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## IN-DEPTH ANALYSIS

# **Banks' internal rating models - time for a change? The system of floors as proposed by the Basel Committee**

External author: **Harry Huizinga**

Provided at the request of the  
**Economic and Monetary Affairs Committee**

November 2016

ECON

EN

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# **Banks' internal rating models - time for a change? The "system of floors" as proposed by the Basel Committee**

External author: Harry Huizinga

Provided in advance of the public hearing  
with the Chair of the Single Supervision Mechanism  
in ECON  
on 9 November 2016

### **Abstract**

This briefing paper reviews evidence showing that the adoption of an International Ratings Based (IRB) approach to estimating risk weights by banks has been associated with reductions in average reported risk weights. Several economic studies find that the lower reported risk weights using the IRB methodology to some extent reflect downward risk manipulation by banks. In a system of floors, the purpose of an aggregate output floor should be to prevent wholesale bank-level downward risk weight manipulation, giving rise to effective bank undercapitalization and a heightened probability of bank failure. Input floors can play a useful role alongside an aggregate output floor, if they are targeted to address the problem of potential mismeasurement of risk.

This paper was requested by the European Parliament's Economic and Monetary Affairs Committee.

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## **LANGUAGE VERSION**

Original: EN

## **ABOUT THE EDITOR**

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This document is also available on Economic and Monetary Affairs Committee homepage at:  
<http://www.europarl.europa.eu/committees/en/ECON/home.html>

Manuscript completed in November 2016  
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## LIST OF ABBREVIATIONS

<b>AIRB</b>	Advanced Internal Ratings Based
<b>BCBS</b>	Basel Committee on Banking Supervision
<b>CET1</b>	Common Equity Tier 1
<b>EAD</b>	Exposure at Default
<b>EBA</b>	European Banking Authority
<b>EBF</b>	European Banking Federation
<b>ECB</b>	European Central Bank
<b>EU</b>	European Union
<b>FIRB</b>	Foundation Internal Ratings Based
<b>IIF</b>	Institute of International Finance
<b>IRB</b>	Internal Ratings Based
<b>LGD</b>	Loss Given Default
<b>M</b>	Maturity
<b>OECD</b>	Organization for Economic Cooperation and Development
<b>PD</b>	Probability of Default
<b>QIS</b>	Quantitative Impact Study
<b>RWA</b>	Risk-weighted Assets
<b>SA</b>	Standardized Approach
<b>SSM</b>	Single Supervisory Mechanism
<b>TRIM</b>	Targeted Review of Internal Models

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## EXECUTIVE SUMMARY

To reduce variation in credit risk-weighted assets, the Basel Committee on Banking Supervision (BCBS, 2016) proposed a set of restrictions on the application of the IRB approaches to measuring risk-weighted assets in March 2016. The three main elements of the proposal are: i) the removal of the option to use the IRB approaches for certain asset classes, ii) the adoption of 'input floors' to risk model parameters for certain exposures, and iii) the introduction of an aggregate 'output floor' to risk-weighted assets based on the standardized approach.

This briefing paper first reviews some evidence showing that the adoption of an IRB approach by banks has been associated with reductions in average reported risk weights. Lower average reported risk weights under the IRB approaches do not necessarily imply that banks have been using the IRB methodology to manipulate their risk weights downward. However, several economic studies show that especially lowly capitalized banks have reported low risk weights under the IRB approaches. This is suggestive evidence of risk weight manipulation by weak banks, as these banks benefit the most from downward risk weight adjustment.

Next, the briefing paper offers an evaluation of how a system of floors, as in the Basel Committee's proposal, is best used to reduce undue risk weight variation under the IRB approaches.

The main purpose of an aggregate output floor should be to prevent wholesale bank-level downward risk weight manipulation, giving rise to effective bank undercapitalization and a heightened probability of bank failure. This implies that an aggregate output floor should be calibrated in such a way that a bank is still strong enough to be turned around by corrective actions (which could include restrictions on dividend pay-outs and forced private recapitalizations), if the aggregate output floor is triggered. Successful application of an aggregate output floor should reduce the chance of bank failure to almost zero.

The implication will be that any losses resulting from the bank's risk taking strategies will ultimately be borne by its shareholders, and not by public authorities or bank debt holders. In this scenario, the bank has the incentive to base its risk taking decisions on an appropriate economic risk and return trade-off, even if the aggregate output floor itself is based on rather crude, relatively risk-insensitive risk weights as determined under the standardized approach.

In a system of floors, input floors can play a useful role alongside an aggregate output floor, if they are targeted to address the problem of potential mismeasurement of risk. Such mismeasurement can arise, if a bank cannot correctly estimate risk for a certain asset class, perhaps because of data limitations.

At this point, it is difficult to say how the Basel Committee proposal of a system of floors will affect the average level of bank capitalization. Surely, however, a system of floors should increase capitalization at the weakest banks that currently face the strongest incentives to manipulate down their risk-weighted assets. The experience gained with the current aggregate floor, which is based on the Basel I methodology, suggests that the impact of a newly introduced aggregate floor on the capitalization of especially the weakest banks can be substantial.

## 1. INTRODUCTION

In 1988, the Basel Committee on Banking Supervision (BCBS) concluded the Basel I Accord, which introduced a risk-based capital requirement stipulating that the ratio of a bank's regulatory capital to the sum of its risk-weighted assets could be no less than 8%. Fixed risk weights were specified for broad categories of assets, such as sovereign debt, mortgages, and corporate exposures that received risk weights of 0, 0.5, and 1, respectively. This system introduced some, but rather limited sensitivity of the capital charges for different exposures to underlying risks.

The Basel II Accord of 2006 aimed to make risk weights more risk sensitive. In addition to a standardized approach to setting risk weights, banks were provided with the option to apply Internal Ratings Based (IRB) approaches to setting risk weights on the basis of the bank's own assessments of credit risk parameters. In particular, a Foundation Internal Ratings Based (FIRB) approach allows a bank to base the risk weight on its own assessment of the probability of default (PD), while the Advanced Internal Ratings Based (AIRB) approach in addition allows a bank to base the risk weight on its own estimates of the expected loss given default (LGD), the exposure at default (EAD), and the instrument's maturity (M).<sup>1</sup> Under the IRB approaches values of the various risk parameters (PD, LGD, EAD, and M) are plugged into formulae provided by the regulator so as to calculate an instrument's risk weight and hence capital charge (with higher risk parameters giving rise to higher risk weights and capital charges).

Banks' internal risk models are highly complex. In practice, this has given rise to considerable variation in estimated risk weights across banks for similar or even the same credit exposures. Different estimated risk weights may result from differences in supervisory guidance or from different modelling practices at the level of the bank. Bank-level variation in calculated risk weights to some extent reflects mismeasurement, as there is some unavoidable arbitrariness in selecting and estimating risk models. Variation in risk weights, however, potentially also reflects efforts by banks to manipulate their estimated risk parameters downward with a view to lowering their regulatory capital requirements.

To reduce variation in credit risk-weighted assets, the Basel Committee (2016) proposed a set of restrictions on the application of the IRB approaches to measuring risk-weighted assets in March 2016. The three main elements of the proposal are: i) the removal of the option to use the IRB approaches for certain asset classes, ii) the adoption of 'input floors' to risk model parameters for certain exposures, and iii) the introduction of an aggregate 'output floor' to risk-weighted assets based on the standardized approach.

This briefing paper evaluates the Basel Committee's proposal to limit credit risk weight variation through the imposition of a system of input and output floors. The paper is organized into two main parts. Section 2 first reviews the available evidence on how the introduction of the IRB approaches of Basel II has affected average risk weight levels and their dispersion. Subsequently, section 3 assesses the Basel Committee's recent proposal as a means to address the shortcomings of the current IRB approaches to risk weight calculation.

Section 2 in particular discusses several studies finding that the introduction of the IRB approaches has been associated with reductions in average reported risk weights. Also, there is evidence of substantive variation of risk weights for the same or similar assets among banks that apply the IRB approaches. Lower average reported risk weights under the IRB approaches do not necessarily imply that banks have been using the IRB methodology to manipulate their risk weights downward. However, several economic studies show that especially lowly capitalized banks have reported low risk weights under the IRB approaches. This is suggestive evidence of risk weight manipulation by weak banks, as these banks benefit the most from downward risk weight adjustment.

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<sup>1</sup> In the FIRB approach, values for LGD, EAD and M are provided by the regulator rather than estimated by the bank.  
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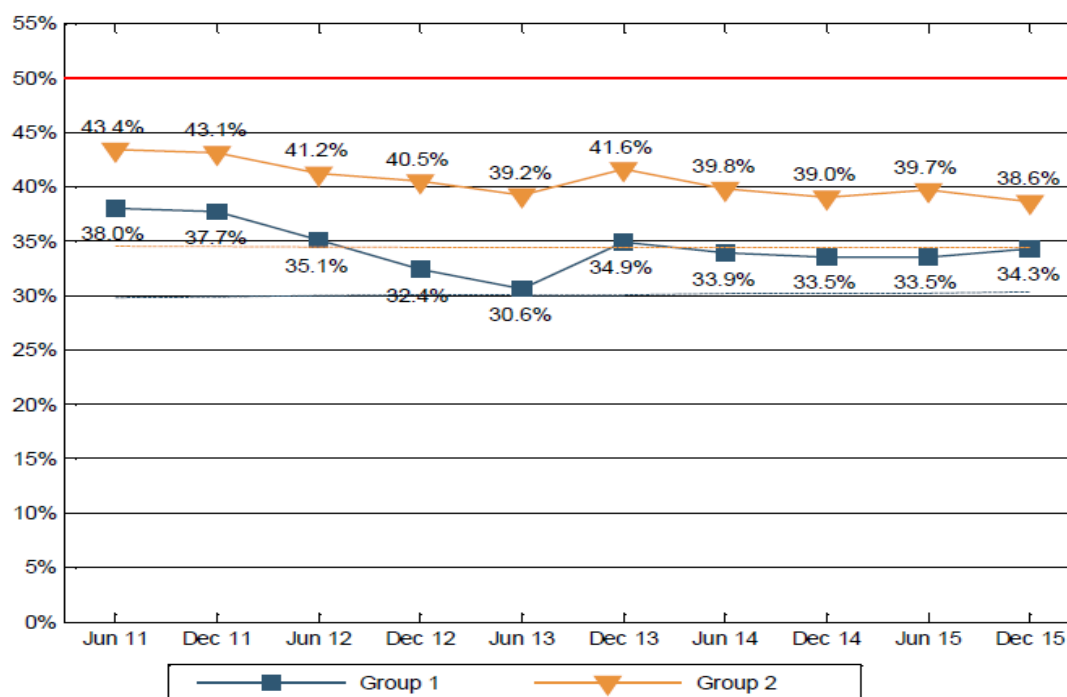
Section 3 addresses the issue of what are the proper roles of input and output floors in a system of floors. In addition, the section reviews reactions of main banking industry groups to the Basel Committee's proposal for an aggregate output floor. Finally, the section discusses the potential impact of the proposal on bank capitalization. Section 4 offers some conclusions.



## 2. THE IMPACT OF THE IRB APPROACHES ON THE LEVEL AND DISPERSION OF RISK WEIGHTS

In recent years European banks have reported trends of increasing regulatory capital and declining average risk weights. The European Banking Authority (EBA, 2016, p. 16) in particular reports that the group of about 45 largest EU banks increased their average Common Equity Tier 1 (CET1) ratio (defined as CET1 capital relative to total risk-weighted assets) from just over 10% in June 2011 to around 13% in December 2015. Higher CET1 ratios in the EU came about through a combination of higher CET1 capital and lower risk-weighted assets. Lower risk-weighted assets in turn were partly achieved by lower average risk weights: for the group of the largest banks, the average risk weight fell from 38.0% in June 2011 to 34.3% in December 2015 (see Figure 1).

**Figure 1:** Relation of risk-weighted assets to exposure for large EU banks



Notes: Group 1 banks are banks with Tier 1 capital in excess of EUR 3 billion and that are internationally active. All other banks are Group 2 banks. The sample includes 45 Group 1 banks and 182 Group 2 banks. Source is EBA (2016, p. 28)

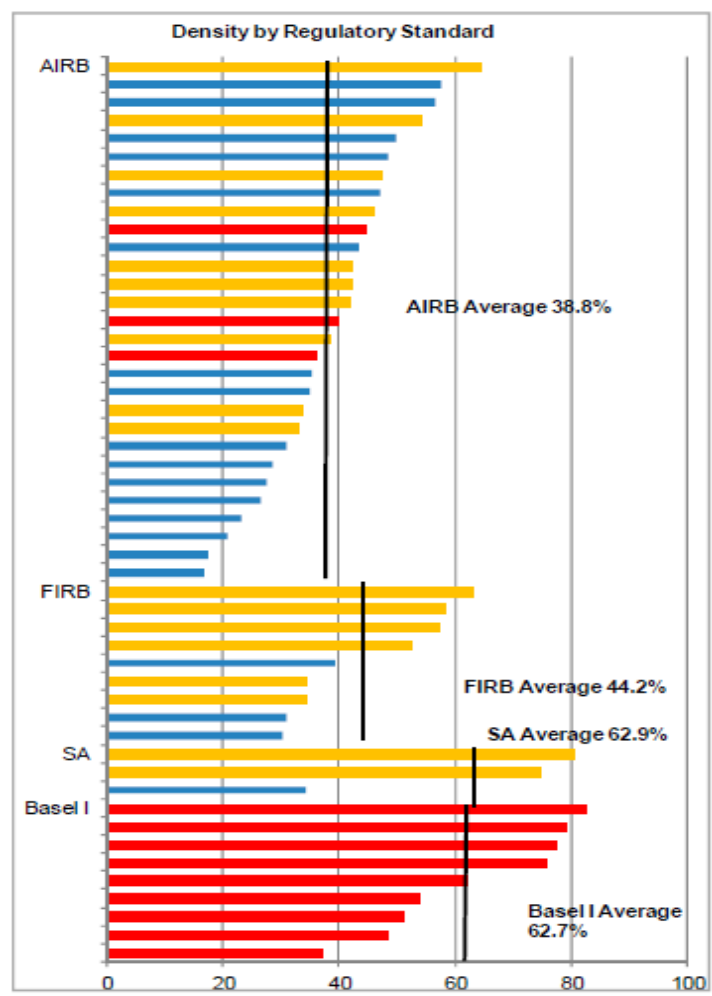
Higher capital ratios and lower average risk weights can in principle be engineered by a less conservative application of the IRB approaches to risk weight determination. Evidence reported in subsection 2.1 suggests that the adoption of IRB approaches by a bank is generally followed by a decline in average risk weights. The IRB approaches are also found to provide banks with considerable discretion in their risk weight calculations, as indicated by considerable dispersion across banks in calculated risk weights for similar assets (see subsection 2.2). Furthermore, several studies conclude that banks use their discretion implicit in the IRB approaches to manipulate down risk weights (subsection 2.3)

### 2.1 The IRB approaches and the level of risk weights

Leslé and Avramova (2012) provide cross-bank evidence of the relationship between the regulatory approach that is used to calculate risk weights and the reported average risk weight for an international sample of 50 systemically important institutions using data for 2011. The average risk weight, or Risk-Weighted Assets (RWA) density, is calculated as the ratio of risk-weighted assets to total assets.

As indicated in Figure 2, the banks in this study are located in Asia (indicated in yellow), in Europe (in blue), or in the US (in red). Banks in Asia and Europe are shown to follow one of the Basel II approaches (i.e., the Standardized Approach (SA), or one of the IRB approaches), while US banks use either the Basel I approach or one of the Basel II approaches. The figure shows that banks using the Basel I methodology reported an average RWA density of 62.7%, slightly less than the average RWA density of 62.9% under the standardized approach of Basel II. Average RWA densities for banks implementing the AIRB and FIRB approaches are considerably less at 38.8% and 44.2%, respectively. Overall, these data show a negative relationship between usage of one of the IRB approaches and reported average risk weights.

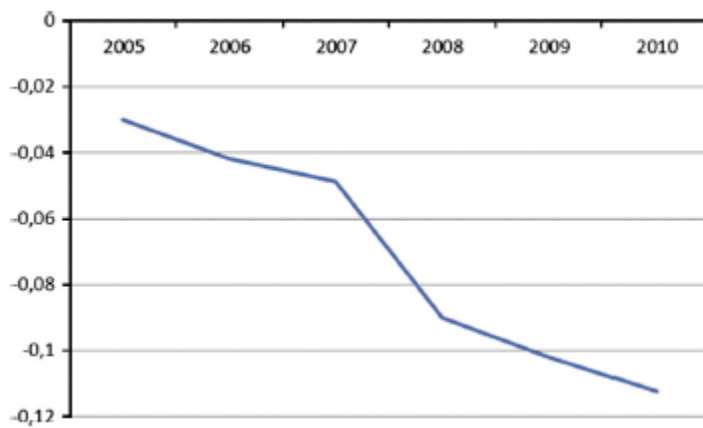
**Figure 2:** Risk-weighted assets over total assets by regulatory standard in percent, 2011



Notes: The sample consists of 50 systemically important banks in 19 countries. Legend: Asia—yellow, Europe—blue, North America—red. Source is Leslé and Avramova (2012, p. 15)

Mariathan and Merrouche (2014) provide evidence of the impact of the adoption of an IRB approach on reported average risk weights over time for a sample of 115 banks from 21 OECD countries. Specifically, these authors compute the difference of the average risk weight of banks that adopted an IRB approach at some point during 2007-2010 and of banks that remained under a non-IRB, standard approach for the 21 countries in the sample over the period 2005-2010. Figure 3 show that banks that at some point adopted an IRB approach reported lower average risk weights throughout the 2005-2010 period. Moreover, the average risk weight of banks that adopted an IRB approach relative to non-adopters declined substantially during 2007-2008, as many banks were implementing the IRB approach. These data suggest that IRB adoption leads a bank to report subsequently lower average risk weights.

**Figure 3:** Average difference of risk weights between banks adopting and not adopting IRB approaches

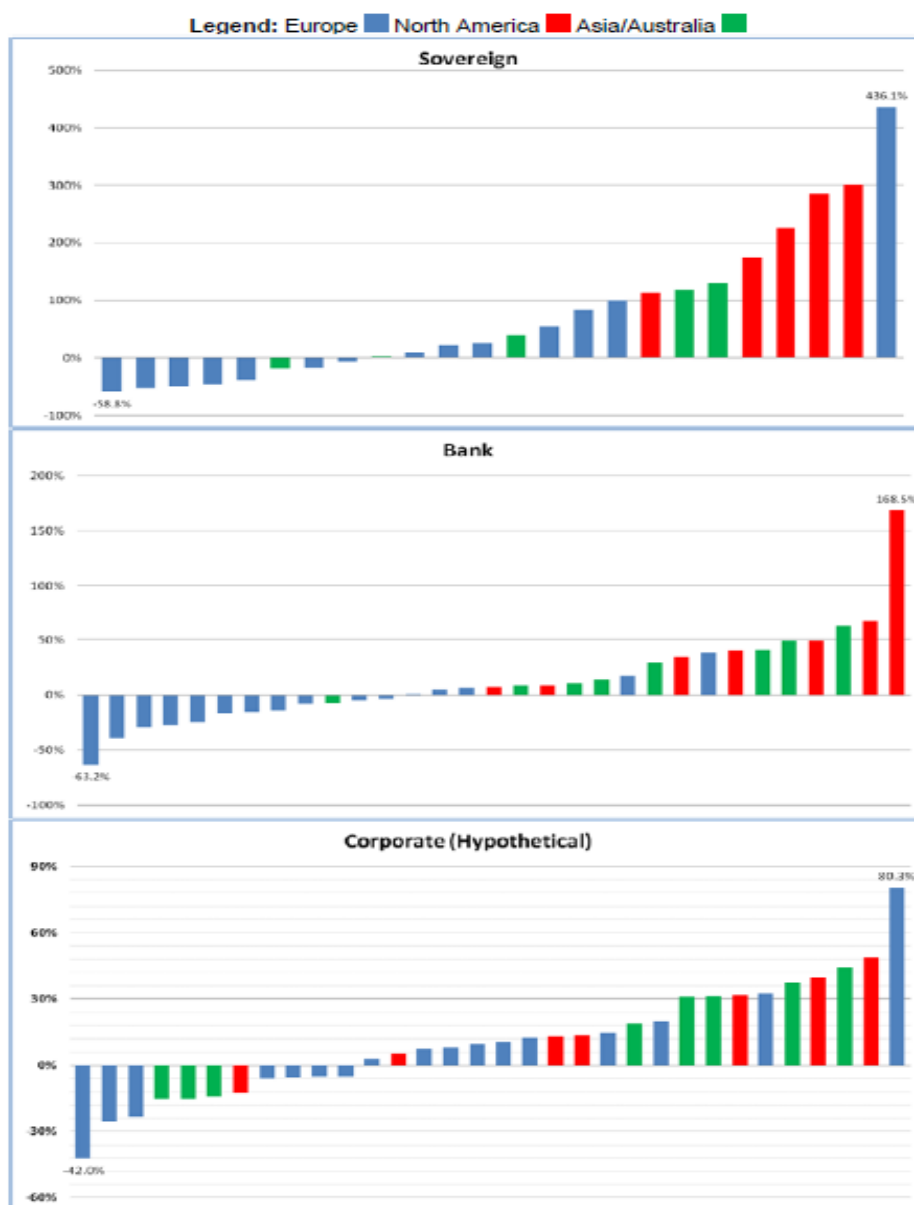


Notes: On the vertical axis is the average difference in the ratio of risk-weighted assets to total assets between banks that adopted an IRB approach during the period 2005-2010 and banks that used a non-IRB, standard approach throughout this period. This difference is first computed per country, and then averaged over the countries in the sample. Data are for 115 banks in 21 OECD countries. Source is Mariathan and Merrouche (2014, p. 306)

## 2.2 The IRB approaches and the dispersion of risk weights

Under the IRB approaches, banks have considerable discretion to estimate risk parameters, potentially leading to interbank dispersion in implied estimated risk weights for the same or similar assets. The Basel Committee (2013a) provides evidence on the cross-bank dispersion of estimated risk parameters for a set of sovereign, bank and corporate credits as reported by a group of 57 large, internationally active banks and 45 non-internationally active banks in 15 jurisdictions. For each bank, the average deviation of its implied risk weights from mean figures was computed separately for the sets of its sovereign, bank and corporate exposures. The results, reproduced as Figure 4, show considerable variation in implied risk weights around mean figures among the examined banks, especially for the sovereign and bank portfolios. In the case of bank exposures, for instance, an unnamed European bank shows an implied portfolio risk weight that is 63.2% lower than the industry average, while a US bank has an implied risk weight that is 168.5% higher than the average. For all three exposure categories, the banks with the lowest implied risk weights are seen to be European.

**Figure 4:** Risk weights based on reported risk parameters relative to industry medians



Notes: Mean percentage difference of risk weights implied by reported risk parameters from cross-bank median risk weight as benchmark. Each bar represents one bank with regions indicated by colours. The dataset covers 57 large, internationally active banking organizations and 45 non-internationally active banking organizations in 15 jurisdictions. Based on data for June 2012. Source is BCBS (2013a, p. 35)

### 2.3 Are risk weights under the IRB approaches manipulated downward?

Lower average risk weights reported by banks using an IRB approach as evident from Figure 2 do not necessarily imply that banks are using the IRB approaches to manipulate risk weights downward. Alternatively, regulators may have structured the IRB approaches so as to yield relatively low risk weights on average. Also, guidance provided by supervisors on how to apply the IRB approaches may on average produce lower risk weights.

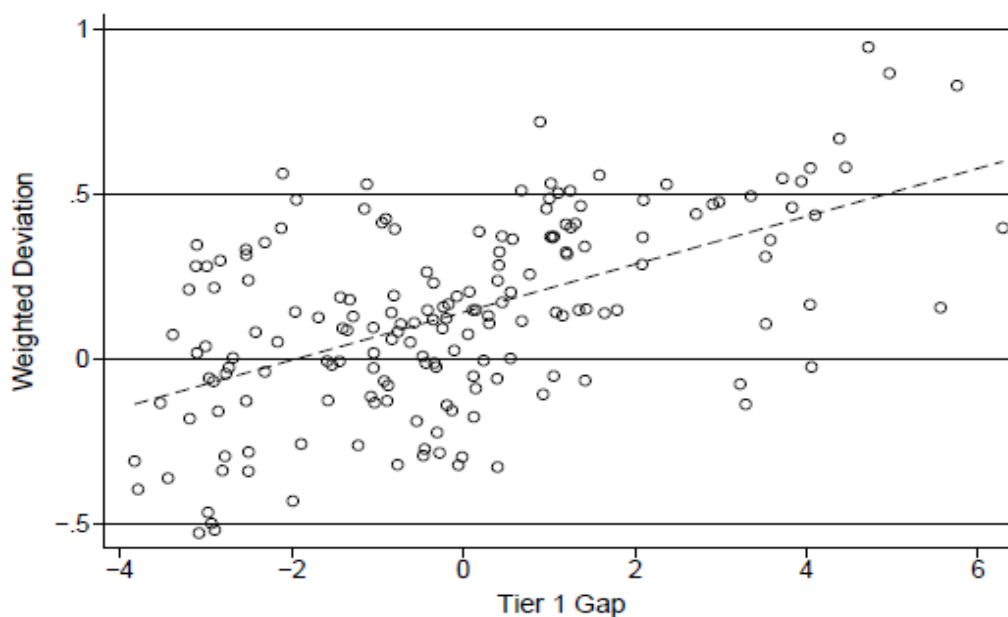
Mariathasan and Merrouche (2014), however, find that variation in banks' reported average risk weights at least in part reflect 'strategic risk-modelling' on the part of the banks. Consistent with a manipulation approach, these authors find that the decline in reported average risk weights after IRB approach adoption is more pronounced for weakly capitalized banks that benefit the most from

downward risk weight adjustment. Furthermore, banks report relatively low average risk weights, if they are located in countries with weak legal frameworks for bank supervision consistent with more ample opportunities for risk weight manipulation.

Plosser and Santos (2014) find similar evidence of risk weight manipulation by examining the risk metrics, including the probability of default (PD), reported by US banks to the Federal Reserve Bank as part of the Shared National Credit program. Under this program, the Fed collects risk estimates of different banks that use an IRB approach for the same syndicated loans. These data make it possible to compare the probability of default reported by different banks for the same credits at the same point in time.

Using these data, Plosser and Santos (2014) constructed a bank-level average deviation of the bank's PD estimates for its portfolio of syndicated loans from the industry-average PDs. Figure 5 plots the bank-level average PD deviation against the bank's so-called Tier 1 Gap as a proxy for its Tier 1 capital ratio.<sup>2</sup> The figure displays a positive relationship between these two variables. This is evidence consistent with active PD (and implied risk weight) manipulation on the part of the banks, as it suggests that weak banks with low Tier 1 ratios report low probabilities of default (giving rise to low estimated risk weights) in order to improve their regulatory Tier 1 capital ratio.

**Figure 5:** Weighted average PD deviations and the Tier 1 Gap



Notes: This figure plots the average deviation from median PD by bank quarter versus the Tier 1 Gap. The average is weighted by the share of utilized funds for that bank-quarter. Tier 1 Gap is the estimated residual from a regression of a bank's Tier 1 capital ratio on size, leverage, profitability and time fixed effects. The analysis is based on a sample of syndicated loan exposures of US banks between 2010Q2 and 2013Q3. Source is Plosser and Santos (2014, p. 26)

<sup>2</sup> The Tier 1 Gap is the residual from a regression of a bank's actual Tier 1 ratio on size, leverage, profitability and time fixed effects. The Tier 1 Gap rather than the actual Tier 1 capital ratio is represented to maintain confidentiality.

### 3. THE BASEL COMMITTEE PROPOSAL OF FLOORS

The Basel Committee (2016) proposes to restrict the potential for the IRB approaches to drive down risk-weighted assets by a combination of ‘input floors’ to risk parameters for selected asset classes, and possibly an aggregate ‘output floor’ to overall risk-weighted assets based on the alternative standardized approach. First, this section summarizes the main features of this proposal of a ‘system of floors’ (in subsection 3.1). Subsequently, it discusses i) the shortcomings of the current IRB approaches that each type of floor can potentially address (in subsection 3.2), ii) reactions from two main banking industry groups to the proposal for an aggregate output floor (in subsection 3.3), and iii) some sparse available indications on how floors could affect bank capitalization (in subsection 3.4).

#### 3.1 The main features of Basel Committee proposal

The Basel Committee proposal removes the option to use the IRB approach for certain asset classes and it imposes a combination of input and output floors. The three main features of the proposal can be summarized as follows (see BCSC, 2016, pp. 1-2):

- The removal of the option to use the IRB approaches for asset classes where model parameters cannot be estimated sufficiently reliably for regulatory capital purposes. These are taken to include banks, large corporates and equities.
- The adoption of ‘input floors’ to risk model parameter estimates for certain exposures to ensure a minimum level of conservatism where the IRB approaches remain available. Specifically, input floors would apply to PD and LGD estimates for corporate and retail exposures.<sup>3</sup>
- The introduction of an aggregate ‘output floor’ to overall risk-weighted assets. Such a floor could be calibrated to lie in the 60%-90% range of aggregate risk-weighted assets as based on the standardized approach.<sup>4</sup>

#### 3.2 The roles of input and output floors in a system of floors

In a consultative document, the Basel Committee (2014) makes the case for an aggregate output floor undergirding aggregate risk-weighted assets. The current proposal, however, is for a combination of input and output floors. This raises the question why we need both types of floors together and what the respective roles of the two types of floors should be. To address this, note that the application of the IRB approaches potentially leads to two distinct problems with estimated risk weights: they can be manipulated downward, and they can be measured with error. To resolve these two problems, we also need two instruments, which can be the two types of floors. The proper assignment of the two instruments is then to deploy the aggregate output floor to primarily address the problem of risk weight manipulation, which leaves input floors as an additional instrument to limit the impact of risk weight mismeasurement.

The main purpose of an aggregate output floor should be to prevent wholesale bank-level downward risk weight manipulation, giving rise to effective bank undercapitalization and a heightened probability of bank failure. This implies that an aggregate output floor should be calibrated in such a way that a bank is still strong enough to be turned around by corrective actions (which could include

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<sup>3</sup> In the IRB approach to credit risk, the probabilities of default (PDs) for the highest-rated corporate and bank exposures are already subject to a floor of 3 basis points. In the case of retail exposures secured by residential properties, the loss given default is subject to a floor of 10% (BCBS, 2013b, p. 17)

<sup>4</sup> Banks using the IRB approaches for credit risk are currently subject to a capital floor that is tied to the Basel I methodology (BCBS, 2013b, p.17)

restrictions on dividend pay-outs and forced private recapitalizations), if the aggregate output floor is triggered.<sup>5</sup> Successful application of an aggregate output floor should reduce the chance of bank failure to almost zero.

The implication will be that any losses resulting from the bank's risk taking strategies will ultimately be borne by its shareholders, and not by public authorities or bank debt holders. In this scenario, the bank has the incentive to base its risk taking decisions on an economic risk and return trade-off. Somewhat paradoxically, an aggregate output floor may restore an appropriate risk sensitivity where bank portfolio decisions are based on economic risk and return, even if the aggregate output floor itself is based on rather crude, relatively risk-insensitive risk weights as determined under the standardized approach.<sup>6</sup>

Relative to an aggregate output floor, input floors are not well-suited to prevent wholesale risk weight manipulation and hence to safeguard financial stability. One reason is that input floors that are applied to only certain exposures leave open the option to manipulate risk weights applied to asset categories that are not subject to such floors, unless input floors are applied almost universally and are calibrated at relatively elevated levels. In this latter case, however, a set of input floors becomes almost equivalent to an aggregate output floor and fails to have any additional value.

This raises the question of whether there is any reason for input floors to exist alongside an aggregate output floor. In a system of floors, input floors may still have a useful role to play to the extent that they prevent mismeasurement of risk stemming from, say, limited experience of a bank with measuring risk for a certain asset class, perhaps because of limited data availability. To serve as a valid backstop to limit mismeasurement, however, input floors should be calibrated at relatively low levels to allow for the non-negligible variation in the actual riskiness of asset portfolios across banks.

In summary, a system of floors should include a robustly calibrated aggregate floor that acts as an effective defence against bank fragility. In addition, a set of input floors calibrated at relatively low levels could serve as safeguards against risk mismeasurement in the case selected asset classes where mismeasurement is a real concern.

### **3.3 Reactions from banking industry groups to the proposal for an output floor**

The adoption of an aggregate output floor is the best defence against substantial downward manipulation of risk weights by banks under the IRB approaches. Hence, it is interesting to consider the reactions of main banking industry groups to this particular part of the proposal. This subsection reviews the pertinent reactions of the European Banking Federation (EBF), that represents European banks, and of the Institute of International Finance (IIF), that represents major banks globally.

The EBF (2016, p. 2) comments on the proposal for an aggregate output floor in the following way:

“The BCBS should reconsider the introduction of output floors. They overlap with the leverage ratio, add complexity, hamper comparability and remove the right incentives for prudent risk management.”

A response to the EBF's criticism that an output floor overlaps with the leverage ratio can be that an output floor is a useful complement to the leverage ratio in the same way that risk-based capital

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<sup>5</sup> Basel III provides for mandatory restrictions on earnings distribution if a bank fails to meet the conservation buffer capital requirement. This restriction will be triggered at higher levels of effective capitalization if the aggregate output floor is a binding constraint on risk weight calculations.

<sup>6</sup> This reasoning is parallel to Blum (2008) who shows theoretically that a leverage ratio requirement may eliminate banks' incentives to manipulate down risk estimates when calculating a risk-based capital ratio. Note that an aggregate output floor cannot eliminate the distortion to bank capitalization choices provided by the deductibility of interest for income tax purposes and may affect the severity of this distortion. This distortion, however, is currently less important due to low bank funding costs.

regulation generally is a useful complement to a leverage ratio. While the EBF is right that an output floor adds complexity, it is not likely to hamper comparability. To the contrary, an output floor obviates the potential for large-scale risk weight manipulation by some banks and hence should make risk weight estimates more comparable across banks. Also, the EBF's claim that an aggregate output floor removes the right incentives for prudent risk management does not appear to be justified. As argued in subsection 3.2, an aggregate output floor that minimizes the risk of bank failure should lead a bank to internalize all the economic costs and benefits of its risk taking strategies, providing more appropriate incentives for prudent risk management.

The IIF's (2016, p. 17) assessment of an aggregate output floor is more positive:

“The industry does acknowledge the need to have a backstop measure to risk-based capital; however, great care should be taken in determining how such a backstop is calibrated, to ensure that banks' key strategic drivers and performance measures are not compromised in their sensitivity to the underlying risk.”

The IIF sensibly states that an aggregate backstop should be calibrated carefully. Ideally, as implied by the IIF assessment, risk weights should be fully risk sensitive. The main objective of calibrating an aggregate output floor, however, is to ensure that banks at all times remain sufficiently capitalized. This reduces the probability of bank failure to negligible proportions, which in turn provides banks with appropriate incentives to base their risk taking strategies on economically correct risk assessments. Thus, an aggregate output floor should not compromise sensitivity to underlying risk

### **3.4 The impact of the Basel Committee proposal of floors on bank capital**

At this point, it is difficult to know how large the impact of the Basel Committee proposal of floors on bank capitalization will be.<sup>7</sup> This impact will depend on all the details of the calibration which are as yet unknown (for instance, we do not know how the aggregate floor will be calibrated). No less important, the impact on bank capitalization will depend on the unknown behavioural responses of banks, as risk taking incentives are changed.

At any rate, the discussion of the impact of the Basel Committee proposal should not be limited to average bank capitalization levels. Far more important is its impact on the capitalization rates of lowly capitalized banks that are most likely to be overstating their present levels of capital through downward risk weight manipulation. The Basel Committee is currently conducting a Quantitative Impact Study (QIS) to shed some light on the likely effects of its proposals on bank capitalization. It remains to be seen to what extent the QIS takes into any behavioural responses on the part of banks, and whether the QIS will provide information on the expected effects on the overall distribution of bank capitalization.

One way to gain some insight into how a newly designed aggregate output floor may affect bank capitalization is to consider the experience gained with the current output floor based on the Basel I methodology.<sup>8</sup> The EBA (2013) provides evidence on the relevance of the Basel I floor for the determination of risk-weighted assets for a sample of 89 EU banks between December 2010 and December 2011. During this period, the contribution of the floor to total risk-weighted assets ranged between 4.0% and 4.4%, which is a non-negligible share, as seen in Figure 6. The EBA (2013, p. 16) reports that the floor was binding for one quarter of the banks in the sample, which implies that for the affected banks the floor contributed a substantially larger share of total risk-weighted assets. In

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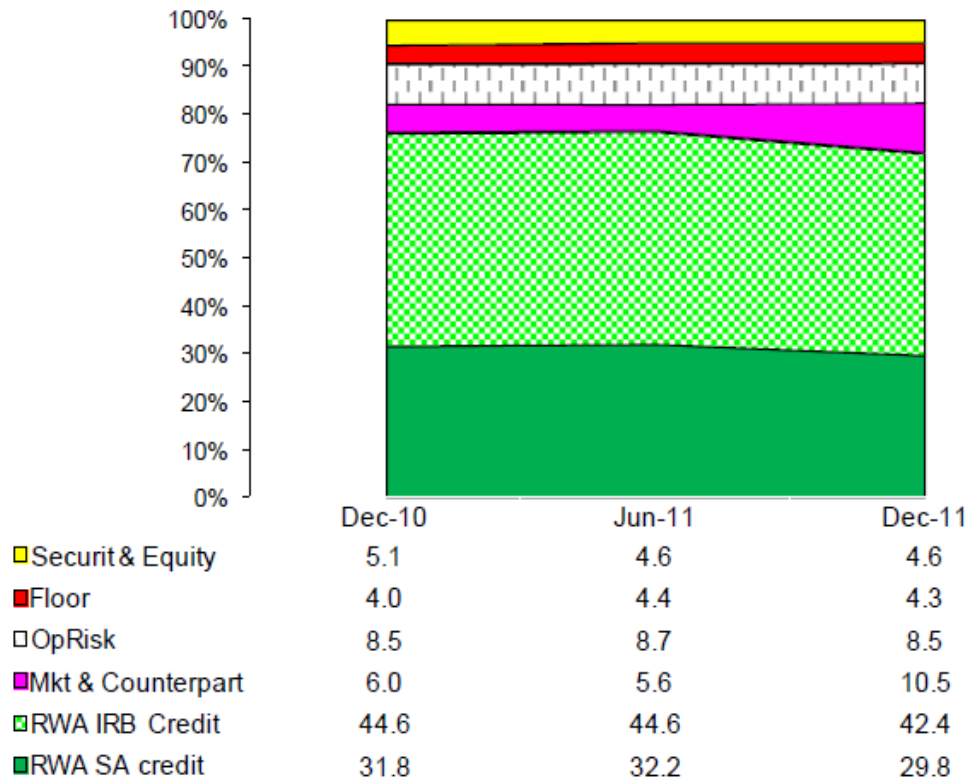
<sup>7</sup> Brooke et al. (2015) find that the appropriate level of bank capital for the UK banking system is at 10-14% of risk-weighted assets. This paper also summarizes a range of earlier studies on the topic of optimal bank capitalization.

<sup>8</sup> The introduction of the IRB approaches as part of Basel II was accompanied by the formulation of an aggregate output floor that was originally set at 95% of Basel I capital, and subsequently lowered in steps to 80% in 2009 when it was supposed to be removed. However, in that year the Basel Committee extended the application of the floor.



an extreme case, the floor contributed 70% of risk-weighted assets of a bank. This makes clear that the effect of an aggregate floor is primarily to prevent wholesale underreporting of total weighted assets (and hence overreporting of capitalization) in some specific instances rather than to increase the average level of reported capitalization.

**Figure 6:** Total risk-weighted assets composition of EU banks

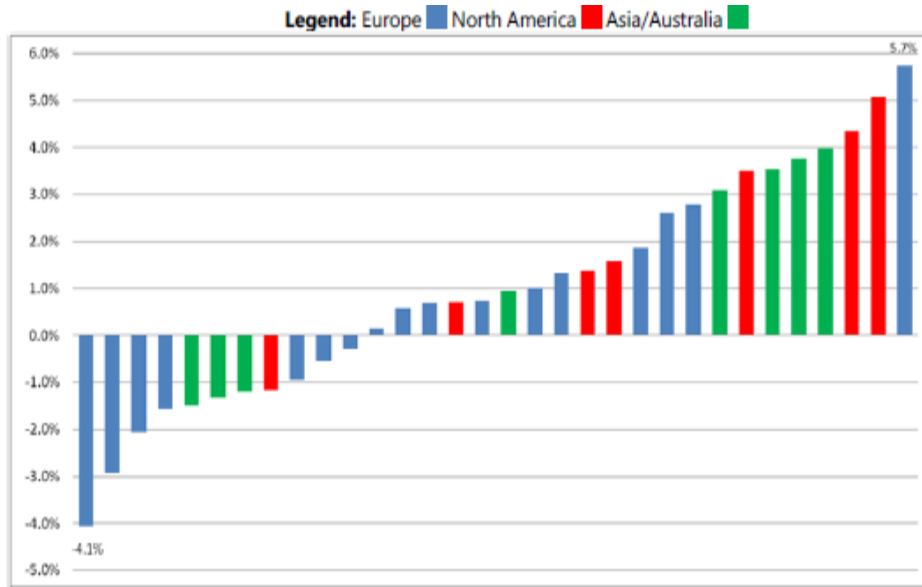


Notes: The sample consists of 89 EU banks. Source is EBA (2013, p. 16)

A further indication of how floors may affect the dispersion of bank capitalization can be gleaned from Basel Committee (2013a). This study conducts the exercise of measuring the impact on the capitalization of major banks, if the banks' reported risk weight deviations for sets of sovereign, bank and corporate assets from the bank-median are reduced to zero (with similar adjustments for other banking book assets). In this exercise, banks that report above-median risk weights will see risk weights adjusted downward (and their capitalization ratios adjusted upward), and vice versa. Figure 7 shows that the calculated capital ratio adjustments range from -4.1% to 5.7%, while the four banks with the most negative adjustments are all European. These data confirm that measures that reduce or eliminate cross-bank variation in estimated risk weights have potentially important implications for the capitalization rates of individual banks.<sup>9</sup>

<sup>9</sup> The Basel Committee proposal of floors will not produce equal risk weights across banks but rather potentially remove the lower tail of the risk weights distribution reported across banks. This implies that floors may produce some negative adjustments in bank capitalization comparable to those reported in Figure 7 without materially affecting banks that currently report risk weights substantially above the industry average.

**Figure 7:** Illustrative impact on capital ratios if bank-level risk weights are adjusted to the median



Notes: This figure display the change from 10% capital ratio if implied risk weights are adjusted to the median and applied to the entire banking book. The chart uses mean risk weight deviations for each bank, and non-zero exposures only. Each bar represents one bank. The dataset covers 57 large, internationally active banking organizations and 45 non-internationally active banking organizations in 15 jurisdictions. Based on data for June 2012. Source is BCBS (2013a, p. 38)

#### 4. CONCLUSIONS

The application of the IRB approaches under Basel II has given rise to considerable risk weight variation across banks. Also, there is evidence that the IRB approaches have enabled downward asset risk manipulation. The Basel Committee (2016) has proposed a system of input and output floors to reduce variation in credit risk-weighted assets. In such a system, the purpose of an aggregate output floor should be to prevent wholesale bank-level downward risk weight manipulation, giving rise to effective bank undercapitalization and a heightened probability of bank failure. Input floors can play a useful role alongside an aggregate output floor, if they are targeted to address the problem of potential mismeasurement of risk.

While the Basel Committee proposals are likely to require banks to raise their capital on average, the main impact will be for those banks that currently are lowly capitalized, as these banks are likely to be most active in downward risk weight manipulation. Evidence from the Basel Committee (2013a) study suggests that some of the banks that will be most affected by the proposals are likely to be European.

The relatively large capital adjustments that are expected for some European banks suggest that in some European countries supervision of the application of IRB models has been inadequate. The data in the Basel Committee (2013a) study are for 2012, and hence predate the start of the Single Supervisory Mechanism (SSM) in 2014 with the European Central Bank (ECB) as the main supervisor.

If the Basel Committee proposals are enacted, discretion on the part of the banks and also the supervisors regarding IRB modelling will be reduced. This will also restrict the potential for inadequate supervision of the application of IRB models. All the same, it is important for the ECB to continue to properly supervise IRB models. In this regard, it is to be commended that ECB has initiated work on a proposal for a targeted review of internal models (TRIM), which will involve on-site investigations of selected credit and other risk models over the 2017-2018 period (see ECB, 2016, p. 35). At present, too little is known about this effort to be able to assess how effective it will be.

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QA-01-16-961-EN-C (paper)  
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PE 587.365

ISBN 978-92-846-0198-1 (paper)

ISBN 978-92-846-0197-4 (pdf)

doi:10.2861/69998 (paper)

doi:10.2861/83904 (pdf)