



# Assessing the recent constraints set by local European banking regulators on the RWA's of IRB models for Residential Mortgages loans

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## **Abbreviations list**

BCBS: Basel Committee on Banking supervision

CRD: Capital Requirement Directive

CRR: Capital Requirement Regulation

DSC: Debt Service Coverage

EAD: Exposure At Default

EBA: European Banking Authority

EBF: European Banking Federation

EL: Expected Loss

ESRB: European Systemic Risk Board

FSA: Financial Stability Authority

IRB: Internal Ratings-Based

LGD: Loss Given Default

LTV: Loan To Value

NBB: National Bank of Belgium

PD: Probability of Default

ROE: Return On Equity

RW: Risk-Weight

RWA: Risk-Weighted Assets

SA: Standardized Approach

UL: Unexpected Loss

# 1. Introduction

Since 2013 and the implementation of the latest Basel regulation in the European legal framework, some local regulators have introduced macro prudential measures targeting Risk-weighted Assets (RWA) 's of IRB models for residential mortgages loans. This Master thesis aims at describing the measures taken by the regulators and their potential repercussion. In order to give a comprehensive environment in which those measures are taking place, it will also review how RWA are calculated for residential mortgages loans exposures.

The residential real estate market is an important sector of the economy. Not only real estate represents a major part of household's wealth and is their major source of collateral, but also the mortgage loans constitute a big part of bank balance sheets. Furthermore, decreases in house prices have an impact on the length and magnitude of cyclical downturn of the economy through reduction of private consumption. Indeed the importance of real estate for the household's wealth means that falling house prices will reduce their ability to borrow. This is reinforced by the fact that the volatility of house prices is low and reduction in household's wealth is therefore likely to last<sup>1</sup>. Due to its importance, regulators tightly follow the housing market.

For banks, experiences of defaults are a part of the credit business. In a portfolio of obligors, some of them will likely not to pay their debt. Those defaults may cause losses of (part of) the principal and/or interest. What will vary between years is the amplitude of the losses incurred by the credit institution.

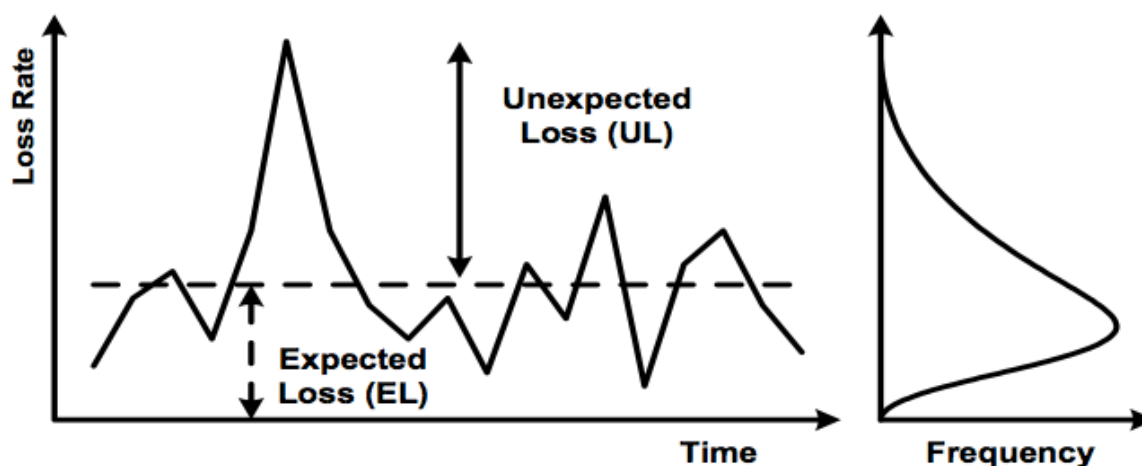
It can be possible to approximate the average losses sustained by credit institution every year. This approximation is called the Expected Loss (EL). It can be defined as the loss the bank can reasonably expect to experience in a year. EL is part of the business cost of credit institutions. Therefore interest rate charged to the borrower should cover it.

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<sup>1</sup> A. KOSE and M. TERRONES, *Collapse and revival : understanding recessions and recoveries*, International monetary fund, 2015, p.118.

In some years, banks bear losses that can go beyond the Expected Loss. The loss higher than the EL is called the Unexpected Loss (UL). The credit institution capital must play the role of a loss-absorber considering potential adverse variations of credit losses.

**Figure 1 Distribution of losses through time**



Source: BCBS explanatory notes on the Basel ii IRB risk weight function, July 2005

The capital requirement is the amount of capital a bank has to hold in order to fulfil its regulatory obligations. Capital ratios are a key indicator of bank's solvency and resilience. The numerator is the amount of capital that the banks hold and the RWA are the denominator of the formula.

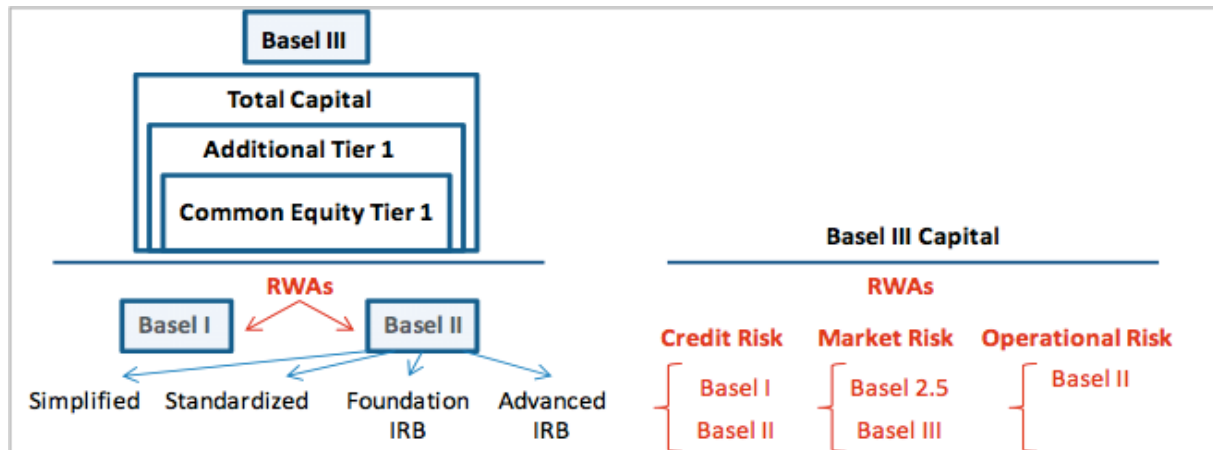
RWA have three important roles outside of the capital ratio formula:

- They provide a common measure for a bank's risk;
- They ensure that capital allocated to assets is commensurate with risk; and
- They highlights where potential asset bubbles are rising<sup>2</sup>.

RWA have been introduced since the Basel i regulation and have known modifications in the subsequent regulations.

<sup>2</sup> V. LE LESLÉ and S. AVROMOVA, "Revisiting Risk-Weighted Assets: Why RWAs differ Across countries and what can be done about it?", *IMF Working paper*, WP/12/90, p.5

**Figure 2: Capital ratios Under Basel iii use several versions of the Basel regime**



Source: BCBS

The objective of the capital requirement is to compute the appropriate level of capital in order to prevent an UL from making the bank insolvent. In order to achieve this objective RWA are therefore key. The Standardised Approach (SA) and the Internal Ratings Based (IRB) approach are the two alternative ways authorized to obtain the Risk Weight of an exposure under the European Union's regulation<sup>3</sup>.

This thesis will be organised as follow. The second section will be concentrated on the standardized approach. It will describe the principles and sources of this approach and will study its evolution afterwards. The third section will be focused on the IRB approach. It will give an overview of the principles and sources, the method used to approximate its risk parameters and the usual result obtained with this second approach. The fourth section will present the measures of local regulators and assess their potential impact.

<sup>3</sup> Basel Committee on Banking Supervision: "An explanatory note on the Basel II IRB risk weight functions", July 2005 available at: <http://www.bis.org/bcbs/irbriskweight.pdf>.

## **2. Risk weight for residential real estates secured by mortgages exposures in the standardised approach and their evolution**

This section will begin by studying the current SA and will then assess the proposition submitted by the Basel Committee regarding its evolution.

### 2.1. Principles and source of Standardised Assets and Risk Weight for retail mortgages

The standardised approach is the “per default” method to calculate risk weight. In the European regulation, the Basel iii prescription has been transposed into the Capital Requirement Directive iv<sup>4</sup> (CRD iv) and the Capital Requirement Regulation<sup>5</sup> (CRR). The following section will study the articles of the regulation concerning S A. The second Chapter of the second title on capital requirements for credit risk of the CRR regulates the standardized approach. The article 107 of the CRR provides that “*Institutions shall apply either the Standardised Approach (...) or, if permitted by the competent authorities (...), the Internal Ratings Based Approach (...) to calculate their risk-weighted exposures amounts (...)*”. Institutions mainly use the SA when they do not have enough information to comply with the requirements of the IRB approach, or when it is too costly to develop the IRB approach. This situation can be found in countries that have experienced large household defaults.

The SA was developed under de Basel ii regulation and is an evolution of the Basel i method. Compared to Basel i, the SA is more risk sensitive. Indeed, when available it uses external ratings to assess the riskiness of asset for most of its exposure class. The following table shows the RW under the SA by exposure class and rating.

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<sup>4</sup> Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms

<sup>5</sup> Regulation n° 575/2013 of the Parliament and the Council of 23 June 2013 on prudential requirements for credit institutions and investment firms.

**Table 1: Credit risk weight by exposure class under the Standardised approach**

| Credit assessment   | Risk Weights         |             |             |                                  |                      |
|---------------------|----------------------|-------------|-------------|----------------------------------|----------------------|
|                     | Claims on sovereigns | Banks       |             |                                  | Claims on corporates |
|                     |                      | Option 1    | Option 2    | Short term claims under Option 2 |                      |
| <b>AAA+ to AA-</b>  | <b>0%</b>            | <b>20%</b>  | <b>20%</b>  | <b>20%</b>                       | <b>20%</b>           |
| <b>A+ to A-</b>     | <b>20%</b>           | <b>50%</b>  | <b>50%</b>  | <b>20%</b>                       | <b>50%</b>           |
| <b>BBB+ to BBB-</b> | <b>50%</b>           | <b>100%</b> | <b>50%</b>  | <b>20%</b>                       | <b>100%</b>          |
| <b>BB+ to BB-</b>   | <b>100%</b>          | <b>100%</b> | <b>100%</b> | <b>50%</b>                       | <b>100%</b>          |
| <b>B+ to B-</b>     | <b>100%</b>          | <b>100%</b> | <b>100%</b> | <b>50%</b>                       | <b>150%</b>          |
| <b>Below B-</b>     | <b>150%</b>          | <b>150%</b> | <b>150%</b> | <b>150%</b>                      | <b>150%</b>          |
| <b>Unrated</b>      | <b>100%</b>          | <b>100%</b> | <b>50%</b>  | <b>20%</b>                       | <b>100%</b>          |

Source: Basel committee June 2006 International Convergence of Capital Measurement and Capital Standards

Article 112 CRR (i) assigns a specific exposure class for “*exposures secured by mortgages on immovable property*”. However, since individuals are not externally rated, exposures secured by residential mortgages do not share the risk sensitiveness of other classes of exposures. The Article 125 CRR stipulates that these exposures “*shall be assigned a risk weight of 35%*”. The competent authorities will assess the appropriateness of this risk weight, at least every year, based on 1) the loss experience and 2) forward-looking development in the immovable property market<sup>6</sup>.

If the exposure is in default, the article 127 CRR prescribes a risk weight of 100%. According to article 178 CRR, an obligor is in default 1) when the institution considers he will unlikely pay his credit obligation or 2) when the obligor is past due more than 90 days on its credit obligation.

Credit institutions that apply the current SA shall therefore assign a risk weight of 35% to their residential exposures secured by mortgages when the loan is performing and a 100% risk weight when these exposures are in default.

<sup>6</sup> Art. 124, 2 of the Regulation (EU) No 575/2013

## 2.2. Recent evolutions concerning SA dedicated to retail mortgages

### 2.2.1. First consultative document on the review and update of the SA from the BCBS

In 2015 the Basel Committee on Banking Supervision (BCBS) has released a first consultative document on the review and update of the SA<sup>7</sup>. It is due to weaknesses in this approach that this consultative document has been issued. The main weaknesses targeted by the Basel Committee were the following:

- The over reliance on external ratings;
- The lack of granularity and risk sensitivity;
- An out of date calibration;
- The lack of comparability and misalignment of treatment with exposures risk weighted under the IRB approach;
- An excessive complexity and a lack of clarity with the standards.

In regards to retail mortgages exposures, the reliance on external ratings is irrelevant. Nonetheless, it is important to point out that external ratings which were at the basis of the evolution to more risk sensitiveness from Basel i to Basel ii is now being abandoned. The reasons for this reversal are that: 1) an over reliance on external rating lead to lack of due diligence and poor risk management and 2) since not all corporate exposures are rated externally it is important to find a methodology that can be applied to every exposures according to the BCBS. The second weakness is more relevant to retail mortgages exposures, as the current approach provides a flat 35% risk weight without taking into account the specificities of the loan itself.

In order to achieve those objectives for residential real estate secured by mortgages exposures, the Basel Committee has proposed in its first consultative document a method with two risk factors. The two factors chosen by the committee were the Loan to Value (LTV) ratio and the Debt Service Coverage (DSC) ratio.

- The LTV ratio corresponds to the total amount of the loan divided by the value of the property;

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<sup>7</sup> Basel Committee on Banking Supervision: “revisions to the standardized approach for credit risk”, 27 march 2015, available at: <http://www.bis.org/bcbs/publ/d307.pdf>.

- The DSC is the ratio of the debt service payment relative to the borrower total income over a given period (monthly or yearly).

Given these two ratios the BCBS has proposed the following table that assigns risk weight.

**Table 2: Credit risk weight for retail mortgage exposure**

|                                       | LTV < 40% | 40% ≤ LTV < 60% | 60% ≤ LTV < 80% | 80% ≤ LTV < 90% | 90% ≤ LTV < 100% | LTV ≥ 100% |
|---------------------------------------|-----------|-----------------|-----------------|-----------------|------------------|------------|
| Loans to individuals with [DSC ≤ 35%] | 25%       | 30%             | 40%             | 50%             | 60%              | 80%        |
| Other loans                           | 30%       | 40%             | 50%             | 70%             | 80%              | 100%       |

Source: Basel Committee March 2015 Revision to the Standardised approach to credit risk first consultative document

#### 2.2.2. Second consultative document on the review and update of the SA from the BCBS

After the release of this first document, the actors of the industry were given the possibility to give their opinion on the document. The answers have raised various problems of measurement and comparability to the use of the DSC ratio<sup>8</sup>:

- Due to the large variation of regulation, like tax legislation, but also all the underwriting practice that could impact the DSC ratio between States, it is hard to find a common definition and threshold that could be applied in a standard approach;
- There could be an issue of legal right to reassess the affordability of borrowers on an ongoing basis;
- The value of the DSC ratio when the loan is granted cannot be clearly linked to the riskiness of this asset in the long term;
- Much of the risk that the DSC ratio can reveal can already be highlighted by the LTV ratio.

Following the consultation, the BCBS has dropped the DSC ratio and has kept the LTV as the main risk driver of the risk weight in the revised standardised approach. The committee has divided the residential real estate exposure class into exposure where repayment is materially

<sup>8</sup> “EBF Response to the BCBS consultation on revision of the standardised approach for credit risk”, 25 march 2015, available at: <http://www.bis.org/bcbs/publ/comments/d307/europeanbanking.pdf>.

dependent on cash flows generated by property and exposures where this is not the case. For these two sub-classes the Basel Committee has proposed the following risk weights.

**Table 3 Repayment is not materially dependent on cash flows generated by property**

|             | LTV ≤ 40% | 40% < LTV ≤ 60% | 60% < LTV ≤ 80% | 80% < LTV ≤ 90% | 90% < LTV ≤ 100% | LTV > 100%                               |
|-------------|-----------|-----------------|-----------------|-----------------|------------------|------------------------------------------|
| Risk weight | 25%       | 30%             | 35%             | 45%             | 55%              | RW <sub>counterparty</sub> <sup>48</sup> |

Source: Basel Committee March 2016 Revision to the Standardised approach to credit risk second consultative document

For LTV over 100%, they divided loan to SMEs to whom they apply a RW of 85% and loan to individuals where the applied RW will be 75%.

**Table 4 Repayment is materially dependent on cash flows generated by property**

|             | LTV ≤ 60% | 60% < LTV ≤ 80% | LTV > 80% |
|-------------|-----------|-----------------|-----------|
| Risk weight | 70%       | 90%             | 120%      |

Source: Basel Committee March 2016 Revision to the Standardised approach to credit risk second consultative document

In order to apply the risk-weight of the above table, the loans must comply with requirements. Those requirements focus on the quality of the collateral (i.e. adequate and prudent valuation of the property, finished property meaning not under construction), the collateral's effectiveness (i.e. legal enforceability in a reasonable time frame, seniority of liens that guarantee legal enforceability over the collateral) and information on the borrower (i.e. ability to repay taking into account the DSC ratio, required documentation for monitoring purpose)<sup>9</sup>.

If applied this new SA can have an impact on banks using this method. In the following paragraph we will try to assess this potential impact.

<sup>9</sup> Basel Committee on Banking Supervision "second consultative document: Revision to the Standardised approach to credit risk second consultative document", 11 march 2016, available at: <http://www.bis.org/bcbs/publ/d347.pdf>, p. 34.

### 2.2.3. Critics and impact

In order to quantify the impact of this potential regulation on Belgian banks using the SA, the following model uses the data of the 2016 NBB Financial Stability Report. This report contains a biannual article that reviews and assesses the recent development in the Belgian mortgage market<sup>10</sup>. Among the data included in this article it is possible to find a distribution of the mortgages loans according to their indexed LTV. This data can give us an approximation of the composition of a bank mortgage loan book. If we combine this data and the risk weight of the second consultative document it is possible to estimate the impact of the proposed changes on the SA. Unfortunately this data does not give the distribution of loans below a LTV of 80%. Future SA RW refers to the RW calculated following the BCBS revision of the standardised approach.

**Table 5: Potential impact of the BCBS revision of the standardized approach**

|                  | Exposure value (a) | Current SA RW (b) | Current SA RWA = (a)*(b) | Future SA RW (c) | Future SA RWA = (a)*(c) |
|------------------|--------------------|-------------------|--------------------------|------------------|-------------------------|
| LTV > 100%       | 5,8                | 35%               | 2,03                     | 75%              | 4,35                    |
| 90% < LTV < 100% | 12,2               | 35%               | 4,27                     | 55%              | 6,71                    |
| 80% < LTV < 90%  | 11,3               | 35%               | 3,9                      | 45%              | 5,08                    |
| LTV < 80%        | 70,8               | 35%               | 24,78                    | 35%              | 24,78                   |
|                  | 100                | 35%               | 35                       | 40,92%           | 40,92                   |

The model shows an increase of 16,9% in the RWA of the bank with the average RW rising from 35% to almost 41%. This rise is caused by the increase in RW for loan with a higher LTV, which is consistent with the objective of higher risk sensitiveness of the BCBS consultative documents. The end result will probably cause a smaller increase since the exposure distribution from the NBB does not provide information on loan with a LTV smaller than 80%. Those exposures being the one that benefit from a decrease in RW.

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<sup>10</sup> National Bank of Belgium: “Review and assessment of recent developments in the Belgian mortgage market”, in *Financial stability report 2016*, available at: [https://www.nbb.be/doc/ts/publications/fsr/fsr\\_2016.pdf](https://www.nbb.be/doc/ts/publications/fsr/fsr_2016.pdf), pp. 121 et s.

Despite the welcoming of improvements, such as improving the risk sensitivity of the SA<sup>11</sup> and hence incentivizing banks to reduce their credit risks, other critics have been raised by the industry concerning the second consultative document of the BCBS:

- A first critic is linked to the scale of the risk weight for loans having a LTV below 80%. Indeed, a report by the ESRB<sup>12</sup> of December 2015, found that the median RW, for 43 European banks using the IRB approach for loans having a LTV below 85%, was lower than 15%. This value can be compared to the 35% RW found in the BCBS consultative document. Actors of the banking industry therefore ask for lower RW for this category of loans or, at least, the possibility for local regulators to reduce RW on the basis of country specificities.
- A second critic regards the distinction between exposures where the repayment is materially dependent on cash flows generated by the property and those in which that is not the case. Actors of the industry find that RW associated with each category do not reflect the difference between those exposures.
- A third critic stresses out that an increase in the RW for higher LTV loans can cause a credit restraint for loan to younger and poorer households<sup>13</sup>.

Improvements are also requested by the industry. The first requested improvement is the introduction of Loan Splitting (LS) in order to reduce cliff effects, as marginal increase in LTV would lead to disproportionate increase in RW. A second enhancement takes the form of higher granularity for loans with a LTV below 40%. Finally, a regular assessment of the value property used as collateral is asked for so has to increase the risk sensitiveness to LTV<sup>14</sup>. The need for this last request is, however, not shared by all the industry since some view it as costly and difficult to implement.

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<sup>11</sup> British Banker Association, “A response by the British Bankers Association to the Basel Committee on Banking Supervision’s second consultative document on : Revisions to the Standardised Approach for credit risk”, march 2016, p. 2.

<sup>12</sup> European systemic risk board (ESRB) is responsible for the macroprudential oversight of the EU financial system and the prevention and mitigation of systemic risk. More information at : [www.esrb.europa.eu/about/background/html/index.en.html](http://www.esrb.europa.eu/about/background/html/index.en.html).

<sup>13</sup> BBA, A response by the British Bankers Association to the Basel Committee on Banking Supervision’s second consultative document on: Revisions to the Standardised Approach for credit risk, march 2016, p.8.

<sup>14</sup> European Banking Federation, “EBF response to the 2<sup>nd</sup> BCBS paper on the revision of the CRSA”, 11 March 2016, available at: [www.ebf-fbe.eu/wp-content/uploads/2016/03/EBF\\_019167L-EBF-response-to-BCBS-2nd-paper-on-Revision-of-CRSA.pdf](http://www.ebf-fbe.eu/wp-content/uploads/2016/03/EBF_019167L-EBF-response-to-BCBS-2nd-paper-on-Revision-of-CRSA.pdf), §§ 33-42; BBA, “A response by the British Bankers Association to the Basel Committee on Banking Supervision’s second consultative document on: Revisions to the Standardised Approach for credit risk”, march 2016, p.8.

All these critics and suggestions have a common goal: the reduction of the overall RW for the SA. This objective is understandable since, as the above models shows, the impact of the actual proposition will be a rise in RW.

As seen above, the RW for retail exposures secured by immovable property under the SA is 35%. The propositions for future evolution of this approach aim at increasing its risk sensitiveness through the LTV use. The use of the DSC is set aside due to the difficult calibration of this ratio between countries. The next section will be concentrated on the second approach to the RW estimation.

### **3. Risk weight for residential real estates secured by mortgages exposures in the internal ratings based approach calculated and their risk drivers**

The internal ratings based approach of the Basel regulation and its European regulation transposition give the possibility to banks to estimate themselves the riskiness of their asset if they meet specific requirements. By opposition to the SA, which uses external ratings, the banks using the IRB approach will develop their own rating system. There are two main objectives to the IRB approach. The first objective is to have higher risk sensitivity to the drivers of credit risk and economic loss; the second objective is to give an incentive to bank to improve their risk management.

This section is divided in three parts: 1) The first part will develop the principles, the sources and the requirements of the IRB approach on residential real estate exposures; 2) The second part will briefly overview the method which are used in the IRB approach; Finally, 3) the last part will be focused on the usual result of the IRB approach.

#### **3.1. Principles and sources of the IRB approach on retail exposure**

##### **3.1.1. Requirements**

The Third Chapter of the second title of the third part of the CRR is the regulation source on the IRB approach. As stated earlier the SA is the default method to calculate risk weight<sup>15</sup>. The use of the IRB is restricted to banks meeting the conditions of the regulation including a period of pre-approval<sup>16</sup>. Those conditions can be found in both the CRR, in the first and the sixth section of the above-mentioned chapter, and in European Banking Authority technical

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<sup>15</sup> Article 107 of the Regulation (EU) No 575/2013

<sup>16</sup> Article 143 of the Regulation (EU) No 575/2013

standard<sup>17</sup>. The main conditions can be found in article 144, 1) of the CRR. This article provides that banks must demonstrate that the following standard are met:

- the bank's rating systems provide an assessment of obligor and transaction characteristics, a differentiation of risk and accurate and consistent quantitative estimates of risk;
- the internal ratings, default probability and loss estimates used in the calculation of own funds requirements are playing a role in the risk management, decision-making process, credit approval, internal capital allocation and corporate governance of the bank;
- the bank has an independent credit risk control unit responsible for its rating systems;
- the bank collect and store all pertinent data to provide effective support to its credit risk measurement;
- the bank document its rating systems, the reason justifying their design and the validation process of those rating systems;
- the bank has validated each rating system during an appropriate time period before the permission to use this rating system. It also has assessed during this time period whether the rating systems are suited to the range of application for which they are designed, and necessary changes have been made following assessment;
- the bank has calculated under the IRB Approach the own funds requirements resulting from its risk parameters estimates;
- the bank has assigned and continues with assigning each exposure to a rating grade.<sup>18</sup>

The goal of these requirements is to ensure the integrity, reliability, consistency and accuracy of both the ratings system developed by the bank and the estimated parameters<sup>19</sup>.

The CRR separates exposures in various classes<sup>20</sup> and gives a specific RWA formula<sup>21</sup> to each of those classes. The next paragraph will develop the formula used to calculate RWA of retail exposures secured by immovable collateral.

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<sup>17</sup> European Banking Authority, "EBA Final draft regulatory standards on the specification of the assessment methodology for competent authorities regarding compliance of an institution with the requirements to use the IRB Approach in accordance with Articles 144(2), 173(3) and 180(3)(b) of Regulation (EU) No 575/2013, EBA/RTS/2016/03", 21 July 2016, available at: [www.eba.europa.eu/documents/10180/1525916/Final+Draft+RTS+on+Assessment+Methodology+for+IRB.pdf/e8373cbc-cc4b-4dd9-83b5-93c9657a39f0](http://www.eba.europa.eu/documents/10180/1525916/Final+Draft+RTS+on+Assessment+Methodology+for+IRB.pdf/e8373cbc-cc4b-4dd9-83b5-93c9657a39f0).

<sup>18</sup> Article 144, 1) of the Regulation (EU) No 575/2013

<sup>19</sup> Basel Committee on Banking Supervision, "BCBS consultative documents on the internal ratings-based approach: supporting document to the new Basel capital accord", 31 may 2001, available at: [www.bis.org/publ/bcbsca05.pdf](http://www.bis.org/publ/bcbsca05.pdf).

<sup>20</sup> Article 147 of the Regulation (EU) No 575/2013

### 3.1.2. Formula

The IRB approach for residential real estate exposures, unlike for exposures to corporates, institutions, central governments and central banks, does not give the possibility to banks to choose between a foundation and an advance approach. Indeed only the advanced approach is possible. In a foundation approach, banks only estimate their Probability of Default (PD<sup>22</sup>), the other parameters of the RW being provided by the national regulator. In an advance approach the bank must calculate all the risk parameters (PD, LGD<sup>23</sup>).

The article 154 of the CRR gives the formula for the calculation of risk-weighted exposures amounts for the retail class of exposures.

Risk-Weighted exposure amount = RW · exposure value

RW taking the following value:

1) if the exposure is defaulted, then PD = 1, and RW shall be calculated with the following formula:

$$RW = \max \{0, 12.5 \cdot (LGD - EL_{BE})\}$$

Where:  $EL_{BE}$  is the estimation of the expected loss for the defaulted exposure

2) if the exposure is not defaulted, then  $0 < PD < 1$ , and RW shall be calculated with the following formula:

$$RW = \left( LGD \cdot N \left( \frac{1}{\sqrt{1-R}} \cdot G(PD) + \sqrt{\frac{R}{1-R}} \cdot G(0.999) \right) - LGD \cdot PD \right) \cdot 12.5 \cdot 1.06$$

Where:

$N(x)$  = the cumulative distribution function for a standard normal random variable

$G(x)$  = the inverse cumulative distribution function for a standard normal random variable

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<sup>21</sup> Article 151 of the Regulation (EU) No 575/2013

<sup>22</sup> Article 4, (54) of the Regulation (EU) No 575/2013 : 'probability of default' or 'PD' means the probability of default of a counterparty over a one year period.

<sup>23</sup> Article 4, (55) of the Regulation (EU) No 575/2013 : 'loss given default' or 'LGD' means the ratio of the loss on an exposure due to the default of a counterparty to the amount outstanding at default.

$R$  = the coefficient of correlation. It can be defined as the relationship between the exposure value and the general state of the economy<sup>24</sup>, for retail exposures secured by immovable property  $R=0,15$

The IRB approach for retail exposures secured by immovable property has thus two main risk parameters: the Probability of Default, PD, and the Loss Given Default, LGD. The next paragraph will describe the main drivers that impact the assessment of these two risk parameters by the industry.

### 3.1.3. Risk drivers

This paragraph will firstly describe the requirements laid down in the EBA<sup>25</sup> technical standard. It will focus afterwards on survey made by the EBA and EBF<sup>26</sup> on the relevant risk drivers used by banks.

The article 35 of the EBA regulatory technical standard on assessment methodology for IRB<sup>27</sup> lists risk drivers that should be used for the assessment process if they are available for the exposure. This list is divided in three categories of risk drivers without giving an exhaustive list:

- Obligor risk characteristics, e.g. personal income information, qualitative information, behavioural information or socio-demographic information;
- Transaction risk characteristics, e.g. the type of product, the type of collateral, the seniority or the loan-to-value;
- Information on potential delinquency.

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<sup>24</sup> B. GENEST and L. BRIE, “Basel II IRB risk weight functions: demonstration and analysis”, 16 february 2013, available at: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2578936](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2578936), p.14.

<sup>25</sup> The European Bankin Authority (EBA) is an independant EU authority which works to ensure effective and consistent prudential regulation and supervision across the European banking sector. The EBA was established on 1 January 2011 as part of the European System of Financial Supervision (ESFS) and took over all existing responsibilities and tasks of the Committee of European Banking Supervisors. More information available at: [www.eba.europa.eu/about-us](http://www.eba.europa.eu/about-us).

<sup>26</sup> The European Banking Federation (EBF) is an association, which represent the interest of the banking sector in the European Union. It represents 32 national banking associations. More information is available at their web site. <http://www.ebf.eu/about-us/>.

<sup>27</sup> Article 35 of the EBA Final draft regulatory standards on the specification of the assessment methodology for competent authorities regarding compliance of an institution with the requirements to use the IRB approach in accordance with Articles 144(2), 173(3) an 180 (3) (b) of the Regulation (EU) No 575/2013, 21 July 2016.

Those risk drivers should be used for each and every risk parameters and exposure categories. They are therefore not specific to PD or LGD for residential mortgage exposures.

More information about the risk drivers can be found in the third interim report on the consistency of risk-weighted assets made by the EBA. This report is based on a study over forty-three banks across 14 EU member States.

Regarding PD, this study found that a significant majority of the banks uses borrower profile and payment behaviour in their models. However, only a proportion of 40% of the banks used debt-service to income ratio and 30% for vintages to their estimation of PD. Finally, some criteria are only scarcely used by banks. Those criteria include variables such as occupier versus buy-to-let<sup>28</sup>, interest rates related variables, maturity and amortisation types. Such categorisation criteria can nonetheless be significant in some banks models.

For LGD drivers, the EBA study gives the percentage of banks using a specific driver in their models. It shows that:

- 81% of the banks use LTV for their models;
- 58% include the type of real estate in their estimation;
- The location of the real estate is present in 44% of the banks models;
- 35% of the banks are reported to use the type of guarantee and the vintage;
- And only 5% of the banks used the type of amortisation.

As for PD drivers, these results describe the number of banks using a driver and not the driver power to estimate the risk parameter in the model.

These are not the only risk drivers used by banks. Some of them might not be directly linked with the obligor or the transaction. The risk appetite and the portfolio management of the bank can also influence the parameters of the RW formula. For instance, a bank with an aggressive lending policy will have a credit portfolio of lower quality leading to a higher PD and therefore a higher RW; the management of the portfolio can reduce the risk by having a close following of the borrowers<sup>29</sup>.

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<sup>28</sup> Buy to let mean: where repayment is materially dependent on cash flows generated by the property.

<sup>29</sup> European Banking Federation, “EBF study on Internal Ratings Based (IRB) models in Europe: Residential mortgages”, available at: [www.ebf-fbe.eu/uploads/Internal\\_Rating\\_Based\\_models\\_in\\_Europe.pdf](http://www.ebf-fbe.eu/uploads/Internal_Rating_Based_models_in_Europe.pdf), p. 16.

Data series used for modelling also impact the estimation result. The samples used for this exercise can vary from banks to banks. A survey of the EBF reveals that most of the participating banks used a sample starting in 2005. However the survey shows that some banks are using a data sample starting earlier. An extended data sample can cause a more conservative estimation of the risk parameters if the data sample includes more periods with higher default rate or decline in house prices.

Ultimately, sources of variation can be specific to some countries. Recovery period, for example, is influenced by the local legal regime and impact the LGD. Indeed, longer recovery periods mean higher LGD. Local regulatory constraints may also cause a variation of the RW or its risk parameters and thus different result from country to country. These regulatory constraints can, for instance, take the form of an increase in the LGD floor.

### 3.2. What are the method to approximate PD and LGD?

The EU regulation does not prescribe the use of a specific statistical model for the estimation of the risk parameters of the IRB RW formula. However, the model used must respect the requirement of the regulation. This means that banks enjoy a certain degree of freedom in choosing an estimation model that suits their aim. The models used by bank include parametric (Generalized linear model<sup>30</sup>, Logit/Probit<sup>31</sup>) and non-parametric statistical models (decision tree<sup>32</sup>).

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<sup>30</sup> J. A. NELDER and R. W. M. WEDDERBURN, “Generalized Linar Models”, *Journal of the Royal Statistical Society*, Vol 135, No. 3, 1972, pp. 370-384; T. L. LAI and S. P. -S. WONG, “Statistical models for the Basel II internal ratings-based approach to measuring credit risk of retail products”, *Statistics and its interface*, Vol.1, 2008, pp. 299-241.

<sup>31</sup> P. SIARKA, “The issue of PD estimation – a practical approach”, *Mathematical economics*, No. 7 (14), 2011, pp. 199 and f. ; E. HAYDEN and D. PORATH, “Statistical methods to develop ratings model”, in B. ENGELMANN and R. RAUHMEIER, *The Basel II risk parameter : estimation, validation, stress testing*, second edition, Springer, 2011, pp. 4-7.

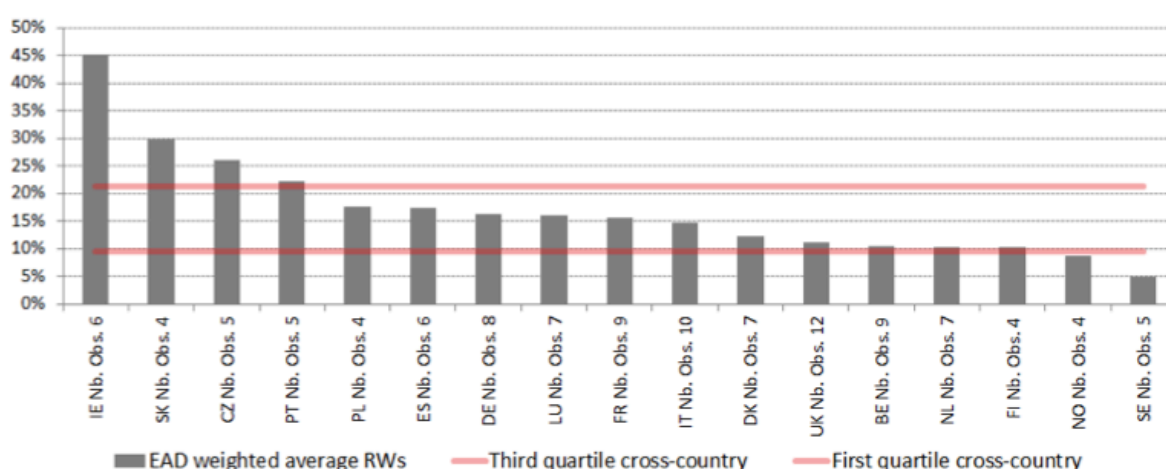
<sup>32</sup> A. DELTOUR and F. DUCUROI, Introduction to Machine Learning techniques used in the Financial industry and practical case study, June 2006, available at : [www.reacfin.com/en/sites/default/files/documents/20160622%20Reacfin%20White%20Paper%20-%20Intro%20to%20Machine%20Learning%20techniques%20used%20in%20the%20financial%20industry%20and%20a%20case%20study%20V1.pdf](http://www.reacfin.com/en/sites/default/files/documents/20160622%20Reacfin%20White%20Paper%20-%20Intro%20to%20Machine%20Learning%20techniques%20used%20in%20the%20financial%20industry%20and%20a%20case%20study%20V1.pdf) ; E. HAYDEN and D. PORATH, “Statistical methods to develop ratings model”, *op cit*, pp. 9-11.

### 3.3. Usual results of the IRB approach

In order to describe the usual RW results obtained through the use of the IRB approach in the European banking sector, surveys from the EBA<sup>33</sup> and the ESRB<sup>34</sup> will be used. These surveys show a country pattern in the exposure at default (EAD) weighted average results. Within one country, variations in RW are generally low. Some countries experience bigger variations that are mostly due to small exposures with low RW<sup>35</sup>. This observation tends to confirm the importance of country based risk drivers.

The above-mentioned country pattern is well reflected in a 2013 EBA survey. This survey found that EAD-weighted average RW range from 45% in Ireland to almost 5% in Sweden. Ireland, Slovakia, Czech Republic and Portugal have a RW superior to the third quartile.

**Figure 3: EAD-weighted average RW range, IRB residential mortgage portfolio, non-defaulted exposures, by country.**



Source: EBA data collection (reference date: December 2012).

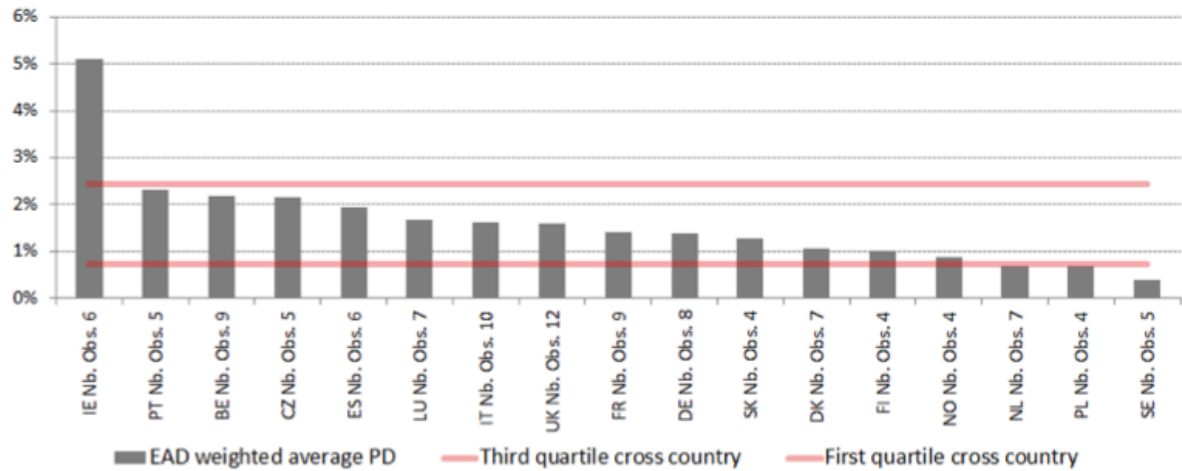
<sup>33</sup> European Banking Authority, “EBA third interim report on the consistency of risk-weighted assets: SME and Residential mortgages”, 17 December 2013, available at : [www.eba.europa.eu/documents/10180/15947/20131217+Third+interim+report+on+the+consistency+of+risk-weighted+assets+-+SME+and+residential+mortgages.pdf](http://www.eba.europa.eu/documents/10180/15947/20131217+Third+interim+report+on+the+consistency+of+risk-weighted+assets+-+SME+and+residential+mortgages.pdf).

<sup>34</sup> European Systemic Risk Board, “ESRB Vulnerabilities in the EU residential real estate sector”, November 2016, available at : [www.esrb.europa.eu/pub/pdf/reports/161128\\_vulnerabilities\\_eu\\_residential\\_real\\_estate\\_sector.en.pdf](http://www.esrb.europa.eu/pub/pdf/reports/161128_vulnerabilities_eu_residential_real_estate_sector.en.pdf)

<sup>35</sup> European Banking Authority, “EBA third interim report on the consistency of risk-weighted assets: SME and Residential mortgages”, *op cit*.

The same survey of the EBA also gives the EAD weighted averaged PD by country. This data confirms the country pattern found for RW. The EAD-weighted average PD range from 5% to 0.4%. Most country are inside the inter quartile range, only Ireland PD is superior to the third quartile.

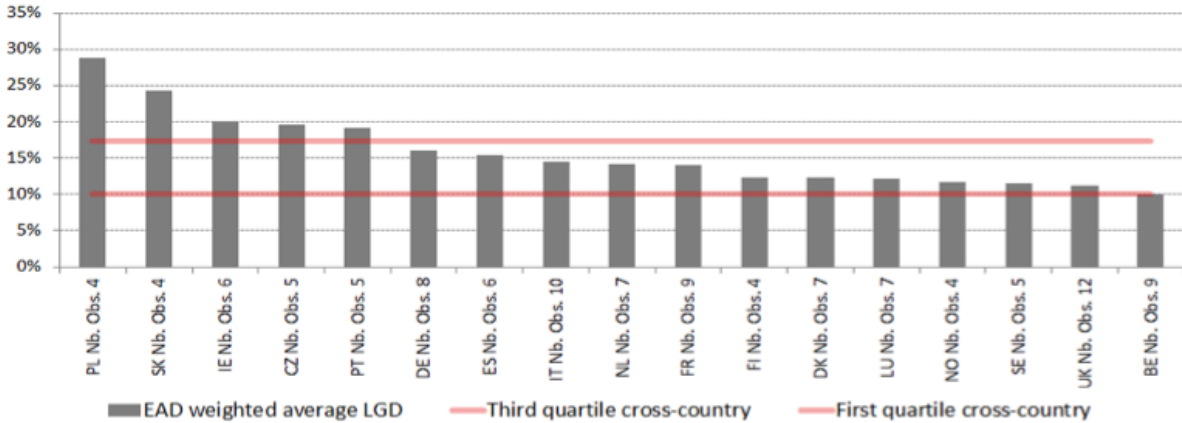
**Figure 4: EAD-weighted average PD range, IRB residential mortgage portfolio, non-defaulted exposures, by country.**



Source: EBA data collection (reference date: December 2012).

The EAD-weighted average LGD range from 36% in Poland to 10% in Belgium. The same concentration as in the PD distribution is not found with more countries over the interquartile range.

**Figure 6: EAD-weighted average LGD range, IRB residential mortgage portfolio, non-defaulted exposures, by country.**



Source: EBA data collection (reference date: December 2012).

The results of this study show that in 2013, only Sweden had a combination of a low PD and LGD. Other countries with a low RW had either a combination of a low PD and a higher LGD: Norway, Finland and Nederland, or a combination of a low LGD and a higher PD: Belgium and United Kingdom. Even if there is a country pattern for RW, PD and LGD, the last two variables take different trends. A low RW does not imply a low PD and LGD.

More up-to-date data on the result of RW for retail mortgages estimation with IRB approach can be found in a November 2016 ESRB report on the vulnerabilities of the EU residential real estate sector<sup>36</sup>.

**Table 6: EAD-weighted average RW range, IRB residential mortgage portfolio, non-defaulted exposures, by country.**

| Country | AT | BE | DE | DK | EE | ES | FI  | FR | IE | IT | LU | NL | PT | SE | UK |
|---------|----|----|----|----|----|----|-----|----|----|----|----|----|----|----|----|
| RW(%)   | 24 | 10 | 16 | 14 | 15 | 15 | <10 | 15 | 37 | 18 | 10 | 15 | 22 | 25 | 11 |

Source: ESRB Vulnerabilities in the EU residential real estate sector (November 2016).

Those RW must be compared to the level of RW fixed by the SA. For those fifteen countries only in Ireland, is the level of RW obtained with an IRB approach (37%) higher than the RW with the SA (35%).

It is important to point out the evolution in RW in Sweden since 2013. Indeed, in the EBA survey the weighted average RW in Sweden was 5% and in the November 2016 report of the ESRB it was at a much higher level of 25%. This evolution has been caused by the measures taken by the Swedish regulator. We will assess this initiative and the measures taken by other local EU regulators concerning RW for residential real estate exposures in the next section.

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<sup>36</sup> European Systemic Risk Board, “ESRB Vulnerabilities in the EU residential real estate sector”, *op cit*.

## 4. Recent initiatives by local regulators and reaction of the industry

### 4.1. Initiatives by local regulators in the EU and EEA

The following paragraphs will describe the measures, taken by local regulators, in the EU and the EEA, which impact RW calculate with the IRB approach for regarding residential real estate exposures.

#### 4.1.1. Belgium

The FSA of Belgium has implemented two measures: the first measure marks five hundred basis points add-on up on IRB RW for exposures secured by mortgages; the second measure increases the LGD floor for exposures secured by a residential retail property with a LTV superior to 80%.

##### 4.1.1.1 Five hundred basis points add-on on IRB RW for exposures secured by residential mortgages

The National Bank of Belgium (NBB), which is the Financial Stability Authority of Belgium, has implemented the measure since the 8<sup>th</sup> of December 2013. The measure consists of an *“increase of RW for retail exposure secured by Belgian residential property for Belgian IRB Bank by an add-on of five percentage point to address asset bubbles in the residential property sectors”*<sup>37</sup>. Its legal basis is the Article 458 (2) of the CRR<sup>38</sup>. The measure must be notified to the *“European Parliament, the Council, the Commission, the ESRB and EBA”*<sup>39</sup>

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<sup>37</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures to address macroprudential or systemic risk”, EBA/Op/2014/02, 30 April 2014, available at: [www.eba.europa.eu/documents/10180/657547/EBA-Op-2014-02+Opinion+on+measures+to+address+macroprudential+or+systemic+risk.pdf](http://www.eba.europa.eu/documents/10180/657547/EBA-Op-2014-02+Opinion+on+measures+to+address+macroprudential+or+systemic+risk.pdf), p.2.

<sup>38</sup> Article 458 of the Regulation (EU) No. 575/2013.

<sup>39</sup> Article 458 (2) of the Regulation (EU) No. 575/2013.

The arguments given by the NBB to justify that “*while developments in the Belgian property market, i.e. growth in house prices and mortgage credit, and signs of overvaluation of the residential property market*” are a threat to Belgian banks, “*risk weights for residential mortgages for Belgian IRB credit institutions seem to be relatively low compared to other countries*”<sup>40</sup>. The cause is that “*internal models are calibrated on historical credit loss data in Belgium and there is no experience of major housing shocks in Belgium in recent decades*”<sup>41</sup>. For the NBB, “*models are able to rank correctly the risks*” but the risk weights could be insufficient to support a severe downturn of the housing market. This situation puts a risk to financial stability at a national level<sup>42</sup>.

In order to take measures under Article 458 of the CRR the FSA must explain why other measures of the CRD/CRR framework “*cannot adequately address the macro-prudential or systemic risk identified, taking into account the relative effectiveness of those measures*”<sup>43</sup>.

- The Article 124 CRR<sup>44</sup> allows the competent authority to set the risk weight at a percentage from 35 % through 150 % for exposures secured by mortgages on residential property, for the SA. The measure of this article was not appropriate since banks using internal models for the exposures towards the residential real estate represent about 90% of the market shares and the 35% RW of the SA is sufficient for the NBB<sup>45</sup>.
- The article 164 CRR gives to the competent authority the power to “*set higher minimum values of exposure weighted average LGD for exposures secured by property in their territory*”<sup>46</sup>. This disposition was not used since “*increasing the floor will penalize institutions with the most conservative lending standards*”<sup>47</sup>.
- For the articles 102, 103 and 104 of the CRD, which provide for bank-specific features related to the risk profile of individual institutions, the NBB also provides justification to their inapplicability. Firstly, those articles provide micro-prudential tools while “*the*

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<sup>40</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures to address macroprudential or systemic risk”, *op cit*, Annexe 1 §14.

<sup>41</sup> *Ibidem*, Annexe 1 §15.

<sup>42</sup> Art 458 (4) (a) of the Regulation (EU) No 575/2013.

<sup>43</sup> Art 458 (2) (c) of the Regulation (EU) No 575/2013.

<sup>44</sup> Article 124 of the Regulation (EU) No 575/2013.

<sup>45</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures to address macroprudential or systemic risk”, *op cit*, Annexe 1 §23.

<sup>46</sup> Article 164 (5) of the Regulation (EU) No 575/2013.

<sup>47</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures to address macroprudential or systemic risk”, *op cit*, Annexe 1 §24.

*main rationale is rather macroeconomic concerns relating to the potential evolution of the residential properties in Belgium*”<sup>48</sup>. A second concern regarding those provisions are their transparency, indeed, “*Pillar 2 measures are currently not publicly disclosed*”<sup>49</sup>.

- The Articles 101 and 102 of the CRD are not applicable since they sanction violation of the IRB requirements and not such requirement were breached<sup>50</sup>.
- The Article 133 that organises the implementation of a systemic risk buffer is not pertinent because the target of the NBB is a “*potential cyclical downturn in the residential real estate market*”<sup>51</sup> and not a structural risk.
- Finally, the counter cyclical buffer of the Article 136 “*applies to all exposures located in a jurisdiction and, thus, would not achieve the objective of the proposed measure*”<sup>52</sup>

The impact of the measure was assessed by the NBB and was estimated to generate an increase of 550 millions of EUR of capital or 2.3% of total capital requirement for banks using IRB model<sup>53</sup>.

FSA of other member State can reciprocate a measure for banks in their jurisdiction. Reciprocation concerns recognition of a measure by a member State taken in another jurisdiction, i.e. the application of the measure to exposures of branches, or cross-border exposure of banks under the supervision of the member State. “De Nederlandsche Bank” (DNB), the Dutch FSA, has reciprocated the measure of the NBB for Dutch banks.

The EBA raised the issue that a constant add-on on RW “*could penalize banks with more conservative credit standards or models*”<sup>54</sup>. The EBA therefore thinks that the same objective could be obtained through the use of institution-specific measures.

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<sup>48</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures in accordance with Article 458 Regulation (EU) No 575/2013”, EBA/Op/2016/03, 19 February 2016, available at: [www.eba.europa.eu/documents/10180/1359456/EBA-Op-2016-03+EBA+Opinion+on+measures+in+accordance+with+Art+458](http://www.eba.europa.eu/documents/10180/1359456/EBA-Op-2016-03+EBA+Opinion+on+measures+in+accordance+with+Art+458), §14.

<sup>49</sup> *Ibidem*, §14.

<sup>50</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures to address macroprudential or systemic risk”, *op cit*, Annexe 1, §26.

<sup>51</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures in accordance with Article 458 Regulation (EU) No 575/2013”, *op cit*, §14.

<sup>52</sup> *Ibidem*, §14.

<sup>53</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures to address macroprudential or systemic risk”, *op cit*, Annexe 1, §35.

<sup>54</sup> European Banking Authority, “EBA: Opinion of the European Banking Authority on measures in accordance with Article 458 Regulation (EU) No 575/2013”, *op cit*, §8.

The measure was taken for two years and has been reviewed and extended in 2016.

#### 4.1.1.2 Increase of the LGD floor for loan with a LTV superior to 80%

The RW add-on will still be applicable and in addition a new measure is proposed. This measure “*will be applied to mortgage loans with an indexed LTV ratio greater than 80%. In this way, the microprudential 10% loss given default (LGD) floor is, for the sole calculation of the macroprudential capital requirement under Article 458 of the CRR, replaced by a 20% LGD floor, if the indexed LTV ratio is between 80% and 90%, and by a 30% LGD floor if the indexed LTV ratio is greater than 90%*”<sup>55</sup>. The measure was calibrated with a stress test “*consisting of a multiplication of the default rate by five and an increase in the LGD by 25 percentage points and a complementing scenario that additionally imposes a minimal default rate per institution*”<sup>56</sup>. The measure has been notified to the EBA the 14<sup>th</sup> of February 2017 and has the same legal basis as the first measure applied by the NBB, the article 458 CRR.

Regarding the economic justification the NBB has added a new argument. Indeed, “*the NBB expects sustained new mortgage lending in the coming years. This may intensify competition between the main credit institutions, triggering increased risk-taking in the form of further easing of credit standards*”<sup>57</sup>. The add-on is still needed but not sufficient to improve the stability of the banking sector in case of a severe downturn.

As for the other measure that NBB could have taken , only the argumentation on the Article 164 CRR has changed. The NBB gives two arguments for not raising the LGD floor. Firstly, not all loan are targeted by the measure while the article 164 would target every exposure. Secondly, “*the proposed macro-prudential requirement will not affect banks’ internal model, whereas Article 164 would lead to a change in the internal model of banks*”<sup>58</sup>.

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<sup>55</sup> *Ibidem*, p.2

<sup>56</sup> *Ibidem*, p.2.

<sup>57</sup> *Ibidem*, p.4.

<sup>58</sup> *Ibidem*, p.4.

#### 4.1.2. Finland

The Finnish FSA is preparing to implement a RW floor of 15% on mortgage loans. The measure should enter in force from the 1<sup>st</sup> of January 2018. The argument given by the FSA is that: *“Higher risk weights are aimed at strengthening the ability of the financial system as a whole to withstand risks related to lending for house purchase, which are amplified by growing household debt”*<sup>59</sup>.

#### 4.1.3. Norway

Norway is a member of the European Economic Area (EEA) and is, therefore, not subject to obligation of notification to European authorities from the CRD/CRR framework<sup>60</sup>. However, since they implemented a macro-prudential measure on having an impact on IRB RW for mortgage loan it is relevant to add this measure in this analysis.

The measure was introduced from the 1<sup>st</sup> January 2014. Its legal basis is the Article 164 of the CRR. It *“increased the minimum EAD-weighted average LGDs for Norwegian retail exposures secured by residential real estate from 10% to 20%”*<sup>61</sup>. The reciprocation of the measure is compulsory<sup>62</sup>.

#### 4.1.4. Sweden

The Swedish FSA introduced since September 2014 a RW floor of 15%, which have been raised afterward to 25%, for mortgage loans. The motivation for raising the floor was to

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<sup>59</sup> Finansinspektionen, “Finansinspektionen macro prudential decision”, 28 march 2017, available at : [www.finanssivalvonta.fi/en/Publications/Press\\_releases/Pages/05\\_2017.aspx](http://www.finanssivalvonta.fi/en/Publications/Press_releases/Pages/05_2017.aspx).

<sup>60</sup> European Systemic Risk Board, “ESRB : A review of macro-prudential policy in the EU one year after the introduction of the CRD/CRR”, June 2015, available at: [www.esrb.europa.eu/pub/pdf/other/150625\\_review\\_macroprudential\\_policy\\_one\\_year\\_after\\_intro\\_crdcrr.en.pdf](http://www.esrb.europa.eu/pub/pdf/other/150625_review_macroprudential_policy_one_year_after_intro_crdcrr.en.pdf), p.8.

<sup>61</sup> *Ibidem*, p.18 ; European Banking Authority, “EBA report: On the range of practices regarding macroprudential Policy measures communicated to the EBA”, July 2015, available at: [www.eba.europa.eu/documents/10180/950548/EBA+report+on+the+range+of+practices+regarding+macroprudential+policy+measures.pdf](http://www.eba.europa.eu/documents/10180/950548/EBA+report+on+the+range+of+practices+regarding+macroprudential+policy+measures.pdf), p.17 ; European Banking Authority, “EBA Opinion on the macro prudential rules in CRR/CRD”, *op cit*, p.53.

<sup>62</sup> Article 164 (7) of the Regulation (EU) No 575/2013.

*“account for structural systemic risk factors, i.e., losses to the wider economy rather than bank-specific credit-losses”*<sup>63</sup>. The legal-basis for the measure is the Pillar 2 of the CRD and more precisely the 103 CRD that provide for the *“application of supervisory measures to institutions with similar risk profiles”*<sup>64</sup>.

The Swedish FSA has not applied the Article 458 CRR due to two reasons. The first reason is the temporality of measures taken under the Article 458 CRR. Indeed such measures are limited to a period of 2 year while this is not the case for measures under the Pillar 2. The second reason is the subsidiarity of the article 458. This article provides that it can be applied only if other measures are not applicable<sup>65</sup>. One of the measures listed in the article 458 is the article 103 CRD. The FSA therefore applied this legal basis.

#### 4.1.5 Conclusion

There are five macro-prudential measures that are applied or in the process of being applied in the EU and the EEA. There are two IRB RW floors, but they use two different legal basis: Pillar 2 in Sweden and Article 458 CRR in Finland. There is an IRB RW add-on in Belgium. There are two increases in LGD floor: one in Norway that applies to all mortgage loan and uses the article 164 as legal basis and one in Belgium that applies to loan with a LTV superior to 80% and the legal basis is the article 458 CRR.

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<sup>63</sup> European Banking Authority, “EBA report: On the range of practices regarding macroprudential Policy measures communicated to the EBA”, *op cit*, p.17.

<sup>64</sup> Article 103 of the Directive (EU) 2013/36/EU.

<sup>65</sup> Article 458 (4) (b) of the Regulation (EU) No. 575/2013.

**Table 7 : Local regulators initiative summary**

| Country | Measure                           | Legal Basis    | Date of introduction                       |
|---------|-----------------------------------|----------------|--------------------------------------------|
| Belgium | 5% pp. RW add-on                  | Art 458. CRR   | December 2013                              |
| Belgium | LGD floor for loan with LTV > 80% | Art 458. CRR   | February 2017<br>(notification to the EBA) |
| Finland | 25% RW floor                      | Art 458. CRR   | January 2018                               |
| Norway  | LGD floor                         | Art. 164 CRR   | January 2014                               |
| Sweden  | RW floor                          | Pillar 2 (CRD) | September 2014                             |

#### 4.2. Impact assessment and Industry's reaction

The raise of RW and the increase in capital due to macro-prudential measures aim at improving the stability of banks and the banking system as a whole. This is obtained through the capacity of sustaining higher unexpected losses. This capacity reduces banks vulnerabilities making them less susceptible to the source of the crisis or to be in a position of distress due to an economic downturn. Banking stability has an important impact on the economy. Indeed, economic crisis that are combined to banking crisis cause longer and deeper recession than economic crisis without banking crisis<sup>66</sup>.

However, “*protection against extreme crises requires substantially more loss absorption capacity, but at the same time, such crises are rare*”<sup>67</sup>. It is, therefore, difficult to assess the benefits of capital increase. Indeed, it also has other effects that can have a negative impact on banks. In the following paragraphs we will briefly assess and describe three potential impact of measures raising RW: 1) the impact to the risk sensitivity of banks, 2) the impact on profitability of banks and the interest rates they apply, and 3) the leaking of lending originally carry out by banks to other financial entities that are not subject to banking regulation.

<sup>66</sup> A. KOSE and M. TERRONES, *Collapse and revival: understanding recessions and recoveries*, op cit, p.105 et s.

<sup>67</sup> J. DAGHER, G. DELL'ARICCIA, L. LAEVEN, L. RATNOVSKI and H. TONG, “IMF staff discussion note : Benefit and cost of bank capital”, SDN/16/04, March 2016, p.29.

#### 4.2.1. Impact to the risk sensitivity of banks

One of the critics given by the EBA to the Belgian macro-prudential measure is that it should be calibrated on a bank-to-bank basis in order to match each bank risk profile. Effectively, the flat RW add-on of 5 hundred basis point as well as the RW floor of the Swedish FSA have a bigger impact on banks with a lower average RW and therefore on banks with a more conservative lending-policy. This can be illustrated by the following simple example illustrating the Belgian 5 percentage point RW add-on.

**Table 8: Impact of the initiatives on Banks risk sensitivity**

|        | Average RW before the macro prudential measure (a) | Average RW after the macro prudential measure (b) | Impact = ((b)-(a))/(a) |
|--------|----------------------------------------------------|---------------------------------------------------|------------------------|
| Bank 1 | 8%                                                 | 13%                                               | + 62,5%                |
| Bank 2 | 10%                                                | 15%                                               | + 50%                  |

In this example Bank 1, which have a more stringent lending policy and therefore a lower average RW, is proportionately more impacted by the measure than Bank 2.

RW floor have another potential impact on risk sensitivity, it nullifies the incentive in capital cost of lower risk exposure. For example, in the case of the Swedish RW floor, the capital cost for exposures that were given a RW of 500 Basis Point before the measure is the same cost as exposures with a RW of 25% after the measure is applied. It can be expected that banks will adapt their mortgage credit portfolio taking into account the new cost in capital<sup>68</sup>.

#### 4.2.2. Impact to the ROE and interest rates

To assess the impact on ROE of the measure raising RW, we will use the Belgian RW add-on. In order to achieve this goal, the ROE will be computed with the following variable<sup>69</sup>.

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<sup>68</sup>O. WYMAN, "The real economy cost of regulation in the Swedish banking system for the Swedish Banker's Association", September 2016, available at : <http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2016/oct/Swedish-bankers-association-Real-economy-cost-of-regulation.pdf>, p. 12.

<sup>69</sup>D. WOUTERS, "Credit Portfolio Management Based on Risk Weighting Models: Past and Future", *Revue bancaire et financière*, 2012/7, p.462.

- (a) Credit portfolio
- (b) Risk Weight
- (c) Interest margin
- (d) Interest result  $(d) = (a) * (c)$
- (e) Cost-income ratio
- (f) Gross result  $(f) = (d) * (1 - (e))$
- (g) Required capital buffer  $(g) = 8\% * (a) * (b)$
- (h) Gross Return on Equity  $(h) = (f) / (g)$

The 10% RW average before the introduction of the measure is used for the initial estimation. For the two subsequent estimations a RW of 15% is employed to show the impact of the 5-percentage point add-on to RW. Data from a 2016 survey are used for the average ROE and Cost-income ratio in the first estimation. Finally, the size of the credit portfolio is Arbitrary fixed to 1000. With simple substitutions it is possible to calculate firstly the interest margin and then the other parameters of the model for the initial estimation. A first modification estimates the impact on the ROE of the RW add-on keeping unchanged every other parameter. A second modification estimates the impact on the interest margin if the bank keeps the ROE of the initial estimation.

**Table 9: Impact of the local regulators initiatives on ROE and interest rates**

|                       |                | Initial estimation | Impact on ROE if all other parameters are kept unchanged | Impact on interest margin if ROE is kept at initial level |
|-----------------------|----------------|--------------------|----------------------------------------------------------|-----------------------------------------------------------|
| (a) Credit portfolio  |                | 1000 <sup>70</sup> | 1000                                                     | 1000                                                      |
| (b) RW                |                | 10% <sup>71</sup>  | 15%                                                      | 15%                                                       |
| (c) Interest margin   |                | 0,2% <sup>72</sup> | 0,2                                                      | 0,3                                                       |
| (d) Interest result   | = (a)*(c)      | 2                  | 2                                                        | 3                                                         |
| (e) Cost-income ratio |                | 60% <sup>73</sup>  | 60%                                                      | 60%                                                       |
| (f) Gross result      | = (d)*(1-(e))  | 0,8                | 0,8                                                      | 1,2                                                       |
| (g) Required capital  | = 0,08*(a)*(b) | 8                  | 12                                                       | 12                                                        |
| (h) ROE               | = (f) / (g)    | 10% <sup>74</sup>  | 6,7%                                                     | 10%                                                       |

<sup>70</sup> Arbitrarily fixed.

<sup>71</sup> Average RW before the introduction of the add-on .

<sup>72</sup>  $c = (0,08 * (h) * (b)) / (1 - (e))$ .

The first modification of the initial estimation can be interpreted as the short-term impact. In this case the bank cannot increase its interest rates following the raise in RW. Concurrence between banks and contractual relationship are reasons that justify the hypothesis of a fixed interest rate at short term. The consequence is a sharp decrease of the ROE from 10% to 6,7%.

In the longer term banks can adapt their interest rates in order to come back at their initial level of profitability. This situation is reflected in the second modification. Due to concurrence between banks it is also reasonable to believe that cost are also a variable that will be adapted in order to return to the profitability of the initial situation. Another way that bank could react to this situation is by shifting their loan portfolio to exposures with a higher profitability. This is not possible in the model since there is only one asset class.

#### 4.2.3. Impact on the structure of the lending supply

Shadow banking is an evolution of the financial sector that has different aspect and is not limited to a single phenomenon. It can be viewed as *“the evolution towards a more market-based financial system, where more financial intermediation occurs outside the banking sector”*<sup>75</sup>. In this case it is welcome by regulators as an alternative to bank lending. A more diversified financial system improves credit and therefore contributes to the growth of the real economy. It can also provide lending when the banking sector is in a situation of credit squeeze. However, *“although increased securitization activity expands the supply of real economy credit by broadening the available base of pledgeable assets, it also creates a vulnerability as the supply (...) is itself governed by the strength of shadow bank balance sheets”*<sup>76</sup>.

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<sup>73</sup> Data from: The cumulative impact of regulation, taxes and a low interest rate environment, available at : [www.febelfin.be/sites/default/files/InDepth/cumulative\\_impact\\_final.pdf](http://www.febelfin.be/sites/default/files/InDepth/cumulative_impact_final.pdf).

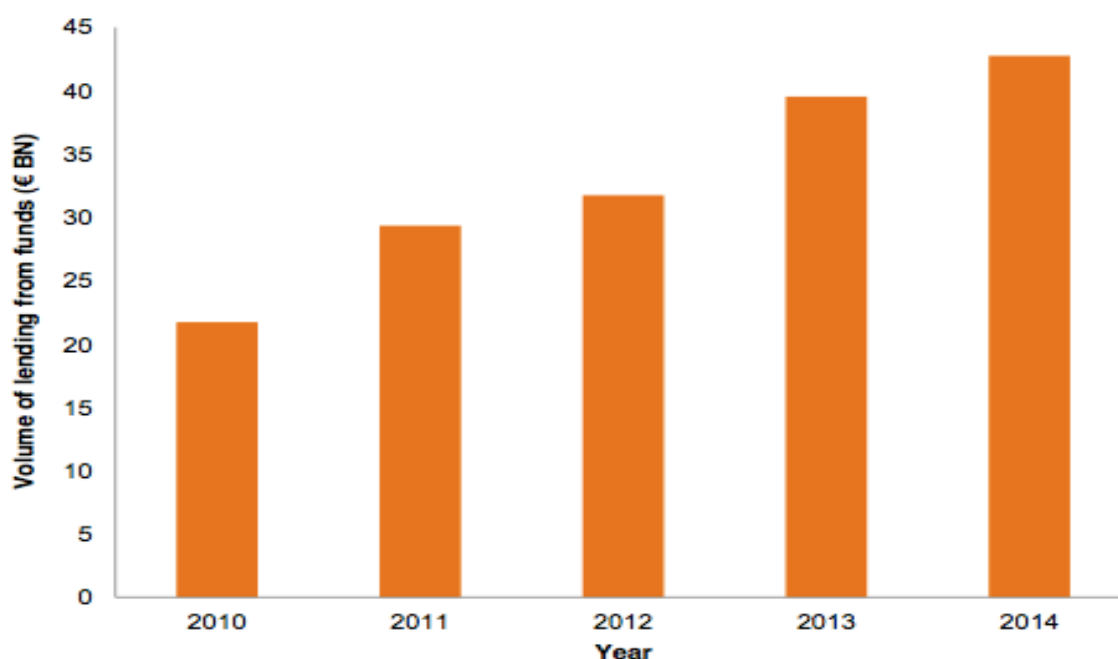
<sup>74</sup> Data from: *Ibidem*.

<sup>75</sup> European Systemic Risk Board, “ESRB strategy paper : Macprudential policy beyond banking”, July 2016, available at: [www.esrb.europa.eu/pub/pdf/reports/20160718\\_strategy\\_paper\\_beyond\\_banking.en.pdf](http://www.esrb.europa.eu/pub/pdf/reports/20160718_strategy_paper_beyond_banking.en.pdf), p. 5.

<sup>76</sup> R. MEEKS, B. NELSON and P. ALESSANDRI, “Bank of England working paper n°487: Shadow banking and macroeconomic instability”, March 2014, p.4, available at: <http://www.bankofengland.co.uk/research/Documents/workingpapers/2014/wp487.pdf>.

One of the reasons of this evolution is the utilization of “*regulatory arbitrage, i.e. the exploitation of differences in regulation, between sectors or countries or both*”<sup>77</sup> by non-banks. This development is highlighted by the banking industry. This led the Dutch Banking Association to point out that: “*when banks are faced with requirements that are higher than economic, non banks will have an advantage (...). This will exacerbate the trend towards lending from the non-banks sectors*”<sup>78</sup>. The evolution of the volume of loan from investment fund in the Nederland gives a clear trend toward a higher presence of non-banks actors.

**Figure 7: Volume of loans from investment fund in NL**



Source: FSB

In the case of the local macro prudential measures on RW they add regulatory cost in the form of higher capital requirement to the banking sector only. This will likely cause “*a shift of exposures from regulated to unregulated or lightly regulated entities*”<sup>79</sup>.

<sup>77</sup> K. BAKK-SIMON, S. BORGIOLI, C. GIRON, H. HEMPELL, A. MADDALONI, F. RECINE and S. ROSATI, “Shadow banking in the Euro area : an overview”, *ECB occasional paper series*, n° 133, April 2012, p.8

<sup>78</sup> Nederlandse Vereniging van Banken, “The NBV response to the Basel capital floors consultation”, 26 march 2015, available at [www.bis.org/bcbs/publ/comments/d306/duba.pdf](http://www.bis.org/bcbs/publ/comments/d306/duba.pdf), p. 13.

<sup>79</sup> O. WYMAN, “The real economy cost of regulation in the Swedish banking system for the Swedish Banker’s Association”, *op cit*, p.28.

## 5. Conclusion

The Master thesis has shown that there are two methods authorised by EU regulation for the risk weighting of residential real estate exposures: On the one hand, the SA is the default approach to compute RWA for residential mortgage loans. This method gives a flat 35% RW for the exposures under scrutiny in this thesis. The major drawback of this approach is its low risk sensitivity. Indeed, it is limited to a distinction between performing exposures and non-performing exposures. Compared to the IRB approach, the SA thus results in high RWA. This approach is therefore scarcely used. For instance, in Belgium only 10% of the exposures are Risk-weighted with the SA and no major banks use it. This situation has led the BCBS to propose a modification of the SA. The modifications introduce a certain degree of risk sensitivity using the LTV ratio. In Belgium, however, the modification could result in higher RWA if the banks keep their residential mortgage loan portfolio in terms of LTV unchanged.

On the other hand, the IRB approach, which requires certain conditions to be met in order to be used, allow bank to internally compute their RWA. This approach is more focused on risk sensitivity and gives banks an incentive to improve their risk management. In Belgium, the weighted-average RW with the IRB approach for residential mortgages loans is 10%<sup>80</sup>. The much lower result of this approach is not without concerns for local European regulators. Situations that combine high households debt and overpricing of the housing have been highlighted in Belgium, Finland, Sweden and Norway. In order to prevent such situation to endanger banks, local regulators have put in place RW add-on, RW floor and LGD floor. These measures are not without consequences for the banking sector. This thesis focuses on three potential impacts of the IRB approach. The first effect is a decrease in risk weight sensitivity and therefore a reduced incentive to improve risk management. This effect is mostly present for RW floors. The second effect of local measure is a higher capital cost for banks. This thesis argues that the increase in cost will impact negatively ROE and will be transferred afterwards to borrowers. The last outcome is a potential modification in the lending supply from bank lending to non-bank lending. This development is due to an asymmetry in regulation burden on banks. Eventhough banking regulation is essential to

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<sup>80</sup> Without the RW add-on of the NBB.

prevent banking crisis from leading to economic crisis or increasing such crisis, it is important to understand its repercussion on a sector which is key to economic growth.

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