirements – thereby complementing other microprudential supervisory initiatives – primarily to allow for continued lending by banks to the real economy despite the difficulties associated with COVID-19. The FSB and the BCBS highlighted the flexibility built into macroprudential regulation and encouraged national authorities to make use of it when adopting measures. In the EU, both the EBA and the ECB called on authorities to reduce the CCyB. In April, once most national measures had been adopted, the ECB publicly endorsed them and highlighted its contribution to the measures. As the microprudential supervisory authority with the power to tighten macroprudential measures in the euro area, the ECB issued a non-

objection decision on the proposed CCyB or other macroprudential buffer-related measures that were mandatorily notified by the national authorities. Along the same lines, and one week earlier, the Eurogroup issued its own statement endorsing the measures taken hitherto to shore up financial stability. In mid-June, as part of its Annual Report 2019 on the banking union, the European Parliament passed a resolution that also supported the national measures taken.

The table A.1 in the annex summarises the main statements issued globally and by the EU containing macroprudential policy guidance. ECB Banking Supervision and the EBA issued statements on 12 March, just one day after the WHO declared the pandemic. The BCBS and the FSB did so a week later (20 March).

The European Systemic Risk Board (ESRB) drastically realigned its work programme to focus – during April and May – on five priority areas concerning mainly macroprudential analysis (see the annex). Having moved into "crisis mode", the ESRB's work resulted in, inter alia:

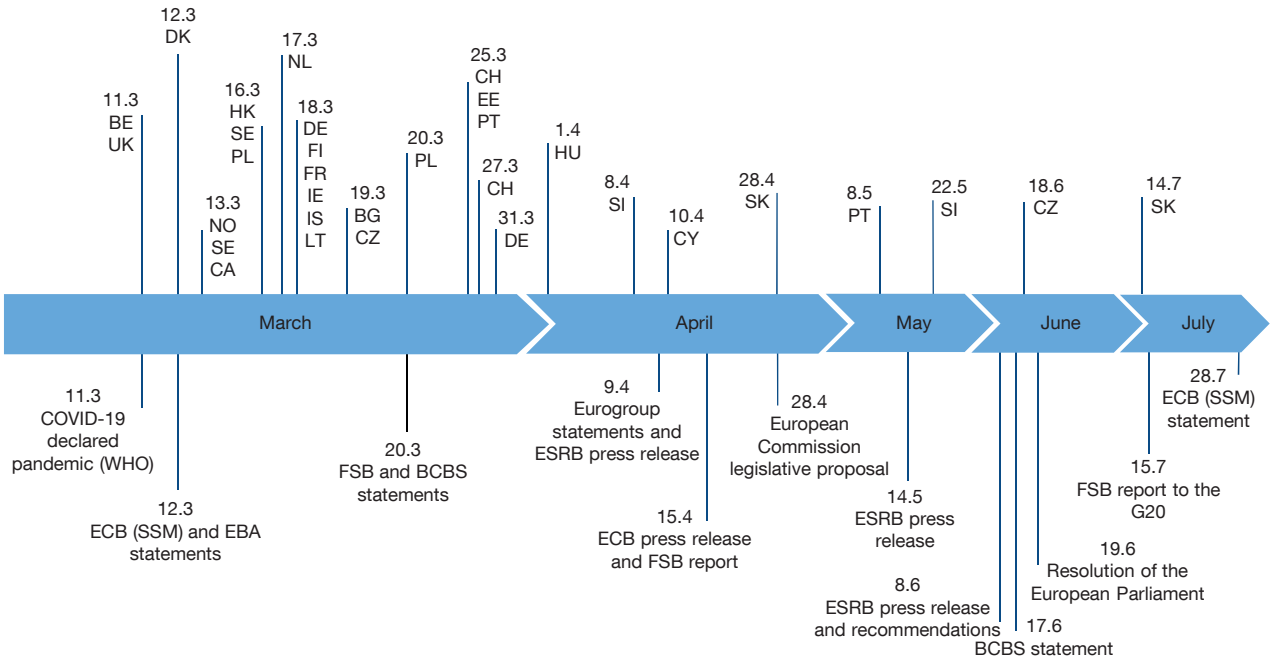
i) a Recommendation for all EU macroprudential authorities on monitoring the financial stability implications of debt moratoria, and public guarantee schemes and other measures of a fiscal nature taken to protect the real economy in response to the COVID-19 pandemic;

ii) a Recommendation for competent microprudential authorities to request that banks, insurance companies, investment firms and central counterparties (CCPs) refrain from making dividend distributions at least until 1 January 2021. This recommendation in turn led the ECB and the SSM national competent authorities to revise their dividend distribution policy at the end of July; and

iii) a Recommendation for competent microprudential authorities, the ESMA and the European Commission on liquidity risks arising from margin calls, with the aim of: i) limiting cliff effects in relation to the demand for collateral; ii) improving stress scenarios for the assessment of CCPs; iii) limiting liquidity constraints related to margin collection; and iv) promoting international standards on mitigating procyclicality in the provision of client clearing services and in securities financing transactions.

Figure 2 includes a timeline of the national macroprudential measures and statements by supranational bodies containing macroprudential policy guidance. Most of the measures, in particular those concerning the CCyB, were taken in the second and third weeks of March. As a result of the commonly followed regulatory timetables, the quarterly review of the CCyB means that at normal times the

Figure 2
TIMELINE OF MACROPRUDENTIAL ACTION (2020)



SOURCE: Devised by authors (drawing on public information).

CCyB rates applicable in the second quarter of the year (or, if the rate is increased, the second quarter of the following year) are announced during the second half of March. This circumstance, combined with the immediacy of the rates' entry into force, partly explains the authorities' swift reaction to the events of the first weeks of March. By contrast, extraordinary macroprudential measures concerning other tools were adopted in the following weeks (although some of them are not in fact effective until 1 January 2021).

The speed of the national macroprudential authorities' reaction was presumably affected by a wide range of factors. On the one hand, domestic epidemiological developments and those in neighbouring countries could have influenced the diagnosis of the severity of the situation and the resulting greater or lesser urgency to take measures swiftly. On the other, the characteristics of the domestic institutional frameworks could also have played their part. Depending on the country, one or more authorities participate in the adoption of measures concerning macroprudential tools subject to flexible governance arrangements (in some countries an authority adopts macroprudential measures upon a proposal from another authority or an interagency committee). Furthermore, in the euro area national macroprudential authorities' obligation to inform the ECB of their proposed measures in advance could also have delayed the announcement of some measures in certain cases.

4 Measures aimed at easing the operational burden: reprioritising resources without undermining financial stability and fostering international coordination

The authorities have introduced a series of adjustments to alleviate the operational burden in order to focus resources on financial stability priorities and the response to COVID-19. COVID-19 has had a widespread impact, affecting not only the financial markets and the real economy but also society as a whole. The social distancing and confinement measures have been applied globally in various jurisdictions with operational capacity consequences for both supervisory authorities and banks, making the adoption of these measures necessary.

Some examples of these adjustments at the international level include international organisations (such as the FSB and the BCBS) reprioritising their work plans to focus efforts on coordinating the response to the crisis. The BCBS postponed all assessment exercises related to the implementation of standards under its Regulatory Consistency Assessment Programme (RCAP) to 2021. At the same time, the BCBS reviewed and reduced the non-essential information for designating global sistemically important banks (G-SIBs) and decided to postpone the implementation of the 2019 revised G-SIB framework by one year, from 2021 to 2022.[28]

The deferral of Basel III implementation is also noteworthy. The Group of Central Bank Governors and Heads of Supervision (GHOS), as the body overseeing the decisions adopted by the BCBS, decided to defer by one year to 2023 the implementation of the Basel III standards finalised in 2017,[29] the market risk framework finalised in 2019 and the Pillar 3 disclosure requirements finalised in December 2018.[30]

The objective of this set of reforms is to complement the Basel III standards adopted in 2011, lessen the excessive volatility of risk-weighted assets (the capital ratio's denominator) and adapt the disclosure standards accordingly. They are a key part of the new regulatory framework arranged internationally in the wake of the crisis. The objective of revising the deadlines to delay implementation by one year is to afford the banking sector and the authorities greater capacity to respond to the short-term impact of COVID-19. By no means is the delay meant to bring into question the essence of these changes or their implementation; in this connection GHOS members unanimously reaffirmed their expectation of full, timely and consistent implementation of all Basel III standards based on this revised timeline. Indeed,

28 Basel Committee on Banking Supervision (2018). The revised framework included a series of enhancements such as the introduction of a trading volume indicator and the extension of the scope of consolidation to insurance subsidiaries.

29 For further details on these measures see Anguren, Castro and Durán (2018).

30 Along the same lines and in order to alleviate the operational burden, the BCBS and IOSCO agreed to extend by one year the deadline for completing the final two implementation phases of the margin requirements for non-centrally cleared derivatives.

current events demonstrate once again the importance of a resilient financial system, which these reforms will help further reinforce.

The European Commission joined the BCBS' initiative and announced the deferral by one year of implementation of Basel III in the EU, while the EBA has postponed its stress test to 2021. To facilitate banks focusing on core banking operational matters, the EBA decided to postpone the 2020 stress test, replacing it with a transparency exercise, which is less resource-intensive for institutions. It also asked the supervisors to give banks leeway in the remittance dates for some areas of supervisory reporting that were not essential to monitoring the crisis and, in general, to postpone non-essential information requests.

5 Conclusion: initial lessons and future considerations

The coordinated response by the authorities, both globally and between authorities entrusted with different regulatory areas, is key. The ramifications of the impact of COVID-19 span sectors and different geographical areas owing to its nature and the existing interconnections in an increasingly globalised world. Against this background, the role of supranational bodies is of the utmost importance.

Turning to the banking sector, the crisis triggered by the pandemic has shown once again the importance of having robust regulation in place at the international level that ensures institutions' capital and liquidity positions. In this connection, the Basel III reform has proven to be a fundamental tool in helping absorb the shock triggered by COVID-19 and shows the importance of jurisdictions fulfilling their commitment to full, timely and consistent implementation of the outstanding reforms.

On the accounting front, the IFRS framework, including the expected credit loss approach for estimating provisions, has proven to be flexible enough to adapt to the situation triggered by COVID-19, enabling supervisors and regulators to provide institutions with guidance on applying the accounting rules under IFRS in order to mitigate the procyclicality of inadequate practices.

Furthermore, the vast experience gained since the outbreak of the COVID-19 crisis will also provide important lessons for macroprudential policy conduct. COVID-19 has been a huge non-cyclical and exogenous shock to the financial system, for which no macroprudential tool was theoretically designed. The countercyclical capital buffer (CCyB) has taken on particular importance in the current setting since it is designed to be released when the credit cycle contracts. However, the CCyB was not a uniformly enforceable requirement pre-crisis and, therefore, its release was only an option for the national macroprudential authorities that had previously set it at a positive rate.

The CCyB operationalisation paradigm bears reflecting upon. Up until the beginning of this year, some authorities had activated the CCyB due to the presence of signs of imbalance in their credit cycles or, alternatively, due to merely precautionary reasons ahead of possible adverse future shocks, taking advantage of the discretionality built into the regulation governing this instrument for shoring up institutions' solvency. The outbreak of COVID-19 has highlighted the benefits of this second approach – based on setting a minimum positive CCyB that can be revised due to cyclical considerations – to cope with unexpected distress exogenous to the financial system. Such a change in the use of the CCyB could be part of a more extensive review of the weight the releasable macroprudential buffers (the CCyB and the systemic risk buffer) should have relative to the structural institution–specific buffers (the G-SII, O-SII and capital conservation buffers). The response to the crisis would have been more effective and flexible had the former's weight relative to the latter's been greater.

Planning the future path of rebuilding the capital buffers as the economic recovery takes hold is another matter that should feature on the prudential authorities' agenda. This issue was highlighted by the BCBS in its 17 June statement, by some Bank for International Settlements officials [Bank for International Settlements (2020)] and by the ECB. Some national authorities [De Nederlandsche Bank (2020)] have publicly presaged, by means of forward guidance, their intention to set a positive CCyB rate to the detriment of structural buffers, with the ultimate aim of affording themselves greater scope for action in response to future crisis episodes. More immediately, the Banco de España has conveyed its intention to hold at 0% the CCyB for a prolonged period, at least until the main economic and financial effects arising from the coronavirus crisis have dissipated [Banco de España (2020e)].

The supervisory and regulatory authorities must remain vigilant in the highly uncertain environment caused by COVID-19 in order to ensure the financial system's resilience. A key area of focus in the future will be strategies for withdrawing the temporary measures adopted. In this regard, the international bodies and national authorities must reflect on and analyse the design of exit strategies that, given the existing uncertainty, must take into account the possible cliff effects they might cause and the potential trade-offs, such as an excessively premature withdrawal that jeopardises the possible recovery.

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— (2020c). "ECB supports macroprudential policy actions taken in response to coronavirus outbreak", press release of 15 April.

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Annex

Table A.1

STATEMENTS BY SUPRANATIONAL BODIES CONTAINING MACROPRUDENTIAL GUIDANCE

Body	Date (2020)	Statements containing macroprudential guidance
European Central Bank (ECB), Single Supervisory Mechanism (SSM)	12 March	ECB Banking Supervision provides temporary capital and operational relief in reaction to coronavirus "The ECB considers that these temporary measures will be enhanced by the appropriate relaxation of the countercyclical capital buffer (CCyB) by the national macroprudential authorities"
	28 July	ECB extends recommendation not to pay dividends until January 2021 and clarifies timeline to restore buffers
European Banking Authority (EBA)	12 March	EBA statement on actions to mitigate the impact of COVID-19 on the European Union banking sector "A number of provisions in the regulatory framework ensure that banks build up adequate capital and liquidity buffers. These buffers, including macroprudential ones, are designed to be used in order to absorb losses and ensure continued lending to the economy during a downturn. Banks should also follow prudent dividend and other distribution policies, including variable remuneration. [...] The EBA is in close contact with the European Systemic Risk Board in order to ensure that microprudential and macroprudential measures are fully aligned"
Basel Committee on Banking Supervision (BCBS)	20 March	Basel Committee coordinates policy and supervisory response to COVID-19 "The Basel III framework includes capital and liquidity buffers that are designed to be used in periods of stress. These include the capital conservation buffer and, by extension, the countercyclical capital buffer and buffers for systemically important banks. [...] Many supervisors are already encouraging banks to make use of these tools, which allow for flexibility in responding to the current circumstances"
	17 June	Basel Committee meets; discusses impact of COVID-19; reiterates guidance on buffers "The measures taken by the Committee at the onset of the pandemic have helped mitigate some of the short-term financial stability risks. […] The Committee views a measured drawdown of banks' Basel III buffers to meet these objectives as both anticipated and appropriate in the current period of stress. Supervisors will provide banks sufficient time to restore buffers taking account of economic and market conditions and individual bank circumstances"
Financial Stability Board (FSB)	20 March	FSB coordinates financial sector work to buttress the economy in response to COVID-19 "The FSB encourages authorities and financial institutions to make use of the flexibility within existing international standards to provide continued access to funding for market participants and for businesses and households facing temporary difficulties from COVID-19, and to ensure that capital and liquidity resources in the financial system are available where they are needed. Many members of the FSB have already taken action to release available capital and liquidity buffers"
	15 April	COVID-19 pandemic: Financial stability implications and policy measures taken "The official sector community is providing a rapid and coordinated response to support the real economy, maintain financial stability and minimise the risk of market fragmentation. This response is underpinned by the following principles: [...] 2. Authorities recognise, and will make use of, the flexibility built into existing financial standards – including through the use of firm-specific and macroprudential buffers – to sustain the supply of financing to the real economy, to support market functioning and to accommodate robust business continuity planning"
	15 July	FSB Chair letter to G20 Finance Ministers and Central Bank Governors "Using flexibility in standards and buffer use. Most measures taken by FSB members have used the flexibility built into international standards, including regarding the use of capital and liquidity buffers. [...] Supervisors have agreed that banks will be given sufficient time to restore buffers, taking account of economic and market conditions and individual bank circumstances"

Table A.1

STATEMENTS BY SUPRANATIONAL BODIES CONTAINING MACROPRUDENTIAL GUIDANCE (cont.)

Body	Date (2020)	Statements containing macroprudential guidance
European Central Bank (ECB)	15 April	ECB supports macroprudential policy actions taken in response to coronavirus outbreak "ECB supports the swift action taken by euro area macroprudential authorities to address the financial sector impact of the coronavirus outbreak by releasing or reducing capital buffers. […] They include releases or reductions of the countercyclical capital buffer, systemic risk buffer and buffers for other systemically important institutions. In addition, some authorities have postponed or revoked earlier announced measures to avoid placing pressure on banks to accumulate capital buffers in a downturn"
European Systemic Risk Board (ESRB)	9 April	The General Board of the ESRB held its 37th regular meeting on 2 April 2020 "Against this background [COVID-19] the General Board underlined that a timely and coordinated policy response is key, in particular to achieve important synergies between fiscal, monetary and regulatory policies. To this end, the General Board decided to focus its attention on five priority areas, specifically: – implications for the financial system of guarantee schemes and other fiscal measures to protect the real economy; – market illiquidity and implications for asset managers and insurers; – impact of procyclical downgrades of bonds on markets and entities across the financial system; – system-wide restraints on dividend payments, share buybacks and other payouts; – liquidity risks arising from margin calls"
	14 May	The General Board of the ESRB takes first set of actions to address the coronavirus emergency at its extraordinary meeting on 6 May 2020
	8 June	The General Board of the ESRB takes second set of actions in response to the coronavirus emergency at its extraordinary meeting on 27 May 2020
Eurogroup	9 April	Report on the comprehensive economic policy response to the COVID-19 pandemic "Financial Stability: We welcome the guidance provided by supervisory authorities to financial institutions on the interpretation and application of the regulatory requirements in the current exceptional circumstances. We also welcome the release of capital buffers. To overcome the financing pressures faced by firms and households, making full use of the flexibility provided for in the regulatory framework is essential"
European Commission	28 April	Coronavirus Response: Commission adopts banking package to facilitate lending to households and businesses in the EU "The Commission encourages the ESRB to coordinate an EU-wide approach as regards the use of macroprudential buffers in the crisis and recovery phase"
European Parliament	19 June	European Parliament Resolution of 19 June 2020 on Banking Union – Annual Report 2019 "General considerations: […] 10. Emphasises that the provision of credit and liquidity by banks plays a decisive role in mitigating the most severe economic consequences of the COVID-19 outbreak on people in the EU; notes, in this context, the legislative and supervisory measures that have been proposed or adopted to make sure that banks keep lending throughout this crisis; welcomes [...] the release of capital buffers"

SOURCE: Devised by authors (drawing on public information).
NOTE: This table does not include references to speeches by officials of these institutions or to regular publications (such as financial stability reports).

The challenges associated with the use of agencies' credit ratings in the context of the COVID-19 crisis

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THE CHALLENGES ASSOCIATED WITH THE USE OF AGENCIES' CREDIT RATINGS IN THE CONTEXT OF THE COVID-19 CRISIS

Abstract

A consequence of the outbreak of the pandemic triggered by COVID-19 is the unprecedented global economic recession that has led rating agencies to increase their credit rating downgrades. This process could continue in the coming months if the unfolding of the pandemic results in a significant worsening of the macroeconomic outlook. Although the financial system's reliance on these ratings has decreased since the global financial crisis, they continue to play a significant role for regulatory purposes and when the investment policies of financial intermediaries and the operational framework of central banks are determined. As a result, these movements could have potentially adverse effects on monetary policy transmission, financial stability and the real economy. The article describes the challenges posed by rating downgrades in these three areas and considers possible measures to mitigate the adverse effects, taking into account the specific characteristics of the current crisis.

1 Introduction

The academic literature has noted the widespread practice of rating agencies downgrading credit ratings in periods of crisis, in order to assess the possible procyclicality of this behaviour.[1] The concentration of rating downgrades during these spells may lead to a worsening of the financing conditions of broad segments of issuers and to lower aggregate investment in the economy.[2] These impacts are magnified when credit ratings are used for regulatory purposes and when financial intermediaries employ them in their investment policies and central banks employ them in their operational framework. Notwithstanding the fact that the reliance on credit ratings has decreased since the global financial crisis, they still play a significant role, therefore, all of the foregoing developments could have a negative impact on monetary policy transmission, financial stability and real activity.

This article considers the implications for monetary policy implementation and for the macro-financial environment of potential credit rating downgrades that might be applied by external credit assessment institutions (ECAIs) due to the COVID-19 crisis and discusses measures which could be taken, where appropriate, to mitigate the effects that the mechanical use of these ratings could have on central banks' targets.

1 See Auh (2015), Bolton, Freixas and Shapiro (2012) and Broto and Molina (2016), among others.

2 The scale and speed of the downgrades of companies' credit ratings have an adverse effect on their valuation [Holthausen and Leftwich (1986)] and their fixed asset expenditure [Acharya, Davydenko and Strebulaev (2012)]. Similarly, changes in the sovereign debt credit rating of countries where specific firms operate affects the latter's financing and investment capacity [Almeida, Cunha, Ferreira and Restrepo (2017)].

Credit ratings directly affect two essential instruments in the area of monetary policy implementation. First, they determine the eligibility of the assets that credit institutions can use as collateral in refinancing operations and the level of the haircut applicable to their value. Second, they determine which assets are eligible for acquisition as part of central banks' different purchase programmes. The downgrading of ratings reduces the assets that are eligible as collateral, which can limit institutions' borrowing capacity. Similarly, it reduces the universe of eligible assets in purchase programmes, therefore limiting the effectiveness of these programmes. This is why credit rating downgrades pose a risk for monetary policy transmission.

From a macro-financial standpoint, credit rating downgrades can lead to a tightening of the financing conditions of the issuers affected, both in the debt and bank funding markets. The effects would be particularly pronounced if the credit rating drops below investment grade. Spanish non-financial corporations and businesses are currently more exposed to these risks than before the global financial crisis. First, the relative weight of financing from bond markets has increased. Second, the bulk of issuers have ratings which are situated at the lower end of the investment grade rating.

The ratings of most Spanish credit institutions are currently in the lower range of the investment grade rating. A potential downgrade of institutions' credit ratings, in addition to the direct effects on the institutions themselves, may also have knock-on effects on other sectors in so far as they may pass on possible higher borrowing costs to customers. Additionally, the value of credit institutions' and other financial intermediaries' assets is exposed to the effects of higher risk in securities markets and of reviews by ECAIs through direct holdings in marketable securities, a significant portion of which are also at the lower end of the investment grade rating. The implications of this exposure are exacerbated by the considerable overlap of securities portfolios across various financial sub-sectors (banking, insurance and investment and pension funds). Therefore, the negative effects which would be triggered by a significant downgrade of credit ratings to below investment grade would be amplified through these common holdings. These changes in the valuation of marketable securities holdings may affect financial institutions' solvency, through unrealised losses which consume capital and the increase in risk-weighted assets (RWAs),[3] and they may also potentially affect liquidity, if they modify these securities' eligibility as collateral.

The rest of the article is structured as follows. Sections one, two and three describe the challenges of credit rating downgrades for monetary policy implementation,

3 The impact on the RWAs relating to debt securities holdings under the standardised approach would be very moderate for Spanish credit institutions, owing to the preponderance of sovereign exposures denominated and financed in local currency, which receive a preferential weighting of 0%, and to the low use of external ratings in the RWAs relating to private corporate issues. The impact on RWAs under the internal ratings-based approach may be greater, through the indirect channel of exposures to the bank loans of businesses which also issue securities and are affected by a ratings downgrade.

macro-economic and financial performance, as well as in the area of financial stability and of exposures of Spanish financial intermediaries. Section four discusses possible measures to mitigate the undesired effects of a potential mechanical use of credit ratings by ECAIs in the above-mentioned areas. The article also includes a box on recent discussions of these matters by international groups.

2 The challenges of credit rating downgrades for monetary policy implementation

Under the Eurosystem's monetary policy implementation, credit ratings play a significant role both in collateralised refinancing operations and asset purchase programmes.

Refinancing operations granted by the Eurosystem to credit institutions[4] should be properly collateralised by financial assets. These financial assets have to meet a series of eligibility criteria and a valuation haircut is applied according to their risk level. The collateral eligibility criteria for marketable financial assets include having a credit rating above a specific threshold; the credit rating is also one of the significant parameters for setting the valuation haircut to be applied to those assets.

The eligibility of marketable securities [government bonds, corporate bonds, covered bonds and asset-backed securities (ABSs)] in the Eurosystem's asset purchase programmes[5] (APP and PEPP) is also determined by their credit rating.

Before the outbreak of the pandemic, marketable financial assets which were acceptable as collateral or eligible for the purchase programmes had to have a rating of at least BBB– (CQS3 in the Eurosystem's nomenclature[6]), except for asset-backed bonds which generally had to have two ratings of at least A– (CQS2), although certain additional asset-backed bonds with two ratings of at least BBB– (CQS3) were also accepted temporarily.

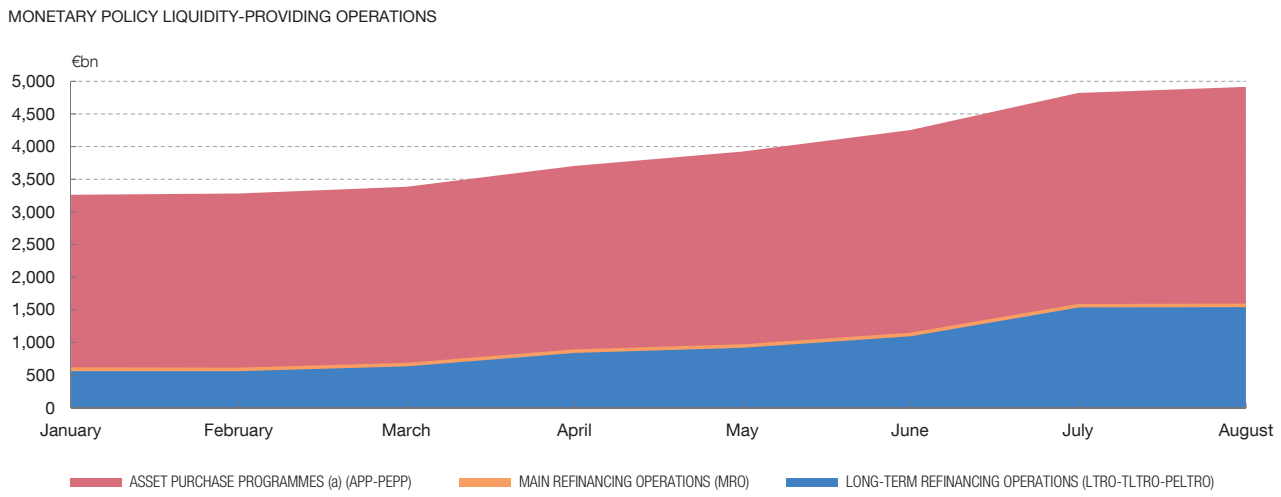
In the context of the COVID-19 crisis, there have been several credit rating downgrades and further reductions are foreseeable. This has an impact on the Eurosystem's *refinancing operations* which is determined by several factors: first, the market value of securities which are eligible as collateral and are affected by these downgrades will decline and second, the valuation haircut applied to them, due to the higher risk, will increase; furthermore, the securities which are no longer investment grade will lose

4 The refinancing operations that the Eurosystem is currently using are main refinancing operations (MROs), longer-term refinancing operations (LTROs), targeted longer-term refinancing operations (TLTROs) and the pandemic emergency longer-term refinancing operation (PELTROs).

5 Asset purchase programme (APP). Pandemic emergency purchase programme (PEPP).

6 The Eurosystem's ratings or credit quality steps are as follows: CQS1 is equivalent to a rating of AAA to AA–; CQS2 to A+ to A–; CQS3 to BBB+ to BBB–; and CQS4 corresponds to BB+ and CQS5 to BB.

Chart 1
LIQUIDITY-PROVIDING OPERATIONS IN 2020



SOURCE: Banco de España: https://www.bde.es/webbde/es/estadis/infoest/e0801.pdf.

a 1% of the amount corresponds to other programmes that have already concluded.

their status as acceptable collateral. Consequently, in order to maintain the financing they already received, institutions will have to provide more collateral against a backdrop in which the universe of eligible assets will have also fallen. If institutions needed additional liquidity, their borrowing capacity could be restricted owing mainly to the reduction in the universe of available assets acceptable as collateral, but also to the higher haircuts applied to and the lower value of those assets affected by rating downgrades which continue to be eligible. A restriction on the institutions' capacity to participate in Eurosystem refinancing operations could affect their capacity to finance the real economy.

The following table shows the significance of the use of marketable assets as collateral in Eurosystem refinancing operations and, consequently, the possible impact of credit rating downgrades on them.

In order to ensure access to Eurosystem financing and ahead of greater use of this financing by institutions, on 7 April 2020,[7] the Governing Council adopted certain measures to relax collateral eligibility requirements which included, most notably, the easing of the conditions for the use of non-marketable assets (loans and advances) as collateral and the general reduction of valuation haircuts for marketable and non-marketable assets. Subsequently, on 22 April,[8] in order to mitigate the impact of rating downgrades on collateral availability, the Governing Council decided to temporarily

7 See ECB (2020a): https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200407~2472a8ccda.en.html.

8 See ECB (2020b): https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200422_1~95e0f62a2b.en.html.

Table 1

BREAKDOWN BY TYPE OF ASSET PROVIDED AS COLLATERAL IN EUROSYSTEM MONETARY POLICY OPERATIONS IN 2020 Q1

	Assets provided as collateral by institutions (%)		
Marketable assets	76	16	Central government bonds
		4	Regional government bonds
		5	Bank bonds
		25	Covered bonds
		3	Corporate bonds
		21	ABS
		2	Other marketable assets
Non-marketable assets	24		
Total	**100**		

SOURCE: ECB: https://www.ecb.europa.eu/paym/coll/charts/html/index.en.html.

grandfather the eligibility of marketable assets and the issuers of such assets that fulfilled minimum credit quality requirements on 7 April 2020. These assets will continue to be accepted as collateral as long as their credit rating does not drop below BB (CQS5), except for asset backed securities whose threshold is set at BB+ (CQS4).

The valuation haircut applied to the marketable assets will be calculated based on their actual credit rating so as to maintain adequate risk protection for Eurosystem operations. On 7 April these haircuts had already been reduced in accordance with the temporary increase in risk tolerance determined by the Governing Council.

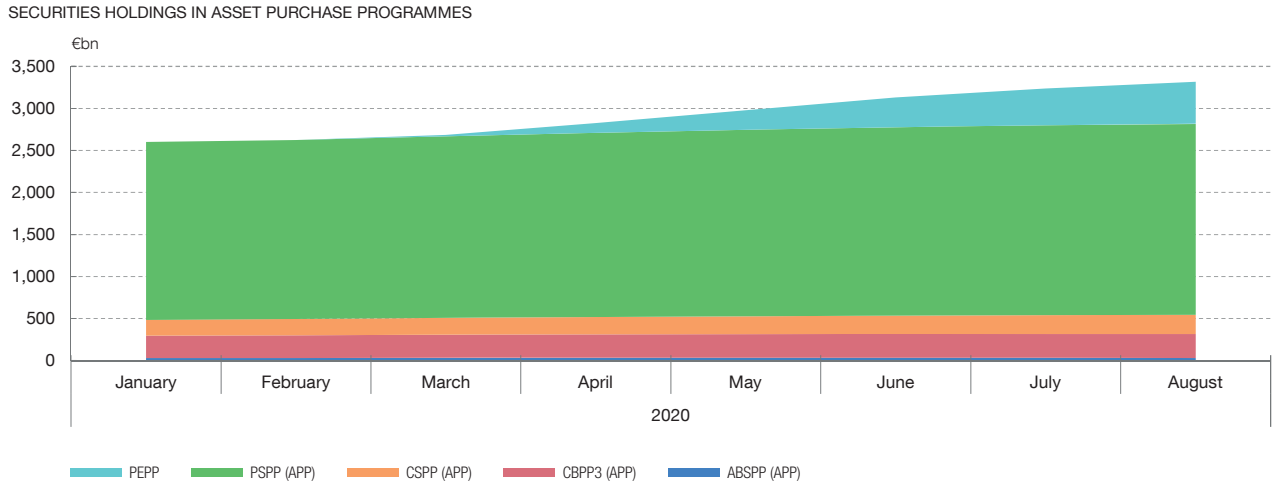
This raft of measures aims to ensure that credit institutions have sufficient assets to contribute as collateral in order to participate in liquidity-providing operations and to continue to provide financing to the economy. The measures will be applied until September 2021 when the first early repayments of TLTRO-III can be made.

The problems posed by credit rating downgrades also affect *the purchase programmes.* In this case, the assets already acquired which are no longer eligible will remain in the portfolio since there would be no obligation to sell them, however, additional purchases of these assets or of these issuers' assets would not be possible.

As a measure to alleviate the effects of the impact of the pandemic, the Governing Council, in addition to expanding the asset purchase programme[9] (APP) with an

9 The asset purchase programme (APP) comprises four programmes: the asset-backed securities purchase programme (ABSPP), the third covered bond purchase programme (CBPP3), the corporate sector purchase programme (CSPP) and the public sector purchase programme (PSPP).

Chart 2
CHANGES IN ASSET PURCHASE PROGRAMMES IN 2020



SOURCE: ECB: https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html.

additional envelope of €120 billion and to introducing the pandemic emergency purchase programme (PEPP) with a final envelope of €1.35 billion, decided to allow Greek bonds to be purchased under the PEPP, which were suspended previously because they did not meet the minimum threshold criterion of investment grade. The following chart shows the changes in the programmes' portfolios during 2020. The significant increase in purchases observed from March stems from the Governing Council's decisions.

At a time like this, one of the constraints of purchase programmes is the universe of assets NCBs can buy, which may be reduced by the effect of credit rating downgrades. This situation poses an additional challenge, since problems relating to the feasibility of purchase commitments may adversely affect monetary policy credibility, and the actions of ECAIs, if they translate into widespread credit downgrades, may exacerbate such problems.

As can be seen in Table 2, the most vulnerable sector to credit downgrades in the private sector purchase programmes is that of non-financial corporations, a large share of which is already in BBB territory. Thus, the CSPP is the most exposed purchase programme.

In the public sector purchase programme (PSPP), although the likelihood of significant rating downgrades of sovereigns to the point of them becoming ineligible is lower than for private debt, the risk that this would entail for monetary policy is higher (as demonstrated by the case of Greece during the sovereign debt crisis).

Table 2

DISTRIBUTION BY RATING OF THE PORTFOLIOS IN THE EUROSYSTEM'S PRIVATE SECTOR PURCHASE PROGRAMMES AND THEIR ELIGIBLE UNIVERSE IN 2020 Q1

Rating (a)	CSPP		ABSPP		CBPP3	
	Eurosystem holdings (%)	Eligible universe (%)	Eurosystem holdings (%)	Eligible universe (%)	Eurosystem holdings (%)	Eligible universe (%)
AAA	0	0	88	85	69	78
AA+-AA–	11	11	12	13	31	21
A+-A–	46	48	0	2	0	1
BBB+-BBB–	43	41	0	0	0	0

SOURCE: ECB: https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html.

a The Eurosystem recognises the first-best rating, except in the case of asset-backed bonds, for which the second-best rule applies.

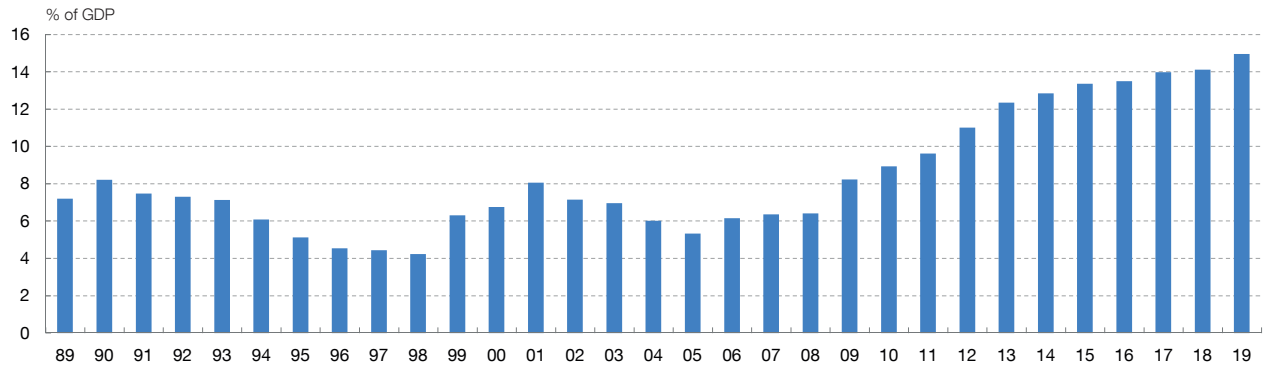
Therefore, an additional deterioration of the credit ratings of issuers and issues could jeopardise the effectiveness of one or several purchase programmes and adversely affect the related bond markets, leading to tensions and to wider spreads, thereby affecting monetary policy transmission.

3 The macroeconomic and financial challenges of credit rating downgrades

The credit rating downgrades of a particular agent's debt issues can translate into a tightening of its financing conditions, both in the debt and the bank funding markets. This effect occurs through various channels: (i) the signalling effect on markets after the rating agency's decision is released; and (ii) credit institutions using external ratings for calculating capital requirements would consume more capital when lending to the agent concerned, an effect which could be passed on in the form of higher interest rates. If the rating were to fall below investment grade, these effects could be amplified, generating a non-linear impact, for various reasons. First, financial intermediaries with an investment mandate that does not allow them to invest in sub-investment grade bonds would be forced to sell them, prompting their price to fall which could be compounded if the asset is illiquid. Additionally, as mentioned above, bonds issued by the agent would cease to be eligible for ECB purchase programmes, leading to further price declines.[10]

10 The contribution of asset purchase programmes to the improvement of the financing conditions of corporations with eligible assets is documented in Abidi and Miquel-Flores (2018) and Arce, Mayordomo and Gimeno (2020), among others.

Chart 3
AMOUNT OF CORPORATE DEBT ISSUED BY SPANISH NON-FINANCIAL CORPORATIONS



SOURCES: Instituto Nacional de Estadística and Banco de España.

The tightening of financial conditions could spread to other agents not directly affected by the downgrade through various channels. First, if the downgrades affect many issuers simultaneously, markets may infer that these revisions reveal negative information about the economic outlook and credit risk of the sectors affected or the economy as a whole.[11] Furthermore, if the credit rating downgrade affects credit institutions or the assets in their portfolios, their market financing conditions could tighten and their possibilities of obtaining financing using their assets as collateral might be hampered. These effects on the banking sector could be even more pronounced if banks' credit ratings are close to speculative grade, as is the case with most Spanish banks. This could lead the banks concerned to pass on the tightening of their financing conditions to their customers.

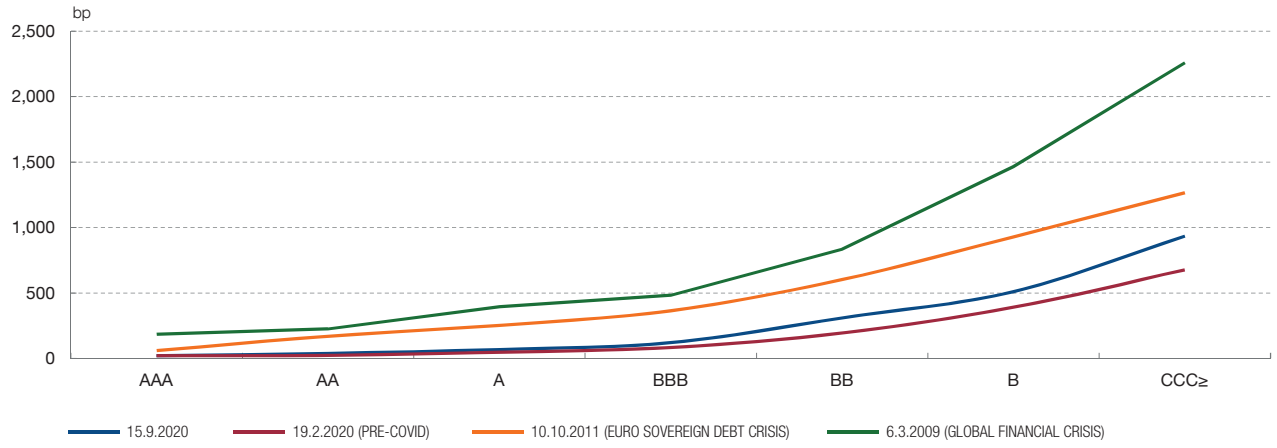
In the event of a sovereign rating downgrade, the knock-on effects on other national agents could be especially significant, as shown by the global financial crisis and the European sovereign debt crisis. During that period, Spain's credit rating downgrade went hand in hand with equivalent downgrades of private issuers.

For Spanish companies and non-financial corporations, the effects of credit rating downgrades may be more acute than in past crises, considering the growing importance of market-based funding, as illustrated by the considerable increase in the amount of corporate debt issued in recent years in terms of GDP (see Chart 3). Currently, this amount represents around 15% of GDP, as compared with 6% in the run-up to the global financial crisis. Chart 4 shows the relationship on different dates between financing costs for non-financial corporations in the euro area and the credit quality of the bonds issued. The slope of this curve rises when credit quality

11 For example, a downgrade of Lufthansa's credit rating could increase the likelihood of a subsequent downward revision of Iberia's rating.

Chart 4

CORPORATE CREDIT RISK SPREADS IN THE EURO AREA



SOURCE: IFS-DataStream.
NOTE: The spread is calculated as an asset swap spread (ICE BofA indices).

falls below investment grade, especially in times of crisis, reflecting the non-linear effects discussed above.

The COVID-19 crisis has prompted substantial effects in the macroeconomic context, both globally and for the Spanish economy. In line with the deterioration of the macroeconomic outlook and the solvency of non-financial corporations, between 28 February and 15 October 2020, there has been a moderate shift in Spanish companies' credit quality towards worse ratings. Downgrades have affected 11.7% of the outstanding amount. Of this change, 6.8 percentage points (pp) relate to downgrades within the investment grade category (BBB– or higher), 3.8 pp to downgrades within the high yield category and 1.1 pp to downgrades from investment grade to high yield. Although the bulk of the outstanding amount remains in the investment grade category, the persistence of the health crisis could cause further downgrades which would push a non-negligible percentage of debt into the high yield category. In fact, on 15 October, 20.5% of the total outstanding amount of bonds rated BBB or BBB– had a negative outlook.

To assess the scale of the effects that credit rating downgrades could have on the Spanish corporate sector, Table 3 shows the distribution of the outstanding amount of bonds issued by Spanish non-financial corporations by credit quality and quantifies the contribution to the corporate sector's gross value added and employment from companies in each rating category.[12] The credit rating used for

12 These calculations are based on information from the Integrated Central Balance Sheet Data Office Survey (CBI by its Spanish abbreviation) as at December 2018 (the latest survey available). The GVA and employment for each company are obtained by aggregating the amounts of the parent company and its subsidiaries.

Table 3

DISTRIBUTION OF THE OUTSTANDING AMOUNT OF BONDS AND CONTRIBUTION TO GVA AND EMPLOYMENT BY RATING CATEGORY (in percentages)

Rating	% outstanding amount	% of GVA (a)	% of employment (a)
A–	2.7	0.3	0.0
BBB+	16.0	0.9	0.2
BBB	57.3	4.1	2.1
BBB–	6.5	1.1	0.9
BB+	2.1	1.3	1.5
BB	2.9	0.2	0.1
BB–	0.2	0.2	0.0
B+	0.0	0.1	0.1
B	0.6	0.1	0.1
B–	1.6	0.0	0.0
CCC+	0.9	0.0	0.1
CCC	0.8	0.2	0.4
NR	8.4	0.7	0.9
Total	100.0	9.3	6.3

SOURCE: Banco de España.

a Contribution to the total for the NFC sector.

each company is the best given by either of the four ECAIs recognised by the ECB.[13]

Owing to the non-linear effects described above, companies with a BBB– rating, representing 6.5% of the outstanding amount of bonds, are most exposed to the adverse effects of a deterioration in credit quality. BBB-rated companies, representing 57.3% of the amount outstanding, are also highly vulnerable to credit downgrades if the effects of the COVID-19 crisis are so severe they ultimately lead to credit rating downgrades of more than one notch. As a whole, these two groups of companies account for 5.2% of GVA and 3% of employment in the non-financial corporations sector.

4 Challenges to financial stability of credit rating downgrades: exposure of financial intermediaries.

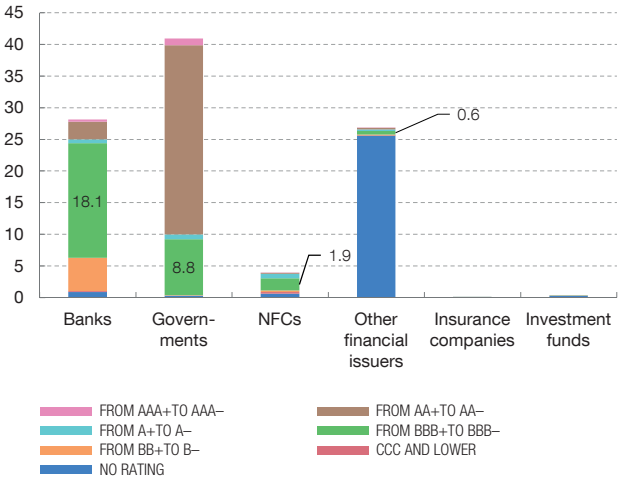
Credit institutions and other financial intermediaries are exposed to actions affecting the credit rating of a number of economic agents through their securities holdings

13 The results are presented on the basis of the S&P and Fitch rating scale. Moody's and DBRS' categories were therefore mapped to this scale. The information on ratings and the outstanding amount of bonds is that available as at 31 July 2020. The outstanding amount of bonds issued by a given company is obtained from issues of the parent company and its resident and non-resident subsidiaries.

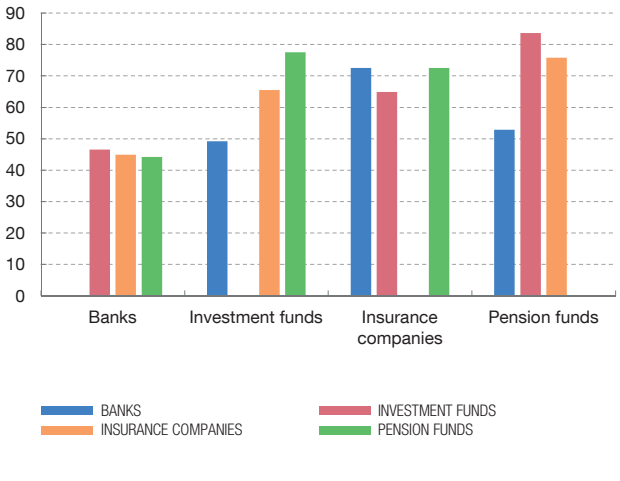
Chart 5

COMPOSITION OF THE BANKING SECTOR'S SECURITIES PORTFOLIO BY RATING AND SECURITIES HOLDINGS OF ISSUERS SHARED WITH OTHER FINANCIAL INTERMEDIARIES

1 COMPOSITION OF THE BANKING SECTOR'S SECURITIES PORTFOLIO BY RATING



2 SECURITIES HOLDINGS OF ISSUERS SHARED WITH OTHER FINANCIAL INTERMEDIARIES



SOURCES: Securities Holding Statistics by Sector (ECB) and Eikon (Reuters).
NOTE: Data at end-2020 Q1. The market value of the holdings is considered (or reasonable value in the case of less liquid instruments). Chart 5.1: the total value of the securities portfolio in the individual balance sheet of the banking sector is approximately €595 billion. The vertical axis shows the percentage of the total portfolio for each counterparty and credit rating. Chart 5.2: for each sector, the vertical axis shows the proportion of securities of issuers shared with the portfolios of other subsectors. For example, the first three bars from the left show that the banking sector has between 44% and 46% of securities in its portfolio with issuers shared with the securities portfolios of other financial intermediaries.

and the interconnectedness of credit institutions with the rest of the financial system, given that, in many cases, banks and other financial agents, most notably collective investment institutions (CIIs), are exposed to the same debtors.

The marketable securities portfolio represents 23% of the Spanish banking system's total assets, on an individual basis.[14] Around 29% of the total securities in this portfolio (some €175 billion) are at the lower limit of the investment grade category, that is, they have a credit rating of between BBB+ and BBB–.[15] The value of these securities could be particularly sensitive to rating downgrades, which in turn, could make it difficult for the issuers to refinance their debt , thereby increasing their risk of default. This category includes holdings of securities issued by the banking sector itself[16] (18%), sovereign bonds (9%) and securities issued by non-financial corporations (1.9%) (see Chart 5.1).

14 Only the assets of Spanish credit institutions are considered, excluding the assets of subsidiaries domiciled abroad. The assets of institutions in other financial sectors which, for prudential purposes, are included in the consolidated financial statements of the same banking group are not considered either.

15 The data refer to the resident banking sector's portfolio of bonds, shares and investment fund shares, which, for prudential purposes, are included in the consolidated financial statements of banking groups that exclude foreign subsidiaries or resident non-banking entities (e.g. securitisation special purpose entities or holding companies). Holdings below investment grade account for around 6% of the portfolio. The information refers to existing ratings as at 16 September 2020.

16 A portion of these securities could be own shares.

The direct interconnections[17] through banking sector holdings of securities issued by other financial sectors are minimal. However, indirect interconnections through securities holdings with shared issuers are significant and range from 40% to 80% of each sector's total assets (see Chart 5.2). Therefore, there is a risk that downgrades of ratings to below investment grade may be amplified (aside from credit institutions' direct exposures) through these shared holdings, for instance, through a spiral of fire sales and price declines. These sales could be triggered by credit rating downgrades to below BBB–, due to the usual mandate of non-banking intermediaries (e.g. investment funds) to invest in the investment grade category. Chart 5 shows, in particular, the large overlap across investment and pension fund securities holdings, which could concentrate similar impacts (the deterioration of their total assets) and lead to symmetrical behaviour (portfolio reallocation, withdrawal of funds by unit-holders) of a large share of these agents in response to the rating downgrade of certain securities. This could affect the banking sector through the aforementioned shared characteristics of securities holdings, but also through its income, to which the marketing of units of CIIs contributes significantly.

For the banking sector, the scope of the study is extended to the total exposure at consolidated level to sovereigns, loans and debt securities, and to debt securities issued by private issuers. Holdings through foreign subsidiaries are thus incorporated. A distinction is drawn between credit exposures classified at fair value, whose balance sheet value reacts directly to changes in ratings, and exposures classified at amortised cost, which do not have to record impairment in their market value for accounting purposes. In June 2020, Spanish credit institutions held €632.4 billion of sovereign debt and corporate bonds issues in their consolidated balance sheets, which comprised mostly sovereign debt (83.3% of the total exposures analysed), and significant institutions directly supervised by the ECB accounted for 89.6% of the total exposure.

Sovereign debt (loans and debt securities) in the consolidated balance sheet of Spanish credit institutions, which amounted to €527 billion at June 2020, is concentrated at banks with higher total assets and is distributed similarly in terms of fair value and held for trading, on the one hand, and amortised cost, on the other (with a weight of approximately 7% of total assets for each category, see Chart 6). For the EU banking sector as a whole (see Chart 7), on European Banking Authority data as at June 2020, the weight of sovereign debt at fair value and held for trading (48.7%) was also similar to that at amortised cost (51.3%). There is, however, cross-country heterogeneity in credit institutions' portfolios. For example, exposures at fair value and those held for trading have a higher weight in the Netherlands (65.3%) and exposures at amortised cost have a higher weight in France (58.7%). Outside the

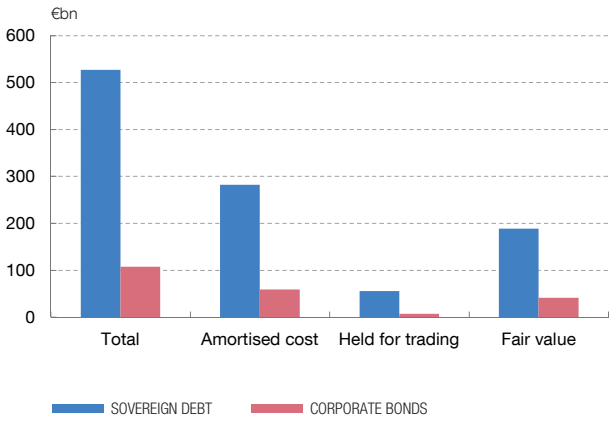
17 Alonso and Stupariu (2019) offer an overview of interconnectedness in the Spanish financial system, highlighting the direct link between the different financial sectors and the indirect interconnections between resident sectors.

Chart 6

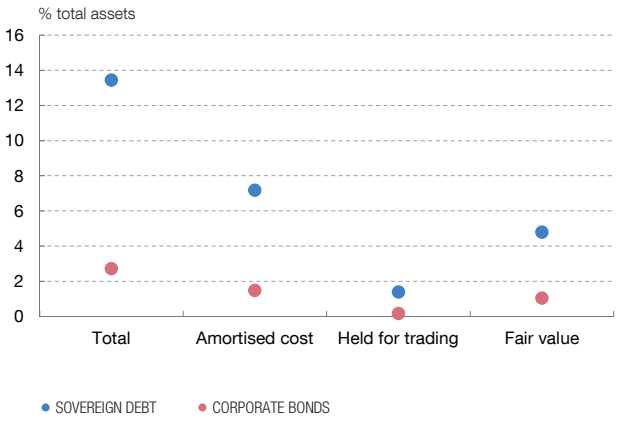
SOVEREIGN DEBT AND CORPORATE BOND HOLDINGS OF SPANISH CREDIT INSTITUTIONS. BREAKDOWN BY ACCOUNTING PORTFOLIO

June 2020

1 SOVEREIGN DEBT AND CORPORATE BOND HOLDINGS OF SPANISH CREDIT INSTITUTIONS
Breakdown by portfolio. Volume



2 SOVEREIGN DEBT AND CORPORATE BOND HOLDINGS OF SPANISH CREDIT INSTITUTIONS
Breakdown by portfolio. Weight



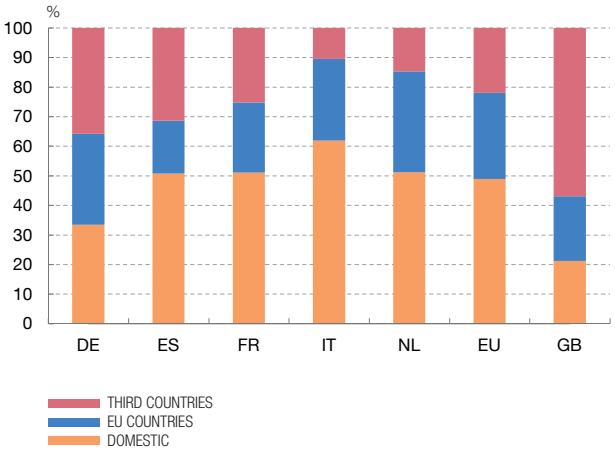
SOURCE: Banco de España.

Chart 7

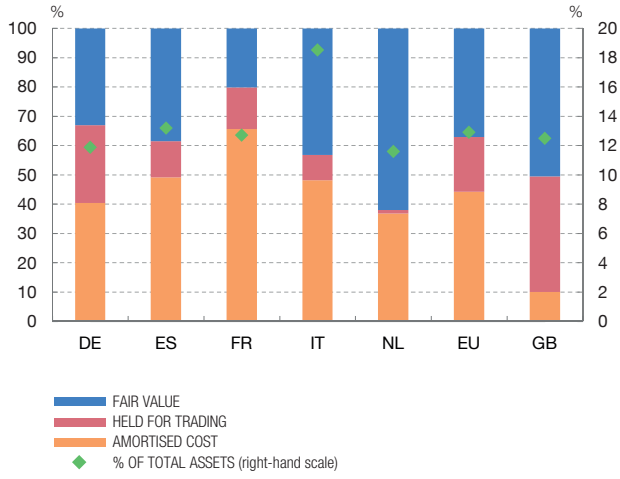
SOVEREIGN DEBT HOLDINGS OF EUROPEAN CREDIT INSTITUTIONS. BREAKDOWN BY COUNTRY AND ACCOUNTING PORTFOLIO

June 2020

1 SOVEREIGN DEBT HOLDINGS OF EUROPEAN CREDIT INSTITUTIONS
Breakdown by issuing country



2 SOVEREIGN DEBT HOLDINGS OF EUROPEAN CREDIT INSTITUTIONS
Breakdown by accounting portfolio



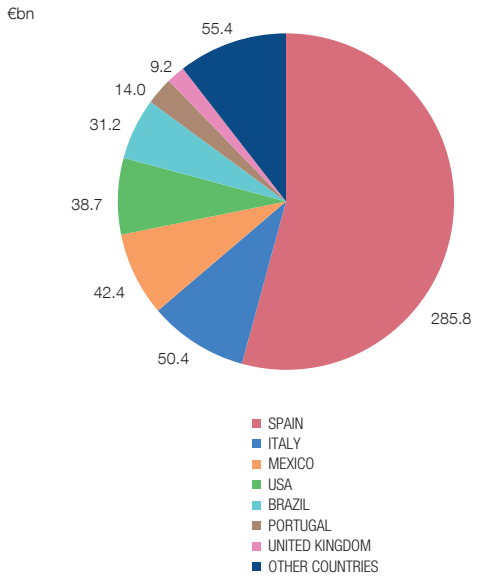
SOURCE: European Banking Authority.

Chart 8

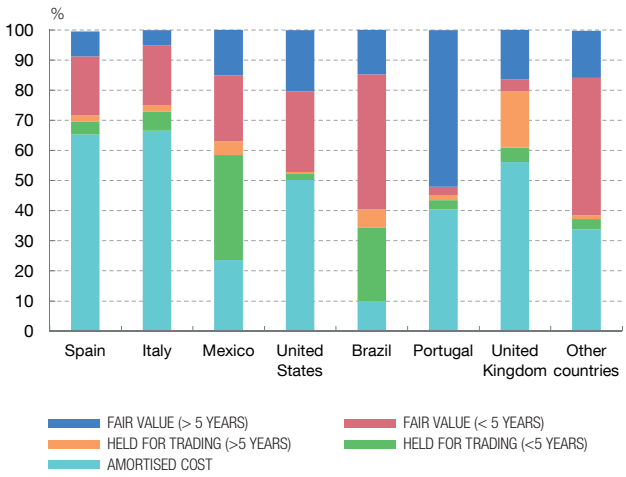
SOVEREIGN DEBT HOLDINGS OF SPANISH CREDIT INSTITUTIONS. BREAKDOWN BY ISSUING COUNTRY AND ACCOUNTING PORTFOLIO

June 2020

1 SOVEREIGN DEBT HOLDINGS OF SPANISH CREDIT INSTITUTIONS
Breakdown by issuing country



2 SOVEREIGN DEBT HOLDINGS OF SPANISH CREDIT INSTITUTIONS
Breakdown by accounting portfolio



SOURCE: Banco de España.

European Union, the sovereign portfolio of UK banks is concentrated in exposures at fair value (89.3%).

The weight of sovereign debt in the total consolidated balance sheet of the Spanish banking sector was 13.4% in June 2020 (see Chart 6). For most significant credit institutions, sovereign debt represented less than 20% of total assets, but in some smaller institutions, it exceeded 25%. In the European Union, sovereign debt carried a weight of 12.9% in the total assets of credit institutions in June 2020, slightly below that of Spanish credit institutions (see Chart 7).

Spanish sovereign debt amounted to €285.8 billion in June 2020, accounting for 54.2% of the total sovereign holdings of the Spanish banking sector (see Chart 8). By volume, the most significant sovereign exposures of Spanish credit institutions were Italy (€50.4 billion), Mexico (€42.4 billion), United States (€38.7 billion) and Brazil (€31.2 billion), jointly accounting for 30.9% of sovereign holdings. Most of the government debt holdings issued by emerging countries (particularly Brazil and Mexico) are classified in held-for-trading and fair value portfolios, while holdings of Spanish and Italian sovereign debt are largely (more than 60%) valued at amortised cost. Holdings of debt issued by the United States and the United Kingdom are

distributed in a comparable manner among the amortised cost and the fair value and trading portfolios.

In the European Union, the weight of domestic sovereign debt in the banking sector's total sovereign holdings was 48.9% in June 2020 (see Chart 7), somewhat below the proportion it represented at Spanish credit institutions. The German banking sector was that in which domestic sovereign holdings carried the least weight (33.4%), compared with the high proportion (61.9%) at Italian banks. In the United Kingdom, UK banks concentrated their sovereign debt holdings in June 2020 in debt issued by third countries (56.9%).

The volume of corporate bonds (issued by credit institutions, other financial corporations – including Sareb – and non-financial corporations) in the consolidated balance sheet of Spanish credit institutions, which amounted to €107.3 billion at June 2020, is concentrated in the largest banks, and mostly valued at amortised cost (54.9% of the total), with some disparity in the use of valuation criteria among institutions. The weight of these exposures in the total assets of Spanish credit institutions was far lower than that of sovereign exposures, below 3% as at June 2020.

5 Possible mitigating measures

Within the domain of monetary policy, in line with the FSB guidelines mentioned in the box above, a measure that would mitigate the impact of automatic adjustments linked to external ratings is the development by central banks of in-house credit assessment capabilities. To date, the Eurosystem has made significant progress in the acceptance of loans to non-financial corporations as collateral through the use of internal credit rating models. It has also developed internal analysis methods in the decisions to purchase asset-backed bonds under asset purchase programmes (APP).

To boost these initiatives, in-house analysis could be extended to other debtor segments, particularly individuals (observing data protection laws) and financial corporations. The internal rating of such loans would allow for a more precise independent analysis of the assets through which they would be indirectly mobilised, such as retained asset-backed securities and own-use covered bonds.

As well as strengthening their in-house assessment capabilities, another way in which central banks can mitigate the adverse effects of the possible rating actions of ECAIs is to temporarily raise their level of tolerance to the risk assumed. In an economic crisis the level of risk of financial assets increases, affecting the risk metrics used by central banks and other institutions. Thus, temporarily raising the level of risk tolerance can be an appropriate economic policy measure if it serves to

Box 1
RECENT DISCUSSIONS BY INTERNATIONAL GROUPS

The procyclical behaviour of credit rating downgrades has already been analysed in the past by the Financial Stability Board (FSB), concerned about the adverse effects of these actions during the crisis of 2008. As a result, the FSB published a set of principles to help central banks, among others, avoid approaches that would imply the automatic use of credit ratings by ECAIs, and replace these, as far as possible, by internal assessments.[1] Since then, the Eurosystem has been working on applying these principles. Key initiatives include the analysis of the different credit assessment sources used ("due diligence") and the authorisation of new internal credit rating models. However, there is still significant reliance on ECAI ratings.[2]

In response to the current pandemic, the FSB has reorganised its work programme to prioritise activities involving analysis of the financial stability implications of COVID-19 and coordination of the response globally. The work of the FSB has identified the procyclicality of credit rating downgrades by rating agencies as one of the risk areas meriting in-depth analysis. In addition, it has launched a mechanism for sharing information about the regulatory and supervisory measures adopted by FSB members to address the pandemic, and has drafted a compendium of measures that is updated and communicated daily to members by the FSB Secretariat. This compendium includes measures relating to credit ratings, such as those taken within the collateral framework for Eurosystem refinancing operations adopted by the ECB.

Turning to the European Systemic Risk Board (ESRB), one of its five priority areas for addressing COVID-19 is analysing the impact of large-scale downgrades of corporate bonds on markets and entities across the financial system. To this end, it set up a working group in April 2020 to research the extent to which these rating downgrades could be problematic, in particular for issuers losing their investment grade status and being downgraded to high-yield (corporate bonds with a rating of BBB represent approximately 60% of the investment grade universe).

The ESRB has observed that the possible forced sales of bonds which were formerly investment grade could result in large spread increases, given the limited absorption capacity of the high-yield bond market, leading to losses for investors and higher funding costs for corporates. From the macroprudential perspective it is therefore important to ensure that the effects of these credit rating downgrades are well understood and do not impair the functioning of financial markets, so that the negative effects on the real economy are minimised. On 14 May, the ESRB published a paper on these issues, and also coordinated a joint analysis with the ECB, EBA, ESMA, and EIOPA,[3] to assess the impact of a common scenario of large-scale corporate bond downgrades on the financial sector (credit institutions, investment funds, insurance companies, pension funds and financial markets).[4]

1 See FSB (2010).
2 See FSB (2014), annex C-38, for a summary of the action plans established by the Eurosystem in 2014 to comply with the principles and reduce reliance on external rating agencies.
3 European Banking Authority (EBA), European Securities and Markets Authority (ESMA) and European Insurance and Occupational Pensions Authority (EIOPA).
4 See *A system-wide scenario analysis of large-scale corporate bond downgrades,* an ESRB technical note, July 2020.

prevent second-round effects, since an excessively prudent approach can limit the transmission of other economic policy measures to the real economy, making it less effective.

In this respect, possible measures to mitigate the procyclical behaviour of credit ratings notably include those aimed at eliminating or alleviating the non-linear effects discussed earlier, which are associated with the rating downgrades of certain issuers or financial assets below the investment grade threshold and could have a significant impact on the transmission of monetary policy. These measures include the

possibility of easing, in certain circumstances such as the current crisis resulting from the COVID-19 pandemic, the application by central banks of collateral eligibility requirements in their financing operations or of eligibility requirements in their asset purchase programmes. As mentioned in the previous section, the ECB's Governing Council adopted such a measure within its collateral framework for financing operations. Other central banks, such as the Bank of England or the US Federal Reserve, have taken similar measures under their asset purchase programmes. In the United Kingdom, HM Treasury and the Bank of England launched, in March, the *COVID Corporate Financing Facility* (CCFF), a scheme to purchase commercial paper from large firms which, to be eligible, are required to be investment grade-rated as at 1 March 2020. They do not lose this status if their credit rating is subsequently downgraded.[18] Under its *Secondary Market Corporate Credit Facility* (SMCCF), the US Federal Reserve decided that corporate bonds which had lost or might lose their investment grade status would remain eligible, provided that they were investment grade as at 22 March 2020 and did not fall below BB–.[19]

In addition, outside the scope of monetary policy, the possibility of temporarily relaxing the investment policies of certain institutional investors with mandates to invest in high credit quality assets should be considered, to avoid disorderly shedding processes which would exacerbate volatility. Such measures would eliminate the amplifying effect that the aforementioned requirements and policies might have on the tightening of financial conditions of issuers affected by rating downgrades to below investment grade. An argument supporting the adoption of such a measure is that the possible increase in exposures with low credit ratings is due, in a crisis such as the present one, to an exogenous event and not to voluntary accumulation resulting from moral hazard issues. This measure would help stabilise bond markets, albeit mainly in the short term, without calling into question the overall use of ratings. Legislation in Spain already covers restrictions on redemptions, the concentration of investments and the liquidity requirements of collective investment undertakings. The instruments implementing this legislation could prove significant for mitigating the impact of rating changes. Moreover, in a crisis such as the current pandemic, extending the scope of these measures to a broad range of institutions should be considered.

The last matter to be addressed here is the assessment of the sensitivity of financial intermediaries' capital and liquidity requirements to procyclical rating adjustments, particularly in the banking sector. Ideally, ratings should already factor in that some issuers are more sensitive than others to cyclical downturns, rather than be subject to real-time adjustments as the downturn unfolds. The problem is that implementing a less cyclical framework in a crisis is not really feasible. For the banking sector, it

18 See https://www.bankofengland.co.uk/markets/covid-corporate-financing-facility.

19 See https://www.newyorkfed.org/markets/secondary-market-corporate-credit-facility/secondary-market-corporate-credit-facility-terms-and-conditions.

would mean "freezing" risk weights for capital requirements or asset quality assessments for liquidity purposes at their 2019 levels. These would not represent cyclically-adjusted average values, but the values during an upturn. Cyclical downturns should be recognised and values should be adjusted. However, this should be orderly and possibly phased in, while avoiding that the short term is overweighted in these adjustments to the ratings and, consequently, to capital and liquidity requirements. This initial adjustment would subsequently lead to a more comprehensive adjustment in the medium term. This year, the possibility of requesting the European Commission for an easing or a suspension has been explored.

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At-risk measures and financial stability

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Abstract

Financial stability is aimed at preventing and mitigating systemic risk, which is largely associated to the tail risk of macrofinancial variables. In this context, policy makers need to consider not only the most likely (central tendency) future path of macrofinancial variables, but also the distribution of all possible outcomes about that path, and focus on the downside risk. Against this background, the so-called *at-risk* methods provide a useful framework for the assessment of financial stability by the recognition of non-linear effects on the distribution of macrofinancial variables. We describe the use of quantile regressions for this purpose and illustrate two empirical applications related to the house prices and the GDP, from which useful insights for policymakers are derived.

1 Introduction

Forecasting is an essential activity for policy makers to conduct the most suitable policy which will in turn achieve its desired objectives. Traditionally, these estimates speak about the central moment of the variable under analysis (e.g., GDP, inflation, house price, among others), that is, its future expected value given the current set of information. However, policy makers need to consider not only the most likely future path for the economy, but also the distribution of all possible outcomes about that path [Greenspan (2004)]. For that aim, in the last years, policy makers have incorporated to their analytical toolkits econometric techniques such as quantile regression, which provide a surveillance framework to identify imminent and medium term threats.

Quantile regression is a statistical technique developed by Koenker and Bassett (1978) intended to estimate the conditional quantile functions of a variable which link the future performance at the τ^{th} quantile of the distribution to the current set of information. This technique provides a useful tool for the identification of the possible differential behaviour of the distribution of a variable of interest instead of focusing on the conditional mean, which may mask distributional effects.

Quantile regression has been applied in different fields. In finance, the most standard application is the computation of value-at-risk [Jorion (2001)], which is the computation of the expected loss of a portfolio given the materialization of an extreme event that may occur with a given low probability, say 5%. In economics, this idea is attractive to study the distributional effects of a particular shock over a macroeconomic variable. Cecchetti and Li (2008) use this method to study the

impact of asset prices on the distribution of inflation and GDP growth, while De Niccolo and Lucchetta (2017) show that this methodology provides more accurate forecasts of GDP downside risk than traditional VAR and FAVAR models. More recently, Adrian et al. (2019) show that this methodology unmasks heterogeneous effects of financial conditions over the GDP growth distribution. The authors evidence the usefulness of this method for disentangling heterogeneous effects of financial conditions on the GDP growth distribution. They provide new evidence on the underestimation of downside GDP tail risk when using traditional models focused on the conditional mean, and on the importance of accounting for financial conditions in explaining the skewness of the GDP growth distribution at horizons of up to 1 year.

Certainly, the methodology offers a flexible method to model the linkages between the financial sector and the real economy with important implications for financial stability. Some recent studies have extended the application of quantile regressions to financial stability issues. Giglio et al. (2016) use this approach to show that a broad set of systemic risk measures skew the industrial production growth distribution in the US and Europe. Aikman et al. (2018) also apply a quantile regression to study the effect of two macrofinancial indices related to leverage and assets valuation on the GDP growth distribution in the UK. Lang et al. (2019) apply quantile regressions to check the early warning properties of cyclical risk measures on the tail of the GDP growth distribution. Lang and Forletta (2019) use this method to measure the impact of cyclical systemic risk on bank profits, finding that high levels of cyclical systemic risk lead to large downside risks to return on assets three to five years ahead.

All these studies have evidenced that models focusing on the conditional mean provide an incomplete picture of the distributions of macrofinancial variables, which tend to be large skewed, mainly towards the left-tail (see for instance Chart 4, which represents the conditional quantile distribution of the Spanish real house price in three different periods of time). The impact of shocks on the low quantiles of a distribution (e.g., the 5th percentile) are measures of downside risk and the models identifying it known as “at-risk” models. In general, the use of quantile estimations of GDP growth, house prices and other macrofinancial variables offer a useful approach to assess financial stability due to the importance of the linkages between the financial sector and real economic activity.

In this article we describe the methodology to estimate “at-risk” measures and present some applications developed at Banco de España. To that aim we first present the “at-risk” methodology. We next show an application to house price-at-risk (HaR) where we forecast the distribution of the Spanish house price. Then, we present an application to growth-at-risk (GaR) and the impact of the macroprudential policy in a panel of 27 European Union (EU) countries.

The rest of the paper is organized in four additional sections. Section 2 describes the quantile regressions methodology. Section 3 presents the application of the HaR

and Section 4 contains the empirical application to GaR and the impact of macroprudential policy. Finally, Section 5 concludes the paper and discusses the usefulness of the quantile regression approach for policymakers.

2 The quantile regression approach

2.1 Basics of quantile regression

The estimation of quantile regressions presents some parallel to classical linear regression methods. Linear regression methods are based on minimizing sums of squared residuals to estimate conditional mean functions. See for instance Chart 1, which depicts the association between one-year ahead real house price growth and real GDP growth based on Ordinary Least Squares (OLS). It can be seen that in these methods, the fitted line (conditional mean function) minimizes the sum of the squares of the distance (i.e., residuals) to each observed point. OLS regression provides measures of changes in the conditional mean and thus, the estimates speak about responses at the mean of the dependent variable to changes in a set of variables. However, the conditional mean gives an incomplete picture for a set of distributions in the same way that the mean provides an incomplete picture of a single distribution [Koenker (2005)]. Moreover, the impact on the central tendency of a dependent variable is not the only quantity of economic interest since we can be not only interested in shifts in the location of a distribution but also in changes in the shape of that distribution.

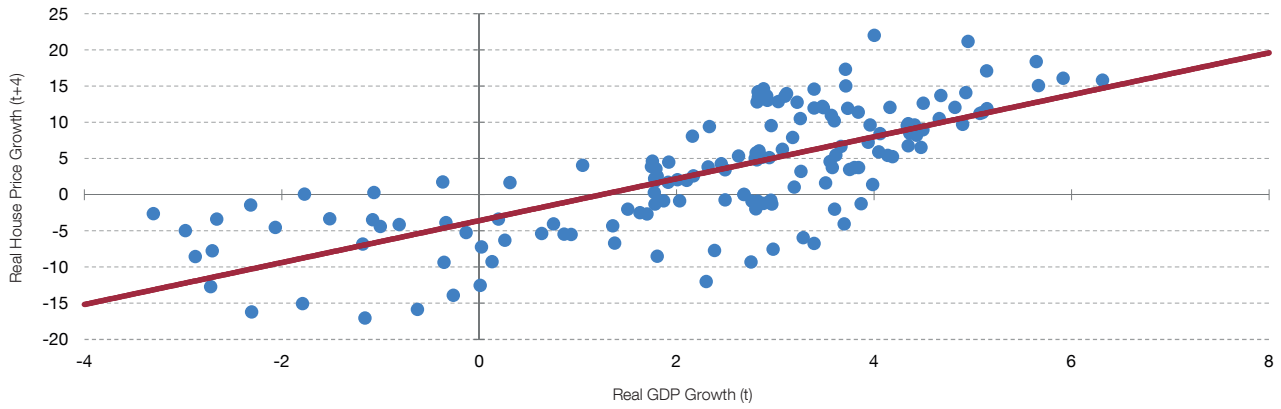
Koenker and Bassett (1978) overcome the above mentioned problems through the concept of quantile regression, which are intended to identify how changes in a set of conditioning variables affect the shape of the distribution of a dependent variable. In particular, quantile regression measures responses of a specific quantile of the variable of interest when a conditioning variable changes. To such aim, quantile regression methods estimate the conditional quantile function at certain quantile τ, on minimizing sums of the weighted absolute value of residuals, where weights depend on the quantile of interest. Chart 2 depicts the association between one-year ahead real house price growth and real GDP growth based on quantile regression methods for the 10th, 50th and 90th quantile. In this case, conditional quantile function at quantile τ is settled to ensure a proportion of τ positive residuals (i.e., fitted values above the observed points) and a proportion of $(1 - \tau)$ negative residuals.

Algebraically, the quantile regression estimator can be defined as:

$$\hat{Q}_{y_t|X_t}\left(\tau \mid X_t\right) = X_t\hat{\beta}_\tau \qquad [1]$$

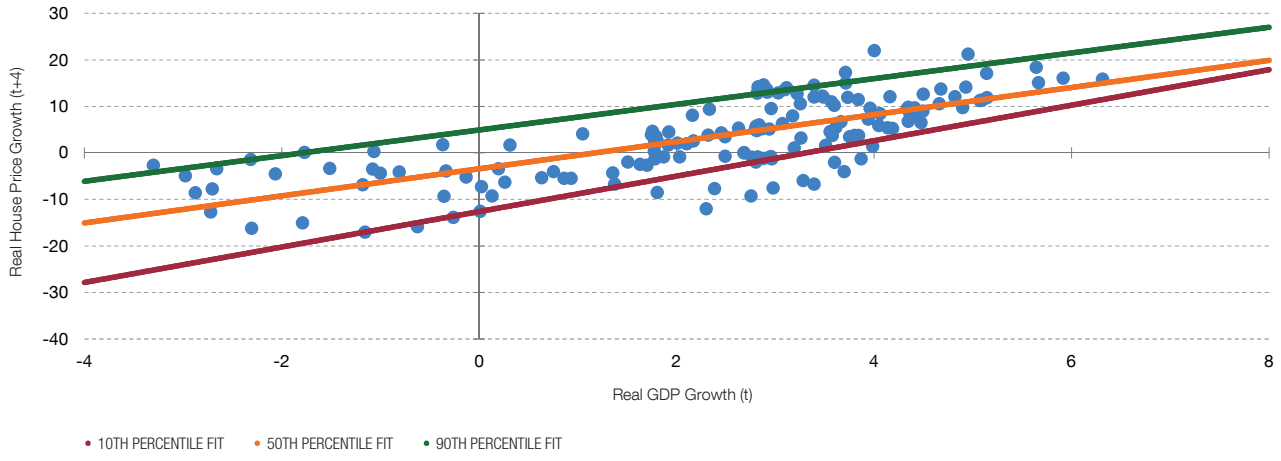
where, $\hat{Q}$ is the estimated quantile function, y_t is the dependent variable, X_t is a vector of explanatory variables, and τ is a given quantile. Koenker and Bassett (1978)

Chart 1
LINEAR REGRESSION



SOURCE: Authors' calculation.

Chart 2
QUANTILE REGRESSION



SOURCE: Authors' calculation.

show that $\hat{Q}_{y_{t|X_t}}(\tau \mid X_t)$ is a consistent linear estimator of the quantile function of y_t conditional on X_t. The regression slope β_τ is chosen to minimize the quantile weighted absolute value of errors such that the linear conditional quantile function, can be estimated by solving:

$$\hat{\beta}_\tau = \arg\min_{\beta_\tau} \sum_{t=1}^{T} \rho_\tau (y_t - X_t \beta_\tau) \qquad [2]$$

$$\rho_\tau = \tau * \mathbf{1}_{(y_t \geq x_t\beta)} \left| y_t - X_t\beta_\tau \right| + (1-\tau) * \mathbf{1}_{(y_t < x_t\beta)} \left| y_t - X_t\beta_\tau \right| \quad [3]$$

where τ_τ represents weights that depend on the quantile, **1** is an indicator function signaling whether the estimated errors are positive or negative, depending on whether fitted values are above/below the observed points.

2.2 Quantile regressions in a panel framework

Quantile regression models allow using panel data. However, if the time dimension (T) is small relative to the cross-sectional dimension (N), or if T and N are of similar size, estimates of the common parameter β may be biased or even under-identified, and an incidental parameters problem may arise. Kato et al. (2012) study how the relationship between the size of N and T is key to guarantee unbiased and asymptotic estimates in panel quantile regressions with individual effects, finding that the main problems arise when T is small. To solve these problems, several methods have been proposed in the literature. Koenker (2004) takes an approach where the α_i's are parameters to be jointly estimated with $\theta(\tau)$ for q different quantiles. He proposes a penalized estimator that correct for the incidental parameters problem. Canay (2011) propose a two-step estimator following the idea that α_i has a location shift effect on the conditional distribution that is the same across quantiles. In the first step the variable of interest is transformed by subtracting an estimated fixed effect, by first estimating a panel linear regression of the variable of interest on the regressors and averaging over T. The estimator is proved to be consistent and asymptotically normal as both N and T grow. A related literature has also developed quantile panel data methods with correlated random effects [see Graham and Powell (2012), Arellano and Bonhomme (2016)]. In general, these estimators do not permit an arbitrary relationship between the treatment variables and the individual effects.[1]

Finally, Machado and Santos Silva (2019) propose the estimation of quantiles via moments in order to estimate panel data models with individual effects and models with endogenous explanatory variables. The advantage of this approach is that it allows the use of methods that are only valid in the estimation of conditional means, while still providing information on how the regressors affect the entire conditional distribution. The approach is easy to implement even in very large problems and it allows the individual effects to affect the entire distribution, rather than being just location shifters.[2]

---

1 Alternatively, Powell (2016) proposes a quantile regression estimator for panel data with non-additive fixed effects that accounts for an arbitrary correlation between the fixed effects and instruments. It is one of the few quantiles fixed effects estimators that provide consistent estimates for small T and for quantile panel data estimators with instrumental variables.

2 In a conditional location-scale model, the information provided by the conditional mean and the conditional scale function is equivalent to the information provided by regression quantiles in the sense that these functions completely characterize how the regressors affect the conditional distribution. This is the result that the authors use to estimate quantiles from estimates of the conditional mean and the conditional scale function.

On the other hand, unobserved fixed effects can be included as in linear regression when the time dimension is large with respect to the cross-sectional dimension [Koenker and Geling (2001)]. Certainly, the fixed effects estimator in panel quantile regressions is the equivalent to the LSDV estimator used in linear regression when T is large in absolute terms and relative to N [Kato et al. (2012)]. In this case, the large sample properties of these estimates are the same of standard quantile regressions and the application is straightforward as it proceeds in a quantile-by-quantile fashion by allowing for a different fixed effect at each quantile [Koenker (2005)].

2.3 Model performance

In order to assess the goodness of fit of the models in sample, one may use the pseudo-R2 ($\tilde{R}^2$) proposed by Koenker and Machado (1999). This measure is dependent on the quantile, so it is a local measure of fit of the quantile specific regression and differs from the OLS R2. In particular, the measure compares the sum of weighted deviations for the model of interest with the same sum from a model in which only the intercept appears, and is defined as follows:

$$\tilde{R}^2(\tau) = 1 - \frac{\sum_{t=1}^{T} \rho_\tau(Y_{t+h} - X_t\hat{\beta}(\tau))}{\sum_{t=1}^{T} \rho_\tau(Y_{t+h})} \quad [4]$$

In addition, there are a broad set of tests that enable us to check the evaluation of the forecast and its properties such as the unconditional coverage (UC) test of Kupiec (1995), the conditional coverage (CC) test of Christoffersen (1998), and the dynamic quantile (DQ) test of Engle and Manganelli (2004). For this, define an indicator variable ($I_{t,\tau}$) that takes value 1 whenever the realization y_{t+h} is below the conditional quantile regressor $\hat{Q}_{y_{t+h|X_t}}(\tau \mid X_t)$:

$$I_{t,\tau} = \mathbf{1}\left(y_{t+h} \leq \hat{Q}_{y_{t+h|X_t}}(\tau \mid X_t)\right). \quad [5]$$

If $\hat{Q}_{y_{t+h|X_t}}(\tau \mid X_t)$ is the conditional quantile of y_{t+h}, given X_t, the on average, the indicator variable should be close to τ for accurate models.

Under the UC we want to test whether, on average, the conditional quantiles provide the correct coverage of the lower τ percentile of the forecast distribution. Thus, the hypothesis that $E[I_{t,\tau}] = \tau$ should be tested against the alternative $E[I_{t,\tau}] \neq \tau$, given independence. The UC test of Kupiec (1995) is a likelihood ratio test of that hypothesis. Christoffersen (1998) develops an independence test, employing a two-state Markov process, and combines this with the UC test to develop a joint likelihood ratio conditional coverage test, that examines whether the conditional quantile estimates display correct conditional coverage at each point in time. Thus, the CC test examines simultaneously whether the violations appear independently and the unconditional

coverage is τ. The DQ test is also a joint test of the independence of violations and correct coverage. It employs a regression-based model of the violation-related variable "hits", defined as $\mathbf{1}\left(y_{t+h} \leq \hat{Q}_{y_{t+h|X_t}}\left(\tau \mid X_t\right)\right) - \tau$, which will, on average, be zero if unconditional coverage is correct. A regression-type test is then employed to examine whether the "hits" are related to lagged "hits", lagged forecasts, or other relevant regressors, over time. The DQ test is well known to be more powerful than the CC test [see e.g. Berkowitz, Christofferson and Pelletier (2011)]. Komunjer (2013) surveys a set of additional tools for the evaluation of conditional quantile predictions.

2.4 Predictive densities

A potential way to estimate the predictive density of the variable of interest is to estimate the conditional quantile curve for each quantile using the methodologies described in Sections 2.1 or 2.2, respectively, depending on the structure of the data. However, this approach presents some finite sample problems such as quantile crossings and extreme quantile. In the former case, the resulting fits may not respect a logical monotonicity requirement since each quantile is independently estimated, and thus, the forecasted τ quantile might not be necessarily lower than the forecasted $(\tau + 1)$ quantile. In the latter case, fitting the conditional quantiles curves to extreme left and right quantiles requires a large data sample to ensure a reasonable fit. Recall that according to equations [2] and [3], the estimation of an extreme left quantile, as 5%, imposes a proportion of 5% positive residuals and thus, a large dataset is highly recommend to avoid that the estimation relies on a handful of points.

To overcome these problems, the full predictive density can be estimated using a two-steps procedure. Firstly, we estimate the conditional quantile curves for a limited number of quantiles (e.g., 10, 25, 50, 75 and 90 percentiles). Then, we can use these predicted values that shape the conditional distribution to estimate the probability density function. The econometric literature has proposed several approaches to carry out this last step. In this study we use a parametric (Skewed t-distribution density) and a non-parametric (Kernel-based density) method to estimate the density functions. Similar to findings by Adrian et al. (2019) we find that results are robust to the use of either method. For illustrative purposes we use the parametric fitting in the house prices-at-risk application and the non-parametric method in the growth-at-risk application (see details of the derivation of the densities with each method in Annex 1).

3 Predicting House Prices

In this section we show an application of the "at-risk" methodology to the real house price. Recently, different surveillance institutions have developed their own House Price-at-Risk (HaR) measures, whose primary objective is to identify the accumulation of downside risks in the housing market. The development of these tools is key for

policy makers due to the tight relationship between house price dynamics and macroeconomics and financial stability. The HaR measure consists of forecasting extreme realizations in the left tail of the conditional distribution of the real house prices (commonly the 5th percentile) to identify in advance risks of large price falls.

For example, IMF (2019) developed their HaR model for a sample of 22 major advanced economies and 10 emerging market economies where the set of conditioning variables include a financial condition index, real GDP growth, credit growth and an overvaluation measure. The ECB (2020) presents a HaR model at euro area level using as explanatory variables the lag of house price growth, an overvaluation measure, systemic risk indicator, consumer confidence indicator, financial market conditions indicator, government bond spread, slope of yield curve, euro area non-financial corporate bond spread, and an interaction of overvaluation and a financial conditions index.

Contrary to the above works who developed their model on a panel setting (as in Section 2.2), in this application we focus on the forecasting of the Spanish real house price (RHPI)[3], and thus, we follow the methodology described in Section 2.1. Firstly, we define our variable of interest as:

$$y_{i,t+h} = \ln\left(\frac{RHPI_{t+h}}{RHPI_t}\right) / \left(\frac{h}{4}\right); h = 1,\ldots,8. \quad [6]$$

where $y_{i,t+h}$ is the quarterly average growth of the RHPI over the horizon h. The model employs quarterly data from 1981Q1 to 2019Q4.

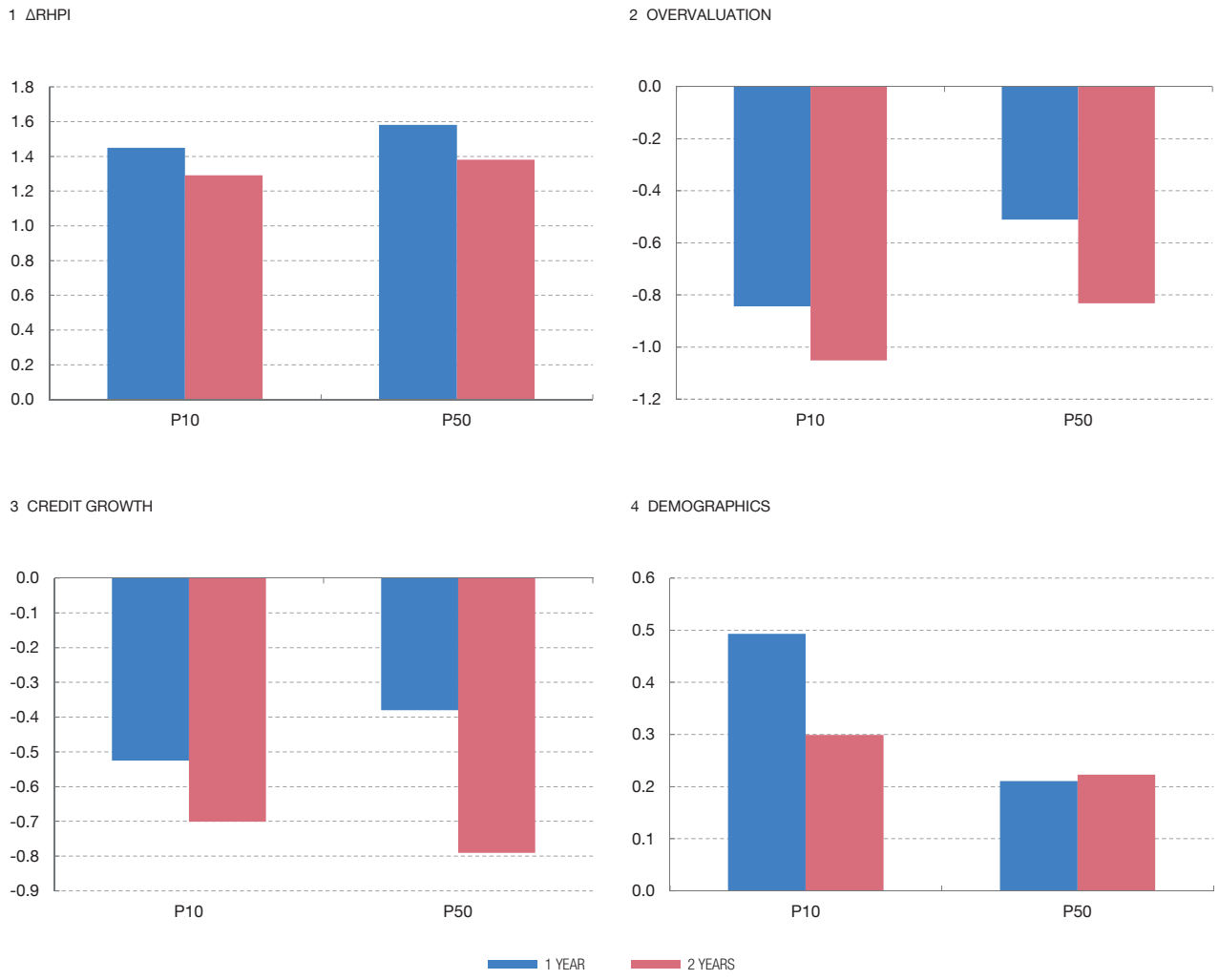
We next estimate the conditional quantile function as in equation [1] where we use as a conditional variables: i) lag of house price growth; ii) overvaluation measure defined as the deviation between the observed price and the estimated long run equilibrium price[4]; iii) the credit growth defined as the deviation between the ratio of household credit to the GDP and their long run trend[5]; iv) year-on-year growth of the population between 30 and 54 years old. Note that, due to the limited number of observations in the sample, we restrict the number of explanatory variables. In addition, we abstract from estimating the conditional quantile function in the extreme quantiles and thus, we shape the density distribution of $y_{i,t+h}$ based on the forecast of the 10, 25, 50, 75 and 90 percentiles. The validity of the model is analyzed through the implementation of the DQ test as described in Section 2.3. for the model at 1 year and 2-years horizons at the 10th quantile. The results indicate that the model satisfy basic requirements of a good quantile estimate such as unbiasedness, independent hits, and independence of the quantile estimates.

3 To construct the nominal House Price Index (HPI) we use two different data sources: 1) Ministerio de Fomento from 1980 to 2006; ii) Instituto Nacional de Estadística (INE) since 2007.

4 The overvaluation is constructed following Martínez-Pagés and Maza (2003).

5 The credit growth is constructed following Jordà and Taylor (2016).

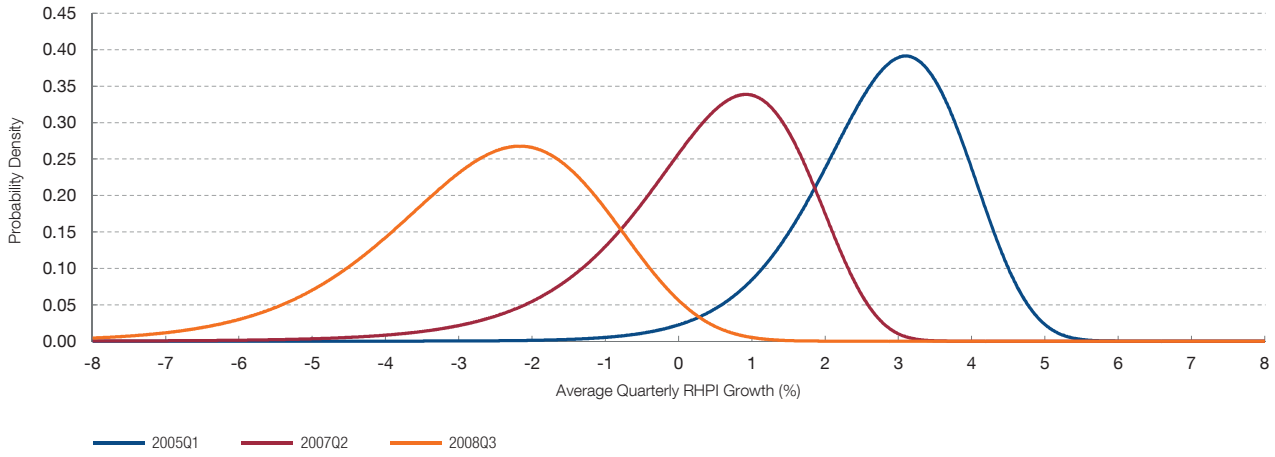
Chart 3
SENSITIVITY OF REAL HOUSE PRICE GROWTH



SOURCE: Authors' calculation.
NOTE: This chart shows the beta coefficients of equation [2] for quantiles 10 (Q10) and 50 (Q50) to changes in the standardized explanatory variables for 1 and 2 year horizons.

Chart 3 shows the sensitivity of the quarterly average growth of the RHPI for the 10 and 50 percentile in 1 and 2 year horizons, in response to a one standard deviation change in the explanatory variables. As one might expect, the coefficient of those variables related to the risk accumulation in the housing market (overvaluation and credit growth) is negative, meaning that the higher the risk accumulation, the higher the likelihood of future drops in the housing market. Indeed, their impacts at the left tail of the distribution – p10 – are stronger in longer horizons (i.e., the magnitude of the coefficient is higher for the 2-year horizon). In addition, their impact seems to be stronger at low percentiles of the distribution. We also observe that the population growth has a positive effect on the future developments of the house market and that this effect is stronger in the extreme realizations (10 percentile), as it is the case

Chart 4
1-YEAR AHEAD FORECASTING DENSITY FUNCTION



SOURCE: Authors' calculation.
NOTE: This chart depicts the 1-year ahead forecasting density function in three different periods: 2005Q1, 2007Q2 and 2008Q3.

with the overvaluation. Finally, we observe that past movements in the housing prices significantly affect the whole distribution of the forecasted housing prices rather than specific percentiles.

Once we have identified the conditional quantile function for the different quantiles and horizons, we next fit, for each horizon, the skewed t-distribution by means of equation [A1.2]. In this application we show the 1-year ahead forecasting density function in three different periods of time. For that aim, we use the conditional quantile functions estimated above using the full sample period. However, one may note that the conditional future growth density forecast depends on two sources of information: i) beta coefficients defining the quantile function; ii) the set of regressors from with the quantiles are computed upon. We take this approach to avoid regressions on very limited number of observations and thus, the only source of heterogeneity in this exercise comes from the heterogeneity in the set of regressors.[6,7]

Chart 4 depicts the forecasting density function in three periods of time: i) 2005Q1; ii) 2007Q2; and iii) 2008Q3. We can see how this powerful tool would have shown to the policy makers the increase in the downside risk. In 2005Q1, real house prices in Spain were growing at 3.3% y-o-y but the downside risk was very limited on that

6 This approach implies that there are no structural breaks in the sample and the quantile estimator is asymptotically consistent, assuming that the estimated beta coefficients will converge to the true "a-temporal" value, as the sample size increases.

7 One might add as an additional source of heterogeneity the use of *real-time* versus the *revised* macrofinancial variables, since real-time data that was available at the time, might be less informative of the downside risks than later revisions of the data. In this work we employ revised macrofinancial variables and thus we are aware that our density forecast might overestimates the information that the policymaker would have had at certain period of time.

Table 1
HOUSE PRICE-AT-RISK

This table contains the 1-year ahead forecasting RHPI growth at 5th percentile (HaR) in three periods of time: 2005Q1, 2007Q2; 2008Q3. For the estimation of the density forecasting we use two alternative approaches related to the estimation of the beta coefficients: i) full sample period (1980-2019); ii) information available in t (1989-t) for each of the three considered periods.

	2005Q1	2007Q2	2008Q3
Full sample	0.828	-2.171	-5.495
Information available in t	0.857	-2.052	-5.504

SOURCE: Authors' calculation.

horizon. However, 2007Q2 depicts a very different picture. We observe a large movement of the full distribution to the left, meaning that downside risk was substantially increasing but also that even in positive scenarios, the growth in the housing market would be weak. The forecasting density function predicted by the 2008Q3 presents a worse picture for 1-year horizon since positive outcomes were highly unlikely to happen.

In order to check whether the use of the full sample betas introduce distortions on the snapshot that policy makers would have seen at that time, we repeat the exercise re-estimating equation [1] using the information available at each point in time. Table 1 shows the evolution of the HaR (i.e., forecasting RHPI growth at 5th percentile) using both methodologies. According to the results reported in Table 1, we do not observe large differences in the HaR under both approaches. According to these results, in 2005Q1, the HaR was 0.83% meaning that in an adverse scenario (so adverse that the probability of an even more negative scenario is only 5%), RHPI would increase by 3.3% over a 1-year horizon (0.83% on average each quarter for the next 4 quarters). However, in 2007Q2 and 2008Q3 the downside risks are completely different and HaR was –2.17% and –5.49%, respectively, meaning that in an adverse scenario, RHPI would decrease by 8.7% and 22%, respectively, over a 1 year horizon.

4 Growth-at-risk and macroprudential policy

Most of previous studies have identified benefits of macroprudential policy in different dimensions such as curbing credit and house prices growth [Claessens et al. (2013), Cerutti et al. (2017)], reducing the probability of systemic crises [Dell'Ariccia et al. (2016)], increasing the probability of survivor of firms in a crisis [Jiménez et al. (2017)], or decreasing the probability of banks' default [Altunbas et al. (2018)]. However, the few studies measuring the impact of macroprudential policy on GDP growth, have identified negative effects. Kim and Mehrotra (2018) identify a negative impact of macroprudential policy on output after analysing an

aggregation of many different instruments in Asian economies. Richter et al. (2019) find that borrower-based measures have negative effects on output growth over a four-year horizon. Noss and Toffano (2016) and Bedayo et al. (2020) identify a negative impact of tightening capital measures on GDP growth in the short-run. In general, these negative effects have been associated to the costs of macroprudential policy.

Those studies have focused on the impact of macroprudential policy on the conditional mean of GDP growth. However, if macroprudential policy effectively reduces systemic risk, we could expect that these benefits are observed in a reduction of the downside risk of GDP growth. Against this background, quantile regressions offer a flexible framework to assess the impact of macroprudential policies on growth-at-risk. This idea has been recently explored by some authors. Duprey and Ueberfeldt (2020) study the interaction between macroprudential and monetary policy in Canada. Aikman et al. (2019) forecast the GDP growth distribution conditional on banks' capital. Brandao-Marques et al. (2020) study the complementarity between macroprudential, monetary policy and foreign exchange interventions. Finally, Galán (2020) provides an analysis of the marginal effect of macroprudential policy on different quantiles of the GDP growth.

In this section, we extend the latter exercise in order to illustrate the usefulness of growth-at-risk models for taking macroprudential policy decisions and evaluating its impact. We estimate a panel quantile regression model of future GDP growth up to 16 quarters ahead on macroprudential policy, cyclical systemic risk, financial stress and their interactions. We use a sample of 27 EU countries with quarterly data from 1970Q1 to 2019Q4. The main data source is the European Central Bank (ECB). Besides annual GDP growth, the set of variables comprises the Systemic Risk Indicator (SRI), the Country-Level Index of Financial Stress (CLIFS) and a Macroprudential Policy Index (MPI). The SRI is a composite index introduced by Lang et al. (2019), that aggregates five cyclical systemic risk variables using weights that optimize the early-warning performance of the indicator from 4 to 12 quarters ahead of systemic crises [see Lang et al. (2019)].[8] Thus, this index would allow characterizing the GDP growth distribution in the mid-term. The CLIFS is an index proposed by Duprey et al. (2015) that aggregates several variables of volatility and tail risk in the equity, sovereign and exchange rate markets. Thus, this index is intended to capture signals of materialised systemic risk, which allow characterizing the GDP growth distributions at short horizons. The MPI is an index that aggregates a broad set of macroprudential measures in different categories over time, and that distinguishes the direction of the policies, providing a measure of the net macroprudential position of a given country. We construct the index using the ECB

8 The variables composing the SRI are the 2-year average change in the credit-to-GDP ratio, the 2-year average growth of house prices, the 2-year average change in the debt-service ratio, the 2-year average growth of equity prices, and the current account balance as a percentage of GDP.

Table 2

PERFORMANCE OF DIFFERENT SPECIFICATIONS OF QUANTILE REGRESSIONS OF CONDITIONAL GDP GROWTH

The table presents the pseudo-R2 obtained from quantile estimations of GDP growth 4 and 12 quarters ahead at five percentiles. Each row represents a regression where the variable in that row is added to those in previous rows. Values in bold represent the maximum value of the pseudo-R2 for each percentile and horizon.

	h=4					h=12				
Percentile	5	25	50	75	95	5	25	50	75	95
GDP	0.15	0.12	0.09	0.10	0.12	0.13	0.10	0.07	0.09	0.11
CLIFS	0.27	0.17	0.13	0.15	0.18	0.15	0.11	0.07	0.09	0.11
SRI	0.32	0.23	0.19	0.21	0.24	0.29	0.24	0.18	0.21	0.24
MPI	0.36	0.27	0.22	0.24	0.28	0.42	0.34	0.29	0.32	0.37

SOURCE: Authors' calculation.

Macroprudential Database introduced by Budnik and Kleibl (2018).[9] In Annex 2 we present details on the computation of the MPI and its characteristics. Finally, the variable of interest ($y_{i,t+h}$) is defined as the annualized average growth rate of real GDP for every country over a time horizon from 1 to 16 quarters ahead, as follows:

$$y_{i,t+h} = \ln\left(\frac{GDP_{i,t+h}}{GDP_{i,t}}\right) / \left(\frac{h}{4}\right); h = 1,\ldots,16 \qquad [7]$$

The proposed panel quantile regression model is the following:

$$\hat{Q}_{y_{i,t+h}|x_{it},\alpha_i}\left(\tau \mid X_{it},\alpha_i\right) = \hat{\alpha}_{i\tau} + \hat{\beta}_{1\tau}y_{it} + \hat{\beta}_{2\tau}CLIFS_{it} + \hat{\beta}_{3\tau}SRI_{it} + \hat{\beta}_{4\tau}MPI_{it} + \hat{\beta}_{5\tau}SRI * MPI_{it}$$
$$+\hat{\beta}_{6\tau}CLIFS_{it} * MPI_{it} + \hat{\beta}_{7\tau}SRI_{it} * CLIFS_{it}; \qquad \tau = 5,10,\ldots 90,95; \qquad [8]$$

where $y_{i,t+h}$ is the annualized GDP growth of country i at t + h quarters ahead as defined in equation [7]; $_i$ represents the unobserved country-effects; y_{it} is the contemporaneous GDP annual growth rate; CLIFS is the index of financial stress; SRI is the composite cyclical systemic risk index; MPI represents the macroprudential policy index; and τ represents the 19 estimated quantiles from the 5th to the 95th percentile.

Departing from the specification in equation [8], we present in Table 2 the performance of different specifications in terms of the pseudo-R2 (equation [4]) for relevant percentiles and two horizons (4 and 12-quarters ahead). This is carried out by adding

9 This database is a large repository of regulatory measures implemented by EU authorities over a long time span. It distinguishes between macro and microprudential measures, the type of instrument, and its direction. Only those measures classified as having a macroprudential objective are retained for this exercise. This includes tightening and loosening measures but excludes decisions where the level or the scope of the instrument remains unchanged.

one additional explanatory variable at a time starting with the contemporaneous GDP growth rate and without considering the interaction terms. We observe that the specifications including the four variables improve the goodness of fit of the model. Nonetheless, the marginal gain varies across quantiles and horizons. In particular, the CLIFS index improves the fit of the model, mainly, at a short-horizon; while the SRI improves more the performance at the longer horizon. Overall, the best fit in all the cases is at the tails, and mainly at the 5th percentile, which represents growth-at-risk.

Certainly, we identify large differences in the estimated effects of SRI, CLIFS and MPI on the left-tail with respect to those estimated in the median. Using the model without interaction terms, Chart 5 shows the response of growth-at-risk and median growth to a one standard deviation increase in the SRI, the CLIFS, and the implementation of one macroprudential measure. We also plot the 95% confidence bands obtained using bootstrapping. We observe that the magnitude and the path of the response of growth-at-risk differs from the one of median growth. In particular, an increase of cyclical systemic risk affects negatively growth-at-risk during a long horizon, while the effect on median growth would be positive during the first 6 quarters. Nonetheless, the effect on the median turns negative and more persistent at longer horizons. These results indicate that the build-up of cyclical risk may feed economic expansions in the short-run but at the expense of higher downside risk in the mid-term.

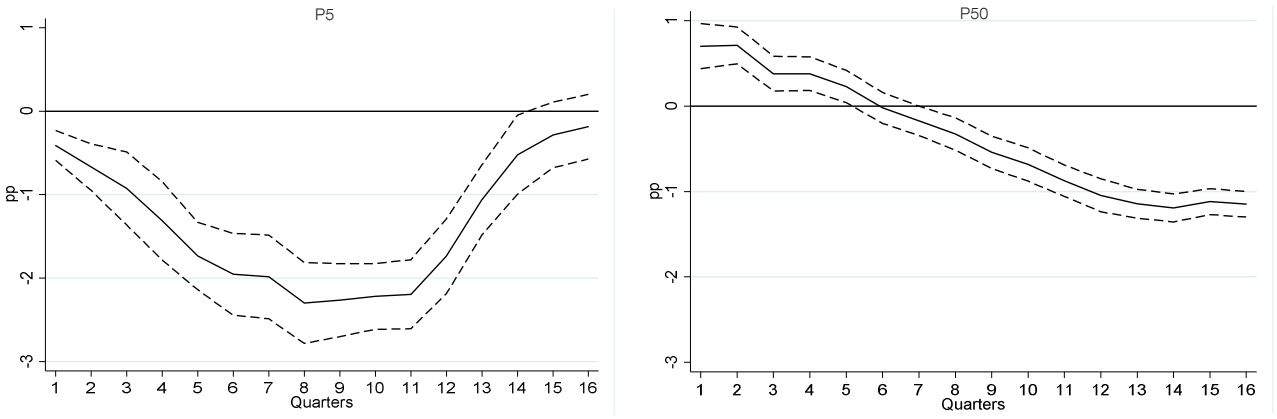
Similarly, an increase of 1s.d. in financial stress has a negative impact on growth-at-risk, but it materializes faster and is less persistent than the impact of cyclical risk. In this case, the negative effect on growth-at-risk reaches its maximum impact around 4 quarters after the shock and dilutes rapidly. This confirms that the effect of financial stress is more contemporaneous given that it is associated to the materialization of risk. The impact on median GDP growth is also negative but its magnitude is one-third than that on growth-at-risk. These results confirm the relevance of disentangling contemporaneous variables of financial risk from those capturing the building-up of cyclical systemic risk.

The response of GDP growth to the implementation of macroprudential policy is also heterogeneous across quantiles and over time. In particular, tightening macroprudential policy has a negative impact on median GDP growth, which confirms the previous findings in studies using conditional mean models. However, the impact on growth-at-risk is positive and the magnitude is larger in the mid-term. In terms of policy, these results suggest that taking early tightening decisions of macroprudential policy would reduce the downside risk of GDP growth through an increase in the resilience of the financial system. In this context, it would be possible to compare the benefits of macroprudential policy on growth-at-risk with the costs associated to reductions in median growth. This would allow policy makers to perform a cost-benefit analysis of macroprudential policy in terms of the same unit of measure, which is beyond the scope of this article [see Brandao-Marques et al. (2020), for a proposal to perform a cost-benefit analysis under this framework through the use of loss functions].

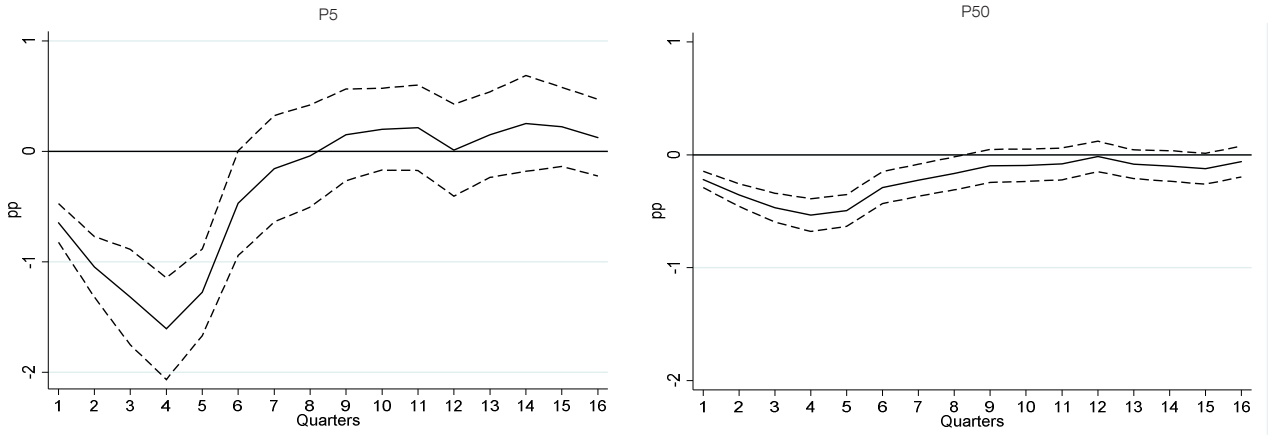
Chart 5

RESPONSE OF GROWTH-AT-RISK AND MEDIAN GROWTH FROM 1 TO 16 QUARTERS AHEAD TO CHANGES IN SRI, CLIFS AND MPI

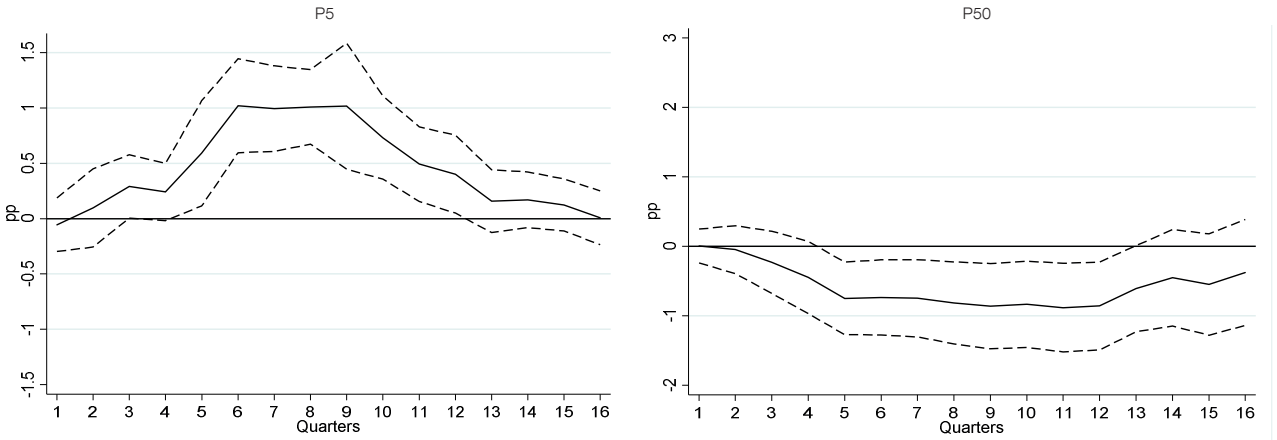
1 INCREASE OF 1 STD. DEV IN CYCLICAL SYSTEMIC RISK



2 INCREASE OF 1 STD. DEV IN FINANCIAL STRESS



3 TIGHTENING OF A MACROPRUDENTIAL MEASURE



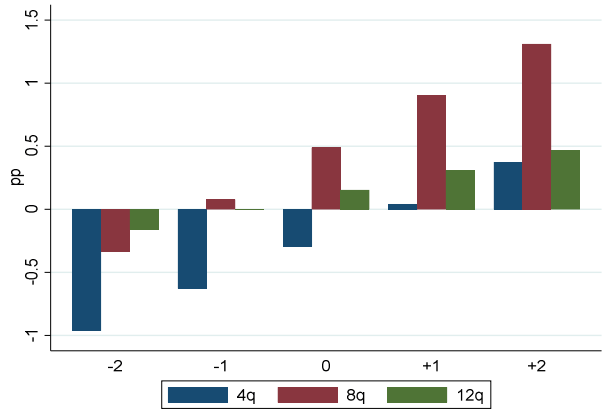
SOURCE: Authors' calculation.
NOTES: The continuous lines represent the estimated coefficients of the MPI in quantile regression at the 5th and 50th percentiles of the conditional GDP growth distribution from 1 to 16 quarters ahead. The dashed lines represent the 95% confidence bands obtained using bootstrapped standard errors with 500 replications.

Chart 6

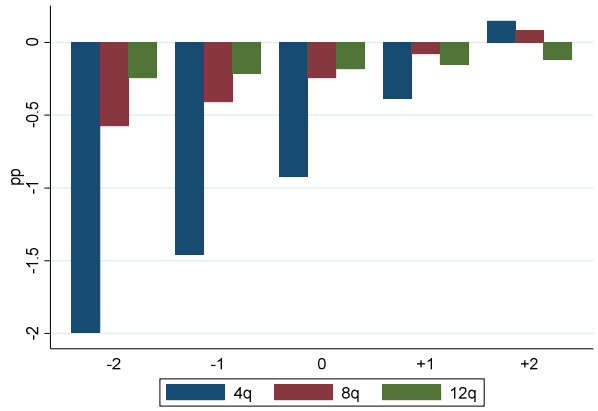
MARGINAL EFFECT OF MACROPRUDENTIAL POLICY ON GROWTH-AT-RISK 4, 8 AND 12 QUARTERS AHEAD CONDITIONAL ON DIFFERENT LEVELS OF CYCLICAL SYSTEMIC RISK AND FINANCIAL STRESS

1 IMPLEMENTATION OF MACROPRUDENTIAL POLICY DEPENDING ON THE LEVEL OF CYCLICAL SYSTEMIC RISK

1.1 NO FINANCIAL STRESS (CLIFS=0.1)

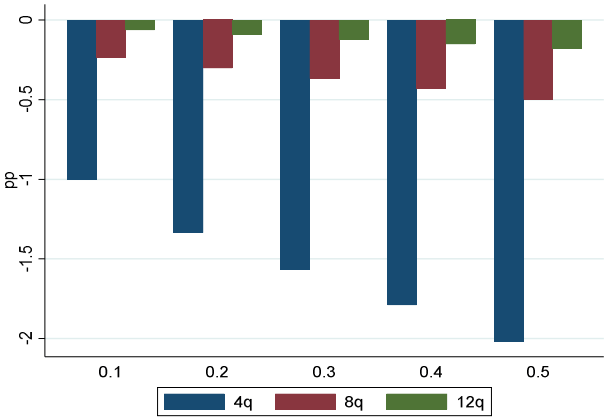


1.2 HIGH FINANCIAL STRESS (CLIFS=0.5)

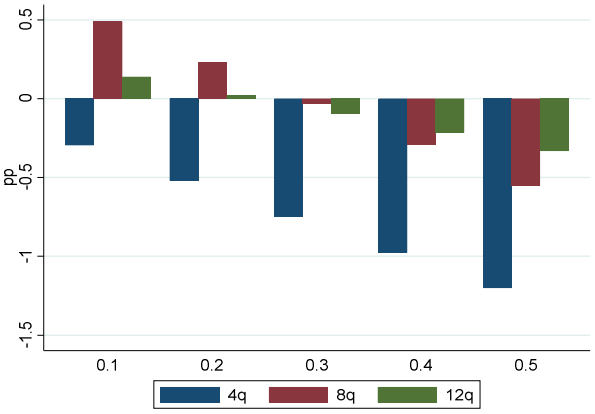


2 IMPLEMENTATION OF MACROPRUDENTIAL POLICY DEPENDING ON THE LEVEL OF FINANCIAL STRESS

2.1 LARGE CONTRACTION OF FINANCIAL CYCLE (SRI=-2 SD)



2.2 NORMAL TIMES (SRI=0)



SOURCE: Authors' calculation.
NOTES: The bars represent the estimated marginal effect of tightening MPI on the 5th percentile of GDP growth at different horizons (4, 8, and 12 quarters ahead of the implementation of a policy). In panels 1.1 and 1.2, the horizontal axes represent a value of the SRI equal to -2, -1, 0, 1, and 2 standard deviations from 0, which represents a normal times situation. In panels 2.1 and 2.2, the horizontal axes represent the values of the CLIFS, where 0.1 is the median value in tranquil periods and 0.5 is the median value reached during systemic events.

Nonetheless, the impact of macroprudential policy on GDP growth may depend on the position in the financial cycle, its amplitude, and the degree of financial stress. In order to account for these interactions, we estimate the full specification in equation [8]. In Chart 6 we plot the marginal effect of the tightening of macroprudential policy on growth-at-risk conditional on different levels of cyclical systemic risk and financial stress at three different horizons. Positive values represent the benefits of tightening macroprudential policy (or the cost of loosening), while negative values represent the

benefits of loosening macroprudential policy (or the cost of tightening). In Panel 1.1, we observe that the positive impact of tightening macroprudential policy during expansions (i.e., increases in the SRI) is greater when disequilibria are larger and that the impact is more evident in the mid-term. Conversely, loosening macroprudential policy has a positive impact on growth-at-risk during periods of contractions in the financial cycle (i.e. reduction in the SRI). These benefits are mainly observed at short-horizons and they become larger when contractions are more severe. In a neutral situation (normal times), the effects are mixed but it still seems that tightening macroprudential policy improves growth-at-risk after 8 quarters.

Under severe financial stress events (Panel 1.2), the benefits of loosening macroprudential policy on growth-at-risk are quite important in the short-term and larger under contractionary phases of the financial cycle. Under the occurrence of these type of events, tightening macroprudential policy is not convenient, even if they are observed during expansionary phases of the financial cycle. Nonetheless, the magnitude of the stress event is also relevant. In Panel 2.1 we observe that under a large contraction, the benefits of loosening macroprudencial policy are important in the short-run at any level of stress, but they can double when moving from a tranquil situation to a very stressed scenario. In normal times (Panel 2.2), the benefits of loosening are lower but the possibility to loosen macroprudential policy if a high stress event materializes would be particularly beneficial.

A more complete picture of the impact of macroprudential policy on the GDP growth distribution can be observed by mapping the quantile estimates at the most relevant horizons identified above into probability density functions. Departing from a baseline "normal times" scenario (i.e. SRI=0, CLIFS=0.1, and MPI at average values), in Chart 7 we show that both the location and the shape of the GDP growth distribution change after a shock either in cyclical risk or financial stress, and that they are also affected by the implementation of a macroprudential policy in the expected direction.

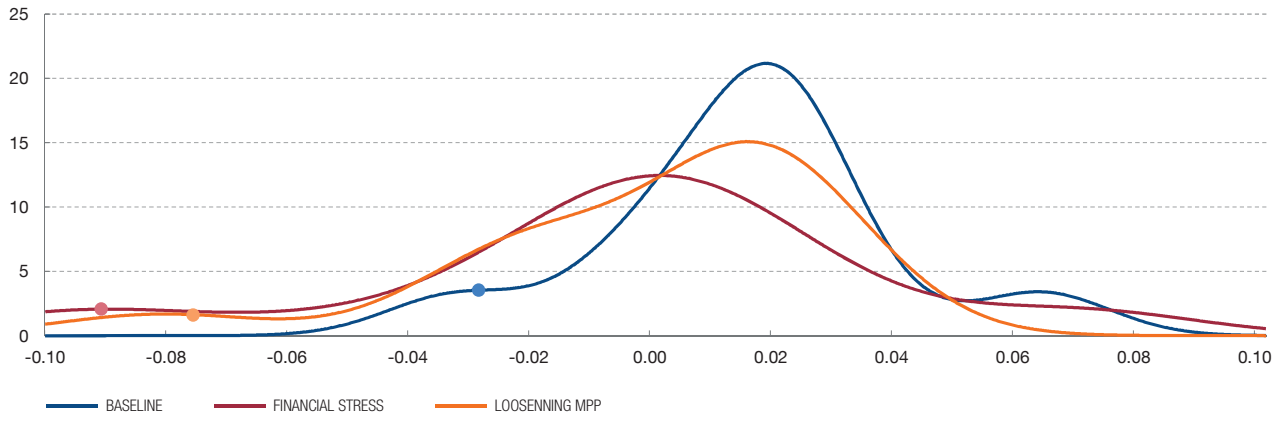
In Panel 1 we observe that a sudden high increase in financial stress, similar to the one observed during the first months of the last global financial crisis and close to the observed in some countries during the first months after the recent COVID-19 shock (CLIFS=0.5), leads to an asymmetric change in the location and shape of the 4-quarters ahead GDP growth distribution. The distribution moves towards left and becomes highly left-skewed. Thus, while median growth drops around 2.5 pp, growth-at-risk decreases 6 pp. Under this scenario, loosening macroprudential policy would improve growth-at-risk in around 1.5 pp.

The effect of a large contraction of the financial cycle, such as the one observed during the last global financial crises in most of countries (–2s.d. change in SRI) is presented in Panel 2. In this case, the change in the 4-quarters ahead GDP growth distribution is mainly observed in the left-tail with a decrease of 4 pp in growth-at-

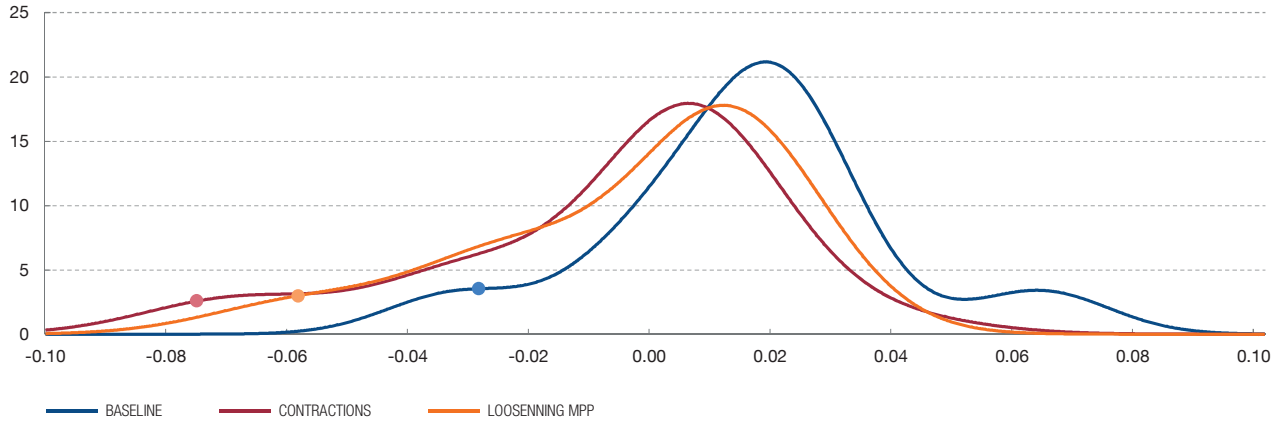
Chart 7

CONDITIONAL GDP GROWTH DISTRIBUTION 4 AND 8 QUARTERS AHEAD UNDER DIFFERENT SCENARIOS

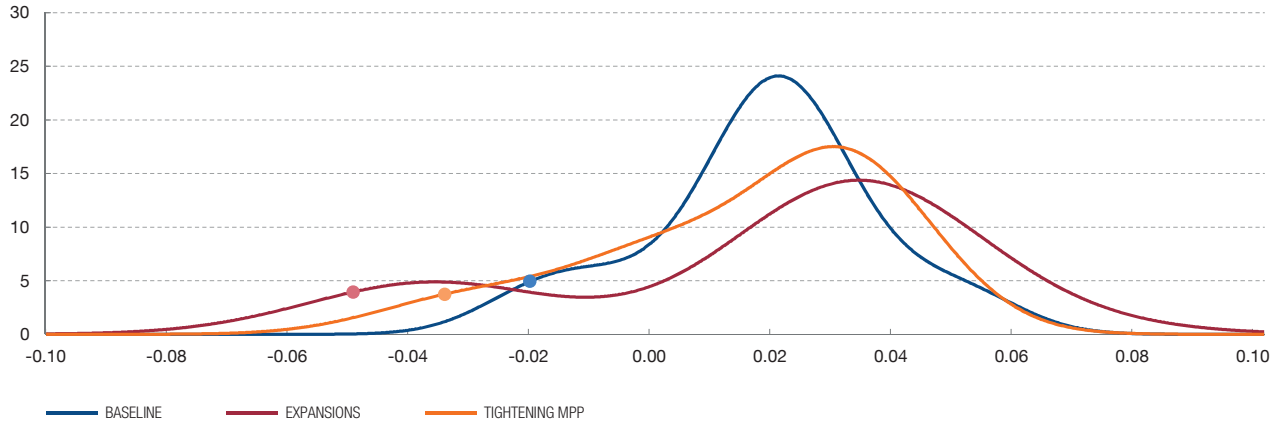
1 LOOSENING DURING FINANCIAL STRESS PERIODS (H=4)



2 LOOSENING DURING CONTRACTIONS (H=4)



3 TIGHTENING DURING EXPANSIONS (H=8)



SOURCE: Authors' calculation.
NOTE: The charts present the estimated GDP growth distributions at the specified horizons after mapping the fitted values of 19 quantile regressions from the 5th to the 95th percentiles into a probability density function using the Kernel-based method described in Annex 1. The black densities represent the baseline cases; the red densities denote the distribution in a situation of high financial stress (CLIFS = 0.5; Panel 1), large contraction (SRI=-2s.d; Panel 2), and large expansion (SRI=+2s.d; Panel 3); and blue densities represent the distribution after tightening (Panels 1, 2) or loosening (Panel 3) a macroprudential measure.

risk. Loosening macroprudential policy in this scenario improves growth-at-risk in around 1.2 pp, although the effect on the median and the right tail is less evident.

Finally, in Panel 3 we show how the GDP growth distribution changes after an expansion of the financial cycle, and the impact of tightening macroprudential policy in this scenario. We map the quantile estimates of GDP growth 8 quarters ahead since the maximum impact of tightening macroprudential policy is evidenced around this horizon. We observe that an expansion of a similar magnitude to that observed in most of countries during the run-up to the last global financial crisis (+2s.d. change in SRI), moves the location of the distribution towards right at the same time that the distribution becomes heavily left-skewed. In particular, growth-at-risk decreases around 3 pp, suggesting that higher GDP growth rates in an expansionary phase becomes at the cost of higher downside risk. Nonetheless, tightening macroprudential policy under this scenario is highly beneficial. We observe that its implementation reduces risk by flattening both tails, while median growth is almost unaltered. In particular, tightening macroprudential policy improves growth-at-risk around 1.7 pp, 8 quarters after its implementation.

Overall, cyclical risk and the materialization of financial stress have important asymmetric effects on the GDP growth distribution, which are especially negative on the left tail, thereby increasing risk for financial stability. Under these scenarios, the benefits of macroprudential policy are evident in terms of improving growth-at-risk. The results are consistent when assessing specific instruments. In Annex 3, we present an assessment of the impact of the capital requirements over the cycle, which also provides a more direct identification of elasticities.

5 Conclusions

Financial stability is aimed at preventing and mitigating systemic risk, which is largely associated to the tail risk of macrofinancial variables. In this context, policy makers need models that allow considering the effects of financial risk and financial stability policies on the whole distribution of these variables, and particularly on the left tail of the distribution, rather than only on the central tendency. The so-called at-risk methods provide a useful framework for the assessment of financial stability by the recognition of non-linear effects on the distribution of macrofinancial variables. In this context, quantile regressions offer a flexible method for this purpose.

We describe the use of the method and illustrate two empirical applications from which useful insights for policymakers are derived. Overall, at-risk-models offer a practical framework to estimate the impact of financial conditions and macroprudential policies on macrofinancial variables directly linked to financial stability; thereby becoming a very relevant tool for policy decisions.

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Skewed t-distribution density

Relative to the t-distribution, the skewed t-distribution adds the shape parameter which regulates the skewing effect of the PDF and CDF. One might use the skewed t-distribution developed by Azzalini and Capitanio (2003) to smooth the quantile function and estimate the probability density function:

$$f\left(y_{t+h};\mu,\sigma,\alpha,\nu\right)=\frac{2}{\sigma}t\left(\frac{y_{t+h}-\mu}{\sigma};\nu\right)T\left(\alpha\frac{y_{t+h}-\mu}{\sigma}\sqrt{\frac{\nu+1}{\nu+\frac{y_{t+h}-\mu}{\sigma}}};\nu+1\right), \qquad [A1.1]$$

where t(·) and T(·) refers to the PDF and CDF of the Student-t, respectively. The four parameters of the distribution pin down the location μ, scale σ, fatness ν, and shape α.

Thus, we can fit the skewed-t distribution by choosing the four parameters that minimize the squared distance between our estimated quantile function $\hat{Q}_{y_{t+h|X_t}}\left(\tau\,|\,X_t\right)$ from equation [1] and the quantile function of the skewed-t distribution $F^{-1}\left(\tau;\mu;\sigma;\alpha;\nu\right)$ from equation [A1.1] to match the chosen quantiles to shape the distribution as follows:

$$\left\{\hat{\mu},\hat{\sigma},\hat{\alpha},\hat{\nu}\right\}=\arg\min_{\mu,\sigma,\alpha,\nu}\sum_{\tau}\left(\hat{Q}_{y_{t+h|X_t}}\left(\tau\,|\,X_t\right)-F^{-1}\left(\tau;\mu;\sigma;\alpha;\nu\right)\right)^2, \qquad [A1.2]$$

where $\hat{\mu}\in\mathbb{R},\widehat{\sigma}\in\mathbb{R}^{+},\hat{\alpha}\in\mathbb{R},\text{and}\,\hat{\nu}\in\mathbb{Z}^{+}$. Very similar fits can be obtained using the skewed-t distribution described in Jones and Faddy (2003).

Kernel-based density

A parametric fitting although practical, introduces strong assumptions on the density function. A non-parametric fit using Kernel-based methods provides a smooth and monotone CDF while allowing for more flexibility [Escanciano and Goh (2014)]. In particular, we focus here on the weighted Kernel interpolation method in Gálvez and Mencía (2014), where the Kernel CDF would be represented by:

$$\sum_{j=1}^{p}w_j\Phi\left(\frac{x-q\left(\theta_j\right)}{B}\right), \qquad [A1.3]$$

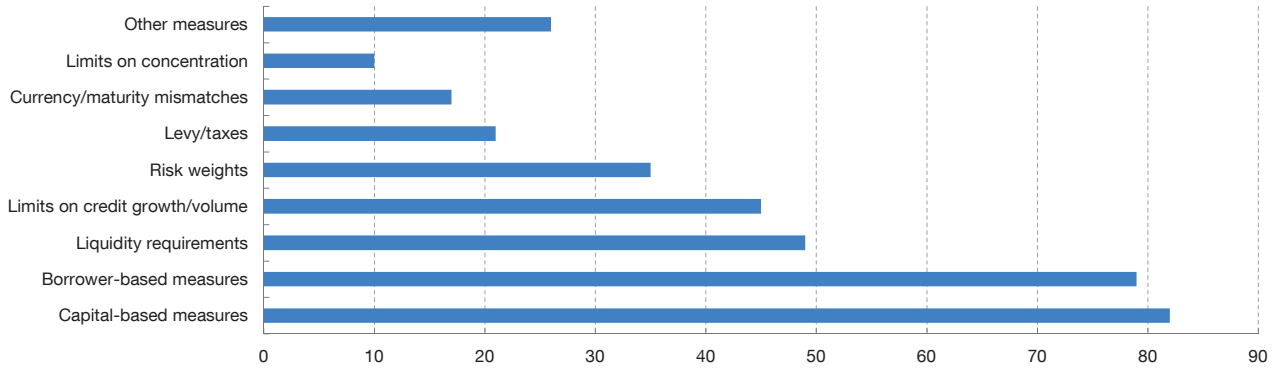
where $\Phi(\cdot)$ is the standard Gaussian cdf; p is the number of estimated quantiles, θ_j represents the quantile j; B is the smoothing parameter; and, w represents the weights $(w_1, w_2, ..., w_p)'$ that minimize the squared distance between the quantile level and its associated cdf. The bandwidth is computed as $B = 1.06 \min(\hat{s}, \hat{r}) p^{-1/5}$, where $\hat{s}$ is the standard deviation and $\hat{r}$ is the interquartile range of the quantile functions. After differentiating the Kernel cdf, the following conditional density is obtained:

$$\frac{1}{B}\sum_{j=1}^{p} \hat{w}_j \phi\left(\frac{x - q(\theta_j)}{B}\right), \qquad \text{[A1.4]}$$

where $\phi(\cdot)$ is the standard normal density function.

Annex 2 The computation of the macroprudential index

Chart A2.1
IMPLEMENTED MACROPRUDENTIAL MEASURES IN THE EU COUNTRIES 1970-2018 BY CATEGORY



SOURCES: ECB Macroprudential Database and own elaboration.
NOTE: The horizontal axis represents the number of macroprudential measures implemented by EU countries from 1970 to 2018 in each category, excluding those where the level or scope of the measure remains unchanged.

Using the information reported in the ECB Macroprudential Database introduced by Budnik and Kleibl (2018) we construct the MPI as a simple sum of the scores on 9 different categories of macroprudential policies for each country. The categories include capital-based measures (i.e., capital requirements, loan-loss provisions and capital buffers), borrower-based measures, liquidity requirements, limits on credit growth, risk weights, taxes, limits to mismatches on currency and maturity, and limits to concentration. The index is computed as follows:

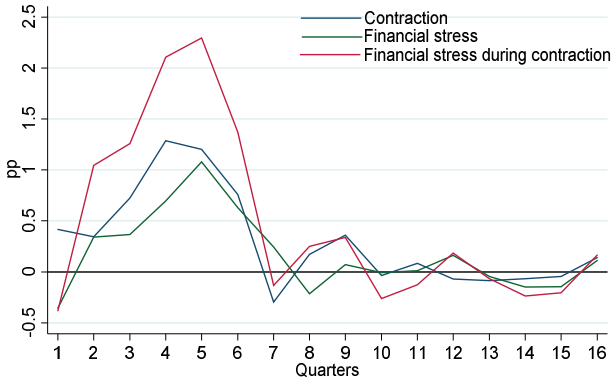
$$MPI_{it} = \sum_{j=1}^{J} SP_{jit} \; ; \; SP_{jit} = SP_{jit-1} + \Delta SP_{jit}, \qquad [A2.1]$$

where, MPI_{it} is the index for country i at quarter t, computed as a sum of the scores SP for each category j. In particular, the score of each category adds 1 when a macroprudential measure is either activated or tightened, while it subtracts 1 when a measure is either deactivated or loosened within that category. The intention of the index is not to capture the intensity of the measures or their change over time. The advantage of the index constructed in this way compared to the use of dummy variables is that it allows evaluating the effectiveness when more than one measure is in place, and then accounting for net tighten or loosen conditions. This approach has been followed also by other authors aggregating macroprudential measures with minor variations [Boar et al. (2017), Cerutti et al. (2017), Kim and Mehrotra (2018), Duprey and Ueberfeldt (2020), Alam et al. (2019)].

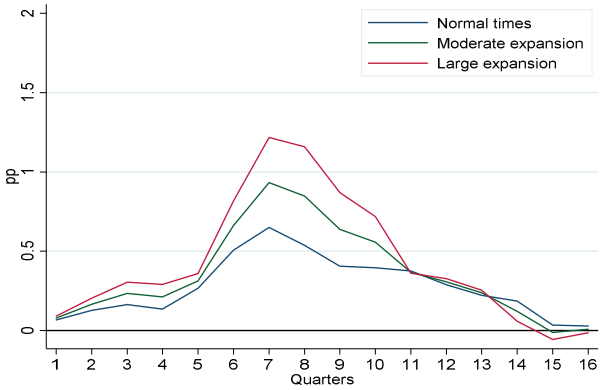
Chart A3.1

RESPONSE OF GROWTH-AT-RISK TO A 1 PP CHANGE IN CAPITAL REQUIREMENTS UNDER DIFFERENT SCENARIOS

1 RELEASE OF 1 PP OF CAPITAL



2 ACCUMULATION OF 1 PP OF CAPITAL



SOURCE: Authors' calculation.
NOTE: The continuous lines represent the estimated response of growth-at-risk from 1 to 16 quarters after a shock equal to a 1 pp change in the solvency ratio under different scenarios: contraction (SRI=-2s.d.), financial stress (CLIFS = 0.5), financial stress during contraction (SRI=-2s.d. and CLIFS=0.5), normal times (SRI=0), moderate expansion (SRI=+1s.d.), and large expansion (SRI=+2s.d.); while holding other variables constant.

The growth-at-risk tool would also be useful for measuring the impact of specific instruments and possibly guiding their calibration. To illustrate this, we extend the previous exercise to assess the effects of capital requirements. We estimate the model in equation [8] but replacing the MPI by the banks' solvency ratio defined in terms of CET1 capital over risk-weighted assets, which is the main metrics for this type of requirements and buffers.

In Chart A3.1, we plot the response of growth-at-risk to a 1 pp change in capital requirements under different scenarios. We observe that releasing capital would produce rapid but low persistent benefits on growth-at-risk, but that the magnitude of the impact depends on the scenario. Under a large contraction of the financial cycle (SRI=-2s.d.), releasing 1 pp of capital leads to a rapid improvement in growth-at-risk, which is evident even from the next quarter. In a high financial stress scenario (CLIFS=0.5), the improvement seems to be slower but the economic impact would be similar 5 quarters after the release. Finally, in a combined scenario of large contraction and high financial stress, the benefits of releasing 1 pp of capital on growth-at-risk would be larger, reaching more than 2 pp.

Conversely, accumulating capital in good times has benefits during an upswing of the financial cycle. These benefits are clearer in the mid-term suggesting the need

of increasing capital early enough in the cycle. Although, the benefits increase with the magnitude of the expansion, under a situation close to the equilibrium (SRI=0), the impact of accumulating capital is still positive.

Overall, these findings support the countercyclical use of capital-based measures, whose benefits in reducing the tail risk of GDP growth are evident not only when releasing capital during contractions, but also when accumulating capital during expansions. Moreover, the positive effects of increasing capital during normal times and releasing it during stress events, also support the use of instruments, such as the countercyclical capital buffer before disequilibria in the financial cycle is observed, and as an effective instrument to mitigate the negative consequences of unexpected events.

Stablecoins: risks, potential and regulation

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Abstract

The technologies underlying money and payment systems are evolving rapidly. Both the emergence of distributed ledger technology (DLT) and rapid advances in traditional centralised systems are moving the technological horizon of money and payments. These trends are embodied in private "stablecoins": cryptocurrencies with values tied to fiat currencies or other assets. Stablecoins – in particular potential "global stablecoins" such as Facebook's Libra proposal – pose a range of challenges from the standpoint of financial authorities around the world. At the same time, regulatory responses to global stablecoins should take into account the potential of other stablecoin uses, such as embedding a robust monetary instrument into digital environments, especially in the context of decentralised systems. Looking forward, in such cases, one possible option from a regulatory standpoint is to embed supervisory requirements into stablecoin systems themselves, allowing for "embedded supervision". Yet it is an open question whether central bank digital currencies (CBDCs) and other initiatives could in fact provide more effective solutions to fulfil the functions that stablecoins are meant to address.

1 Introduction

Finance and technology have always been co-developmental, with global trends in digitisation and datafication transforming finance over the past several decades.[1] The 2010s, however, ushered in a burst of energy around digital innovation in finance, emanating from rapidly evolving technologies, particularly information and communications technologies (ICT). These innovations have affected not only financial services like payments, credit, investment and insurance, but also the core foundations of the financial system – namely money – itself [BIS (2018 and 2020)]. The COVID-19 crisis has accelerated the shift to digital payments. It has fanned public concerns about viral transmission through cash (see Chart 1.1) and led to a surge in the use of digital payments [Auer et al. (2020a)] (see Chart 1.2).

As with all periods of rapid innovation, there is the potential for excessive hype, fads and hyperbole, as highlighted in the classic financial instability hypothesis [Fisher (1933), Minsky (1975 and 1982) and Kindleberger (1978)] or the more

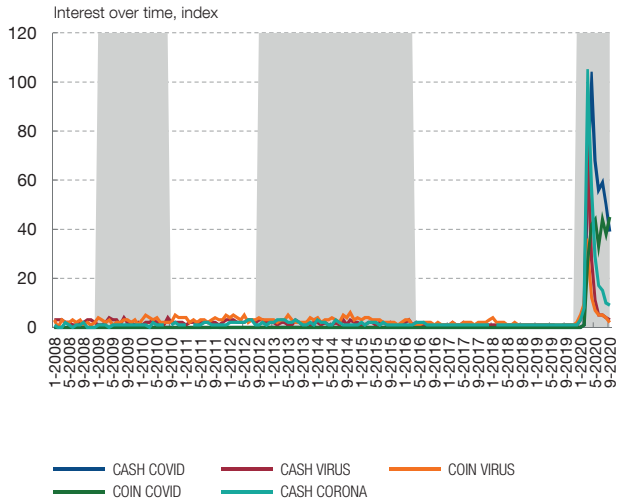
1 Digitisation can be defined as the process of changing information from analogue to digital form. This is sometimes confused with digitalisation – the use of digital technologies to change a business model and provide new revenue and value-producing opportunities, or the process of moving to a digital business. See Gartner (2020). Datafication, meanwhile, refers to the collective tools, technologies, and processes used to transform an organisation into a data-driven enterprise.

Chart 1

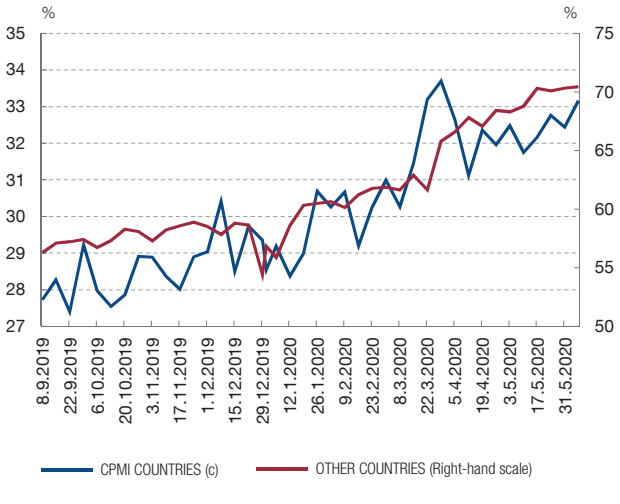
CONCERNS ABOUT VIRAL TRANSMISSION BY CASH HAVE ACCELERATED THE SHIFT TO DIGITAL PAYMENTS

The shaded areas in Chart 1.1 indicate Jan 2009-Aug 2010 [Swine Flu (H1N1)], Sep 2012-Mar 2016 [Middle East Respiratory Syndrome Coronavirus (MERS-CoV)], Dec 2013-Mar 2016 (West African Ebola epidemic) and Dec 2019-current (COVID-19). The black vertical line in Chart 1.2 indicates 30 January 2020, when the World Health Organisation (WHO) declared the COVID-19 outbreak a "public health emergency of international concern".

1 SEARCH INTENSITY OF RELEVANT TERMS HAS SHOT UP... (a)



2 ... LEADING TO GREATER USE OF CONTACTLESS CARDS (b)



SOURCES: Auer et al. (2020a), BIS (2020) and Google Trends.

a Data accessed on 21 Mar 2020. Data resulting from worldwide Google search queries for selected terms in the period 2008-current, indexed to 100 by peak search interest.
b Share of contactless in all card-present transactions by a global card network. In many countries, transaction limits for contactless payments were raised in Q2 2020.
c Countries that are members of the Committee on Payments and Market Infrastructures (CPMI). Excludes MX and TR due to data availability.

contemporary Gartner hype cycle [Gartner (2020)]. For authorities and the public alike, separating the "wheat from the chaff" in digital innovation remains a challenge. Just as Paul Volcker questioned the value of past financial innovations in the aftermath of the 2008 Great Financial Crisis [WSJ (2009)], future observers may look back sceptically on some current digital innovations. For central banks and regulators, these challenges take on particular importance in their pursuit of financial and monetary stability.

Today, authorities around the world are grappling with the rise of digital currencies and decentralised finance based on both emerging technologies – particularly various combinations of distributed ledger technology (DLT) and blockchain[2] – and

2 The term "blockchain" is often used interchangeably with systems which are often based on a combination of DLT and blockchain, in which blockchain is in fact a cryptographic security structure. While it is often used with DLT, it can in fact be used in the context of permissionless, permissioned DLT and even in centralised systems, in which blocks of transactions are encrypted together. For a discussion of the spectrum of different types of DLT, see Wadsworth (2018).

advances in traditional centralised systems underpinning finance. Many argue that a technological revolution is occurring in money and payment systems [Arner et al. (2020)]. From the creation of Bitcoin in 2009, to the emergence of "stablecoin" projects such as Dai, HUSD, Paxos Standard, Tether, TrueUSD and USD Coin starting from 2014, to the announcement of Facebook's Libra project in 2019, technological challenges to existing monetary frameworks have put a broader set of regulatory issues on the agenda [see Fatás and Weder di Mauro (2019), G7 Working Group on Stablecoins (2019) and FSB (2020)]. An overarching consideration is that, when faced with innovations, authorities must consider how best to apply regulation so that similar economic and financial risks emerging from varying technologies and participants are treated similarly, avoiding regulatory arbitrage. Still, the "regulatory dialectic" of regulation, regulatory avoidance and re-regulation [Kane (1977 and 1981)] may be unavoidable.

While Bitcoin and other cryptocurrencies have not evolved into major alternatives to sovereign monetary arrangements, stablecoins have raised new challenges. They also offer opportunities for specific use cases, with private stablecoins aiming to be adopted as a means of payment for online purchases ("e-commerce"), peer-to-peer and micro-payments and a range of potential future applications. As discussed further below, they also have the potential to serve as a digital monetary instrument to embed in DLT applications, including for programmable money or smart contracts.

In the current policy debate, a stablecoin can be defined as a cryptocurrency that aims to maintain a stable value relative to a specified asset, or a pool or basket of assets [FSB (2020)].[3] Following the "money flower" of Bech and Garratt (2017), stablecoins inhabit the same realm as Bitcoin and other cryptocurrencies, in that they are electronic, can be exchanged peer-to-peer and are not issued by central banks. Stablecoins are token-based; their validity is verified based on the token, itself, rather than the identity of the counterparty, as is the case for account-based payments [see Kahn (2016)].

The idea of stablecoins is not entirely new. Indeed, one can argue that early European public deposit banks, such as the 17th century Bank of Amsterdam, shared an economic structure with modern stablecoin proposals [Frost et al. (2020), Carstens (2019) and Knot (2019)]. Stored value cards and money market funds (MMFs) also offer some parallels, as do various forms of mobile money, with discussions of electronic or "e-money" dating to the 1990s. Yet DLT has allowed for the creation of new digital forms of money and payment systems that could serve novel purposes and extend some of the well-known economic and regulatory issues with past innovations into the digital realm. Existing stablecoins such as Tether, USD Coin and Maker's

3 The FSB and other international policy committees refer to cryptocurrencies as "crypto-assets" to emphasise that they are not currencies. In this paper, we will use the two terms synonymously.

Dai, aim to serve as a means of settlement for automated financial products. They offer also offer the possibility of so-called "smart" contracts, i.e. self-executing code, and possibilities for "programmable money".[4] Stablecoin proposals like Libra claim that they will make possible new forms of online exchange through their 24/7 availability, borderless nature, fractionalisation[5] and integration with non-financial services. In this light, they aim to challenge existing digital means of payment for e-commerce like traditional bank payments, credit cards and electronic wallets.

The market value of existing stablecoins (Tether, USD Coin, Dai, etc.) reached USD 14 bn in August 2020, yet authorities are braced for a world in which these volumes are orders of magnitude higher. If this comes to pass, regulation and supervision will need to adapt quickly, both to monitor and assess risks from stablecoins, and to address risks to the economy, consumers and the financial system. Facebook's announcement of its Libra project has taken the private stablecoin onto an entirely different plane than any previous cryptocurrency or stablecoin: it is the first proposal backed by a group of corporations for a "global stablecoin" aimed at retail payments.[6] Also with the changes introduced in Libra 2.0 [see Libra Association (2020)], this project involves the creation of both a new stablecoin with both existing and new payment systems. The Libra stablecoin in particular could be used across Facebook's rapidly growing payments offerings in multiple markets including Facebook Pay, WhatsApp Pay and Instagram Pay, with potentially rapid access to hundreds of millions of retail customers in a very short period. If successful, Libra could easily attain mass adoption across multiple jurisdictions given the established networks of Facebook and other Libra Association members, with the potential to achieve substantial volumes relative to the existing payments providers. This could bring a range of benefits, particularly in the context of cross-border transfers, but it also raises substantial questions for monetary and financial authorities.

The fact that regulation should treat similar risks arising from differing technologies similarly does not preclude public authorities themselves from embracing innovation. Authorities are applying technology in their own functions, whether in the context of regulation and supervision or in the provision of public goods. These public goods include appropriate monetary instruments (constantly evolving with technology) and supporting payment and liquidity infrastructures. Whereas "financial regulation" is the process of setting the rules that apply to the regulated entities, "financial supervision" is the compliance monitoring and enforcement of these rules, which has to be dynamic and adaptable. In particular, technology opens up new possibilities

4 Smart contracts can be formally defined as programmable distributed applications that trigger financial flows or changes of ownership if specific events occur [FSB (2017)]. In other words, they are algorithms that automate the execution of contracts. Programmable money is not precisely defined in the literature, but generally refers to a similar set of applications that make automated payments conditional on certain objective criteria. See Section 2.

5 Fractionalisation refers here to the ability to pay in very small units, e.g. small fractions of one cent.

6 Global stablecoins are those that can build on existing large, cross-border user bases to scale rapidly and achieve substantial (global) volume. See G7 Working Group on Stablecoins (2019) and FSB (2020).

to develop better forms of financial infrastructure, enhance supervisory processes and regulatory outcomes, and even for embedded supervision [Auer (2019b) and Arner et al. (2017)].

Stablecoin proposals are one area where embedded supervision may work in practice. Information is a central function of regulation, both from the standpoint of enhancing market functioning and efficiency, and as from the standpoint of supervision, whether for purposes of market integrity, customer and investor protection, or prudential supervision. Direct automated provision of data as a licensing or registration requirement for digital payment systems and markets provides an important opportunity to better use technology to achieve regulatory and supervisory objectives as well as reduce costs for market participants. While many DLT companies have not necessarily focused on this joining of technology, regulation and supervision, it is being seen in some contexts. The automated provision of information by certain large value digital payments platforms, such as Alipay and WeChat Pay in China, provides one example.

At the same time, there are open questions as to whether central bank digital currencies (CBDCs) and other initiatives could fulfil these functions even more effectively than privately developed stablecoins. CBDCs would enjoy the backing of the central bank and would not be subject to the same conflicts of interest around the asset backing and stabilisation mechanism. Their value could be fixed by design to the currency they reference (in particular in systems where the CBDC was actually the digital representation of the currency), thus eliminating fluctuations in value. The question is how a CBDC could be designed to offer robust interoperability with novel decentralised financial solutions [see Auer and Böhme (2020) for a taxonomy of technological designs].

Meanwhile, a number of improvements to existing payment systems could be an alternative or complement to both stablecoins and CBDCs. In particular, appropriately designed public sector and public-private initiatives, like retail fast payment systems (FPS), supported by public digital identify (ID) infrastructures, are already greatly improving the speed, availability and universal access of payments in many countries. In theory, FPS could offer additional functionalities or become interoperable with DLT applications. These could help to achieve some of the same policy goals.

This paper is organised as follows. Section 2 discusses extant stablecoins and stablecoin proposals, and means for monitoring them, including indicators on price volatility, volumes, use and economic potential. Section 3 discusses the specific case of Facebook's Libra, in particular its latest incarnation ("Libra 2.0"). Section 4 discusses principles for regulating stablecoins, in particular regarding financial stability and conflicts of interest around their asset backing. Section 5 discusses the promise of embedded supervision in the context of stablecoins, CBDCs and other financial technology frameworks. Section 6 concludes.

2 The stablecoin sector and how to monitor it

Like the proverbial phoenix, stablecoins have risen from the ashes of the 2018 cryptocurrency bubble. After its introduction in 2009, Bitcoin saw at least two distinct periods of boom and bust – first in late 2013/early 2014, ending with the high-profile hack of crypto-exchange Mt. Gox, and second in late 2017/early 2018, when the market capitalisation of Bitcoin, Ether and other crypto-assets peaked at USD 830 bn before crashing. After the latest high-profile speculative bubble, it became clear that the high price volatility of existing cryptocurrencies impaired their usability as a means of payment, store of value or unit of account.[7] As such, attention moved to a new type of digital asset which sought a stable value against one or more fiat currencies and/or other assets. Stablecoins like Tether (introduced in January 2014), USD Coin, Dai and others entered the limelight. However, it was the announcement of Facebook's Libra proposal in June 2019 which for the first time offered a stablecoin with serious potential to emerge as a monetary alternative with scale – the first so –called "global stablecoin" (see next section).

Stablecoins aim to preserve a stable value through at least two distinct mechanisms. Most commonly, stablecoin issuers purport to back stablecoins with fiat currency, assets or other cryptocurrencies; these are called asset-linked stablecoins. By contrast, algorithm-based stablecoins seek to use algorithms to increase or decrease the supply of stablecoins in response to changes in demand [FSB (2020)].

Initially, stablecoins evolved in order to address the failure of Bitcoin and other cryptocurrencies to provide an effective monetary and payment instrument. This reflected the preference of main market participants to base transactions and payments on sovereign fiat currencies, in particular the US dollar. It also reflected weaknesses in Bitcoin and other crypocurrencies inter alia as means of payment, store of value or unit of account. However, as no digital form of the dollar or other sovereign fiat currencies was available, market participants developed the stablecoin structure as a means to address this issue, as well as to provide an instrument to support hedging between crypto-assets and fiat currencies. The need was for a bridge between DLT and fiat currencies, with stablecoins seeking to fill this need. This was particularly relevant in the context of high volatility in the price of Bitcoin, making it less useful as a payment instrument and more of an investment – speculative or otherwise – or hedge. For instance, Tether claims to provide "individuals and organizations with a robust and decentralized method of exchanging value while using a familiar accounting unit" [Tether (2016)]. Tether has become a common means of putting funds into and out of crypto trading platforms. Issuers have also portrayed stablecoins as a solution to promote financial inclusion and address issues in cross-

7 The lack of scalability and high costs of achieving payment finality with permissionless DLT based on "proof-of-work" are also barriers to adoption. Second-layer solutions such as the Lightning Network aim to enhance efficiency, yet the only fundamental remedy may be to depart from proof-of-work [Auer (2019a)].

border payments, particularly for emerging markets: this is in fact the central proposition initially put forward in the context of Libra [Libra Association (2019)].

Beyond these use cases, a range of new DLT/blockchain applications would benefit from a trustworthy monetary and payment instrument to embed in digital environments. For instance, many DLT projects aim to combine a digital environment and a monetary or payment instrument. In the context of decentralised systems, i.e. financial systems without formal intermediaries, a representation of value is very useful in designing smart contracts. One large example is Ethereum – a digital environment and infrastructure built on a dedicated digital token (Ether). In each case, however, the volatility of the underlying crypto-asset has been a major barrier for effective settlement. This has spurred the desire for a means to effectively link digital transactions with fiat currencies, and the case for stablecoins.

If successful, stablecoins could be a means to simplify and enable novel forms of exchange in the digital economy. For instance, smart contracts could allow for the automation of certain transactions – such as only transferring the funds for a house purchase once an inspection report has been received and confirmed. The financial transfer is thus automated on the basis of certain objective conditions, which trigger payment. The digital payment would be linked to fiat currency and accounts via the stablecoin. Decentralised transactions could enhance the efficiency of wholesale payments and settlement, trade finance and capital market transactions [FSB (2019)].[8] In such transactions, embedding payment into the transaction has the potential to both reduce risk (particularly payment and settlement risks) as well as enhance efficiency. Smart contracts could also execute micro-payments in the so-called "Internet of Things", such as self-driving cars that pay one another to change lanes when one is in a hurry and traffic is particularly heavy, or computers that pay one another for file storage space or processing power [see Milkau (2018)]. Governments could use "programmable money" in the form of stablecoins to restrict the purposes that government-to-person payments could be used for, such as only groceries, or making such funds "expire" after a certain period.[9] Of course, this could also be done in the context of CBDCs or even "synthetic" CBDC structures, i.e. arrangements in which a private intermediary's digital token is directly backed with central bank reserves or liquidity facilities [see Auer et al. (2020b)]. Finally, because of their 24/7 availability, borderless nature and fractionalisation, i.e. their ability to support programmable micropayments [McLaughlin (2020)], stablecoins could become a convenient digital means of payment for e-commerce. Particularly when integrated into online platforms, they could challenge current means of

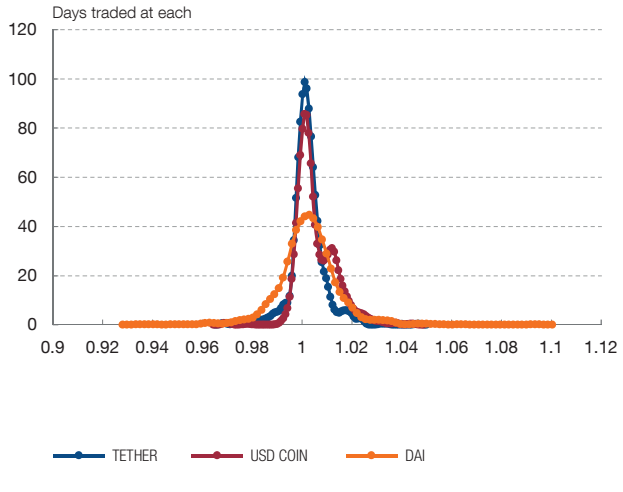
8 Decentralisation of financial services refers to the elimination – or reduction in the role – of intermediaries or centralised processes. This may include the decentralisation of risk-taking, decision-making and record-keeping away from traditional intermediaries. See FSB (2019).

9 Experiments to date show that programmable money can also be used for more prosaic purposes. Feltwell et al. (2019) show the sometimes fanciful ideas of consumers, such as paying money into a penalty jar when personal resolutions not to eat junk food are broken, or adding money to a savings account when the International Space Station passes overhead.

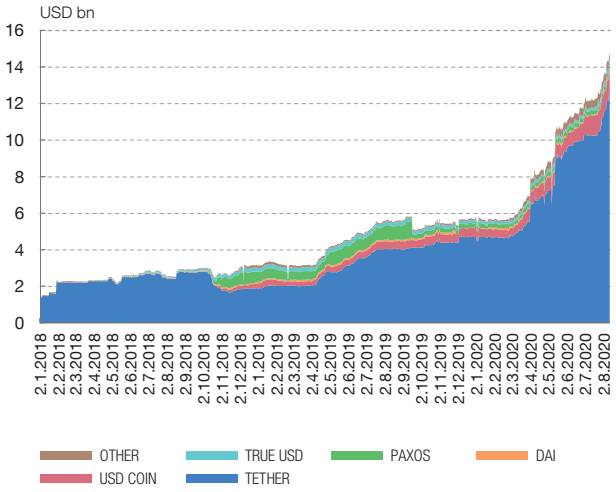
Chart 2

STABLECOIN MARKET DEVELOPMENTS

1 EXISTING STABLECOINS FLUCTUATE IN PRICE (a)



2 MARKET CAPITALISATIONS HAVE GROWN STRONGLY



SOURCE: The Stablecoin Index, Messari.

a Histogram of daily trading prices in USD. The sample includes Tether (2 Jan 2018-14 Aug 2020), USD Coin (9 Oct 2018-14 Aug 2020), Dai (2 Jan 2018-14 Aug 2020), Paxos (28 Sep 2018-14 Aug 2020) and TrueUSD (6 Mar 2018-14 Aug 2020).

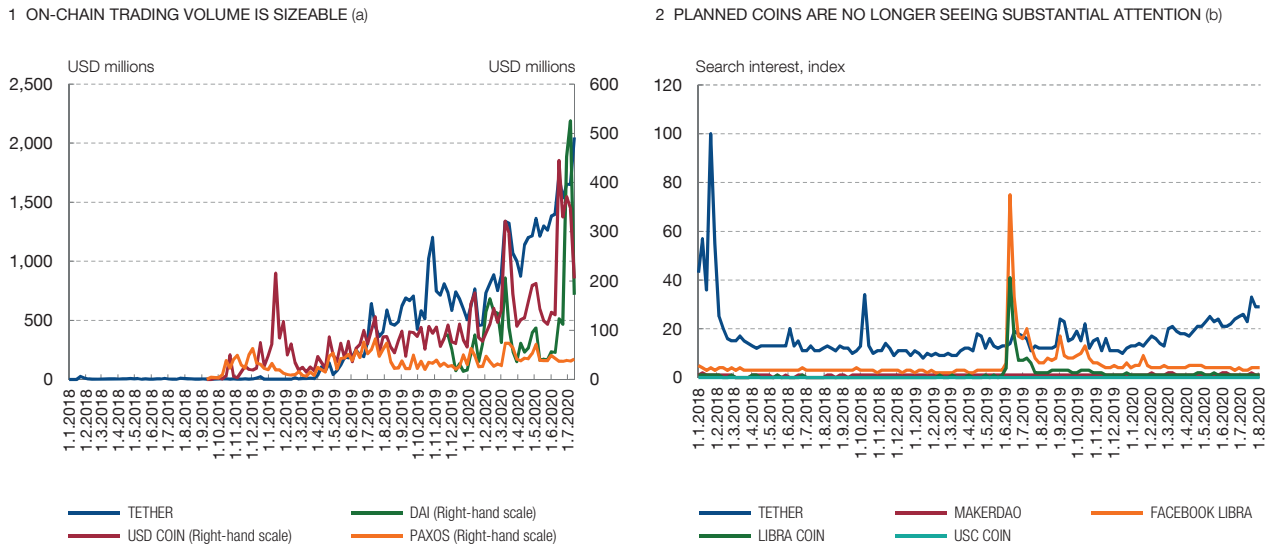
payment like credit cards and electronic wallets. In wholesale transactions, they could allow for "atomic settlement", i.e. delivery-versus-payment, where a payment and the transfer of ownership for e.g. a security happen at the same time.

To achieve these ambitions, stablecoins must have a stable value. For all stablecoins currently in existence, there has been some price volatility in practice, i.e. fluctuation relative to the reference assets (see Chart 2.1). This has led some policymakers to quip that stablecoins are neither stable nor coins [ECB (2019) and Woolard (2019)]. Nonetheless, volatility is much lower than that of Bitcoin, Ether and other cryptocurrencies. Over 2020, the market capitalisation of extant stablecoins (e.g. Tether, USD Coin, Dai and Paxos) has grown, from a low level (see Chart 2.2). The total market value of these coins reached USD 14 billion in August, dominated by Tether[10]. This is tiny relative to the global financial system and even relative to the market for crypto-assets, but this may understate their usage in specific contexts. Indeed, it is estimated that in mid-2018, up to 80% of Bitcoin trading volumes involved Tether on one side of the transaction [Vigna and Russolillo (2018)]. Moreover, it is notable that stablecoin market capitalisation has more than doubled since the start of the COVID-19 pandemic. In the same period, there has been a large rise in digital payments more generally, and in related services such as e-commerce [Auer et al. (2020c)].

10 This measure does not take into account JPM Coin, launched in February 2019 to enable instantaneous payments between institutional clients of JP Morgan based on blockchain [JP Morgan (2019)]. The current volume of JPM Coin is undisclosed.

Chart 3

USE OF STABLECOINS HAS INCREASED WHILE ATTENTION HAS SHIFTED



SOURCES: Glassnode Studio and Google Trends.

a Weekly average.
b Worldwide interest. Data accessed on 14 August 2020.

In parallel to the growth in market capitalisation (a stock measure), the use of stablecoins has increased, as seen in more transactions in stablecoins on the Bitcoin blockchain (a flow measure). In fact, total transfer volume in Tether reached USD 1.6 billion in July 2020, while on-chain transfers in Dai and USD Coin peaked at USD 400-500 million (see Chart 3.1). As a live coin, Tether continues to see high internet search interest from the general public, even as search interest in Facebook Libra has recently ebbed (see Chart 3.2).

These current trends are informative to the extent that they give clues into the potential future growth and operation of stablecoins. From what has been presented, at least three insights can be drawn. First, the value of stablecoins against reference assets may still fluctuate more than existing digital instruments like e-money.[11] Second, while stablecoins are by nature less susceptible to speculative bubbles of the type that Bitcoin and other cryptocurrencies have experienced, their market capitalisation may nonetheless rise and fall rapidly with purchases and redemptions by investors. Worse yet, without additional private or public backstops, stablecoins can be subject to severe price discounts or self-fulfilling runs, especially when backed by risky or opaque assets and in times of market turmoil. Furthermore, if stablecoins were to gain significant usage, runs on stablecoins could provoke fire sales of the assets used to back their value. This

11 Details of the pegging mechanisms differ across stablecoins. For example Lyons and Viswanath-Natraj (2020) argue that in case of Tether, it appears that most of the fluctuations are driven by arbitrageurs' inability to employ their balance sheets to profit from price differentials.

could have negative spillovers on the rest of the financial system [Adachi et al. (2020) and G7 Working Group on Stablecoins (2019)]. Third, and more positively, indicators for monitoring stablecoins in real time are available. Prices, market capitalisation, on-chain transfers and search interest may all be useful measures of specific aspects of stablecoin markets. A forward-thinking design process may yield further indicators for the purpose of market monitoring and financial supervision that can be made available by design.

3 Case study: the structure of Facebook's Libra 2.0

While the potential attractiveness of stablecoins for specific use cases in DLT systems is clear, no cryptocurrency or stablecoin has emerged as a real competitor or alternative to major sovereign fiat currencies. From a regulatory standpoint, there have been clear regulatory and supervisory issues, in particular around market integrity [anti-money laundering/combating the financing of terrorism (AML/CFT)] and consumer and investor protection. So far, the concerns around financial or monetary stability have been limited in most jurisdictions.

3.1 Libra 2.0: a primer

This changed with Facebook's announcement in mid-2019 of its plan to create Libra, a combination of a private stablecoin and a global electronic payment framework. Facebook's initial proposal for the first "global stablecoin" ("Libra 1.0") met with considerable scepticism by policymakers around the globe.[12] After an intense dialogue with regulatory authorities, on 16 April 2020, the Libra Association published a revamped "Libra 2.0" stablecoin proposal [Libra Association (2020)].

Libra 2.0 features a three-layer architecture. The first layer is the value backing of two distinct types of stablecoins: i) single-currency stablecoins in US dollars (USD), British pounds (GBP), euro (EUR) and Singapore dollars (SGD), referred to as Libra$, Libra€, etc.; and ii) a global stablecoin (LBR) that is a basket of the single-currency stablecoins (see Chart 4). The second layer is the Libra Blockchain, the wholesale payment system where the Libra Blockchain makes stablecoins available to payment service providers (PSP) and e-wallet providers, such as Facebook's digital wallet Novi (previously called Calibra). In the third layer, the single-currency stablecoins and LBR are made available to other clients and wallets.

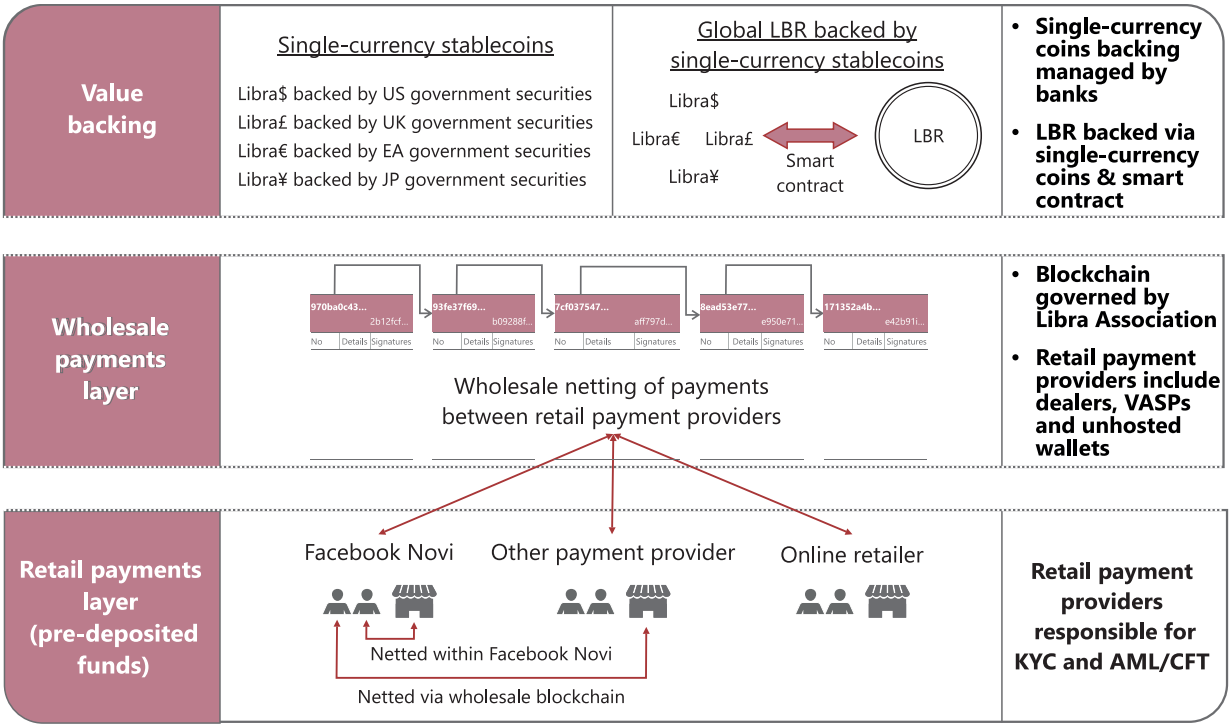
The value backing of the Libra stablecoin is two-tiered. The first tier is the Libra Reserve, a traditional asset-based value guarantee for single-currency stablecoins.

12 See Libra Association (2019) for the proposal, and G7 Working Group on Stablecoins (2019), FSB (2020) and Zetzsche et al. (2020b) for the policy discussion on Libra.

Figure 1

THE ARCHITECTURE OF LIBRA 2.0: A GLOBAL LBR AND SINGLE-CURRENCY STABLECOINS

Libra 2.0 is to feature both single-currency stablecoins and a global stablecoin (LBR) that is a basket of the single-currency stablecoins. The architecture has three layers. The first layer is the value backing. In the second Libra Blockchain/wholesale layer, the various stablecoins are made available to retail payment providers through dealers/market makers. The third layer is that these payment service providers, in turn, make LBR and the single-currency stablecoins available to retail clients for use in payments.



SOURCES: Auer et al. (2020a), BIS (2020) and Google Trends.

The second tier is a DLT-based smart contract combining single-currency stablecoins into the global stablecoin, LBR.

In the Libra Reserve, custodian banks hold assets on behalf of the Libra Association backing the single-currency stablecoins. The asset backing would be composed as follows. Over 80% are to be invested in short-term securities (up to 3 months remaining maturity) issued by liquid sovereigns with low credit risk (i.e. A+ rating from S&P and A1 from Moody's, or higher). The remainder is to be held in cash, with overnight transfers into MMFs. The MMFs must invest in short-term liquid sovereign debt (up to 1 year remaining maturity) with low credit risk. The white paper notes that there will be no currency risk as the currency composition of assets will match the composition of outstanding single-currency stablecoins. The Libra reserve has provisions to address emergencies such as rapid outflows of funds during market turmoil. The Libra reserve can temporarily halt conversion or apply haircuts.

The second tier of Libra 2.0 is a DLT-based global stablecoin. Custodian banks use their digital signature to cryptographically sign their guarantee into the public Libra Blockchain. Once these value guarantees are signed into the Libra Blockchain, LBR is a smart contract combining several single-currency stablecoins into a basket of currencies. For every LBR that is created, the smart contract "locks in" the respective amount of single-currency stablecoins on the Libra Blockchain. The white paper mentions as an example a 50% weight for Libra$, 18% for Libra€, and 11% for Libra£ (the remaining 21% is not spelled out).[13]

All major policy decisions will require the consent of two-thirds of the Libra Association Council's representatives. Each of the association's members will have one council member, including Facebook, which will also have only one vote.

On the technological implementation of voting arrangements; the Association will not use permissionless DLT (i.e. abstain from using proof-of-work or proof-of-stake).[14] This contrasts with the first white paper, which aimed to begin with a permissioned system then gradually move to permissionless DLT within 5 years. Instead, a permissioned DLT system will be used, similar to most major financial sector blockchain/DLT initiatives. The consensus protocol will require a two-thirds majority in line with the Association's voting rule.

The white paper has a comprehensive discussion on how to comply with AML/CFT regulation and due diligence. The Libra Association owns a subsidiary called Libra Networks, which is directly responsible for operating the Libra payment system, minting and burning Libra stablecoins and administering the Reserve. Members of the Association will become Validators of the network, i.e. they will validate the transactions on the Libra blockchain. It also specifies four different types of payment service participants:

— Designated Dealers (market makers buying and selling Libra stablecoins from/to Libra Networks and which do not interface directly with users).

— Regulated Virtual Asset Service Providers ("VASPs") that are registered or licensed as VASPs in Financial Action Task Force (FATF) member jurisdictions.

— Certified VASPs (certified by the Libra Association but not regulated by a public authority).

13 The white paper mentions the possibility that the basket weights are controlled "by a group of regulators and central banks or an international organization [e.g., IMF] under the guidance of the Libra Association's main supervisory authority [e.g., FINMA]".

14 See Budish (2018) and Auer (2019a) for an assessment of the economic potential of permissionless DLT.

— "Unhosted wallets" – i.e. anonymous wallets which pose potentially high financial crime risks. (It is unclear if these wallets will meet regulatory requirements in practice).

VASPs and "unhosted wallet" providers would have the ability to offer consumer facing services, such as buying, selling, transferring and holding (in a wallet) Libra stablecoins. They will interface with Designated Dealers when required (e.g. to buy stablecoins against fiat currencies).

The white paper and a tweet by the Libra Association from 16 April 2020 state that the association has applied for a payment system license with the Swiss Financial Markets Authority (FINMA) for its subsidiary Libra Networks, confirmed by a press release from FINMA.[15] The news agency Reuters reports that the Libra Association will register with the U.S. Treasury's Financial Crimes Enforcement Network (FinCen).

3.2 Policy implications of Libra

The description of the key issues in Libra Association (2020) is much clearer than the original white paper [Libra Association (2019)]. The Association has made progress in addressing some of central concerns voiced in G7 Working Group on Stablecoins (2019) and FSB (2020). In particular, it has addressed many of the AML/CFT concerns (aside from those generally existing around "unhosted wallets") and clearly detailed the backing of the reserve.

However, some key issues remain. Generally, it has been widely noted that Libra has been scaled down, but this is not necessarily true. Paramount is that LBR is to be created as a new unit of account with an elastic net supply, with potential for use in payments across the globe. One may argue that LBR is factually no different from the Libra 1.0 proposal. LBR is backed by a basket of country-specific stablecoins, which in turn are backed by high-quality sovereign assets. Libra 1.0 would have been backed directly by a basket of high-quality sovereign assets. The establishment of the individual major currency stablecoins does however largely address most concerns in those jurisdictions regarding currency substitution risks [Bank of Canada (2020)].

LBR does still threaten currency substitution, i.e. clients may use LBR as an alternative to the sovereign currency in a given jurisdiction, particularly those outside of major currency areas with established Libra stablecoins. This is noted in the new white paper: "If adoption in a region without a single-currency stablecoin on the network generates concerns about currency substitution, then the Association could work with

15 See https://twitter.com/Libra_/status/1250786192502685696.

the relevant central bank and regulators to make a stablecoin available on the Libra network" [Libra Association (2020), p. 10].

That said, it is unclear how large demand for LBR will be, as many customers could prefer a single currency Libra (e.g. Libra$). At the same time, for cross-border transactions in particular, the availability of not only LBR but also the single currency stablecoins may provide an attractive alternative for many markets with currencies that are not widely accepted outside of their jurisdiction.

It is also unclear how the single-currency stablecoins differ from other forms of financial intermediary-created money such as fractional reserve banking and money market funds. The white paper states that "because of the 1:1 backing of each coin, this approach would not result in new net money creation". However, if banks engaged in the equivalent activity of the single-currency stablecoins, that would be seen as money creation: the Libra Association will have government bonds as assets and sight-deposit like liabilities or functionally like a money market fund. The launch of the single-currency stablecoins could hence have systemic implications, and lead to a substantial part of the money supply being taken out of the control of the central bank and the banking system. It could also remove a significant stock of safe assets from the banking system, a concern voiced by Kahn et al. (2020).

The governance of the Association is also not fully elaborated. Voting among the members is spelled out, and a list of criteria for applying for membership is provided. The list touches on ownership and respectability of the company, AML/CFT compliance, the technical ability to run a validator node and more subjective aspects such as company location and the geographic reach of users. Periodic reviews of membership are planned. Yet it remains to be seen in practice if these fair and transparent rules will be adequately applied to all members, and therefore will allow for proper governance of the arrangement.

Compared with the 2020 FSB consultation report on "global stablecoin" (GSC) arrangements, which spells out 10 recommendations aimed at authorities and GSC arrangements, an early analysis of Libra 2.0 proposals reveals some gaps. In particular, the compliance framework described is geared towards AML/CFT and sanctions but does not inform on other aspects of market integrity, market conduct and consumer and investor protection. More generally, no details are given on a comprehensive compliance framework for the overall GSC arrangement and its service providers, including how to ensure ongoing compliance. No details are given regarding compliance with international standards from the Committee on Payments and Market Infrastructures (CPMI) and International Organization of Securities Commissions (IOSCO). These would be relevant for activities pertaining to a Libra as a systemically important payment system or other form of financial market infrastructure (FMI) and also to the management of the reserve [IOSCO (2020) and FSB (2020)].

Regarding AML/CFT compliance with FATF rules, certified VASPs and unhosted wallet providers will not benefit from the same level of compliance achieved by Regulated VASPs, and only the latter will seek full FATF compliance. Risk mitigation measures regarding the management of the reserve appear incomplete at this stage. For instance, details on loss-absorbing capital buffers, restrictions from lending and other aspects are missing, alongside further details on the composition of assets comprising the reserve.[16]

While the Libra Association plans contingency measures in response to stress scenarios that could result in a run from Libra stablecoins, contingency and business continuity plans are not provided for the overall GSC arrangement, e.g. in case of failure of a significant number of validators, and/or VASPs or unhosted wallets. No comprehensive resolution framework, including continuity and recovery of identified critical functions and activities of the Libra GSC arrangement is provided. No details are given on any contractual obligations in place to ensure such mechanisms are effective, or on the involvement of relevant authorities. This is a major omission.

4 Principles for regulating stablecoins

In order to address the concerns which have arisen around stablecoins and to provide an appropriate framework for market evolution, authorities around the world are working to develop regulatory systems and structures. At the international level, discussions around crypto-asset and stablecoin approaches are taking place through the G20, G7, FSB, IOSCO, BCBS, FATF and others. A range of other authorities including those in Switzerland, Russia and the UK have either enacted related legislation or are in the process of development. From the standpoint of major jurisdictions, probably the most comprehensive approach so far was announced by the EU in September 2020 [EC (2020)].

As a starting point, it is important to differentiate between stablecoins in general – which raise many regulatory issues but so far are not systemically important – and what the FSB has called "global stablecoins" or the EU calls "significant stablecoins" – where the bar for compliance on a range of policy issues will be much higher. In particular, the latter pose higher risks to financial stability, monetary policy transmission and monetary sovereignty that would not be present for more limited-purpose coins. They may be considered "systemically important payment systems" or other forms of FMI. This section will consider principles for regulating both in turn.

In regulating any stablecoin, the starting point should be an appropriate registration or licensing regime, which allows for adequate information and monitoring, combined with prudential requirements in appropriate cases. It is essential to build systems to

16 Coelho et al. (2019) discuss how technology might help to bring down the cost of AML/CFT.

collect data on such instruments. Thus, a registration requirement is likely to be useful in the jurisdiction of establishment. Because of the inherent cross-border potential, authorities will need to combine this with information sharing arrangements between each other. Without data and monitoring, potential financial stability risks may develop unobserved. In particular, there is the potential that a limited-purpose stablecoin may quickly evolve into a global stablecoin, thus fomenting much higher financial stability risks. This highlights the value of proportional graduated approaches, with differential treatment based on factors relating to the underlying structure or scale. For example, the proposed EU approach will provide different requirements for utility tokens (non-stablecoins), financial instruments (under the existing financial regulatory framework), e-money stablecoins (single currency, on-demand payment at par), asset-backed stablecoins, and significant stablecoins. The latter, which pass certain thresholds, have much higher regulatory requirements.

In addition to financial stability risks, stablecoins clearly raise a number of other regulatory and supervisory concerns, in particular in relation to market integrity and consumer/investor protection.[17] Much attention has been already directed by international regulatory organisations – in particular the G20 and FATF – towards AML/CFT issues and approaches to crypto-assets and these apply fully to stablecoins. Likewise, international regulators – in particular IOSCO – are considering issues relating to market manipulation, fraud, abusive practices toward consumers, etc. [IOSCO (2020)]. These traditional market regulatory concerns arise in the stablecoin context as in the crypto-asset area more broadly. Yet stablecoin arrangements bring with them additional investor protection concerns given the link between the digital asset and fiat currency or other assets. In particular, stablecoin issuers may face a strong incentive to invest in risky assets, or to lend out assets backing the stablecoin, to achieve higher returns [see Frost et al. (2020)]. Indeed, in the absence of regulation, stablecoin issuers can earn a profit by investing in higher-return or illiquid assets, or by lending funds or assets, while paying low or no interest to stablecoin holders. These incentives make asset segregation and collateral considerations key, in addition to market surveillance and disclosure frameworks.[18]

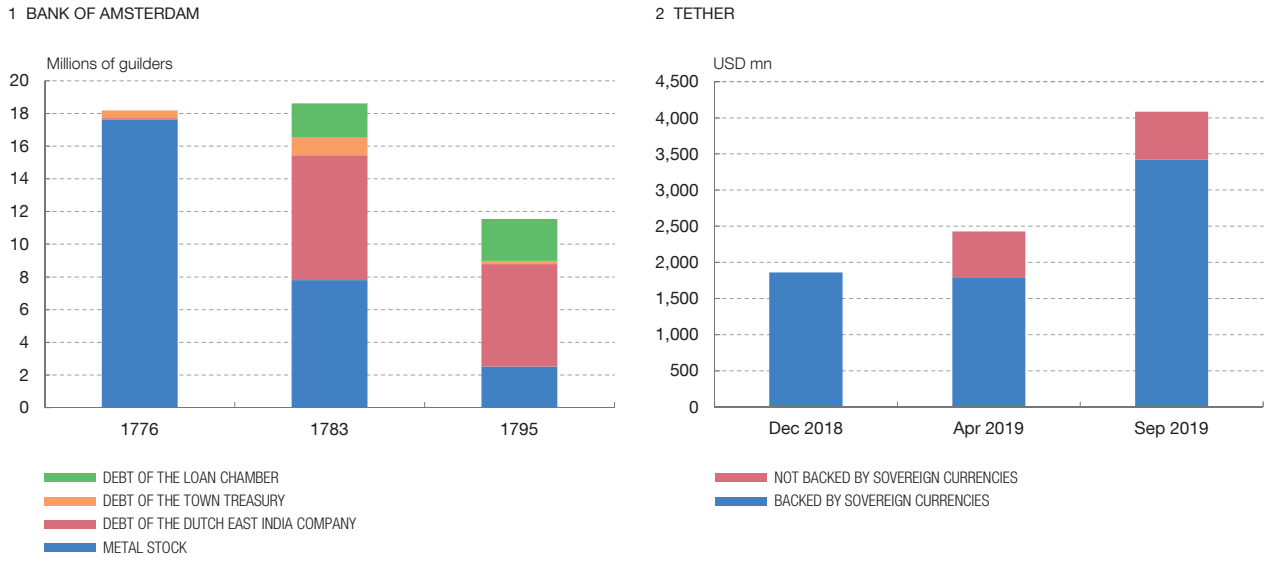
These arguments have historical and current examples. Throughout history, whenever new issuers have been successful in circulating a currency, they soon find themselves tempted to engage in profitable activities such as borrowing and lending. During the Mexican Revolution, for example, several different generals issued currencies or forced banks to make loans to pay soldiers' salaries, leading to high inflation and a debasement of the private bank currencies in circulation [Bátiz Vázquez (2009)]. As a more recent example, the issuer of Tether had until recently claimed that every Tether

17 Auer and Claessens (2018) build a database of regulatory news pertain to cryptocurrencies and examine how such events effect valuations and usage.

18 An additional facet is fraud. If a global stablecoin is able to enhance inclusion, it customers – who are less accustomed to managing their financial lives (especially online) – may be more vulnerable to phishing attacks and account takeovers in general.

Chart 4

TETHER: "DÉJÀ VU ALL OVER AGAIN"?



SOURCES: Van Dillen (1934), Frost et al. (2020), CoinMarketCap and author's calculations.

was 100% backed by fiat currency. Since 2019, it has been accused by the New York Attorney General of lending at least $700 million to Bitfinex, an affiliated crypto-asset trading platform [see NYAG (2019)]. The shift from full backing by safe assets to a mix of safe assets and credit is in some ways reminiscent of the Bank of Amsterdam in the late 18th century, which lent extensively to the Dutch East India company, the Town Treasury and Town Loan Chamber prior to its downfall. A key difference is that in Tether's case, the balances have actually continued to grow after the extent of lending to affiliated entities has come to light (see Chart 5).[19]

Regardless of their size, the digital and borderless nature of stablecoins will raise cross-border coordination issues. As such, as a first principle for policy, it will be essential to develop appropriate regulatory and supervisory tools in advance. This is particularly true from the standpoint of global stablecoins; tools should be activated when a global stablecoin or global stablecoin arrangement is identified. The tools could come from a variety of experiences. One example is the supervisory college approach which is now applied to large cross-border banks. Another comes from the experience with FMIs: these are in some cases supervised via supervisory colleges, in others established under specific legal and regulatory systems as part of a cooperative design approach between private and public participants (such as SWIFT, CLS and

19 Griffin and Shams (2020) find, based on blockchain data, that purchases with Tether are timed following market downturns and result in sizable increases in Bitcoin prices. They argue that these results are "consistent with Tether being printed unbacked and pushed out onto the market" (p.1918).

Euroclear). In some cases, this could involve regulation as a utility or operation by the central bank or otherwise itself [Zetzsche et al. (2021)]. Reflecting this approach, to the EU has proposed not only a framework addressing the full scope of digital assets, but also a separate framework for the licensing, regulation and supervision of DLT FMIs.

Second, more informal means of cooperation will be needed. Memorandums of understanding (MoUs) and multilateral memorandums of understanding (MMoUs) could be helpful from a cross-border standpoint. The challenge in many cases will be the necessity to bring such instruments into the formal regulatory and supervisory perimeter of relevant authorities.

Third, beyond information sharing and enforcement, international standards may be particularly useful from the standpoint of approaches to embedded supervision – setting standards for the systems and approaches which could be required as part of the registration/licensing process for stablecoins. We return to this in the following section.

Fourth, for global stablecoins, specific regulatory treatment is necessary. Like most forms of systemically important FMI or financial institution – both domestic and global – systemic importance can be difficult to define precisely.[20] The elements however are some combination of size, scale and interconnectedness: economies of scope and scale combined with network effects all potentially suggest systemic importance in the context of the financial system. This is reflected in the EU proposals, in the context of both "significant stablecoins" as well as DLT FMIs.

In seeking an approach to global stablecoins, a key challenge is identification of GSCs. This is problematic because the entry of non-traditional participants in finance – particularly large technology companies (big techs) – means that existing size, scale etc. can all be leveraged very rapidly to achieve a dominant position in specific market segments or financial infrastructures [BIS (2019) and Petralia et al. (2019)]. From a financial stability standpoint, in addition to traditional risks of "too big to fail" and "too connected to fail", the private sector nature of stablecoins raises risks to monetary policy transmission and may threaten the effectiveness of the central bank's lender of last resort function. For all technological systems – private or otherwise – operational and cyber incidents are relevant, but these become even more pressing for a stablecoin that may be very widely adopted. Because of the scale, other issues also rise to the financial stability level, including market integrity (the risk of a global stablecoin being widely used for criminal activities), consumer protection (the risk that a collapse destroys many individuals' financial resources) and risks of anti-competitive behaviour and restrictions on innovation (due to market dominance). Such identification could build on frameworks for global systemically important financial institutions (G-SIFIs), or could be done in the context of a specific proposal – as in the context of Libra, or as has been done with CLS. Proposals could be

20 For a discussion of indicators on systemic importance in the context of banking, see BCBS (2013).

both purely private or some sort of public-private process, as has been historically more common in the evolution of major payments infrastructure domestically, regionally and internationally.

The content of the regulatory approach would involve a variety of specific instruments. These could be activity-based, entity-based or infrastructure-based depending on the nature of the specific GSC. Activity-based approaches would vary depending on the nature of the products and services offered. These could relate to payments, securities, etc. Cooperation and coordination on licensing, market access, supervision, resolution, etc. would all be required.

The key point is that the Libra experience should be used as an opportunity to develop systems at the global level to identify GSCs, to put in place appropriate supervisory arrangements and to monitor their activities and impact. This is exactly the approach that is being pursued in the context of the development of a set of 10 principles from the FSB to address GSCs [FSB (2020)] as well as the new EU proposals. The FSB principles highlight:

— the need of the supervisory authority to have appropriate powers, tools and resources;

— that regulatory requirements should be applied on a functional and proportional basis;

— that there is comprehensive regulation, supervision and oversight on a cross-border basis and that these are met by a GSC arrangement before commencing operations;

— that GSC arrangements have in place a comprehensive governance, risk management and fit and proper framework, robust data systems, appropriate resolution and recovery plans; and

— that GSC arrangements provide sufficient data and legal clarity for users, particularly around redemption and insolvency.

In looking at approaches, to the extent that one is creating an automated financial product, it may well make sense to explore automated or embedded supervisory approaches (see next section).

Last, the repercussions of stablecoins on the disintermediation of the traditional banking sector should also be taken into account. If consumers switch from sight deposits and payment accounts towards stablecoins, traditional bank lending could become costlier [see Kahn (2016)]. A closely related implication is that certain central banks could receive substantial inflows onto their balance sheets if stablecoins are

to be restricted to keep reserves at the central bank (as is often the case under e-money regulations). This may also affect the transmission of monetary policy.

5 From regulation to supervision: the promise of "embedded supervision"

Regulation and supervision are evolving with technology. In some cases, in addition to the use of technology for regulatory compliance, monitoring and implementation (regtech and suptech), regulatory and supervisory requirements are being built into technological systems. Some jurisdictions are already implementing or planning automated reporting [see EC (2020)]. In recent work, Auer (2019b) puts forward the concept of "embedded supervision". Embedded supervision is a framework that provides for compliance to be automatically monitored by reading the ledger of a DLT-based market (see Chart 6). The ledger of a DLT-based market contains much information relevant for supervisory purposes. As such, it can be used to improve the quality of data available to the supervisor, while reducing the need for firms to actively collect, verify and report data to authorities. Through their use of DLT, stablecoins could allow this approach in practice.

Allowing for *embedded supervision* could be of substantial importance for the development of so-called asset "tokenisation" – the process by which claims on or ownership in real and financial assets are digitally represented by tokens, allowing for new forms of trading and improved settlements [Bech et al. (2020)]. In particular, one key early use case of embedded supervision may be in the monitoring of the full asset backing of a blockchain-based stablecoin. Currently, USDC and Paxos publish monthly public auditor reports of the smart contract and of the reserve on their websites; to reduce fraud risk this process could be fully automated and even real-time.[21] To exemplify both the merits and limits of embedded supervision applied to stablecoins, consider the revised Libra proposal.[22] Libra 2.0 highlights that when it comes to applying embedded supervision, one needs to carefully distinguish the use of DLT from other traditional elements that involve technology, but still rely on the value underpinning provided by supervised institutions and the legal system. Auer (2019b) discusses principles that should govern a framework designed to make use of a market's distributed ledger for financial supervision.

A first of these principles goes back to how the value underpinning of the single-currency stablecoins is guaranteed in Libra 2.0: it is the banks' digital signatures in the ledger that underpin the value of these coins. Obviously, there is nothing other than the judicial system that obliges banks to honour these guarantees. The first principle of embedded supervision is that the process of tokenisation must be supported by the

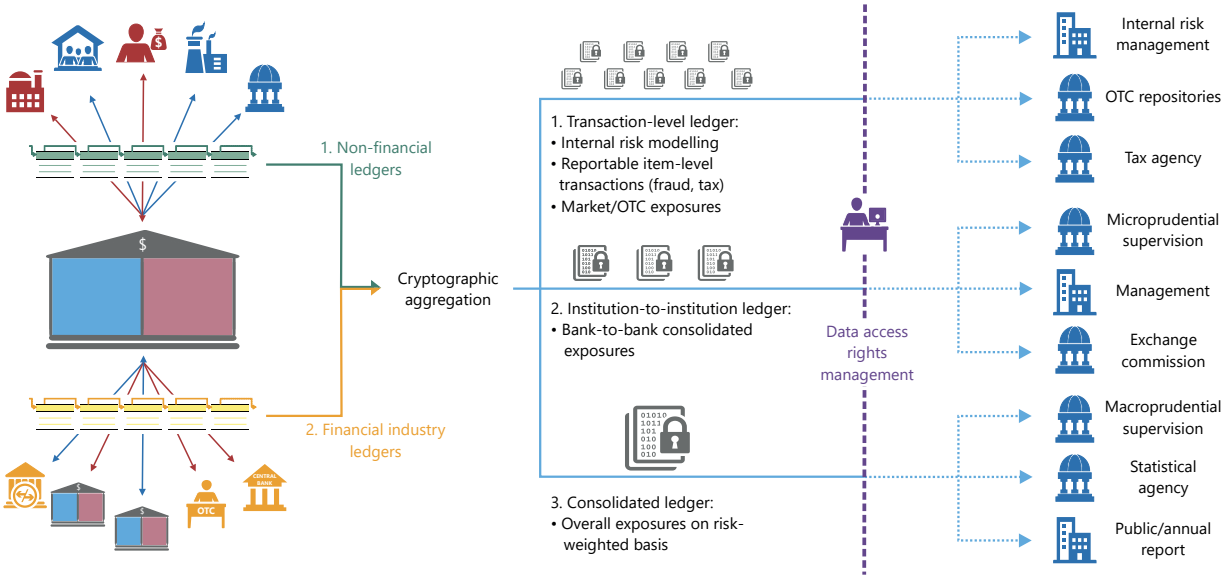
21 There are many concerns with Libra that go beyond the discussion of the value backing discussed, see the above discussion in Section 4.

22 Other examples include MakerDao's DAI, as well as other "on-chain" stablecoins in the terminology of Bullmann et al. (2019).

Figure 2

COMPLIANCE MONITORING PROCESS USING EMBEDDED SUPERVISION

Embedded supervision can verify compliance with regulations by reading the distributed ledgers in both wholesale (symbolised by the green blockchain) and retail banking markets (symbolised by the yellow blockchain). Supervisors could access all transaction-level data. Alternatively, the use of smart contracts, Merkle trees, homomorphic encryption and other cryptographic tools might give supervisors verifiable access just to selected parts of such micro data, or relevant consolidated positions such as to institution-to-institution or sectoral exposures. Firms would only need to define the relevant access rights, obviating the need for them to collect, compile and report data.



SOURCE: Auer (2019b).

legal system. The connection between the claim on or ownership in the underlying asset and the record of the digital token must ultimately be established by the legal system and relevant contractual arrangements. This is true for stablecoins, but also for assets such as real estate or shares in a bricks-and-mortar business. Importantly, this means that just as in a traditional financial system, a decentralised financial system needs to be backed up by an effective legal and judicial system and supporting enforcing institutions for contractual arrangements [see Zetzsche et al. (2020a)].

A second principle relates to exchange in DLT-based markets: transactions and transfer of ownership must be irrevocable and final – otherwise balance sheet items are not definitive [see CPMI-IOSCO (2012) and CPMI (2017)]. Even with "permissioned" DLT, there may be no central entity capable of vouching for finality with a legally binding signature. The risks of one party failing to settle transactions remain [Bech et al. (2020)]. As such, another criterion for transaction finality must be established, with payment finality being a particular concern.

A third principle is to consider how the market will react to being automatically supervised. Embedded supervision focuses on the concept of economic finality

proposed in Auer (2019a), i.e. economic finality is the notion that a transaction is final once it is no longer profitable to reverse it.[23] When it comes to applying this consideration to the case of Libra 2.0, the white paper does not spell out how transaction finality will be achieved. It does spell out a standard process to achieve consensus on transactions via a 2/3 supermajority among the association members. What is however missing is a set of rules that would spell out what were to happen if indeed 2/3 of the members of the association were to coordinate to fraudulently undo transactions via so-called history reversion attack. Further information is thus needed to establish economic finality, and to ensure that attempts to deceive the supervisor will be unprofitable.[24] It is of course important to remember that technological finality or even contractual finality is not the same as legal payment finality [see Zetzsche et al. (2018)], which will generally require settlement across the books of the central bank or via an appropriately authorised payment system.

The last principle concerns the broader societal goals when designing embedded supervision. Despite substantial technological advances of recent decades, financial services have for a long time remained expensive [Philippon (2015) and Bazot (2018)]. This might partly reflect high barriers to entry in financial services, some of which are created by the administrative burden of complying with financial regulation. As a side effect of their focus on detailed regulation and supervision to tackle the risks of large and complex financial intermediaries, supervisors may have inadvertently further favoured concentration – by creating compliance costs that weigh disproportionately on smaller intermediaries (see Chart 7).[25] While these are certainly not the only barriers to entry in financial markets, measures to reduce such costs may enhance competition and contestability.

One goal of embedded supervision should hence be to achieve high-quality compliance at lower cost, thus levelling the playing field for large and small institutions.[26] In the context of Libra 2.0, one operational aspect is for supervisors to take an active role in the design of the market, in particular regarding standardisation of the database structure – for example, to ensure interoperability of the Libra blockchain with other blockchains. A second goal might be to develop a freely available open-source suite of monitoring tools with the aim of clarifying how specific regulatory frameworks are applied in practice. A third goal is to ensure the legal finality of payments, as is the case for today's payment systems.

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23 Auer (2019a) examines economic finality for the proof-of-work-based consensus schemes used in Bitcoin.

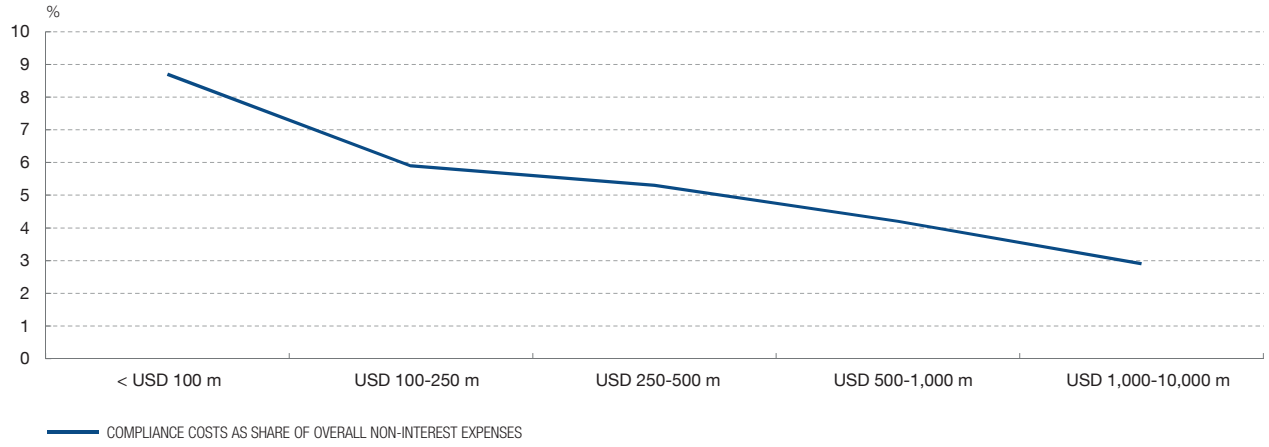
24 Auer (2019b) extends the theoretical considerations regarding transaction finality to the impact of the supervisors' actions on the regulated market. Regulated firms incur a cost in complying with regulation that they would not incur voluntarily. By the same token, in the DLT world, this creates incentives for a regulated firm to cheat the supervisor by altering the transaction history in the blockchain. He thus also models the supervisor's impact on the market.

25 In particular, following the Great Financial Crisis, politicians, legislators and supervisors have focused on increasing the resilience of the financial system and, in particular, of the large banks that account for the bulk of total positions and thus aggregate risk, an effort that is still ongoing [see e.g. Carstens (2018)].

26 See Broeders and Prenio (2018) for a general assessment of suptech in bringing down the cost of compliance.

Chart 5

SMALLER FINANCIAL INSTITUTIONS ARE DISPROPORTIONATELY AFFECTED BY COMPLIANCE COSTS



SOURCES: Auer (2019b) and Dahl et al. (2016).
NOTE: Estimate for US deposit-taking institutions.

Efficient guidance of market standards to ensure contestability may also require an adequate definition of what it means to truly "decentralise" decision-making, risk-taking and system governance [see Buterin (2017) and FSB (2019) for a discussion, and Walch (2019) for a critical review].[27] Regulators and supervisors can steer some design elements of new decentralised markets, as they will set the market standards under which regulatory compliance can be automated [see also Zetzsche et al. 2020a)].

A further operational goal is to reduce the marginal cost of doing business by facilitating access to trustworthy official information. One measure that could be easily implemented would be for public authorities to directly offer digitally signed and time-stamped information that could be fed into relevant market ledgers – or to set standards so that private intermediaries could do so. In many cases, financial contracts may reference data originating from the official sector, such as the central bank's policy rate or data releases from the national statistical office. Moreover, in many jurisdictions, firm and land registries are operated by the government. Low-cost tokenisation of the underlying firms and real estate would be facilitated if these registries were to make their information accessible in a digitally signed, time-stamped and publicly available form.

A last operational aspect concerns the handling of disputes. Regulatory frameworks or standards could guide arbitration processes if any information referenced in smart

27 Even with the most decentralised systems, many aspects of centralisation remain, for example when it comes to the evolution of the code (core developers, etc.). Further to this, as shown by the concentration of the mining power of all of the world's major cryptocurrencies in the hands of only a few companies or mining pools, even systems that are intended to be decentralised have a tendency to centralise, owing to unforeseen returns to scale. Regulators and supervisors could counter this, for example, by setting standards that guide or encourage entry into the verification market or by mandating open data requirements.

contracts turns out to be fraudulent. This could happen where the smart contract has a security flaw (as is frequently the case) [see Luu et al. (2016) and Fröwis and Böhme (2017)] or in other unforeseen events, such as if a smart contract depends on an interest rate benchmark that ceases to exist. Ultimately, though, the world is sometimes too complex to be put into code. Moreover, cases concerning individuals may generate personal information that needs to be handled with confidentiality, and such that users have recourse if data are used improperly. Thus, the more intractable cases may always need to be handled via an old-fashioned legal process [see Zetzsche et al. (2018)]. In this light, the added value of decentralised automation should be seen as simplifying the standard execution of a contract.

One possible function of stablecoins – a desired function from the standpoint of users – is to provide a digital means of payment which can be embedded in both DLT and traditional centralised environments in order to reduce payment and settlement risks and transaction costs, in particular enhancing user trust in systems and payments. One could think of this as "embedding" payments within transactions and their settlement. From this standpoint, stablecoins offer a potentially desirable innovation but also one which could create a range of new risks and concerns.

However, this discussion highlights that a better solution could in fact be using technology to embed fiat currencies in the same way, for instance in the context of central bank digital currencies (CBDCs). Central banks around the world are researching and developing CBDCs [Boar et al. (2020) and Auer et al. (2020b)]. Both wholesale and retail CBDCs provide a combination of private sector expertise and central bank value backing and infrastructure. By design, CBDCs would have a fixed value against other representations of the central bank's currency. Indeed, in most designs, a CBDC would be a direct claim on the central bank in question [Auer et al. (2020b)]. While private sector intermediaries still may offer client-facing services, the inherent conflicts of interest, by which intermediaries seek to achieve higher returns with the funds entrusted to them, would be eliminated. Even "synthetic" CBDC arrangements in which a stablecoin is not a claim on the central bank, but in which the issuer has direct access to central bank liquidity, similar to many RTGS systems, could offer some of these benefits.

Some of the benefits also could be achieved through less far-reaching reforms to existing payment systems. For instance, retail fast payment systems (FPS) may allow for the 24/7 availability and speed that consumers and businesses are demanding. It may also be possible to programme payments in such a way as to support atomic settlement (immediate "delivery-vs-payment"), to allow for very small values (micro-payments) or to be interoperable with DLT systems. Together with advances in digital ID, such systems could also work to enhance financial inclusion and universal access [Arner et al. (2018)]. Indeed, the recent experience with the India Stack [D'Silva et al. (2019)] shows that great strides can be achieved through public payment and other infrastructures that do not rely on DLT, stablecoins or CBDCs. Unlike CBDCs, FPS

build on existing accounts at intermediaries. Such accounts are not backed by the sovereign, but they also do not lead to concerns around "digital runs" or disintermediation. It is possible for such advances to be complementary to efforts to issue a CBDC as a robust public digital means of payment.

From the standpoint of payment finality, this typically is defined to occur when a transfer takes place in the books of the central bank. Finality can also take place if the relevant legal framework provides for it to take place in the context of a regulated payment system. As such, while a stablecoin or FPS may not offer finality in the same way as a CBDC (as CBDC payments would settle across the books of the central bank, both in token-based or account-based systems), the legal and regulatory framework for the licensing and supervision of payments systems must provide for requirements for systems to provide for such finality. This would provide a clear opportunity for mandating embedded supervision into such systems.[28]

Overall, it is not clear that stablecoins are necessarily needed to provide some of the benefits that they purport to serve. While a digital representation of value could hold great potential in many applications, CBDCs may offer these benefits without the inherent fluctuation in value or conflicts of interest entailed by stablecoins. Improvements to existing payment infrastructures, or new infrastructures that do not rely on DLT, may also be able to fulfil many of the use cases for stablecoins. FPS may serve some of the same goals, or serve as a useful complement. Thus, in the same way that stablecoins from previous centuries [Frost et al. (2020)] were an evolutionary step on the road to central banking, today's stablecoins could too eventually give way to other reforms. This may include robust sovereign-backed alternatives and new means to connect central bank money across borders [Auer et al. (2020d)].

6 Conclusion

Finance and technology continue to evolve together. Today, technology is not only transforming finance, but money as well, with the advent of a range of challengers to traditional sovereign currencies, from Bitcoin to Libra. Of these, the evolution of new technology-based "stablecoins" offers important potential to embed a digital monetary instrument in distributed systems and transaction frameworks. Yet as with all technologies for payments and all structures involving asset backing, there is a need for adequate regulation. Moreover, while most stablecoins offer limited financial and monetary stability risk, the advent of global stablecoins raises much larger issues and concerns. Going forward, it is essential for authorities have the tools, skills and technology to identify the evolution or creation of stablecoins, in

28 International spillovers have to be take into account in the context of CBDC design. Ferrari et al. (2020) show that CBDC issuance amplifies international spillovers of macroeconomic shocks. However, the magnitude of these effects depends on CBDC design features; for example they can be mitigated by limits on transactions by non-residents.

particular global stablecoins, and to build appropriate regulatory and supervisory frameworks.

Technology also offers the potential not only to enhance supervision but in fact to provide new tools for implementing regulation. Stablecoins and other forms of decentralised finance not only provide regulatory and supervisory challenges but also opportunities for embedding supervisory and monitoring frameworks directly into systems during the process of their creation and authorisation. This has the potential to enhance achievement of regulatory and supervisory objectives through the technology which initially was targeted with making the role of regulation unnecessary. Still, there are open questions as to whether central bank infrastructures, like CBDCs or retail fast payment systems, with a role for private sector services built on top, could provide many of these same opportunities more effectively.

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Digitalization, retail payments and Central Bank Digital Currency

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Abstract

Facing the challenges and leveraging the opportunities from digitalization may require changes to the traditional business model of central banks. This paper focuses on retail payments, where changes are being rapid and highly demanded by customers worldwide. Considering competition and financial stability arguments, it provides a rationale for central banks to have a deeper involvement in retail payment systems by building and keeping control of core components of these systems. Central Bank Digital Currency and Fast Payment Systems are assessed as alternative tools serving central banks to foster efficiency, resilience and security in retail payments, as well as to preserve financial stability.

1 Introduction

Digitalization of everyday activities is happening rapidly. In the case of payments, we assist to an era where improvement via digitalization is also highly demanded by customers at a worldwide scale. Nowadays, most consumers expect payments to be fully digital, (near) instant and mobile-first, whether online or at the point of sale, and providing a seamless user experience [BIS (2020)]. New technological advances make it feasible for private sector parties to develop payment systems that add value to final users and bypass settlement by central banks. In some jurisdictions cash circulation is falling rapidly, in others private-owned payment infrastructures are concentrating most operations, and stablecoins are emerging with the potential to enhance efficiency in the provision of financial services, although they are also raising concerns regarding integrity and financial stability.

Digital innovation is radically changing payment services. If adopted in a significant scale, some of the developments may challenge the ability of central banks to effectively fulfill their mandates towards price and financial stability. Others, or even the very same technological developments that are challenging central banks, would entail opportunities to profit from efficiency gains in payments services and set the basis for innovation from the financial system to spills over to the general public. Facing challenges and leveraging opportunities may require strategic decisions, confront new risks, change the traditional central banking business model, and maybe revise central banks' objectives in the digital era. Since one size may not fit all needs, it is prudent to carefully study the motives that justify central banks' action, possible strategies and their potential implications in order to inform policymakers.

The contribution of this paper is twofold. First, it aims to contribute to the ongoing discussion by presenting a conceptual perspective on the challenges and opportunities that central banks are facing in the new digital era. Second, to discuss how Central Bank Digital Currency (CBDC) and alternatively Fast Payment Systems (FPS) may serve central banks to continue playing a pivotal role in maintaining the safety and integrity of the payment system, fostering competition among payment services providers (PSP), and providing a basis for sound innovation in the financial system. Recently, CBDC and FPS have been topical issues; the strands of literature to which this paper contributes have been growing as rapidly as digitalization. See, for instance, Kiff et al. (2020) for a survey of research on retail CBDC and Bech et al. (2020) for a recent description of advances regarding FPS.

The focus of this paper is on retail, as opposed to wholesale, payment systems. A payment system is a set of instruments, procedures and rules for the transfer of funds among participants. Retail payments typically relate to the purchase of goods and services by consumers and businesses. Each of these payments tends to be for relatively low amounts, but volumes are large. In contrast, wholesale payments are typically large-value payments between financial institutions. Given their systemic importance, wholesale payment systems are generally owned and operated by central banks; differently from retail payment systems that are traditionally in the hands of the private sector.[1]

I would argue that digitalization may provide a rationale for central banks to have a deeper involvement in retail payment systems. In the digital era, the importance of network effects and relatively large investments in payments may imply market failures, so that market equilibrium may show extreme outcomes with either underdevelopment or severe threats to financial stability. Since payment systems are built on trust, a common good that is hard to construct and easy to lose, central banks may play and important role in balancing efficiency gains in normal times against potential loss of confidence in stress times. While this applies either to wholesale and retail payment systems, digitalization makes market failures more important for the retail segment, justifying a deeper involvement by central banks. To fulfill this task, central banks need appropriate tools, which reasonably must be digital. One of these tools may be building and keeping control of core components of either a CBDC or a FPS with a tiered architecture where private-sector PSP compete for customers by innovating and offering new products and overlay services.[2]

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1 Generally, cash is provided by central banks acting as a monopolist, but its distribution and the operation of retail payment systems are done by the private sector. In some cases where the use of cash diminished dramatically, the concentration of power by the private sector may justify central bank intervention as we will argue through the text.

2 The platform model proposed in a recent discussion paper by the Bank of England (2020), as well as the e-Peso pilot in Uruguay and the Sand Dollar pilot in The Bahamas (that are revised in Section 4), have this feature in common.

The term CBCD is not well-defined yet, and it is commonly used to refer to several related concepts. By focusing on its key features, a CBDC could be best defined as a (new) form, i.e. digital, of central bank money: it is a liability of the central bank that serves as a unit of account, medium of exchange and store of value. Through the years, coins and banknotes, the most usual forms of physical cash, have provided support for these three functions of money, representing central bank currency that is accessible to the general public. Central banks have also experienced with some forms of electronic money and digital payment systems, in particular for wholesale transactions, where commercial banks generally make reserve deposits at central banks. In the digital era, one may think that a direct step would be that central banks offer retail CBDC that may be used by the general public as a complement, or even a substitute, for physical cash. As far as the central bank is truthful, the CBDC system is robust and attractive, and a large population holds and uses it, then the CBDC may serve the core functions of money. Hence, a retail CBDC would constitute a third form of central bank money, along with cash (physical) and reserves (digital, but whose access is limited to commercial banks).

Indeed, the list of central banks declaring interest in researching CBDC, launching pilots and proofs of concept, and even concluding experimentation has nothing but increased in the last years. In practice, however, the adoption of CBDC is, at least, in slow motion. Possible explanations for this low speed adoption of CBDC may stem from the requirements and the consequences of digitizing central bank money. Differently from physical cash, exchanging digital money between two parties necessarily requires third-party involvement in the form of an infrastructure, system or mechanism supporting the transfers. Hence, the discussion about CBDC is necessarily linked to an assessment about the payment infrastructure underlying it; so that issuing digital money does not follow directly from the fact that central banks issue physical cash [Kahn et al. (2019)].

On top of technological uncertainty, cybersecurity, security of information and other related risks that are inherent to any digital payment infrastructure, the case of a CBDC raises other important concerns that central banks should consider. For instance, exchange of information would be substantial in a CBDC system. While this information may be socially useful to enhance security in payments, users may have a legitimate concern about privacy, in particular anonymity, and even about the possibility that the information could be used with other purposes than the transaction in which it was generated.[3] In addition to that, a retail CBDC would require a close relationship of the central bank with final users; but traditionally central banks have followed a business model far away from the general public. Anonymity concerns and lack of comparative advantages of central banks to satisfy final users' needs

3 Cybersecurity, security of information and the fact that public authorities may have access to large volumes of agents' information are characteristics mostly related to digitalization. Hence, they will be present in CBDC and in alternative digital retail payment systems.

may endanger users' experience and thus a broad adoption of the CBDC by the general public, which is needed for the success of a retail payment system given the network effects in payment infrastructures.

If the introduction of a CBDC is successful, then the concerns refer to the possible negative impact that a rapid adoption of CBDC may cause on financial intermediation via massive withdrawals of commercial bank deposits, its effects on the structure of the banking industry and the stability of the financial system. Related to this, other concerns refer to the possibility that a CBDC would facilitate bank runs, and thus challenge the capacity of the central bank to act as lender of last resort. Finally, the impact of a CBDC on the conduct of monetary policy is also a matter of concern.

Interestingly, most of the trade-offs could be balanced and the associated risks mitigated by properly designing the CBDC system. Indeed, great part of today's discussion among central banks assessing CBDC is related to design and implementation issues. Moreover, since there is not one-size-fit-all solution, different designs may better adapt to the specificities of each jurisdiction and policy objectives. It could also be the case that alternative arrangements, like the fast retail payment systems that recently have been adopted in more than 50 jurisdictions or the proposed "synthetic" forms of CBDC [see Adrian and Mancini-Griffoli (2019)], better fulfill the objectives of providing a fast, efficient, innovative, competitive, resilient and stable payment system. More research and evaluation of alternatives is necessary in order to inform these decisions. This paper aims to contribute in this line.

The rest of the paper is organized as follows. Section 2 reviews the potential impact that digitalization may have in the business model of central banks, provides a rationale for a deeper involvement of them in the financial infrastructures for retail payments, and argues that the participation of the private sector is essential in no-core components of the payment infrastructure. Section 3 revises CBDC basic arrangements, i.e. account- and token-based, and discusses how different concerns may be mitigated by an appropriate design of the CBDC system. This section also explains how FPS and "synthetic" CBDC may constitute alternatives to CBDC. In Section 4 two recent CBDC pilots are revised: the Uruguayan e-Peso and the Sand Dollar in The Bahamas; as well as the experience with the TARGET Instant Payment Settlement (TIPS), a fast payment system in Europe. Section 5 offers some final remarks.

2 Digitalization and central banking

Digitalization is driving the world in a direction where the incorporation of digital technologies to everyday activities is rapid, at a worldwide scale, and highly demanded by customers who nowadays attach more value to immediacy and users' experience. Some of these developments may challenge the ability of central banks

to effectively fulfill their mandates towards price and financial stability, as well as to provide safe and efficient payment systems. Others, however, will represent opportunities to profit from efficiency gains and set the basis for innovation in financial services that spills over to the general public. Facing challenges and leveraging opportunities may require strategic decisions, address new risks and change the traditional objectives and business model of central banking.

Doing things the same way as before in this new digital era may be riskier for central banks than taking a proactive approach. Past experiences from other industries may help to illustrate this point. Think for instance that the use of physical letters and postcards has been substituted by emails and digital photos, with the estimated number of letter-like items sent worldwide in one year roughly equal to the number of emails sent in a single day. Paradoxically, Kodak invented the digital photo camera and went bankrupt. The company misunderstood customers' needs and their demand for better experiences taking pictures to the point that maintained its business model based on paper pictures for too long. There has been a high development and penetration of information and communication technologies. For example, companies that today are categorized as BigTechs (e.g. Google, Facebook and Amazon) did not exist 30 years ago. Today, digitalization is being prominent in the financial system. In payments, it is going even further, with a high demand for speed, better users' experiences and mobility. And looking ahead, the so-called "stablecoins" (i.e. cryptocurrencies designed to minimize the volatility of its price relative to some "stable" asset), like other crypto-assets, have the potential to enhance efficiency in the provision of financial services, but they may also generate risks to financial stability [FSB (2020)]. These developments imply challenges to the traditional business model of central banking.

In this digital era, the sole play of market forces may determine extreme-outcome equilibria in the payment system with either underdevelopment or severe threats to financial stability. On the one hand, network effects in the payment system may imply coordination problems among market participants, leading to fragmented and non-competitive payment infrastructures. On the other hand, in a retail payment system that is fully controlled by private banks, a banking problem could translate in loss of confidence in the payment system, challenging its robustness and resilience. Hence, these market failures provide a rationale for central banks' intervention in order to balance efficiency gains in normal times against potential technological vulnerabilities and loss of confidence in times o stress. Since payment systems are built on trust, a common good which is hard to construct and easy to lose, central banks have a rationale to protect efficiency and security in the payment system by acting as operators, regulators and catalysts. Hence, central banks need to be part of the new digital paradigm. They should be prepared to fulfill their mandates and ready to exploit new technologies in favor of the common good. Moreover, central banks need to be proactive in order not to arrive too late to the new digital revolution that is taking place at a global scale, to be able to continue fulfilling their mandates

on behalf of society, and to contribute to a healthy development of the financial system.

An active role of central banks towards financial digitalization would be of particular importance in jurisdictions where the private sector does not take a leading role on technological innovation. In these cases, the payment system will remain underdeveloped without the intervention of the central bank to foster competition and efficiency, as well as to facilitate financial inclusion. The central bank would also pursue an objective of increasing safety in retail payments by countering risky digital currencies that are not backed by a trusted government, as well as other private initiatives with the potential to affect the security of the payment system. These objectives could be achieved through Central Bank Digital Currency (CBDC) or alternatively with fast payment systems (FPS) that are made available for the general public. Since there is no one-size-fits-all solution, it is key for policymakers to understand the features of each arrangement and the specificities of their design. These issues are discussed in Section 3. In the rest of this section, I will dig deeper on the reasons justifying the argument that central banks should seriously consider to build and keep control of core components of retail payment infrastructures.

To start with, although commercial banks would already have in place the technology to provide a fast and efficient retail payment infrastructure, they may choose, as it happens in several jurisdictions, not to do so. Moreover, they would have the means to block access to other market participants that intend to enter the market, leading to inefficiencies in the payment system and high costs for final users. Several reasons may be behind this kind of behavior. First, non-bank retail payment providers would compete with banks' deposit-taking business and reduce their income from fees in interbank transfers and other payment arrangements that are under their control. Second, commercial banks are in a privileged situation to have a dominant position in the payment system because they have access to customers' accounts. Third, a payment system infrastructure exhibits large network effects, requires a relatively large investment and careful risk management. These features may hinder the necessary coordination among market participants for an efficient payment infrastructure to emerge as a decentralized equilibrium, leading to fragmented and inefficient payment systems. Fourth, given the importance of network effects, the rents from access to data and the sunk costs required to enter, the market equilibria could be characterized by international firms operating as nearly natural monopolies in domestic markets.

Central bank action may help to overcome these problems. For instance, a CBDC could solve the coordination problem by offering a centralized solution. It could also tame a monopolistic payment services provider by making the market for payments contestable. In turn, efficiency gains will come by lowering barriers to entry, solving interoperability problems and spurring innovation. In this regard, interoperability appears essential to level the playing field between market participants. A CBDC

may facilitate a prolific field for startups developing new products and services, e.g. digital wallets with enhanced customers' experience, and provide incentives to existing financial institutions to offer better payment products and services. Fast payment systems and synthetic CBDC[4] may also serve to achieve this target as we will discuss in Section 3.

Interestingly, as argued by Kahn et al. (2019) economic history suggests that unless there is a competitive threat or underlying demand from the general public, traditional financial institutions will not have incentives to adopt the infrastructure that is provided by the central bank. Hence, it is crucial to generate access conditions for non-traditional financial institutions in order to generate competitive pressure to traditional financial intermediaries. In the case of a CBDC, these non-traditional institutions could be non-bank PSPs.

CBDC would only have social benefits if it is broadly used. Hence, some disintermediation would be inevitable because some switch of funds from commercial bank deposits into central bank money in the form of CBDC will occur. However, the significant and rapid movement of deposit balances from commercial banks into CBDC could have implications for their balance sheets and affect the amount of credit provided by banks to the wider economy with an impact on economic activity and, possibly, financial stability. Nonetheless, CBDC can be designed to manage the trade-off between benefits and risks; and, central banks could provide liquidity to the financial system in order to ameliorate the negative effects. Moreover, according to Adrian and Mancini-Griffoli (2019) a massive migration of deposits to CBDC seems unlikely in an environment in which bank deposits and the banking system function properly, so that the banking model as such is unlikely to disappear. Commercial banks will feel pressure from CBDC, but they should be able to respond by offering more attractive services and products.

In the other extreme of the spectrum, i.e. when the private sector has been able to solve the coordination problem and is offering digital payment solutions to the general public, intervention by the central bank may also be deemed necessary. Consider, for instance, the case of Sweden. During the last decade, the Swedish banking system developed a very efficient payment system. The success has been of such magnitude that most people today are using it through their computers and mobile phones. The use of physical cash, on the other hand, has been falling dramatically during the last years. Today, more and more retail stores are not accepting cash as a mean of payment, which is possible because cash is not legal tender. Moreover, forecasts predict that people will completely stop using physical

4 Fast payment systems are infrastructures where "the transmission of the payment messages and the availability of 'final' funds to the payee occur in real-time or near real-time on as near to a 24/7 basis" [see CPMI (2016)]. Broadly speaking, a synthetic CBDC may be achieve by opening central bank reserves to non-traditional financial institutions [see Adrian and Mancini-Griffoli (2019) and Section 4.2].

cash by 2025. In scenarios like this, the central bank will face tremendous challenges to fulfill its mandates. Since the retail payment system relies completely on an infrastructure owned by private banks, any banking problem would automatically convert into a problem to the payment system, challenging its resilience and stability. Similarly, cryptocurrencies (and in particular stablecoins) would be rapidly adopted if they manage to offer a stable value and to integrate as a mean of payment in electronic trade. In this case, stablecoins could threaten cash, the payment system, consumer protection and even the stability of a financial system [Ayuso and Conesa (2020)]. Adrian and Mancini-Griffoli (2019) make the concern extensive to other forms of electronic money that are offered with private backstop. While electronic money may be more convenient than cash as a means of payment, it raises questions about the stability of the system.

While digitalization challenges central banks, it may also provide new tools to face the challenges. For example, introducing a CBDC in a cashless economy may help building an instrument that is accepted by the public and allows the central bank to offer a resilient and stable payment system that may serve as backup during a financial crisis. This strategy may have a rationale in a financial stability concern. According to Rochet (2009), public intervention needs to focus in maintaining the integrity of some parts of the financial infrastructure that are deemed "vital" to the economy. Retail payment systems may be considered to belong to this category.[5] Hence, protecting financial infrastructure, e.g. the one behind retail payments, becomes fundamental to make the financial system more resilient and also to reduce the need for future government intervention.

Even if central banks assume a prominent role in retail payment systems, an approach where a central bank does everything, with no private sector involvement, is unlikely to work. Both central bank and private sector involvement will be necessary to develop an efficient and safe digital payment system for retail purposes. The central bank would provide and closely oversee the strategic parts of the systems, i.e. those that are vital for its well-functioning and stability. This is the case of several FPS around the world and should be the case with CBDC. The private sector would find a level playing field to compete in the provision of welfare improving services to customers. The design principles for retail payments elaborated by the Bank of England (2020) provide a basis to achieve this type of design which is reliable and resilient, fast and efficient, and innovative and open to competition.

Overall, central bank digital currency would serve central banks as a strategic tool in order to foster efficiency and security in retail payments, as well as to preserve financial stability. They may also imply additional challenges. In several cases, these challenges would be solved via an adequate design of the CBDC system. In other

5 For instance, the recent COVID-19 pandemic has shown the importance of having retail payment infrastructures that are resilient and continue operating under extreme circumstances.

cases, however, a CBDC could not be the best solution to achieve a central bank's objectives and other fast retail payment system would provide a better balance between pros and cons. The next section will analyze design features of CBDC and alternative retail payment systems.

3 CBDC and alternative payment systems

A CBDC could serve central banks to achieve the objectives discussed in Section 2. Other payment arrangements may do as well. This section revises the basic mechanics and implications of different types of CBDCs and alternative payment systems.

3.1 Central Bank Digital Currency

3.1.1 Introducing CBDC

The term CBDC is commonly used to refer to several concepts; it is not well-defined yet. However, it is envisioned by most as a new form, i.e. digital, of central bank money: it is a liability of the central bank that serves as unit of account, medium of exchange and store of value. A critical difference with existing forms of universally accessible central bank money, e.g. cash, is that CBDC does not have a physical but a digital form. And this simple difference is key to explain both the interest and the low speed of adoption of CBDC by central banks. Differently from cash, transferring digital money between two parties necessarily requires the involvement of a third-party. Kahn et al. (2019) argue that for this reason a digital version of cash cannot be equivalent to physical cash. Ayuso and Conesa (2020) highlight that the discussion about CBDC is complicated by the fact that the term CBDC commonly refers to both the digital representation of central bank money and its payment mechanism. Hence, an assessment of CBDC needs to be closely related to a discussion about payment infrastructures.

However, electronic representations of central bank money are already used in practice. Central banks offer digital money in the form of reserves or settlement accounts held by commercial banks, and less frequently by other financial institutions. In turn, reserves facilitated the emergence of real-time gross settlement (RTGS) systems in the 1980s to speed up wholesale payments that are now the standard around the world. Hence, central bank digital currency for wholesale purposes is not new.

The innovation would be that central banks offer digital representations of their money for general purposes, i.e. to retail users. Bech and Garratt (2017) propose a taxonomy of money, known as "the money flower", as the intersection of four key

properties: issuer, form, accessibility and type.[6] In this section, I will focus on the petal where the issuer is the central bank, the form is digital and the central bank digital money is widely accessible. The fourth property, i.e. type, refers to whether the CBDC is token- or account-based. The latter is alike the categories of object- or claim-based money in Adrian and Mancini-Griffoli (2019), who add more properties to complete what they call "the money tree" taxonomy: value, backstop and technology. Value refers to whether money serves as unit of account, a characteristic of central bank money, or its redemption is at a fixed or variable value. Fixed value redemption characterized money provided by commercial banks, e.g. payments that entail the transfer of funds from one bank account to another, and money provided by new players in the payments landscape, e.g. e-money[7] issued by Alipay and WeChat Pay in China, and by M-Pesa in East Africa. Backstop refers to whether the redemption guarantee is backstopped by the government, as in the case of commercial banks money, or relies on prudent business practices put in place by the issuer, as in the cases of e-money referred before. Finally, the technology may be centralized, i.e. transactions going through a central proprietary server, or decentralized by making use of decentralized ledger technologies (DLT). Choices around technology would have a major impact on the extent to which CBDC meets the overall objectives. In principle, it is not presumed that any CBDC must be built using DLT, and there is no inherent reason it could not be built using conventional centralized technology.

It is worth to remember the main characteristics of physical cash, the most recognizable form of central bank money, before going deeper into the analysis of its digital form. Cash, the notes and coins that have been in the wallets of people for centuries, are objects or tokens serving as visible and tangible representations of the liability of the central bank towards holders. As far as the central bank is truthful and large population uses the tokens, they may serve as store of value, medium of exchange and unit of account, i.e. the core functions of money. Cash has security embedded in order to prevent duplication and falsification. If those easily recognizable security features are hard to replicate, they increase the cost of generating counterfeiting tokens and reduce the cost of verification. In general, verification by the receiver of a payment in cash is cheap and instantaneous, and the physical exchange of cash is evidence of acceptance of authenticity. Therefore, cash appears to be an efficient and low risk medium of payment for transactions of relatively low value.

An important difference between physical and digital cash is the cost of counterfeiting. Therefore, according to Kahn et al. (2019), issuing digital money in token form does not follow immediately from the fact that central banks issue cash. Counterfeiting of digital tokens may happen because a valid token may be attempted to be spent

6 Bech and Garratt (2017) call to the last category "technology", which I have changed to "type" in order to avoid confusion with the categories proposed by Adrian and Mancini-Griffoli (2019).

7 e-money refers to electronically stored monetary value denominated in, and pegged to, a common unit of account such as the euro, dollar, or renminbi, or a basket thereof.

more than once, a problem known as double spending. It may also occur because hackers may use unexplored vulnerabilities on cybersecurity to generate new tokens at a marginal cost close to zero. Another important difference between physical and digital cash stems from their nature. While physical cash embeds tangible and easily recognizable security features and can be transferred from hand to hand, digital cash in the form of tokens embeds non-tangible security features and need a third party, either centralized or decentralized, in order to verify the tokens and make transactions.

In turn, the need for a third party to transfer digital tokens between two parties has important implications. Apart from the threats to cybersecurity and the protection of final users' information, two risks that are present in almost all digital activities, the choice of the technology underlying the payment systems for the digital currency and the impossibility of replicating exactly all features of physical cash become crucial to make the case for a CBDC.

Regarding technology, centralized solutions that are available today may be too costly or slow to adopt compared with physical cash. This may represent a constraint to scale up a CBDC payment system. Decentralized technologies may not be a cost-effective substitute [see, for instance, Chapman et al. (2017)]. Additionally, they are still in a developing stage that could question their resilience to support a CBDC, where the reputation of central banks is at stake. Moreover, interoperability of DLT or blockchain technologies with other technologies may face important challenges and require large investments. In turn, these problems may question their capacity to foster innovation and competition in some segments of the payment system where it may be desirable. Moreover, given the importance of network economies in a payment system, it could diminish the attractiveness of this type of technologies for CBDC. Auer and Böhme (2020) provide an overview of underlying trade-offs and the related hierarchy of technical design choices.

Maybe the hardest feature of physical cash to be replicated by digital cash is anonymity. In a transaction with physical cash nothing else is needed than the exchange of banknotes or coins. In transactions with digital money, however, a third party may collect information that identifies, for instance, the tokens and the identity of the payer and the payee. This information may be socially useful to enhance security in the payment system, e.g. through reversals of fraudulent transactions, and to fight money laundering and the financing of illegal activities. From an individual point of view, however, the social gains are traded off with the loss in privacy and the possibility that the information may be used for other purposes than the specific transaction in which it was generated. This trade-off may be particularly relevant for low-value transactions.

Together, the technology supporting a CBDC, the design of the payment infrastructure underlying it, and key features helping to favorably solve trade-offs like security-

anonymity, will influence the willingness of customers to use a CBDC. And this opens another front in which generally central banks do not have neither advantages nor expertise: users' experience is important but central banks traditionally do not have direct connection with the general public. Hence, private sector involvement would be deemed necessary. The design of the CBDC will also have crucial implications for innovation and the development of the payment system, its efficiency and level of competition. In addition, it will also impact other financial activities, e.g. financial intermediation. In what follows, I will analyze basic arrangements for CBDC, selected design issues and their possible implications.

3.1.2 Basic CBDC arrangements

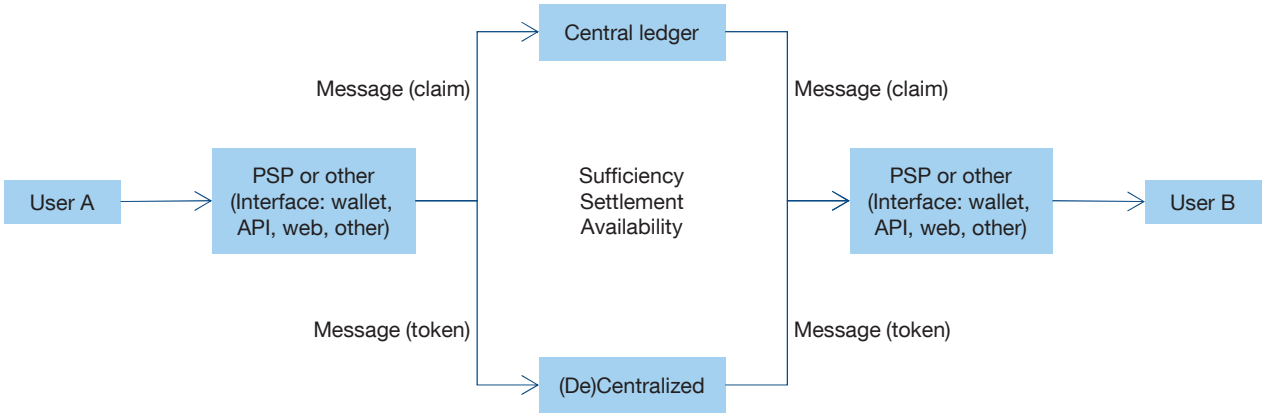
Figure 1 describes the basics for User A to transfer digital money to User B in a simple CBDC system.

One possible arrangement consists of a CBDC based on accounts (represented as a central ledger at the top in Figure 1). The basic idea is not new and can be traced back to the proposal of "deposited currency" by Tobin (1985). A transaction in an account-based CBDC would resemble today's transactions between commercial bank accounts, except for the fact that accounts would be held with the central bank. In this case, the central ledger at the central bank would receive a message from User A asking to transfer the claim she has with the central bank to User B. The central ledger would check the validity of the message and the sufficiency of funds in User's A account, settle the transfer, make the funds available in the account of User B and send a message to User B confirming her claim with the central bank. As highlighted by Mancini-Griffoli et al. (2018), the exchange of information would therefore be substantial. The central bank would ensure settlement but only after verification of the identity and authority of User A to use the account, sufficiency of funds, and authenticity of User B's account.

The idea that the general public could have access to accounts at the central bank is interesting. However, it has been feasible for long time, even before the emergence of technological advances like DLT and blockchain, but central banks have not implemented it; differently from the case of wholesale deposits where commercial banks reserves at the central bank is an extended practice and generally support high value payment systems, e.g. RTGS.

Several reasons would justify that opening accounts to the general public will not be the preferred choice of central bankers. To start with, the central bank would need to directly interact with the general public, where it does not have a comparative advantage. The cost of verifying the identities of a large number of users and of managing their accounts would make the system too expensive to operate. Second, an account-based CBDC would put the central bank in a position of direct competition

Figure 1
CBDC: BASIC ARRANGEMENTS



SOURCE: Own elaboration.

with commercial banks. This would imply undesirable effects on financial disintermediation with consequences on the development, competition and stability of the financial system, and in turn economic activity. Third, when dealing with final users, central banks would be relatively less customer-oriented than private companies. In addition to that, an account-based CBDC would make available to the central bank a large volume of information about financial transactions of individuals. These factors could discourage potential customers because they may assign high value to their experience using the CBDC and have concerns about their privacy.

Another CBDC arrangement involves digital tokens. In this case, and depending on the design of the system, User A will send a message requesting to transfer a token of her own to User B or alternatively will directly transfer the token itself. In the first case, tokens are stored and secured in a central repository, as in the Uruguayan e-Peso pilot described in Section 4. In the second case, tokens are stored in users' devices, alike physical banknotes in wallets. In this case the central bank issues tokens and maintains the list of outstanding tokens. When a transaction occurs, the central bank authenticates the tokens against the list, destroys the old token and issues a new one that is transferred to the recipient, as in the case of Sand Dollar in The Bahamas. The first case is representative of a centralized system and the second case of a decentralized token-based CBDC.

Technological options to develop a centralized system are larger than those to develop a decentralized one, which for the moment is restricted to DLT and blockchain technologies. A centralized system would be developed either in DLT or blockchain, possibly as a private and permissioned platform, but also in proprietary software. Differently from cryptocurrencies like Bitcoin, in the case of a CBDC there is a central

authority, the central bank, with the authority to verify the authenticity of tokens as nowadays happens with counterfeit banknotes and, even more importantly, with the authority to control the quantity of money in circulation. Therefore, the key advantage of DLT or blockchain technologies, i.e. the possibility of validating tokens and then transactions without the intervention of a central authority, is of second order for the case of a CBDC. Hence, other features of the technology like cybersecurity, cost, speed and delay in verification of transactions, scalability and interoperability with other systems would gain power at the time of choosing the underlying technology for the CBDC.

It seems prudent that the core of a CBDC system is under the control of the central bank because of its importance and the risks that are involved. It is possible that some activities, like for instance maintenance, could be outsourced; but it seems crucial that the central bank keeps control not only of the minting of digital currency, but also of the central ledger in an account-based system or the technology underlying transactions in a token-based one. As discussed in Section 2, these activities are strategic to fulfill the objectives of central banking. In addition to that, central banks would also fulfill roles as regulator and catalyzer in the retail payment system.

Central banks, however, do not have any advantage in dealing directly with final users. It may be very challenging for central banks to perform know-your-customer and identification of customers, to provide support 24/7 and to offer customer-oriented services. Private sector companies, however, are more efficient in doing these activities. They could provide the interface of the CBDC system to final users. Interfaces could range from digital wallets to API and web services. They could be provided by payment service providers (PSP), including banks and other institutions with access to the payment system, or other type of institutions offering CBDC's related solutions and overly services. These institutions need to be authorized by the central bank to access the CBDC system after confirming that they fulfill interconnectivity and security of information required standards, as well as other regulatory requirements. Opening this tier of a CBDC system to market competition would foster FinTech development and innovation, increasing the efficiency of the system and improving the offer of products that are closer to users' needs.

The platform model proposed by Bank of England (2020) envisages the above mentioned elements. It is a token-based proposal, with a CBDC infrastructure under the control of the central bank that would process payments, providing the minimum necessary functionality for CBDC payments. Based on this basic infrastructure, private sector PSP would handle the interaction with end-users of CBDC and provide additional payments functionality through overlay services. PSP would need to meet criteria and regulation to start offering CBDC-related services. Furthermore, they should be supervised on an ongoing basis, in order to ensure consumer protection, interoperability and resilience of the CBDC system.

3.1.3 Selected design issues

Both account and token-based systems are record-keeping arrangements. There would be a large amount of information available to the central bank. Of course, it could be used for good purposes, e.g. to reverse erroneous or fraudulent operations. Nevertheless, users might have legitimate doubts about other uses that the central bank, and more generally the government, would like to do with the transactions data. There is a lawful concern for privacy and even for anonymity,[8] to the point that it would explain the prevalence of cash as a medium of exchange and the appeal of cryptocurrencies.[9] Therefore, lack of anonymity in a CBDC system would discourage users; but complete anonymity would increase the risk of serving as a vehicle for financing illegal activities.

The design of the CBDC system needs to solve the trade-off between anonymity and its risks. In so doing, there could be several elements that combined would provide an adequate balance. First, for a CBDC system to work properly it may not be necessary that the identity of users is known by the central bank when processing each single transaction. In principle, some kind of identification number for final users is needed, which need to be linked one to one with their real identities. In this case, the central bank would observe the transactions without knowing the identity of the users that are behind of them.

Second, it would be possible to track final users if necessary. For instance, the relevant information about users' identity may be encrypted, and then even if it is at the central bank, it is not directly available. Provided that the central bank is truthful and that there are clear protocols and accountability arrangements to access the information, it would reassure users about the protection of their privacy. In certain prespecified cases or under the order of a competent authority, e.g. a Court of Law prosecuting illegal activities, the files can be decrypted in order to access the necessary information.[10]

Third, it is of course necessary to do due diligence and know-your-customer actions. This task would be done by the institutions that are providing the interface and dealing directly with final users, e.g. PSP, as it is today the case with financial intermediaries in banking activities. In this case, if there are several PSP, the

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8 Garratt and Van Oordt (2019) formally show that there is a public good aspect of privacy in payments that arises because individual customers do not bear the full cost of failing to protect their privacy when are exposed to price discrimination in a dynamic framework. As a consequence, when left to market forces alone, the use of privacy-preserving means of payments may be sub-optimal.

9 It is worth noting that the feature of anonymity in cash was not intended but a consequence of the lack an adequate technology to identify the holder of each banknote and coin.

10 In practice, similar mechanisms have worked in the past for the case of commercial banks deposits in several jurisdictions under "deposit secrecy" schemes. The information about a deposit and its depositors were legally protected from the request of third parties, included government agencies. Nevertheless, the regulator (and possibly the deposit insurance scheme) maintains encrypted sensible information about commercial banks deposits, including the identity of their owners.

information about users and their transactions will be partitioned among them. Therefore, each PSP would observe the transactions that its customers do through it but remains ignorant about the identity of the senders of transfers received by its customers and of the receiver of the transactions originated by them. It also remains ignorant about transactions made by other users that are not its customers, and even of that of their customers when are done through another PSP. This partition of information will constitute an extra layer of privacy for final users.

Fourth, a combination of the previous three elements would provide a level of privacy and anonymity that may be appealing for final users. It needs, however, to be balanced with clear protocols to persecute nefarious and illegal activities. A possibility that was mentioned before is that the information about the identity of final users and their transactions can be decrypted at the request of a competent authority, e.g. a judge or a court of justice. Interestingly, the transactional information may allow to trace back transactions completely, which may be useful for instance in AML/FT cases. Moreover, it may be used to generate automatic alerts for suspicious operations that, in turn, can be investigated by the competent authority. Therefore, traceability of operations and the generation of automatic alerts are features that a CBDC systems could offer in order to strengthen the arrangement to persecute illegal activities. These features would still be possible in a design that preserve privacy of honest users and (pseudo) anonymity.

Fifth, an additional layer of security may be introduced by setting limits, for instance, to the amount of digital money that each user can hold or to the amount of transactions in a given period. This kind of caps would discourage the use of the CBDC systems for money laundering and financing of terrorism. Other potential advantages have to do with the reduction of the risk of a user losing large amounts of digital money in a hypothetical case of a security failure, as in the case of losing banknotes from our pockets. A drawback of introducing limits would be the potential for bad users' experience in those cases where the limits are too low compared with their needs. However, this could be circumvented via financial innovation. For instance, a possibility is the development of products allowing to split relatively large transactions into smaller ones as to be processed through several PSP. In addition to foster innovation and improve users' experience by allowing a variety of products that better accomodate users' needs, this kind of innovation would also increase competition among PSP.

Last but not least, the limits would reduce the disintermediation concerns that are associated to the potential of massive migration of bank deposits to CBDC. Yet, the possibility of aggregating payments for some users, possibly with higher fees than in the case of transactions below the caps, would increase contestability to financial intermediaries in the market for deposits, pushing a reaction to reach a new equilibria, possibly with the outcome of better services to customers like, for instance, the association of bank accounts with the CBDC payment system. In this case, the CBDC

system would waterfall to associated commercial bank accounts those amounts exceeding the caps in digital wallets.

Summarizing, the design of the CBDC system would have deep implications for its security and adoption by users. It would also affect the competitive behavior in the payment system but also in the market for financial intermediation. Moreover, a potential competitive disadvantage of central banks in dealing directly with the general public would be circumvented by a design that involves competition between the payment services providers offering the interface for the CBDC system. Other aspects of design would foster innovation and competition in this segment. Overall, the system should be simple and transparent.

3.2 Alternatives: Fast retail payments and synthetic CBDC

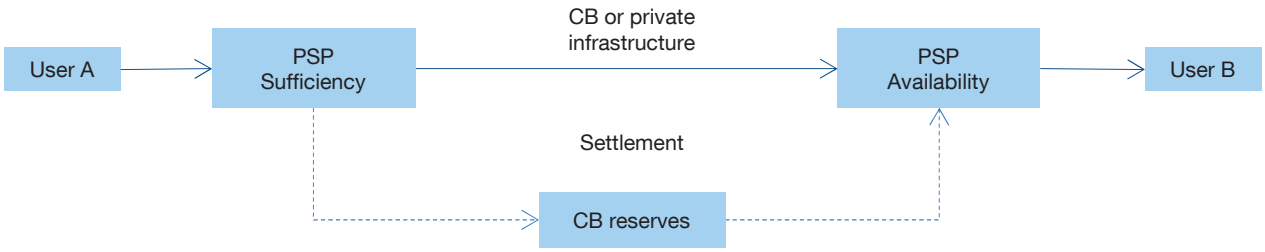
Before introducing a CBDC it is worth to evaluate other possibilities to fulfill similar objectives. Under some circumstances, fast retail payment systems (FPS) may represent a potential alternative to CBDC. These systems have been developed in many jurisdictions.[11] Bech and Hancock (2020) argue that as a result of information and communications technology improvements and (more recently) consumer demand, domestic payments are increasingly convenient, instantaneous and available 24/7. The improvements began to emerge in the 2000s and their diffusion mirrors that of the RTGS systems that emerged in the 1980s [Bech et al. (2017)]. Initially these innovations were limited to making the front end more convenient, but more recently innovations have started to address the back end and have increased the speed of retail payments.

As in the case with CBDC, in a FPS "the transmission of the payment messages and the availability of 'final' funds to the payee occur in real-time or near real-time on as near to a 24/7 basis" [see CPMI (2016)]. Also as with CBDC, FPS are payment infrastructures that facilitate payments between users at multiple PSP rather than just between the customers of the same PSP. This feature focuses on open systems, where users can access the payment system through any number of PSP; this includes, as in the case with CBDC, banks. There are, however, several differences. Maybe the most important is that a FPS does not need central bank money in digital form in order to operate.

Figure 2 shows the basic arrangement of a FPS. User A starts a transfer through the interface provided by her preferred PSP. This PSP checks the sufficiency of funds to be transferred, differently from the case with CBDC where it is the central bank that does this check. Then, the PSP sends the payment message through the payment

11 According to Bech et al. (2020) currently, 55 jurisdictions have FPS, and this number is projected to rise to 65 in the near future.

Figure 2
FAST RETAIL PAYMENTS AND sCBDC: BASIC ARRANGEMENTS



SOURCE: Own elaboration.

infrastructure. In the other extreme, the PSP of the payee receives the message and makes the funds available to User B. The payment infrastructure would be operated by the industry, generally as a consortium of PSP, or provided by the central bank. Interbank settlement would either be done immediately after receiving the payment messages or deferred, which would imply certain degree of risk assumption by participating banks. And the central bank could or could not be involved in the settlement process. I will consider these differences with CBDC in the rest of this section.

A privately owned payment infrastructure may emerge as a coordinated effort by PSP in a jurisdiction. In practice, this coordination effort generally results in the interconnection between those PSP and the existing or enhanced core clearing and settlement systems. Payment infrastructures often exhibit significant network economies, as well as economies of scale and scope. This would explain why the adoption of a fast payment system is typically not solely an individual decision. Rather, it tends to be a decision that requires coordination and collective decision-making as argued by Bech et al. (2017).

Collective decision-making by an industry consortium in order to solve the coordination problem behind the implementation of a fast payment system is often complicated and time-consuming. The involved parties would weigh the short run costs more than the potential, uncertain and difficult to quantify long term benefits, and refrain to implement the infrastructure, possibly leading to underdevelopment in the retail payment system. Therefore, getting incentives for the private implementation of a fast payment system may require a catalyst or strong outside incentives, potentially from the public sector.

Incentives could also steam from inside the private sector, for instance, as a strategic reaction to other PSP increasing competition and making the payment system contestable. In this case, part of the PSP community may find it worth to implement

a fast payment infrastructure in order to gain a competitive advantage. Since broad coverage of end users is important to realise the benefits of these payment services, which have strong network effects and require relatively large investments, private implementation by a part of the PSP community in a jurisdiction would lead to imperfect competition in fast payments. Again, public intervention will be deemed necessary. This time, in the form of competition policy to tame a monopolistic payment infrastructure, to facilitate the interconnection among infrastructures in an oligopolistic market structure, to guarantee access to third parties, e.g. new entrants like FinTech companies, to protect customers from abuse, and to foster efficiency in the payment system.

Alternatively, a fast payment system could be owned by the central bank, which is likely to consider monetary and financial stability issues. For instance, in a situation of financial stress like a banking crisis, a fast payment system under the control of the central bank would have the advantage of being easier to maintain operative than in the case that this infrastructure is operated by banks. A central bank would also be in a better position than the private sector to evaluate the potential benefits of fast payments such as the scope for improving services, to satisfy customer needs, and the prospect for future innovation. The possibility of a central bank to take such long-run factors into account, i.e. financial stability, development and innovation, could provide a rationale to consider adopting a strategic view in the implementation of fast payments. At this point, it is worth noting that the very same reasons would justify implementing a CBDC. In this regard, both CBDC and fast payment systems are alternative ways for a central bank to keep control over critical infrastructures in the digital era.

A fast payment system of a central bank would provide a fast, highly secure and resilient technology infrastructure. It may work alongside the RTGS service and provide the minimum necessary functionality. Hence, as in the case of a CBDC, this infrastructure could serve as the platform to which private sector PSP would connect in order to provide customer-facing payment services. Moreover, PSP could also build additional functionality that might be provided as a value-added service for some or all their users, increasing competition and improving users' experience. Also as in the case of a CBDC, PSP would be subject to appropriate regulation and supervision in line with any risks they might pose.

In a privately-owned fast retail payment system the transmission of the payment message and the availability of funds to the payee occur in (near) real-time. It could be the case that the system works with fund settlements among PSP in real time as well. In other words, after funds have been debited from the payer's account, an interbank settlement takes place prior to finally crediting the account of the payee. In this case, credit risk among PSP participating in the system is negligible, but there is important liquidity risk because each PSP requires sufficient liquidity to support real-time settlements of fast payments. However, fund settlement among PSPs does

not necessarily need to occur in real-time and with every payment order, but it could take place at pre-specified times during the day and in batch mode. In deferred settlement, liquidity risk is smaller, but PSP carry credit risk because in each transaction the payee's PSP advances the funds to the final user before inter-PSP settlement occurs. In practice, a variety of tools can mitigate this risk, including prefunding of positions, a maximum limit on the net position between two PSP, and collateralization of debit positions [Bech et al. (2017)].

The central bank would have a role on the settlement process of a privately-owned fast retail payment system. Nowadays commercial banks hold accounts at the central bank that allow them to settle payments by transferring perfectly safe funds in a digital form, i.e. central bank reserves. Adrian and Mancini-Griffoli (2019) propose to extend access to central bank reserves to non-bank PSPs. The ability to hold central bank reserves would allow non-bank PSPs to overcome credit and liquidity risk involved in the settlement process. It would also provide a level playing field because no single market participant has an advantage in allowing payments among customers, and interoperability in payments is ensured. Offering selected non-bank PSPs access to central bank reserves, though under strict conditions, could raise risks. Requiring non-bank PSPs to hold the totality of users' funds at the central bank in the form of reserves would mitigate them. In this case, non-bank PSPs would be financial institutions that cover hundred percent of their liabilities with central bank reserves, i.e. narrow banks that facilitate payments but do not lend to the private sector.

Adrian and Mancini-Griffoli (2019) argue that central banks in some countries could partner with PSPs to effectively provide what they call "synthetic" CBDC, or sCBDC. Differently from the full-fledged CBDC model described in Section 3.1 and the FPS provided by the central bank discussed above, under a sCBDC model the central bank would only offer the settlement platform to payment service providers other than commercial banks by providing access to central bank reserves (it is represented in dashed lines in Figure 2). Other parts of the retail payment system will be responsibility of the private sector PSP, in particular managing customer data and performing transactions in a fast payment system.

As in the case of a FPS, in a sCBDC system there is no central bank money in digital form that is made directly accessible to the general public. Central bank reserves will be made accessible to non-bank PSPs, as it is the case today with commercial banks, but it will not be accessible to the general public. Nevertheless, Adrian and Mancini-Griffoli (2019) argue that as soon as non-bank PSPs issue their digital money backed one for one with central bank reserves, then final users essentially hold and make transactions in a central bank liability.[12] Hence, the possibility of

12 From a legal point of view, however, it may be important differences on the rights that have a holder of a sCBDC with respect to those that have the non-bank PSP that is allow to make bank reserves at the central bank.

transacting in central bank reserves with a hundred percent reserve requirement, i.e. like in a narrow banking scheme, is a way to synthetize central bank digital currency.

Summarizing, fast retail payment systems and synthetic forms of central bank digital money could achieve similar objectives than a full-fledged CBDC. Selecting among the options and determining specific design issues imply to seriously consider the market failures to solve and the advantages and risks of each system in the framework of existing public policy objectives. The balance could imply the optimality of different arrangements depending on the characteristics of the payment systems.

4 CBDC pilots and FPS experiences

With regards to CBDC, there is no one-size-fits-all solution. As highlighted by CEMLA (2019), the introduction of a CBDC needs to be preceded by an in-depth analysis of the design issues that must better serve for each central bank. In this section I review two experiences with retail CBDC for domestic use in Latin America and the Caribbean: the CBDC pilots of Uruguay, called e-Peso, and of The Bahamas, called Sand Dollar. They share some design features like, for instance, a tiered architecture with the core system under the control of the central bank and third parties leading with final users. They have, however, deep differences on the underlying technology and other characteristics that we will discuss in what follows.[13] The section ends with the revision of a recent experience with a fast payment system: the TARGET Instant Payment Settlement (TIPS) offered by the Eurosystem since late 2018.

4.1 e-Peso

A digital currency issued by the Banco Central del Uruguay (BCU), called e-Peso, circulated in Uruguay between November 2017 and April 2018. e-Peso is legal tender currency issued by BCU, alike physical Uruguayan Pesos banknotes, in a digital form. This section describes the main features of the e-Peso pilot.[14]

The preparation of the pilot started several years before the first e-Peso was put in circulation in late 2017. In 2014, BCU was approached by The Roberto Giori Company, a firm specialized in money security, with a preliminary proposal to create legal tender digital money which is secure and reliable. Then, legal, information security and technological aspects were evaluated to be sure that the relevant risks were under strict control. Risks include financial and legal ones, but also reputational risk

13 This section profits from the peer review effort of CBDC pilots done the CBDC Working Group of the Forum of FINTECH Experts at CEMLA during 2019-20 (see https://www.cemla.org/fintech/english.html). I would like to thank Chaozhen B. Chen from the Central Bank of The Bahamas for fruitful exchange, as well as Raúl Morales, Pablo Picardo and José Luis Vázquez for your contribution in that effort.

14 This section is largely based on Bergara and Ponce (2018).

that was a matter of particular concern. Several measures were undertaken to reasonably mitigate cyber risk and to make sure that the system provides adequate standards regarding security of information. Other risks, e.g. financial and reputational risks, were reasonably hedged through detailed contracting with the participants.

The e-Peso system involves several participants. In addition to Banco Central del Uruguay, who mints the digital e-Peso tokens, and The Roberto Giori Company, who provides the core payment system for them (Global Solution for Money Technologies), there were four more participants in the pilot: the state-owned telecom company, Antel, provides the telecommunication network. IBM provides data storage services, management and control of e-Pesos transactions.[15] It also provides support to customers through a call center. Inswitch Solutions, a Uruguayan FinTech specialized in mobile financial services, provides the interface for the management of users, transfers and transactions. Final users need to register through Inswitch, which performs due diligence and know-your-customer. Moreover, digital wallets keep linked to the mobile phone SIM card of the owner. Finally, Redpagos (a payment service provider with branches all around the country) offers cash-in and cash-out services, i.e. exchanging physical banknotes by e-Pesos and vice versa. In addition to these participants, final users include individual customers and retail businesses.

A series of caps were incorporated in the pilot in order to generate a controlled environment for risk management. To start with, e-Peso circulated by a limited period of time: six months. The issuance of e-Peso bills was limited to 20 million Uruguayan pesos. The number of users was limited to 10,000 mobile phone users of Antel. More precisely, the first 10,000 users that install the e-Peso application and register to the pilot could make transactions. The maximum balance in e-Pesos wallets was set to 30,000 Uruguayan pesos (equivalently to 1,000 US dollars) for final individual users and to 200,000 Uruguayan pesos for retail business registered in the pilot. Finally, the system allows two kind of digital transactions: peer-to-peer transfers among final users and peer-to-business payment between final users and registered retail businesses.

The core e-Peso system has two components. First, a "digital mint" under the control of the central bank generates the e-Peso notes and uses cryptography to provide security. Digital notes are then tokens. Nevertheless, the system needs a second component to operate and e-Peso could not be transferred directly among final users without being validated in this second component: "a digital vault". This vault holds e-Pesos in individual, encrypted and anonymous digital vaults that are linked one-to-one with final users' digital wallets. Hence, e-Peso is nor purely token-based neither account-based in their classical definitions: tokens need to be centrally validated and there are not accounts but vaults. Interestingly, the partition of information allows providing (pseudo) anonymity to transactions since final users are

15 During the pilot the management of the e-Peso payment system was outsourced to IBM, but this is matter of evaluation in the aftermath of the pilot due to the importance of keeping control of it by the central bank.

just identified through their telecom provider and digital wallet, but they are anonymous in the core system. Nonetheless, transactions can be traced back and the identity of users revealed under the authorization of a competent authority, e.g. a court of justice.

Other features of the e-Peso system are as follows. First, the system provides instantaneous settlement on a 24/7 basis. Second, the e-Peso system uses internet as the principal channel and the USSD telecom protocol as secondary authentication method, enhancing security, and as a contingency channel. The e-Peso pilot did not feature off-line transactions, but without access to the internet transactions were processed on-line via the USSD protocol. Third and related to the previous point, in the e-Peso system users can make transactions without an internet connection or even without a smartphone. Fourth, e-Pesos are secured at the core system even if users lose their mobile phones or their digital wallets password. This also enhances security with respect to physical banknotes. Fifth, each e-Peso bill will have a unique serial number (through cryptography) and specific denomination. These features are aimed to improve security because they help to prevent double spending and counterfeiting. Nevertheless, they could increase the technical requirements of the system when the e-Peso denomination in a particular wallet is not appropriate to make the transaction.

The e-Peso pilot helps to evaluate many aspects of the technologies for CBDC, and central bank business models applied to the payment system. It was also useful to visualize tentative answers to relevant questions about the impact of a CBDC. For instance, a matter of concern refers to the impact of e-Peso on banks and other financial institutions. During the e-Peso pilot, banks were deliberately kept out of the pilot in order to have a firewall to keep risks under control, but several banks approached the project manager asking to be allowed to participate. Banks seem to visualize profitable business opportunities and potential for cost reduction linked to e-Peso. A very preliminary assessment indicates that there will not be major disruptive effects in the financial intermediation activities. Should a CBDC like e-Peso be put in production, then it is likely that the banking system reaches a new equilibrium. Of course, the characteristics of this equilibrium will depend on the settings of e-Peso.

A CBDC like e-Peso may contribute to a level playing field for sound competition and innovation in the financial market. It may reduce entry barriers for startups developing new products and services, e.g. digital wallets with enhanced customers' experience, and could provide incentives to incumbent financial institutions to offer better products and new e-Peso related services. For instance, during the pilot registered businesses just needed a mobile phone to operate e-Peso. Given the small scale and limited time of the pilot no other investment was needed to link existing billing systems to the e-Peso system, and existing communication technology was enough to operate the e-Peso. All these areas would need innovations and development of solutions to solve, for instance, the ways in which other payments platforms and systems (POS, for instance) will connect to the e-Peso system. Moreover, digital

wallets were just provided by one FinTech during the pilot. This segment could also be open to competition should the e-Peso goes into work. Last but not least, efficiency and security in the payment system may dramatically improve by the introduction of a CBDC. Moreover, e-Peso could contribute to the objectives of financial inclusion.

4.2 Sand Dollar

The Bahamas started in December 2019 a pilot phase with a digital version of the Bahamian dollar, called Sand Dollar. As a consequence of Hurricane Dorian, which impacted The Bahamas between the 24th of August and the 10th of September 2018, public infrastructure resulted seriously damaged. The damage extended to the payment system itself given the geography of the country, which is composed of fewer than 700 islands. In this context, the Central Bank of The Bahamas started the Sand Dollar pilot with the main targets of improving financial inclusion and access and making the domestic payment system more efficient and competitive. The Sand Dollar is aimed at addressing some of the current financial access gaps provided by both, remoteness of some communities outside of a cost-effective range of physical banking services, and onerous customer due diligence and know your customer requirements. This CBDC initiative aims to achieve universal access to digital payments and financial services, underpinning government efforts to digitize and make a more efficient spending and tax administration.

The pilot starts in two islands: Exuma in the first place, and Abaco in the second place. Exuma was chosen due to its landscape and similarity with the Bahamas' geographic landscape. Abaco was selected due to its economic recovery after Hurricane Dorian. A public relation national campaign was developed to educate the public on the use of Sand Dollar. Moreover, the main dissemination efforts are put on building user base through public outreach and authorized financial institutions. The system offers a free of charge service for final users. However, looking ahead, the operation may generate a nominal fee for the upkeep of the service which may be shared amongst all of the beneficiaries of the system.

In terms of design, Sand Dollar is a token-based CBDC, which is minted by the central bank solely. As in the e-Peso pilot, critical functions of the project are all under direct control of the central bank, i.e. minting and settlement. However, certain maintenance, penetration testing and system audits could be outsourced. Alike e-Peso, the Sand Dollar can be seen as a real-time, retail, digital cash-transactions system, featuring 24x7 availability.

A key difference between e-Peso and Sand Dollar is that the latter is based in a DLT-enabled core system which works as a private and permissioned platform. Regarding the validation process, the system relies on a cognizant consensus model based on

a “proof of work” protocol. In order to prevent double-spending and counterfeiting the system uses enhanced short-lived (time sensitive) one-time web tokens instead of traditional reusable tokens that are used in the case of e-Peso. The Sand Dollar system seems to deliver a technological solution that is scalable and trustable. In terms of data protection, the system seems to be able to respect and protect users’ data and anonymity, accordingly, as no personal information is ever stored on the DLT permissioned network. Nevertheless, if there is a need to investigate nefarious activity, traceability of transactions is always possible.

Interoperability is guaranteed through supervised financial institutions: commercial banks, payment service providers and money transmission businesses integrated via API connectivity to the Sand Dollar network. Currently in addition to commercial banks, there are seven payment service providers in the market. Only these supervised financial institutions are allowed to handle the distribution of Sand Dollars. For that purpose, they have accounts at the central bank. These institutions are responsible for applying due diligence and know your customer regulation. Moreover, end-user overlay services are expected to operate in a competitive environment. In this respect, innovations are expected to be developed based on the Sand Dollar system. For instance, a card-based access option has been developed to satisfy the needs of the less technological savvy demographics. Moreover, authorities are working with financial intermediaries to link the Sand Dollar system directly to bank accounts.

The wallets of final users are encrypted and secured and can only be accessed with a unique PIN number or through biometrics. Wallets can also be blocked through accessing the wallet on a secondary device, in case it is necessary (if it is stolen). All transactional data is centralized and housed in a central bank’s datacenter. Furthermore, the system has a built-in proprietary resilience network that allows users to connect to the Sand Dollar network without data and internet connectivity.

While the envisioned ecosystem provides room for the private sector to play different roles, no private-owned institution has control over the transmission and settlement of transactions, which are offered in real time by the Sand Dollar system housed at the central bank. Hence, the central bank maintains control of the most strategic parts of the system: minting, transmission, settlement and data protection. Yet, this CBDC system has the potential to generate competition in the financial market and then better products and services to final users, whilst it does not impact the stability of the financial system.

4.3 TIPS

In November 2018 the Eurosystem launched a new market infrastructure service known as TARGET Instant Payment Settlement (TIPS). This service allows final users

to make fund transfers in euros,[16] within seconds, in a 24/7 basis and with the highest standards of security against settlement risk, since the transactions are carried in central bank money. TIPS shares most of the features of a fast payments system offered by a central bank that were discussed in Section 3.2. In particular, it is offered by the Eurosystem as an extension of its real-time gross settlement system, TARGET2, uses it to settle payments in central bank money, and authorized PSP are enabled to offer individuals and firms instant payment services through the countries served by the Eurosystem, ensuring reachability and interoperability.

TIPS represents a response to the growing consumer demand for digitalization and instant payments that are accessible anywhere and at any time. In this context, several European countries were planning their own solutions and a number of national schemes appeared or were under development. Starting in a national basis, however, poses the problem that the new instant payment systems would have stopped at national borders, leading to a fragmented landscape and slowing further harmonization of payments in Europe. Hence, a challenge for the Eurosystem is to ensure that these national solutions do not promote fragmentation into the European retail payments market, a risk that TIPS aims to minimize.

To operate in TIPS, payment services providers must be eligible to access central bank money, i.e. they need to fulfill the same requirements for participating in TARGET2. In such a case, a participant PSP can open one or more dedicated TIPS account with a central bank member of the Eurosystem. These accounts are then used to settle instant payments conducted through TIPS. When a participant PSP sends a payment transaction message to TIPS, it validates and reserves the amount to be transferred in the account of the sender. Next, TIPS forwards the payment transaction for acceptance to the receiving PSP. Once a positive reply is received by TIPS, it performs the settlement and confirms the transactions to both the sending and the receiving participants. Settlement is then final and irrevocable. According to the operator, the end-to-end processing time of a transaction is 10 seconds or less. The price per instant payment transaction is fixed at 0.20 eurocent until at least November 2020, although the system intends to work with a full cost-recovery and not-for-profit principles, so that this amount could vary in the future.

Participation on the TIPS system is subject to the same rules than those applied in TARGET2, the RTGS system. In particular, there are three avenues through which a PSP could operate. First, as participant a PSP is eligible to open one or more accounts in TIPS. Moreover, participants may let other parties to instruct payments on their behalf by using the participant's account. Second, by entering into a contractual agreement with a participant, a reachable party is able to access that participant's TIPS account. In general, reachable parties adhere to the SEPA Instant Credit Transfer (SCT Inst, a scheme for pan-European instant payments aimed to

16 The system supports multi-currency technical capability as well.

favor digitalization and fast payments in Europe together with the harmonization of direct debits and credit transfers across national borders) but do not want to open a TIPS account. Instead, they send and receive payment instructions using a participant's TIPS account. In general, participants set maximum limits for the reachable party under a functionality called Credit Memorandum Balance. This functionality allows efficient risk management without splitting liquidity. A third way to participate on TIPS is to become an instructing party by entering into a contractual agreement with one or more participants or reachable parties to instruct payments on its behalf. Overall, the three forms of adhering to TIPS by a PSP provide an ample set of possibilities as to facilitate adoption and reach final users with customized payment services.

As fast payment system offered by a central bank, TIPS is based on the RTGS service to provide the minimum necessary functionality, guarantee a fast and secure process of transactions, and enable a deployment process without interruption in the service. Consequently, it is capable of instantly settling a large volume of payments at relatively low cost. Furthermore, it is compatible with the strict supervision requirements of the Eurosystem, as well as with the CPMI-IOSCO guidance on cyber resilience for financial market infrastructures.

The feature of being an extension of TARGET2, which already has an extensive network of participants across Europe, will help TIPS to achieve reachability and implementation in a short period of time. Moreover, the first 10 million payments made by each participant PSP before the end of 2019 were free of charge in order to promote adoptability. In addition to that, another feature that may help adoption of TIPS is that it is compliant with SEPA Instant Credit Transfer (SCT Inst Scheme). This scheme is expected to be used by a large number of payment service providers across Europe. Indeed, it is currently being used in 22 countries by more than half the total number of European PSP. The estimated share of SCT Inst volumes in the total has continuously growing since its start in 2018 to reach 6.47% during the second quarter of 2020.

5 Final remarks

Digitalization implies challenges to central banks and also provides new tools for them to face the challenges and better fulfill their mandates. With regards to retail payments, the digital era provides a rationale for central banks to have a deeper involvement in the core payment infrastructures. If the current market equilibrium is characterized by fragmented and inefficient payment systems, central bank intervention offering basic payment alternatives may foster innovation and competition by solving the coordination problems that are inherent to markets with large network effects, and by increasing contestability. If the (foreseeable) market equilibrium is characterized by a monopolistic infrastructure under the control of the

private sector, the central bank would provide an alternative payment infrastructure in order to tame the monopoly and to keep control of a reliable backup payment system in case of financial problems. As digitalization progresses, retail payment infrastructures acquire systemic characteristics that justify public intervention in order to maintain their integrity.

Facing challenges and leveraging opportunities may require strategic decision, face new risks and change the traditional objectives and business model of central banking. Minting central bank money in digital form, i.e. Central Bank Digital Currency (CBDC), appears as a potential avenue that is being explored by central banks around the world. Alternative Fast Payment Systems (FPS), which are currently provided by more than 50 central banks, would also serve the same purposes. In this paper different arrangements, design options and experiences are described an assessed. Overall, the design options of a CBDC system are pretty large and may be tailored to better fulfill the requirements in different jurisdictions. The topic is in a state of flux and more research and experimentation is needed in order to make informed strategic decisions. Nevertheless, an approach where the central bank does everything does not seem to be the best option. While central banks should build and keep control of the core components of either a CBDC or a FPS, private sector involvement will be optimal in a tiered architecture where payment services providers compete for customers, innovate and offer overlay services.

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A future-proof retail payments ecosystem for Europe – the Eurosystem's retail payments strategy and the role of instant payments therein

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A FUTURE-PROOF RETAIL PAYMENTS ECOSYSTEM FOR EUROPE – THE EUROSYSTEM'S RETAIL PAYMENTS STRATEGY AND THE ROLE OF INSTANT PAYMENTS THEREIN

Abstract

Electronic retail payments are a vital part of the financial infrastructure, as recent experiences during the coronavirus disease 2019 (COVID-19) have underscored. Already existing upward trends in popularity of e-commerce and contactless payments at the point of sale have increased, possibly with a structural impact. Although significant efforts have been made since the inception of the euro to integrate the European retail payments market, some shortcomings still remain. In particular, the landscape of payment solutions for the point-of-sale and e-commerce remains fragmented. National solutions are not interoperable, resulting in a reliance on global solutions based outside Europe for cross-border transactions. To overcome this fragmentation and strengthen the autonomy of the European retail payments market, the Eurosystem supports market initiatives for retail payments that they fulfil five key objectives: pan-European reach, customer friendliness, cost efficiency, safety and security, European identity and governance, and, in the long-run, global reach. Instant payments are well-suited to form the basis for new European solutions. It is therefore essential for instant payment services to become available to all citizens and businesses across Europe. The Eurosystem therefore promotes the further implementation of instant payments, including in its role as payment system operator, through its TARGET Instant Payment Settlement service.

1 Introduction

Since the outbreak of the coronavirus (COVID-19) pandemic, electronic payments in general and specifically contactless payment methods at the point of sale have surged in popularity across Europe, as reported to the Euro Retail Payments Board (ERPB) in July 2020 [ERPB Secretariat, ECB Directorate-Banknotes (2020)]. Ad-hoc surveys carried out by national central banks (NCBs) show a significant shift from cash to cashless payments: e.g., 43% of German consumers reported a change in their payment habits in shops [see Koch (2020)]. Online and mobile payments generally increased during the COVID-19 crisis, with most NCBs observing double-digit growth rates in terms of number of payments. In addition, e-commerce increased in particular in March, April and May 2020 [see Eurostat (2020)]. In this respect, the pandemic appears to have accelerated an already existing trend towards cashless payments. In 2019, the total number of non-cash payments in the euro area increased by 8.1% to 98.0 billion in 2019 compared with the previous year, with a total value of €162.1 trillion [ECB (2020a)], which may result in a structural increase induced by positive experiences of first-time users and potentially further strengthened by commercial promotions.

These developments underline the need for electronic payment solutions that meet the needs of European consumers and businesses. Technological innovations both enable and increase the social demand for faster, cheaper and more user-friendly payment services that work seamlessly across borders. It is essential for both the industry and central banks to respond to these developments by taking action to ensure the continued availability of safe and efficient payment services, which is vital for fostering public trust in a currency [see e.g. CPMI (2012)]. After all, of all the functions of money, its means of payment function is particularly central to – and visible in – people's daily lives.

These considerations are at the core of the Eurosystem's retail payments strategy, which was relaunched in November 2019 and has its initial focus on point-of-sale and e-commerce payments. Building on past achievements such as the Single Euro Payments Area (SEPA), the Eurosystem has called on the industry to provide a competitive pan-European point-of-sale and e-commerce payment solution that meets the needs of European users and exploits the benefits of the Single Market. The European Central Bank (ECB) supports market-based initiatives that are working towards such a pan-European payment solution, such as the recently announced European Payments Initiative (EPI) [see ECB (2020b)].

Instant payments play an important role within the Eurosystem's retail payments strategy. Relying on previously unavailable instant payments technology could be the key to considerable efficiency gains compared to existing payment solutions. Subsequent cost savings for merchants will eventually also be passed on to consumers, thereby benefitting every European citizen.

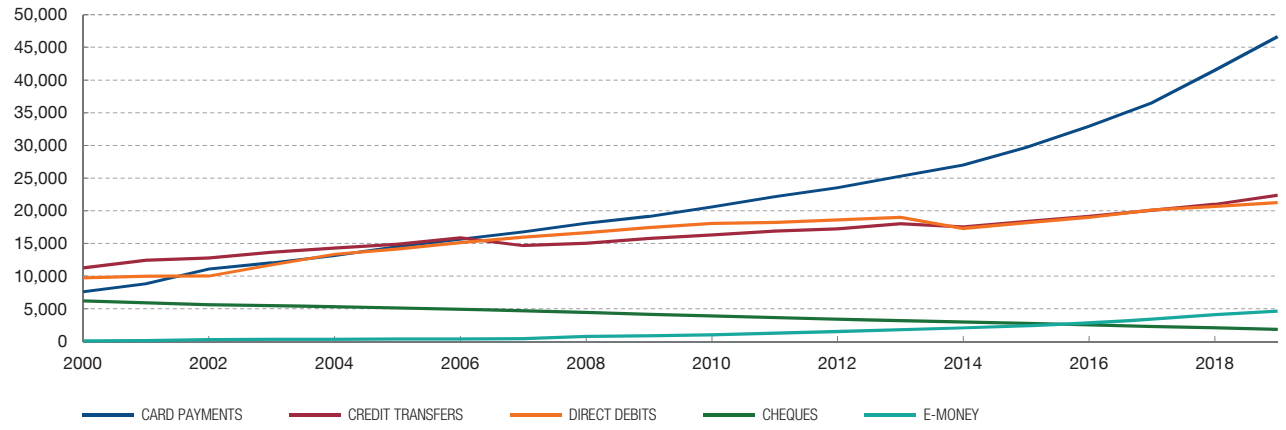
This article discusses the Eurosystem's retail payments strategy (section 2), with a particular focus on instant payments (section 3). It addresses achievements made so far as well as remaining shortcomings, and how these can be overcome. It concludes with an outlook for the European retail payments market of the future (section 4).

2 Eurosystem retail payments strategy

2.1 Current retail payments landscape

The most commonly used retail payment instruments in Europe are cards, credit transfers and direct debits. Cards have been the fastest growing means of payment in Europe for several years now, as can be seen in Chart 1. This trend points towards an increasing importance of electronic payments at the point-of-sale, since this is the main use case for payment cards. Credit transfers (e.g. via online banking or sent in bulk by businesses) and direct debits (mainly used for recurring payments such as utilities) show more modest growth levels.

Chart 1
USE OF THE MAIN PAYMENT SERVICES IN THE EURO AREA



SOURCE: ECB payment statistics.

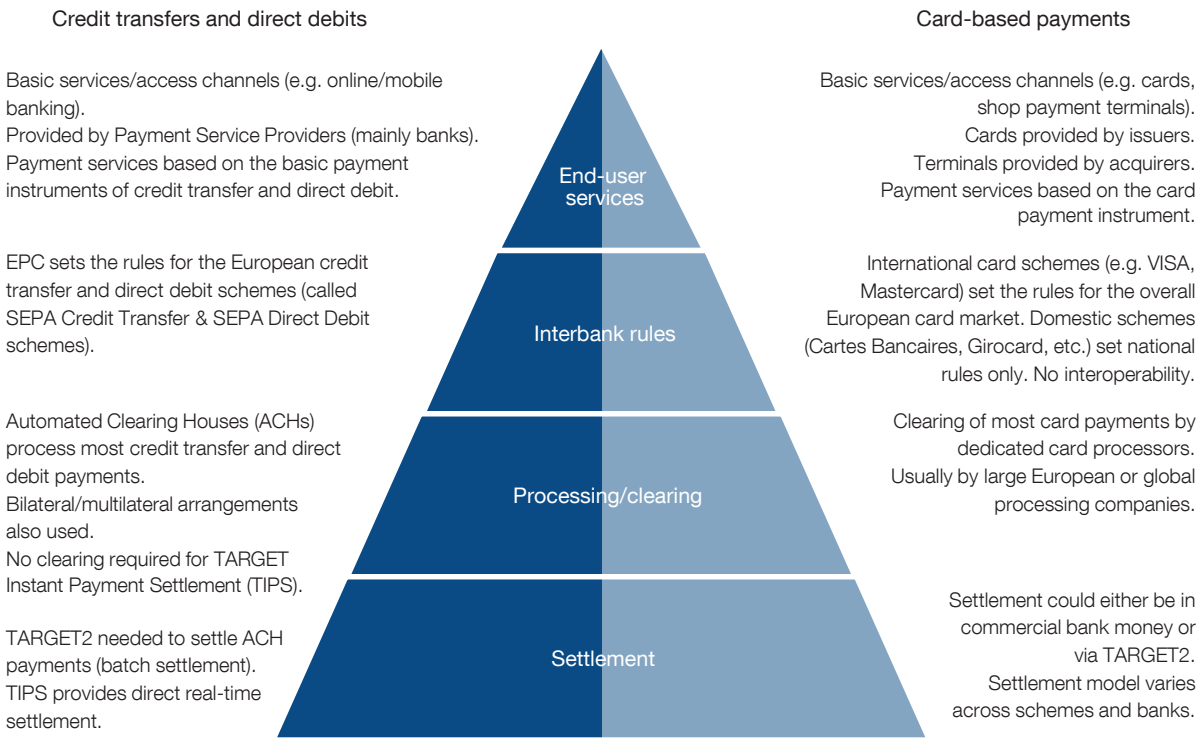
Traditionally, the provision of retail payment services in Europe can be described as a set of layers. Payment services for end-users are provided by several thousand banks and other payment service providers. Transactions between customers of different banks are made possible through on common interbank rules and infrastructures for the processing, clearing and settlement of transactions.[1] At each level, different actors play a role, as set out in figure 1.

Before the euro, each country had its own retail payments "pyramid", or even multiple pyramids. Transactions between pyramids were costly and inefficient. Cross border credit transfers took several days, and cross-border direct debits were impossible. Likewise, people were often unable to pay with their card when travelling in another European Union (EU) country. Significant work has been carried out by the Eurosystem, the European Commission and private stakeholders (e.g. banks, payment schemes, processors) in order to harmonise and integrate these national pyramids. This work is referred to as the migration towards a SEPA, the main milestones of which are set out in figure 2.

The main focus of retail payment integration in the EU has been on credit transfers and direct debits, which now have been standardised. National schemes have been replaced by SEPA Credit Transfers (SCT) and SEPA Direct Debits (SDD), managed by the European Payments Council (EPC). European citizens and businesses can use these payment instruments across Europe under the same conditions as in their country of residence. This has led to a significant increase in the number of cross-

1 Alternatively, in "closed-loop" systems, payments can only be made between the customers of an individual provider.

Figure 1
RETAIL PAYMENTS PYRAMID

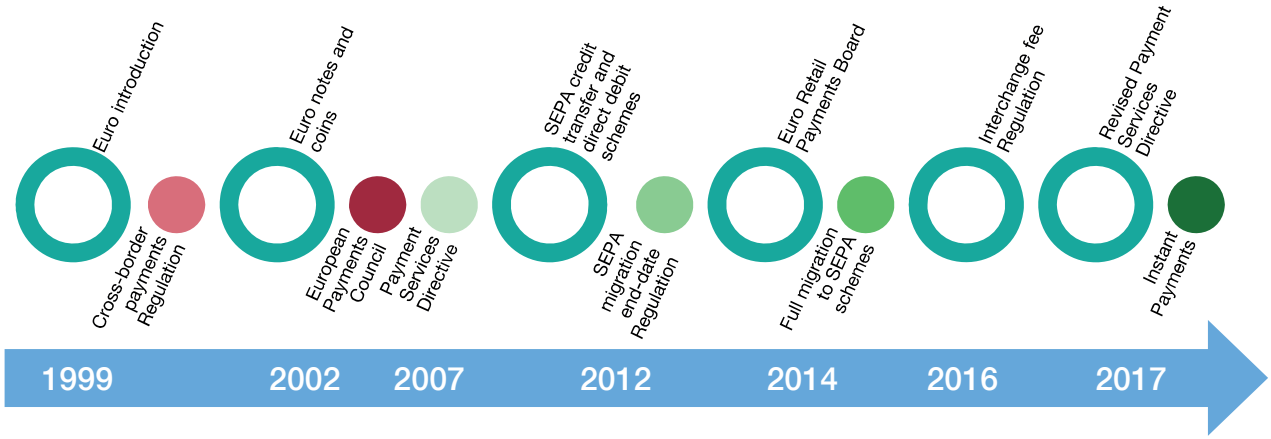


SOURCE: ECB Payment Statistics.
NOTE: A *payment scheme* is a single set of rules for the execution of payment transactions between banks (or other payment service providers) and to a varying extent covering also their end-user services. Card schemes typically include more detailed rules on end-user services than credit transfer and direct debit schemes, due to the need to ensure technical interoperability between the card and the payment terminal and the need to have clarity on users' rights and obligations. A *payment solution* covers at least the end-user services layer, and usually relies on (one or several) more generic schemes for the interbank rules. It is however also possible for a solution to develop its own rules for this layer.

border payments, as reported in ECB (2019a). In 2017 instant payments [more specifically: SEPA instant credit transfers (SCT Inst)] were added to this set of pan-European payment instruments.

For card payments, technical standardisation did take place but a European card scheme was not developed. The remaining national card schemes are not interoperable, and therefore cannot be used cross-border. For this reason, an international card scheme (such as VISA or Mastercard) is needed for paying by card when travelling within Europe. The role of the international schemes has become more and more important, not just for cross-border but also for transactions within national EU jurisdictions. Following their efforts to expand their acceptance beyond their traditional segments (travel and entertainment) they have entered the terrain of the national card schemes. In fact, some banks have concluded it was no longer worthwhile to issue cards with both the national card scheme and the international card scheme. By the end of 2016, international card schemes represented more than two-thirds of transactions made with payment cards issued in the EU [see ECB (2019b)].

Figure 2
REALISATION OF SEPA – TIMELINE OF EU PAYMENT INTEGRATION



SOURCE: ECB.

In e-commerce, too, global companies play an important role. A significant amount of e-commerce payments are done via PayPal or with credit cards (usually of international schemes). In addition, tech giants such as Apple and Google have entered the market with payments solutions for both in-store and mobile commerce payments. These in turn mostly rely on the international card schemes, thereby further strengthening the position of these global companies.

Increasing dependency on global companies may have significant side-effects in the area of governance and sovereignty. Global players may not or cannot fully take the needs of European payment service users on board. Furthermore, it cannot be excluded that geopolitical tensions may negatively affect the smooth functioning of the European payments ecosystem. Moreover, dependency on only a handful of large payment providers may lead to a lack of competition to the detriment of end-users.

In light of this, the Eurosystem considers the absence of a European payment solution for point-of-sale and e-commerce payments a major gap in the European retail payments market.

2.2 Eurosystem objectives

In order to address the shortcomings described in the previous paragraph, the Eurosystem supports market initiatives for payment solutions that fulfil the following objectives:

i) *Pan-European reach and customer experience:* The solution should enable consumers to make payments at the national and EU level under the same

conditions and with a consistent customer experience. Pan-European reachability with wide merchant acceptance is needed in order to drive consumer adoption and trust.

ii) *Convenience and cost-efficiency:* The solution needs to enable an easy, friction-free, user-friendly and superior payment experience for consumers and merchants. It should cater for their needs and characteristics in order to drive wide adoption. The solution should enable the initiation of payments via different tools (e.g. payment cards, mobile phones and wearables), channels and technologies (e.g. near-field communication - NFC) and be offered under cost-efficient conditions.

iii) *Safety and security:* The solution should comply with all relevant legal, regulatory and oversight requirements. It should offer high levels of fraud prevention in line with Strong Customer Authentication under the revised Payment Services Directive (PSD2) and offer consumer protection with robust complaint and refund procedures.

iv) *European brand and governance:* To provide clarity to payers about the possibility of using the solution across Europe, a common European brand should be adopted. This will visually position the European payments market in the global ecosystem. To ensure that the solution fully caters for European needs, a transparent European governance structure should also be adopted. This structure should allow relevant stakeholders to have direct influence in terms of the strategic direction and business model.

v) *Global acceptance (a longer term deliverable):* To meet the needs of end-users, the payment solution should also be usable by EU citizens for transactions to merchants based outside the EU (i.e. to facilitate travel, commerce and tourism). If a European solution would not cater for this, consumers would need to resort to other providers for these payments. Therefore the longer-term objective of global acceptance should be targeted from the beginning.

2.3 Role of instant payments within the retail payments strategy

A new European payment solution should ideally build on the existing achievements of SEPA. This means: using the existing interbank rules and infrastructures where this is possible. Of the SEPA payment instruments, the instant credit transfer is the one that has the greatest potential. In a context where the close-to-real-time delivery of goods and services is increasingly becoming the norm, the need for payment services that match this speed is growing. Instant payments are well suited as the basis for innovative solutions that address this need. Furthermore, they have the potential to be a cost-efficient alternative for merchants, because (in contrast to card payments) there is no

need for a guarantee (given the instant transfer of funds). Instant payments should therefore be a core element in a future pan-European solution.

2.4 Market response to the Eurosystem's strategy

In July 2020, a group of 16 large euro area banks announced an initiative to launch a unified payment solution: the EPI [see EPI (2020)]. The envisaged solution encompasses a payment card and a digital wallet, enabling in-store, online and person-to-person payments as well as cash withdrawals. The aim of the initiative is to replace national schemes for card, online and mobile payments with the new European solution. As it is based on the SCT Inst scheme, it can capitalise on the existing harmonised rules and state-of-the-art infrastructures underpinning the scheme. The launch of the EPI was welcomed by the ECB (2020b) and the European Commission (2020). However, to fully meet the Eurosystem's objectives the EPI "will have to tackle the fragmentation in European retail payments and should encompass all euro area countries, and eventually the entire European Union", as noted by ECB Executive Board member Fabio Panetta [in ECB (2020b)].

3 Instant payments

3.1 Background

Instant payments are electronic retail payment solutions that process payments in real time, 24 hours a day, 365 days a year, where the funds are made available immediately for use by the recipient. There is a global trend towards instant payments: as reported by Bech, Hancock and Zhang (2020), as of March 2020 instant payment systems were live in 55 jurisdictions, and planned in another 10. As discussed by the Committee on Payments and Market Infrastructures (CPMI)[2] [CPMI (2016)], advances in information technology are an important driver behind this trend. They have made cost-efficient real-time processing possible, and also commercially viable thanks to the spread of advanced mobile communication devices. Furthermore, these technological advances have changed end-users' expectations. Instant payments bring payments up to speed with other digital services such as messaging and streaming services, where real-time is the norm.

In many jurisdictions, central banks have played an active role throughout the process of introducing instant payments. In what is called their catalyst role, many central banks have used their influence, knowledge and analytical capabilities to solve coordination issues in their markets, by adding a strategic, long-term perspective and/or fostering the use of common standards [see CPMI (2016)].

2 A committee located at the Bank for International Settlements.

Depending on their specific mandate, central banks may go beyond this and take action as regulator. A key example of this is Hungary, where the central bank introduced legislation to make it mandatory for payment service providers to offer instant payments as a "new normal" [see Kajdi et al. (2019)].

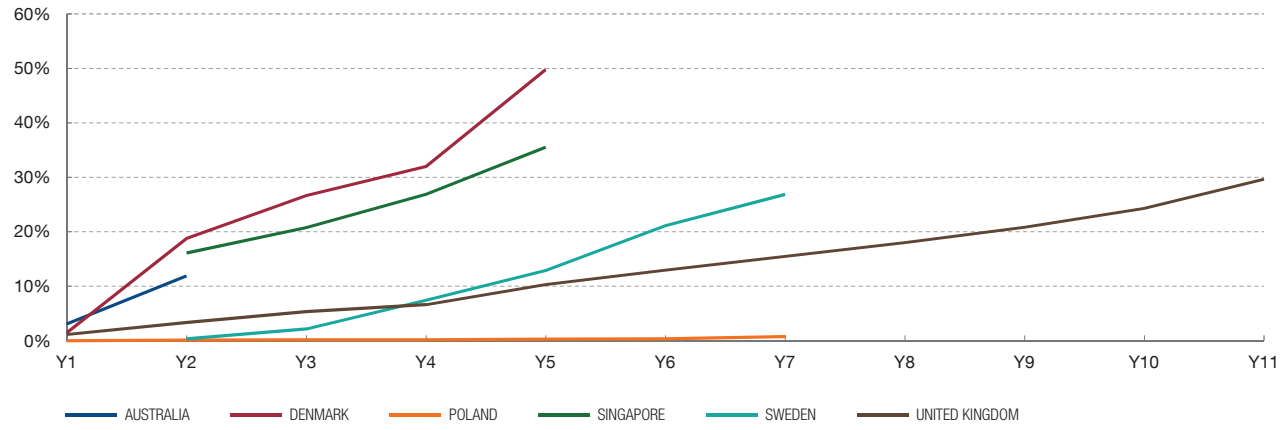
Another way in which central banks support instant payments is in their role as operator of payment systems. As described by the CPMI (2016), some central banks have made changes to their settlement systems to support private instant payment systems, for example by providing instant payment systems operators accounts in which central bank money liquidity can be blocked to guarantee settlement. Other central banks decided to build a 24/7/365 service for instant settlement in central bank money.

Based on the information provided by the CPMI (2016), it appears that at the time the latter approach was fairly rare, although two of the examples provided could be considered to fall into this category (Australia and Mexico). However, in the years thereafter additional central banks decided to follow this approach. A particularly interesting case is Sweden, where the central bank (Sveriges Riksbank) is moving away from its previous approach in which it provided a private operator with an account to back its operations [as described in CPMI (2016)]. The decision to move towards 24/7/365 settlement in central bank money was based on the consideration that "central bank money is the safest way for banks and other financial institutions to make payments" [Sveriges Riksbank (2020)]. Another relevant case is the Federal Reserve, which decided to develop a settlement service for instant payments to "permit banks of every size in every community across the country to provide real-time payments to their customers" [Federal Reserve Board Governor Lael Brainard, in Federal Reserve (2019)].

This example illustrates that when deciding on their approach towards instant payments, central banks take into account not only considerations related to payments, but implications for other central bank tasks: in particular monetary policy and financial stability. For example, there is the risk that instant payments due to their speed could aggravate bank runs. As noted in the European System of Central Banks' response to the European Commission's consultation on a retail payments strategy for the EU [European Commission (2020)], mechanisms to stop the payment process in the case of a bank run or other severe problem need to be in place. The CPMI (2016) furthermore notes that for financial stability, risk management in instant payment systems is essential, in particular if an instant payment system becomes systemically important. Moreover, a potential migration of high value transactions from central bank's settlement systems to private instant payment systems could raise financial stability concerns. However, instant payments could also have a positive effect on financial stability, since the possibility for banks to make urgent payments 24/7/365 could enable them to manage operational or financial risks outside business hours. As for monetary policy concerns, the CPMI notes that central banks need to consider how to handle balances held in instant payment systems with

Chart 2

INSTANT PAYMENTS AS A SHARE OF ALL CREDIT TRANSFERS



SOURCES: ECB payments statistics, BIS Committee on Payments and Market Infrastructures, Reserve Bank of Australia, Narodowy Bank Polski, Monetary Authority of Singapore, Faster Payments.
NOTES: Data up to 2018; Singapore: share of credit transfers and direct debits; United Kingdom: instant payments defined as Single Immediate Payments only.

respect to reserve requirements. Also, the demand for or supply of the balances that depository institutions place with their central banks may be affected, which could have implications for monetary policy implementation. Such broader considerations may affect the choices central banks make on how to support instant payments.

In some countries, instant payments have quickly become a widely used payment instrument, whereas in others usage has grown more slowly, as can be seen in Chart 2.

These different levels of uptake may be explained by several factors, as discussed in Hartmann et al. (2019). Some of these are external to the instant payment service, such as end-user access to telecommunications and payment infrastructures and the existing payment behaviour within a country. Countries with a rapid uptake of instant payments tend to be highly digitalised, including high usage of electronic payments (e.g. high usage of card payments as compared to cash). Other determining factors are characteristics of the instant payment service itself, i.e. reach of the service, fees charged to end-users and usability for various use cases, such as person-to-person, point-of-sale or corporate payments.

As for reach, an interesting example is the United Kingdom, where the initial uptake of Faster Payments was lower than expected [see VocaLink and PriceWaterhouseCoopers (2009)]. Usage really too off only after a change in legislation made participation in Faster Payments de facto mandatory for all banks [as noted in CPMI (2016)]. In Sweden[3]

3 Swish, the Swedish instant payment solution, was launched by a cooperation of six of the largest banks in Sweden, as reported on Swish's website (n.d.a).

and Denmark[4], by contrast, the reach of their respective instant payment services was elevated from the start. In both of these countries, uptake of these services was fast, and high levels of usage were reached much faster than in United Kingdom.

With respect to fees, in countries with high levels of instant payments usage, such as the three mentioned above [see Jacob and Wells (2011); MobilePay (n.d.), Swish (n.d.b)] as well as Singapore [see Menon (2016)], instant payments are typically free for consumers. A contrasting example is Poland, where fees for instant payments are typically considerably higher than those for traditional credit transfers [see Narodowy Bank Polski (2015)]. This 'instant payments as a premium service' approach has led to much lower transaction volumes. Relatedly, there are cases where instant payments are not just priced at the same level as traditional credit transfers, but positioned as their replacement. For example, in the United Kingdom, Faster Payments has become the norm for online banking [see Faster Payments (2018)]. Likewise, many banks in Australia are re-routing transactions to the new instant payment system (New Payments Platform) without customers being aware of it [see Fitzgerald and Rush (2020)]. This has likely contributed to the fast initial uptake of instant payments in that country.

Finally, it appears that the wide availability of a payment solution enabling instant payments via mobile devices has contributed to the success of instant payments in several countries. Key examples include Sweden [see Sveriges Riksbank (2019)] and Denmark [see Danish Payments Council (2019)]. Such solutions make it more convenient to make instant payments to other individuals and/or to merchants, depending on their specific features. They also make instant payments easier to promote thanks to their clear branding. As for usability for payments by businesses, this depends on the extent to which banks make instant payments available via corporate channels, as well as on the maximum transaction amount for an instant payment. In both the United Kingdom and Singapore, these maximum amounts have been raised over time in response to increasing demand [see Faster Payments (2015); ABS (2015, 2018)].

3.2 Instant payments in euro

3.2.1 History and set-up

The Eurosystem has been a strong supporter of instant payments in euro since 2014, when it brought the topic to the attention of the ERPB. The ERPB, which brings together high-level representatives of the demand and supply side of the euro retail

4 The Danish instant payment system, the Straksclearing, started with 46 direct and 43 indirect participants, as compared to 51 direct and 43 indirect participants in the other Danish retail payment systems, as reported by Danmarks Nationalbank (2015).

payments market to foster the integration, innovation and competitiveness of euro retail payments in the EU, recognised the need for a more innovative payment instrument with pan-European reach. Following the migration to the SCT and SDD schemes, the Eurosystem and the ERPB sought to prevent renewed fragmentation in the euro retail payments market through the introduction of non-interoperable instant payment solutions. The ERPB therefore invited the EPC to design a scheme for instant payments in the SEPA countries: the SCT Inst scheme.

The SCT Inst scheme required infrastructures capable of processing transactions in real-time and on a 24/7/365 basis. Several Automated Clearing House (ACHs) developed such infrastructures. Transactions processed in the instant payment systems of the ACHs are backed by a pool of funds held in Second-generation Trans-European Automated Real-time Gross settlement Express Transfer system (TARGET2). The Eurosystem implemented enhancements in TARGET2 to support this. The Eurosystem also developed its instant payment system, TARGET Instant Payment Settlement (TIPS), which settles SCT Inst transactions immediately in central bank money. The Eurosystem's approach towards instant payments in its operator role has therefore been twofold: both providing private operators with central bank accounts to back their operations and providing an instant, 24/7/365 settlement service in central bank money.

By providing TIPS, the Eurosystem aimed to ensure the availability of a pan-European instant payment system accessible to all market players. To this end, it implemented a flexible participation structure enabling direct participation as well as the possibility to become reachable without having a TIPS account, settling using the account of a TIPS participant. It also provided the possibility to send instructions to TIPS via a third party such as an ACH (called an instructing party within the TIPS context), as an alternative to interacting directly with TIPS. Furthermore, it implemented a pricing policy based on equality, transparency and non-discrimination. It was decided not to charge fees for opening and maintaining accounts, nor for receiving or reporting, but only for sending transactions (set at € 0.002 per transaction for the first two years of operation) [see Bayle de Jessé (2018)]. Such a pricing model makes TIPS accessible also for parties with low transaction volumes, for which fixed fees may be a barrier.

The Eurosystem's approach thus shows that the key considerations behind the Federal Reserve's and the Riksbank's decisions to provide instant payment settlement services also played a key role: enabling settlement in central bank money and facilitating the provision of instant payment services by all relevant market participants.

3.2.2 Current status

As of 11 September 2020, 2254 payment service providerss participate in the SCT Inst scheme, i.e. 56% of SCT scheme participants. Although there are SCT Inst

participants in 22 SEPA countries, the vast majority are located in the euro area [see European Payments Council (n.d.)].

The usage of instant payments in the euro area is increasing, but still relatively low. As of June 2020, 7% of credit transfers in the euro area are instant, according to ECB estimates [based on data provided by Eurosystem NCBs; see ECB (2020c)]. The potential level of usage is likely to be considerably higher. The conditions for instant payments in the euro area generally favourable, as discussed by Hartmann et al. (2019). The infrastructure needed to support the use of instant payments is quite widely available. A large majority of the population uses the internet and many of them access the internet via mobile devices [see Eurostat (2019)]. Moreover, the EU's Digital Single Market strategy [see European Commission (n.d.)] includes initiatives to improve internet access and connectivity, which should improve the situation in those countries that are still lagging behind.

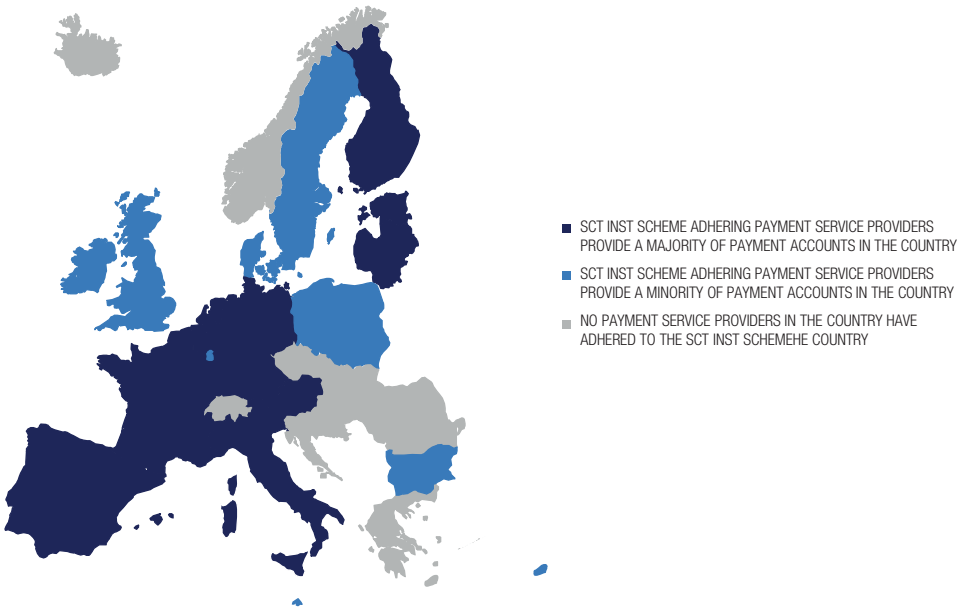
Instant payments do not seem to have reached their full potential in the euro area. Several underlying factors may explain this.

First of all, the availability of instant payment services to end-users differs between countries. For instant payments to become one of the major payment instruments, they need to be available to all consumers and businesses, regardless of where they hold their payment account. In many countries payment service providers made considerable progress towards this, often working together to ensure wide reach. Examples of such cooperative efforts include Spain [see Langa (2018)], Belgium [see De Lepeleire (2019)] and the Netherlands [see Van Dijk and Mallekoote (2019)]. However, according to EPC data, in a number of euro area countries instant payments can be sent from or received on only a minority of payment accounts, or even none at all (see figure 3).

Secondly, within the euro area, business models for instant payments differ between countries and between individual banks. Although statistics per country are not currently available, anecdotal evidence points towards vastly differing levels of usage, with higher usage being linked to lower fees. Particularly high levels of usage have been reported in countries where banks have taken the 'instant by default' approach, for example in the Netherlands [see Van Dijk and Mallekoote (2019)] and in Estonia [see Estonian Retail Payments Forum (2019); Soosalu (2020)].

Thirdly, convenient end-user solutions are not yet widely available in all euro area countries. The importance of this can be seen by looking at the example of Spain, where the mobile payment solution Bizum has quickly become popular [see Rodríguez Ferrer (2020)]. Around Europe, many end-user solutions have either recently been used or are being planned, as can for example been seen in a recent stocktake by the ERPB Working Group on a framework for instant payments at the point-of-interaction (2020). In this stocktake, 43 existing or planned instant payment

Figure 3
SCT INST SCHEME ADHERENCE LEVELS IN THE SEPA COUNTRIES



SOURCE: ECB.

solutions for the point-of-sale and/or e-commerce were reported. The implementation of these solutions is expected to contribute to the usability of instant payments by consumers. Usability of instant payments for businesses was initially limited due to the maximum transaction amount of €15,000. This amount has been increased to € 100,000 in July 2020, which should facilitate higher usage by businesses [see EPC (2020)].

Evidently, that there is still considerable room for growth in instant payments in the euro area. There is, however, another factor to take into account. For instant payments to become one of the main European payment instruments, and the basis for new European payment solutions, they have to work across Europe. Currently, this is not always the case. This is because there is a lack of interoperability in the bottom layers of the retail payments pyramid: the clearing and settlement layers. For this reason, many banks have chosen to join – directly or indirectly – more than one instant payment system. However, even those that have done so cannot necessarily reach all other banks, because this depends on those other banks' choice of infrastructures. Moreover, participation in several instant payment systems means that banks have to split their liquidity. Each of the systems requires banks to prefund their payment capacity within the system, and funds can only be moved from one system to another within the opening hours of TARGET2 [see also Bindseil and Terol (2020)].

There is also fragmentation at the top of the pyramid. This is not just because there are many existing and planned end-user solutions: that in itself could be a sign of healthy competition. The issue is rather that these solutions are not interoperable with each other. Since many of these have a limited geographical scope (as reported in the above mentioned ERPB working group interim report), a continued lack of interoperability could lead to a situation similar to that of the national card schemes. These solutions may become successful at national level, but for cross-border payments reliance on global companies would remain.

3.2.3 Ongoing developments

It is clear that there are still efforts to be made by all parties in the instant payments pyramid for this new payment instrument to achieve its full potential. Many of these efforts are already underway.

Central banks of the Eurosystem continue to act as catalysts to increase the reach of the scheme, if not to all banks then at least to a level that ensures that all European consumers and businesses can use instant payments. Should market forces not be sufficient to achieve this, there may be a need to consider a mandatory end-date (as noted by the European Forum for Innovation in Payments – co-chaired by the ECB and the European Commission – in its November 2019 statement).

Also in its catalyst role, the Eurosystem promotes the implementation of end-user solutions with pan-European reach. To this end it seeks to overcome fragmentation, on the one hand by promoting standardisation and interoperability and on the other hand by supporting initiatives for pan-European end-user solutions. The ERPB is the Eurosystem's primary channel for the promotion of standardisation and interoperability. ERPB work is currently underway on an interoperability framework between solutions for instant payments at the point-of-sale and in e-commerce. Other standardisation and interoperability initiatives can also make an important contribution to overcoming fragmentation. Among those, the upcoming SEPA Request-to-Pay scheme (developed by the EPC) is particularly notable. It will enable both individuals and businesses to request a payment, including all the details needed for the intended payer to initiate the transaction [for further details see Jacquelin (2020)]. As for pan-European end-user solutions, supporting these is the core of the Eurosystem's retail payments strategy. The ECB has publicly welcomed the EPI as a market response to the Eurosystem's retail payments strategy, and will continue to monitor the initiative to foster further alignment with the Eurosystem's objectives.

The Eurosystem is also taking action to overcome the fragmentation in the clearing and settlement layer. In July 2020 it announced changes in TIPS that should ensure pan-European reach of euro instant payments. Firstly, all payment service providers which have adhered to the SCT Inst scheme and are reachable in TARGET2 should

also become reachable in a TIPS central bank money liquidity account. Secondly, all ACHs that offer instant payment services should migrate their accounts from TARGET2 to TIPS. This will enable each SCT Inst scheme participant to reach all others, without depending on the actions of other payment service providers or ACHs. In addition, all ACHs will be able to offer pan-European reach to their customers, without the need bilateral agreements to establish links, and there would be no potential credit exposure for cross-ACH transactions. Furthermore, liquidity traps can be prevented, since ACHs' accounts will be funded from TIPS rather than TARGET2. This facilitates moving liquidity from one ACH to another without the current limitations posed by the opening hours of TARGET2 [see ECB (2020c)]. With this new set-up, the Eurosystem will continue to offer choice. Banks can choose to send their payment instructions to an ACH or directly to TIPS. If they send them to an ACH, they can choose to have them settled in TIPS one-by-one, or for the ACH to provide finality in its books backed by funds held in the ACH's TIPS account [see Bindseil and Terol (2020)].

4 Concluding remarks: future outlook for the European retail payments market

As businesses and public authorities are currently thinking of how to shape the new normal in a post-COVID-19 world, it is essential to ensure that retail payment services can meet the changing demands. There may be a continued higher use of e-commerce or of mobile devices to initiate payments. Authorities may wish to enable faster pay-outs of e.g relief payments to households and businesses in emergency situations, as also noted by Federal Reserve Governor Lael Brainard in an August 2020 speech. Whatever these future demands will be concretely, it is clear that changing demands ask for innovation to ensure that payment services can be integrated smoothly into new business and private sector processes. Instant payments form a good basis for innovative payment solutions that enhance efficiency and user convenience. Furthermore, European governance is required to ensure that the needs of European stakeholders are met. Therefore, the successful implementation of the above mentioned initiatives for further development and implementation of instant payment services, standardisation, interoperability and pan-European payment solutions has the potential to be a real game-changer for the European retail payments market. Payment services in Europe would increasingly be based on instant payments, aligning the speed of retail payments with that of other digital services. Retail payment services would support real-time processes in digital services, e-commerce, physical commerce, industry, logistics and beyond. European citizens and businesses would no longer be faced with barriers preventing them from using their familiar (national) payment solutions for transactions to other EU countries. Instead they would be able to use the same European solution across the EU. Rather than continued fragmentation along national lines and increasing reliance on a few global companies, Europe would have its own payment solution that would be able to compete with global solutions, supporting our Single Market and single currency. The SEPA would be completed.

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Incorporating sustainability factors into asset management

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Abstract

This article analyses the reasons why an investor might be interested in investing in a sustainable asset. First, we observe that the rate of return required in the market is lower than that of other assets lacking the green label. This is shown to be the case even for assets with the same level of risk. Accordingly, it does not seem as though it can be attributed to climate-change risks being priced in by the market. However, the investor base for sustainable assets is shown to differ from that for conventional assets. It can therefore be argued that investors in these assets use a type of optimisation in which they incorporate a third factor (sustainability), in addition to minimising risk and maximising return, into the selection of their investment portfolios. Lastly, this article explores the various strategies that investors might adopt to incorporate the sustainability factor into their asset portfolios.

1 Introduction

The commitments to reduce greenhouse gas emissions under the Paris Agreement will require sizeable investments. The agreement itself establishes the need to mobilise the funding required to achieve the transition to a more sustainable economy [Marqués and Romo (2018)]. Indeed, the European Commission estimates that to cover the sustainable investment needs that the European Union would be required to make under the European Green Deal Investment Plan, €1 trillion would need to be mobilised over the next decade. To this figure we must add the financing needs in other economic areas.

To steer funds towards initiatives related to mitigation and the transition to a sustainable economy, financial markets commenced the transition via a solution involving the issuance of green bonds.[1] This is an increasingly relevant market segment that is undergoing exponential growth (see Chart 1). In 2009, issuance was less than $1 billion, whereas in 2019 alone it totalled $200 billion. The currency distribution is similar to that of conventional bonds. This shows that this market has a broad geographical distribution and is not exclusive to a single region.

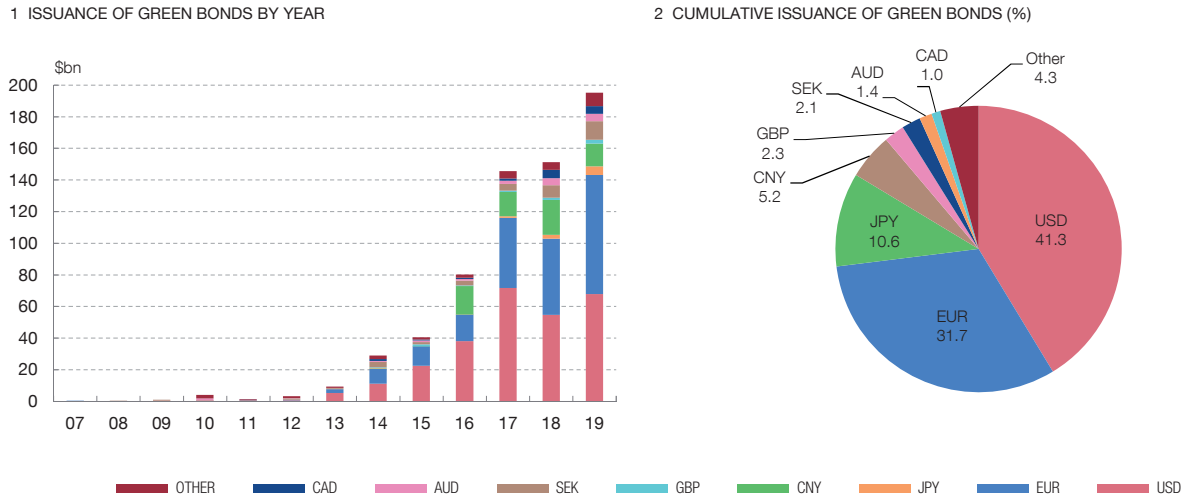
The increase in the supply of green assets has been accompanied by rising demand from investors, so much so that the yield required by the market on these assets can

1 A green bond is one whose funds are earmarked for financing projects that are directly related to sustainability, the preservation of natural resources and the transition to a low-carbon economy [González and Núñez (2019)]. The principles that a bond must satisfy to be considered green include: the identification of the activity to be financed; the quantification of the environmental impact; periodic reporting on the use of the funds; and certification by an external assessor of attainment of the goals set for the issuance.

Chart 1

GREEN BONDS ISSUED BETWEEN 2007 AND 2019 BY CURRENCY OF ISSUANCE (a)

Issuance of green bonds has grown exponentially.



SOURCE: Climate Bonds Initiative.

a To make the issues comparable, the volumes issued were translated using the average US dollar exchange rate for each year.

be lower than that sought on other similar assets lacking an explicit and pre-specified "green" use. This yield spread in favour of green bonds is referred to as a green premium or "greenium".

Some previous studies have estimated this greenium. For instance, Fatica et al. (2019) analyse 268,083 issues, 1,131 of which are green. The paper finds that no premium exists for bonds issued by financial institutions, while a negative premium (lower yield on green bonds than on conventional ones) does exist in the case of those issued by non-financial corporations and by supranational institutions especially. The findings of Larcker and Watts (2020), for a sample of 2,896 green bonds issued between June 2013 and July 2018, and Hachenberg and Schiereck (2018), for a limited sample of 63 bonds, are somewhat similar. Conversely, the findings of Karpf and Mandel (2017) point to a small positive premium (higher yield on green bonds than on conventional ones) in the US municipal bond market. Bachelet et al. (2019) propose an explanation for this discrepancy. Upon analysing 89 bonds from institutional and corporate issuers, the authors found that for (small) private issuers there is a positive yield spread for green versus conventional bonds. They attribute this to their lower liquidity. This reasoning is reinforced because, conversely, for institutional issuers, which have higher liquidity, the spread is negative (around 2 bp). Ehlers and Packer (2017), comparing bonds from the same issuer, calculate a greenium ranging from 10 bp on AAA bonds to 40 bp for BBB bonds. Baker et al. (2018) estimate that in the case of US municipal bonds, green bonds have

yields 26 bp lower than conventional ones. Lastly, Zerbib (2019) estimates a slightly negative premium of –2 bp on average for green bonds versus equivalent conventional ones for the entire sample (between 2013 and 2017). This was corroborated when analysing the euro and US dollar portfolios separately.

First, this article aims to identify whether the greenium referred to in the literature exists (Section 2). To do so, green and conventional bonds issued by the same institution – and, therefore, free of credit risk – and equities are analysed. Upon confirming its existence (and its upward path), we are faced with the mystery of why this potential inconsistency in the market exists. It could only be explained by either a different risk level or by the existence of a sustainability factor incorporated by the investors in addition to yield and risk (Section 3). Section 4 explores the possibility of whether sustainability is including risk factors. However, we confirm that there is scant connection between the two. This leads us to favour the sustainability factor option. Section 5 explores, from a theoretical standpoint, how this third dimension in the selection of investment portfolios may explain the existence of a negative greenium, and how the various sustainable investment strategies tally with the aforementioned theoretical approach.

2 The emergence of a greenium in the financial markets

Broadly speaking, financial assets are deemed to have different yields if their risk levels change. For instance, in the case of fixed-income securities, the differences may be due to varying credit risk, because of the issuer or because of the creditor's priority in the ranking of claims (senior debt versus subordinated debt), or additional collateral items (such as covered bonds). Among bonds with the same credit risk (same issuer, priority in the ranking of claims and collateral items), yield spreads may arise due to their different duration, which implies a different sensitivity to interest rate fluctuations. Controlling for all of these aspects is necessary if we want to estimate a greenium.

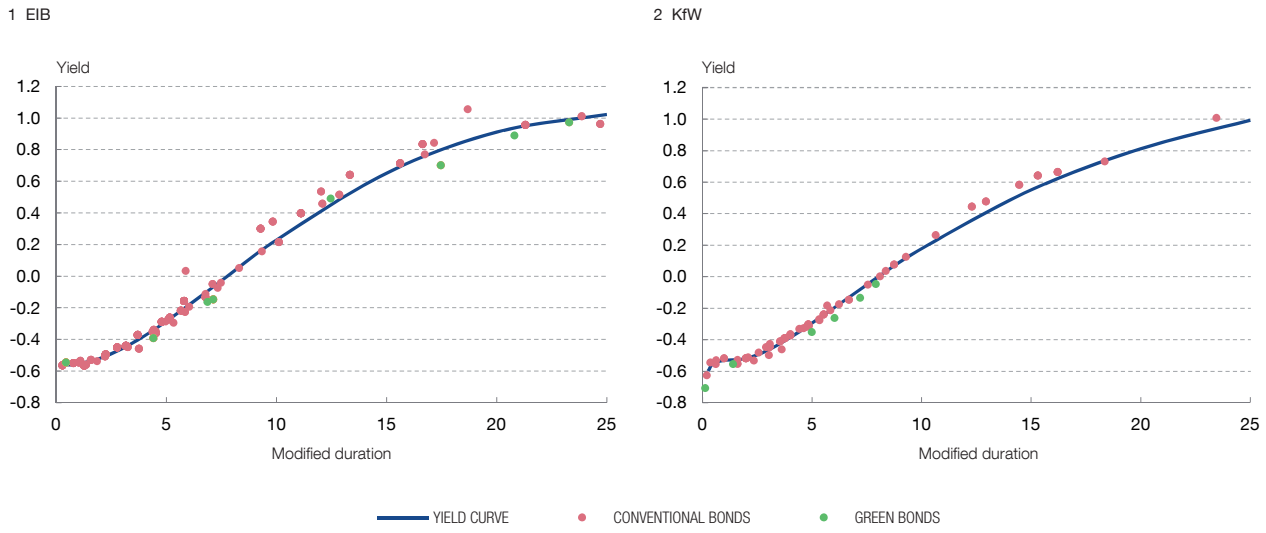
To estimate a greenium as accurately as possible, we have focused on two particular issuers, which have regularly issued green bonds for a longer period: the European Investment Bank (EIB) and Kreditanstalt für Wiederaufbau (KfW) (see Chart 2). This enables us to rule out differences due to different levels of credit risk, since all the bonds considered have the same credit risk level (they are all senior debt, from the same issuer and without additional collateral items). To control for duration risk, we only used fixed-rate bonds and estimated the yield curve for each specific day,[2] using these issuers' (KfW and EIB) conventional bonds lacking the "green label", and compared the theoretical yield that, based on this curve, each green bond would have with the yield actually observed in the market for those green bonds. By comparing bonds with the same level of credit and duration risk, the spreads can

2 Using the Svensson model for the term structure of interest rates.

Chart 2

YIELD CURVE OF BONDS ISSUED BY THE EIB AND KfW (a)

The market demands a lower yield on green bonds than on other bonds, even when they are issued by the same issuer and have the same risk level.



SOURCE: Own calculations.

a Market prices on 31 May 2019.

only be considered to be greeniums. For instance, Chart 2 shows how to obtain this greenium on a specific day (31 May 2019). In this case, Chart 2 shows the yield of the various fixed-rate bonds denominated in euro issued by KfW and EIB based on their duration (conventional bonds in brown and green bonds in green). Using the estimated curve as a reference, we can see that for green bonds in the 4 to 8 year tranche, the (negative) greenium is between 6 and 8 bp for EIB and KfW, respectively.

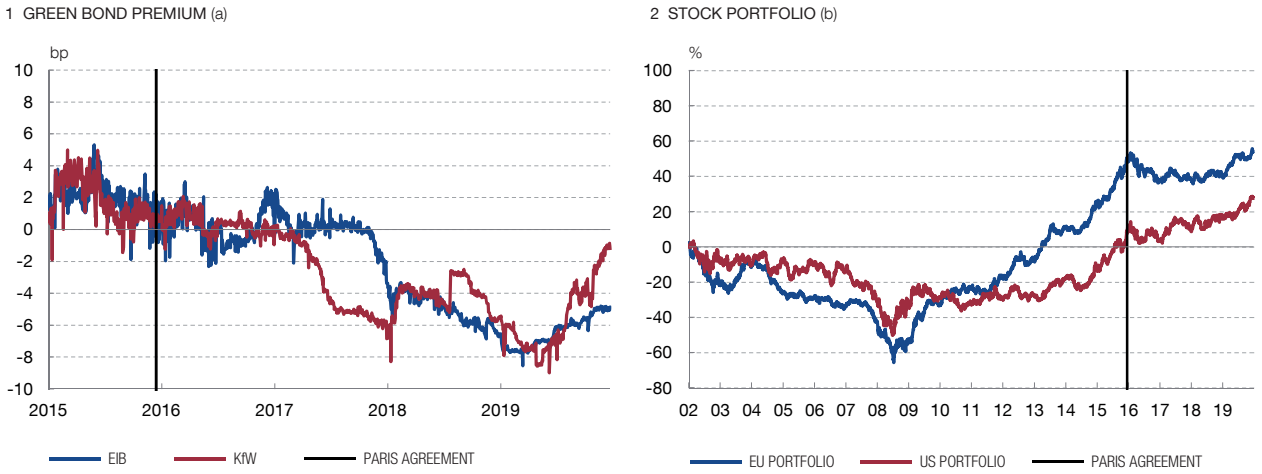
By replicating this analysis daily (from January 2015 to December 2019), it is possible to obtain the trend in the greenium, as shown in Chart 3.1, for both the EIB and KfW. At the start of the period analysed (2015-2016), we observe that there is no greenium or, where there is, it appears to be positive. This finding would be consistent with Bachelet et al. (2019) concerning the lower liquidity of green bonds, which could result in them having a positive premium. Yet following the adoption of the Paris Agreement, and as issuance of and appetite for green bonds have increased, penalties due to the lack of liquidity have ceased to be relevant. Conversely, throughout 2017 (for KfW) and 2018 (for the EIB) the premiums began to be negative (in favour of green bonds versus conventional bonds) reaching 8 bp in 2019 H1. However, they diminished in 2019 H2.

The findings are not confined to the bond market. Although the possibility of isolating the greenium from other factors is especially viable with bonds where we have

Chart 3

YIELD SPREADS BETWEEN GREEN AND CONVENTIONAL ASSETS IN THE FIXED INCOME (CHART 3.1) AND EQUITY (CHART 3.2) MARKETS

Investors require lower yields on greener assets in both the fixed income and equity markets.



SOURCE: Banco de España.

a The premium is calculated as the average of the spreads between the yield of the green bonds and the yield they should have based on the yield curve estimated using conventional bonds.
b The cumulative yield is calculated on the basis of a portfolio with a long position in the 10% of the assets with the smallest carbon footprint (excluding financial assets), financed via a short position in the 10% of the assets with the largest carbon footprint.

multiple assets from the same issuer, it is also possible to perform a somewhat less accurate analysis with shares. For instance, in the equity market we also observe different behaviour across greener or browner assets. To make this comparison, we used non-financial corporations on the Standard & Poor's 500 and broad EURO STOXX indices. We then organised these firms on the basis of their carbon footprint (standardised by their respective value-added) and, for each jurisdiction, we created a portfolio with a long position in the 10% of firms with the smallest carbon footprint (equal-weighted), financed with a short position in the 10% of firms with the largest carbon footprint (also equal-weighted). By having a long and short position, we are controlling for the market factors affecting all the firms equally. Therefore, the portfolio's yield should be guided by the factor differentiating the long and short positions, i.e. their carbon footprint. The outcome of this investment strategy is presented in Chart 3.2. This shows that until 2008 this strategy was clearly negative (i.e. the firms with the largest carbon footprint performed better on the stock market than those with the smallest carbon footprint).[3] However, this changes between 2009 and 2016, with a clear advantage for the firms with the smallest carbon footprint, particularly for the European portfolio. This difference in performance has held in

3 This finding is consistent with Delgado (2019). In this case, the NPL ratio of the industries with the largest carbon footprint was lower than that of the whole economy. This difference is attributed to the fact that they are more mature industries with fewer historical risks in which climate change is not a factor. However, were we to consider the future climate risks, the outlook changes. This would be where the balance of risks would shift.

Europe and increased in the United States in recent years. Hence, the markets can be deemed to also be demanding a lower return on the shares in greener corporations. This would once again be a greenium in the equity market.[4]

3 Theoretical justification for the existence of a greenium

The presence of a greenium may be viewed as paradoxical. If there were no difference in risk between a conventional asset and a green asset (as is the case with green and conventional bonds issued by the same issuer),[5] we would be in a situation such as that reflected in Chart 4.1. The assets that are on the efficient frontier are those that offer the highest return for a given risk level. Under this framework, the existence of a negative greenium means that, for the same risk level, green assets offer a lower expected return than other conventional alternatives. Thus, green bonds would be less attractive than conventional bonds and demand for them should be lower. For a rational investor seeking to optimise profitability versus risk, there is no incentive for investing in green assets.[6]

A possible explanation to this paradox is that the markets are considering that conventional bonds are riskier than green bonds (thus explaining the existence of a greenium). This would mean that Chart 4.1 is incorrect because, in reality, the efficient frontier would be shifted to the right for conventional bonds, as the risk would be higher than customary metrics would imply (see Chart 4.2). In this situation, the green bonds would be above the frontier, since investors would be incorporating climate risks into their investment decisions, despite these decisions not being included in the customary metrics. In this situation greenium estimates do not reflect a greater preference for green bonds, but rather the incorrect valuation of conventional bonds' climate risks.

This explanation may be valid for bonds issued by different issuers that are exposed to different climate risk levels. However, it is more difficult to justify when the difference is found between green and conventional bonds issued by the same issuer, since they have the same risk level (money is fungible and they have the same payment priority as the rest of the issuer's senior debt); therefore, the greenium cannot be attributed to a different risk level. The only alternative in this case is to consider that in seeking to optimise their portfolios, investors not only take into account return and risk factors, but they increasingly take into account a third factor we could call sustainability (see Chart 5).

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4 Unlike with the green bonds, in the exercise with the equity portfolios we did not control for the long and short positions' potentially different risk levels.

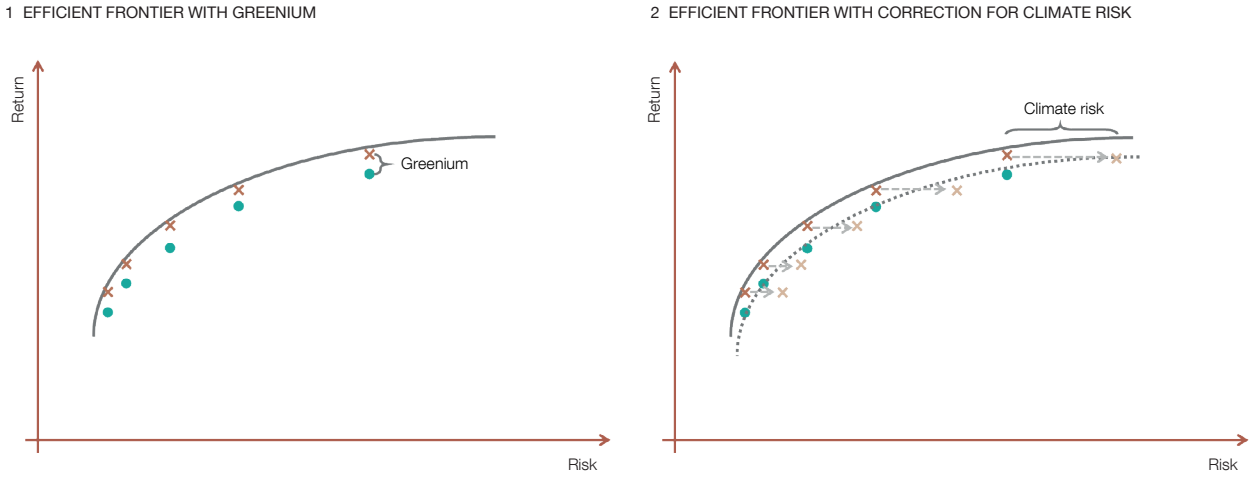
5 The greenium obtained can be understood to have a lower value, since we are comparing a single issuer's issues, with the same risk. If we were to look at different firms, the difference in profitability would be even higher [see Marqués and Romo (2018)].

6 By contrast, if there were no greenium, issuers would lack incentives for their issuance as such (particularly if it is borne in mind that green bond certification and subsequent verification entails additional costs for the issuer). However, what is observed is that this market is growing.

Chart 4

EFFICIENT FRONTIER FOR GREEN AND CONVENTIONAL BONDS

There are alternative explanations for the differences between green and conventional bond returns.

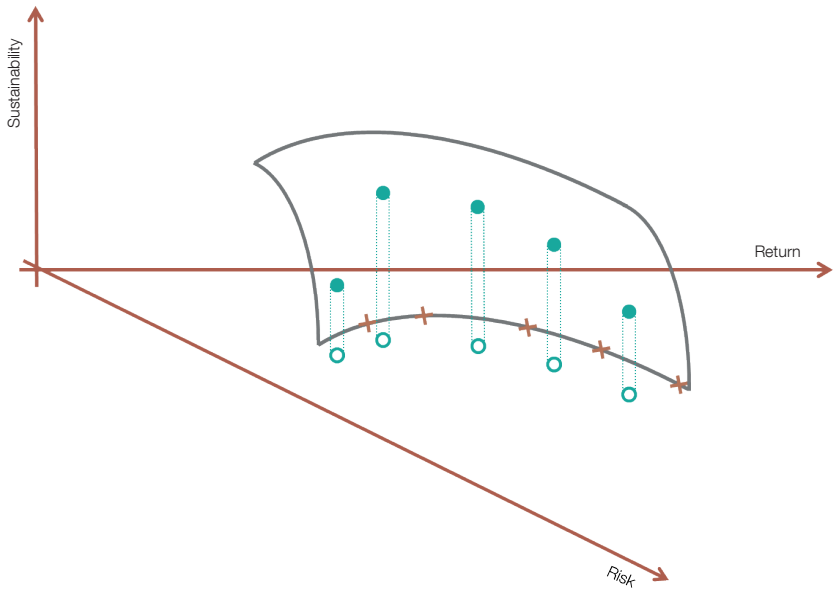


SOURCE: Own data.

Chart 5

EFFICIENT FRONTIER FOR GREEN AND CONVENTIONAL BONDS

There are alternative explanations for the differences between green and conventional bond returns.



SOURCE: Own data.

Under the theoretical framework of Chart 5, we move from portfolio optimisation according to risk-return criteria to optimisation based on three criteria (return-risk-sustainability). The efficient frontier would now have three dimensions (with sustainability being the third axis). Conventional bonds would be on the risk-return efficient frontier if the sustainability factor was zero (the same as in Chart 4.1). However, for higher sustainability values, the efficient frontier would shift to the right (the same as in Chart 4.2). The greenium would thus be the result of the projection of the return-risk-sustainability efficiency area on the risk-return plane.

In the next two sections we will explore the implications of the two alternatives proposed (different risk level, preference for sustainability).

4 Climate risk

Climate change can be considered as a source of financial risk [NGFS (2019a)], insofar as the materialisation of some of the most adverse scenarios would result in losses in the value of physical and financial assets. However, climate risks differ from other traditional financial risks in certain essential aspects. First, they can be considered to have a greater scope and magnitude than the usual risks (market, credit and operational). This is because the effects of climate risks are widespread across multiple agents and firms and in most cases they are irreversible once a specific threshold is reached. Second, as this is an unprecedented situation, past data provide scant information about performance under the different scenarios. In addition, these scenarios are contingent upon public decisions and policies adopted and implemented now or in the immediate future. Therefore, although it is a predictable risk, it subject to a high level of uncertainty.

The literature on risks associated with climate change has traditionally classified these risks into two large categories: physical and transition risks.

Physical risks arise from climate-related events and from changes in the equilibrium of ecosystems. These risks include the probability of incurring financial losses resulting from the growing severity and frequency of extreme meteorological phenomena (such as heat waves, landslides, flooding, forest fires and storms) and progressive long-term climate change (such as changes in precipitation, extreme climate variability, ocean acidification, and rising sea levels and average temperatures). Not all sectors are equally exposed to these risks, just like the geographical location of economic activity affects exposure to physical risks. However, the variable that does not need to be related to physical risk is the amount of greenhouse gas emissions produced by issuers of financial assets. In this connection, the physical risks of climate change are a paradigmatic example of the negative externality of CO_2 emissions.

Transition risks are related to the transition towards an economy low in greenhouse gas emissions. Meeting the carbon footprint reduction commitments of the Paris Agreement will likely require implementing more stringent legislation or the creation of carbon taxes, changing agents' preferences and the production or demand for certain products. Likewise, agents' preferences and research may lead to technological changes that render products or sectors obsolete. In any event, this transition might significantly affect certain sectors of the economy, causing losses in the value of the financial assets linked to them.

Transition risk depends on the type of regulatory response given to climate change and, with it, the type of transition such response entails. For instance, an early, but gradual, response might be sufficient to correct the main negative effects of climate change, in turn minimising transition risks. Conversely, if the response is delayed, physical risks might materialise and the response would have to be sudden and unforeseen, possibly prompting a disorderly transition process in attempting to avoid further physical risks. This implies that the two types of risks will be very closely related. Unlike physical risks, it may be thought that transition risks will mostly affect the sectors emitting the most greenhouse gases, since they are those that will have to bear more taxes and more legislative pressure. However, it cannot be ruled out that undesirable effects resulting from the transition will ultimately affect persons or sectors not responsible for the current situation of exposure to climate change risk.

In the case of both physical and transition risk, the main problem is the difficulty in assessing climate risks owing to the complexity of their estimation, as reflected by the absence of consistent data among providers [Alonso and Marqués (2019)]. To illustrate this problem, we will compare credit ratings with Environmental, Social and Governance (ESG) ratings at end-2019. Thus, in the case of credit ratings by the main credit rating agencies, considerable alignment is observed between the different agencies' opinions (see Chart 6). However, if we try to conduct the same exercise using ESG ratings, a much higher dispersion between data providers' opinions is seen (see Chart 7). This divergence makes the use of ESG ratings in asset valuation more difficult.

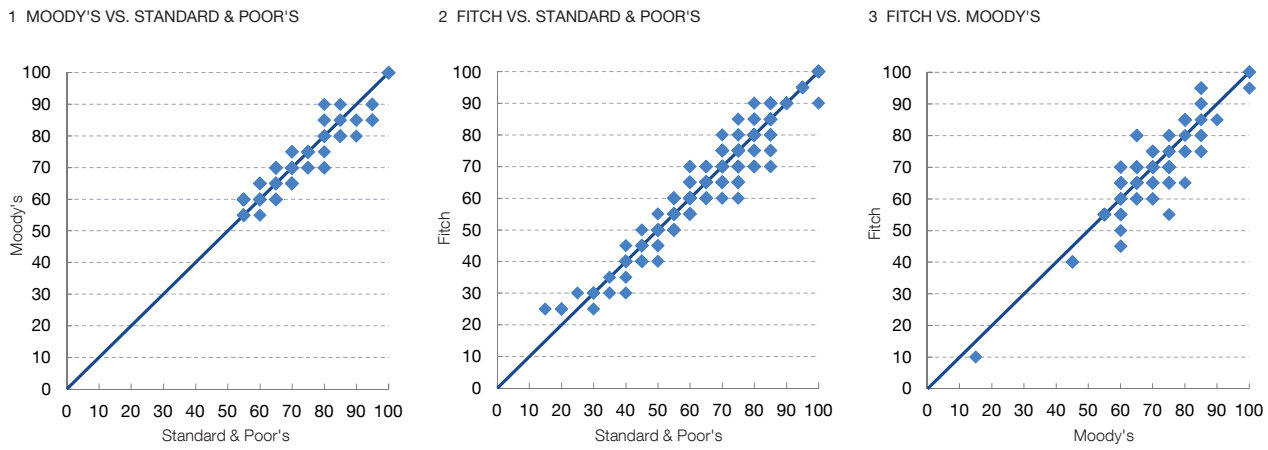
Insofar as climate change is a source of financial risk, rating agencies may be expected to have included these considerations in their own credit ratings. However, a comparison of credit ratings with ESG ratings shows that the correlation between the two is quite low (see Chart 8). Indeed, issuers with a higher credit rating are not necessarily those with better valuations in terms of exposures to climate risk.

A hypothesis about this low correlation, reflecting the scant impact of climate factors on credit risk, is the difference between the evaluation horizons of the risks assessed. While rating agencies assess the risk that an issuer will not meet its financial

Chart 6

CREDIT RATING ALIGNMENT BETWEEN AGENCIES (a)

Issue risk assessments by credit rating agencies are aligned.



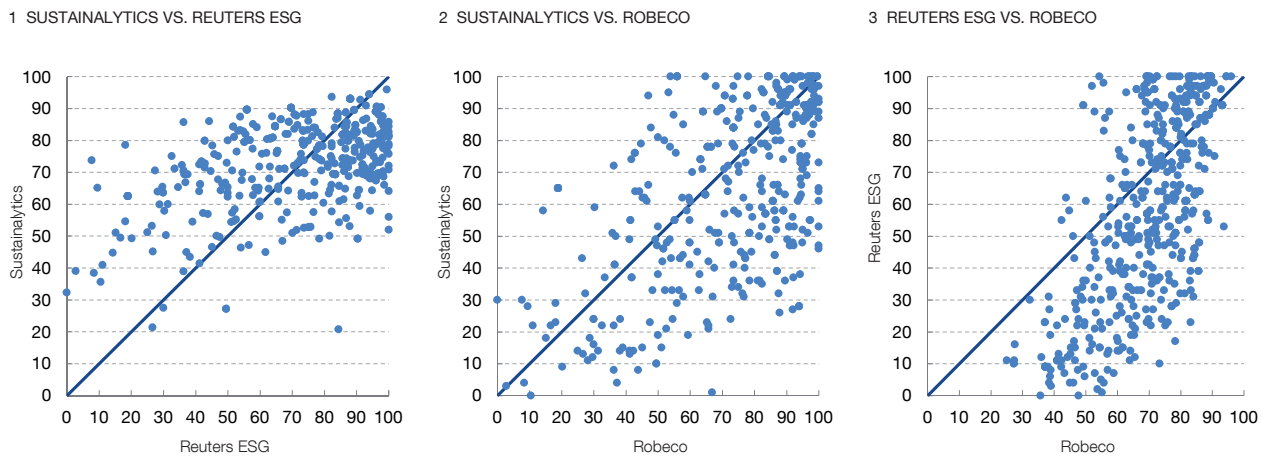
SOURCES: Moody's, Standard & Poor's and Fitch.

a The scales between agencies have been standardised based on their equivalences, subsequently standardising the scores on the basis of deciles.

Chart 7

ALIGNMENT BETWEEN ESG DATA PROVIDERS (a)

Sustainability assessments by different sources are highly dispersed.



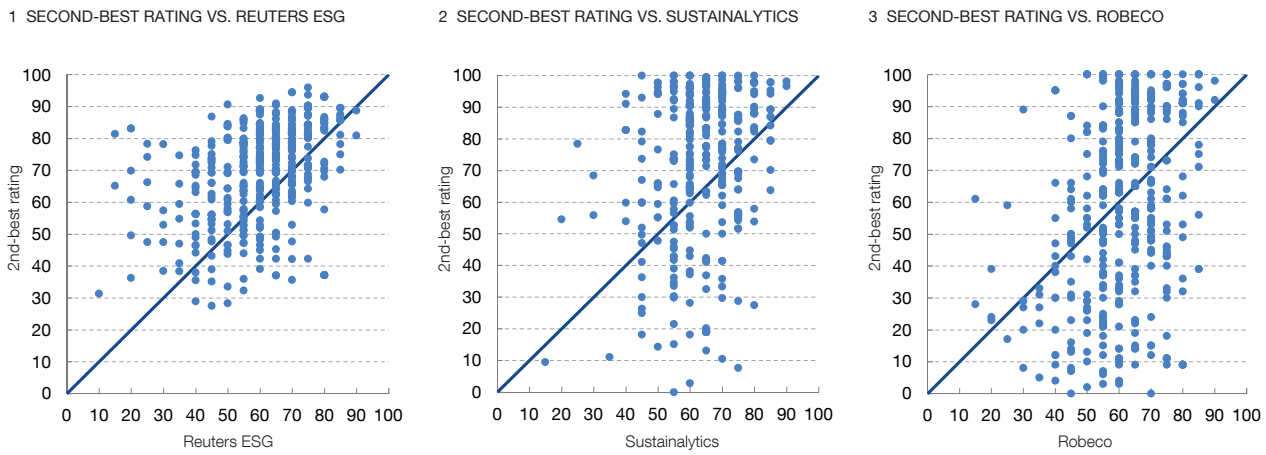
SOURCES: Reuters, Robeco and Sustainalytics.

a The ESG scales have been standardised on the basis of deciles, the lowest levels being those with a lower green score.

Chart 8

CORRELATION BETWEEN CREDIT RATINGS AND GREEN RATINGS

The correlation between assessments by credit rating agencies and sustainability ratings providers is very low.



SOURCES: Moody's, Fitch, Standard & Poor's, Reuters, Robeco and Sustainalytics.

obligations over a 2-3 year horizon, climate risks have a probability of materialising and affecting the valuation of the assets over a significantly longer horizon. This is reflected in the correlation between the two types of risk being even lower when we compare short-term credit ratings (which assess compliance risk over a few months) with climate-related ratings (see Chart 9.1). These results appear to suggest that as the credit risk assessment horizon becomes longer, the weight of climate-related considerations increases. Inevitably, ratings at longer terms than those currently calculated would take them into account.

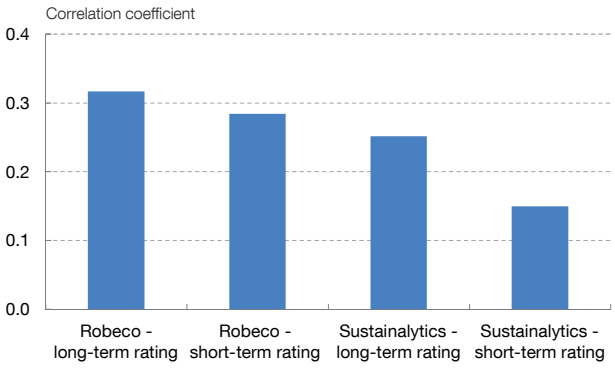
Indeed, the relationship between credit risk and ESG ratings may even be negative. Although sovereign bonds do not usually have ESG ratings, we can associate them with the country's carbon footprint. As seen in Chart 9.2, at least in the case of EU countries, the carbon footprint and the credit rating are inversely related.

Nevertheless, all of this reasoning is based on considering that green assets and conventional assets have a different risk profile. However, as shown in Section 1, even assets that have the same issuer may have a different price depending on whether or not they are classified as green. Given this situation, it is difficult to justify that the premium is due to a different risk profile. One explanation could lie in the commitments involved in the issuance of a green bond. The commitment to invest in green activities means that, in addition to a default risk (credit risk), the bond would have a green default risk. Although this second risk does not entail declaring a credit event for the issuer, it would give rise to a reputational loss for the issuer. It could be argued that in order to avoid the effects of such reputational risk, before failing to

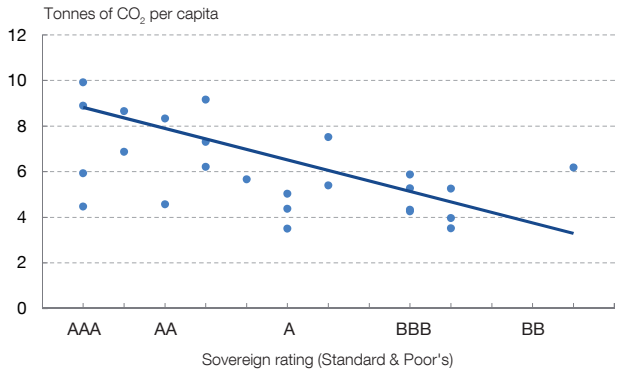
Chart 9

CORRELATION BETWEEN CLIMATE RATINGS AND CREDIT RATINGS, BY ASSESSMENT HORIZON AND BY COUNTRY, BASED ON CO_2 EMISSIONS

1 CORRELATION BETWEEN CLIMATE RATINGS AND CREDIT RATINGS



2 RELATIONSHIP BETWEEN CO_2 EMISSIONS AND SOVEREIGN RATING



SOURCES: Robeco, Sustainalytics, Standard & Poor's and Eurostat.

meet the commitment, the issuer would redeem the bond early, which would justify a negative premium. However, there is no way of substantiating this reasoning to date, nor of assessing whether reputational risk would be sufficient to justify the differences in return observed, since debt issuers have still not seen sufficient green defaults.

5 Investor base strategies

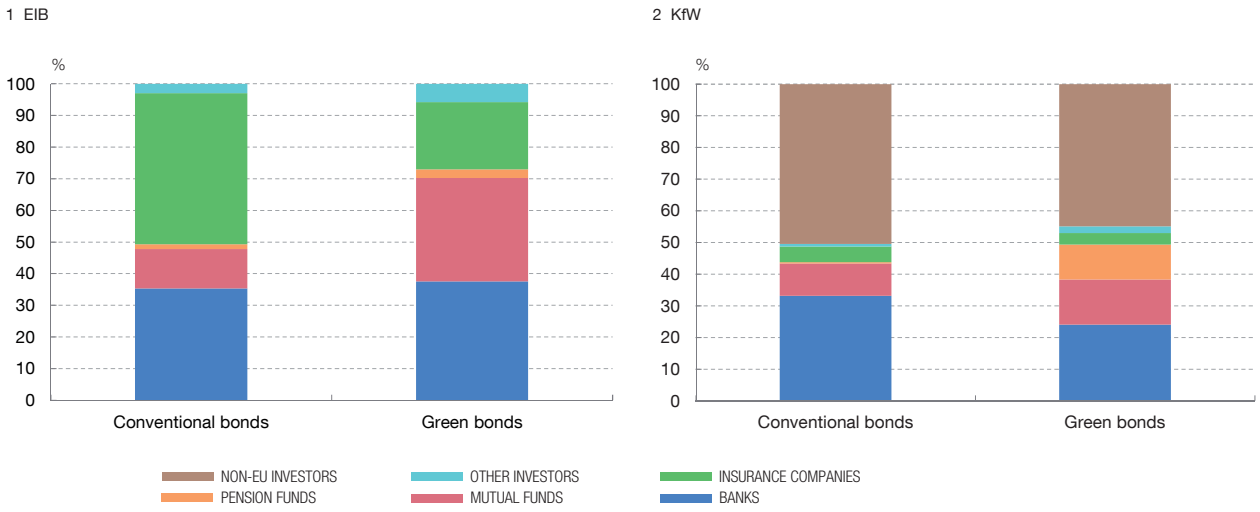
Alternatively, as indicated in Section 2, investors may already be considering sustainability as an additional factor to return and risk in the selection of their portfolios. If this is the case, the investor base for each type of asset can be expected to be different, depending on its sustainability appetite, in other words, on how much profitability it would be willing to forfeit or how much risk it would be prepared to assume to attain a higher level of sustainability in its portfolio. The case of green bonds issued by the same institutions as those issuing conventional bonds, with the same level of risk, is ideal for testing this hypothesis. Chart 10 shows how the green bonds of the EIB and KfW have a higher proportion of pension and investment fund investors than other bonds issued by the same institutions.

The differences in asset holdings may arise from diverse investment and pension fund mandates, which include restrictions on and incentives for the selection of portfolios. In practice, we have identified five possible strategies that investors might adopt to incorporate the sustainability factor into their investment portfolios [NGFS (2019b)]:

Chart 10

INVESTOR BASE BY SECTOR, ACCORDING TO THE TYPE OF BOND

Investors vary depending on whether they invest in green bonds or other types of bonds.



SOURCE: Securities Holdings Statistics by Sector.

i) *Negative screening.* This involves systematically excluding companies, sectors or countries that are controversial in terms of the sustainability from their investment channels.

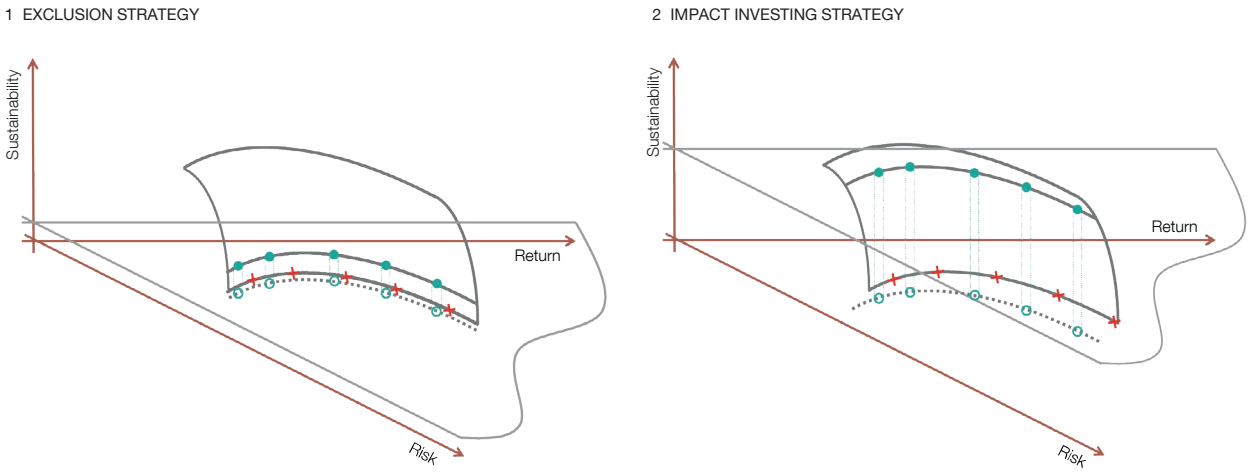
ii) *Impact investing.* This consists of creating specific portfolios investing exclusively in projects that are expected to have a positive impact on sustainability, particularly green bonds.

In the selection of portfolios, the qualitative implications of these two strategies are similar and consist of curtailing the universe of eligible assets. Thus, when viewed as a mathematical problem of optimisation, the selection of portfolios would seek a restricted optimal portfolio rather than an unrestricted optimal portfolio and the returns obtained would be the same as, or lower than, that of the unrestricted one. The investor's potential loss in terms of returns would be offset by sustainability gains. In quantitative terms, impact investing implies greater restrictions than the negative-screening strategy, and would therefore also entail greater trade-off between return and sustainability.

Using the efficient frontier diagram shown in Chart 5, the negative-screening strategy would involve replacing the projection on the zero sustainability plane observed with another in which the surface would be intersected by a slightly higher plane (to exclude less sustainable assets). With the new plane (see Chart 11.1), the selection of portfolios would be exactly the same as before, based on risk-return optimisation.

Chart 11

EQUIVALENCE ON THE RETURN, RISK AND SUSTAINABILITY EFFICIENT FRONTIER OF THE IMPLEMENTATION OF THE EXCLUSION AND IMPACT INVESTING STRATEGIES



SOURCE: Own data.

In the case of impact investing, the effect would be the same, except that the eligible assets would be those with a high level of sustainability, and the new projection plane would thus be far higher than that used in the negative-screening strategy (see Chart 11.2).

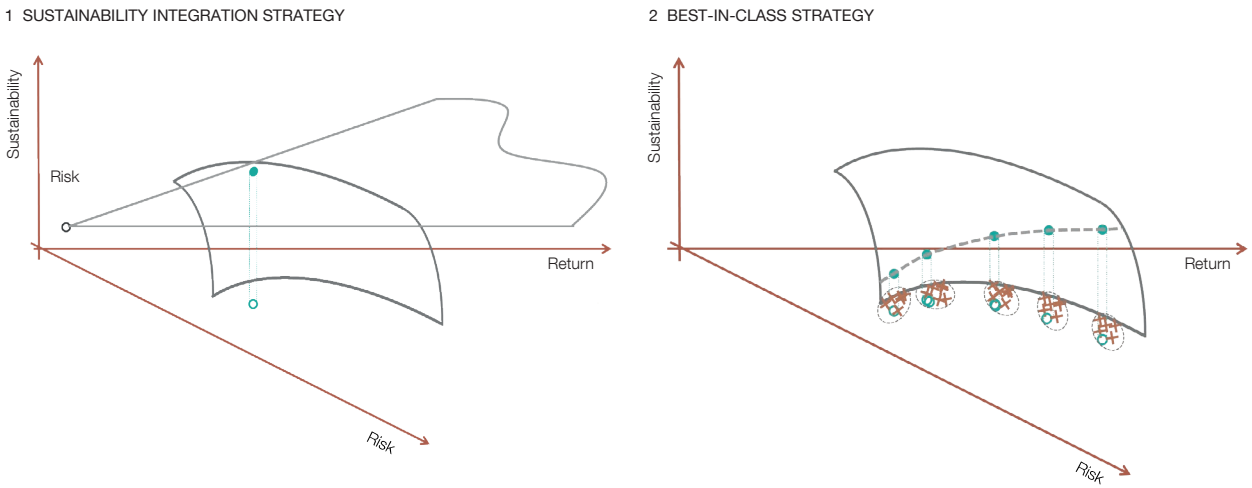
From a practical standpoint, both the negative screening and impact investing strategies are easy to implement in the current environment in which information on sustainability does not abound. All they require is clear criteria to identify which assets should be excluded from or included in the portfolio. Asset exclusion is common practice among many pension and investment funds and, generally, among investors concerned about reputational aspects (examples of excluded activities are arms, countries at war or countries that do not comply with certain criteria, highly polluting industries). As for impact investing, there are private initiatives that certify certain assets as green (for example, the Climate Bond Initiative has a list of green bonds certified by third parties). However, these criteria are not uniform and are open to criticism. As an alternative, official taxonomies for "green activities" are currently being prepared to enable the creation of impact portfolios (China already has one and the European Union's taxonomy is in the final approval stages).

iii) *ESG integration.* This includes sustainability as a third factor, along with return and risk, in the investment analysis.

iv) *Best-in-class.* This is a strategy whereby portfolios are selected in two stages. The first is the traditional selection of the types (and weights) of assets that will

Chart 12

EQUIVALENCE ON THE RETURN, RISK AND SUSTAINABILITY EFFICIENT FRONTIER OF THE IMPLEMENTATION OF THE SUSTAINABILITY INTEGRATION AND BEST-IN-CLASS STRATEGIES



SOURCE: Own data.

form part of the portfolio, according to risk-return criteria, and the second is the selection from among each asset type of those with a higher sustainability factor.

In theory, the incorporation of sustainability as a third factor in the selection of portfolios implies (in contrast with earlier criteria) that all assets are included in the potentially eligible universe. Thus, the efficient frontier would cover the entire surface of the three dimensions (return-risk-sustainability). A risk-free asset (one with no risk, normally a sovereign bond) and a given level of return (risk-free) and sustainability, generates a capital allocation plane (all the possible combinations between the risk-free asset and the portfolios on the efficient frontier surface), which will enable identification of the market portfolio as that in which the plane is tangential to the efficient frontier (see Chart 12.1).

All the above is simply the translation into portfolio theory of the existence of a third dimension in the selection of portfolios. In practice, the strategy would be applied by identifying the target sustainability level, as is done with the target risk level, to then search for the portfolio which maximises returns subject to the selected risk and sustainability levels. However, although application seems easy in theory, in practice, it is very complicated, at least for now, since it requires very clear sustainability metrics and their translation into a uniform standard of measurement. As we have explained in the previous section, this is still far from being the case, and therefore the high uncertainty about the sustainability of each asset in practice means that this is not a viable solution. In the case of equity portfolios, there is the option of considering the greenhouse gas emissions of

each firm as a measure of its sustainability (or lack thereof). However, when we try to extend this concept to fixed-income securities, the complexity increases. First of all, a criterion must be selected for assigning emissions between fixed-income securities and equities. In addition, fixed-income securities pose problems of their own. For example, in the case of covered bonds or asset securitisations, there are reasons for not considering the sustainability of the institution which issues them, but that of the assets backing the bonds. Determining the sustainability of risk-free assets is even more complex, since there are no clear or generally accepted criteria for allocating the carbon footprint to sovereign bonds [Gimeno (2020)].

The complications involved in the practical application of the strategy integrating sustainability have led to the use of the best-in-class strategy to address the problem. Identifying the most sustainable asset within a limited sub-set of assets is more straightforward than in the previous strategy, since it does not require comparing the sustainability criteria of very diverse assets such as covered bonds, sovereign or corporate bonds or shares, but only those within each sub-set. In theory, the best-in-class strategy generates an efficient frontier along the return-risk-sustainability surface which will intersect different sustainability planes (see Chart 12.2).

In practice, the best-in-class strategy also requires identifying what is to be understood by "best". Again, the lack of uniform criteria means that the interpretations vary, from those based on external assessments to others based on internal approaches such as the search for i) the best in the sector (leaders in terms of sustainability, owing to their smaller carbon footprint within the sector/asset class); ii) the best in terms of the transition (those who are reducing their carbon footprint the most within the sector); or iii) the best in the universe (only the highest-ranking firms, regardless of the sector).

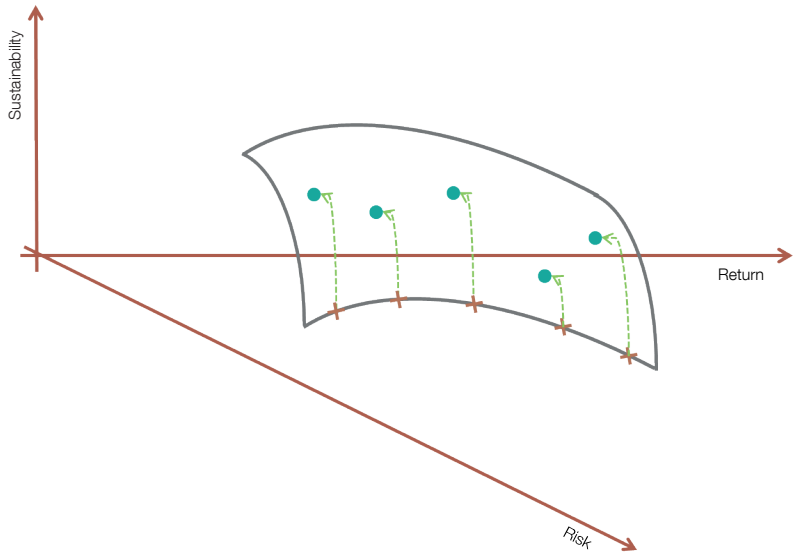
There is one last strategy that does not incorporate the sustainability factor in the selection of portfolios, but in the investor's subsequent actions:

v) *Voting and engagement.* This involves exercising ownership rights with the intention of changing a firm's behaviour on sustainability issues.

The voting and engagement strategy does not exclude any firm from the eligible asset universe. Even those which would be ruled out by a negative screening strategy are acceptable under the voting and engagement strategy. The aim is to exert all possible pressure as an investor to ensure that the firm adopts sustainability measures (see Chart 13). Naturally, to be effective, this strategy requires that investors are sufficiently large for the firm to feel compelled to make the changes requested/called for.

Chart 13

EQUIVALENCE ON THE RETURN, RISK AND SUSTAINABILITY EFFICIENT FRONTIER OF THE IMPLEMENTATION OF THE VOTING AND ENGAGEMENT STRATEGY



SOURCE: Own data.

6 Conclusions

There is growing social awareness of climate change risks and the need to take action. Financial markets are no exception to this phenomenon, and increasing attention is being paid to sustainability factors. The existence of a growing green bond market segment is evidence of this. This article shows the increasingly negative trend of the greenium, from 2 bp reported in previous papers to 6-8 bp estimated in 2019. In fact, growing demand for this type of asset may lead to the continued growth of this negative greenium, which favours green bonds. In addition, we have shown that the preference for green assets is not limited to fixed-income securities, but that there is also a growing appetite for equities, as a result of which firms with a smaller carbon footprint have had a better stock market performance than those with a larger footprint.

Taking a traditional financial approach, in terms of return and risk, if two assets with the same level of risk offer different returns, the one with a lower return would, in principle, be less attractive. Therefore, the existence of a negative greenium would mean that investors would be less interested in these assets. However, the increasing pace of growth of this market segment, along with strong demand for such assets, raises the question of trying to find a way of reconciling the two aspects. On one hand, sustainable assets may be thought to provide better protection against the risk of climate change, and that firms implementing measures to address the transition to a sustainable economy will, in the long run, find it easier to adapt and thus obtain

greater returns. This implies that, when comparing the risk-return profile of the two hypothetical assets mentioned above, we would actually be saying that the greener asset has a lower level of risk and thus, the required rate of return on the market is lower. However, there are reasonable doubts as to whether investors can effectively include climate risks in their risk-return assessments. First, the climate risks we are referring to are unprecedented, and there are no observed past references that could be included in the econometric models to assess risk. Second, the qualitative inclusion of these risks, similar to that applied to credit risk by rating agencies, is subject to much uncertainty, since it is in the early stages, and the indicators are thus very mixed. Lastly, the differences between investment horizons and those of the potential materialisation of climate risks make their inclusion in risk assessment less likely.

It can therefore be argued that certain investors opt to include sustainability factors in their investment decisions regardless of the return-risk factors of these financial assets. Accordingly, when selecting their portfolios, agents would be optimising a utility function with three variables (return, risk and sustainability) instead of two (return and risk). Thus, investors might be willing to forfeit some returns on their portfolios if sustainability is improved. In the last section of this article, we have explored, from a theoretical standpoint, the different strategies investors may use to include this third factor of sustainability in their portfolio selection. However, all these strategies are possible approaches to the problem and will continue to be imperfect solutions until the quality of the information on the sustainability of assets improves and is at least comparable to that available to investors on those same assets' risk and return.

Finally, it is worth noting that this study is limited by the fact that it concludes at the end of 2019, and does therefore not reflect the economic and financial impact of the pandemic on investor attitudes. The materialisation of totally unexpected risks for investors, for which there is no historical precedent in the past century, has similar connotations to what we have discussed earlier with respect to climate change. It is therefore reasonable to ask ourselves whether the pandemic has led investors to rethink the way they incorporate this type of risk into their investment decisions; whether the three-pronged approach of ESG investment now includes, in addition to the environmental aspect raised in this article, the social aspect, with all the funding needs of states and firms to address the problems generated by COVID-19; whether the proliferation of social bond issues are going to crowd out green bonds, or if, instead, they are going to contribute to driving the latter out of their market niche to become standard bond issues. These are all legitimate questions that will help define future avenues of research.

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