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FINANCIAL INNOVATION IN THE DIGITAL AGE: CHALLENGES FOR REGULATION AND SUPERVISION

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FINANCIAL INNOVATION IN THE DIGITAL AGE: CHALLENGES FOR REGULATION AND SUPERVISION

Abstract

Banks have always managed to make the most of technology to improve their efficiency and the service provided to their customers, but they now face a new wave of innovation with much wider implications for financial services. Despite the acknowledged benefits, developments in technology and their implications on the efficiency, financial stability, consumer protection and integrity of the financial system require a holistic response by regulators and supervisors.

This paper aims at analyzing the potential benefits of the digitisation of finance, the new risks that digital infrastructures, business and distribution models and customer solutions may pose, and the expected regulatory and supervisory response. The new digital paradigm presents new risks in terms of cyber security, consumer protection, operational continuity and fraud, among others. These are not fully covered by the traditional supervisory and regulatory approach. Hence there is a need for a renewed regulatory and supervisory framework that fully captures the potential of digital innovation and makes the financial system more resilient against future crises. The response should rest, at least, on four pillars: well-defined policies on the control and management of new technological risks in the financial sector, the launch of innovation hubs, the creation of supervised safe environments for market experimentation (regulatory sandboxes) and the acquisition of new digital skills and a collaborative mindset.

1 The digital transformation of the economy and the society

The evolution of economy and society is featured by continuous change. Most of the time, this change is slow and incremental but, every now and then, rapid disruptive changes take place in short periods of time, leading to what are commonly known as "revolutions". We are living now one of these stages of disruption. Massive adoption of digital technologies invented in the second half of the 20th century, namely the Internet and mobile phones, together with the exponential growth in computation and storage capacity at a lower cost, is radically transforming the world, profoundly changing personal relationships, business organisations and, in general, the way economic value is created.

Triggered by technological advances and by other socioeconomic dynamics, a series of trends have emerged related to consumer behavior and business models. The combined effect of these three groups of transformational forces – i.e., those pertaining to consumer behavior, technology and business – have given rise to the so-called *"fourth industrial revolution"* which is already reshaping the economy and society, and will further continue to do so in the future, producing disruptive changes at an unprecedented speed, following an exponential rather than a linear pace.

First, most *consumers are immersed in an information and services continuum* to which they can be constantly connected through their personal ecosystem of devices. In this new environment, customers have more power than ever. They feel they need to be connected, anywhere, anytime. They also want their needs to be met immediately, including the consumption of relevant and useful content. Customers are also becoming increasingly aware of the benefits that smart data can bring.

The changes in consumer behavioural patterns take on special importance in the context of the two new generations: *millennials and centennials.*[1] It is crucial to understand the

1 Millennials or Generation Y are young people born in the 1980s and 1990s and Centennials or Generation Z are people born from 2000 onwards.

services that are being and will continue to be demanded by these younger generations and by older "non-native" generations which are rapidly becoming digitalised. Apart from this, their loyalty to banks is much less evident than that of previous generations. More than 70% of them would use a financial service offered by a company from outside the sector, compared with 50% of older customers.

Second, the growth in *mobile technology* and the development of smartphones has changed the digital landscape to the point that most of our online connections are made in mobility.

Digitisation of interactions, sensorisation and connectivity are driving exponential growth in the volume of generated data. Now the challenge is how to turn this data into actionable knowledge. *Big data technologies* along with the advances in *Artificial Intelligence and Machine Learning* will help to improve interaction in areas such as virtual assistants or automation through algorithms, and to extract this knowledge through the identification of behavioural patterns of consumers, predict future market trends or prevent transactional fraud.

The success in the use of the above-mentioned technologies can nevertheless be weighed down by heavy and rigid legacy infrastructures with a high cost of ownership. Companies are trying to overcome this hindrance by evolving towards *"smart" infrastructures,* like *cloud computing,* which are flexible, agile and efficient, easily manageable in cost and effort.

Third, in this world where technology serves as a basic facilitator, and consumers run away from complexity, forward-looking companies have realised that they have to *change their business model.* A satisfactory customer experience means getting their problems solved in real time through the channel of their choice. The implications of this integrated experience for companies are complex, because it requires the ability to provide tailored solutions, knowing the context in which the customer is, and to orchestrate the necessary channels to deliver them in a transparent way. It also requires profound changes in the talent and culture within the organisation, which must evolve towards structures which are more agile and flexible and less hierarchical within more collaborative environments in which information can flow without unnecessary restrictions.

Moreover, exponential technologies have facilitated the surge of *new digital native competitors* in practically every industry. These competitors are coming from outside established sectors. They have detected trends in customer behaviour and technologies that offer chances of success in competition with incumbents. There are two main types of new digital competitor: big internet players (such as Google, Apple, Amazon or Facebook) and start-ups with a flexible business model and without legacy structures.

All in all, these three forces have been affecting almost every industry in the world for the last 10 years, with a pervasiveness and depth which are transforming every value chain.

2 Digitisation: Reshaping the financial industry[2]

This digital revolution has also arrived in the financial sector. Currently there is no doubt that the financial sector is at a major crossroads. The negative impact of the economic environment on banking, expectations of a prolonged period of low interest rates and the stagnation in lending lead inevitably to the quest for transformation processes that enable costs to be reduced and a boost in revenues. Things become more complicated if we take

2 J. M. González-Páramo (2016), admission speech at the Royal Academy of Moral and Political Sciences "Reinventing banking: from the great recession to the digital disruption", http://www.racmyp.es/R/racmyp/docs/discursos/D90.pdf.

into account two additional factors: the reputational problems still weighing on banks and the assimilation of the aftermath of the regulatory tsunami. Accepting that all the above requires profound changes in the sector; the presence of this radical disruptive force, the *digital revolution, has changed everything.*

Paradoxical as it may sound, technology could become the major gearshift in the financial sector for decades. In fact, banking has always managed to take advantage of technology to improve its efficiency and the service provided to its customers, but it now faces new developments with much wider implications.

Digital disruption may help banks to survive the pressures of low growth, waning profitability and tough regulation, and to solidly re-establish customers' trust and reputation with society. If banks can offer a better user experience, they will again come closer to what customers demand and need to satisfy their aspirations and take advantage of the opportunity of this new age, since they are already being exposed to the digital transformation in nearly every aspect of their daily lives.

The disruption characterising the transition in banking is reflected in irreversible changes in both the demand for and supply of financial services. On the demand side, we are already seeing radical *changes in the patterns of consumption* and savings behaviour of a whole generation. The two new generations of digital natives, the millennials and the centennials, have started joining the labour force, and in the coming years they will become increasingly important customers not just of banking but of a whole range of sectors. In a context of increasing competition such as the current one, it is crucial to understand the services that are being and will continue to be demanded by these younger generations and by older "non-native" generations which are rapidly digitising.

As for the disruptions seen in supply, the sector is facing greater *competition* and *technological* changes that will decisively affect the quantity, quality and price of financial services.

Regarding competition, over the past few years we have seen an increase in the number of new players coming from the digital world, the "fintechs". Their objective is to concentrate on specific segments of the value chain (foreign exchange, payments, loans, trade, asset management or insurance, for example), unbundling or disaggregating the services previously originated and sold by the banking sector. These companies start without the burden of having to maintain a physical distribution network, the rigidities of corporate culture, the upkeep of obsolescent technological systems or tough banking regulations. Also, the sector will have to compete not only with providers emerging in the financial sector, but also with those arriving from other areas, in particular, the major digital companies, Google, Apple, Facebook and Amazon (which we refer to under the acronym GAFA).

And new competition will be joined by technological changes either underway or yet to come. As we have seen, there are a number of exponential technologies interacting with other digital innovations, such as the large-scale use of big data, artificial intelligence, blockchain and cloud computing. All this will open the way to different modes of participating in the digital ecosystem, such as by acquiring or taking equity stakes in "fintechs", by developing internal capabilities or through open innovation.

Thus, the real question is not whether *banking will change radically,* which it undoubtedly will, but rather whether banks will still play a significant role in the new financial ecosystem. Banking would have to adapt its strategies radically to survive this unbridled competition

from new entrants. Success will be determined by the ability to, first, take care of their main asset: the customer experience, secondly re-establish their reputations; and finally, reach keener prices and automation of processes so that customers can devote only the time they consider absolutely necessary to administering their finances.

This model requires profound changes of *talent and culture* within the organisation, which needs to evolve towards structures which are more agile and flexible, and less hierarchical, within more collaborative environments in which information can flow without unnecessary restrictions. The cultural change must favour the process of continuous innovation, which values learning through success, and in which failure is quickly identified and controlled, allowing progress to be made towards the realisation of the bank's strategic vision. Thus it involves a transformation in three areas: technological, strategic and in terms of corporate culture and talent. It is, in short, a complete *reinvention of the banking business.*

In this context of disruptive change, two forces will be fundamental for determining the speed of change and the scenario towards which the sector will move. The first, which is internal in nature, concerns the banks' vision of the future and their technological, financial and organisational capacity for self-transformation. The second is the role of the regulators and supervisors as drivers of or brakes on the changes needed during the transition.

3 Regulation and supervision: financial stability and consumer protection

As mentioned above, regulators and supervisors act as key drivers of, or brakes on, the changes needed during the transformation of the financial industry. As a starting premise, *regulation in the financial sector is necessary, as is more intensive supervision than in other sectors.* This general principle is based on the intrinsic characteristics of the banking business, primarily understood as the means of channelling the savings generated in the economy towards the different participants: individuals, businesses and governments. This process of intermediation is organised broadly through the transformation of maturities and the provision of various financial services that facilitate daily transactional operations by customers, mainly linked to the space of payments.

The recurring crises that have been experienced in the world economy over the past decades have shown that the existence of strong financial systems is crucial for stability and economic growth. The prerequisite for achieving economic stability is to ensure that financial institutions work properly. The aim is to safeguard the stability of the financial system by ensuring that the vital roles played by the banking sector in the economy do not suffer significant disruption or that the institutions do not collapse.

To this end, regulation and supervision in the sector seeks *four objectives:* i) promoting the stability of the financial system, avoiding systemic risk, bank runs and the malfunctioning of payment services; ii) maintaining the safety and solvency of banks; iii) protecting consumers of financial services, and iv) improving efficiency and competition in the system.[3]

Traditional regulation has played an essential role in the development of the financial sector to date. However, often the *promotion of innovation* in the financial sector has been a *secondary objective* for the authorities, if not disregarded altogether. This factor, coupled with the significant barrier to entry posed by banking regulation itself (which has deterred many potential new entrants), explains why the industry has been able to develop its own

3 See for example European Central Bank, *Mission statement of the SSM,* ECB (website), <https://www.bankingsupervision.europa.eu/about/mission-statement/mission-statement-of-the-ssm/html/index.en.html> or Bank of Spain, *Objetivos básicos,* Banco de España (website) <http://www.bde.es/bde/es/areas/supervision/funcion/objetivos_basico/Objetivos_basicos.html>.

pace of innovation in competitive terms to differentiate itself from other banking actors and without fearing the entry of new players with radically different approaches.

However, as mentioned before, the digital transformation of the economy and the society changes everything, thus forcing authorities to adopt an active position. Regulation and supervision are now challenged to provide a regulatory framework that balances the promotion of the new digital value propositions – which benefit the customer and introduce efficiency gains in the market – and protection against the associated risks.

4 The transformation of financial services: benefits and risks

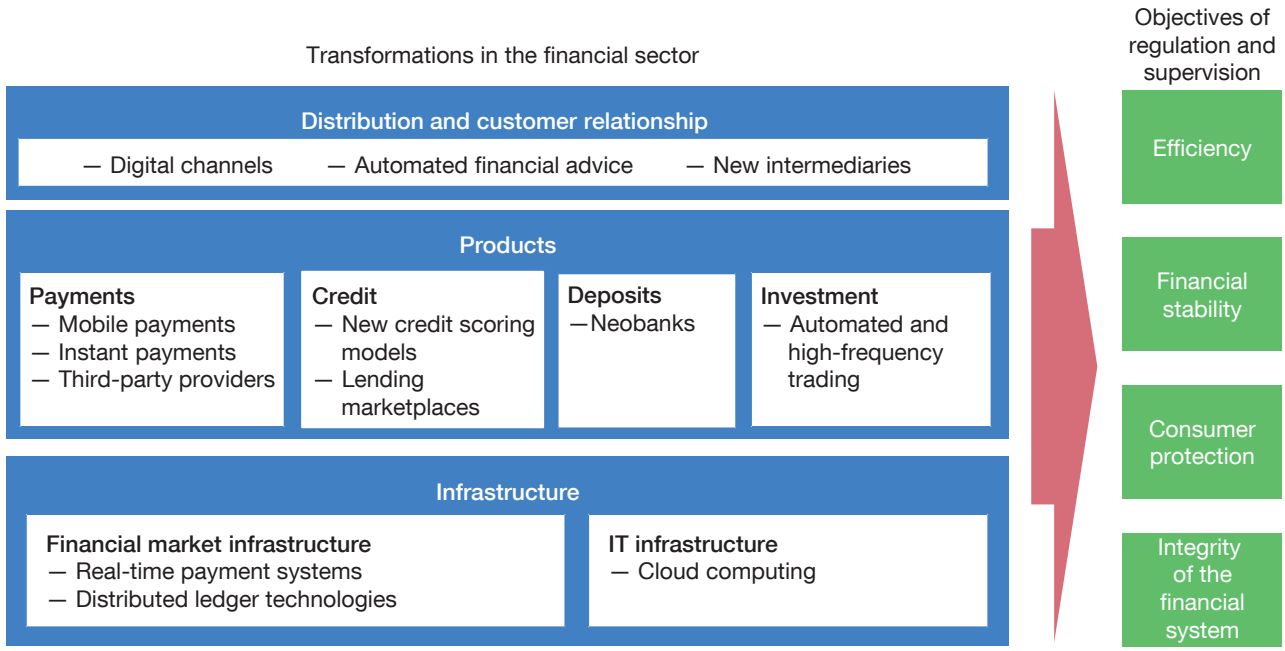
This section provides a framework to analyse how transformation of the financial sector could impact the aforementioned objectives of regulatory and supervisory authorities.

For the analysis to be systematic, the different transformations of the financial sector are categorised into those affecting the *infrastructure,* the *banking products* and the *distribution* – or, more generally, the customer relationship –. The first block comprises both financial market infrastructures – clearing and settlement of payments and securities – and the Information Technology (IT) infrastructure that powers the operations of each financial institution. The products block is subdivided into the usual categories of financial products: payments, credit, deposits and investment. The final block covers the distribution of products, the provision of financial advice and other intermediation services that are involved in the distribution value chain of financial services. The main focus of this analysis is on retail financial services. However, some changes in wholesale and investment banking are also covered, particularly with respect to financial market infrastructure and investment products.

Figure 1 shows the general analytical framework, including the main changes that are taking place in each of the blocks. The following subsections discuss the impact of each of the changes. Efficiency gains are presented first, followed by the implications (positive, negative or ambivalent) for financial stability, consumer protection and for the integrity of the financial system.

GENERAL FRAMEWORK

FIGURE 1



SOURCE: Author's elaboration.

Aside from this framework, it is important to note that technological advances are also directly helping the industry and the authorities to better address the (traditional and new) risks to financial stability, consumer protection and the integrity of the financial system. The so called *"RegTech" solutions* improve risk management functions and facilitate more effective and efficient compliance with regulatory requirements. They do so by focusing on the automation of manual processes and the links between steps in analytical/reporting processes, the improvement of data quality, the creation of a holistic view of data, the automated analysis of data with applications that are able to learn during the process, and the generation of meaningful reports that can be sent to regulators and used internally to improve key business decision making.[4, 5] The potential usage by supervisors of Regtech solution has also been highlighted by De Nederlandsche Bank: "technological innovation offers opportunities for supervisors, for example with respect to the automation of certain supervisory processes."[6]

4.1 INFRASTRUCTURE

Real-time payment systems

Real-time payment systems allow financial institutions to offer instant account-to-account payments to retail and business customers on a near-24/7/365 basis. Spain is already building its own system, that will be interoperable with the European Instant Payments scheme, which is also under construction and should be available by the end of 2017. The Bank of Spain and the European Central Bank are taking a leading role in this process, supporting bank efforts in this field, addressing clearing and liquidity concerns and promoting European interoperability and harmonisation.

Real-time payment systems involve significant initial implementation costs for payment service providers (PSPs). However, they *may lead to efficiency gains* in the future, due to reduced investment costs for the maintenance and upgrade of legacy systems, and lower variable management costs if real-time payments substitute other payment methods such as cash or cheques.[7]

From the perspective of *financial stability,* real-time payment systems introduce new risk challenges when compared to traditional retail payment systems. The continuous availability of the system (including outside normal business hours) makes *operational continuity* and reliability more demanding, both for the payments system and for the participating PSPs. Moreover, given the speed of e-payments, any delay or interruption in the service will be directly observable by end-users, which could lead to a quicker triggering of reputational risk. In traditional retail payments with deferred clearing, some operational incidents may go unnoticed by the customers.[8] Furthermore, *higher fraud risk* may also exacerbate operational risks. Indeed, the immediate availability of funds for the payee may make real-time payment systems a more attractive target for fraudsters.

4 Casadas, V., & Sebastián, J. (2016) RegTech, the new magic word in FinTech. *Digital Economy Outlook,* February 2016, pp. 4-5. BBVA Research. <https://www.bbvaresearch.com/en/public-compuesta/digital-economy-outlook-february-2016/capitulo/regtech-the-new-magic-word-in-fintech/>.

5 Van Liebergen, B. *et al.* (2016) *Regtech in Financial Services: Solutions for Compliance and Reporting.* Institute of International Finance. <https://www.iif.com/system/files/regtech_in_financial_services_-_solutions_for_compliance_and_reporting.pdf>.

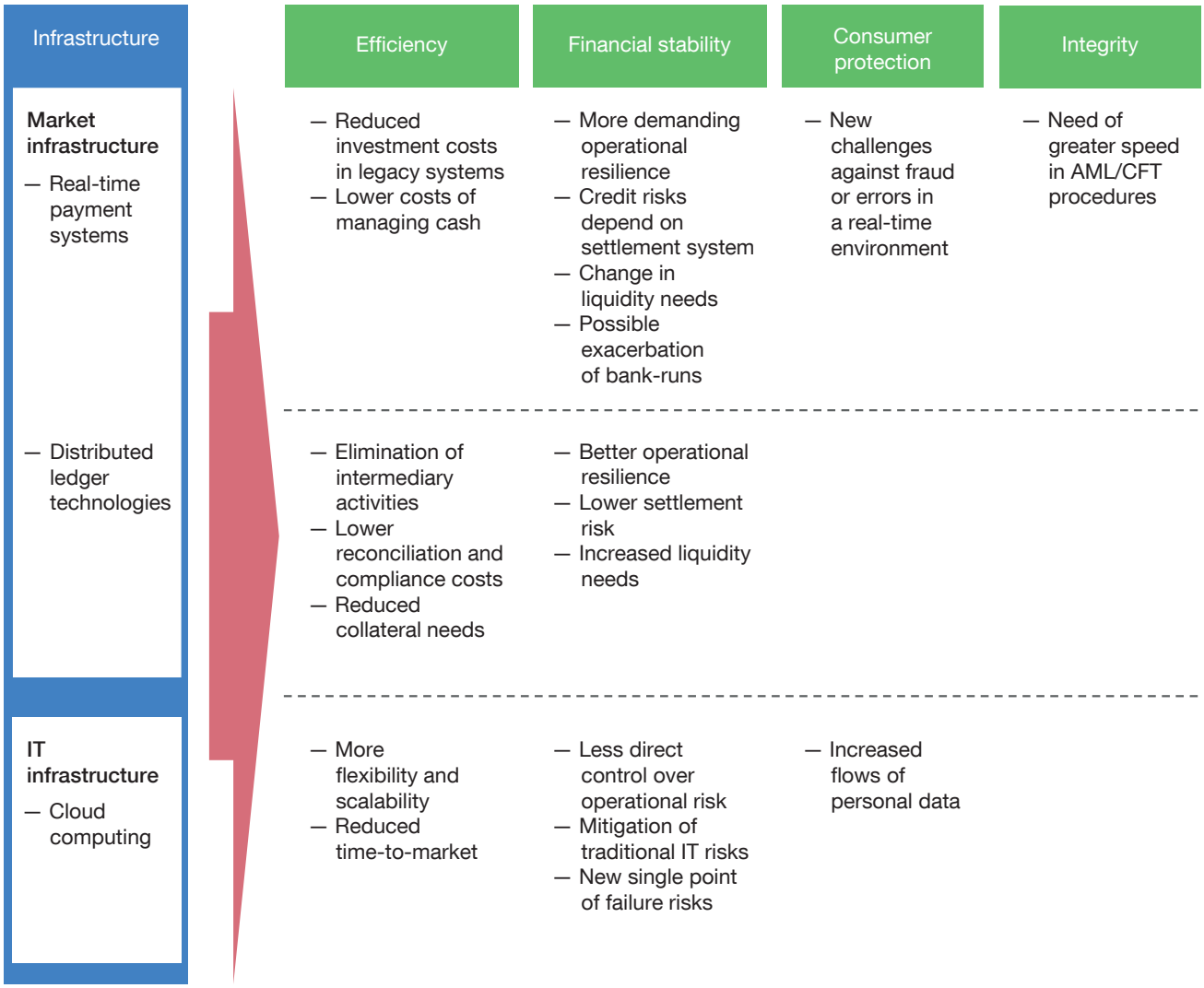
6 De Nederlandsche Bank (2017). *Technological innovation and the Dutch financial sector*.

7 BIS Committee on payments and Market Infrastructures (2016). Fast payments – *Enhancing the speed and availability of retail payments,* BIS <http://www.bis.org/cpmi/publ/d154.htm>.

8 Fernández, A., & Gorjon, S. (2016). Pagos Inmediatos: ¿Evolución o Revolución?, *Revista de Estabilidad Financiera,* 30. pp. 63-90. Banco de España. <http://www.bde.es/f/webbde/GAP/Secciones/Publicaciones/InformesBoletinesRevistas/RevistaEstabilidadFinanciera/16/MAYO%202016/restfin2016303.pdf>.

IMPACT OF CHANGES IN INFRASTRUCTURE

FIGURE 2



SOURCE: Author's elaboration.

The introduction of credit risk for the participating PSPs depends on whether the settlement of payments transactions takes place in real time (gross) or deferred (net). In the latter case, the payee's PSP will face the credit risk of advancing the funds to its customer before actually receiving the money from the payer's PSP. This credit risk can be mitigated in different ways: by increasing the frequency and timing of settlement cycles, by signing loss-sharing agreements between the participating PSPs, by setting limits on the maximum net debit or credit positions, or by requiring PSPs to pre-fund or collateralize their positions. However, setting limits might result in some payment transactions being rejected if the limits are binding. This might *erode the confidence of customers* on the system.

Regarding liquidity risks, systems with real-time settlement involve continuous liquidity needs, including outside normal business hours. In systems with deferred settlement, liquidity needs are not continuous and are mitigated by the netting of transactions, as in traditional retail payment systems. However, liquidity risks are enhanced if new settlement cycles are introduced, particularly outside normal business hours.

Another impact on financial stability is the potential *exacerbation of the risk of bank-runs,* especially if combined with automated advice or decision making, since depositors could

use real-time payment systems to quickly transfer funds in case of bad news concerning a financial institution.

The continuous operability of real-time payment systems and the immediate availability of funds also raise new challenges for consumer protection, particularly against fraud or errors. Likewise, preserving the integrity of the financial system requires improving and adapting anti-money laundering and combating the financing of terrorism (AML/CFT) procedures to the speed of real-time payment systems. Just like with fraud, the immediate availability of funds may attract illegal economic transactions to real-time payment systems.

Distributed ledger technologies

Another transformation of financial market infrastructures arises from the application of distributed ledger technologies (DLTs) to the clearing and settlement of payments and securities transactions. DLTs facilitate Delivery-versus-Payment (DvP) in these transactions *without the need of an intermediary,* by allowing the simultaneous transfer of cash and securities between parties.[9] Permissioned DLT networks, with access restricted to pre-approved institutions, can lead to *efficiency gains* due to the reduction or elimination of intermediary agents and steps. For instance, in cross-border payments, correspondent banking could no longer be necessary. In securities clearing and settlement, reconciliation costs could be lowered or even eliminated, since DLT networks build an immutable and unique record of transactions, instead of the duplicative records of traditional systems.[10] Compliance costs could also be reduced, since supervisory authorities can become a special node of the DLT network and directly observe the transactions. Moreover, since simultaneity of clearing and settlement in DLT networks reduces credit or counterparty risk, there are also efficiency gains due to reduced collateral needs and capital requirements. For derivatives, further efficiency gains can be materialised if DLT-based smart contracts enable the self-execution of contractual clauses.[11]

From the perspective of financial stability, the application of DLTs to the settlement of payments and securities transactions can *reduce settlement risks.* However, this *increases liquidity needs* and, therefore, liquidity risks. Furthermore, the application of DLTs can *improve the operational resilience* of financial market infrastructures, since the system of multiple validation nodes might make errors or cyber attacks more difficult, as well as making the detection and recovery from incidents faster. Nevertheless, the technology will first have to prove that it is sufficiently safe and robust.

Outside the formal financial system, DLTs are behind *private cryptocurrencies* such as Bitcoin. Although the idea of rule-based monies can be attractive in certain contexts, the public and ownerless nature of many of these cryptocurrencies involves *significant risks* for consumers: fraud, security, volatility, etc. Moreover, the anonymity (or pseudo-anonymity) of these DLT networks poses serious risks for anti-money laundering and combating the financing of terrorism (AML/CFT). For this reason, the European Union will

9 This is true if we assume the existence of a "cash ledger" within the DL network so that both types of assets (cash and securities) are on the same infrastructure. For this reason, so-called "settlement coins" are being defined as a way of putting a cash equivalent in the ledger.

10 Pinna, A., & Ruttenberg, W. (2016). Distributed ledger technologies in securities post-trading. *Occasional Paper Series,* nº 172. European Central Bank. <https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf>.

11 Brainard, L. (2016). The Use of Distributed Ledger Technologies in Payment, Clearing, and Settlement at *The Institute of International Finance Blockchain Roundtable,* Washington, D.C., April 14, 2016. Federal Reserve System. <https://www.federalreserve.gov/newsevents/speech/brainard20160414a.pdf>.

include the providers of cryptocurrency exchange and wallet services under the revised AML Directive. Moreover, if private DLT networks and cryptocurrencies grow significantly, outside the formal financial system, several risks for financial stability may arise.

Cloud computing in IT infrastructure

Financial institutions are also transforming their IT infrastructure with the migration of workloads to cloud computing services. When compared to legacy and centralised architectures, *cloud solutions offer multiple opportunities* associated to flexibility and scalability, and allow financial institutions to innovate faster, gain efficiency, reduce time-to-market and improve productivity exponentially. Cloud computing also allows a shift from capital expenditures to operating expenses and offers means for banks to manage computing capacity to satisfy customer demands at peak periods.

The use of cloud computing services has several *implications for financial stability.* For instance, outsourcing part of the IT infrastructure means that financial institutions have less direct control over *operational risks.* Nevertheless, cloud computing providers may be better prepared to deal with security and other technological risks due to their scale and specialisation. In addition, cloud computing may *mitigate traditional IT risks,* such as capacity or resilience. Indeed, it increases the resilience of data due to the "redundancy" system in which data is stored. Since backups can be located in remote places, there is a greater probability that they can be used in the event of a catastrophe. In any case, *Service Level Agreements* (SLA) between financial institutions and cloud computing providers, and the security measures required to the latter, become a key issue for operational risk.

Another impact on financial stability is the possible emergence of *new single point of failure* risk if there is a concentration in the providers of cloud services for the banking sector. This is likely to happen considering the economies of scale in the provision of cloud computing services, as well as the specific and more stringent requirements for providing these services to the financial industry.

From the perspective of consumer protection, the use of cloud computing services increases the *flow of personal data.* Therefore, there is a need to push for strong security measures, such as encryption techniques, and to comply with data location requirements, including international personal data transfers outside the EEA, while securing access to data by competent authorities.

If an adequate *business continuity plan,* exit strategies for the case of termination of the contractual relationship is not put in place, it can have negative consequences both for financial stability and consumer protection.

4.2 PRODUCTS

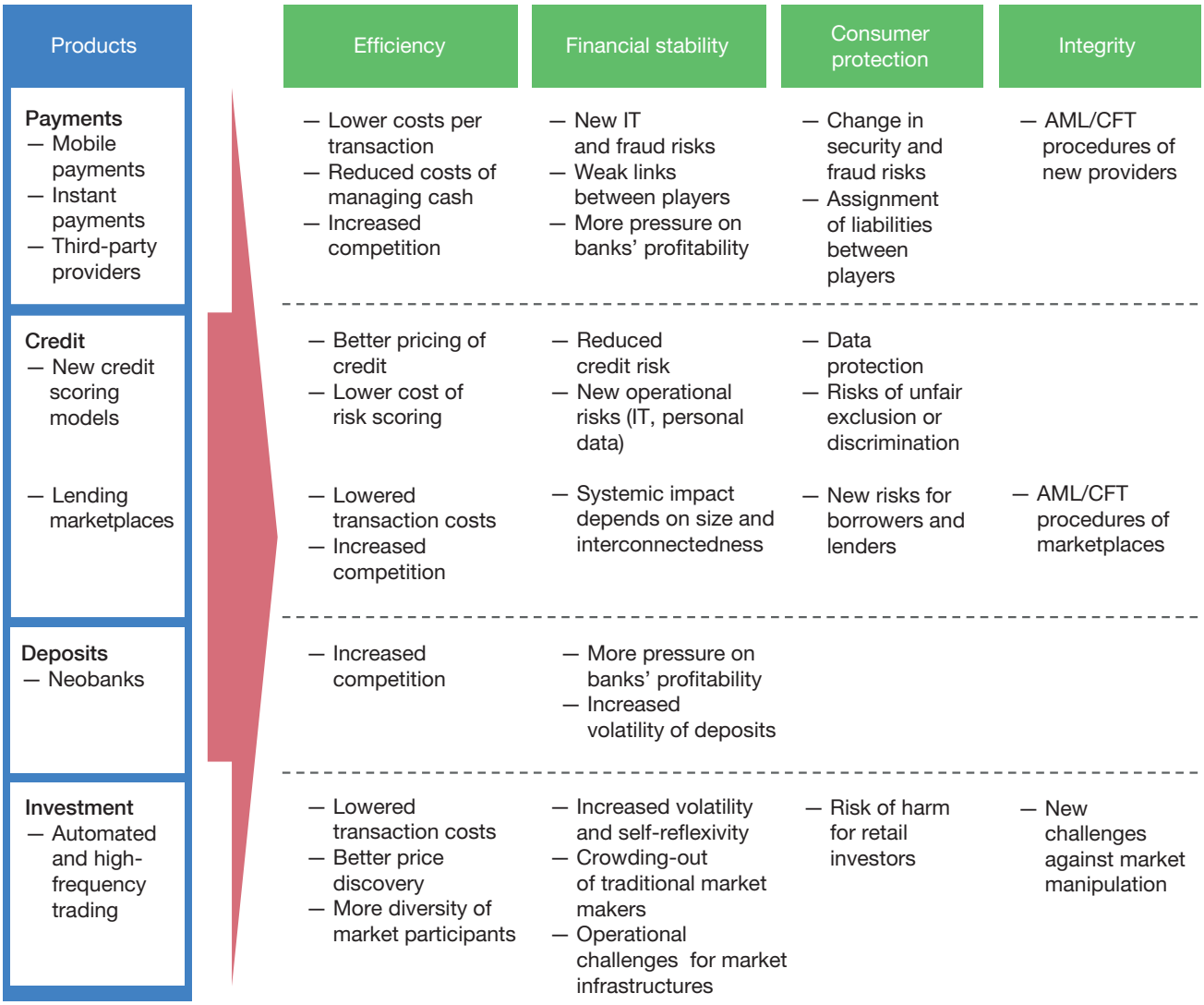
4.2.1 Payments

Retail payments is one of the areas of financial services with the greatest innovation activity, both by banks and new players. This subsection covers innovation in payment products, some of which run over the innovative infrastructures that were explained in the previous section.

Card-based payments are going mobile, thanks to digital wallets – which store and manage cards virtually – and NFC technologies, which enable contactless payments. As well as banks, mobile phone manufacturers and operating systems (Apple, Samsung, Android) are entering into this business as providers of digital wallets.

IMPACT OF CHANGES ON PRODUCTS

FIGURE 3



SOURCE: Author's elaboration.

New payment solutions are also being developed based on account-to-account credit transfers. For instance, real-time retail payment systems are enabling the development of new solutions for peer-to-peer and consumer-to-merchant payments. The immediate and unconditional availability of funds for the payee offers potential for these solutions to partially substitute card-based payments. Moreover, the new EU Payment Services Directive will allow third-party payment services providers (TPPs) to initiate credit transfers on behalf of customers. This will further increase competition in payments, by allowing more players to provide account-based payment services.

Other innovative solutions are arising from the application of distributed ledger technologies (DLTs) to cross-border payments. A number of services are already in the market, based on the public blockchain of bitcoin.

Innovations in retail payments have the potential to *reduce costs per transaction,* particularly in micropayments and cross-border payments, and promote the use of e-payments. This may lead to further efficiency gains for the financial system given the

cost of managing cash. Moreover, the entrance of new players (digital wallet providers, TPPs) increases competition in retail payments.

In terms of *financial stability,* several risks and vulnerabilities may arise from innovative payment solutions. Regarding operational risks, digital and mobile-based solutions increase the relevance of *technological resilience and cyber risks,* and change the nature of fraud risks. Furthermore, increased competition increases pressure on the profitability of banks, both directly (by reducing margins in the payments business) and indirectly, since new players gain access to payments data that is valuable for cross-selling purposes (e.g. credit offerings).

In addition, the greater *interdependency between players,* with "weak links" between banks, other payment services providers (e.g. TPPs), and new players involved in the value chain of payments (e.g. mobile operators or manufacturers), may introduce vulnerabilities for the financial system.[12] The laxer the regulatory framework for these new players, the more severe the vulnerabilities are likely to be.

New digital payment services also raise new challenges for *consumer protection.* For instance, security and fraud risks depend on the technological solutions employed. Moreover, the interrelations between different players require a clear allocation of liabilities in case of fraud or errors, to avoid consumer detriment. Finally, to preserve the integrity of the financial system, new payment services providers must always be subject to the same AML/CFT requirements.

4.2.2 Credit

New credit risk models

The combination of increased availability of data, greater data processing capabilities and new analytical techniques, which is usually referred to as "big data", allows financial services providers to improve their models for *creditworthiness assessment.* New models usually incorporate broader sources of data, such as payment transactions, browsing history or even social networks, and make sophisticated analysis of such data through complex algorithms. Indeed, algorithms form part of any firm's know how assets and are increasingly becoming a source of competitive advantage.[13]

Applying big data techniques to credit risk models may improve the accuracy of the scoring of potential borrowers, which indeed allows providers to make more accurate pricing decisions for loans and other credit products. In addition, the inherent automation of these models may reduce the cost of obtaining risk scorings and, hence, the cost of processing loan applications or making pre-authorised credit offers. This cost reduction, if combined with increased access to external data, may help credit providers to assess the risk scoring of non-customers or low-engaged customers for which they have limited historical data. In this regard, the new Payment Services Directive (PSD2) and the General Data Protection Regulation (GDPR) will enable customers to transfer their personal data between different firms. Furthermore, the use of new sources of data can extend access to credit into segments that were previously excluded due to the inability to assess their creditworthiness. All these effects may significantly increase the efficiency of credit markets, both directly and through increased competition between providers.

12 Pauget, G. (2016). Systemic risk in payments. Financial Stability Review, 20, pp. 37-44. Banque de France. <https://publications.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-20_2016-04.pdf#page=37>.

13 Álvarez Caro, M. (2017). Algorithms challenge the banking industry. *Digital Economy Outlook.* January 2017, pp. 4-6. BBVA Research. <https://www.bbvaresearch.com/wp-content/uploads/2017/01/DEO_Jan17_Cap1.pdf>.

From the perspective of *financial stability,* improved credit scoring models may reduce the credit risk of financial institutions. Nevertheless, the impact of new models must be carefully assessed along a significant period of time, particularly when credit is extended to previously excluded segments. Regarding operational risks, the use of more personal data and the greater reliance on processing technologies and algorithms must be taken into consideration.

New credit scoring models also raise a number of *challenges for consumer protection.* First, the processing of personal data has to be properly authorised by the consumer, as well as being subject to high-level privacy and security standards. Second, consumers might be unfairly excluded from access to credit as a result of outdated or inaccurate data or due to incorrect inferences being made by algorithms.[14] In addition, although big data technologies and algorithms reduce human biases and force decisions onto a more reliable empirical foundation, they might also introduce more complex types of discrimination against certain social groups. To address all these challenges, providers must be subject to requirements on the design of algorithms and the automation of decisions, and consumers must be empowered with transparency and recourse rights.

Lending marketplaces

Lending or crowdfunding marketplaces have entered into the credit business with a completely different business model from that used by banks and other credit providers. Instead of providing credit themselves, with their own capital or through financial intermediation, crowdfunding platforms connect savers and borrowers and facilitate them to directly reach credit agreements. Information and communication technologies have facilitated these direct interactions between individual agents by significantly lowering transaction costs (search, bargaining, etc.). Formally, the European Banking Authority (EBA) defines lending-based crowdfunding as "open calls to the wider public by fund seekers through a third party, typically an on-line platform, to raise funds for a project or for personal purposes, in the form of a loan agreement, with a promise to repay with (or in certain cases without) interest".[15]

In general, digital platforms introduce efficiency gains in the markets where they operate by *lowering transaction costs* and internalising the externalities between the two sides of the market that they connect (e.g. borrowers and savers). As a particular type of digital platform, lending marketplaces can also lead to these benefits. However, for this to be the case, it is essential for them to be able to successfully address the *information asymmetries between lenders and borrowers* and hence mitigate moral hazard and adverse selection problems. In any case, successful crowdfunding platforms may offer an alternative to traditional bank credit and hence *increase competition* in some segments of the financing market, or even extend the market to previously underserved consumers.

Although the amount of credit issued through crowdfunding platforms has rapidly grown in the last decade, it still represents a very small share of total credit volumes. Therefore,

14 European Banking Association (2016). *Discussion paper on innovative uses of consumer data by financial institutions* (EBA/DP/2016/01). <https://www.eba.europa.eu/documents/10180/1455508/EBA-DP-2016-01+DP+on+innovative+uses+of+consumer+data+by+financial+institutions.pdf>.

15 European Banking Association (2015). *Opinion of the European Banking Authority on lending-based crowdfunding* (EBA/Op/2015/03). <https://www.eba.europa.eu/documents/10180/983359/EBA-Op-2015-03+(EBA+Opinion+on+lending+based+Crowdfunding).pdf>.

the *impact of crowdlending on financial stability is still limited.* However, if it is not appropriately regulated and supervised, and high growth rates remain in the future, it could become relevant to financial stability. In particular, systemic risks could arise due to the *interconnections between lending marketplaces and financial institutions,* some of which are already participating as investors in the crowdlending market. Marketplace lending should be monitored as part of the so-called "shadow banking" activity, which is generally defined as "credit intermediation that involves entities and activities fully or partially outside the regular banking system."[16]

From the perspective of *consumer protection,* marketplace lending involves a number of risks for both lenders and borrowers that the regulatory framework has to mitigate. Credit and liquidity risks, lack of *information* or misleading information, and the *operational continuity* of platforms are some of the most relevant risks. Moreover, AML/CFT requirements must ensure that crowdfunding platforms are not used for illicit purposes.

Finally, it is worth mentioning the challenges associated with its *business model.* The immediate issue is whether the platforms can find *the funding to back future lending* at the same kind of clip. Attracting additional money is crucial because the companies' revenues are increasingly reliant on new lending. Platforms receive as much as 90 per cent of their fees on new loans, rather than from existing customers. Without new loans, revenue would plunge. The original P2P model, which matched retail investors with retail borrowers, was straightforward. But platforms struggled to find enough cash from small investors to cope with the rampant demand for credit. So they turned to institutional investors – and increasingly to banks that would repackage loan portfolios in the form of securitisations –. Moreover, as Mark Carney recently highlighted, "how stable this funding will prove through-the-cycle is not yet clear, as the sector's underwriting standards, and lenders' tolerance to losses, have not been tested by a downturn."[17]

4.2.3 Deposits

Taking deposits from the general public is a highly standardised and regulated activity, limited to bank-licensed institutions. This has made deposit products relatively immune from technological changes, particularly when compared to payment or credit products. Nevertheless, competition in deposits – and particularly on current accounts – has increased due to the entrance into the market of new digital-only banks, usually referred to as *neobanks.* Compared to incumbents, these neobanks benefit from greater agility and efficiency, due to the absence of legacy infrastructures and physical distribution networks. In some countries, regulatory authorities have facilitated the emergence of these new banking players. For instance, the UK's Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA) jointly launched a "Bank Start-up Unit" in January 2016 to provide information and support to newly authorised banks and to those planning to apply for a banking licence. Previously, in April 2013, they had introduced a "mobilisation" route – also known as "authorisation with restrictions" – to help start-ups in the process of becoming fully operational banks.

Increased competition in deposits benefits consumers and creates incentives for financial institutions to gain *efficiency.* However, from the perspective of *financial stability,* it may add pressure on the profitability of banks – as a result of lower margins – and could

16 Fraile, A,, Romero, A. & Segovia, A.I., Turning the spotlight on shadow banking: pros and cons of the darkness, *Digital Economy Outlook,* January 2017, pp. 10-12, BBVA Research. <https://www.bbvaresearch.com/wp-content/uploads/2017/01/DEO_Jan17_Cap31.pdf>.

17 Carney, M. (2017) "The Promise of FinTech – Something New Under the Sun?", <http://www.bankofengland.co.uk/publications/Documents/speeches/2017/speech956.pdf>.

increase the volatility of deposits. Regarding consumer protection and AML/CFT, neobanks are subject to the standard rules and requirements.

4.2.4 Investment

The use of algorithms to determine trading decisions has grown considerably in a number of financial markets (notably equity and foreign exchange markets), amid advances in computing power and the speed of information processing. The Bank of International Settlements (BIS) defines automated trading as a trading technology in which order and trading decisions are made electronically and autonomously.[18] High-frequency trading (HFT) is a subset of automated or algorithmic trading that has become particularly common. In HFT, orders are submitted and trades executed at high speed and a very tight intraday inventory position is maintained.[19] These strategies benefit from quickly processing of information on market conditions and from the ability to react instantaneously to such information. Estimates suggest that HFT currently accounts for up to three-quarters of equity trading volumes and around 40% of FX.[20]

HFT may improve market *efficiency* by lowering transaction costs, helping price discovery and increasing the diversity of market participants. However, it has complex implications for *financial stability,* given the heterogeneous externalities that it introduces for other market participants.[21] For instance, HFT may increase volatility in stressed market conditions. Algorithmic traders are usually more active in periods of low volatility, but they may suddenly withdraw liquidity in periods of disruption, when it is needed most (see footnote 20). Indeed, some *"flash crashes"* have been held to stem from black-box trading combined with high-frequency trading.

Other implications for financial stability arise from the increased "self-reflexivity of markets" – price changes are increasingly driven by prices themselves – and the *risk of crowding-out traditional committed market-makers,* whose presence is particularly necessary in adverse market conditions. These market-makers may migrate their activities to other trading venues if they perceive they are at a disadvantage with respect to high-frequency traders. A final implication for financial stability is that market infrastructures must be prepared to deal with the surging speed of messaging and trading (see footnote 21).

From the perspective of investor protection, common or retail participants may be harmed by some of these trading strategies. Indeed, some HFT tactics may be designed to obscure their actual trading intent, which might increase the *risk of market manipulation.* In general, preserving the integrity of the financial system faces new challenges in the context of automated and high-frequency trading.

4.3 DISTRIBUTION AND CUSTOMER RELATIONSHIP

Digital channels

The basis of all the changes has been the development of digital channels (mobile apps, web pages, etc.), which are increasingly gaining relevance in the relationship of consumers with financial services, particularly for accessing information and conducting operations.

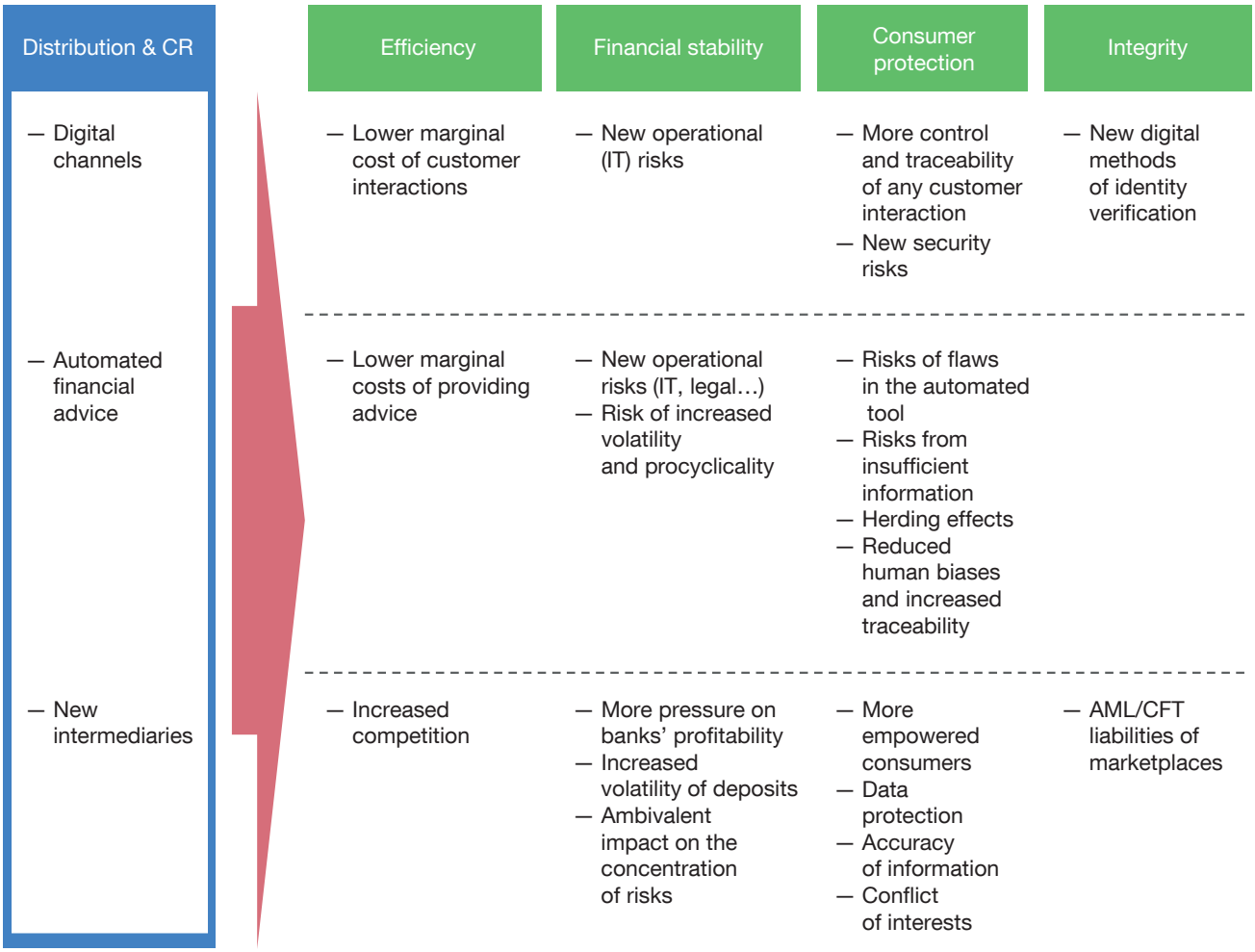
18 BIS Markets Committee (2011), *High-frequency trading in the foreign exchange market,* Basel: BIS. <http://www.bis.org/publ/mktc05.pdf>.

19 BIS Markets Committee (2016). *Electronic trading in fixed income markets,* Basel: BIS. <http://www.bis.org/publ/mktc07.pdf>.

20 Carney, M. (2017). The Promise of FinTech – Something New Under the Sun?, [Speech] Deutsche Bundesbank G20 conference on *"Digitising finance, financial inclusion and financial literacy".* Wiesbaden, 25 January, <http://www.bankofengland.co.uk/publications/Documents/speeches/2017/speech956.pdf>.

21 European Central Bank (2016). *Financial Stability Review,* ECB. May 2016, pp. 54-56, <https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview201605.en.pdf>.

IMPACT OF CHANGES IN DISTRIBUTION AND CUSTOMER RELATIONSHIP FIGURE 4



SOURCE: Author's elaboration.

Due to automation and economies of scale, digital channels allow financial institutions to gain efficiency in comparison to branch networks or even telephone channels. In terms of financial stability, they change the nature of some operational risks *from physical to cyber security,* and increase the relevance of *technological resilience* and continuity.

Digital channels allow firms to control more directly and retain traceability of any information they provide to consumers. In non-digital channels, communication with customers can suffer from human biases or errors that it is difficult for firms to identify and avoid. Therefore, new digital channels may contribute to *enhancing consumer protection* by improving information transparency and accuracy. Nevertheless, they also introduce new security risks.

When digital channels are used to acquire and onboard customers, new challenges arise for anti-money laundering and combating the financing of terrorism. Traditionally, the identity of new customers was verified by banks' employees, face-to-face, against national identity documents. Fully digital onboarding processes rely on new methods of identity verification, such as video conferences, e-ID documents or biometric solutions. As in general with digital channels, these solutions may lead to cost savings in the onboarding of new customers, particularly when fully automated methods – without human intervention – are used. However, the technologies employed have to be robust and reliable enough to minimise *AML risks,* as

well as the potential risks to consumer protection (fraud, identity theft, privacy) and the operational risks related with the increasing reliance on technology.

Automated financial advice

Beyond the digitisation of distribution and customer relationship channels, another area of innovation is the automation of financial advice, which is usually referred to as "robo advice". An increasing number of firms are providing advice to consumers without – or with limited – human intervention, making use of computer-based algorithms and/or decision trees. According to the Joint Committee of the European Supervisory Authorities (ESAs), this automation of advice is currently more prevalent for securities than for banking products.[22]

Automation leads to significant economies of scale and can therefore decrease the marginal cost of providing financial advice. These *efficiency gains* make financial advice accessible to previously excluded or underserved consumers, which in turn will have access to a wider range of financial products. Moreover, the independent intermediation of "robo advice" services might increase competition between the providers of financial products, creating incentives for further efficiency gains in the financial system.

From the perspective of financial stability, automation tools involve *technological and cyber risks* that have to be included into the framework of operational risks. Indeed, faults or errors in automated tools might affect a large number of customers and increase the exposure of firms to legal and reputational risks. Moreover, the extension of automated advice could lead to increased *market volatility and procyclicality.* If automated advice services are based on similar algorithms, a significant number of customers may end up making similar investment decisions. Depending on its size, this herding effect might lead to losses for consumers, trigger reputational risks and even have systemic consequences.

For consumers, *the ESAs have identified several risks from "robo advice"* services.[23] Some risks are related to consumers having limited access to information or limited ability to process that information or seek clarifications. This might lead consumers to make unsuitable financial or investment decisions. Other risks are related to flaws in the functioning of the automated tool, due to biases, errors, hacking or manipulation of the algorithm. Moreover, if the use of automated tools becomes widespread, 'herding effects' might lead to consumer detriment, as previously explained. On the positive side, automation avoids human biases and eases the traceability of the advice provided, which may help consumers to enforce their rights.

"Robo-advice" services present different degrees of automation and human intervention, which indeed condition the intensity of the risks that have been explained. An extreme level of automation, that goes further than simple advice, is the automated management of financial assets. The risks involved in these services are similar in nature to the ones in the automated advice, but usually greater.

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22 Joint Committee of the European Supervisory Authorities [2016]. *Report on automation in financial advice.* EBA <https://esas-joint-committee.europa.eu/Publications/Reports/EBA%20BS%202016%20422%20%28JC%20SC%20CPFI%20Final%20Report%20on%20automated%20advice%20tools%29.pdf>.

23 Joint Committee of the European Supervisory Authorities (2015). *Joint Committee Discussion Paper on automation in financial advice (JC 2015 080).* EBA <https://www.eba.europa.eu/documents/10180/1299866/JC+2015+080+Discussion+Paper+on+automation+in+financial+advice.pdf>.

New intermediaries

Finally, another relevant change in the distribution of financial services is the disintermediation of the relationship between customers and providers. Traditionally, customers had a direct, close – and usually exclusive – relationship with their bank. Indeed, for the majority of retail clients, their bank was the only point of contact for any financial need. Nowadays, a number of new players are offering different types of "intermediation services": account information services which, apart from aggregating data from different bank accounts, provide personalised suggestions; comparison sites which allow consumers to shop around and look for the financial product that best suits their needs; or marketplaces in which consumers can directly sign up to products from different providers. Crowdfunding platforms constitute a particular type of the latter, but their particular impact on the financial system has already been covered. The new EU Payment Services Directive (PSD2) will facilitate the flourishing of intermediation services since it will allow customers to directly share their bank account data with third-party payment service providers.

Intermediation services *increase the comparability* of financial products and services and *lower the cost of switching* between providers. Therefore, they promote more intense competition between financial services providers and can lead to efficiency gains in the financial system.

From the perspective *of financial stability,* this increased competition might increase pressure on the profitability of financial institutions, by lowering margins and threatening the existing cross-selling and cross-subsidy strategies. Moreover, these new services, together with advice and automation tools, can contribute to increase the volatility of deposits and exacerbate liquidity risks and bank runs.

The impact of intermediation services on the *concentration of risks* is complex. On the one hand, comparison sites or marketplaces could reduce the cost of customer acquisition for new or small players. However, more intense competition could lead to market concentration on a reduced number of players that would be able to benefit from large economies of scale. This effect is likely to be prevalent for highly commoditisable products, and might lead to increased concentration in financial stability risks.

Account aggregators, comparison sites or marketplaces can empower consumers and help them to have more control over their personal finances. However, they also raise new challenges for consumer protection. For instance, preserving the protection of personal data in a framework in which more players have access to such data, ensuring accuracy of the information provided to customers and requiring intermediaries to properly disclose their incentives to recommend particular products or services. Finally, regarding AML/CFT, there must be a clear assignment of liabilities when marketplaces allow customers to directly sign up to products from different providers.

5 Seeking a balance between innovation, financial stability and consumer protection

As mentioned before, innovation and digitalisation offer an unprecedented opportunity for the financial sector to improve its efficiency, better manage its risks and provide more value to customers. Furthermore, the introduction of digital innovations benefits the whole financial system, and these innovations improve the quality and variety of banking services, facilitate risk sharing, complete the market, and improve allocative efficiency.[24] However *innovations*

24 Shalhoub, L. (2017). Bahrain aspires to become a FinTech hub. *Arab News.* 1 March 2017 <http://www.arabnews.com/node/1061351/business-economy>.

do not arise in isolation; they require an appropriate environment to promote them. Among all the deterrents to innovation, environmental uncertainty is probably the most important one, and regulation is a key ingredient of this habitat.[25] This is because the successful introduction of something new into the market already has an intrinsic high degree of uncertainty. In some dimensions there are explicit prohibitions, but in many others, it is precisely the absence of a specific regulatory and supervisory framework which risks stifling innovation. There are projects that do not fit squarely into the existing regulatory framework. This means that they face an uncertainty which is either delaying projects (awaiting the approval of the authorities) or blocking them before their launch onto the market to avoid regulatory risks, as a result of the legal uncertainty and lack of trust being generated.

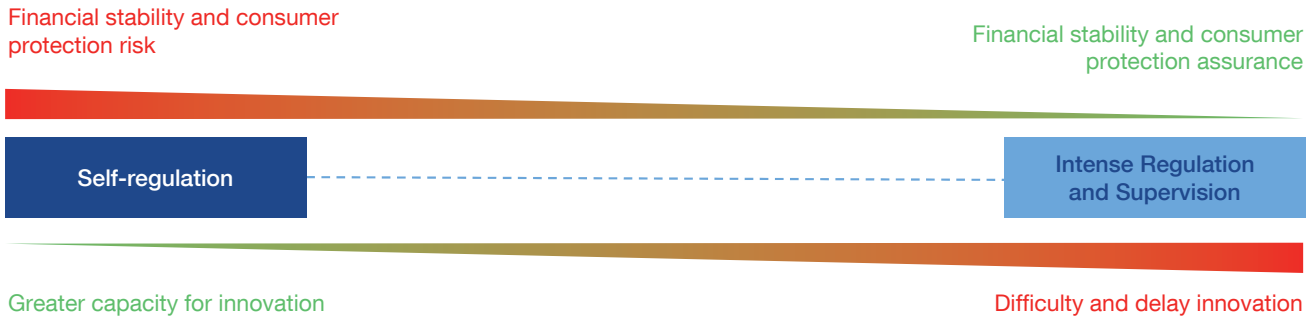
Tackling the above mentioned regulatory challenges appropriately requires a breadth of vision on the part of all concerned, both public authorities and the private sector, with a view to taking advantage of these opportunities, overcoming the obstacles that currently exist. The *best way forward is to adopt a holistic approach* to seeking a balance between the promotion of the new digital value propositions with protection against the risks involved. *How can we find the balance between both worlds?*

As shown in Figure 5, there are two extreme scenarios:

— On the one hand, one could think of a *self-regulatory approach* where the financial institutions and new players from FinTech set their own rules of operation and control based on the risk appetite that each is willing to assume. In this environment, the private sector would have a high capacity for innovation, but without a doubt would take on *more risks.*

  This approach has a significant handicap. The increased competition due to the entrance of new digital native players adds pressure on the banks' profitability. The absence of a standard regulation may imply that weaker banks and new competitors simply have little incentives to comply with their self-imposed rules. In the absence of regulation, the unique incentive is the market discipline. However, market discipline, understood as an "external control", cannot be seen as an effective tool for limiting excessive risk-taking in an

TWO POLAR OPTIONS TO REGULATE AND SUPERVISE THE FINANCIAL SYSTEM FIGURE 5



SOURCE: Author's elaboration.

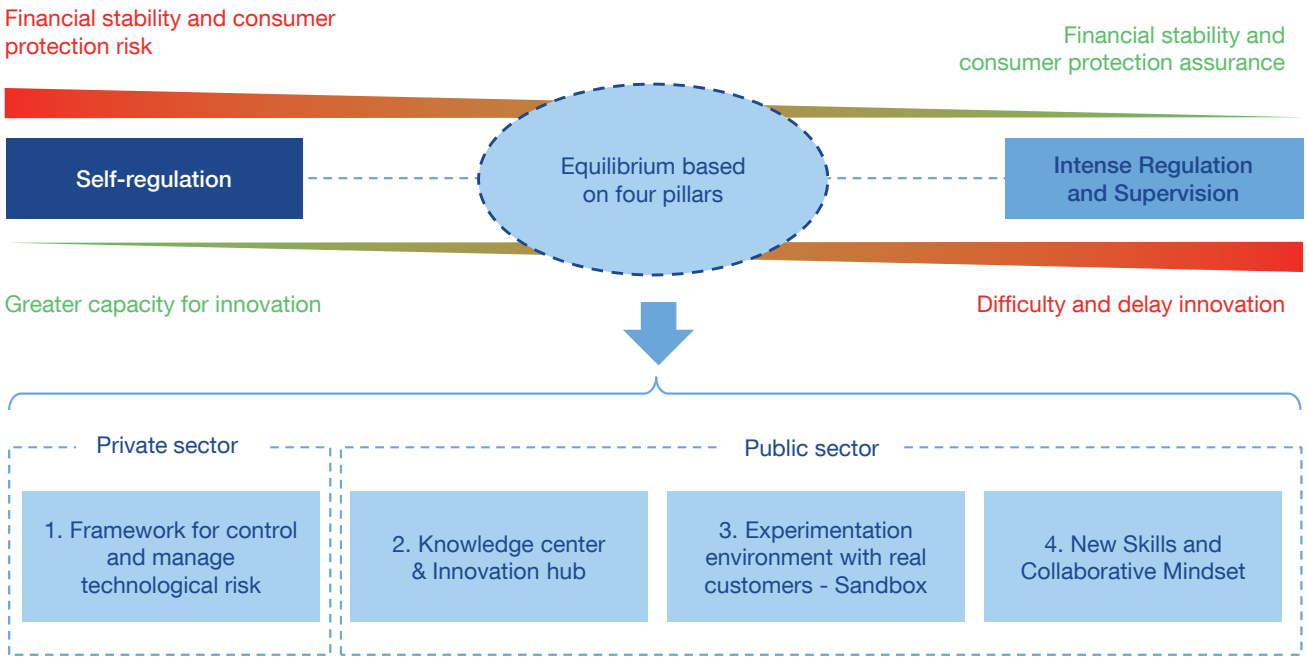
25 Edquist, C., & Chaminade, C. (2006). Industrial policy from a systems-of-innovation perspective. *EIB papers,* 11(1), pp. 108-132, <https://www.econstor.eu/bitstream/10419/44862/1/51566457X.pdf>.

environment of low regulation and supervision. In this way, the system would be taking on a high risk in terms of financial stability and consumer protection that lay beyond the control of the authorities.

— On the other hand, the opposite approach is an environment of *intense regulation and supervision* where all new developments must be covered by pre-existing regulation and approval processes, with supervisory monitoring on each case. Undoubtedly, this approach significantly reduces new risks, but the speed and degree of development of the system would lag well behind the demands of customers.

Recognising that both alternatives pose advantages but also disadvantages, there is a need to find a *compromise solution* that is consistent with the current regulatory framework the life cycle of innovation, with the participation of public and private institutions and taking into account the idiosyncrasies of each country. In fact, the financial sector is highly regulated and there is a strong link with the national environment, as all players must be authorised to operate in only certain jurisdictions, but are not automatically allowed to provide services in other countries. Besides, we must understand that the level of bancarisation and the maturity of the financial sector varies among regions. Finally, there are other factors that could affect the introduction of new services, such as the existence of venture funding, the potential market size, and the literacy level of the population. All of these issues must be taken into account when deploying any mechanism to improve the financial system, as some new ideas will fit some countries or regions but would not be suitable for others. However, *although there is no magic formula to foster foolproof innovation, there are different approaches with some elements in common* which are being introduced in different countries, and all of them agree that it is of paramount importance to improve the relationship between regulators and the industry. These different paths have some common practices which can be seen in the more detailed analysis below.

A COMPREHENSIVE AND HOLISTIC REGULATORY AND SUPERVISORY APPROACH FIGURE 6



SOURCE: Author's elaboration.

On the one hand, the *private sector needs to have well-defined policies on the control and management of technological risks* (cybersecurity, data protection, etc.) associated with the new value propositions. These policies must be integrated into the governance of the entity in order to set down and measure the risk appetite that it is acceptable to take on. It is therefore not only necessary to know and understand the risks that the new digital environment poses, but there also needs to be an internal policy of measurement, setting of limits and monitoring of technological risks that will allow the entity to perform a self-assessment of the risks involved in adapting to this new change.

On the other hand, the *public sector is currently being challenged* to find ways to support innovation, in order to alleviate uncertainty, sum up the efforts of the different agents while retaining knowledge that can be used to improve their regulatory tasks. As a response to this demand, a significant number of regulatory and supervisory authorities from different countries are already launching initiatives to promote digital financial ecosystems. Those initiatives may be grouped into *three categories:* A) an innovation hub, B) a regulatory sandbox, and C) new skills and collaborative mindset.

Overall, these initiatives allow authorities to have early and direct knowledge of these innovations, which is essential for the regulatory and supervisory framework to be kept up-to-date and to face any new challenges effectively. The main characteristics of the three initiatives will be described below.

Innovation hub

Regulation is usually regarded as one of the main stoppers of financial innovation. This perception is based on the strict obligations to provide financial services, and on the conservative interpretation of some of those principles. In order to become more accessible, financial authorities are implementing different *initiatives to move closer to the industry* and to provide more *efficient and timely response to its needs.*

Regarding this issue, it is important to mention the first steps taken by the Financial Conduct Authority (FCA)[26] in the UK, which in 2014 launched a specific programme called Project Innovate that has resulted, among other things, in an Innovation Hub which gives direct support to innovative companies and organises activities to bring the FCA closer to the innovation ecosystem. In Spain, in December 2016 the Comisión Nacional del Mercado de Valores (National Stock Market Commision, CNMV) launched a similar *FinTech Hub* initiative pursuing the same objectives. Additionally, a *Technical Committee on Financial Innovation* has been created with the participation of the Spanish Treasury, the Bank of Spain, the CNMV, the Dirección General de Seguros y Fondos de Pensiones (General Directorate of Insurance and Pension Funds, DGSFP), the Agencia Española de Protección de Datos (Spanish Agency for Data Protection, AEPD) and the Comisión de Prevención de Blanqueo de Capitales e Infracciones Monetarias (Commission for the Prevention of Money Laundering and Monetary Offense, SEPBLAC) that meets regularly to discuss issues related to technological innovation in financial services.[27]

This concept of the Innovation Hub represents a *contact point for regulators and industry* to share common views and gather advice to better navigate legal issues. It can be a

26 Financial Conduct Authority (2016). Fintech and innovative businesses. FCA *(webpage).* <https://www.fca.org.uk/firms/fintech-and-innovative-businesses>.

27 This concept of the Innovation Hub is also followed by other States, there are examples of established initiatives like the Monetary Authority of Singapore (MAS) FinTech Lab, the Australian Securities & Investments Commission (ASIC) Fintech Hub or the United States Office of the Comptroller of the Currency (OCC) Innovation Office.

digital service or a physical venue and represents a contact point for companies and public services. The idea is to collaborate in the initial phases of new value propositions by providing a common space in which to exchange needs, thoughts, and ideas.

Setting up a structure to understand and encourage financial innovation brings further benefits, like the possibility of *establishing links abroad with other hubs* in order to enlarge the geographical scope of those initiatives. At this point, it is worth highlighting two illustrative examples of how proactive regulators are signing cross-border agreements. The Singapore MAS[28] has signed cooperation agreements with the United Kingdom, South Korea, Switzerland, and India. And the Australian ASIC[29] already has agreements with the United Kingdom, Canada, and Kenya. These agreements focus on helping business to expand to other geographical areas safely and easily. Additionally, there is an interest in the exchange of knowledge in order to better understand the new trends and how they may impact existing regulations. Although this exchange of know-how is still at a very early stage, future evolutions might potentially lead to the creation of a legal figure similar to the Financial Services Passport that already exists in the European Union.

Although the recent proliferation of these hubs shows that it is an interesting practice, other authorities have just *improved their access channel without launching a concrete innovation hub* yet, such as Germany, which provides information and a contact for FinTech through the Federal Financial Supervisory Authority (BaFin),[30] or Dubai,[31] which has taken its first steps with a dedicated portal that provides guidance to FinTech participants, although it expects to evolve into a deeper collaboration, building strategic partnerships with relevant stakeholders.

In the same field, some authorities have entered a *period of reflection to identify new channels to interact* with the private sector and to accompany them in the digital transformation journey. A clear example is France,[32] which is aiming at improving its legislation and, simultaneously, creating better communication channels to cater to industry enquiries. The French financial authorities are aiming to provide what they call "FinTech-friendly regulation", that eases the requirements to start a FinTech business and a programme to allow fast-track registration and authorisation for foreign start-ups. This programme has been boosted by the creation of several incubators and the FinTech, Innovation and Competitiveness (FIC) division within the Autorité des Marchés Financiers (AMF).

All in all, it is important to note that different players could have diverse needs based on the different levels of technological development and risks. Therefore, there may be approaches focused only on new entrants and start-ups, but most initiatives launched by most advanced authorities are intended to serve all stakeholders. *A comprehensive approach with different options is probably the best approach, as it will benefit the whole ecosystem and ensure that there are positive spillovers to all participants.*

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28 Monetary Authority of Singapore (2016). *Fintech Regulatory Sandbox Guidelines. Singapore: Singapore Government.* <http://www.mas.gov.sg/~/media/Smart%20Financial%20Centre/Sandbox/FinTech%20Regulatory%20Sandbox%20Guidelines.pdf>.

29 ASIC (2016) Innovation Hub. ASIC *(webpage).* <http://asic.gov.au/for-business/your-business/innovation-hub/licensing-and-regulation/>.

30 BaFin (2016) Company start-ups and fintech companies. *BaFin (webpage).* <https://www.bafin.de/EN/Aufsicht/FinTech/fintech_node_en.html>.

31 Dubai International Financial Centre (2017). Dubai International Financial Centre Launches 'FinTech Hive at DIFC', the Region's First FinTech Accelerator, Supported by Accenture. Dubai International Financial Centre Pfress Relase, 10January 2017. <https://www.difc.ae/news/difc-launches-fintech-hive-difc-regions-first-fintech-accelerator-supported-accenture>.

32 ACPR (2016) *La conférence de l'ACPR.* Paris, 25 November 2016. <https://acpr.banque-france.fr/fileadmin/user_upload/acp/Communication/Conferences/20161125-Presentation-Fintech.pdf>.

Regulatory sandboxes

The new digital landscape poses significant challenges for authorities, as its embryonic stage makes it difficult to determine how it will be affected by the current regulatory framework and, therefore, makes it is difficult to decide whether specific initiatives should be allowed or not. As a response to these concerns, authorities could take a conservative approach denying the authorisation in order to preserve the financial system. As an alternative, *the creation of a supervised safe environment for testing with real customers before entering the market emerges an option that allows the leveraging of innovation and systemic stability.* This experimental space involves a close control provided by the financial authorities with a regulatory relief for all participants, while ensuring protection for customers and for the economy as a whole. This solution was provided by the British FCA in 2015 with the creation of the Regulatory Sandboxes, an idea that has attracted the interest of several organisations and that has recently led to the emergence of similar initiatives in other countries.

In order to improve the conditions that can lead to innovation, the regulatory sandboxes propose an space where regulators and entities are better able to grasp each other's point of view, strengthening communication and increasing common understanding, and thus contributing to a significant reduction of bottlenecks. It is of interest to mention that their *implementation can add significant value to regulators, consumers and entities,* by allowing them to understand how the ecosystem works, the opportunities as well as the risks inherent in all the initiatives. Firstly, companies are expected to be keener on trying out new products and services that could potentially improve competition and ultimately benefit consumers. Secondly, the regulatory framework can also benefit from the use of these sandboxes, as they permit a better understanding of the costs, benefits and risks of new propositions. And, lastly, consumers will enjoy the benefits of efficiency gains and obtain access to more competitive financial services.

In order to achieve a common definition of regulatory sandboxes, *some degree of homogeneity is needed in the setting of criteria* to enter this controlled space, in the internal operations and, finally, in the conditions under which the exit will take place. There are common attributes in all of the sandboxes that have already being released or are being planned. The nature of this concept makes it an exceptional process that should not be used as a shortcut to avoid regulation.

- First of all, the *project should be innovative.* The rationale behind this concept is that if a similar product has already been introduced in the market, there is previous knowledge of how it is being affected by the current regulatory framework and, therefore, allowing a sandbox would work against level playing field principles. However, one question arises regarding the way we define innovation. Although there is no single definition, we understand that it is "something *new* introduced into the market".

- Secondly, while in the sandbox, there is a *strict monitoring by the authority* in charge, which will be closely following all the improvements and helping when required. For its part, the company that has started the project must achieve certain milestones and implement any changes demanded by this authority. Thoughtfully following these procedures is vital for the success of the sandbox.

Another key element in the sandboxes is to *allow regulatory exceptions* while the project is being tested and is still unsure what its impact will be in the current framework.

Nonetheless, not all geographical areas are relaxing the same requirements at this stage. There are examples of sandboxes that only contemplate the relief of licensing requirements, as is the case of the Swiss Fintech Supervisory Sandbox released in 2016, while other nations are open to the customisation of the set of rules that should apply, like Abu Dhabi's RegLab[33] programme or the creation of waivers to permit exceptions, which is one of the options that the FCA could provide. Nevertheless, it is important to mention that there are limitations for this legal alleviation: the *regulation that is relaxed must fall under the sphere of competence* of the authority in charge of the sandbox, and Anti-Money Laundering or Combating the Financing of Terrorism regulations should fully apply along with consumer protection safeguards that need to be applied in order to ensure that the testing is not done at the expense of individuals rights.

Additionally there are different views among authorities regarding *who should participate in the regulatory sandbox.* Although most initiatives are open to all players, Hong Kong's Fintech Supervisory Sandbox[34] has started conducting pilot schemes only for banks while the Indonesian[35] plans to provide support for developers are targeted more to new entrants. In all cases, the need to establish a sandbox must be carefully reviewed on a case-by-case basis, taking into account the potential benefits for consumers, regulators and companies. This "on demand" approach arises from the fact that innovation is uncertain and there is no information about what potential business models or products might require this service. All in all, limiting the different options to *a single list of potential use cases could deter future projects.*

Finally, we must underscore that the regulatory sandboxes concept is quite recent, and new initiatives are currently being deployed. Nevertheless, there are more mature models that have already entered their first cohort of projects. Good examples come from the United Kingdom,[36] Singapore[37] and Australia.[38] Other initiatives are currently in the definition process of how these safe spaces should be, like Bahrain[39] and Kenya.[40] In the near future, we are likely to see the emergence of new regulatory sandboxes, as this idea has already captured the interest of several organisations and authorities.

New skills and collaborative mindset

To achieve success in launching regulatory sandboxes and innovation hubs requires two prerequisites: first, authorities should embark on the establishing of a *transparent and*

33 Abu Dhabi Global Market (2016). Abu Dhabi Global Market Sets Out Proposal for *FinTech Regulatory Framework in the UAE.* Abu Dhabi Global Market Press Release, 10 May 2016. <https://www.adgm.com/mediacentre/press-releases/abu-dhabi-global-market-sets-out-proposal-for-fintech-regulatory-framework-in-the-uae/>.

34 Hong Kong Monetary Authority (2017). Fintech Facilitation Office (FFO) *Hong Kong Monetary Authority (webpage),* <http://www.hkma.gov.hk/eng/key-functions/international-financial-centre/fintech-facilitation-office-ffo.shtml>.

35 Bank Indonesia launches fintech office. (2016) *Outlaw. 21 November 2016,* <https://www.out-law.com/en/articles/2016/november/bank-indonesia-launches-fintech-office/>.

36 Financial Conduct Authority (2016). Fintech and innovative businesses. FCA *(webpage).* <https://www.fca.org.uk/firms/fintech-and-innovative-businesses>.

37 Monetary Authority of Singapore (2016). *Fintech Regulatory Sandbox Guidelines. Singapore: Singapore Government.* <http://www.mas.gov.sg/~/media/Smart%20Financial%20Centre/Sandbox/FinTech%20Regulatory%20Sandbox%20Guidelines.pdf>.

38 ASIC (2016) Innovation Hub. ASIC *(webpage).* <http://asic.gov.au/for-business/your-business/innovation-hub/licensing-and-regulation/>.

39 Shalhoub, L. (2017). Bahrain aspires to become a FinTech hub. Arab News. 1 March 2017, <http://www.arabnews.com/node/1061351/business-economy>.

40 Capital Markets Authority (2017). *Kenyan and Australian regulators sign agreement to support fintech innovation.* Press Release 21 October 2016, <http://asic.gov.au/about-asic/media-centre/find-a-media-release/2016-releases/16-359mr-kenyan-and-australian-regulators-sign-agreement-to-support-fintech-innovation/>.

collaborative environment with all stakeholders, and, second, authorities should endeavour to increase the *knowledge and capacity of their staff* in relation to digital and technical innovations.

Collaboration among all public sector authorities is paramount. The speed and complexity of technological innovation demands regular knowledge sharing and close dialogue with other stakeholders, such as market participants, supervisors and legislators. In this regard, given the organisational complexity of some organisms, it is desirable that within them there should be a *figure responsible for ensuring the coordination and consistency* of the institution as a whole in regard to all the activities relating to innovation and digital transformation.

In this strategy, it is also essential to have active involvement by the various private and public actors. In the case of the *private sector,* it is obvious that all stakeholders should be involved – banks, technology companies, start-ups, etc. – while preserving a level playing field for all them. As regards the public sector, the collaboration should be extended to all authorities and not only to supervisors and policy-makers. This would include market authorities, financial supervisor, AML watchdogs, financial and industrial ministry, etc.

For this dialogue and cooperation to be effective, regulators and supervisors *need to invest in new skills* (such as expertise in cybersecurity or big data). It is important for the institutions to build up a solid base of knowledge to allow them to understand and manage the types of issues that could arise in the new environment in the most efficient manner possible, as often these are new topics for which there is simply no previous experience to call upon. As the De Nederlandsche Bank highlighted recently,[41] this can be achieved through training of staff and a targeted recruitment policy.

Developing new skills and capabilities would also allow authorities to maximise the new opportunities that technological innovation offers. *Supervisors may benefit from the new Regtech solutions,* which use new technology propositions in the context of regulatory monitoring, reporting and compliance.

An ecosystem in which suppliers and authorities are in permanent contact, and in which the latter are aware of technological innovations at an early stage, will lead to a rejuvenated framework of regulation and supervision which will facilitate innovation, while addressing the risks in the most effective way possible.

The transformation of the sector will necessarily produce occasional errors that will be committed as a normal result of an innovative process in which not just companies, but also regulators and supervisors, will be leading the way. In this regard, it is extremely important that the answers given by the authorities to these unintended consequences are proportionate. This will mean that financial institutions can continue making progress without fear in the innovation process that is so needed by the sector.

6 Conclusion

Banks have always managed to make the most of technology to improve their efficiency and the service provided to their customers, but they now face a new wave of innovation with much wider implications for financial services. *Digital disruption may help the financial sector to survive* the pressures of low growth, waning profitability and tough regulation, and to solidly re-establish trust among its customers and reputation within society. If

41 De Nederlandsche Bank (2017). *Technological innovation and the Dutch financial sector.*

banks can offer a better user experience, they will again come closer to customer demands and needs. To satisfy their aspirations and bring them the opportunity of this new age, since they are already exposed to the digital transformation in all aspects of their lives, banking must experience its reinvention.

Despite the aforementioned acknowledged benefits, developments in technology and new market dynamics *pose challenges in financial stability, consumer protection and integrity of the financial sector* – key objectives of regulators and supervisors –. From the perspective of financial stability, operational IT and cyber security risks have become a key concern among authorities. Cyber threats may create huge economic damage, but also if there is lack of confidence in the safety and security of digital technologies, the adoption of new technologies will falter even if they offer substantial benefits. Additionally, automated tools and services, such as electronic trading platforms and robo advisors, may increase the risk of market volatility and procyclicality. New players are often subject to laxer regulation and supervision, and increased competition adds pressure on the banks' profitability. Incumbent banks need to change radically; otherwise they are at risk of disappearing as we know them today.

From the perspective of consumer protection, the application of new technologies involves new security risks, and greater access to and use of customers' data increases the relevance of personal data protection. Moreover, some risks arise from automated tools, but they also allow for more control and traceability of the customer relationship. Finally, regarding the integrity of the financial system, the anonymity of virtual currencies and the greater speed of payments entail new risks related to money laundering and terrorism financing.

BENEFITS AND RISKS FROM THE TRANSFORMATION OF FINANCIAL SERVICES FIGURE 7

EFFICIENCY

+ Automation of processes
+ Disintermediation (blockchain)
+ Flexible and scalable IT infrastructure
+ Increased competition
+ Lower costs of managing cash

FINANCIAL STABILITY

– New operational IT risks
– New providers subject to laxer controls
– More pressure on banks' profitability
– Interconnections and third-party reliances
– Increased volatility and procyclicality
? Change in the concentration of risks
+ New tools to manage risks

CONSUMER PROTECTION

– New security risks
– Greater access to and use of personal data
– Risks from automated tools
– New providers subject to laxer rules
+ Control & traceability of customer interactions

INTEGRITY

– Anonymity of virtual currencies
– Greater speed of payments
+ New tools to monitor & analyse transactions
? Digital methods of identity verification

SOURCE: Author's elaboration.

The *aforementioned new risks* are not fully covered by the traditional supervisory approach (i.e. capital or liquidity requirements). So regulators and supervisors must tackle them without hindering the transformation of the financial industry. It is worth highlighting that new digital proposition is at an early stage and it certainly does not pose significant financial stability and consumer risks so far. However, the *exponential nature* of the new digital infrastructures, business and distribution models and customer solutions allows them to go from "too small to care to too big to fail" in a very short period of time, requiring authorities to have a far-reaching and anticipated perspective.

In this context, further *regulatory and supervisory work still lies ahead of us* to fully capture the potential of digital innovation and to prepare the financial system for future crises. In this regards, it is welcomed the work that the IMF High Level Advisory Group on Fintech the FSB Fintech Working Group have been carried out since last year. Although there is not a magic regulatory and supervisory formula, any solution should rest on *four key pillars:*

— The private sector needs to have well-defined policies on the control and management of new technological risks.

— Knowledge centers and innovation hubs are key contact points for regulators and industry to share common views and gather advice to better navigate legal issues.

— The creation of supervised and safe pre-market testing environments, the so-called regulatory sandboxes, emerges as an option that fosters innovation while preserving systemic stability.

— Authorities should work to increase the knowledge and capacity of their staff in relation to digital innovation, as well as develop a collaborative mindset.

To sum up, every decision that public and private stakeholders make from now on must be approached with a great sense of responsibility, taking into account *three key guiding principles.* First, the customer must be put at the center of any initiatives with ambition to succeed. Second, as future developments in technology and the competitive landscape remain uncertain, we need to pay special attention to the rise of new challenges. And finally, collaboration and communication among all stakeholders is vital in order to make the most of digitisation in finance, while preserving financial stability and ensuring adequate consumer protection.

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EXECUTIVE COMPENSATION AND FIRM LEVERAGE. A POLICY ORIENTED SURVEY

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EXECUTIVE COMPENSATION AND FIRM LEVERAGE. A POLICY ORIENTED SURVEY

Abstract

This paper surveys the literature that studies the connection between leverage and executive compensation. First, we discuss the dynamics of pay-for-performance compensation and how to measure it. Then we study the theoretical underpinnings of how firm leverage may be related to the compensation structure of its executives. After reviewing the empirical work on the topic we survey the policy implications. We discuss recent work that shows positive outcomes from regulating executive compensation, but that raises a cautionary note: regulating leverage directly seems more efficient than regulating executive compensation.

1 Introduction

Following the 2008 financial crisis, there has been a lively debate in the academic and policy circles about regulating executive compensation to avoid excessive firms' leverage. Some countries have regulated the structure or the level of compensation, especially for financial firms, while others have adopted say-on-pay regimes that increase shareholder's weight in the design of executive compensation.

For example, the European Union (Directive 2013/36/EU and CRDIV) has established that bonuses at credit institutions and investment firms cannot exceed 100% of fixed salary (200% if the company wins shareholder approval). The U.S. is also discussing new rules to curb executive compensation in financial institutions [Wall Street Journal (2016)]. Correa and Lel (2016) document that eleven countries have passed laws to give shareholders direct influence on executive compensation policies (i.e., say on pay laws). In Spain, the "Ley de Sociedades de Capital" regulates executive compensation.[1] For public companies, the "Código de Buen Gobierno" approved in 2015 by the Spanish Securities and Exchange Commission (CNMV) recommends the use of deferred compensation and clawbacks clauses.

In this article, we discuss the literature that studies the connection between firm leverage and executive compensation. Our survey is selective and guided by two policy questions. First, we study the effects of executive compensation on firm's leverage. We focus on whether the structure of compensation affects the willingness to borrow following a credit stimulus. Governments and central banks often try to stimulate economic activity by promoting credit supply. This is referred to as monetary policy's risk-taking channel. It was especially important during the Great Recession because, once the policy rates hit the zero-lower bound, many Central Banks resorted to unconventional policies to lower banks' borrowing costs and expand credit supply [Correia et al. (2016), Gambacorta and Shin (2016)]. The literature has focused on what types of lenders react more.[2] In this article, we discuss papers that focus on the borrowers, which is a relatively unexplored question. This work can help us understand in what settings the credit expansion policies of Central Banks may have the maximum impact.

Second, we discuss recent work that studies when and how executive compensation should be regulated. The literature suggests that it may be more effective to directly limit leverage rather than trying to affect it indirectly by imposing limitations on executives' compensation.

1 Articles 217-220 and 529.

2 See, for example, Dell'Ariccia, Laeven and Suárez (2017), or Jiménez et al. (2014).

2 Definitions and Basic Facts

In this section, we define how the literature measures pay-for-performance compensation. After that, we discuss the dynamics of the structure of executive compensation. We use CEO and executives as synonyms. The key take-away is that pay-for-performance compensation has increased over time, especially since the mid-1980s.

2.1 DEFINITIONS

In the literature, the executive's exposure to firm performance is called the pay-performance sensitivity. To understand better this concept, we consider a simple one period model inspired in Edmans and Gabaix (2016). The firm has no debt to simplify. Let S be the firm's equity value at the beginning of the period.

Let the CEO's compensation be $c=F+\theta S$, where θ denotes the CEO's equity ownership in the firm. We assume risk-neutrality. In this case, the pay-performance sensitivity is θ, the variation in the executive's wealth when the stock's price changes. This measure is also known as the CEO's percentage stake. Jensen and Murphy (1990) estimate this sensitivity as follows:

$$\theta = \frac{\text{Nr. shares owned by CEO} + \text{Nr. options owned by CEO} \times \Delta}{\text{Nr. shares outstanding}} \quad [1]$$

Δ denotes the stock option's delta. *Delta* measures the degree to which an option is exposed to shifts in the price of the underlying asset. Hall and Liebman (1998) show that the portfolio of unexercised stock options is the largest component in CEO's performance-pay sensitivity. Estimating delta for this portfolio of options can be challenging since firms do not typically report the features of options granted in previous years, like their maturity or their strike price. Shareholders can manage executives' pay-performance sensitivity (the slope θ) by either granting more shares, more stock options or, in the case of options, through their delta. There is a positive relation between stock options' delta and pay-performance sensitivity. The executive's risk exposure increases when the sensitivity increases.

For risk-averse CEOs we cannot ignore the effect of firm volatility on the executive's incentives. Instead of talking of the CEO's dollar pay we should talk about her certainty equivalent wealth, CE. Guay (1999) decomposes the executive's certainty equivalent wealth into two components:

$$\text{CE} = \text{E(wealth)-risk premium} \quad [2]$$

When the executive is risk neutral, the second element vanishes and we converge to the previous analysis. Differentiating equation [2] with respect to firm risk (σ) we obtain the following expression:

$$\frac{\partial \text{CE}}{\partial \sigma} = \frac{\partial \text{E(wealth)}}{\partial \sigma} - \frac{\partial \text{(risk premium)}}{\partial \sigma} \quad [3]$$

Guay (1999) calls the first element in equation [3], $\frac{\partial \text{E(wealth)}}{\partial \sigma}$, the wealth effect. This effect operates through the non-linearity of the executive's compensation cash flows. Three examples: 1) for stock options, this effect corresponds to *vega*, the option's sensitivity with respect to the volatility of the underlying stock. Vega is positive because of the convexity of the option payoffs with respect to the stock price; 2) bonuses that include a compensation

for outperforming certain benchmark and no (or limited) penalty in the case of underperformance also exhibit an option-like behaviour with respect to the volatility of firm cash flows; 3) in leveraged firm, common stock can be interpreted as a call option on the firm's cash flows with debt's face value as the strike price [Black and Scholes (1973) and Jensen and Meckling (1976)].

The second element in equation [3], $\frac{\partial(\text{risk premium})}{\partial\sigma}$, is called the risk-aversion effect. When shareholders increase pay-performance sensitivity (θ in equation [1]), risk averse executives will demand a premium for bearing more firm-specific, non-diversifiable risk. Equation [3] says that the size of this premium varies with the executive's sensitivity with respect to firm risk. This sensitivity is higher for non-diversified executives (i.e., when the CEO's compensation is a larger fraction of her total wealth) and for more risk averse executives.

In the case of options, Carpenter (2000) and Ross (2004) show theoretically that, due to the risk-aversion effect, higher stock volatility may actually decrease the value of options when options are deep enough in the money (i.e., when the price-to-strike price is large enough). This theoretical argument can be extended to any convex, option-like compensation structure, like common stock from a levered firm.

Moreover, there are several other features of executive compensation that could affect firms' risk taking. Like trading, option or maturity restrictions, market vs. stock performance or severance packages. For instance, severance packages, combined with stock options can increase the vega of the executive compensation.

2.2 MEASURING PAY-FOR-PERFORMANCE

The literature typically considers two measures of pay-performance sensitivity. The first measure is the *percentage stake* or Jensen-Murphy measure. It corresponds to θ in equation [1]. This measure captures the dollar variation of the CEO's wealth for a given dollar variation in firm's value. In a seminal paper, Jensen and Murphy (1990) study the compensation of CEOs in large publicly traded U.S. firms for the 1974-1986 period. They estimate that CEOs percentage stake is very low. On average, executive compensation increases only $3.25 for every $1,000 increase in firm's value, which denotes very low levels of management ownership. They conclude: "Corporate America pays its CEOs like bureaucrats".

The second measure is the *dollar equity at stake*, which measures the variation in the CEO's dollar pay relative to the percentage variation in firm's value. Hall and Liebman (1998) calculate the dollar equity at stake among the CEOs of the largest US companies from 1980 to 1994. The sensitivity of the median CEO direct compensation (salary, plus bonuses, plus new grants of restricted stock, plus stock options) is about 0.3, meaning that a 10% stock return leads to 3% increase in CEO dollar compensation. However, they also show that the results are different when there is re-pricing of the holdings of stock and, especially, the stock options. Taking them into account, the sensitivity increases to about 3.9. In other words, a 10% stock return is associated (median value) with a 39% increase in the CEO's dollar pay. This is not the pay-performance sensitivity of a bureaucrat!

2.3 STYLIZED FACTS

The structure of CEO compensation is very heterogeneous across countries. Table 1, which comes from Fernandes et al. (2013), highlights several stark differences. For example, equity-based compensation has a significantly larger weight in the U.S. (39%), Canada (32%), and the U.K. (30%) than in the rest of the countries in the sample.

SAMPLE SIZE AND LEVEL AND STRUCTURE OF CEO PAY BY COUNTRY TABLE 1

Country	Number of CEOs in Sample and Data Source			% of Market Cap	CEO Total Pay ($ million)		Mean Composition of CEO Pay (%)			
	BoardEx & Exec	Corp. Filings	Total		Mean	Median	Salary	Other	Bonuses	Stock & Options
Australia	8	129	137	82	$2.4	$1.7	46	10	26	18
Belgium	37	2	39	73	1.6	0.9	58	5	27	10
Canada	7	166	173	79	3.1	2.2	33	10	26	32
France	192	0	192	88	2.4	0.9	61	2	22	15
Germany	106	0	106	78	3.6	2.4	39	10	41	10
Ireland	32	1	33	98	2.4	1.7	44	8	25	22
Italy	71	2	73	80	5.2	2.7	56	4	29	12
Netherlands	80	1	81	92	2.4	1.4	44	12	23	22
Norway	47	2	49	90	1.7	1.0	56	3	25	15
S. Africa	6	50	56	80	1.7	1.3	43	7	36	14
Sweden	83	1	84	90	1.7	1.1	62	18	19	2
Switzerland	21	10	31	55	6.1	2.3	50	4	21	25
United Kingdom	561	0	561	91	2.9	1.7	42	9	19	30
Non-U.S.	1,251	364	1,615	83	$2.8	$1.6	46	8	24	22
U.S.	1,648	0	1,648	90	$5.5	$3.3	28	6	27	39
All 14 countries	2,899	364	3,263	87	$4.2	$2.3	37	7	25	31

SOURCE: Fernandes et al. (2013).
NOTE: 2006 fiscal year CEO pay data extracted from S&P's ExecuComp database (U.S.), BoardEx (non-U.S.) (collectively "BoardEx & Exec" in the table), or hand-collected from corporate filings. "% of Market Cap" is computed for each country as the market capitalization of firms with CEO pay data divided by the total market capitalization of firms in Worldscope. We exclude CEOs in their first years to compute the CEO pay statistics. CEO Total Pay is defined as the sum of salaries, bonuses (including all nonequity incentives), benefits, and grant-date values for stock options, restricted stock, and performance shares.

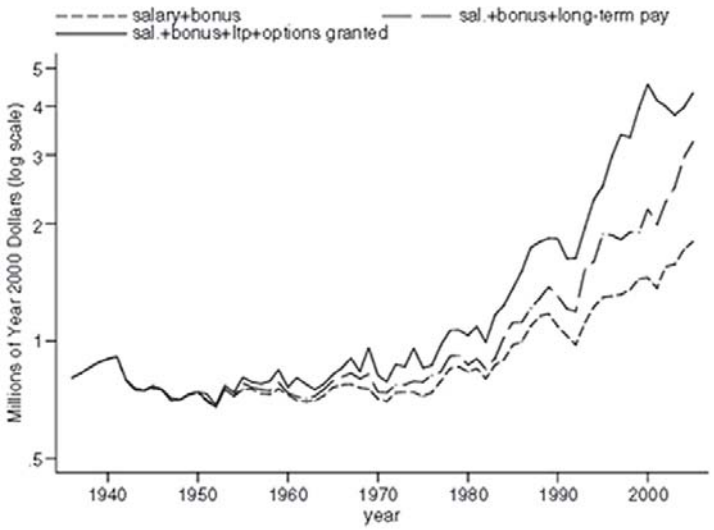
Table 1 shows the four key components of executive compensation: 1) Salary is fixed, non-contingent compensation; 2) Other components may include pension plans, insurance benefits and perquisites (like a club membership, for instance); 3) Bonuses are non-equity incentive plans based either on the board discretion or on the achievement of certain objectives. These objectives can be expressed in terms of accounting performance (like a target for earnings-per-share), market performance, or the relative ranking of the firm with respect to its peers; 4) The equity-based component includes stock option grants (at their Black-Scholes value) and stock grants (at their market value).

The compensation of CEOs and board members in Spain is regulated by the Governance Code of Listed Companies from 2015.[3] This Code follows the principle of "comply or explain." It limits the use of stock and stock options to executive board members (recommendation #57) and specifies that variable pay in general, and stock and stock options in particular, must be subject to vesting period of at least three years and that the redemption of stock and stock options is limited to twice the value of their fixed remuneration (recommendation #62).

According to the 2015 Annual Report on the Remuneration of Firm Officers, the mean total pay for CEOs among the 35 largest firms in the IBEX-35 was 3.05 million euros.[4] Of that amount, 46% corresponds to salary, the equity-based compensation (including shares granted and the profit from exercised stock options) amounts to 38% of the total compensation.

3 *Código de Buen Gobierno de las Sociedades Cotizadas,* CNMV (2015).
4 *Informe Anual de las Remuneraciones de los Consejeros de las Sociedades Cotizadas,* CNMV (2015).

MEDIAN TOTAL COMPENSATION AND ITS COMPONENTS, 1936-2005 CHART 1

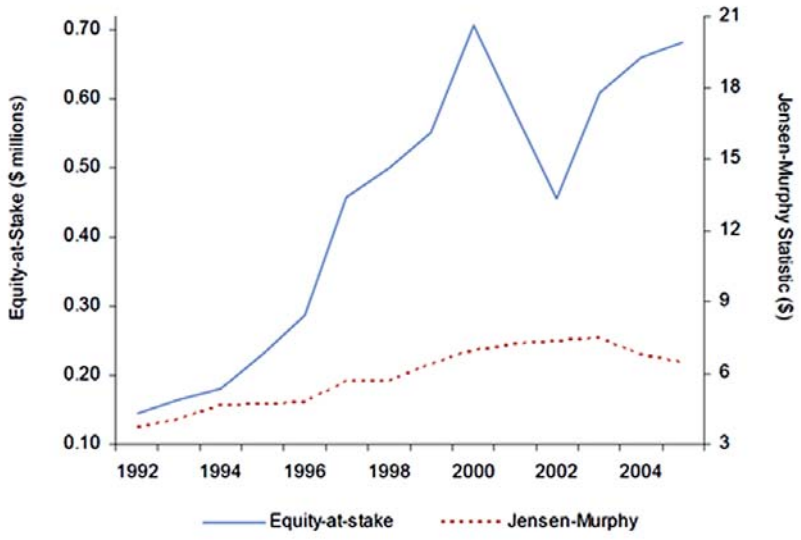


SOURCE: Frydman and Saks (2010).
Each line shows the median value of compensation defined as an increasing number of types: salary and current bonuses (paid out in stock or in cash); salary, current bonuses, and long-term incentive payments (paid out in stock or in cash); and salary, current and long-term bonuses, and the Black-Scholes value of stock options granted. Based on the three highest-paid officers in the largest fifty firms in 1940, 1960, and 1990 (a total of 101 firms).

Chart 1 from Frydman and Saks (2010) shows that the large weight of equity based compensation in the U.S. is a recent fact. Until the 1960s, equity-based compensation was rare among U.S. companies. Executive compensation consisted basically of fixed salary and cash bonuses. Since the 1960s, stock grants started to become usual in long-term incentive plans. The big "revolution" in CEO compensation came when a tax reform taxed stock options as capital gains at a much lower tax rate than labour income. As Chart 1 shows, stock options increased dramatically since the 1980s.

Chart 2 from Frydman and Jenter (2010) compares the two measures of pay-for-performance for S&P 500 firms. The right axis is the Jensen-Murphy, or percentage stake measure, that computes the dollar change in pay per $1,000 increase in firm's value. The

EQUITY AT STAKE AND JENSEN-MURPHY PROXY OF PAY-FOR-PERFORMANCE CHART 2



SOURCE: Frydman and Jenter (2010).

left axis is the change in dollar pay per 1% change in firm's value (dollar equity at stake). The two lines differ because of the growth in firms' values over time. Executives tend to own smaller stakes in larger firms. As a result, firm's growth leads to higher equity-at-stake incentives. Both measures show an increase in pay-for-performance pay over time.

3 Compensation and Firm's Leverage. Theory

In this section we survey the theoretical literature studying the theoretical underpinnings of how a firm's leverage is related to the compensation structure of its executives. For a given level of compensation, when the variable share is larger we say that compensation is more convex, or has a higher pay-for-performance sensitivity.

We should mention that the literature we are reviewing in this section assumes the existence of an *arms-length* relationship between the CEO (the agent) and the compensation committee (representing the board and, ultimately, the shareholders). We could term this approach as the contractual approach. This is not the only view. Pioneered by the work of Bebchuck and Fried (2004), a strand of the literature challenges the arms-length assumption and argues that the observed contracts are not justified by firm performance or firm characteristics. This literature stresses rent extraction by CEOs interested in their own agendas.

Since the work of Jensen and Meckling (1976) and Holmstrom (1979), it is well understood that linking compensation to performance is a powerful instrument to align the interests of executives and shareholders. For example, the investment choices of under-diversified, risk averse executives may conflict with the interest of well-diversified shareholders. The former may decide to avoid risky projects with positive Net Present Value, to focus on conservative investments. Shareholders may encourage risk-taking by increasing the *vega* of their executives compensation. For example, by including stock options in the CEO's compensation package. This is the wealth effect component discussed before in equation [3].

The seminal paper linking compensation structure and leverage is John and John (1993). In this paper, the authors study a model that incorporates a moral hazard conflict between shareholders and executives. Higher delta in the executive's compensation may, as we have seen, align the incentives of both agents. On the other side, higher delta exacerbates the executive's risk appetite resulting into a risk-shifting conflict between shareholders and bondholders. Bondholders will discount this conflict pushing up bond premia. To mitigate the extra cost of debt induced by risk-shifting, the optimal compensation contract will reduce pay-performance sensitivity as firm's leverage increases.

Contrary to the risk-shifting incentives, Lambert, Larcker and Verrecchia (1991) show empirically that options may decrease incentives for risk-taking. Theoretically, the models of Carpenter (2000) and Ross (2004) predict that, for risk averse executives, higher stock volatility entail a negative risk-aversion effect which may dominate the wealth effect.

Confirming the previous prediction, Lewellen (2006) shows that if managers are risk averse and not well diversified, in-the-money options discourage executives risk-taking and leverage for a wide range of parameters. In other words, if the manager's risk-aversion is large enough and she cannot hedge her exposure to the firm's stock volatility, the risk-premium component in [3] encourages executives to reduce firm's leverage as the options' vega increases. Carlson and Lazrak (2010) show that risk-averse managers more exposed to variable pay exhibit lower leverage.

The models proposed in all these papers provide arguments for why the *level* of leverage across different firms should be *negatively* related to the ratio of variable pay to the fixed

component of the total CEO compensation. However, the empirical literature, reports conflicting findings on whether the correlation between pay-for-performance compensation and firm's leverage is positive or negative [Tosun (2015)]. Edmans and Gabaix (2016) discuss that the literature lacks a model in which leverage and compensation are jointly determined in a framework that allows for risk aversion, effort, risk taking and endogenous costs of borrowing.

Gete and Gomez (2017) is a first attempt to endogenize effort and leverage decisions in a model with exogenous cost of borrowing. The authors analyze the interaction between leverage and executive compensation in a model in which the executives' choice of effort is endogenous and affects the likelihood of a crisis. Making CEO's effort endogenous unveils a novel channel for the relation between leverage and compensation. In particular, when the CEO is optimistic about asset prices in states of distress, there is a complementarity between effort and leverage. Optimism encourages higher leverage, and higher leverage entices higher effort to avoid the larger losses if the low state on nature is realized. Simultaneously, as the manager is compensated with equity, the manager has more incentives to supply effort in a more leveraged firm.

Dahiya, Gete and Ge (2017) revisit the existing theory and by making effort, leverage and credit spreads endogenous, expands it with new insights. The authors describe an economy with one firm that is owned by a shareholder who in turn has to hire a CEO to run the firm. The model also has a lender from whom the CEO borrows. The CEO is risk-averse while the shareholder and the lender are risk-neutral. The firm is exposed to productivity shocks whose mean is increasing in CEO's effort. This effort is costly for the CEO and noncontractable. The CEO receives a compensation contract composed of a fixed part and a share of the firm's profits. She decides effort and leverage. The lender prices firm's leverage with an endogenous spread over its costs of funds to be compensated for the risk of default from the firm.

The paper shows that the sign of the cross-sectional correlation between the *level* of leverage and the structure of compensation depends on the interplay of three channels: a) More convex compensation encourages effort by exposing the CEO to the rewards from higher firms' profits (increasing the CEO's pay-for-performance sensitivity); b) Like in Gete and Gómez (2017), there is a complementarity between leverage and effort that encourages leverage. That is, more convex compensation induces higher effort and since this makes bad shocks less likely then leverage increases; c) When the CEO is risk-averse, more convex compensation discourages leverage. The basic trade-off faced by the CEO is the level of variable compensation to accept and how much to borrow. This arises because both of these factors are sources of risk for her. That is, her total compensation has higher variance when either pay-for-performance or leverage are larger.

Channels a) and b) above generate a *positive* cross-sectional correlation between the level of leverage and the degree of convexity of executive compensation. Channel c) induces a *negative* correlation. For plausible calibrations the authors find that, except when variable compensation or CEO's risk-aversion are small, channel c) dominates and the correlation between the level of leverage and pay-for-performance compensation is negative.

Interestingly, Dahiya, Gete and Ge (2017) predict that the relationship between the *change* in leverage and variable compensation is unambiguously *positive* after an expansive shift in credit supply. This happens because the variable component makes the CEO more exposed to firm's value. Since the credit subsidy generated from the monetary policy shift increases the value of the borrowing firm, its CEO will borrow more if she is promised a larger share of the firm (i.e. higher variable compensation).

Moreover, after expansive credit policies, the shareholder offers contracts with less variable pay. The shareholder understands that after the stimulus the CEO is supplying more effort and choosing higher leverage, which are complements, and sees less need to provide variable compensation to motivate the CEO.

4 Compensation and Firm's Leverage. Empirical Work

Both compensation and firm's risk are endogenous. Thus, there are reverse causality problems. Variable compensation can encourage or discourage leverage for the reasons discussed above. However, it may also be the case that shareholders anticipate the risk conditions that the firm will face and design CEO's compensation to optimize their performance. Moreover, there may exist other reasons (omitted variables) that simultaneously drive compensation and risk-sensitivity. Thus, it is a difficult empirical problem to analyze whether compensation drives firm's risk. We review next how the literature has dealt with this problem.

Palia (2001) uses a system of simultaneous equations on panel data to investigate the relation between managerial pay-performance sensitivity and firm's value, controlling for the CEO's age, education and experience. His results show no relation between the firm's *Q*-value and CEO's pay-performance sensitivity.

Chava and Purnanandam (2010) use the change of the Financial Accounting Standards in the U.S. in 2005. According to this regulation, options had to be accounted for at their fair value and not at their intrinsic value. This regulatory change made options less attractive than restricted stock. The authors find that higher vega leads to more leverage, while higher delta is associated with lower leverage. Hayes, Lemmon, and Qui (2012) examine the relation between option pay and executives' risk-taking exploiting the same change in accounting regulation than Chava and Purnanandam (2010). However, they do not find a strong relation between the decline in option pay and less risky investments.

Shue and Towsend (2017) use a creative instrumental variable to identify causality. They use multi-year option plans as instrument because the expected number of granted options does not change with firm's performance. The authors find that a 10% increase in new options granted leads to a 2.8-4.2% increase in equity volatility. This increase in risk is driven largely by higher leverage. A similar conclusion is obtained by Panousi and Papanikolau (2012). They show that the negative effect of idiosyncratic risk on investment is stronger when risk-averse executives hold a higher fraction of the firm's stock.

Dahiya, Gete and Ge (2017) use data on corporate leverage and compensation from China's 2008 credit stimulus. The goal is to study how the structure of compensation alters firms' incentives to borrow. China is unique as its banking sector is almost completely state owned. This addresses the problems associated with the transmission of monetary and credit policy when risk-averse or poorly capitalized banks refuse to expand credit. This "supply" side problem of credit expansion has been the focus of the bank lending channel literature [see for example Gambacorta and Shin (2016) or Gambacorta and Marques-Ibanez (2011)]. However, this issue is absent in China given the complete control of the banking sector by the government. Deng et al. (2015) state this bluntly: "Beijing ordered state-owned banks to lend and they lent."

Following an unexpected deterioration of the economy in the fourth quarter of 2008, China's government suddenly exhorted banks to lend more and at cheaper rates. Total loan quotas, which are the lending targets that bank officials should meet, were increased from $4.9 trillion CNY in 2008 to almost $10 trillion CNY in 2009 [Cong and Ponticelli (2017)]. At the

same time, the Central Bank dramatically lowered banks' reserve requirements and expanded money supply. The annualized growth rate of real M2 went up from 14.9% in 2008Q4 to 26.2% in 2009Q1, and to 33.9% in 2009Q2. Ouyang and Peng (2015) state that "this was the biggest stimulus program in the world, equal to about the three times size of the U.S. effort." The literature agrees that nobody anticipated this large credit stimulus [Naughton (2009) and Deng et al. (2015)].

Dahiya, Gete and Ge (2017) show that the level of leverage and CEO's variable share of compensation are negatively correlated in the cross-section of Chinese firms. This suggests that CEO's risk-aversion is a dominant factor. Second, right after the 2008 credit push, the firms with a higher share of variable compensation increase their leverage faster. Thus, the structure of the executive compensation has a significant influence on which firms reacted more to the credit stimulus. The results are robust across different specifications and controlling for the main alternative drivers of compensation and leverage. They are particularly strong for firms in the real-estate sector. This suggests an interesting interaction between increases in leverage induced by convex compensation, and those caused by higher collateral values [Chaney, Sraer and Thesmar (2012), or Cvijanović (2014)].

5 Executive compensation as a policy tool to control leverage

From what we have reviewed above, there is theoretical and empirical support for the structure of compensation driving leverage dynamics. Following the 2008 financial crisis, there has been a lively debate in the academic and policy circles about regulating executive compensation to avoid excessive firms' leverage. In this section we survey some work on the optimal regulation.

John et al. (2000), Bebchuk and Spamann (2009), Bolton et al. (2011), Raviv and Sisli-Ciamarra (2013), Hakenes and Schnabel (2014), or Thanassoulis (2014) propose arguments for regulation based on risk-shifting problems and externalities from competition in labor markets.

Gete and Gómez (2015) analyzes the impact of remuneration practices on banks' risk-taking, captured by the level of short-term leverage, in a model with fire sales externalities but exogenous effort and exogenous compensation contracts. Fire sales externalities are at the center of the new macroprudential approach to regulation [Kashyap et al. (2011)]. Fire sales occur when financially distressed firms need to sell assets at prices below their value in a best-use scenario. Fire sales can be quite sizeable and lead to high discounts relative to face value. For instance, in March 2012, Spain's Banco Santander sold property-backed loans for EUR 750 million at a 62 percent discount to face value. In June of the same year, the UK's Lloyds sold property-backed loans for EUR 971 million after a discount of 52 percent.

Gete and Gómez (2015) show that when fire sales externalities are not internalized by a bank's shareholders and executives, borrowing is higher than the socially optimal level. Regulating executive compensation can achieve socially superior outcomes because it alters the incentives of bank executives. They analyze four compensation structures proposed by the academic literature:

1 First, plain-vanilla equity fails to internalize fire sales externalities, as it does not "penalize" short-term relative to long-term payoffs.

2) and 3) Deferred equity and long-term bonuses unrelated to short-term profits can restore the efficiency loss induced by the fire sales externality. Long-term bonuses unrelated to short-term profits increase the opportunity cost of fire

sales, thus, reducing fire sales. Deferred compensation works if agents value one dollar less in the future than in the present. If that is the case, then deferred compensation reduces the rewards from short-term debt. Thus, it lowers the incentives to leverage and sell at a discount in the case of a liquidity shock. Deferred compensation would be useless if it is invested in an interest-making account paying the same interest rate as the bank executives' discount rate. In fact, deferred compensation can be thought of as a tax on compensation, where the tax rate is the executives' discount rate.

4) Bail-in bonds reduce incentives to short-term debt by paying equity in cases of bank distress, in which equity has no value. The advantage of bail-in bonds is that they are a "cheaper" way to provide incentives. They increase the opportunity cost of fire sales in periods with liquidity needs while avoiding any remuneration for executives in periods with no liquidity problems.

Compensation schemes in real life are actually more complex than in this model. They may include severance packages (which may increase the compensation's *vega*), trading restrictions (to limit the manager's ability to game the compensation incentives), or vesting periods for stock options. These mechanisms may help to curb CEO's risk appetite. Our numerical exercises, however, show that regulating the level of compensation can have unintended consequences. Setting upper or lower bounds on the number of shares, deferred shares and/or the size of long-term bonuses may lead bank executives to an overcautious choice of debt and, ultimately, fire sales below the socially optimal level.

Based on these insights, Gete and Gómez (2017) show that, when the CEO's choices of leverage and effort are endogenous, letting shareholders vote on the design of compensation schemes (like say-on-pay schemes) fails to prevent socially inefficient firms' overleverage. Regulating the ratio of variable-to-fixed payments (but not the level of compensation) can deliver socially optimal leverage levels.

Gete and Gómez (2017) conclude that, at least for risk-neutral agents, the optimal regulation is not the regulation of executive compensation. A cap on debt is socially more efficient: it can restore the efficient level of debt with a lower distortion in managerial effort. Whether this result holds after introducing managerial risk aversion remains open for future research.

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EUROPEAN BANKS US DOLLAR LIABILITIES: BEYOND THE COVERED INTEREST PARITY

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EUROPEAN BANKS US DOLLAR LIABILITIES: BEYOND THE COVERED INTEREST PARITY

Abstract

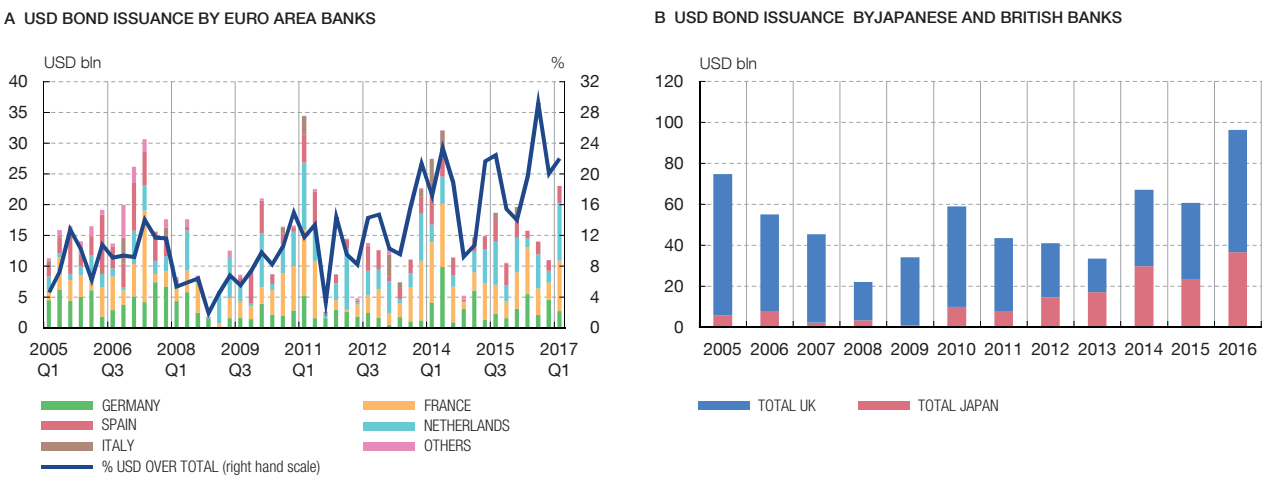
This article provides an update of the determinants of dollar-denominated long-term debt issuance by euro area banks, with a particular focus on deviations from Covered Interest Parity (CIP).These deviations, which have become more common since the global financial crisis, may have contributed to the so-called "covered cost savings" for banks issuing in US dollars at different moments in time. In contrast, negative savings may have deterred issuance in this currency during other periods. Since 2015, the relationship between covered cost savings and US dollar issuance seems to have weakened although "opportunistic" issuance may have persisted. We also document that recent regulatory reforms have enhanced the issuance of subordinated and other specific forms of long-term debt by euro area banks. These banks may have been incentivized to issue these bonds in US dollar, given the traditionally deep and wide US dollar investor base (i.e. strategic issuance). In addition to this, we investigate the possible reasons for CIP deviations as measured by the cross-currency basis swap. We conclude by analyzing possible financial stability consequences of the reliance of banks on US dollar markets and discuss how the supply of US dollars by non-banking entities, particularly those located in emerging economies, can create risks to the global financial system.

1 Introduction

Banks can choose between various currencies to fund their operations. The specific choice of the funding currency has not been investigated thoroughly for banks in the literature. This is somewhat surprising as some banks increasingly have been issuing in foreign currency. This article will investigate this issue in detail. More specifically, we shall focus on US dollar issuance by euro area banks.

The absolute amount of US dollar-denominated bonds issued by banks headquartered in the euro area totaled more than $60 billion in 2016, the fourth-largest yearly amount after 2007 and the second highest ever when only fixed-coupon bonds are considered. Moreover, the proportion of US dollar-denominated long-term debt over total issuance by

US DOLLAR-DENOMINATED BOND ISSUANCE BY NATIONALITY (a) CHART 1



SOURCE: Dealogic.

a Includes debt instruments with an original maturity of 18 months and longer. Securitizations, retained and government guaranteed bonds excluded. The nationality of a bank is defined as the country where the parent is headquartered.

euro area banks was around 19% in 2016, the highest relative amount on record. US dollar issuance by these banks was very strong during the first months of 2017 as well, both in absolute and in relative terms ($23 billion and 22%, respectively) (Chart 1, panel A). Recent large US dollar debt bank issuance is framed within the general trend towards heavier US dollar debt supply by euro area banks since the historical lows recorded during the global financial crisis (2%). Moreover, this tendency has held relatively steady in spite of high quarterly volatility and the negative impact of some periods of market distress. For instance, US dollar debt supply by euro area banks fell significantly during the euro area financial crisis in 2011-2012, during the rising geopolitical tensions at the end of 2014 and in parallel to the turbulences in the European Contingent Convertible Capital (CoCos) bond market at the beginning of 2016. An upsurge in US dollar borrowing usually followed these downturns, signaling the interest of euro area banks to further increase the importance of the US dollar in their long-term market funding operations.

By country, Germany was the largest issuer of US dollar-denominated bonds before the global financial crisis. However, the dominance of this country declined in line with total bond issuance activity of German banks after the abolishment of government guarantees for their regional banks (Landesbanken) in 2005 and the bankruptcies of some German banks in 2007-2009 [Van Rixtel et al. (2016) and Romo González (2016)]. After the crisis, the largest issuers were France and the Netherlands, being the latter the most important US dollar bond issuer in 2016. On the other hand, the share of Spanish and Italian banks within the euro area increased slightly after the crisis, but was in 2016 still below the pre-crisis levels.

Outside the euro area, US dollar long-term debt issuance by Japanese banks also has been very high in recent years. Japanese banks issued a historical record amount of almost $37 billion in 2016 (55% of their total bond issuance) (Chart 1, panel B). British banks, which were traditionally heavy issuers of US dollar debt in the past, have also increased their share of US dollar bond funding in recent years: more than 60% of total bonds issued by British banks in 2016 was denominated in US dollars, the highest proportion ever for these issuers.

What motivates a non-US bank to issue in US dollars? The US dollar is the dominant international currency, which explains the preference for US dollar debt borrowing and its' dominance in foreign exchange reserve holdings. For instance, the share of the US dollar in outstanding international debt securities and in the official holdings of foreign exchange reserves was around 60% and 64% in 2015, respectively [ECB (2016); see also Avdjiev et al. (2016)]. According to Shin (2016), the global banking system "runs in dollars", given the preeminent role of the US dollar in international transactions. However, the importance of the US dollar as the main anchor or international funding currency explains the level but not necessarily the developments in US dollar-denominated bond issuance by euro area banks in the last decade. In order to understand the latter, the specific literature on the determinants of foreign-currency denominated debt is more useful. The studies on the topic broadly point to three reasons for issuing foreign-currency debt: 1) on-balance sheet hedging of foreign currency exposures; 2) opportunistic issuance in order to realize lower issuance costs and 3) strategic drivers, linked to the characteristics of the investor base.

The most frequently mentioned motivation for the issuance of debt denominated in a foreign currency is that it serves as a natural hedge to assets that are denominated in a similar foreign currency i.e. to perform on-balance sheet hedging. Literature on the topic has mostly focused on non-financial firms, for which there is ample empirical evidence of

on-balance sheet hedging (e.g. Keloharju and Niskanen, 2001 and Allayannis et al., 2003). As for financial institutions, it can be considered that banks completely hedge their positions [e.g. McGuire and Von Peter (2009a and 2009b); Fender and McGuire (2010) and Ivashina et al. (2015)] and that they have regulatory incentives to do so. For example, Ivashina et al. (2015) argue that if banks were to leave currency risks unhedged, they would face an additional regulatory capital charge. However, banks do not necessarily need to fully match on-balance the currency denomination of their assets and liabilities. When assets denominated in a specific currency are larger than liabilities in the same currency for a bank, such as in the case of Japanese banks and some euro area banks (see sections 4 and 5), it is assumed that they use off-balance sheet instruments to hedge their currency risk [e.g. McGuire and Von Peter (2009a and 2009b) and Eklund et al. (2012)].

Other studies suggest that firms issue foreign currency debt opportunistically to take advantage of Covered Interest Parity (CIP) and Uncovered Interest Parity (UIP) deviations in international markets. These deviations can create so-called "covered" or "uncovered" cost savings or "bargains" when issuing debt [McBrady and Schill (2007) and Habib and Joy (2010)]. When firms issue on an unhedged basis, they borrow in the currency with the lower interest rate and do not buy any protection against the appreciation of that currency, in spite of UIP theory predicting exactly that outcome. It constitutes a sort of carry trade [Liao (2016)]. We assume that banks are more receptive to reap the benefits from covered cost savings than uncovered cost savings, given their better knowledge of and access to derivatives markets. Moreover, it is unlikely that banks leave open currency positions or expositions to currency fluctuations, given high regulatory costs, as explained above. Hence, they will probably hedge any US dollar funding operation rather than leaving it unhedged. In fact, some anecdotal evidence points to positive covered cost savings as the main drivers of US dollar debt issuance by banks [e.g. Moody's (2011) and JP Morgan (2015)]. However, other studies yield different results, based on banks adopting a counterparty position in currency swaps [McBrady and Schill (2004) and Habib and Joy (2010)]. More recently, Liao (2016) points to large public firms from developed countries issuing opportunistically more frequently on a hedged than on an unhedged basis.

Finally, companies may strategically issue in a foreign currency to gain access to deeper, more liquid or more complete markets or to a wider investor base [Keloharju and Niskanen (2001)]. Given that transaction costs in more liquid markets are lower (as long as these costs are a decreasing function of volumes), firms would prefer to issue foreign currency denominated debt in related liquid markets over more illiquid options [Munro and Wooldridge (2009) and Hale et al. (2014)]. For instance, Hale and Spiegel (2009) consider that foreign "vehicle currencies" such as the US dollar are useful to reduce administrative costs, given their economies of scale. Interestingly, the issuance of debt for strategic reasons may constitute a long-term funding strategy for banks which may lead them to deviate from pure opportunistic issuance in some cases, given the importance of maintaining their presence in a certain market [e.g. as described for US dollar-denominated covered bonds in ECBC (2016)].

In Romo González (2016), we provided an econometric analysis of the main drivers of US dollar-denominated debt issuance for a sample of banks located in the euro area, Switzerland and the UK between 2005 and the beginning of 2013. We find evidence supporting the hypothesis that banks issued US dollar-denominated debt for opportunistic reasons. More specifically, we show that European banks took advantage of CIP deviations and find support for the on-balance sheet hedging hypothesis and, to a certain extent, for strategic motivations. Moreover, we also show that high financial distress in markets

reduced the access to US dollar markets of European banks and that banks perceived as stronger (e.g. higher-rated) had better access to US dollar markets than weaker banks. In this article we will summarize some of the findings in Romo González (2016) and we add a descriptive update of the newest developments in US dollar-denominated long-term debt issuance by euro area banks and of covered cost savings. Hence, the structure of this article is as follows. Section 2 gives a theoretical explanation of the short-run and long-run CIP and the connection of CIP with the concept of covered cost savings. Section 3 explains the developments of covered cost savings for euro area banks with a particular focus on the developments between 2013 and 2016, when US dollar-denominated bond issuance by euro area banks increased to new record highs. We find some evidence that this trend overall has been less driven by opportunistic motivations, particularly since 2015 and more driven by strategic and regulatory factors. This notwithstanding, opportunistic motivations could explain to a certain extent the preference for US dollar denomination of some bonds issued by euro area banks. Section 4 analyzes the motivations for CIP deviations provided by the literature on the topic, with a particular focus on the most recent studies. Section 5 reflects on the consequences to financial stability related to banks' cross-border activities and US dollar funding as well as the possible new risks created by non-bank providers of US dollars in the FX swap market for the financial system. Finally, section 6 concludes.

2 An introduction to CIP and covered cost savings

A non-US bank may issue US dollar denominated debt "opportunistically" whenever US dollar borrowing is less costly on a hedged basis than borrowing in the domestic currency. The CIP is a no- arbitrage condition or condition of indifference such that when it holds, both funding options are cost-equivalent and the bank would be indifferent between one and the other. More specifically, at short maturities, CIP defines "the relationship among the spot exchange rate, the interest rate in two countries, and the forward rate... (which) implies that a borrower who hedges in the forward exchange market realizes the same domestic borrowing rate whether borrowing domestically or in a foreign country" [Fabozzi and Modigliani (2008), p. 659]. Short-term CIP in simple terms is defined as [see Popper (1993)]:

$$(1 + r^{€}_{t,t+n})\, F_{t,t+n}/S_t = (1+r^{\$}_{t,t+n}) \quad (1)$$

where $r^{€}_{t,t+n}$ and $r^{\$}_{t,t+n}$ are the domestic currency respectively foreign-currency risk-free rates for the period between t and t+n, S_t is the spot exchange rate at t (US dollar per unit of euro) and $F_{t,t+n}$ is the outright FX forward rate at t expiring at t+n. The left-hand side of the equation would represent the FX swap implied US dollar rate from the euro [Baba and Packer (2009)].[1] If CIP does not hold, we should add a non-zero basis (x) to Formula (1) such that:

$$(1 + r^{€}_{t,t+n} + x)\, F_{t,t+n}/S_t = (1+r^{\$}_{t,t+n}) \quad (2)$$

If we apply logs to (2) and rearrange the terms, we have the following expression of short-term CIP:

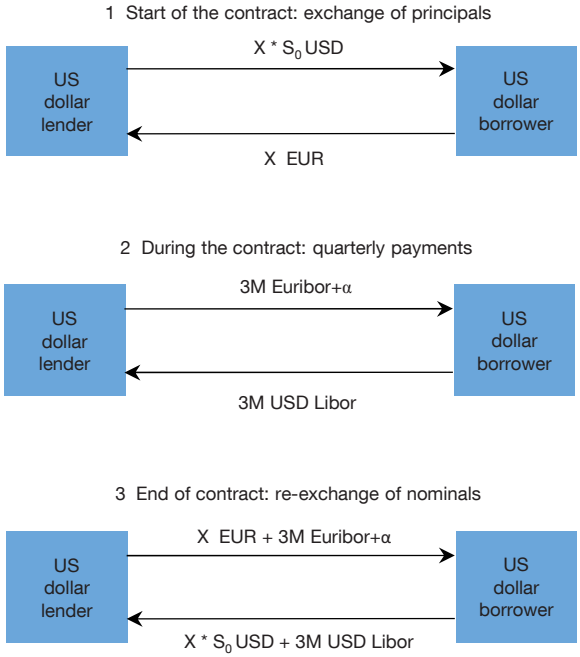
$$x = r^{\$}_{t,t+n} - (r^{€}_{t,t+n} + f - s) \quad (3)$$

1 The CIP condition can be also explained using an FX outright forward contract, which is defined as an agreement to exchange two currencies at a future date at an agreed upon exchange rate [Foreign Exchange Committee (2010)]. A FX swap is defined as a contract in which a party borrows one currency from, and simultaneously lends another to the counterparty, being the amount of repayment fixed at the FX forward rate [see Baba et al. (2008)].

Where f and s are the log equivalents of $F_{t,t+n}$ and S_t, respectively.[2] If x is negative, direct borrowing in euros in the cash market is more expensive than borrowing in US dollars and converting the proceeds to euros through a FX swap (i.e. direct euro borrowing is more expensive than "synthetic euro borrowing").

FX swaps are liquid only for terms below 1 or 2 years [Baba et al. (2008) and Popper (1993)]. Hence, at longer maturities, investors and borrowers may rather use currency swaps to hedge currency risk.[3] A currency swap is an agreement, usually ranging between 1 and 30 years, in which two parties agree to exchange a series of interest payments in different currencies (in contrast to FX swaps, where there are no periodical interim payments). These payments can be fixed or referenced to a floating rate and, in contrast to interest rate swaps (IRS),[4] notional principals can be exchanged at the beginning of the contract based on the initial spot exchange rate, S_t, and exchanged back at the maturity date at the same spot exchange rate S_t.[5] There are several kind of currency swaps, but in what follows we will focus on the so called cross-currency basis swaps (CCBS), in which floating interest rates in different currencies (e.g. 3-month Euribor and US dollar LIBOR) are exchanged periodically, as in Figure 1. In this case, following market convention the basis or spread α is added to the domestic currency floating reference.[6] Interestingly, a negative α would be detrimental for counterparty demanding US dollars in the CCBS (it receives 3-month Euribor "minus" α). Likewise, the counterparty providing US dollars in the CCBS benefits from a negative α, given that its' periodic payments will be lower than the 3-month

FUNCTIONING OF A NON-MARK TO MARKET CROSS-CURRENCY BASIS SWAP FIGURE 1



SOURCE: Adapted from Baba et al. (2008).

2 We assume that Ln (1 + r) ≅ r.
3 Market players can, alternatively, roll-over short-term FX swaps to cover a currency risk for the long-term. The roll-over strategy can be profitable for some investors, such as Japanese pension and insurance investors [BofAML (2017)].
4 In a plain vanilla interest rate swap (IRS), two counterparties exchange a stream of interest payments, one fixed and other floating, in a common currency. The interest rate payments are based on a notional principal but the parties do not exchange the notional principal.
5 This is the description of a non-mark to-market CCBS. In a mark-to-market CCBS, principals are reset periodically [Credit Suisse (2013)].
6 The CCBS basis α is different to the basis x in Formulas 2 and 3. As explained below, whereas x measures deviations from CIP in the short-run, CCBS basis α measures deviations from CIP in the long-run.

Euribor. Hence, every time the basis α is negative, a potential profitable arbitrage strategy consists on lending US dollars in the CCBS until the basis α is near or equal to zero.

For the reasons mentioned above, the long-run CIP condition requires currency swaps, in what Popper (1993) calls the "swap-covered interest parity condition". Given that the focus of our study is long-term bond issuance by banks, the long-run version of CIP based on currency swap rates is more useful for our study than the short-run CIP version [see also Habib and Joy (2010) and McBrady and Schill (2007)]:

$$r^{€}_{t,t+k} - c^{€}_{t,t+k} = r^{\$}_{t,t+k} - c^{\$}_{t,t+k} \quad (4)$$

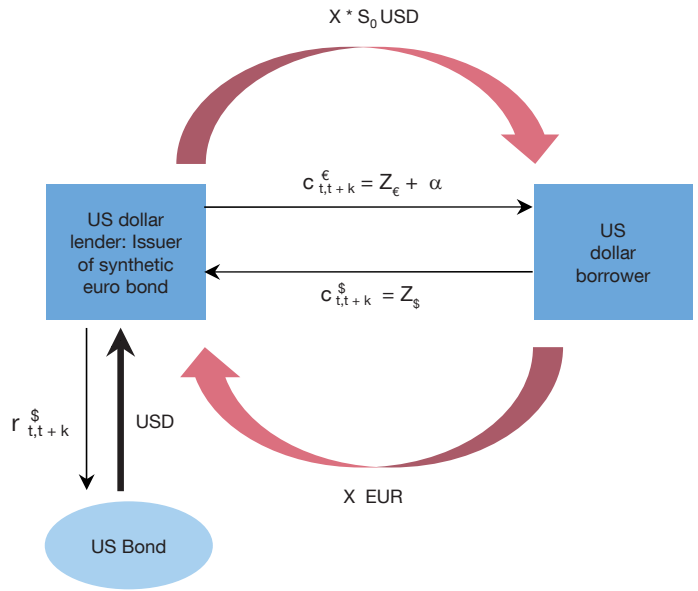
where $r^{€}_{t,t+k}$ and $r^{\$}_{t,t+k}$ are the domestic currency and foreign-currency rates between t and t+k, respectively; $c^{€}_{t,t+k}$ is the domestic (fixed) currency swap yield at maturity k and $c^{\$}_{t,t+k}$ is the foreign currency (fixed) currency swap yield at maturity k. As explained in Romo González (2016), $c^{€}_{t,t+k}$ is a combination of the domestic currency IRS fixed rate ($Z_€$) and the CCBS basis α, and $c^{\$}_{t,t+k}$ is equivalent to the US dollar IRS fixed rate ($Z_\$$) (See Figure 2 horizontal arrows). Equation (4) implies the following: if long-run CIP holds, a bank which covers its position through currency swaps should be indifferent between borrowing in the domestic currency (e.g. the euro) or in the foreign currency on a hedged basis (e.g. the US dollar). If CIP does not hold, a bank would have an opportunity to make riskless profits through arbitrage until the cost of borrowing in domestic currency equals the cost of hedged borrowing in US dollars. For example, if a euro area bank observes the following in the market:

$$r^{€}_{t,t+k} - c^{€}_{t,t+k} > r^{\$}_{t,t+k} - c^{\$}_{t,t+k} \quad \text{or} \quad r^{€}_{t,t+k} > r^{\$}_{t,t+k} - c^{\$}_{t,t+k} + c^{€}_{t,t+k} \quad (5)$$

It would be more expensive to issue a euro denominated-long term bond (pay $r^{€}_{t,t+k}$) than issuing a "synthetic euro denominated bond" (paying $r^{\$}_{t,t+k} - c^{\$}_{t,t+k} + c^{€}_{t,t+k}$, see Figure 2), that is, than issuing an US dollar-denominated long-term bond on a hedged basis. Notice that this is called a synthetic euro denominated bond, because the US dollar lender is replicating the payments of an euro-denominated bond through a swap.

ISSUING A SYNTHETIC EURO-DENOMINATED BOND

FIGURE 2



SOURCE: Author's elaboration.

In equation (3) we gave the general definition for the short-run CIP basis (x) based on risk-free rates (as if borrowers could borrow at risk-free rates). CCBS basis α stands for the long-run CIP basis when the interest rates are IRS rates.[7] However, banks usually pay a premium over IRS rates when borrowing in the long-term debt markets (i.e. they pay a positive "swap spread"). Hence, we define a specific long-term basis for euro area banks such that:

$$B = r^{\$}_{t,t+k} - c^{\$}_{t,t+k} + c^{€}_{t,t+k} - r^{€}_{t,t+k} \quad (6)$$

$$c^{€}_{t,t+k} = Z_{€} + \alpha$$

$$c^{\$}_{t,t+k} = Z_{\$}$$

When B is negative (or when the basis "widens" or there are CIP deviations, in what follows), we would be back to the situation described by Formula (5) in which it is more expensive to issue a euro- denominated bond than to issue a US dollar-denominated bond on a hedged basis (i.e. create a "synthetic euro denominated bond"). Hence, we expect that when B is below zero, euro area banks are more inclined to issue US dollar-denominated long-term debt and swap the proceeds to euro through a combination of IRS and CCBS (or directly through a fixed-for-fixed currency swap). When B is positive, on the contrary, there should be more bonds issued in euros in relative terms. When B is close to zero, we say that there are no CIP deviations for euro area banks. Notice in Formula (6) and Figure (2) that when the CCBS basis α is negative, the lender of US dollars in the CCBS has a benefit over the borrower of US dollars because it will pay less than the euro IRS. A euro area bank issuing in US dollars to lend them in the CCBS may obtain a profit. Moreover, a more negative basis α makes the basis B even more negative.

In Romo González (2016) we defined "covered" (borrowing) cost savings [following e.g. Habib and Joy (2010)]. Covered cost savings are just the negative of B and measure the borrowing costs savings that any euro area bank could make by issuing a US dollar-denominated bond and swapping the proceeds into euros, instead of issuing directly in euros. Hence, a negative B is equivalent to positive covered cost savings and when the basis is close to zero, covered cost savings of issuing in US dollars on a hedged basis are close to zero as well. If covered cost savings are zero, we assume that there are no CIP deviations:

$$\varepsilon^{C} = (r^{€}_{t,t+k} - c^{€}_{t,t+k}) - (r^{\$}_{t,t+k} - c^{\$}_{t,t+k}) \quad (7)$$

Where again:

$$c^{€}_{t,t+k} = Z_{€} + \alpha$$

$$c^{\$}_{t,t+k} = Z_{\$}$$

In what follows, we will focus on the covered cost savings for euro area banks instead of on the basis. We expect a positive relationship between covered cost savings and the ratio of US dollar debt issued by banks over total issuance.[8] In order to calculate covered cost savings for euro area banks, we use the yields of several investment grade indices from Markit and Bank of America Merril Lynch (BofAML). These indices provide a measure for the costs for financial companies and banks in euros and US dollars. Ideally, a yield

7 See Du et al. (2016) for further detail.

8 We obtain a similar picture when comparing US dollar total issuance over total issuance of bonds denominated in euros controlling for the spot exchange rate variations over time.

comparison should be drawn on a bond by bond basis, comparing US dollar and euro-denominated bonds of similar rating and maturity issued by the same bank. Hence, the indices used here are mere approximations,[9] although similar methods are used in some investment banks' reports and studies [e.g. BofAML (2017) for calculations on investors' demand for US dollar assets and Liao (2016).[10] We will use 10 year CCBS and IRS swaps to match the average maturity of US dollar fixed-coupon bonds since 2005.[11]

3 Covered cost savings and US dollar issuance

Chart 2, panel A, shows general covered cost savings for euro area banks for "synthetic euro bonds" vis-à-vis direct issuance in euros[12] as well as the relative amount of US dollar-denominated bond issuance by euro area banks over total issuance in all currencies. As expected, the Chart shows a positive correlation between both variables during most of the period considered. Covered cost savings were negative but relatively close to zero between 2005 and 2007, when markets were still enjoying relative good funding conditions and arbitrage by market players was effectively keeping the basis near zero.[13] However, since 2007 the level and the development of covered cost savings have varied substantially. We can classify covered cost savings for euro area banks into three different periods since the global financial crisis, depending on the general behavior of the variable.

The first period covers approximately the global financial crisis, which was essentially a US centered crisis or a US dollar crisis. It was characterized by very negative covered cost savings, which sunk to historical record lows at the beginning of 2009 (some time after the fall of Lehman Brothers in September 2008) and remained very negative until the end of 2010. Negative covered cost savings were mainly driven by the large spread differentials between the US dollar and the euro. This can roughly be approximated by the spreads between the yields and the IRS rates for each currency. According to this measure, long-term funding in US dollars relative to euros became very expensive (see Chart 4, panel A). Even when the CCBS basis α was negative, signaling profitable opportunities for CIP arbitrage (see Formula 7), high funding costs for euro area banks at that time might have made the arbitrage through US dollar bond issuance unprofitable for them. In consequence, relative total US dollar debt issuance by euro area banks was only around 2% on average by mid-2009.

9 For example, the BofAML and Markit indices are based on bonds issued by entities from different nationalities e.g. the investment grade US dollar BofAML banking index include US dollar bonds issued by non-euro area banks; similarly, the euro banking BofAML index includes euro bonds issued by non-euro area banks. Thus, these indices may not be fully representative of the real interest rates faced by euro area banks or financial companies during our sample period. Second, the bonds included in these indices do not necessarily have a ten year maturity, as is the case of the currency and interest rate swaps used for the approximation. Moreover, even though all bonds included are investment grade, differences in costs may arise between banks rated near the AAA or AA marks and banks closer to the below investment-grade threshold. The former is solved by using the different maturity and rating structures of Markit, although in this case, we take into account funding costs of all financial companies and not only banks (see Chart 3 panel B).

10 Du et al. (2016) provide a detailed explanation on their method for calculating long-term CIP deviations for KfW, an agency fully backed by the German government considered to be risk-free. They use zero-coupon yield curves and swap rates as proxy for CIP measures. In one of their appendices they explain how to exactly calculate the basis for coupon bearing bonds.

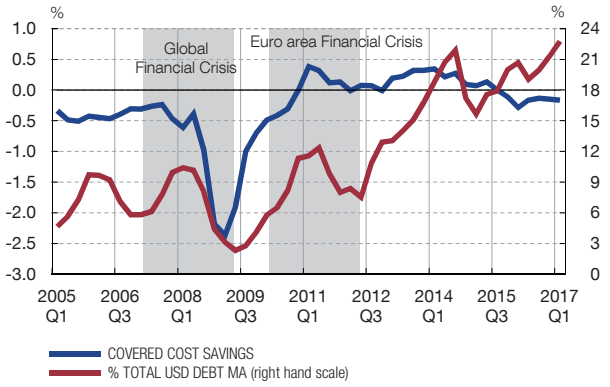
11 Generally similar results, with only some exceptions, are obtained when 5-year swaps are used for the period between 2005 and 2013. This would roughly match the median maturity of US dollar bonds issued by euro area banks.

12 Here we used the banking BofAML indices to track the performance of euro and US dollar investment-grade debt, respectively, publicly issued by banks. To qualify for these indices, the bond must have at least 18 months to final maturity when issued (which matches the maturity of our sample) as well as a fixed-coupon schedule and a certain minimum amount outstanding. The US dollar banking BofAML index includes investment-grade US dollar-denominated bonds issued in the US market by US and non-US banks. As with all approximations, using alternative indices or alternative calculation methods provide some changes in the levels of Covered Cost Savings, but overall trends are similar. Bond issuance includes fixed-coupon instruments only.

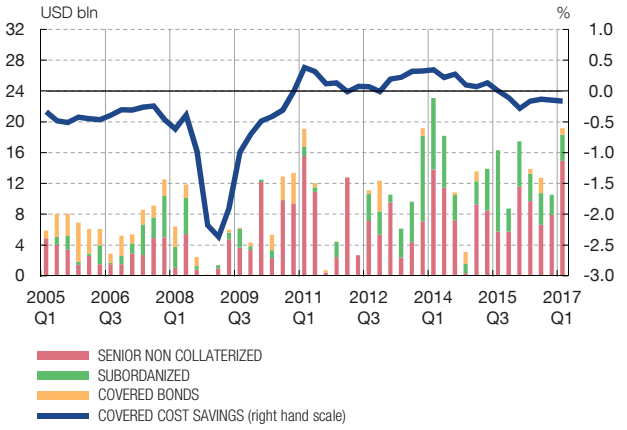
13 For the calculations of the basis we are not taking into account transaction costs in derivative markets as in Du et al. (2016) or Pinnington and Shamloo (2016).

US DOLLAR-DENOMINATED BOND ISSUANCE AND COVERED COST SAVINGS (a) CHART 2

A USD BOND ISSUANCE BY EURO AREA BANKS AND COVERED COST SAVINGS



B USD BOND ISSUANCE BY EURO AREA BANKS BY INSTRUMENTS AND COVERED COST SAVINGS



SOURCES: Dealogic, BofAML, author's calculations.

a USD debt includes fixed-coupon debt instruments with an original maturity of 18 months and longer. Securitizations, retained and government guaranteed bonds excluded from total USD bond issuance. Covered cost savings calculated as quarterly averages using 10 year swaps.

In contrast, covered cost savings turned positive during the euro area financial crisis, which started in May 2010 with the announcement of the first bail-out package to Greece. Covered cost savings reached a historical high at the beginning of 2011. In parallel, US dollar total debt issuance recovered from its 2009 lows and accounted for a 12% of total issuance by euro area banks on average in mid-2011. US dollar total debt activity fell afterwards, affected by the spillover of sovereign tensions to the banking sector and the increase of currency redenomination risk. As during the global financial crisis, credit spread differentials were significant drivers of the covered cost savings of banks. Given that the focus of the financial crisis was located on Europe, euro-denominated long-term funding costs for banks increased significantly and were at times even higher than costs of funding in US dollars. Volatility was very high during this period as banks tapped markets whenever a window of opportunity opened, coinciding with the brief periods of lower risk aversion in international markets.

Covered cost savings were positive until around mid-2015 when US dollar debt issuance accounted for around 18% of total debt issuance on average by euro area banks. However, the positive correlation between these savings and US dollar funding seems to have weakened since then: covered cost savings started to decrease due to higher US dollar funding costs, in parallel to the end of the quantitative easing policies by the Fed by the end of 2014 and the enactment of very accommodative policies by the ECB. Interestingly, US dollar bond issuance activity continued trending higher and reached a new historical record high in the third quarter of 2016 in relative terms (29%). The obvious question is what drove this huge growth of US dollar denominated debt issuance by euro area banks in recent years. To answer this, we need to take a look at the composition of the US dollar debt issued by banks, in which the share of subordinated debt has increased substantially (Chart 2, panel B).

One of the biggest drivers of the upsurge in US dollar funding by euro area banks between 2013 and 2016 was the issuance of subordinated long-term debt. Subordinated[14] US dollar denominated-bond issuance has rapidly increased since 2010, from around $1 bln to almost

14 We consider here fixed-coupon subordinated bonds only.

$22 bln in 2015 (Chart 2, panel B). Although it decreased in 2016, total issuance was still more than $16 bln that year, well above the historical average. In relative terms, the share of US dollar subordinated bonds represented around 30% of total US dollar bond issuance in 2016, which compares to only 3% in 2010 (Chart 3, panel A). The trend towards higher issuance of subordinated bonds by euro area banks has not been exclusively limited to US dollar long-term debt: banks needed to issue subordinated debt in order to meet the new capital requirements stipulated by Basel III and the Capital Requirements Directive (CRD IV) in the EU. Moreover, subordinated debt is required to build the new TLAC and MREL buffer requirements, which have already entered into force, or will do so very soon.[15] That said, subordinated debt accounted only for 11% of total euro denominated-bond issuance in 2016. Even if euro denominated covered bonds are excluded (which account for 43% of the total euro bank bond universe), subordinated debt still has a lower weight in total euro denominated bond issuance than its US dollar equivalent. In consequence, there seems to have been a bias towards subordinated long-term issuance in US dollars by euro area banks.

Why did euro area banks start to issue this large amount of US dollar-denominated subordinated bonds? A couple of possible drivers come to mind. First, as mentioned before, euro area banks needed to meet the new capital and bail-in regulatory requirements. Second, strategic motivations related to issuance in the US dollar could have played a very important role. According to several market reports, euro area banks have been taking advantage of the traditionally deep and wider US dollar investor base, particularly during times of market uncertainty [see for example Fitch Ratings (2016)].[16] Moreover, US dollar investors have been more receptive to European banks' new regulatory bonds than other investors, due to the perception of improving credit fundamentals of European banks, although some concerns for profitability and bad loans still exist [Goldman Sachs (2017)]. Finally, pricing considerations could have been important as well. Many of the US dollar denominated-subordinated bonds issued by euro area banks since 2012 have been issued at maturities of 10 years or longer. Moreover, most have been rated in the BBB bucket. Chart 3, panel B, shows covered cost savings for bonds issued by financial companies as reported by Markit. Covered cost savings are currently positive for BBB bonds in the 7 to 10 year maturity bucket. Hence, even though the positive correlation between covered cost savings and total US dollar debt issuance has been not so clear since mid-2015 (recall Chart 2, panel A), a further breakdown of these savings by rating and maturity shows that opportunistic funding of subordinated debt probably continued to be a important driver of US dollar long-term debt issuance.

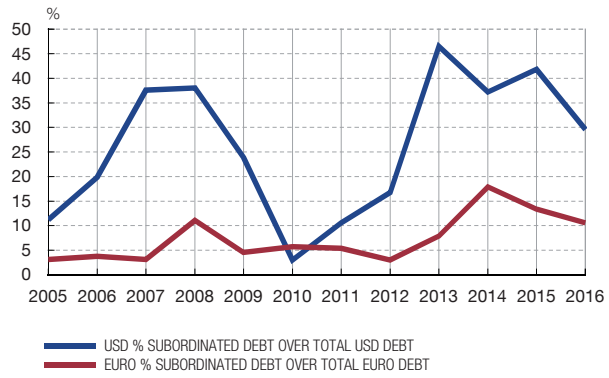
Finally, strong issuance of US dollar-denominated subordinated bonds by euro area banks decelerated in 2016 and in the first quarter of 2017. This was most likely due to the sell-off in the CoCo market at the beginning of 2016 and political uncertainties in Europe, such as the UK referendum in June to leave the EU and the elections in several European countries in the first half of 2017 [for more details, see Fuertes et al. (2017) and LBBW (2017)]. In general, issuance of subordinated bonds is traditionally more affected by market turmoil and financial distress than other kinds of debt perceived by investors to be safer, such as covered bonds, regardless of opportunistic pricing considerations. This can be seen in the low overall issuance of subordinated bonds in the period between 2009 and 2012.

15 The Financial Stability Board (FSB) issued the final Total Loss-Absorbing Capacity (TLAC) standard for global systemically important banks (G-SIBs) in November 2015. European GSIBs will be required to meet TLAC since January 2019. In addition to this, the Bank Recovery and Resolution Directive (BRRD) requires adequate "bail-in" capital for all banks in the EU since January 2016 (the minimum requirement for own funds and eligible liabilities or MREL). The goal of both requirements is very similar (that banks have enough loss-absorbing capacity in case of resolution) although there are differences with respect to some of their features.

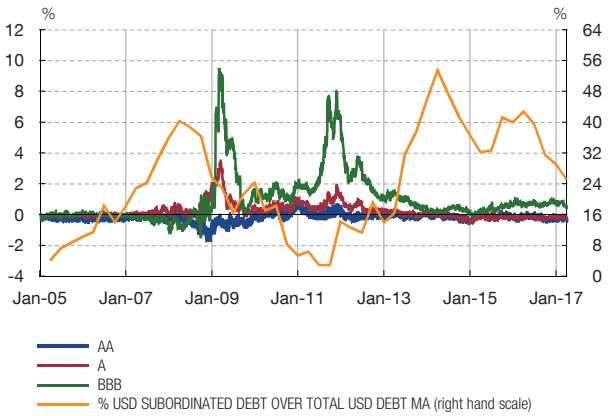
16 Europeans banks have also issued large quantities of US dollar-denominated "Formosa" bonds since 2014 i.e. bonds sold in Taiwan. Strategic motivations seem to have driven this trend as well.

SUBORDINATED BOND ISSUANCE BY CURRENCY AND COVERED COST SAVINGS (a) CHART 3

A PROPORTION OF SUBORDINATED DEBT BY CURRENCY



B COVERED COST SAVINGS BY RATING 7-10 YEARS AND SUBORDINATED DEBT



SOURCES: Dealogic, Markit, authors' calculations.

a USD debt includes fixed-coupon debt instruments with an original maturity of 18 months and longer. Securitizations, retained and government guaranteed bonds excluded from total USD bond issuance. Covered cost savings using Markit yield financial indices.

Interestingly, another positive factor driving US dollar bond issuance by euro area banks in 2016 may have been the replacement of US Money Market Funds (US MMFs) funding with more long-term US dollar denominated debt (see section 5).[17] Moreover, since the beginning of 2017, issuance of senior non-preferred bonds by euro area banks has picked up, which are also needed to comply with TLAC/MREL buffer requirements.[18] As with subordinated debt, the tapping of the liquid and diversified US dollar investor pool has been an important motivation to increase issuance of these bonds denominated in US dollars.

4 Developments in the cross-currency basis swap markets and covered cost savings

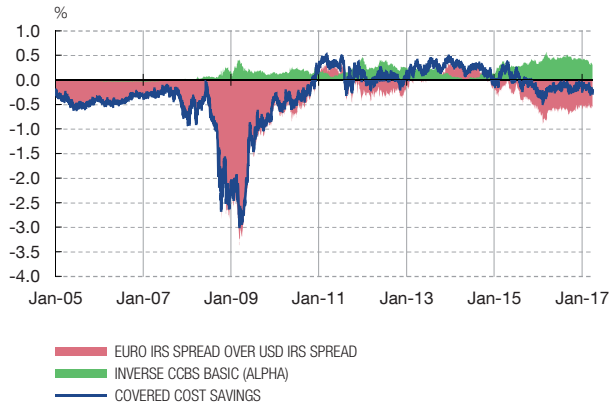
As discussed before, changes in the cross-currency basis swap (CCBS basis α) are a driver of covered cost savings of euro area banks or of the "bank basis" B (see components in Formulas (6) and (7) and Chart 4, panel A). More specifically, a negative basis α in the currency swap markets for some currencies such as the euro and the yen against the US dollar enlarge the cost savings that euro area (Japanese) banks can realize by issuing in US dollars on a hedged basis (by issuing "synthetic euro bonds"). Therefore, in this section we will focus on the developments in global financial markets that drove deviations in CIP as measured by the CCBS basis. As we shall discuss, several studies suggest that the factors driving these deviations since mid-2014 are different to those driving the basis during the crises periods of 2007-2008 and 2010-2012. In general, both policy and academic studies have concentrated on deviations from CIP, particularly since 2007, as measured by the CCBS basis and the shorter-term FX swap basis (basis α and x in section 2). In relation to this, the CCBS basis regained importance in the breakdown of covered cost savings since the end of 2014 (Chart 4, panel A).

17 US dollar short-term lending by US MMFs was negatively affected by the US MMF reform effective in October 2016. This reform affected mostly the so called institutional prime MMFs, which were heavy investors on short-term debt securities issued by US and non-US banks. This reform, which had the goal to avoid market disruptions as seen during the global financial crisis, implied the adoption of floating net asset value for institutional prime MMFs, among other measures. This reduced the attractiveness of prime funds vis-à-vis other MMFs such as institutional government MMFs, not affected by these reforms. As a result, prime MMFs in the US substantially reduced their holdings of short-term debt securities issued by banks.

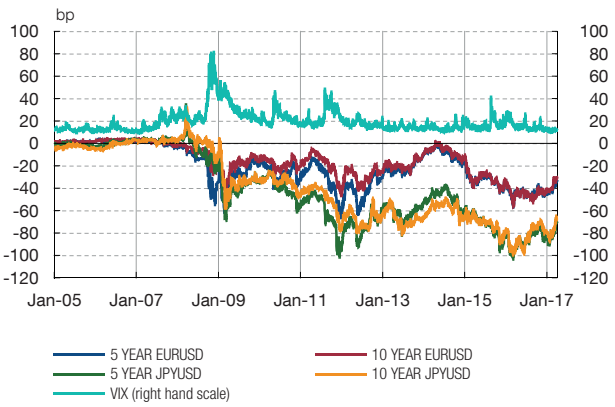
18 The EU is currently working on harmonizing the different approaches inside the EU on bank creditors' insolvency ranking. The European Comission announced in November 2016 its' support for the "contractual subordination" option or the "un-preferred tier senior debt" as a way to harmonize the building of TLAC buffers inside the EU [European Commission (2016) and LBBW (2017)].

DECOMPOSITION OF COVERED COST SAVINGS AND CROSS-CURRENCY BASIS SWAP (a) CHART 4

A BREAKDOWN OF COVERED COST SAVINGS



B CROSS-CURRENCY BASIS SWAPS FOR EUR AND JPY AGAINST THE USD



SOURCES: Datastream, BofAML, authors' calculations.

a Covered cost savings calculated using 10 year swaps and daily data.

Chart 4, panel B, shows the development of the CCBS basis from 2005 up to 2017 for the euro and the yen against the US dollar for 5- and 10-year maturities. In the pre-crisis period, the basis was very small and close to zero, which implies that profitable deviations in the CIP were transitory [Akram et al. (2008)]. Large CIP deviations between 2008 and 2012 (i.e. widening of the basis or a more negative basis) were linked to episodes of US dollar funding and liquidity distress, large dollar shortages, heightened transaction costs and the deterioration of the creditworthiness of non-US banks in need of US dollars. For instance, during the global financial crisis and the euro area financial crisis, deviations of CIP were the result of the heavy borrowing of US dollars in FX swap markets by (mostly) non-US banks to compensate for the loss of access to the US dollar interbank market and US MMFs [see Nakaso (2017); BIS (2016) and Pinnington and Shamloo (2016)]. The introduction of central bank US dollar swap lines and the adoption of measures to reduce liquidity and credit risk possibly were effective in narrowing the basis at that time [Baba and Packer (2009)]. However, in spite of no apparent funding or liquidity distress, the basis started to widen again in mid-2014 and has stayed persistently away from zero ever since then. Moreover, CIP deviations persist even after controlling for credit risk and transaction costs, which point to real arbitrage opportunities for market players [Du et al. (2016)].

According to the literature on the topic, CIP deviations since mid-2014 mainly have been driven by large demand and supply imbalances in the FX and currency swap markets, or as Du et al. (2016) show, by a combination of "global imbalances" and costly financial intermediation. On the one hand, there has been an excess demand for US dollars in the FX derivative markets against some other currencies, driven by monetary policy divergences across countries. On the other, high demand has not been met with enough supply of US dollars (i.e. not enough lenders of US dollars). As a result, the basis is large and negative for some currencies such as the euro and the yen, signaling a significant and persistent premium for borrowing US dollars against these currencies in the FX swap and the cross-currency basis swap markets. Interestingly, and as Borio et al. (2016) points out, whereas demand factors explain why the basis opens up, supply factors explain why it does not close.

Turning first to *demand imbalances,* which mainly consist of an excessive demand for US dollars, the main driver has been probably the monetary policy divergence between the US vis-à-vis the ECB and the BOJ, particularly since 2014 [Iida et al. (2016)]. This is not a

mere coincidence: the Federal Reserve (Fed) ended bond purchases in 2014 after gradually reducing them since the end of 2013 ("Fed tapering"). The tightening of the Fed contrasted with further easing by the ECB and the BOJ. For instance, in September 2014 the ECB announced its ABS purchase programme and a refi rate cut. Later on, at the beginning of 2015, the ECB announced a QE programme. Finally, the ECB corporate bond purchase programme, announced at the beginning of 2016, helped reducing bond spreads in the euro area further. Monetary policy divergences across areas created incentives for investors located in the euro area and Japan to acquire US dollar denominated-assets in a "search for yield" behavior, and made it more attractive for (non-financial) companies located in the US to issue in foreign-currencies ("reverse Yankees"[19]). At least some of these investors and issuers hedged their assets and liabilities through FX and currency swaps.[20] Evidence in favor of divergent monetary policies driving CIP deviations has been found by e.g. Du et al. (2016), Avdjiev et al. (2016) and Iida et al. (2016). Liao (2016) points to cross-currency issuance by non-financial companies as an independent driver of long-term CIP deviations.

In addition, another important source of US dollar hedging demand has been attributed to banks [Borio et al. (2016), Sushko et al. (2016), BIS (2016) and Barclays (2015)]. This can be proxied by large US dollar funding gaps, or US dollar mismatches between assets and liabilities, of certain banks,[21] which have been particularly large for Japanese banks. Currency mismatches of these banks were already large before the crisis and continued to increase in recent years, in parallel to monetary policy divergences between Japan and the US. By contrast, some euro area banks have changed their role after the crisis from arbitrageurs of the CIP (i.e. lenders of US dollars) to that of borrowers of US dollars (see Chart 5 in section 5). Hence, even if large opportunistic US dollar bond issuance by euro area banks in recent years could have increased their supply of US dollars in the FX swap and the currency swap markets, on a net basis, euro area banks currently demand more US dollars than what they supply in these markets. This has been further exacerbated by monetary policy divergences as well as potentially by some regulatory reforms, such as the US MMF reform. The latter reform, which became effective in October 2016, increased the cost of acquiring US dollars as prime MMFs in the US substantially reduced their holdings of short-term debt securities issued by banks (such as commercial paper and certificates of deposits), particularly by French and Japanese banks. This could have added more pressure to the short-term basis, as banks in net demand of dollars may have turned to FX swap markets to obtain US dollar funding.[22]

We turn now to *supply imbalances* in FX and currency swap markets as an explanation of the persisting deviations from CIP. These imbalances have been linked mostly to regulatory changes affecting banks, as well as tighter risk management by banks and more scrutiny

19 Reverse Yankees are one example of synthetic US dollar funding, in which a non-financial company located in the US issues in euros given its lower cost vis-à-vis funding in US dollars. These issuers would transform the euro denominated bond into a synthetic US dollar bond using a cross-currency swap by borrowing US dollars, contributing to put further downward pressure on the basis. Reverse Yankee issuance by US non-financial corporations increased from €32 bln in 2013 to € 70 bln in 2016, the highest amount ever, probably enhanced by the ECB corporate purchase programme. However, issuance in yen by US non-financial corporations has been more modest (around € 1 bln in 2016), given perhaps the smaller size of the Japanese corporate bond market (Borio et al., 2016).

20 According to Liao (2016), whereas debt issuers tend to match the maturity of the swap to that of their foreign-currency denominated bonds, institutional investors use short-dated FX forwards and roll them over.

21 As mentioned before, whenever on-balance sheet US dollar assets (such as loans and bonds) are larger than US dollar liabilities, it is assumed that this mismatch is offset with off-balance sheet hedging instruments such as FX and currency swaps.

22 However, according to some analysts [JP Morgan (2016)], it is unlikely that banks completely replaced their prime MMF funding with FX swaps, given their high cost.

by the public to banks since the crisis [Du et al. (2016), Iida et al. (2016) and Liao (2016)]. Regulatory changes may have created balance-sheet constraints for arbitrage activities of banks. In other words, global banks may not only have contributed to a wider basis by hedging their large US dollar investments through the FX and cross-currency swap markets, but also they may not have been able to actively arbitrage the basis, as they used to do before the crisis [e.g. Du et al. (2016)]. Hence, in spite of large opportunistic issuance of US dollar-denominated debt by euro area banks (see section 3), this has not been enough to close the basis, potentially due to regulatory constraints of banks. This notwithstanding, Iida et al. (2016) propose that these regulatory reforms also could have reduced the link between CIP deviations and non-US banks' credit risk, potentially avoiding wide deviations of CIP during periods of stress. Moreover, banks are perceived as safer, given higher and stricter regulatory requirements.

Recent studies suggest that there are various regulatory reforms which could negatively affect arbitrage in the FX and currency swap markets. First, the Basel III leverage ratio, to be implemented from 2018 onwards, requires banks to maintain at least 3% of Tier 1 equity over their an exposure measure, which includes both on-balance and off-balance sheet items as well as derivatives [BCBS (2011 and 2016)]. Moreover, the systematically important financial institutions in the US need to meet the enhanced "Supplementary Leverage Ratio", which settles a higher threshold and may further impede upon arbitrage in FX and cross-currency swap markets. Du et al. (2016) show larger quarter-end deviations of the (short-term) basis since 2015, when European banks started to calculate their leverage ratio based on their quarter-end balance sheets.

Second, Basel III has not only increased capital requirements of banks, but also it has introduced a capital charge for potential mark-to-market losses of "Over-The-Counter" (OTC) derivatives [Accenture (2015) and EBA (2015)]. This, combined with more cautious management practices, has led arbitrageurs to take into account both market and counterparty risk in the valuation of their derivative portfolios, increasing de-facto banks' balance sheet constraints and driving the basis wider [Suhko et al. (2016) and Borio et al. (2016)]. Moreover, risk management practices based on Value at Risk (VaR) frameworks have also contributed to deviations from CIP, as they put constraints on bank balance sheets and reduced bank-related arbitrage activities in FX swap markets [Avdjiev et al. (2016) and Du et al. (2016)].

Third, Basel III has increased liquidity requirements for banks through the Liquidity Coverage Ratio (LCR), which has been binding since 2015. This ratio requires that banks have sufficient high-quality liquid assets to cover potential outflows of liabilities for a 30-day period. This could mean that there is potentially less cash available to take positions in currency swap markets, as these funds may be invested in other liquid assets in order to meet the LCR requirements [Barclays (2015)]. Finally, Arai et al. (2016) and Iida et al. (2016) suggest that regulatory reforms may have discouraged market-making by banks in the FX swap market, reducing liquidity in these markets and increasing transaction costs. Du et al. (2016) also mention the prohibition of US banks to engage in proprietary trading in FX forwards and swaps (Volcker Rule) and OTC derivative reforms as responsible for increasing the costs of arbitrage in the FX swap and currency swap markets of banks [see also IMF (2017)].

The question arises as to whether there are other non-bank market players that are less affected by regulation, which potentially could arbitrage the basis and help putting an end to CIP deviations. It has been documented that high-grade entities, such as supranational

organizations and national agencies, may act as arbitrageurs of the basis through the issuance of synthetic domestic currency debt (i.e. issuance of hedged US dollar bonds) [e.g. Barclays (2015)]. Real money investors, which comprise asset managers, sovereign wealth funds (SWFs) and foreign official reserve managers, in many cases located in emerging market economies, could also play a role, although doubts arise with respect to their stability as US dollar providers in the derivatives markets (see section 5) [Iida et al. (2016)]. In any case, the fact that the basis is still considerably in negative territory shows that arbitrage by banking and non-banking entities is still not sufficient to close the gap. Hence, more research is needed to identify the barriers hindering arbitrage of CIP deviations for several currencies.

5 Spillovers to international financial stability

In previous sections we have described the reliance of euro area banks on US dollar markets, which points to growing international connections of banks, in spite of the recent crises. Hence, it seems important to carefully analyze the access of European and other non-US banks to the various US dollar funding markets from a financial stability point of view: monitoring only the domestic currency funding environment would provide a partial picture of banks' potential vulnerabilities and of potential spillovers to the stability of the whole financial system.[23] Of course, funding in US dollars by banks is linked directly to their assets in this currency and their asset-liability management practices. Hence, we begin this section providing an overview of the development of US dollar mismatches of euro area and Japanese banking systems and their reliance on FX swaps and currency swaps to obtain US dollars. Second, we will reflect on how alternative non-bank providers of US dollars, particularly in the FX swap markets, can create additional risks to the financial system, given that little is known about their behavior in case of market distress or in case of tighter US monetary policy.

Chart 5 shows the difference between US dollar denominated-foreign liabilities for euro area and Japanese banks and their US dollar denominated-foreign claims (i.e. US dollar lending). The difference is negative, particularly for Japanese banks, which means that these banks have a "US dollar funding gap", meaning that their liabilities in US dollars are not enough to cover their assets in US dollars. Hence, in spite of large US dollar bond issuance by euro area banks since 2011, their US dollar denominated liabilities are currently lower than their US dollar denominated assets.[24] In addition, on aggregate for all non-US banks, the difference between their foreign claims and foreign liabilities in US dollars has rapidly increased from the lows recorded during the global financial crisis and the euro area financial crisis [Nakaso (2017)]. In general, a US dollar funding gap can be problematic in two ways. First, the most obvious risk is that when non-US banks cannot obtain US dollars to fund their US dollar assets, their domestic central bank has to step in to provide limited US dollar liquidity assistance[25] [IMF (2017)]. The second problem arises from the growing reliance of non-US banks on the FX swap and currency swap markets to fund or hedge their US dollar mismatches.

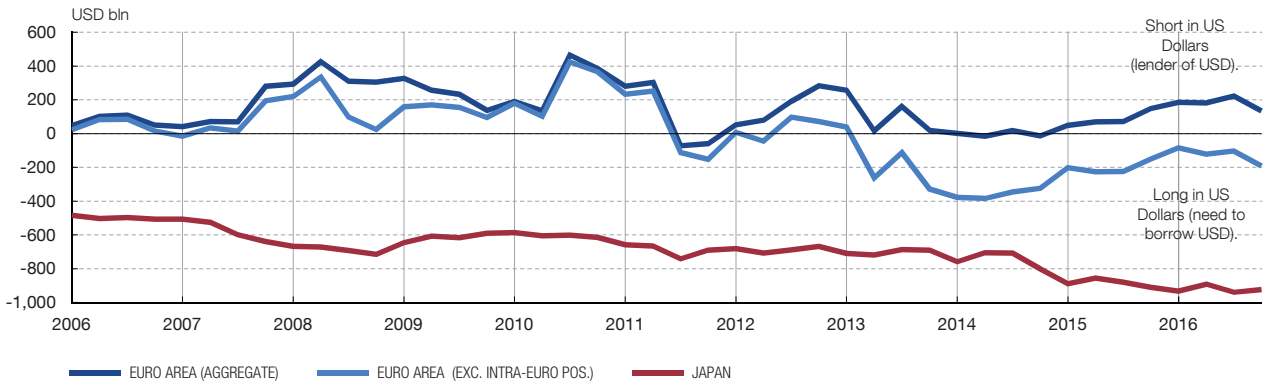
Even if banks are able to obtain these US dollars through FX and currency swaps, these instruments create a whole new set of specific risks for banks. We will focus on just two of them [for the full overview, see Eklund et al. (2012)]. The first one is *counterparty risk,* that is, the risk that the counterparty in the swap defaults on its payments. Counterparty risk

23 This has been recently and explicitly acknowledge by the Nakaso (2017).

24 This is of course in aggregated terms, as net positions at the euro area country level vary considerably.

25 In fact, the US dollar swap lines established for the first time in 2007 and 2008 between the Fed and several other central banks alleviated this problem in the context of US dollar shortage during the global financial crisis.

NET DOLLAR LIABILITIES BY BANKING SYSTEM (a) CHART 5



SOURCES: BIS Locational Banking Statistics by nationality and Consolidated Banking Statistics, immediate counterparty basis.

a Excluding inter-office positions.

increases with the term of the swap, as the volatility of the currencies exchanged grows over time. The second risk is *refinancing or rollover risk.* In general, refinancing risk arises every time one entity funds long-term assets with shorter-term liabilities, as sometime in the future the entity needs to obtain new financing to fund its assets. A European or Japanese bank with a long-term US dollar denominated-asset may decide to hedge it with a shorter-term FX swap and roll it over until the asset matures. This creates a "US dollar maturity mismatch" and exposes the bank to the risk that the counterparty does not want to renew the swap or the costs of renewing the FX swap increase substantially. In that case, the bank may be forced to sell the US dollar asset, which may be difficult in case of market distress [McGuire and Von Peter (2009b)]. The second option is to match the maturity of the asset with a longer-term cross-currency swap. Of course, the longer the term of the swap, the lower the refinancing risk. But as we have seen, the longer the tenor of the swap, the greater the counterparty risk is too.

In case many banks follow a similar hedging pattern, this can create risks for the whole financial system. For instance, before the global financial crisis, Japanese and some European banks did not only have a "US dollar funding gap", but had a "US dollar maturity mismatch" as well. According to McGuire and Von Peter (2009a and 2009b), the large increase of US dollar denominated assets before the crisis for some European banking systems was mostly funded through short-term liabilities such as FX swaps, interbank loans and central bank borrowings. The increase in liquidity and counterparty risk since mid-2007, linked to the global financial crisis, led to severe dislocations in the FX swap and other short-term markets. This, coupled with less funding from US MMFs for European banks, forced them to either sell their structured products at large discounts or to lengthen the maturity of their assets, further contributing to global US dollar shortages. Fender and McGuire (2010) show that maturity mismatches of those European banking systems that were long in US dollars at that time fell right after the crisis, but did not disappear completely. As of today, foreign currency maturity mismatches continue to persist for banks in advanced economies [IMF (2017)].

In order to avoid an excessive reliance of non-US banks on FX and currency swap markets and an escalating pressure on the basis, having accessible alternative US dollar funding markets is of vital importance. This was recently epitomized by the US MMF reform, where there is some evidence that non-US high-grade banks may have replaced partly their US dollar denominated commercial paper and certificates of deposits with longer-term debt

securities, avoiding a US dollar funding shortage [BIS (2017)].[26] This could have helped driving US dollar debt issuance by banks higher in 2016 [Reuters (2016); see also section 3]. In this line, Nakaso (2017) shows that following the reform, Japanese banks mostly replaced MMF funding with more US dollar-denominated deposits, bonds and repos. All in all, it is important to monitor US dollar funding conditions and markets in general and not focus on just one specific source of US dollar funding.

Another potential source of vulnerabilities to the financial system is related to non-bank arbitrageurs of CIP deviations. As mentioned before, banks are not the only market players with the ability to arbitrage the basis by supplying US dollars in the FX and currency swap markets. There is certain evidence, particularly for the Yen/USD FX swap market, of a greater weight of other suppliers of US dollars such as real money investors [Iida et al. (2016), Arai et al. (2016) and Nakaso (2017)].

The main problem is that it is unclear how stable these suppliers of US dollars are in the long-run. Actually, there are some signs suggesting that these investors as not very reliable, meaning that they could rapidly withdraw their supply of US dollars in certain circumstances [Iida et al. (2016)]. For instance, it has been documented that real money investors have increased their investments in Japanese government bonds (JGBs) on a FX hedged basis [Arai et al. (2016)]. The arbitrage works in a similar way to the issuance of "synthetic euro bonds" by euro area banks, as documented in section 2. Real money investors investing in JGBs would obtain yen funding through the FX swap or currency swap market and exchange US dollars in return.[27] This means that the real money investor would be paying the "negative" basis and earn a positive hedged return through the investment in JGBs, equal to or even higher than that of investing in US Treasury securities, in spite of very low or even negative yields on JGBs (see Figure 3).[28] Of course, it is clear that these investors are only willing to swap their US dollar holdings in the FX or currency swap markets as long as these trades are profitable. When this is no longer the case, they may disappear as a source of dollar funding. In general, real money investors, particularly those located in emerging economies, could cut their US dollar lending in FX swap markets in times of market distress. For instance, it seems that emerging market foreign exchange reserve managers tend to reduce their US dollar supply in the FX swap markets when they need to defend their currencies [Iida et al. (2016)]. In the same vein, there are signs that sovereign wealth funds reduce their supply of US dollars in the FX swap markets when the fiscal situation of their countries worsen, for example due to lower commodity prices [Arai et al. (2016)].

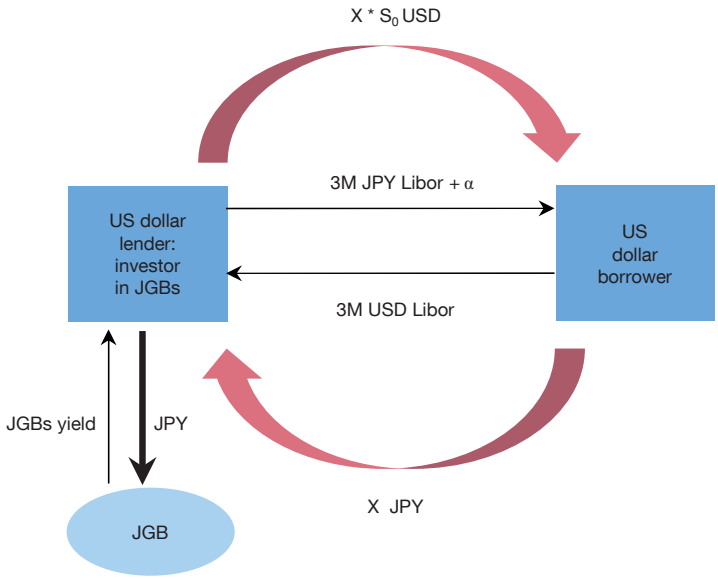
This has led some to wonder what will happen when the tightening cycle of the Fed progresses further, causing higher funding costs and a stronger US dollar. As Nakaso (2017) explains, a tightening by the Fed may have a negative impact on the economic growth of emerging countries by reducing oil prices and unleashing capital outflows and depreciation pressures on their currencies. This would lead to lower supply of US dollars in the FX swap markets by real money investors located in these countries, causing larger CIP deviations, a wider basis (i.e. higher costs for obtaining US dollars in FX currency swap markets) and higher costs of US dollar funding for banks (both directly in cash

26 According to the BIS (2017), non-US banks also replaced their US MMF funding with dollar deposits and excess reserves at the Fed.

27 Evidence point to arbitrage mainly through the shorter-term FX swap market, but in order to make it clearer for the reader and consistent with previous figures, Figure 3 depicts a CCBS instead. The underlying idea would be the same in both cases.

28 These potential positive hedged returns of investing in JGBs could explain the rapid increase in China's holdings of Japanese debt securities in 2015 and 2016 [Van Rixtel and Xu (2017)].

FIGURE 3



SOURCE: Author's elaboration.

markets and in the FX swap and currency swap markets). This would reduce US dollar-denominated lending, also to entities located in emerging economies, contributing to lower economic growth, which would reduce further the supply of US dollars in the FX swap markets from investors based in these countries. In this line, Avdjiev et al. (2016) and Shin (2016) show that an appreciation of the dollar is associated with more pronounced deviations from CIP. In all this, monetary policy and differences in the monetary policy stance of the major central banks play a crucial role. He et al. (2015) empirically show the expansionary effect of the unconventional monetary policy by the Federal Reserve on the supply of cross-border credit by global banks. Interestingly, the authors conclude that the negative effects on global liquidity of a tightening by the Federal Reserve would be partly offset by the expansionary monetary policies of the ECB and BOJ: abundant and cheap supply of domestic currency would provide collateral for euro area and Japanese banks in the FX swap markets. The net effect would depend, however, on whether the tightening by the Fed would increase global risk aversion in international markets or not.

In conclusion, deviations from CIP as measured by the US dollar FX swap and CCBS basis are indicators of the risks to the global banking system derived from banks' international activities, which generate cross-currency funding needs that are to a large extent denominated in US dollars. Moreover, deviations from CIP can also be used as a measure for the "procyclicality of international financial intermediation" driven by the interconnection of banks and non-bank US dollar providers in the FX swap markets [Nakaso (2017)]. Careful monitoring of cross-border activities of banks as well as their dependency on non-banking providers of US dollars would further contribute to the safety of the financial system.

6 Conclusions

In this article we have described how US dollar long-term funding by euro area banks has been increasing since the global financial crisis, particularly in relative terms. In Romo González (2016), which studies US dollar bond issuance by European banks between 2005 and the beginning of 2013, it is shown that banks could have issued US dollar-denominated debt for opportunistic factors, as well as for other reasons. In this article we provide a brief theoretical update of Romo Gonzalez (2016) and describe US dollar bond

issuance by euro area banks since 2013 up until the first quarter of 2017. We find some evidence that high US dollar-denominated bond issuance by euro area banks since 2013 mainly has been motivated by regulatory developments and strategic drivers, as euro area banks would have been benefiting from the appetite of a liquid and diversified US dollar investor base. Moreover, the positive correlation between covered cost savings and US dollar bond issuance as found in Romo González (2016) seems to be less strong since 2015. That said, this relationship could still exist for certain bonds, such as those with a lower rating and a specific maturity. Moreover, given the close connection between covered cost savings for euro area banks and the deviations of CIP, we document the drivers of CIP deviations as measured by the CCBS basis. According to the latest research on the topic, CIP deviations since mid-2014 have been driven by a combination of demand and supply factors. These factors are linked to monetary policy divergences across regions, to their impact on global imbalances and possibly to new regulations mainly affecting banks.

In addition to this, we discuss how impaired access to US dollar markets by non-US banks may have negative consequences for the stability of the global financial system. This is so because some euro area and Japanese banks still have a large amount of US dollar-denominated assets which need to be funded in the same currency to avoid "US dollar mismatches" or "US dollar funding gaps". Moreover, US dollar maturity mismatches caused by non-US banks hedging long-term US dollar assets with shorter-term FX swaps need to be monitored as well, as epitomized by the global financial crisis. Finally, there is some evidence pointing to a bigger role of "alternative" US dollar providers located in EMEs, particularly in some FX swap markets. Little is known about how reliable these US dollar suppliers are in case of market distress. Negative spillovers to EMEs of higher US dollar interest rates could disrupt the supply of US dollars coming from these agents. Should other agents not be willing to step in, scarcity of US dollars could create risks for the global financial system and central banks would need to step in as during the global and the euro area financial crises. All these tensions would be reflected in wider CIP deviations, which constitutes an excellent measure of the risks to the global banking system derived from non-US banks' international activities.

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REQUERIMIENTOS DE CAPITAL POR RIESGO DE CONTRAPARTIDA: EL NUEVO MÉTODO ESTÁNDAR

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REQUERIMIENTOS DE CAPITAL POR RIESGO DE CONTRAPARTIDA: EL NUEVO MÉTODO ESTÁNDAR

Resumen

Desde el comienzo de la crisis financiera, el Comité Bancario de Basilea ha reformado su marco de determinación de requerimientos de capital para las entidades de crédito en un intento de hacerlo más racional y más sensible al riesgo. En este intento, el nuevo modelo estándar de requerimientos por riesgo de contraparte será la nueva referencia que deberán considerar las entidades y está llamado a llenar el vacío existente entre los actuales modelos no internos y el interno.

1 Introducción

La actividad en los mercados de derivados financieros se ha incrementado notablemente durante los últimos veinte años. Este incremento ha sido causado tanto por operaciones de cobertura de riesgos económicos subyacentes ajenos a los propios contratos de derivados como por operaciones sencillamente especulativas. El riesgo de contrapartida puede ser definido en un sentido amplio como el riesgo de crédito surgido en esas operaciones de derivados y su principal diferencia con respecto al riesgo de crédito tradicional es que en este último el importe sometido al potencial impago es conocido de antemano, mientras que en aquel no lo es debido a su carácter volátil.

Tradicionalmente, este tipo de riesgo de crédito ha sido percibido como reducido, tanto por la propia naturaleza de las entidades participantes en su contratación como por la ausencia de una crisis sistémica que obligara a revisar en profundidad esta creencia. En este contexto, cuando Lehman Brothers se declaró en quiebra en septiembre de 2008, congeló más de 900.000 contratos de derivados, que suponían un 5 % de las transacciones a nivel global[1], y provocó con ello el colapso de los mercados financieros. Además, si bien este riesgo, a nivel de entidad individual, no suele aparecer entre los riesgos considerados más importantes, en algunos casos representa la mayor parte de los requerimientos por riesgo de crédito[2].

Adicionalmente, y con el propósito de recalcar la importancia de este riesgo, los derivados financieros tienen como principal característica que su valor de mercado está determinado por la evolución de un activo subyacente. Ante movimientos de este, el valor de aquel se puede llegar a multiplicar sustancialmente y puede llegar a comprometer severamente la situación patrimonial de una entidad. En segundo lugar, la relación del valor del derivado con el activo subyacente en muchos casos no es lineal y resulta difícil de anticipar. Si una de las entidades contratantes no ha estimado correctamente las distintas eventualidades posibles, puede encontrarse en un escenario donde se haya comprometido su capacidad de repago.

En un artículo anterior del autor[3], en esta misma revista, sobre el riesgo de contrapartida se describió cómo las entidades de crédito debían reconocer contablemente los riesgos asociados al uso de estos contratos derivados y, por otro lado, cómo habían de cubrir con capital eventuales deterioros crediticios asociados a ellos.

1 Para mayor detalle, véase Fleming (2014).
2 En este sentido, véase European Banking Authority (2016).
3 A este respecto, véase el artículo citado de Gil y Manzano (2013).

Desde aquel entonces, el marco regulatorio prudencial ha continuado avanzando en distintas direcciones. Por un lado, se ha establecido un marco específico para las Cámaras de Contrapartida Central desde el Banco Internacional de Pagos de Basilea (BIS, o el Comité). Por otro, se ha establecido la obligatoriedad de incorporar en categorías de derivados OTC la presencia de Cámaras de Contrapartida Central (CCP). Y, finalmente, se ha reformado sustancialmente el modo en que las entidades de crédito han de calcular los requerimientos de capital por riesgo de contraparte.

El propósito de este artículo es describir en detalle este último punto. El anterior marco prudencial ha sido criticado fundamentalmente por no reconocer apropiadamente los efectos mitigadores derivados de la existencia de acuerdos tanto de reposición de colaterales como de compensación contractual. Este nuevo marco nace con el propósito de mejorar el tratamiento de estos dos elementos mitigadores y de poder ser utilizado por CCP[4], las cuales han de facilitar la liquidación centralizada de derivados.

El nuevo marco estándar de requerimientos por riesgo de contraparte será el encargado de calcular la cifra de exposición al riesgo de crédito, base del cálculo de los requerimientos de capital. Para ello, las entidades habrán de sumar un valor de mercado neto de colaterales intercambiados y una estimación regulatoria de la exposición potencial futura de aquellos derivados incluidos en un mismo conjunto compensable de operaciones con una misma contraparte.

Es opinión del autor que este nuevo marco será capaz de ofrecer cifras de requerimientos mínimos de capital más ajustadas a los riesgos efectivamente asumidos. Es decir, será más sensible al riesgo. Finalmente, a pesar del reconocimiento más favorable de los acuerdos de colateralización y de compensación contractual, y a pesar de estudios contradictorios que existen a este respecto y que serán considerados posteriormente, el resultado global de la implantación del modelo parece que producirá cifras de requerimientos superiores a las preexistentes.

En un primer bloque del artículo se describirá el marco propuesto por el BIS. En un segundo, se describirá la respuesta europea al citado marco. Y, por último, se presentarán las conclusiones del autor a este respecto.

2 Nuevo marco estándar de requerimientos por riesgo de contraparte

Este nuevo marco elaborado por el BIS será el encargado de sustituir los anteriores Método de Valoración a Precios de Mercado (CEM) y Método Estándar (SA). Tanto el propio Comité como la industria han coincidido en señalar que una de las principales debilidades identificadas respecto del primero de ellos ha sido la falta de discriminación entre posiciones colateralizadas y sin colateralizar a través de acuerdos de reposición de márgenes en el cálculo de exposiciones potenciales futuras[5]. Resulta necesario destacar el papel central que desempeñan estos acuerdos de reposición de márgenes en los mercados de derivados hoy en día[6]. También se ha señalado lo arbitrario e insensible al riesgo realmente asumido del componente de cuantificación de la exposición potencial futura y, por último, el tratamiento excesivamente simplista de los acuerdos de compensación

4 Véase para un mayor detalle Basel Committee on Banking Supervision (2011) y Wayne y White (2012).

5 Véase Wayne y White (2012) y Basel Committee on Banking Supervision (2014).

6 Un acuerdo de reposición de colateral es una manera efectiva de mitigación del riesgo de contraparte y consiste en el intercambio de colateral entre las distintas partes a medida que varía el valor de mercado de los derivados referidos en estos acuerdos. Estos acuerdos consideran un margen de variación *(margin call),* que será intercambiado durante la vida del contrato a medida que resulte necesario, y en ocasiones un margen inicial *(initial margin),* que será depositado al comienzo de la vida del contrato. Véase, a estos efectos, Gregory (2010) y Leif Andersen (2017).

contractual[7]. En su beneficio hay que señalar que ha resultado ser un método ampliamente utilizado por las entidades debido a su sencillez y a la facilidad de interpretar los resultados obtenidos.

En cuanto al segundo de los métodos, el SA, tal y como señala el propio BIS, aunque es más sensible al riesgo, no ha diferenciado tampoco entre operaciones colateralizadas y sin colateralizar en el cálculo de las exposiciones futuras; tampoco ha capturado adecuadamente las volatilidades realmente observadas durante períodos de tensión; la definición de conjunto de operaciones compensables ha sido compleja, lo cual derivaba en que una misma situación en distintas entidades pudiera llegar a ser tratada de distintas maneras; la relación entre exposición actual y exposición futura no ha estado resuelta de un modo incontrovertido, toda vez que solo se podía capitalizar una de ellas; finalmente, ha sido un método concebido para aquellas entidades que deseaban prescindir de las cargas asociadas a la implantación de un modelo interno, pero en la práctica ha seguido necesitando de la modelización de las sensibilidades en las posiciones no lineales por parte de las propias entidades, tras aprobación previa del supervisor[8].

Por todo lo anterior, el BIS ha presentado el Nuevo Método Estándar de Cálculo de Requerimientos por Riesgo de Contrapartida (SA-CCR), que sustituirá a los anteriormente citados. Entre los principales objetivos declarados por el BIS está el poder ser implantado de manera satisfactoria para un amplio abanico de operaciones, tanto colateralizadas como sin colateralizar, bilaterales (OTC) o liquidadas a través de CCP. Adicionalmente, se pretende que sea un modelo fácil de implementar, que supere el máximo número de las limitaciones presentes en las alternativas previamente existentes, que utilice en la medida de lo posible alternativas prudenciales ya existentes, que minimice la discrecionalidad de las autoridades nacionales y que mejore la sensibilidad al riesgo realmente asumido por las entidades sin crear complejidades innecesarias.

2.1 OBJETIVO

El marco de requerimientos prudenciales de capital por riesgo de contraparte está incluido en el más general riesgo de crédito. Este último tiene como propósito obligar a las entidades a cubrir con capital la eventualidad del impago crediticio de sus contrapartes. De manera análoga, los requerimientos por riesgo de contraparte tienen como objeto cubrir esa misma eventualidad, pero referida, fundamentalmente, al conjunto de los derivados OTC. La especificidad de estos últimos con respecto a la inversión crediticia tradicional es que adquieren valor monetario o lo pierden en respuesta a movimientos de un activo subyacente. Ello supone la presencia de un componente volátil del que carece, por lo general, la inversión crediticia.

Adicionalmente, y aunque no es objeto directo de este artículo, conviene recordar que estos requerimientos son calculados en paralelo a los surgidos por ajuste de valoración

7 Generalmente, cuando las entidades contratan varios productos financieros derivados con una misma contraparte, entra dentro de lo posible que algunos adquieran un valor positivo para sus intereses, y otros, lo contrario. El propósito de los conjuntos compensables de operaciones *(netting)* es que las exposiciones de distinto signo que se puedan generar en ellos se puedan compensar entre sí, reduciendo el nivel de exposición neta con una misma contraparte. Para que esto resulte posible, se ha de firmar un acuerdo de compensación contractual, que se aplicará ante la eventualidad de un *default.* Existe la posibilidad de tener firmado más de un acuerdo de compensación contractual por contraparte. Para mayor detalle, véase Gregory (2010). Para un conocimiento pormenorizado de los requisitos que han de cumplir las entidades para lograr el pleno reconocimiento prudencial del *netting,* véase Parlamento Europeo y del Consejo (2013).

8 Solo dos entidades de la Unión Europea han aplicado este método [European Banking Authority (2016)]. Es opinión del autor que esta falta de popularidad ha sido debida a que es un método que, sin conseguir la sensibilidad del enfoque avanzado IMM, requería de la modelización interna de deltas asociadas a las posiciones no lineales y de la validación supervisora de estas. Para mayor detalle sobre lo comentado, consultar Basel Committee on Banking Supervision (2011) y Parlamento Europeo y del Consejo (2013).

crediticio (CVA). Si bien no resulta incontrovertido el posible solapamiento entre ambas cargas[9], tanto el BIS como el ordenamiento jurídico comunitario lo han resuelto permitiendo reducir el importe del ajuste contable por CVA de la cifra de exposición por riesgo de contraparte y siendo la exposición calculada por riesgo de contraparte la base de cálculo del requerimiento prudencial por CVA.

2.2 *EXPOSURE AT DEFAULT* (EAD)

Los requerimientos de recursos propios para cubrir el riesgo de contrapartida se basan en el tratamiento del riesgo de crédito surgido de la inversión crediticia, que tiene como fórmula base para su cálculo la siguiente:

$$\text{Requerimientos riesgo de crédito} = \text{EAD} \times f\,(\text{PD, LGD, M, } \rho) \qquad [1]$$

Esta fórmula es la empleada por el enfoque avanzado, método IRB[10], para el cálculo de las ponderaciones de riesgo (RW o f (.)), que tiene como *inputs* la probabilidad de impago (PD), la severidad (LGD), el vencimiento remanente (M) y, finalmente, la correlación o grado de dispersión de la cartera crediticia (ρ).

$$\text{RW o } f\,(\text{PD, LGD, M, } \rho) = \text{LGD} \times \varphi\left(\frac{\varphi^{-1}(\text{PD}) + \sqrt{\rho}\,\varphi^{-1}(0{,}999)}{\sqrt{(1-\rho)}}\right) \times \text{MA (PD, M)} \qquad [2]$$

Esta forma de calcular las ponderaciones es compartida por el riesgo de crédito y por el riesgo de contrapartida, encontrándose la diferencia en el modo en que se calculan las exposiciones.

El nuevo marco SA-CCR calcula la citada exposición para cada uno de los distintos conjuntos de operaciones compensables que pudiera tener una entidad. Esta exposición tiene como objetivo replicar de cierta manera la obtenida mediante el método de los modelos internos (IMM), el cual emplea un multiplicador α y una Exposición Efectiva Esperada (EEPE). Para el SA-CCR, esta EEPE a nivel de conjunto compensable es calculada como sigue:

$$\text{EAD} = \alpha \text{ x (RC + PFE)} \qquad [3]$$

Donde α = 1,4, RC representa el coste de reposición o valor de mercado neto actual, y PFE, la exposición potencial futura. Esta fórmula recuerda a la ya conocida del CEM, pero difieren ambas en dos importantes aspectos. El primero de ellos, la introducción del factor multiplicativo alfa, y el segundo, el nuevo tratamiento dado a las operaciones colateralizadas dentro la fórmula del SA-CCR.

RC pretende representar bajo este marco una estimación conservadora del importe que una entidad perdería si la contraparte impagara en el momento de su cálculo. Por el contrario, PFE representa el incremento en la exposición que se podría producir desde hoy hasta el momento de presentarse el impago y está directamente relacionado con la volatilidad asociada al tipo de productos.

2.3 COSTE DE REPOSICIÓN

Para conjuntos compensables sin acuerdos de intercambio de colateral, RC representa la pérdida que ocurriría si la contrapartida impagara inmediatamente. Si ello sucediera, y en ausencia de colaterales, RC sería igual a máx(Valor de mercado actual;0). Nótese que,

9 Para detalles al respecto, Basel Committee on Banking Supervision (2011) y Parlamento Europeo y del Consejo (2013).

10 Mencionar, únicamente, que aquellas entidades que hayan optado por el método estándar proceden al cálculo de sus RW en función de *ratings* emitidos por agencias de calificación o aplicando las ponderaciones preestablecidas a tal efecto.

en el hipotético caso de que este coste de reposición o valor de mercado resultara negativo, ello supondría un riesgo de crédito para la contraparte, pero no para la hipotética entidad objeto de nuestro análisis[11].

No obstante, es posible que existan acuerdos de compensación sin acuerdos de intercambio de colateral, pero que, a pesar de ello, cuenten con colateral intercambiado. Este colateral, es definido como Importe de Colateral Independiente (ICA) y es intercambiado en el comienzo de la operación. Este puede ser entregado o puede ser recibido. El recibido reducirá la exposición en caso de impago y tendrá signo positivo a efectos de su inclusión en la fórmula correspondiente. El entregado puede ser perdido en la eventualidad del impago salvo que se encontrara situado en una cuenta a la cual no afectara el posible impago. Todo lo anterior se resume en una cifra, el Importe de Colateral Independiente Neto (NICA), que tendrá signo positivo si el colateral recibido excede del entregado, y que de esta manera contribuirá a reducir la exposición.

En conjuntos compensables sin colateralizar, todo el colateral ha de provenir por definición en exclusiva de NICA y el RC es obtenido restando del valor de mercado neto del conjunto compensable el valor del posible colateral entregado inicialmente y ajustado en su valoración:

$$RC_{noMargin} = \max \{V - C_{CE}(1\ Year); 0\} \quad [4]$$

Este valor ajustado del colateral (C_{CE}) es obtenido tras aplicar un ajuste por volatilidad a él; negativo, si el valor del colateral es positivo, y a la inversa. El importe del ajuste por volatilidad del colateral dependerá del horizonte temporal considerado. Por defecto, el horizonte temporal será de un año en el caso de los conjuntos compensables sin intercambio de colateral[12] y el Período de Margen por Riesgo (MPR) en el caso de los conjuntos colateralizados. Este MPR representa el período transcurrido entre el último posteo de colateral *(margin call)* realizado por la contraparte antes de su *default* y la cancelación de las operaciones tras la declaración del impago.

El RC es interpretado, por tanto, como la pérdida que podría producirse si la contrapartida de una entidad impagara en un momento indeterminado del año siguiente el valor de mercado del conjunto compensable de operaciones referido. Debido a la incertidumbre asociada al momento del impago, el valor de mercado neto del conjunto compensable neto de colateral resulta complejo de estimar y el Comité ha establecido una serie de cautelas adicionales. Antes de producirse un impago, el Comité estima que el valor de mercado del conjunto compensable habrá resultado lo suficientemente elevado como para solicitar la reposición de margen o *margin call,* de existir esta posibilidad. Esto ocurriría cuando el valor de mercado, positivo para la entidad, resultara superior a la suma del umbral mínimo (TH) más el importe mínimo que se ha de transferir (MTA). Habría que considerar igualmente la posible existencia de NICA.

$$RC_{Margin} = \max \{V - C_{CE}(MPR); TH + MTA - NICA; 0\} \quad [5]$$

11 Ante la eventualidad descrita, la entidad objeto de nuestra atención sufriría en este caso pérdidas por riesgo de mercado. Este puede ser definido como la posibilidad de incurrir en pérdidas, generalmente en la cartera de negociación, ante movimientos desfavorables de las variables de mercado.

12 Resulta ser el mismo período base de cálculo elegido por el Comité para el cálculo de los requerimientos mínimos de capital por riesgo de crédito. En otras palabras, estos requerimientos pretenden ser una aproximación prudente de las pérdidas que se pueden llegar a producir en el transcurso de un año.

La fórmula [4] es la que se ha de aplicar en los casos de conjuntos compensables sin intercambio de colateral, y la [5], la correspondiente a conjuntos colateralizados. Por último, es necesario considerar la existencia de un último límite: [5] no puede resultar superior a [4] con el objeto de prevenir situaciones en las cuales los umbrales mínimos hubieran resultado demasiado elevados y su cálculo pudiera derivar en requerimientos punitivos para los conjuntos colateralizados de las entidades.

2.4 EXPOSICIÓN POTENCIAL FUTURA

El nuevo acuerdo ha refinado este componente con respecto a los modelos no internos previamente existentes haciéndolo más sensible al riesgo.

El SA-CCR define el PFE como el producto de un recargo *(add-on)* a nivel de conjunto compensable y un multiplicador dependiente de la ratio de exceso de colateral neto recibido y ajustado en su valoración sobre el ya citado *add-on*. El objetivo del multiplicador es reconocer la presencia de posibles excesos en el colateral neto entregado sobre el valor de mercado de los derivados produciendo menor PFE:

$$PFE = W\left(\frac{V - C_{CE}}{\text{Add-on}^{\text{aggregate}}}\right) \text{x Add-on}^{\text{aggregate}} \qquad [6]$$

2.4.1 Estimación del *add-on*

El *add-on* pretende ser una estimación prudente de la EEPE de cumplirse todas y cada una de las siguiente condiciones: el valor de mercado de cada transacción individual es cero, no se ha posteado ni recibido ningún colateral, no hay intercambios de efectivo durante el horizonte temporal previsto y la evolución del valor de mercado sigue un movimiento browniano aritmético de media cero y volatilidad fija. Todas las condiciones anteriores son necesarias para permitir que el *add-on* agregado sea una función lineal de la volatilidad del valor de mercado del conjunto compensable.

A nivel de una transacción individual i, el valor de mercado según el modelo subyacente en el nuevo SA-CCR, en un momento t cualquiera, puede ser representado bajo las asunciones previas como sigue:

$$V_i(t) = 1_{\{M_t \geq t\}}\, \sigma_i \sqrt{t}\, X_i \qquad [7]$$

Donde el primer término de la ecuación de la derecha es una variable booleana, σ_i es la volatilidad del valor de mercado de la transacción i, M_i es el vencimiento residual y X_i es una variable aleatoria estándar normal. De manera parecida, para un conjunto compensable[13]:

$$V(t) = \sigma(t) \sqrt{t}\, Y \qquad [8]$$

$$\sigma(t) = \left[\sum_{i,j} 1_{\{M_i \geq t\}}\, 1_{\{M_j \geq t\}}\, r_{ij}\, \sigma_i\, \sigma_j\right]^{1/2} \qquad [9]$$

La Expected Exposure[14] (EE), o exposición esperada positiva, puede ser definida algebraicamente en función de lo anterior como:

$$EE^{\text{no-margin}}(t) = E[\max\{\sigma(t) \sqrt{t}\, Y; 0\}] = \frac{1}{\sqrt{2\pi}} \sigma(t) \sqrt{t} \qquad [10]$$

13 Para mayor explicación del proceso seguido, consúltese Basel Committee on Banking Supervision (2014).
14 Para una detallada explicación de los distintos tipos de exposición, véase Gil y Manzano (2013).

Adicionalmente, conviene recordar que el *add-on* pretende ser una aproximación de la EEPE. Todo ello lleva a la siguiente fórmula en el caso de un conjunto compensable sin intercambio de colateral:

$$\text{Add-on}_{\text{aggregate}}^{\text{no-margin}} = \frac{1}{1\ \text{year}} \int_0^{1\ \text{year}} EE^{\text{no-margin}}(t)\, dt = \frac{2}{3}\ \frac{1}{\sqrt{2\pi}}\ \sigma(t) \sqrt{1\ \text{year}} \qquad [11]$$

Que, finalmente, y gracias a las hipótesis restrictivas previamente enunciadas:

$$\text{Add-on}_{\text{aggregate}}^{\text{no-margin}} = \left[\sum_{i,j} r_{ij}\, \text{Add-on}_i^{\text{no-margin}}\, \text{Add-on}_j^{\text{no-margin}} \right]^{½} \qquad [12]$$

$$\text{Add-on}_i^{\text{no-margin}} = \frac{2}{3\sqrt{2\pi}}\ \sigma_i \sqrt{\frac{\min(M_i;1\ \text{year})}{1\ \text{year}}} \qquad [13]$$

Donde el último término de la ecuación [13] reescala el resultado obtenido para aquellas operaciones individuales con vencimiento dentro del siguiente año en un intento de evitar su sobrerrepresentación en el agregado a través de la compensación con operaciones con un vencimiento más dilatado.

En el caso de conjuntos compensables colateralizados, las fórmulas [12] y [13] han de ser adaptadas, cambiando el horizonte temporal previamente elegido de 1 año al asociado con el MPR correspondiente:

$$\text{Add-on}_{\text{aggregate}}^{\text{margin}} = \left[\sum_{i,j} r_{ij}\, \text{Add-on}_i^{\text{margin}}\, \text{Add-on}_j^{\text{margin}} \right]^{½} \qquad [14]$$

$$\text{Add-on}_i^{\text{margin}} = \frac{1}{\sqrt{2\pi}}\ \sigma_i \sqrt{\frac{\text{MPR}}{1\ \text{year}}} \qquad [15]$$

Una vez establecido el marco teórico de referencia, es interesante resaltar que el punto crítico de la efectiva implantación de [12] y [14] reside en el cálculo de las volatilidades asociadas a nivel de transacción. De permitirse a las entidades su modelización, el SA-CCR resultaría ser un híbrido entre el anterior SA y el IMM. Así, el Comité ha decidido detallar y estandarizar el proceso de su cálculo. A estos efectos, ha establecido que un primer paso consiste en asignar cada transacción individual a una de las cinco clases de activos identificados: tipo de interés (IR), tipo de cambio (FX), crédito, renta variable y materias primas.

Una vez realizada la asignación entre clases de activos, la entidad ha de aplicar la fórmula de cálculo del *add-on* prudencial, para lo cual habrá de emplear volatilidades y correlaciones previamente calibradas por el regulador para cada una de las categorías de activo. Estas volatilidades y correlaciones son mostradas en el cuadro 2, y nótese que, según lo severas que resulten ser en comparación con las realmente existentes en la cartera típica de las entidades, tanto más elevada resultará la cuantificación de los requerimientos de capital.

La fórmula de *add-on* prudencial mostrada en el nuevo marco SA-CCR es como sigue:

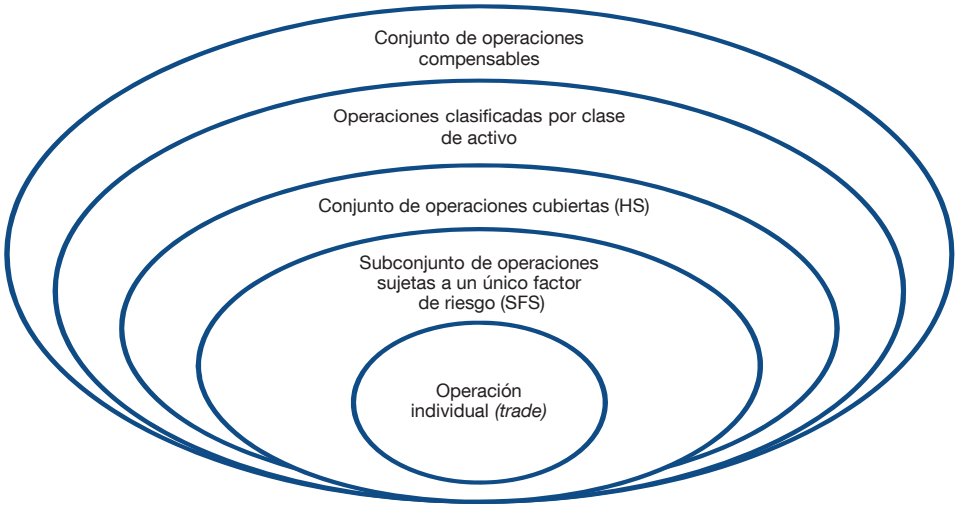
$$\text{Add-on}_i^{(\text{trade})} = \delta_i\, d_i^{(a)}\, SF_i^{(a)}\, MF_i \qquad [16]$$

δ_i es el delta de la transacción e informa de la dirección de la posición, positiva o negativa, y permite además escalar el *add-on* en aquellas posiciones no lineales. No se permiten estimaciones internas de este parámetro, sino que se han de emplear los valores regulatorios suministrados para cada clase de activo. $d_i^{(a)}$ es el nominal ajustado y tiene como propósito cuantificar el tamaño de la posición. $SF_i^{(a)}$ es el factor supervisor y es una estimación

supervisora de la volatilidad asumida por cada clase de activo. MF_i es definido como el factor de vencimiento[15], cuyo objeto es ajustar el peso de las operaciones con vencimiento inferior al año dentro del conjunto de operaciones compensables. La fórmula [16] resulta ser equivalente a [13] y [15] mediante la siguiente ecuación:

$$\sigma_i = \frac{3\ SF_i^{(a)}\sqrt{2\pi}}{2} |\delta_i|\ d_i^{(a)} \qquad [17]$$

Una vez determinado el *add-on* a nivel de operación, se ha de proceder a su agregación a nivel de conjunto de operaciones compensables. Si bien las reglas de agregación presentan especificidades según la clase de activo, el proceso general se podría visualizar de la siguiente manera:



El SFS permite la plena compensación de operaciones dentro de un HS. De esta manera:

$$\text{Add-on}_j^{(SFS)} = \sum_{i \in SFS_j} \text{Add-on}_i^{(trade)} \qquad [18]$$

Cada clase de activo puede estar compuesta por distintos HS[16], y estos, a su vez, por distintos factores de riesgo reconocidos como SFS. Cada HS es el nivel más elevado en el cual se permite el reconocimiento de los beneficios asociados a la compensación, si bien se ha de considerar en este nivel la existencia de correlaciones entre SFS tal y como son proporcionadas por el regulador, lo cual disminuye los beneficios asociados a la diversificación:

$$\text{Add-on}_m^{(HS)} = \left[\sum_{j,k \in HS_m} \rho_{jk}\ \text{Add-on}_j^{(SFS)}\ \text{Add-on}_k^{(SFS)} \right]^{1/2} \qquad [19]$$

Por último, la agregación realizada a nivel de contraparte por conjunto de operaciones compensables:

$$\text{Add-on}^{(\text{no margin})} = \sum_m |\ \text{Add-on}_m^{(HS)}\ | \qquad [20]$$

15 $MF_i^{(\text{no-margin})} = \sqrt{(\min\{M_i, 1\ \text{year}\}/1\ \text{year}}$ y $MF_i^{\text{margin}} = 3/2\sqrt{\text{MPR}/1\ \text{year}}$

16 Un HS es definido como el conjunto de operaciones en un acuerdo de compensación contractual para el cual se permite la compensación parcial o completa a efectos del cálculo de la PFE.
Los HS presentes en cada clase de activo reconocida en el SA-CCR son:
- Tipo de interés, un HS por cada divisa.
- FX, un HS por cada par de divisas.
- Crédito, un único HS.
- Renta variable, un único HS.
- Materias primas, cuatro HS.

2.4.2 Nominal ajustado $d_i^{(a)}$

Posteriormente se explica cómo este parámetro es incorporado en el cálculo de los distintos *add-on*. Este parámetro ha de ser calculado a nivel de transacción individual y recogerá tanto su tamaño como su vencimiento.

Para derivados de tipo de interés y derivados crediticios, el nominal ajustado es el producto del nominal por la duración supervisora (SD_i):

$$d_i^{(IR)} = \overline{N}_i \, SD_i \qquad [21]$$

$$SD_i = \frac{\exp(-rS_i) - \exp(-rE_i)}{r} \qquad [22]$$

Siendo $\overline{N}_i$ el nominal promedio de la transacción, S_i la fecha de comienzo de la operación, E_i la fecha de finalización[17] y r = 0,05.

Para FX, el nominal ajustado es definido como el nominal de la pata del derivado en moneda extranjera convertida a moneda local. Si ambas patas resultaran estar nominadas en moneda extranjera, aquella con mayor valor en moneda local será el nominal ajustado.

Para renta variable y materias primas, el nominal ajustado es definido como el producto del precio actual por unidad por el número de unidades referenciadas en cada contrato.

2.4.3 Delta de la operación δ_i

Esta será calculada a nivel de operación y será incorporada en el cálculo de los *add-on* específicos descritos con posterioridad. Este ajuste reflejará tanto la dirección de la operación como su posible no linealidad.

PARÁMETRO DELTA COMITÉ **CUADRO 1**

δ_i	Largo en el factor de riesgo	Corto en el factor de riesgo
Instrumentos no opciones ni CDO	+1	–1
	Opciones compradas	Opciones vendidas
Call	$+\Phi\left(\frac{\ln\left(\frac{P_i}{K_i}\right)+0{,}5\sigma_i^2 T_i}{\sigma_i\sqrt{T_i}}\right)$	$-\Phi\left(\frac{\ln\left(\frac{P_i}{K_i}\right)+0{,}5\sigma_i^2 T_i}{\sigma_i\sqrt{T_i}}\right)$
Put	$-\Phi\left(\frac{\ln\left(\frac{P_i}{K_i}\right)+0{,}5\sigma_i^2 T_i}{\sigma_i\sqrt{T_i}}\right)$	$+\Phi\left(\frac{\ln\left(\frac{P_i}{K_i}\right)+0{,}5\sigma_i^2 T_i}{\sigma_i\sqrt{T_i}}\right)$

Donde P_i es el precio del subyacente, K_i es el precio de ejercicio y σ_i es la volatilidad supervisora tal y como se define en un cuadro posterior. ϕ representa una distribución normal acumulada estándar (a).

	Comprado (largo en protección)	Vendido (corto en protección)
Tramos CDO	$+\frac{15}{(1+14A_i)(1+14D_i)}$	$-\frac{15}{(1+14A_i)(1+14D_i)}$

A_i es el punto de fijación del tramo CDO y D_i es el punto de separación del tramo.

FUENTE: Basel Committee on Banking Supervision (2014).

a El valor de esta función resulta de la aplicación de Black-Scholes. Para mayor detalle, véase Hull (2015).

17 En el SA-CCR se ha de considerar la existencia de cuatro fechas. Dos de ellas aplicables exclusivamente a tipo de interés y crédito: S_i es la fecha de comienzo de un contrato de derivados y E_i es la fecha de finalización de este contrato. Adicionalmente, M_i es aplicada en todas las categorías de activos y es el vencimiento de un contrato en la última fecha donde el contrato pudiera estar activo. A estos efectos, se puede imaginar un *swap* de tipos de interés firmado a día de hoy en el cual los intercambios de efectivo no comenzarán hasta dentro de cinco años y donde estos durarán diez años. En este caso, M sería igual a 15, S igual a 5 y E igual a 15. Finalmente, T_i es aplicable a opciones de toda clase de activos y es la última fecha de ejercicio contemplada en el contrato.

2.4.4 Factor supervisor SF_i[a]

El siguiente paso es convertir el nominal efectivo en una estimación válida de EEPE. Para ello se utiliza un factor o factores específicos por cada clase de activo que incorpora la estimación supervisora de volatilidades y correlaciones implícitas en cada HS. Estas estimaciones supervisoras se han incluido como cuadro 2.

2.4.5 *Add-on* por tipo de interés y por FX

Este *add-on* captura el riesgo de tipo de interés surgido de los nominales con distintos vencimientos entre los cuales se manifiesta una correlación imperfecta. El SA-CCR divide los derivados de tipos de interés en distintos vencimientos según su fecha de finalización (SFS): menos de un año, entre uno y cinco años y superior a cinco años. Se permite la plena compensación dentro de cada categoría de vencimiento, solo parcialmente a nivel de HS por moneda, y no se permite ninguna compensación entre distintas monedas (HS).

El *add-on* por riesgo de tipo de interés se calcula como la suma de los *add-on* a nivel de HS. Primero, se ha de calcular el nominal efectivo de cada categoría de vencimiento k en un HS j ($D_{jk}^{(IR)}$):

$$D_{jk}^{(IR)} = \sum_{i \in (Ccy_j,\, MB_k)} \delta_i \, d_i^{IR} \, MF_i^{margin;non\text{-}margin} \quad [23]$$

Donde d_i^{IR} es calculado según [21] y δ_i es extraído del cuadro 1.

En un segundo paso, se agregarán los distintos vencimientos a nivel de HS:

$$\text{Nominal efectivo}_j^{IR} = \left[(D_{j1}^{IR})^2 + (D_{j2}^{IR})^2 + (D_{j3}^{IR})^2 + 1{,}4\, D_{j1}^{IR} D_{j2}^{IR} + 1{,}4\, D_{j2}^{IR} D_{j3}^{IR} + 0{,}6\, D_{j1}^{IR} D_{j3}^{IR} \right]^{1/2} \quad [24]$$

$$\text{Add-on}_j^{IR} = SF_j^{IR} \, \text{Nominal efectivo}_j^{IR} \quad [25]^{18}$$

$$\text{Add-on}^{IR} = \sum_j \text{Add-on}_j^{IR} \quad [26]$$

El caso particular de los derivados de tipo de cambio resulta ser a estos efectos un caso simplificado del de tipo de interés:

$$\text{Nominal efectivo}_j^{FX} = \sum_{i \in HS_j} \delta_i \, d_i^{FX} \, MF_i^{margin;non\text{-}margin} \quad [27]$$

$$\text{Add-on}_{HSj}^{FX} = SF_j^{FX} \, | \, \text{Nominal efectivo}_j^{FX} \, | \quad [28]$$

$$\text{Add-on}^{FX} = \sum_j \text{Add-on}_j^{FX} \quad [29]$$

2.4.6 *Add-on* por crédito y por renta variable

En el caso del *add-on* por derivados de crédito se permiten dos niveles de reconocimiento de los beneficios derivados de la diversificación. El primero de ellos, a nivel de cada referencia subyacente. En este caso, se permite una plena compensación y hemos de hallar un *add-on* a nivel de cada entidad de referencia k:

$$\text{Nominal efectivo}_k^{Crédito} = \sum_{i \in Entity_k} \delta_i \, d_i^{Crédito} \, MF_i^{margin;non\text{-}margin} \quad [30]$$

$$\text{Add-on}(Entity_k) = SF_k^{Crédito} \, \text{Nominal efectivo}_k^{Crédito} \quad [31]$$

18 Conviene recordar que en el caso del tipo de interés, como puede comprobarse en el cuadro 2, el factor supervisor es igual al 0,5 %.

En segundo lugar, estos *add-on* por referencia han de ser agregados a través de unas correlaciones supervisoras estimadas sobre la base de un modelo de factor único que permite una compensación parcial basada en correlaciones:

$$\text{Add-on}^{\text{Crédito}} = \left[\left(\sum_k \rho_k^{\text{Crédito}} \text{Add-on}(\text{Entity}_k) \right)^2 + \sum_k \left(1 - (\rho_k^{\text{Crédito}})^2\right) (\text{Add-on}(\text{Entity}_k))^2 \right]^{1/2} \quad [32]$$

Y los mismos pasos se han de dar en lo referido a la renta variable:

$$\text{Nominal efectivo}_k^{\text{Renta variable}} = \sum_{i \in \text{Entity}_k} \delta_i \, d_i^{\text{Renta variable}} \, MF_i^{\text{margin;non-margin}} \quad [33]$$

$$\text{Add-on}(\text{Entity}_k) = SF_k^{\text{Renta variable}} \, \text{Nominal efectivo}_k^{\text{Renta variable}} \quad [34]$$

$$\text{Add-on}^{\text{Renta variable}} = \left[\left(\sum_k \rho_k^{\text{Renta variable}} \text{Add-on}(\text{Entity}_k) \right)^2 + \sum_k \left(1 - (\rho_k^{\text{Renta variable}})^2\right) (\text{Add-on}(\text{Entity}_k))^2 \right]^{1/2} \quad [35]$$

2.4.7 *Add-on* por materias primas

En este caso hemos de contemplar la existencia de distintas subclases de materias primas que son las que definen el nivel máximo del HS. Así mismo, los beneficios por diversificación a nivel de cada subclase reciben el mismo tratamiento que para el crédito y la renta variable:

$$\text{Nominal efectivo}_k^{\text{mmpp}} = \sum_{i \in \text{Type}_k^j}^{\text{mmpp}} \delta_i \, d_i^{\text{mmpp}} \, MF_i^{\text{margin;non-margin}} \quad [36]$$

$$\text{Add-on}(\text{Type}_k^j) = SF_{\text{Type}_k^j}^{\text{mmpp}} \, \text{Nominal efectivo}_k^{\text{mmpp}} \quad [37]$$

$$\text{Add-on}^{\text{mmpp}} = \left[\left(\sum_k \rho_j^{\text{mmpp}} \text{Add-on}(\text{Type}_k^j) \right)^2 + \left(1 - (\rho_j^{\text{mmpp}})^2\right) \sum_k (\text{Add-on}(\text{Type}_k^j))^2 \right]^{1/2} \quad [38]$$

2.4.8 Multiplicador

Como un principio general, la sobrecolateralización debería reducir los requerimientos de capital por riesgo de contraparte. Como ya se ha comentado previamente, el colateral puede reducir tanto el coste de reposición como el PFE.

De una manera algebraica resumida, la EE de un conjunto de operaciones compensables es definida[19]:

$$EE^{\text{margin}}(t) = E(\max(V(t) - C(t); 0)) \quad [39]$$

El SA-CCR no considera variaciones dinámicas en el valor del colateral y asume igualmente que el movimiento del valor del conjunto compensable de derivados sigue un movimiento browniano de media nula. Adicionalmente, t será igual al MPR.

$$V(MPR) = V + \sigma(0) \sqrt{MPR} \, Y \quad [40]$$

Donde $\sigma(0)$ es la volatilidad en el momento inicial del conjunto de operaciones compensables y se mantendrá constante durante todo el cálculo e Y es una variable estándar normal.

19 Véase Gregory (2010) y Pykhtin (2010).

Considerando las dos ecuaciones[20] anteriores:

$$PFE^{margin} = [V - C_{CE}(MPR)]\,\Phi\left(\varphi(0)\,\frac{V\text{-}C_{CE}(MPR)}{Add\text{-}on^{margin}_{aggregate}}\right) + \frac{Add\text{-}on^{margin}_{aggregate}}{\varphi(0)}\,\varphi\left(\varphi(0)\,\frac{V\text{-}C_{CE}(MPR)}{Add\text{-}on^{margin}_{aggregate}}\right) \quad [41]$$

$$y = \frac{V\text{-}C_{CE}(MPR)}{Add\text{-}on^{margin}_{aggregate}} \quad [42]$$

Donde $\Phi(.)$ es una variable aleatoria normal acumulada y $\Phi(.)$ es una variable aleatoria normal. En este punto resulta necesario destacar que el coste de reposición o valor neto de mercado no es deducido de la PFE planteada. De esta manera, en los casos en los cuales el valor neto de mercado del conjunto compensable sea superior al valor del colateral neto, las entidades habrán de computar sus requerimientos de capital separadamente para los componentes del coste de reposición y para la PFE.

Recordar que, por definición, el multiplicador es igual a la ratio PFE sobre *Add-on*. De esta manera se llega a la formulación teórica definitiva, la cual es mostrada en el gráfico 1, definida como curva del modelo inicial.

$$W_{model}(y) = \min\left\{1;\ y\ \phi\left[\varphi(0)\ y\right] + \frac{\varphi\left[\varphi(0)\ y\right]}{\varphi(0)}\right\} \quad [43]$$

La fórmula [42] está basada en la asunción de que el valor neto de mercado del conjunto de operaciones compensables de derivados está normalmente distribuido. No obstante, el Comité adopta una función más conservadora para evitar la presencia de valores asintóticamente nulos[21]. Esto es mostrado en el gráfico 1 como curva de ajuste exponencial:

$$W_{exp}(y) = \min\left\{1;\exp\left(\frac{y}{2}\right)\right\} \quad [44]$$

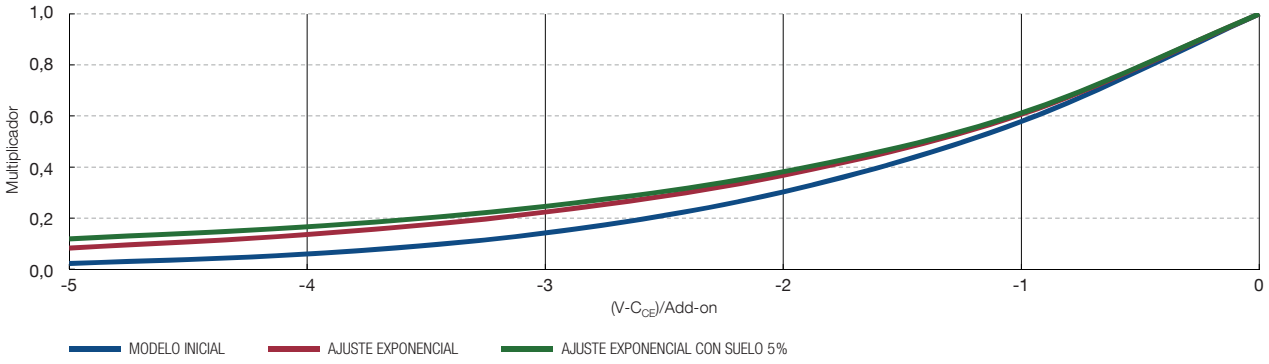
Finalmente, se consideró que [43] continuaba permitiendo valores nulos del multiplicador, y de los requerimientos de capital asociados, en casos de infinita sobrecolateralizacion. Por ello, se decidió establecer un suelo al importe de capital que los conjuntos compensables han de requerir. Finalmente, ello es mostrado en el gráfico 1 en la curva de ajuste exponencial con suelo del 5 %:

$$W_{SA\text{-}CCR}(y) = \min\left\{1;Floor + (1 - Floor)\exp\left\{\frac{y}{2(1 - Floor)}\right\}\right\} \quad [45]$$

Las diferencias entre [43], [44] y [45] se pueden observar en el gráfico 1:

IMPACTO DEL MULTIPLICADOR

GRÁFICO 1



FUENTE: Basel Committee on Banking Supervision (2014).

20 Para un mayor desarrollo algebraico, consultar Basel Committee on Banking Supervision (2014).

21 El factor 2 aparece en la fórmula para permitir que [43] y [44] tengan el mismo punto de partida.

En lo referido a los conjuntos de operaciones compensables sin colateralizar, es decir, aquellas sin un intercambio de colateral más allá del momento de la firma del contrato, se presenta un problema, dado que la fórmula [42] carece de forma cerrada para casos distintos de V-CE (t) = 0. El SA-CCR adopta un enfoque pragmático en este caso y se limita a redefinir la variable y definida en [42]:

$$y = \frac{V\text{-}C_{CE}(MPR)}{\text{Add-on}^{\text{no-margin}}_{\text{aggregate}}} \qquad [46]$$

3 Incorporación al ordenamiento jurídico de la Unión Europea

El 23 de noviembre de 2016 la Comisión Europea presentó su propuesta de modificación del Reglamento 575/2013, de requerimientos prudenciales de las entidades de crédito y las empresas de inversión (CRR). Está previsto que esta propuesta se comience a aplicar transcurridos dos años desde su publicación en el *Diario Oficial de la Unión Europea,* hecho que no se ha producido todavía. El objetivo declarado de dicha propuesta es adoptar los nuevos estándares internacionales de captura de riesgos adoptados por BIS, los cuales pretenden resultar más sensibles al riesgo que los previamente existentes, alineando requerimientos de capital con riesgo realmente asumido y logrando un uso más eficiente del capital de las entidades de crédito[22]. Se espera que esto redunde en una mejora de la economía de la Unión. Es destacable que esta propuesta de modificación de la CRR incorpora, junto a la modificación del tratamiento del riesgo de contraparte, otras propuestas de modificación, como la de la ratio de apalancamiento y la *Fundamental Review of the Trading Book* (FRTB). El impacto a largo plazo estimado por la Comisión de la introducción de todo el paquete legislativo propuesto restaría entre un –0,03 % y un –0,06 % del PIB, mientras que ello habría contribuido a reducir un 32 % el importe de los fondos públicos inyectados en apoyo del sistema bancario en una situación de crisis similar a la vivida durante los años 2007 y 2008.

La introducción del SA-CCR en la CRR se ha realizado a través de la modificación de los artículos 273 a 299 del capítulo 6, título II, de la parte tercera de dicha normativa. Como se puede comprobar de inmediato, se trata de una modificación sustantiva de dicho bloque. Para ello, resultará necesario adaptar las definiciones utilizadas por la CRR a este nuevo marco, la sustitución del CEM y su reemplazo por el nuevo SA-CCR. Del mismo modo, se produce la eliminación del SA y se modifica el Método de la Exposición Original (OEM)[23, 24]. Así mismo, se permite la aplicación de un SA-CCR simplificado que resulta novedoso y, junto al OEM, es específico de la regulación comunitaria.

La propuesta de modificación comunitaria incorpora la totalidad del marco del Comité ya descrito. Adicionalmente, empero, incluye una serie de especificidades que son debidas a razones de técnica jurídica y de necesaria adaptación al marco regulatorio comunitario preexistente, o bien a razones materiales. Nos centraremos principalmente en estas últimas.

En primer lugar, se permitirá un caso donde la EAD sería nula. Esto solo será posible cuando el conjunto de operaciones compensables incorpore opciones vendidas en exclusiva, el valor de mercado del acuerdo de compensación resulte negativo en todo momento, las primas asociadas ya hayan sido satisfactoriamente cobradas, y no existan acuerdos de

22 Véase *Explanatory Memorandum,* en European Commission (2016).

23 Para una descripción detallada de los distintos modelos de cálculo contemplados en la CRR, consultar Gil y Manzano (2013).

24 El Método de la Exposición Original no es contemplado por el Comité como una de las opciones regulatorias disponibles. No obstante, está diseñado para ser aplicado por aquellas entidades cuyas exposiciones en derivados y asimilados no sobrepasan un umbral de materialidad.

reposición de márgenes. Esto no estaba incluido en el marco de Basilea (el acuerdo a estos efectos), pero este había reconocido dicha opción en una de las *Frequently Asked Questions*[25] respondidas al respecto.

En segundo lugar, el acuerdo reconoce la presencia de colateral, tal y como ya se ha descrito. La propuesta de modificación de la CRR obliga a que, cuando todas las transacciones del conjunto compensable estén registradas en la cartera de negociación, se cumplan las reglas del artículo 299. Los efectos de este artículo son, esencialmente, determinar qué elementos no asimilables al efectivo son admisibles y la remisión al artículo 223, «Método amplio de colateral financiero», en lo relativo a su valoración. Cuando dentro de uno de estos conjuntos compensables se incorpore alguna operación no incluida dentro de la cartera de negociación prudencial, la lista de colateral admisible será más restringida.

En lo referido al mapeo necesario a las distintas clases de activos, se incorpora una nueva: Otros riesgos. Esta constituirá un único HS a los efectos de cálculo de la PFE. Así mismo, se establece como regla general que las entidades utilicen sus modelos prudenciales de cálculo de requerimientos de riesgo de mercado para determinar cuál es el factor primario de riesgo con mayor sensibilidad a estos efectos. En este mismo punto se encarga a la Autoridad Bancaria Europea (EBA) que desarrolle con mayor detalle cómo identificar los factores de riesgo primarios para entidades que apliquen los métodos de cálculo de requerimientos por riesgo de mercado menos sofisticados, así como las reglas aplicables en presencia de más de un riesgo material.

En lo referido a la definición de HS a efectos del cálculo de la PFE, ninguna novedad relevante más allá del reconocimiento de que la categoría Otros riesgos formará un HS separado y que se permite de manera expresa a las autoridades competentes que soliciten el detalle necesario para determinar cómo se están tratando aquellas operaciones donde el principal factor de riesgo es la volatilidad o el riesgo de base entre factores.

Se encarga a la EBA, igualmente, que desarrolle la fórmula de cálculo del delta, así como la calibración necesaria de la volatilidad de tipos de interés compatible con tipos negativos. Igualmente, ha de desarrollar qué otros elementos cualitativos se pueden considerar para determinar si la posición es larga o corta en el factor de riesgo primario en aquellos casos en los cuales los métodos cuantitativos disponibles no faciliten esa discriminación.

Quizá la novedad más relevante es la introducción de un SA-CCR simplificado junto a la modificación del Método de la Exposición Original. Ambos métodos resultan ser propios del ordenamiento jurídico comunitario y tienen como objetivo poner a disposición de las entidades métodos de aplicación más sencillos en los casos de un menor tamaño y complejidad. De esta manera, el SA-CCR simplificado podrá ser aplicado por las entidades donde la suma del valor de mercado en valor absoluto de las posiciones en derivados no exceda del 10 % del total balance ni de 150 millones de euros. Por su parte, el método OEM podrá ser aplicado cuando esa métrica no exceda los umbrales reducidos del 5 % y de 20 millones de euros.

En lo referido al SA-CCR simplificado, no permite el reconocimiento de NICA en el cálculo del RC, y en los casos en los que existe un acuerdo de intercambio de colateral el RC

25 http://www.bis.org/bcbs/publ/d333.pdf.

queda reducido a la simple adición de umbrales de reposición de margen e importe mínimo que se ha de transferir. Igualmente, desaparece el multiplicador que recoge el efecto de la sobrecolateralización de la PFE. También, con respecto a la PFE, simplifica los términos MF_i y elimina la presencia de deltas distintas de uno, volatilidades y correlaciones.

Finalmente, en relación con el OEM, este se ha vuelto más sensible al riesgo, pero producirá presumiblemente mayores requerimientos de capital. A partir de ahora, la exposición será calculada como la suma de un coste de reposición, calculado de manera similar a como lo es en el SA-CCR simplificado, y de un componente de exposición potencial futura simplificado. Se permite también un cierto reconocimiento de los beneficios por colateralización y por acuerdos de compensación contractual. Finalmente, se revisan al alza los porcentajes que se han de aplicar sobre los nominales involucrados en el cálculo de la exposición potencial futura.

4 Conclusiones

El presente artículo ha descrito tanto las debilidades del marco de captura del riesgo de contraparte anterior como el nuevo marco SA-CCR propuesto por BIS y su propuesta de adaptación a la regulación prudencial comunitaria.

La implantación del marco descrito en la regulación prudencial de la Unión Europea será realizada a través de la modificación del Reglamento 575/2013. Ahora bien, se atenderán las peticiones de aplicación proporcionada recibidas tanto de la industria financiera como de la EBA, permitiéndose la aplicación de dos métodos simplificados en un esfuerzo por racionalizar la aplicación de la norma. Ello parece una solución razonable, habida cuenta de la tipología de entidades que utilizan estos productos en muchos casos.

El impacto global de la introducción de este nuevo marco implicará un incremento de los requerimientos de capital, según la EBA[26], si bien no será significativo en términos agregados, habida cuenta del escaso peso del riesgo de contrapartida en el conjunto de riesgos soportados por las entidades. Según las estimaciones de la EBA, este nuevo marco supondrá un incremento medio directo del 40 % en los requerimientos específicos por riesgo de contraparte y un impacto aún mayor una vez se considere el impacto subsiguiente en las exposiciones con cámaras de contrapartida, riesgo por CVA, ratio de apalancamiento y régimen de grandes exposiciones. Esto, en un entorno de reforzamiento de los niveles de solvencia medios, resultará sin duda en un impacto de necesaria consideración por parte del sector[27].

A juicio del autor, el marco propuesto mejorará sustancialmente la captura de riesgos por parte de la regulación prudencial. Ello redundará, desde un punto de vista macroprudencial, en una mayor estabilidad del sistema, al acercar el volumen de requerimientos mínimos de capital globales a los riesgos realmente asumidos. Desde un punto de vista microprudencial o de la supervisión de su implantación y funcionamiento, la conclusión es francamente positiva en ese mismo sentido. Las entidades habrán de calcular

26 Para mayor detalle, véase el documento de European Banking Authority (2016).

27 No obstante, es necesario destacar la existencia de estudios teóricos que parecen contradecir este incremento previsto de exposición. Así, Wayne y White (2012), además de realizar un pormenorizado esfuerzo descriptivo de los pasos que se han de seguir en la aplicación práctica de los métodos CEM y SA-CCR, realizan una comparación de los resultados obtenidos por ellos a través de múltiples carteras. Los requerimientos parecerían similares a nivel de operación individual, pero más reducidos, a favor del SA-CCR, en presencia de grandes conjuntos compensables de operaciones. Los autores también concluyen que pueden existir incentivos para realizar una gestión activa de los resultados de este método. Como limitación del estudio, los autores señalan que las carteras analizadas están mayormente enfocadas en tipos de interés y FX, lo cual podrían introducir un sesgo indeterminado, así como ciertas limitaciones en la identificación de la delta aplicable.

sus requerimientos mínimos de capital con un método no dependiente de modelos internos más sensible al riesgo, lo cual permitirá alinear estos con las cifras ofrecidas por metodologías de cálculo de capital económico más sofisticadas. Si bien dichas cifras no coincidirán, es esperable que las diferencias se reduzcan y que se mejore la comparabilidad entre entidades.

No obstante, según el autor, son varias las cautelas que hay que adoptar. El nuevo marco nació con el objetivo de ser sencillo de aplicar, pero en comparación con el modelo de referencia anterior, el CEM, resulta mucho más complejo de entender y de aplicar. Adicionalmente, la calibración llevada a cabo por el BIS no resultará ajustada a todas las situaciones. Esto debería resolverse parcialmente en el marco del cálculo del capital económico interno por parte de las entidades, donde las más avanzadas en términos de gestión de este riesgo deberían poder ofrecer sus propias calibraciones y estimaciones de requerimientos de capital sobre una base de alta comparabilidad. Igualmente, se echa en falta una mayor granularidad en categorías como FX. Una única categoría genérica parece pobre e insatisfactoria y conduce a una solución similar a la ofrecida por el marco anterior. Por otro lado, las entidades, en su interacción con el Comité, mostraron cierta inquietud por la arbitrariedad en la definición de los distintos suelos empleados. Finalmente, desde un punto de vista más general, el desarrollo de alternativas no basadas en modelos internos cuantitativamente sofisticados mejora la comparabilidad y la sensibilidad al riesgo, pero a costa de reducir potencialmente los incentivos para adoptar los enfoques más avanzados de cálculo de capital interno y de gestión.

Para acabar, y desde un punto de vista más general, recientemente la literatura académica[28] se ha venido mostrando preocupada por la falta de incentivos que las contrapartes pudieran tener en gestionar con eficacia el riesgo de contrapartida surgido en sus posiciones de derivados. Más en concreto, se apunta la posibilidad de que las contrapartes con grandes exposiciones en derivados son aquellas con los sistemas de gestión de riesgos más eficientes o bien aquellas con perfiles de riesgo más opacos y complejos y sistemas de riesgos más inadecuados para esta complejidad. Siguiendo este razonamiento, para conseguir alinear de un modo más eficaz los intereses de aquel que tiene la exposición crediticia en derivados con los de aquel encargado de gestionar el riesgo subyacente final, las políticas de reposición de márgenes[29] parecen ser una herramienta al menos tan eficaz como los requerimientos de capital. Por ello, en opinión del autor, y como reflexión final, no siempre importa cuán sofisticado y sensible sea el marco de cálculo de requerimientos de capital por riesgo de contraparte. Una contraparte puede haber modelizado de una manera adecuada los comportamientos previstos del valor del subyacente del contrato, pero la presencia de riesgo moral en la contraparte puede acabar por arruinar ese esfuerzo. Así, las entidades, los reguladores y los supervisores deben considerar, junto a la cuantificación del riesgo asumido en los términos ya descritos en el presente artículo, el impacto de las políticas de reposición de márgenes que pudieran existir, o la ausencia de ellas y el posible riesgo moral asociado. Con ello, se conseguiría mejorar, sin duda, un riesgo ciertamente difícil de gestionar por parte de las entidades.

28 Véase, por ejemplo, Biais y Heider (2016).

29 A este respecto, véase también Leif Andersen (2017).

TABLA DE PARÁMETROS SUPERVISORES DEL COMITÉ DE BASILEA

CUADRO 2

Clase de activo	Subclase	Factor supervisor	Correlación ρ supervisora	Volatilidad supervisora
Tipo de interés		0,50%	N/A	50%
FX		4,0%	N/A	15%
Crédito, *single name*	AAA	0,38%	50%	100%
	AA	0,38%	50%	100%
	A	0,42%	50%	100%
	BBB	0,54%	50%	100%
	BB	1,06%	50%	100%
	B	1,6%	50%	100%
	CCC	6,0%	50%	100%
Crédito, índice	IG	0,38%	80%	80%
	SG	1,06%	80%	80%
Renta variable, *single name*		32%	50%	120%
Renta variable, índice		20%	80%	75%
Materias primas	Electricidad	40%	40%	150%
	Petróleo/gas	18%	40%	70%
	Metales	18%	40%	70%
	Agricultura	18%	40%	70%
	Otros	18%	40%	70%

FUENTE: Basel Committee on Banking Supervision (2014).

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Número 1 – septiembre 2001

La provisión para insolvencias en las entidades de crédito. Presente, futuro y pasado
Rafael Prado

Número 2 – noviembre 2002

Debida diligencia con la clientela de los bancos
Comité de Supervisión Bancaria de Basilea

Las Cuarenta Recomendaciones
Grupo de Acción Financiera sobre el Blanqueo de Capitales

Directrices globales para la prevención del blanqueo de capitales en actividades de banca privada
Grupo Wolfsberg

El sistema financiero y el blanqueo de capitales
Ignacio Palicio Díaz-Faes

Número 3 – julio 2003

El modelo contable IASB. Análisis comparativo con la normativa de las entidades de crédito españolas
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Comunicación de la Comisión al Consejo y al Parlamento Europeo. La estrategia de la UE en materia de información financiera: el camino a seguir

Reglamento de aplicación de las IAS en la UE, de 19 de julio de 2002, relativo a la aplicación de Normas Internacionales de Contabilidad

Mejora de la transparencia bancaria. Información pública e información supervisora para fomentar sistemas bancarios sólidos y seguros
Comité de Supervisión Bancaria de Basilea

Grupo de Trabajo Multidisciplinar para mejorar la Información Difundida

Número 4 – mayo 2006

Impacto de la Circular Contable 4/2004 sobre el balance y la cuenta de pérdidas y ganancias de las entidades de depósito españolas
Daniel Pérez

Número 5 – diciembre 2006

El programa de evaluación del sector financiero del Fondo Monetario Internacional/Banco Mundial
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Preparación del FSAP en el Banco de España
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Evaluación del cumplimiento de los «Principios básicos para una supervisión bancaria efectiva»
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SIGLAS, ABREVIATURAS Y SIGNOS UTILIZADOS

AAPP	Administraciones Públicas
AIAF	Asociación de Intermediarios de Activos Financieros
ANFAC	Asociación Nacional de Fabricantes de Automóviles y Camiones
BCE	Banco Central Europeo
BCN	Bancos Centrales Nacionales
BE	Banco de España
BOE	Boletín Oficial del Estado
BPI	Banco de Pagos Internacionales
CBE	Circular del Banco de España
CE	Comisión Europea
CCAA	Comunidades Autónomas
CCLL	Corporaciones Locales
CECA	Confederación Española de Cajas de Ahorros
CEM	Confederación Española de Mutualidades
CFEE	Cuentas Financieras de la Economía Española
CNAE	Clasificación Nacional de Actividades Económicas
CNE	Contabilidad Nacional de España
CNMV	Comisión Nacional del Mercado de Valores
DEG	Derechos Especiales de Giro
DGSFP	Dirección General de Seguros y Fondos de Pensiones
DGT	Dirección General de Tráfico
DGTPF	Dirección General del Tesoro y Política Financiera
EC	Entidades de crédito
EFC	Establecimientos financieros de crédito
Eonia	Índice medio del tipo de interés del euro a un día *(Euro Overnight Index Average)*
Euríbor	Tipo de interés de oferta de los depósitos interbancarios en euros *(Euro Interbank Offered Rate)*
Eurostat	Oficina de Estadística de las Comunidades Europeas
EPA	Encuesta de población activa
FAAF	Fondo para la Adquisición de Activos Financieros
FEADER	Fondo Europeo Agrícola de Desarrollo Rural
FEAGA	Fondo Europeo Agrícola de Garantía
FEDER	Fondo Europeo de Desarrollo Regional
FEOGA	Fondo Europeo de Orientación y Garantía Agrícola
FEP	Fondo Europeo de Pesca
FFPP	Fondos de Pensiones
FGD	Fondo de Garantía de Depósitos de Entidades de Crédito
FIAMM	Fondos de Inversión en Activos del Mercado Monetario
FIM	Fondos de Inversión Mobiliaria
FMI	Fondo Monetario Internacional
FMM	Fondos del Mercado Monetario
FSE	Fondo Social Europeo
IAPC	Índice Armonizado de Precios de Consumo
ICO	Instituto de Crédito Oficial
IFM	Instituciones Financieras Monetarias
IGAE	Intervención General de la Administración del Estado
IIC	Instituciones de Inversión Colectiva
INE	Instituto Nacional de Estadística
INVERCO	Asociación de Instituciones de Inversión Colectiva y Fondos de Pensiones
IPC	Índice de Precios de Consumo
IPI	Índice de Producción Industrial
IPRI	Índice de Precios Industriales
IPSEBENE	Índice de Precios de Servicios y de Bienes Elaborados No Energéticos
ISFLSH	Instituciones Sin Fines de Lucro al Servicio de los Hogares
IVA	Impuesto sobre el Valor Añadido
NEDD	Normas Especiales de Distribución de Datos del FMI
OBS	Obra Benéfico-Social
OCDE	Organización de Cooperación y Desarrollo Económicos
OIFM	Otras Instituciones Financieras Monetarias
OM	Orden Ministerial
OOAA	Organismos Autónomos
OOAAPP	Otras Administraciones Públicas
OPEP	Organización de Países Exportadores de Petróleo
OSR	Otros Sectores Residentes
PDE	Protocolo de Déficit Excesivo
PEC	Pacto de Estabilidad y Crecimiento
PIB	Producto Interior Bruto
PIBpm	Producto Interior Bruto a precios de mercado
PNB	Producto Nacional Bruto
RD	Real Decreto
RM	Resto del Mundo
Sareb	Sociedad de Gestión de Activos Procedentes de la Reestructuración Bancaria
SCLV	Sistema de Compensación y Liquidación de Valores
SEC	Sistema Europeo de Cuentas
SEPE	Servicio Público de Empleo Estatal
SME	Sistema Monetario Europeo
TAE	Tasa Anual Equivalente
TEDR	Tipo Efectivo Definición Restringida
UE	Unión Europea
UEM	Unión Económica y Monetaria
UE-15	Países componentes de la Unión Europea a 30.4.2004
UE-25	Países componentes de la Unión Europea desde 1.5.2004
UE-27	Países componentes de la Unión Europea desde 1.1.2007
UE-28	Países componentes de la Unión Europea desde 1.7.2013
VNA	Variación Neta de Activos
VNP	Variación Neta de Pasivos

SIGLAS DE PAÍSES Y MONEDAS

De acuerdo con la práctica de la UE, los países están ordenados según el orden alfabético de los idiomas nacionales.

BE	Bélgica	EUR (euro)
BG	Bulgaria	BGN (lev búlgaro)
CZ	República Checa	CZK (corona checa)
DK	Dinamarca	DKK (corona danesa)
DE	Alemania	EUR (euro)
EE	Estonia	EUR (euro)
IE	Irlanda	EUR (euro)
GR	Grecia	EUR (euro)
ES	España	EUR (euro)
FR	Francia	EUR (euro)
HR	Croacia	HRK (kuna)
IT	Italia	EUR (euro)
CY	Chipre	EUR (euro)
LV	Letonia	EUR (euro)
LT	Lituania	EUR (euro)
LU	Luxemburgo	EUR (euro)
HU	Hungría	HUF (forint húngaro)
MT	Malta	EUR (euro)
NL	Países Bajos	EUR (euro)
AT	Austria	EUR (euro)
PL	Polonia	PLN (zloty polaco)
PT	Portugal	EUR (euro)
RO	Rumanía	RON (nuevo leu rumano)
SI	Eslovenia	EUR (euro)
SK	Eslovaquia	EUR (euro)
FI	Finlandia	EUR (euro)
SE	Suecia	SEK (corona sueca)
UK	Reino Unido	GBP (libra esterlina)
JP	Japón	JPY (yen japonés)
US	Estados Unidos	USD (dólar estadounidense)

ABREVIATURAS Y SIGNOS

M1	Efectivo en manos del público + Depósitos a la vista.
M2	M1 + Depósitos disponibles con preaviso hasta tres meses + Depósitos a plazo hasta dos años.
M3	M2 + Cesiones temporales + Participaciones en fondos del mercado monetario e instrumentos del mercado monetario + Valores distintos de acciones emitidos hasta dos años.
m€/me	Millones de euros.
mm	Miles de millones.
A	Avance.
P	Puesta detrás de una fecha [ene (P)], indica que todas las cifras correspondientes son provisionales. Puesta detrás de una cifra, indica que únicamente esta es provisional.
pb	Puntos básicos.
pp	Puntos porcentuales.
SO	Serie original.
SD	Serie desestacionalizada.
T^i_j	Tasa de la media móvil de i términos, con j de desfase, convertida a tasa anual.
m_j	Tasa de crecimiento básico de período j.
M	Referido a datos anuales (1970 M) o trimestrales, indica que estos son medias de los datos mensuales del año o trimestre, y referido a series de datos mensuales, decenales o semanales, que estos son medias de los datos diarios de dichos períodos.
R	Referido a un año o mes (99 R), indica que existe una discontinuidad entre los datos de ese período y el siguiente.
...	Dato no disponible.
—	Cantidad igual a cero, inexistencia del fenómeno considerado o carencia de significado de una variación al expresarla en tasas de crecimiento.
0,0	Cantidad inferior a la mitad del último dígito indicado en la serie.