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The Impact of Basel III on Trade Finance: The Potential Unintended Consequences of the Leverage Ratio

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Abstract

The treatment of trade finance, particularly in the form of short-term letters of credit, has been subject to policy discussions during the making of Basel III rules. International public institutions representing the trade and development communities requested that the relatively light regulatory treatment accorded to such instruments under previous versions of the Basel framework be by and large preserved to avoid penalizing developing countries' trade, which relied to a large extent on such instruments. Trade finance private lobbies requested an even more favorable treatment. In the end, the Basel Committee on Banking Supervision (BCBS) made relatively limited concessions, closer to the demands of international organizations. The discussion focused on the imposition of a leverage tax on letters of credit, as part of the leverage ratio to be applied to all off-balance sheet instruments. This paper focuses on this particular aspect of the inter-institutional dialogue. Most of this discussion was based on principles and empirics. This paper offers a relatively simple model approach showing the conditions under which the 100% leverage tax on assets such as letters of credit would reduce their natural attractiveness relative to higher-risk ones, which stand in the balance sheet of banks. The conclusions of the model are consistent with the final approach selected by the Basel Committee in the final version of Basel III, which are different than its original proposals. It offers, perhaps ex-post, an analytical confirmation of the right choice made by policy-makers on empirical grounds.

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1 Introduction

The Basel III framework, which was published by the Basel Committee in December 2017 and entered into force at the beginning of 2018, strengthens prudential requirements on banks with a view to achieving a safer financial system. New guidelines on capital, liquidity, maturity and leverage aim at reducing the incentives for building-up high-risk, highly leveraged banks assets responsible for the 2008-09 dislocation of the global financial system.

Trade finance has been supporting the expansion of global trade flows in recent decades, and is generally seen as a low risk asset, with little or no role in the 2008 collapse of the financial system. On the contrary, its supply had been adversely affected by the contagion from the other segments of the financial industry. Traditional forms of trade finance, such as letters of credit and other self-liquidating instruments, are mostly short-term in nature, carry low given risk of default, and are highly collateralized (by the merchandise). Because letters of credit are simple (but irrevocable) commitment to pay, they are placed off banks' balance sheet. They had been granted favorable capital and liquidity treatment under Basel II. More recent forms of trade finance, such as supply chain finance, which cover the funding of receivables and payables within a supply chain, stand on banks' balance sheet, as any other funding facility.

After 2008-9, the trade and development communities have been attentive that the necessary re-regulation of the financial industry did not bear unintended consequences on trade and its financing, notably the trade opportunities of developing countries post-financial crisis. Developing countries were important users of letters of credit. This meant that such simple trade finance instruments kept their regulatory "comparative" advantage, should this be supported by the necessary evidence on their alleged low level of risk. Early drafts of the Basel framework had raised concerns over new provisions, notably that a supplementary leverage ratio on the letters of credit and other short term, self-liquidating instruments would be imposed (Auboin, 2010). An inter-institutional dialogue was requested by the World Trade Organization and the World Bank. It took place under the auspices of the G-20 to review possible provisions affecting trade finance. In its 2011 Decision (BIS (2011)), the Basel Committee on Banking Supervision (BCBS) addressed some of the concerns raised by international organizations. Deeper demands by private lobbies were not satisfied. However, the BCBS decided not to change its the proposed 100% leverage tax on the letters of credit and other trade finance instrument standing off-the-balance sheet of banks. The continuing discussion on this point was based mainly on arguments of principle, and on empirical evidence that the international organization concerned requested the private sector to collect in

the meantime. The statistics collected, gathered by the trade finance industry in a Trade Finance Register, offer a unique perspective, unknown during the making of Basel II, on the low risk given default of trade finance. Anyhow, the dialogue still lacked a proper theoretical framework on which to base a decision.

This paper takes stock of the discussion, and presents the most recent data on the Trade Finance Register. It also contains a relatively simple model of a bank's maximization of its net worth, which demonstrates that imposing a full (100% instead of 20%) leverage tax on letters of credit discourages its use relative to more risky trade finance instruments which precisely stand in the balance sheet for such reasons. The Trade finance register confirms the higher level of risk (although moderate in absolute terms) of trade finance loans relative to letters of credit, which tends to confirm the findings of the model. The final version of Basel III confirms the preliminary decision made by the Basel Committee in 2014 to reduce the leverage ratio, also consistent with the ex-post findings of the model. The Decision of the Basel Committee was made on the basis of several "good sense" arguments, i.e., a recognition that letters of credit were not a major source of leverage, the low level of risk inherent to letter of credits, and the already low credit conversion factor (CCF) on capital that had been accorded to letters of credit a much higher CCF on the leverage ratio would have appeared contradictory to the CCF on capital, although it could be argued that the two ratios may have somewhat different prudential aims.

The reminder of this paper is organized as follows. Section II analyzes the existing literature on the topic, section III offers more background on the prudential treatment of letters of credit as a safe way to finance trade, while section IV offers a simple model describing the relative loss of attractiveness of these instruments relative to other ones. Section V analyses the findings and concludes.

2 Related Literature

The literature offered only limited leads as to how this could be achieved. Several papers address, in general, the impact of prudential cost (at best reduced to the capital cost) on asset allocation, the balance between marginal cost and revenues of assets in the balance sheet, and the cost of credit. No paper proposed a methodology to assess the impact of one measure in the relative choice of assets on and off-the-balance sheet. Zicchino (2006) describes the mechanisms under which the capital-to-asset ratio in the risk-weighted asset system of Basel II had contributed to pro-cyclical lending during the period of application of the framework. His simple model shows how banks maximize

their net worth by choosing the loan return, level of deposits, investment in trade securities and capital subject to cash-flow constraints, loan demand, financial constrain and balance-sheet identity. He demonstrated arithmetically that the optimal level of capital held by banks is (a) a negative function of the expected marginal cost of external funds (b) a positive function of the expected demand for loans (which itself is a function of existing economic conditions) (c) a negative function of the expected marginal cost of loans (d) a positive function of the volatil- ity of loan demand (e) a negative function of the elasticity of the loan demand (bigger elasticity implying less monopoly power), and (f) a positive function of the regulatory capital.

Another interesting approach was developed by Blum (1999), who considered that capital adequacy ratios increased banks riskiness. The point was that, as raising equity was quite costly, particularly in an inter-temporal model in which the value of capital is higher tomorrow than today, hence the only possibility to increase equity tomorrow was to increase risk today. He showed that an increase in capital regulation can raise the marginal return on risk. The rationale in linked to the fact that under binding regulation, equity tomorrow is more valuable to the bank than it is today. In a regime of binding capital requirements, the amount that can be invested in the risky but profitable asset is restricted to a multiple of the value of equity. This implies that an additional unit of equity leads to an additional investment larger than one unit in the risky asset. Due to this leverage effect, equity is more valuable to a regulated bank. A bank facing binding capital rules has therefore a higher incentive to increase equity tomorrow. However, if a bank finds it prohibitively costly to raise additional equity in the capital market or is unable to do so, the only way to increase the amount of equity is to increase risk today.

Finally, Elliott and Al (2012) have examined the impact of increased capital requirement on lending rates (loan cost). They found that the total net additional cost of funding new capital requirement was quite modest in most financial markets, not the least because many financial institutions held ex ante target minimum ratio (for common equity) well above the regulatory requirements.

While useful, though, none of these papers in themselves help us answer the central question of this paper, ie how the imposition of a leverage ratio on trade finance would change the incentive in using it. Part of the reason is that previous papers do not deal with off-balance sheet commitments, which have increased, taking advantage of the loopholes of Basel II. The creation of a leverage ratio to off-balance sheet commitments, under Basel III, is hence a central piece of the new Basel III framework. It is precisely aimed at avoiding the accumulation of toxic assets off the balance sheet of banks, particularly when it aims at circumventing the capital charge on assets. It is there-

fore understood that the leverage ratio, for good reasons, is aimed at reducing the attractiveness of such commitments. It is also well understood that the application of a leverage ratio at a 100% CCF from a 3% threshold, is not equivalent to multiplying by five the 20% CCF applied for capital purposed to letters of credit. It is nonetheless likely to be a (substantial) increase in the cost of prudential regulation for this particular category of products, in absolute and relative terms.

3 Background on the prudential treatment of short-term trade finance

3.1 The Capital Ratio and the Trade Finance Register

Traditionally, short term, structured trade finance has received preferred capital treatment on the part of national and international regulators, as well as by international financial agencies in the treatment of trade finance claims, on grounds that trade finance was one of the safest, most collateralized, and self-liquidating forms of trade finance. This was notably reflected in the low credit conversion factor (CCF) determined under the Basel I framework for the capitalization of such instruments as self-liquidating letters of credit, bank acceptances and other short term collateralized commitments to pay. For letters of credit and other self-liquidating trade instrument, the CCF was set at 20%, i.e. five times lower than any on-balance sheet loan (all loans standing into the balance sheet are capitalized at 100% of their face value, i.e. at a 100% CCF).

Box 1 illustrates the way the capital charge was calculated under the Basel I framework.

Box 1: Simple Credit Conversion Factor Example for "short-term, self-liquidating trade related contingencies" under the Standardized Approach of Basel I

- Unrated LC: US$ 1,000,000
- Application of a risk-weight of 100%
- Capital requirement of 8%: US$ 1,000,000 * 8% = US$ 80,000
- CCF of 20%: US$ 80,000 * 20% = US$ 16,000 in total capital to set aside

Source: WTO Document WT/WGTDF/W/42

The use of CCF values of 20% was widely regarded at the time as recognition of the low risk of lending on trade and transactions related contingencies in comparison to other forms of lending products. Trade-related contingencies are contingent liabilities that arise from trade-related obligations underpinned by the movement of goods or the provision of services and evidenced by commercial contracts which document the arrangement between the buyer and the seller. Hence, trade-related contingencies are hardly speculative in nature. In providing for such facilities, the banks are simple intermediaries between the parties, i.e. the buyer and the seller, and are offering a service providing for risk mitigation and transaction structuring for the counterparties[1].

Under the Basel II and III frameworks, the 20% credit conversion factor was maintained for short-term self-liquidating letters of credit arising from the movement of goods (e.g., documentary credits collateralized by the underlying shipment, to be applied to both issuing band confirming banks). However, one provision of Basel II reduced the positive incidence of the low CCF, by requiring that, unless permitted otherwise by their local regulators, bank capitalize letters of credit and the like for a full year, even though the maturity of such instruments is actually lower. This issue was raised and addressed in the context of the above-mentioned G-20 sponsored dialogue that took place in 2011 between the WTO and World Bank, on the one hand, and the Basel Committee on Banking Supervision (BCBS), on the other. In preparation for such a dialogue, the WTO Director-General had requested to the International Chamber of Commerce (ICC) Banking Commission to collect industry data on credit risk and default for trade finance under the pilot trade finance register, to ascertain the alleged low- risk character and absence of leverage of the industry [2]. The aggregate data initially delivered by ICC covered 9 major international banks, over

[1]A letter of credit provides an irrevocable guarantee to the exporter that, should the goods and/or services be delivered to the importer according to contractual terms, and in presence of compliant documents, that it will be paid by the bank that issued that letter of credit (the bank of the importer). The letter of credit also provides assurances to the importer, in particular that of receiving the goods and/or services ordered, in line with the compliant documentation, and under any contractual terms set out in the purchase agreement. The obligation of the issuing bank to pay the beneficiary of the letter of credit, most generally the exporter, is hence contingent on the exporter delivering the merchandise as detailed in the letter of credit, but also in accordance with all the other requirements specified in the documented credit. The documentation required in a letter of credit depends on the level of complexity of the transaction and the degree of security that the two parties wish to have on the transaction: security of payment, security and transparency regarding the description of the goods, security regarding the clearance of customs, transportation process and delivery on time, and other kinds of risks related to the transactions.

[2]The low CCF for capital purposes accorded to letters of credit by the Basel II framework was largely based on anecdotal evidence. The Trade Finance Register Project was the first attempt to actually build an authoritative source of trade finance-related credit risk and default database. The 2017 ICC Trade Register Report pays tribute to then WTO Director-General Pascal Lamy for having provided the "initial impetus", and the Asian Development Bank for seed funding, to create a database hosted by the ICC. The ICC database has been consulted and taken into account by the Basel Committee during the dialogue held with the WTO, the World Bank and the ICC.

5 million trade finance transactions, and revealed less than 1,150 defaults (0.2%). It also revealed that the average tenor of a letter of credit was around 95 days.

Since then, the trade finance register has continued to expand. The ICC has been issuing annual Trade Finance Register Reports. The latest, 2017 report includes data from 25 banks amounting to 20 million transactions since 2008 and USD 11 trillion in trade transaction value. The 2017 register reveals that the default rate on letters of credit remains unchanged over time at 0.2%. Since over 70% of the loss is recovered through the sale of the underlying merchandise, the total loss rates on these products is 0.1% or less[3]. By comparison, the average default rate on short-term import and export loans was 0.8%, which is about 4 times higher than letters of credit, although such default rate on trade loans remains in relative terms low relative to other categories of short-term loans (consumer lending, etc).

Figure 1: Risk characteristics of short-term trade finance products, 2008-16

CATEGORY	Default Rate	Implied maturity (days)	Recovery rate
Import and export letters of credit	0.22%	80	71%
Loans for import/export	0.8%	120	45%
Performance guarantees	0.36%	110	18%
Total	**0.46%**	**90**	**52%**

Source: ICC Trade Register Reports' averages (2011, 2013, 2015, 2017)

The data examined by the Basel Committee was not considered to be sufficiently convincing to reduce the CCF below 20%, which was a demand by the industry, but not by international institutions.

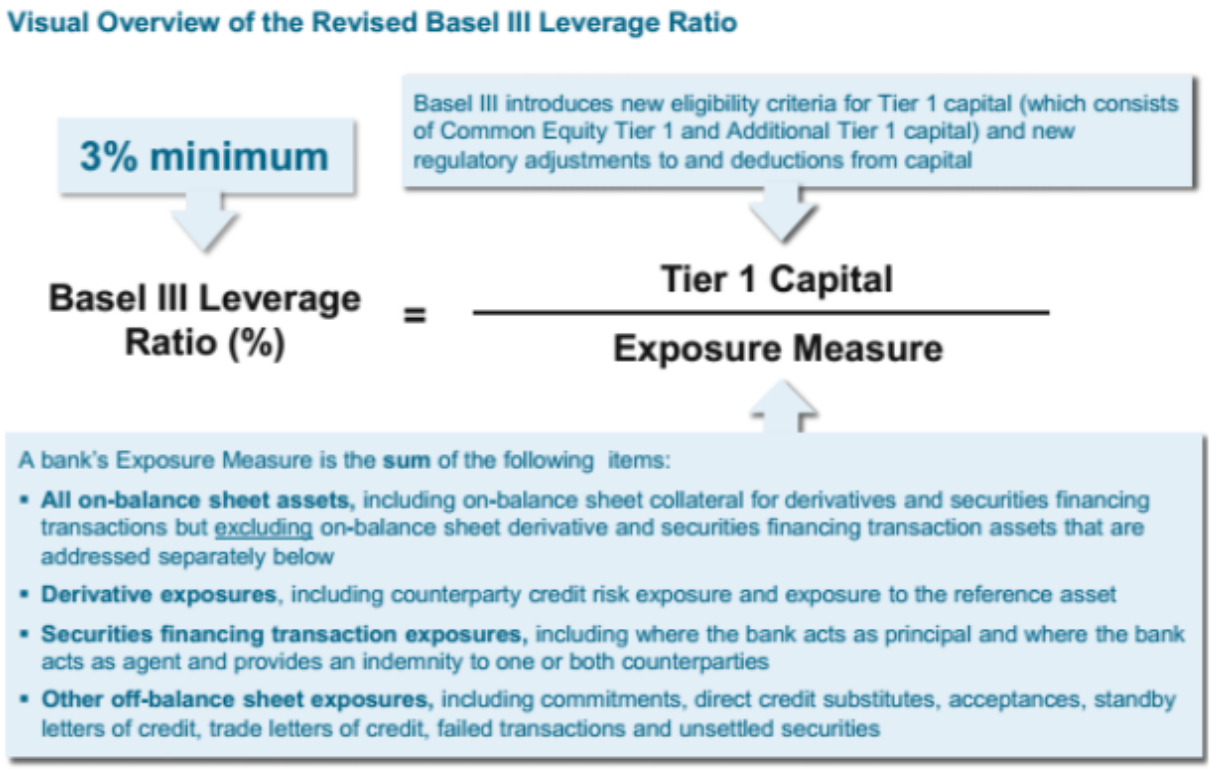
3.2 The specific case of the leverage ratio

Another key aspect concerned the future implementation of the leverage ratio on letters of credit and the like, which according to Basel III rules issued in 2011, should be subject to a non-risk based 100% credit conversion factor for the purpose of calculating this ratio. To be noted is the fact that the 100% CCF for calculating the capital charge is not to be confused with the 100% CCF

[3]More details on the trade register is available at: http://www.iccwbo.org/products-and-services/trade-facilitation/banking-commission-market-intelligence. Annual Reports can be found under this website. 2016 data comes from the "2017 ICC Trade Register Report: Global Risks in Trade Finance".

for the purpose of the calculation of the leverage ratio. According to Basel III guidelines, the 100% leverage tax would only apply from a threshold of 3% of capital, upwards. The formula allowing for the calculation of the leverage ratio can be visualized as in Figure 2.

Figure 2:



Source: Davis Polk, 'Basel III Leverage Ratio: US Proposes American Add-On, Basel Committee Proposes Important, Denominator Changes", page 7, July 19 2013.

There is here undisputed support to the argument that the recent financial crisis was caused by an excess of leverage in banks, and that the concentration off-balance sheets of toxic assets, often aggregated in special vehicles has been one of the reasons behind the blindness of banks managements regarding the actual deterioration of their institutions net worth. It is also not

disputed that the packaging of such asset-backed securities aimed at minimizing capital requirements for such assets. The leverage ratio is therefore a positive measure to avoid the concentration of toxic assets off-the-balance sheets of financial institutions, feeding distrust and fostering irresponsibility among the successive holders of such assets.

Though, one argument defended by the WTO since the proposal of such measure has been the absence of leverage involved in short term trade finance transactions, due to the one-to-one relationship with merchandise trade. Moreover, contingent trade finance obligations, such as letters of credit, are off the balance sheet essentially for process reasons. The WTO acknowledged, though, that the dialogue with Basel Committee Members should be fact-based, and had to be fed by data collected by the industry. From this point of view, the WTO has strongly encouraged commercial banks to feed in the ICC trade finance registry, which constitutes a true public good, and is taken very seriously by the Basel Committee. It is also acknowledged in this paper that the leverage ratio is not yet in application. It has finally been noted by the WTO that under the CRD IV regulation, the European Union is planning to set the credit conversion factor for the calculation of the leverage ratio at rates of 20% and 50% for contingent trade finance instruments, i.e. at a lower level than planned by the Basel Committee (100%). It is also indicated that in assessing the leverage ratio for short term and export (long term) trade finance, the EU would look at its impact on trade finance and export credit provision, so that it does not hinder global export growth. On the contrary, the US authorities have not only decided to apply the 100% CCF for the leverage ratio but also to add a supplementary measure of leverage for systemically important banks.

In its Decision on 25 October 2011, the Basel Committee has already largely answered some of the concerns pertaining to the application of a leverage ratio to short term contingent trade products. The Basel Committee argues in particular that:

- it would not change the CCF for calculating the leverage ratio because this calculation was intentionally designed to be simple and not risk-based;
- the leverage ratio applied only from a 3% capital threshold;
- the leverage ratio was subject to a flat 100% CCF, except for one category of assets, i.e., commitments that are unconditionally cancellable by a bank without prior notice. This exception does not include trade finance products, such as letters of credit, which are irrevocable binding commitments for the bank and cannot be cancelled without prior agreement of the beneficiary.

The introduction of an exception to the flat 100% leverage ratio was somewhat of a surprise to the trading community in the sense that part of the argument for applying the leverage ratio to trade finance was to avoid creating a hole into the net, i.e. creating exception that would endanger the rule by weakening it. From a conceptual point of view, the fact of treating cancellable commitments, such as credit card commitments, better than trade finance (which are non-cancellable) can be discussed at some length. Loss given default data on trade finance indicate a 0.1% chance of letters of credit falling into the balance sheet only when the obligor fails to pay. While data is not immediately available, in the light of the recent financial crisis it could easily be argued that, even if they are cancellable within 24 hours, credit card commitments (off the balance sheet) of banks have put banks balance sheets at a bigger risk than trade finance commitments.

The question raised in the small analytical model developed Section 4 is whether the 100% leverage ratio was in the first place more desirable than the level of 20% requested by the WTO and the World Bank for secured forms of trade finance (letters of credit), notably in view of their relative attractiveness vis--vis on balance-sheet products of trade finance.

3.3 The Leverage Ratio and the Relative Attractiveness of Trade Finance

Indeed, the main argument that can be opposed to the leverage ratio applying to off-balance sheets letters of credit and other self-liquidating instrument is that it changes the relative attractiveness of these low-risk (hence low-capital based) and low remuneration instruments which greatly contribute to the security of trade.

The change in relative attractiveness is against on-balance sheet lending, be it trade-related such as supply chain trade overdrafts (i.e. a change is relative attractiveness between on-balance sheet and off-balance sheet products) and/or any other type of other on-balance sheet lending (i.e. this time a change in relative attractiveness between trade and non-trade lending).

The logic of letters of credit and the like being more attractive than outright, in-balance sheet lending is the difference in risk involved. As indicated earlier, letters of credit and the like are secured contingent obligations which are accepted by banks against control over the merchandise, the latter being at least of equivalent value to the loan obligations. Data from the ICC registry indicate that the merchandise helps banks recover their assets in 60% of defaults. One strong element of security in the system is the fact that, historically, one can re-sell the traded merchandise at the contracted price or at least with little discount. This is different from real-estate based assets

which underlying collateral value may be more volatile, as reflected in the recent financial crisis. Hence, the 20% CCF granted for capitalization purpose seems to be justified in comparison to other trade-related loans which do not imply a control over the merchandise, and which do not provide as much documentation (such as the description of financials, customs and shipping documentation, etc.) about the risk involved in dealing with the counterparty. Overdraft financing for companies, whereby the banks manages the flows of payables and receivables on an-going basis, is closer to regular, liquidity management risk for corporates, for any other purposes, and may carry more risk for the bank than the transaction-based structures underlying the letters of credit. This explains that on-balance sheet lending is subject to higher capital (and liquidity) requirements for short term trade commitment of possibly the same maturity.

The question of the attractiveness of structured trade finance relative to in-balance sheet trade-related lending cannot be analysed as for any normal available substitutes. The reality of trade finance is that managing open-account; in-balance sheet lending - hence taking care of liquidity management on behalf of firms involved in international trade requires sophisticated roll-over as well as re-financing management. This is not the case in most developing countries, in which money market re-financing may not be as deep as in developed countries, access to foreign currency with the market or the central bank more difficult, and in which collateral or capital is much harder to find with client companies to which they lend or provide liquidity. In other words, the propensity to use merchandise-based collateralized lending (or even cash-collateralized, in commodity trade), is higher in developing countries than in countries with very sophisticated financial markets and techniques.

4 The Model

In this model we want to show in a very simple way the problem of the bank that has to choose how much to invest in different assets in the presence of two constraints: a capital ratio and a leverage ratio. The goal of the bank is to maximize its final net worth. At the beginning of the period assets have to equal liabilities. Liabilities are represented by deposits (D) and capital issued by the bank (K). Assets are represented by the loans issued by the bank to finance different projects. We distinguish between balance sheet and off-balance sheet assets: the former have to be always backed up by capital, the latter do not necessarily.[4] In order to simplify the analysis as much as

[4]With the introduction in Basel III of capital and leverage requirements also all the off-balance sheet items have to be backed up by capital.

possible, we assume that the bank holds only two assets. An in-balance asset that finances project A and an off-balance asset that finances project B (asset B can be interpreted as a letter of credit). Project A has a return R_A is normally distributed with mean μ_A and variance σ_A^2 . Then there is the second project B, whose return R_B is normally distributed with mean μ_B and variance σ_B^2. In this simple world the following balance-sheet identity has to hold:

$$X_A = D + K; \tag{1}$$

where X_A are the holdings of the in-balance sheet asset. We follow the banking literature[5] and we assume that capital is more costly than deposits. There are several reasons that justify this assumption: differences in the tax treatment of interest payments and dividends, the presence of transaction costs, asymmetric information, deposit insurance and the different maturity that typically characterizes capital and deposits. In our model this implies that the interest paid by deposits, R_D , is smaller than the cost of capital, R_K. Net worth at the end of the period is defined as the difference between returns originating from the holdings of on balance and off-balance sheet assets, and the costs associated to capital and deposits:

$$K_1 = X_A R_A + X_B R_B - R_D D - R_K K. \tag{2}$$

As already mentioned, in Basel III the regulator has introduced two constraints aiming at reducing as much as possible banks' exposure towards risky assets. The first constraint is represented by the capital ratio, according to which banks' capital value has to be at least equal to 8% of their assets. This constraint is represented by equation (3) in the model: The ratio of capital over risk-weighted assets has to be equal to a parameter γ that is 8% in Basel III:

$$\frac{K}{X_A + \alpha X_B} = \gamma. \tag{3}$$

As you can observe, asset B is multiplied by a parameter $\alpha < 1$: this states that asset B is less risky than A and has a conversion factor that is lower than 100%. In other words, asset B receives a lower weight in the calculation of the total value of assets held by the bank, given its low level of riskiness. Additionally Basel III introduced a leverage ratio establishing that the ratio between

[5]Myers and Majluf (1984) and Berger, Herring and Szego (1995)

capital and total asset holdings has to be at least equal to 3%.

$$\frac{K}{X_A + \beta X_B} = \xi, \tag{4}$$

In equation (4) the parameter β attached to asset B is used as another conversion factor and the parameter ξ equals 3% in Basel III. In the initial formulation of Basel III, the regulator was proposing to treat in-balance sheet and off-balance sheet assets equally. In other terms, the initial proposition of Basel III was to attribute in the leverage ratio the same degree of riskiness to all assets, thus fully considering their value in the calculation of total assets. In our equation (4) this would be equivalent to give a value of 1 to the parameter β.

The goal of this model is to analyze how the different treatment of off-balance sheet assets can affect banks' investments decisions. In what follows we look at two limit cases: the first one, in which we assume that off-balance sheet assets receive the same treatment in the two constraints. Moving from the assumption in which α is a conversion factor that truthfully reflects the riskiness of the asset, we first look at the case in which the factor α is applied in the two constraints ($\beta = \alpha$). Second, we analyze the effects of the original proposition of Basel III, according to which off-balance sheet assets should have fully entered the calculation of total assets. This is equivalent to impose that the parameter β equals 1.

By equating equations (3) and (4), we can express the holdings of asset A, X_A, as function of of asset B holdings, X_B

$$X_A = \frac{\beta\xi - \gamma\alpha}{\gamma - \xi} X_B \tag{5}$$

where the holdings of the in-balance sheet asset, X_A, are a function of the relative cost of capital and leverage, γ and ξ, subject to the values of α and β that represent the conversion factors used for asset B in the two constraints. Whenever the product $\beta\xi$ increases relatively to $\gamma\alpha$, we observe a positive correlation between the holdings of the two assets. When it decreases, we observe a negative correlation instead. The first important point that we can make thanks to the model is that the relative values of the two conversion factors α and β affect the relationship between the two assets. If β is larger than α, the two assets will be seen as complements: A bank rationally will hold them both. If instead β equals α, the two assets will be used as substitutes: A bank will hold either A or B.

This result is reflected in the value of equilibrium capital. Using either equation (3) or equation

(4), we can express the initial capital as a function of X_B as well

$$K = \gamma\xi\frac{\beta-\alpha}{\gamma-\xi}X_B. \tag{6}$$

Consistently with what we found in equation (5), whenever β is larger than α, the value of capital is positive. In the opposite case, it becomes negative. In other words, if there is a positive correlation between asset A and asset B holdings, the bank needs to finance its assets with additional capital. If instead the correlation between the holdings of the two assets is negative, this signals that the bank is financing its investment in one asset by selling the other one. Hence, in the presence of a negative correlation between the two holdings, the bank is internally financing its investment and the need for capital is reduced. The bank maximizes a mean-variance utility function whose argument is future net capital that includes both the returns from in-balance and off-balance assets:

$$K_1 = R_A X_A + R_B X_B - R_D D - R_K K, \tag{7}$$

where, using the identity in (1), we define also deposits as a function of X_B . The first order condition coming from the maximization problem defines the optimal holdings of asset B and is

$$X_B = \frac{\mu_A\frac{\beta\xi-\gamma\alpha}{\gamma-\xi} + \mu_B - R_D((1-\gamma)\frac{(\beta\xi-\gamma\alpha)}{(\gamma-\xi)} - \gamma\alpha) - R_K\gamma\frac{\beta-\alpha}{\gamma-\xi}}{\frac{(\beta\xi-\gamma\alpha)^2}{(\gamma-\xi)^2}\sigma_A^2 + \sigma_B^2} \tag{8}$$

According to equation (8), the optimal holdings of asset B are an inverse function of the volatilities of the two returns and depend on four other factors: the expected value of the returns on the two assets, the cost of deposits and the cost of capital. The way these factors affect the holdings of asset B depends on the correlation between X_A and X_B, which can be either positive or negative. When the correlation is positive, the holdings of X_B are increasing in line with the expected return on X_A, μ_A. In that case, it is also decreasing with the cost of capital, R_K, and of deposits, R_D. When the correlation is negative, the holdings of asset B decrease with the expected value of the return on asset A, μ_A. In that case, it increases with the cost of deposits, and to a lesser extent, with that of capital; as one asset finances the other the bank needs less capital.

In what follows we compare two interesting cases. In the first case we assume that $\beta = \alpha$, i.e., the same conversion factor is used for the capital and the leverage ratios. In the second case, we look at what happens when $\beta = 1$, i.e., when the asset B is treated as an asset that is as risky as asset A in the leverage ratio.

4.1 $\beta = \alpha$

When $\beta = \alpha$, there is a negative relationship between the holdings of the two assets, as shown in equation (9), which we can derive using equation (5):

$$X_A = -\alpha X_B. \tag{9}$$

Whenever the bank is investing in one of the two assets, it is selling the other one. Through the selling of one asset, the bank internally finances itself and does not need to issue any initial capital to back up its investments.

$$K = 0. \tag{10}$$

The optimal holdings of asset B become:

$$X_B = \frac{-\alpha\mu_A + \mu_B + R_D\alpha}{\sigma_B^2 + \alpha^2\sigma_A^2} \tag{11}$$

They are inversely related to the weighted sum of return A and return B volatilities. They increase with asset B expected return μ_B and decrease with asset A expected return μ_A. X_B is positively related to the cost of deposits R_D because the off-balance asset B does not need to be backed up by deposits. Given that X_A and X_B are negatively correlated, an increase in X_B reduces X_A and, with it, the need for deposits. As the cost of deposits R_D increases, the bank substitutes asset A with asset B. More precisely, as we can see from equation (11), a marginal increase in X_B reduces X_A by α. This implies a lower need for deposits that is proportional to α. As R_D increases, it is optimal for the bank to reduce its holdings of asset A and increase those of asset B. Finally, given that there is no need for initial capital, the cost of capital does not appear in the expression. We can apply to equation (11) current market conditions in which the cost of deposits R_D is very close to zero. In such a situation the bank would be induced to hold positive amounts of asset B whenever $\mu_B > \alpha\mu_A$. Given that in Basel III the value for α is 0.2, this condition would mean that X_B would be positive so long as the average return on asset A is not five times larger than the average return on asset B. In reality asset A returns are not five times larger than asset B returns. Therefore our model predicts that a bank would increase its holdings of the off-balance asset and reduce its holdings of the in-balance asset, in the scenario that we are considering here.

4.2 $\beta = 1$

In this second case there is a positive relationship between asset A and asset B holdings:

$$X_A = \frac{\xi - \gamma\alpha}{\gamma - \xi} X_B \tag{12}$$

and the initial capital expressed as a function of X_B is positive and equals:

$$K = \gamma \frac{(1-\alpha)\xi}{\gamma - \xi} X_B \tag{13}$$

Differently from before, in order to respect the two constraints the bank has to hold at the same time a long position in both assets. This means that in this case a positive initial capital is necessary, in order to satisfy the two requirements. The optimal holdings of the off-balance assets are:

$$X_B = \frac{\mu_A \frac{\xi-\gamma\alpha}{\gamma-\xi} + \mu_B - R_D((1-\gamma)\frac{(\xi-\gamma\alpha)}{(\gamma-\xi)} - \gamma\alpha) - R_K\gamma\frac{1-\alpha}{\gamma-\xi}}{\frac{(\xi-\gamma\alpha)^2}{(\gamma-\xi)^2}\alpha_A^2\sigma_A^2 + \sigma_B^2} \tag{14}$$

As before, the optimal holdings of X_B are inversely related to a weighted sum of the volatilities of the two returns. They are, this time, increasing in both expected returns μ_A and μ_B in a way that is proportional to the correlation between X_A and X_B described in (12). X_B is now decreasing in both the cost of deposits and the cost of capital. Given (12), a long position in the off-balance asset implies a long position also in the in-balance asset and, therefore, an increase in the costs associated to initial capital and deposits.

In this second scenario our model predicts positive holdings of the two assets. More specifically, comparing the findings of the two extreme cases that we analysed, as the value of the conversion factor β increases from α to 1, we observe a reduction in the optimal holdings of the off-balance sheet asset, B, and an increase in the optimal holdings of the in-balance sheet asset, A. The value of X_B in equation (11) is larger than in equation (14), while X_A is larger in equation (12) rather than in equation (9).

5 Findings of the Model

The model allows to determine the conditions for the optimal holdings of two assets, one in-balance sheet and one off-balance sheet, subject to the two requirements imposed by Basel III: a capital

ratio and a leverage ratio. The holdings of the off-balance sheet asset that in the model we call B can be expressed as a function of the holdings of the in-balance sheet asset, A in the model. The parameter values of the two assets (such as the cost of capital, relative return on each assets, etc) will determine whether the correlation between the holdings of the two assets is positive or negative.

One key parameter is the conversion factor β that is applied to asset B for the purpose of capitalization and for the purpose of calculating the leverage ratio . This parameter determines the relative attractiveness of asset B relative to asset A. We have considered two extreme scenarios: one in which the conversion factors for the in-balance sheet asset A and for the off-balance sheet asset B are the same, ($\beta = \alpha$), and one in which the conversion factor used in the leverage ratio for asset B is equal to 100%, i.e., well above that of the used for the capital ratio.

If the CCF applied to the capital and leverage ratios of asset B are the same, thus the model predicts that the holding of asset B is likely to be inversely related to that of asset A. This means that if the CCF for a letter of credit standing off the balance sheet was equally of 20% for capital and for leverage purposes, thus investors would be induced to consider the two assets as substitutes. A numerical exercise shows that actually they would choose asset B instead of asset A (an on-balance sheet loan). However, in the second case, if the CCF for the calculation of the leverage ratio were to be 100% (five times higher than the CCF for capital), the two assets would be considered as complementary. In such a situation a bank would hold the two assets at the same time.

If we compare the results obtained under the two extreme cases we get that as the conversion factor β associated to the off-balance sheet asset goes from α to 1, we observe a gradual reduction in the holdings of asset B and an increase in the holdings of asset A.

To sum up, the results suggested by the model are twofold: First of all, the model clearly shows that when the conversion factor used in the two requirements is the same ($\alpha = \beta$), the two assets are seen as two alternatives. The bank holds either one or the other. On the contrary, when the off-balance sheet asset B fully enters the calculation of total assets in the leverage ratio, i.e., $\beta = 1$, the two assets are seen as complements.

Second, our numerical solution shows that whenever off-balance sheet assets are treated in a consistent way in the capital and in the leverage ratios, banks have a tendency to increase their holdings of less risky assets and to limit their holdings of risky assets. Otherwise, they reduce their holdings of off-balance sheet riskless assets and heavily invest in riskier in-balance sheet assets.

6 Conclusion

At the same time as this simple model was being designed, the Basel Committee reversed its decision regarding the leverage ratio in early 2014, weakening the CCF from 100% down to 20%. The discussion has been filtering through Basel Committee Members, on the basis of arguments made by the WTO and World Bank, and the data published every year by the ICC. While the Basel Committee rightly considered initially, in its Decision of 2011, that the probability of default described in the ICC statistics was not an exact proxy of the likelihood of letters of credit obligations falling into the balance sheet, ICC statistics have been improved to cover actual default, recoveries and default after recoveries close to the concept of risk defended by the Basel Committee (Table 1). The reversal of the Basel Decision was mainly justified by the fact that several jurisdictions had decided otherwise, in their implementation legislation (the European Union, following an approach supported by the European Commission, approved by the Council of Ministers in May 2012 and endorsed by the European Parliament in late 2013, decided to reduce the leverage tax on such products to 20%). As other Members of the Basel Committee favoured this approach the Basel Committee reconsidered its guidelines on leverage for trade assets on 12 January 2014.

The consistency in the ICC data, post 2011, showing that letters of credit were showing a four times lower default rate than short-term import and export loans, may indeed have played a role in these jurisdiction's decisions. It certainly offered to specialists food for thoughts. As our portfolio model shows, there are thresholds from which letters of credit would become less attractive if "taxed" at the higher CCF rate. Additionally, the model suggests a detail that might not have been taken into consideration yet: A lower CCF in favour of off-balance sheet assets, besides increasing the use of off-balance sheet assets, might also produce the effect of efficiently limiting the exposure of banks towards risky in-balance sheet assets.

Perhaps the ICC data from 2015 to 2017 did not justify a further adjustment. In any case, the Basel III framework will be subject to further reviews, and it is foreseen the ICC data continue to be produced.

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