CREDIT PORTFOLIOS AND RISK WEIGHTED ASSETS: ANALYSIS OF EUROPEAN BANKS

Carlos Trucharte Artigas, Carlos Pérez Montes, María Elizabeth Cristófoli, Alejandro Ferrer Pérez and Nadia Lavín San Segundo [*]

(*) Directorate General of Financial Stability and Resolution, Banco de España. The authors gratefully acknowledge the insightful comments of Jesús Saurina, Daniel Pérez and an anonymous referee.

Abstract

This article analyzes the data on credit exposures and risk weighted assets (RWAs) disclosed by the European Banking Authority as result of the comprehensive assessment of European banks in 2014. We examine the sectoral composition of the credit portfolio and study exposure volumes, RWAs, and RWA densities of different sub-portfolios (corporates, retail, etc.). We find that the IRB (Internal Ratings Based) approach to calculate RWAs is extensively used in exposures to the private sector and that this usage is more intense coinciding with situations in which there is a greater reduction in RWA density with respect to the SA (Standardized Approach), alternative method to calculate RWAs. There is also significant variation across countries in terms of IRB use and savings in terms of RWA density, and therefore in capital requirements.

1 Introduction

This article presents an analysis of bank credit portfolios and their associated risk weighted assets (RWAs henceforth) for a sample of EU economies: Germany (DE), Spain (ES), France (FR), Italy (IT), the Netherlands (NL), and the United Kingdom (UK). We investigate the sectoral composition of credit portfolios (central banks and public sector, banks, corporate, retail and others), the use of standard (SA henceforth) and internal rating based (IRB henceforth) methodologies to compute RWAs, the density of RWAs (defined as the amount of RWAs over credit exposures) and the relation between RWA density and the method (SA or IRB) used for the computation of RWAs.

The analysis relies on novel data on credit exposures of European banks as of December 2013 published by the European Banking Authority (EBA henceforth) following the stress test exercise conducted in year 2014 at the European level.[1] The portfolios considered through the different sections of the article include total exposures (sum of domestic and international exposures), with the exception of the analysis of international portfolios in Section 4.

The objective of this article is, first of all, to provide the reader with real figures of the banks' actual calculations of their RWAs and, in addition, offer an empirical perspective, essentially based on the inspection of data, on whether or not there could be a relation between the usage (intensity) of the IRB method and savings in RWAs.

The examination of the EBA dataset reveals significant differences between countries in terms of the distribution of total credit exposure across sub-portfolios, percentage of exposure subject to the IRB approach, and savings in RWAs by the use of the IRB approach instead of the SA method. For the sample of countries under study, we also observe positive correlation between the savings in RWAs that can be achieved by the application of the IRB approach, and the percentage of exposure that falls under this method.

The investigation of the savings in RWAs includes the construction and use of an indicator that measures the *ex-post* realization of the *ex-ante* incentives that banks have to use the IRB approach instead of the SA method. From this metric, we observe that the gap in terms of RWA density between IRB and SA portfolios may be suggesting two alternative conclusions:

1 The dataset used in this article is public and it can be found at the following link: http://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014/results.

The density of RWAs in IRB portfolios is too low. These advanced models offer the possibility of saving RWAs (and therefore reducing capital requirements) to the banks that have effective access to them. Banks, looking for a more adequate risk-related approach to calculate their capital requirements, could have been using, to some extent, the IRB method with the aim of reducing their required capital. On the other hand, it may be the case that the density of RWAs in SA portfolios is not measuring properly the actual risk of those exposures, probably because of its excessive simplicity, which results in inaccurate capital requirements under this method. In that respect, the IRB approach could be considered as the method capable of correcting the measurement deficiencies found in SA portfolios and, as a result, producing more adequate capital requirements, capturing the inherent risk existing in each credit portfolio.

These two opposing conclusions imply, however, that the system for calculation of RWAs in Basel III, which is based on the dichotomy between the SA and IRB approaches, creates dysfunctions in risk-based capital requirements and probably induces incentives for regulatory arbitrage.

Before going any further, it may be worth recalling that Basel II implied a complete rupture with Basel I in terms of how RWAs were calculated. The idea of computing capital requirements to account for the real risk behind credit exposures, was the main reason driving the regulatory reform of Basel II.

Basel II introduced two possibilities for banks to calculate their capital requirements. The first one, called the Standardized Approach (SA), though simple, implied a different vision and measurement of risk with respect to the former regulatory situation. Credit exposures were classified in distinct categories based on the risk of borrowers, either as measured by external ratings, or as determined by the type of exposure. Alternative to the SA, the IRB Approach changed completely the philosophy behind the calculation of the RWAs. This approach relied on the capability of banks to calculate their own credit risk parameters, which plugged into the IRB capital formulae, produced the final capital requirements. Basel II was intended to obtain a more accurate and adequate relation between inherent risk of credit portfolios and required capital derived from them.

The implications of Basel II were not only in terms of risk, but also in terms of development of IT and database systems by private banks, and validation procedures by supervisors. The latter were required to adapt their methods and procedures to validate the approaches used by banks to calculate their RWAs.

After the recent financial crisis, bank capital regulation has been thoroughly revised, leading into the new Basel III framework. This reform has increased the amount and quality of eligible capital elements, with the aim of reinforcing banks' capital structure. In addition, further capital buffers are also required (capital conservation buffer, counter-cyclical capital buffer, etc.). However, Basel III did not include substantial changes in the computation of RWAs defined in Basel II.

Consequently, the measurement of credit risk, in particular, the computation of RWAs, is still a relevant factor of the bank capital framework, and its analysis of great importance. In this regard, other regulatory authorities have conducted studies of the implementation of the IRB method and the characteristics of RWAs. The Basel Committee in BCBS (2013) analyzes in a top-down framework the impact of RWA computation method and portfolio composition. They find that methodological choices have an impact on RWA density,

which is not driven exclusively by fundamental risk factors. Additionally, this study of the Basel Committee also considers a hypothetical portfolio exercise (HPE) in which banks are required to compute RWAs for a portfolio with known characteristics by the regulator. This HPE is an eminently bottom-up exercise. The Financial Supervisory Authority (FSA) in the UK also conducted HPE exercises in 2007 and 2009, as documented in FSA (2010), showing that different banks appraised differently the credit risk of the same given portfolio with characteristics controlled by the regulator.

EBA also conducted an analysis of the consistency of RWAs after the stress test of 2011. In EBA (2013a), a top-down analysis of RWAs and expected losses is conducted for the banking book, with higher emphasis on exposures under the IRB method. The study of EBA aims to relate individual bank differences in terms of RWA density to different factors including RWA computation method. EBA finds that fundamental risk factors are an important driver of RWAs, but that other factors are also relevant. EBA (2013b and 2013c) present complementary analysis for large exposures portfolios, SMEs and mortgages. Additional descriptive studies from regulatory authorities include Le Leslé and Avramova (2012) and Ledo (2011), which carry out international comparisons of RWAs across different countries. Arroyo *et al.* (2012) comment on the limits of the comparison of RWAs across banks and jurisdictions. The new dataset provided by the EBA makes possible to perform an updated analysis with a high level of granularity and a more homogenous dataset.

To the best of our knowledge, the academic literature studying the effect of RWA computation methods on RWA density is relatively scarce. Bruno *et al.* (2015), Mariathasan and Merrouche (2014) and Beltratti and Paladino (2013) analyze the relation of RWA density and use of IRB with bank level variables. These articles generally rely on panel data constructed partially from Pillar 3 reports, and face some limitations in terms of break-down of credit exposures. Behn *et al.* (2014) analyze data on German firms and provides an interesting example of the use of micro data at the loan level to control for fundamental risk and isolate the effect of the method used for RWA computation.

Going back to our analysis based on the EBA data, we find several stylized facts regarding RWAs and the use of the IRB method. For Spanish banks in the sample, compared with banks in other countries, it can be said that their credit portfolios are characterized by: I) a high relative weight of the retail portfolio (40.9% of the total portfolio in Spain compared to 31.2% in the entire sample of countries); II) a lower use of the IRB approach (42% of the credit exposure in Spain is subject to the IRB approach compared with 62% for the total sample); III) and significant savings in RWAs calculated under the IRB approach instead of the SA method, although lower than the savings obtained by banks in other sample countries. Compared with the RWAs resulting from the application of the SA, the use of the IRB method in Spain produces reductions in RWA density of 16% and 43% for the total and the private sector portfolios respectively, whereas the application of the IRB method in the total sample of countries is associated with relative reductions in RWA density of 23% and 52% in these same portfolios. Netherlands, the United Kingdom and France present all significant savings in regulatory capital associated with the use of the IRB approach, compared with the capital requirements calculated with the SA method. These countries also display high actual effective use of this method in the private sector portfolio.

The analysis of the exposures abroad of the banks in our sample provides results comparable to those obtained with data on total exposures. The majority of international exposures is also subject to the IRB approach, and there is a relation between the use of the IRB

approach and lower RWA density associated with this method. Western Europe and USA concentrate the majority of the international exposure portfolios; though some countries are exposed to other geographies, e. g., Spanish banks hold significant exposures to Latin America and UK banks have a sizeable presence in Asia Pacific. Exposures in developed economies are more likely to be subject to the IRB approach than exposures in emerging economies such as China or Latin America.

The structure of the rest of the article is as follows. Section 2 analyzes the composition of credit portfolios by sector and method of calculation of RWAs. Section 3 presents a detailed analysis of exposures, the use of IRB and SA computation methods for RWAs and RWA density for different sectoral portfolios. Section 4 analyzes the main international exposures of the banks in the sample. Section 5 introduces policy discussion based on the analysis of the correlation of the use of the IRB approach and the savings in RWA density associated with this methodology. Section 6 gathers concluding remarks.

2 Composition of Credit Portfolios

2.1 SECTORAL COMPOSITION

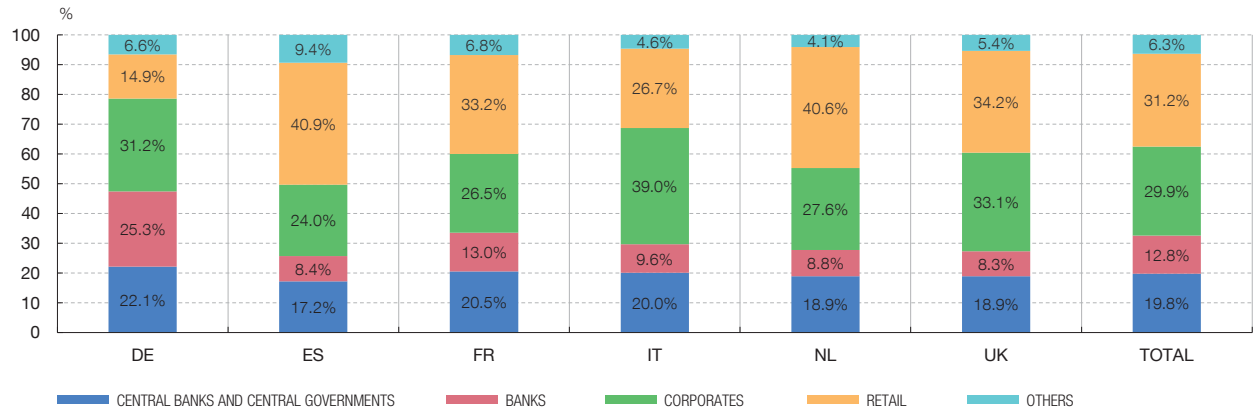
In this section, we firstly identify the weights of the different portfolios analyzed over total credit exposures. The examined portfolios include: Central Banks and Central Governments, Banks, Corporates and Retail. Additionally, there is an others category that includes exposures to equity instruments, securitizations and other assets that are not debt obligations.

In Chart 1 and in the rest of charts in this section, a bar is shown for each country, presenting the relative weights of different portfolios over total exposure in that country. Additionally, we also present a bar for the total sample portfolio, which is obtained as the sum of the portfolios of the different countries that form the sample.

Chart 1 shows that the retail and corporate portfolios represent the highest portions of credit exposure in the total sample. The relative weights of these two portfolios are practically identical (approx. 30%) and represent jointly over 60% of the total credit exposure. For Spain, the retail portfolio accounts for 41% of total exposure, above the weight observed in the rest of countries. The corporate portfolio in Spain represents only 24% of the total exposure, which is the lowest weight for the countries considered. For Germany, it is noteworthy that the exposures to the public sector and banks represent almost 50% of the total credit portfolio.

COMPOSITION OF THE TOTAL CREDIT PORTFOLIO BY COUNTRY
December 2013

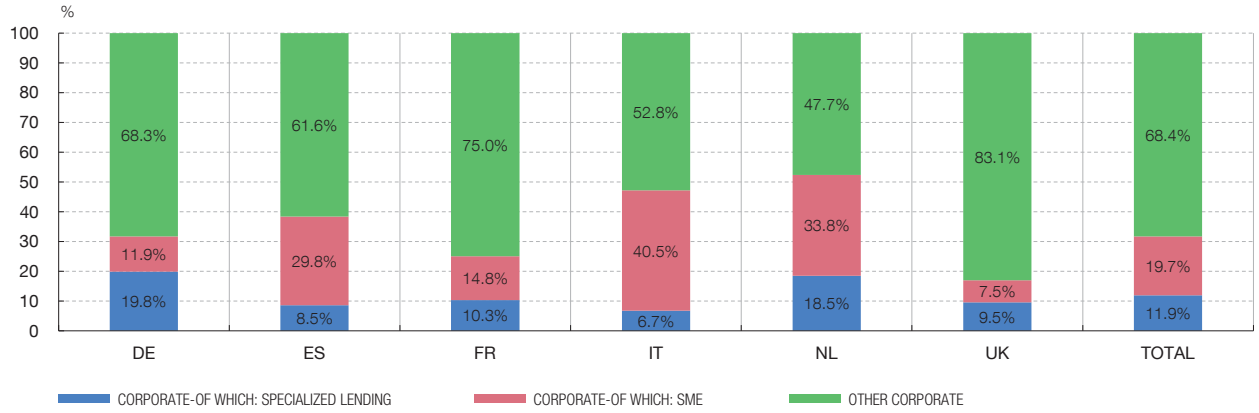
CHART 1



SOURCE: European Banking Authority.

COMPOSITION OF THE CORPORATE CREDIT PORTFOLIO BY COUNTRY
December 2013

CHART 2



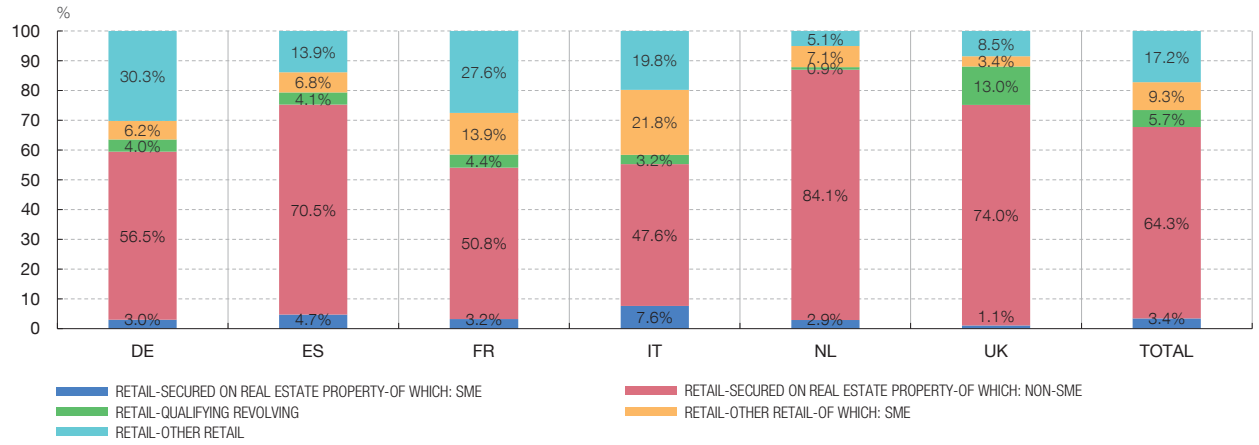
SOURCE: European Banking Authority.

Chart 2 shows the composition of the corporate portfolio, distinguishing between specialized lending, SMEs, and other corporates. Globally, the weights of exposures to specialized lending (11.9%) and SMEs (19.7%) are significantly lower than the weight of the exposure to other corporates (68.4%). The proportions of the corporate sub-portfolios in Spain are similar to those found in the total sample, but with a higher relative weight of the SME portfolio (29.8%). Germany (11.9%) and the UK (7.5%) have the lowest weights for the SME portfolio.

Chart 3 presents a breakdown of the retail portfolio into the following sub-portfolios: credit to SMEs secured with real estate property, credit excluding SMEs secured with real estate property (basically, mortgages to individuals), qualifying revolving, and other retail (both to SMEs and to individuals). We observe that, for the entire sample of countries, 64.3% of the retail portfolio is formed by credit to individuals secured with real estate property. In Spain, this percentage reaches 70.5%, surpassed only by the Netherlands (84.1%) and the UK (74%). France (50.8%) and Italy (47.6%) are the countries where the retail portfolio is more weakly connected to the portfolio of individuals secured by real estate property.

COMPOSITION OF THE RETAIL CREDIT PORTFOLIO BY COUNTRY
December 2013

CHART 3



SOURCE: European Banking Authority.

2.2 CALCULATION METHODS FOR RWAs

We classify credit exposures in this section according to the method used to calculate RWAs. Chart 4 presents the breakdown of the total credit portfolio into exposures subject to the SA and IRB methods. The percentage figures in the upper part of Chart 4 indicate the RWA density over total exposure, whereas the percentage figures within each bar indicate the fraction of the exposure that is classified either as IRB, or as SA.

RWA density over total exposure is 36% for the total sample of countries and 44% for the case of Spain. None of the countries incorporated into the analysis has a density greater than that of Spain. For the total sample, 62% of credit exposures use the IRB approach for calculating RWAs, while this percentage drops to 42% in the case of Spain. The Netherlands is the country for which its banks have the highest percentage of exposure subject to the IRB approach (84%).

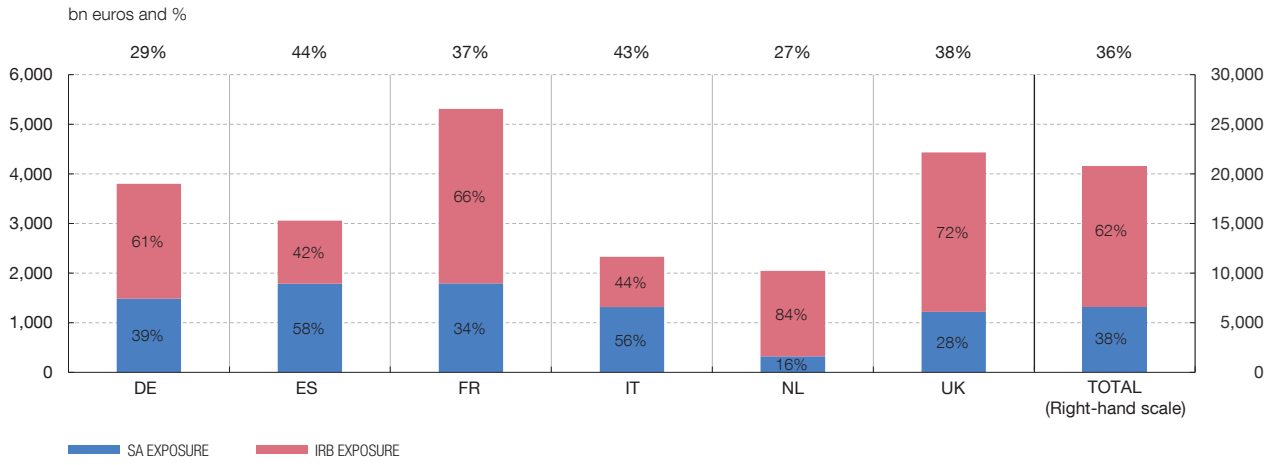
As shown in Chart 4, Spain is, with approximately 3,000€ billion, the fourth country by exposure size after France, the United Kingdom and Germany, but still ahead of Italy and the Netherlands. This observed distribution is partly due to the fact that the data for each country do not include its entire banking system, but only those banks that fall under the direct supervision of the SSM. The rightmost column provides the amount of exposure for the total sample (approx. 20,000€ billion), with the corresponding scale on the right axis.

Chart 5 separates total credit exposures as a function of the method used to compute RWAs, SA or IRB. This chart provides for each type of exposure in each country the volume of RWAs in a blue bar (scale on the left axis) and the excess of credit exposure over RWAs in a pink bar. The total height of the bar that results from piling up the bars of RWAs and the excess of credit exposures over RWAs informs thus of the size of the total credit exposure. The percentage within each bar indicates the density of RWAs. This same information is provided for the aggregate of the total sample (scale on the right axis).

In the total sample, the RWAs of the exposures subject to the SA approach reached a volume of 3,300€ billion out of a total exposure of 7,900€ billion, implying a RWA density of 43%. Exposures subject to the IRB approach reached 13,000€ billion, with RWAs of 4,200€ billion, and therefore with a density of 33% (a difference of ten percentage points

EXPOSURE AMOUNTS, DISTRIBUTION BY IRB AND SA APPROACHES, RWA DENSITY. TOTAL CREDIT PORTFOLIO
December 2013

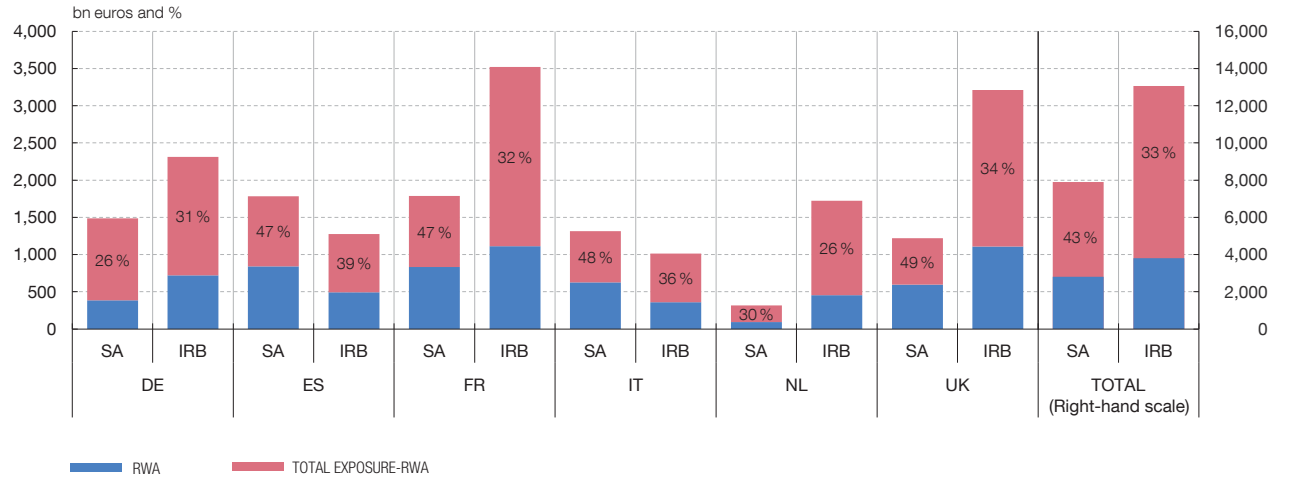
CHART 4



SOURCE: European Banking Authority.

EXPOSURE AMOUNTS, RWAs AND RWA DENSITY BY IRB AND SA. TOTAL CREDIT PORTFOLIO
December 2013

CHART 5



SOURCE: European Banking Authority.

with respect to the SA exposures). For Spain, the RWA density is higher than that observed for the total sample, with values of 47% and 39% for the SA and IRB exposures. For Germany, the RWA density observed in exposures subject to the IRB approach (31%) is greater than that of exposures under the SA approach (26%). The result in the German case is driven by the exposures to central banks, central government and banks, as shown in more detail in Section 3.

3 Portfolio Analysis

This section presents details of the distribution of exposures and RWAs by country for the various portfolios considered. In each subsection, a portfolio is analyzed and two figures are presented. The first figure shows, for the individual countries and the total sample, total RWAs, the excess of total credit exposure over total RWAs and the corresponding RWA density. The second figure includes this same information, with disaggregation according to the method used to calculate the RWAs, SA or IRB. Each figure shows a bar by country and, when applying, the approach used to calculate RWAs. Within each bar, we distinguish by color RWAs (blue bar) and the excess of credit exposure over RWAs (pink bar), and the corresponding RWA density is also indicated as a percentage number. The total height of each bar denotes the size of the total credit exposure. As in previous figures, an additional bar is included with the data for the aggregate of all countries, which is referenced to the right axis.

3.1 CENTRAL BANKS AND CENTRAL GOVERNMENTS

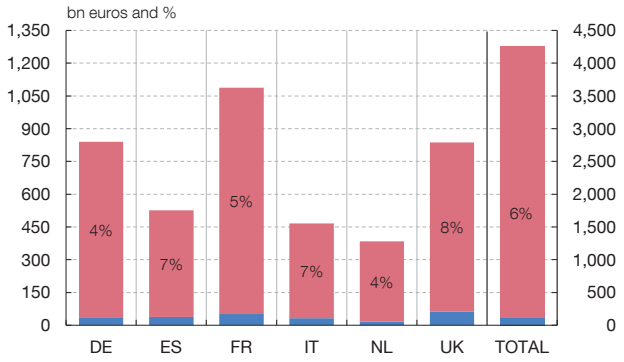
The portfolio of central banks and central governments presents a RWA density over total exposure of 6% for the total sample and 7% for the case of Spain, as shown in Chart 6.1. The exposure volumes for this portfolio in the total sample and in Spain amount, respectively, to approximately 4,100€ billion and 500€ billion.

RWA densities for exposures under the SA and IRB approaches are respectively 5% and 7% in the total sample (Chart 6.2). In the case of Spain, the RWA density of SA exposures is 7%, slightly higher than in the total sample, and the RWA density of IRB exposures is 25%, which is the highest value in the whole sample. In Spain, the volume of IRB exposures in the portfolio of central banks and central governments is minimal, which makes less relevant this high RWA density. For the entire sample, the SA approach is also predominant, with approximately 2,400€ billion in SA exposures and only 1,700€ billion in IRB exposures.

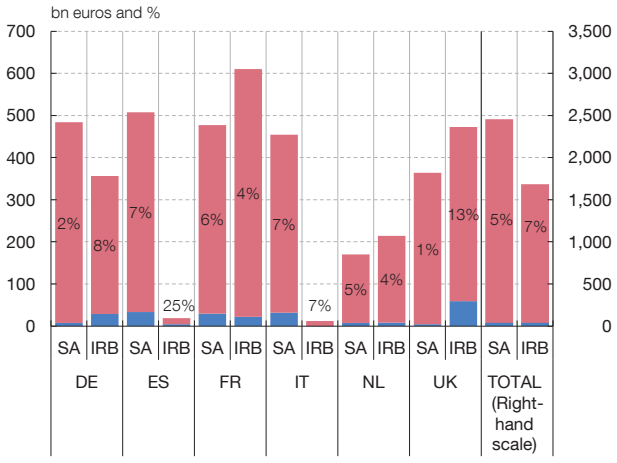
CENTRAL BANKS AND CENTRAL GOVERNMENTS PORTFOLIO

CHART 6

1 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
December 2013



2 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY BY IRB AND SA
December 2013



SOURCE: European Banking Authority.

3. 2 BANKS

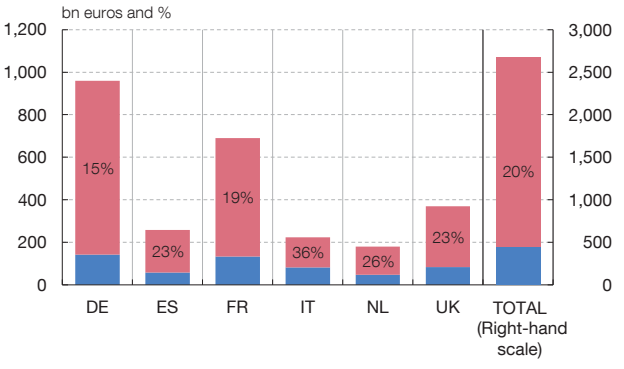
The bank portfolio has a RWA density of 20% for the total sample and 23% in the case of Spain (Chart 7.1), only second to the Netherlands (26%) and Italy (36%). The exposure volume in this portfolio is approximately 2,700€ billion for the total sample and 260€ billion for Spain.

Distinguishing between standard and IRB exposures, the RWA density in the total sample is 18% for the former and 23% for the latter (Chart 7.2), with similar volumes of around 1,400€ billion for both types of exposure. In the case of Spain, RWA densities are similar under both methods: 23% in SA and 22% in IRB. The exposure volumes that fall under each method are also quite similar and close to 100€ billion.

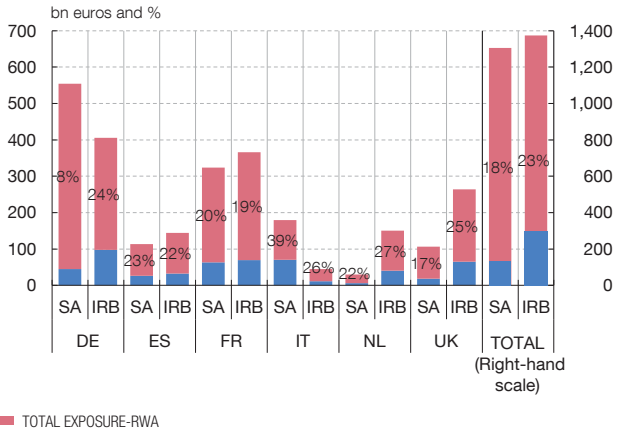
BANK PORTFOLIO

CHART 7

1 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
December 2013

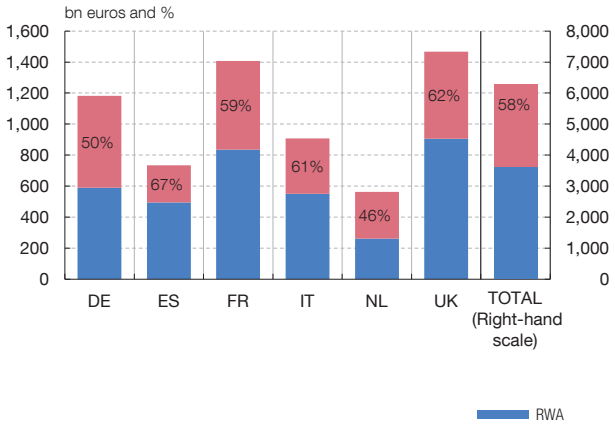


2 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY BY IRB AND SA
December 2013

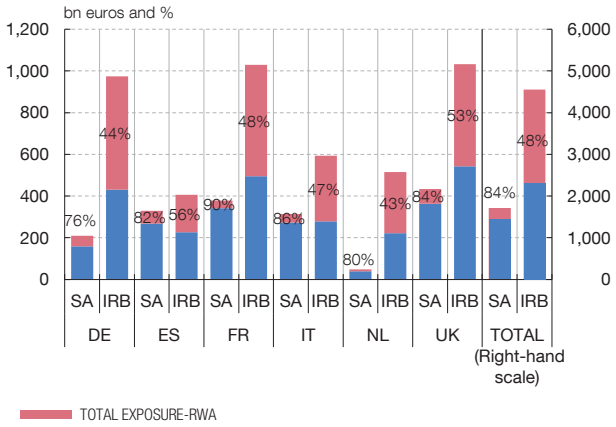


SOURCE: European Banking Authority.

1 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
December 2013



2 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY BY IRB AND SA
December 2013



SOURCE: European Banking Authority.

3.3 CORPORATE PORTFOLIO

The corporate portfolio has a RWA density of 58% in the total sample, while RWA density in this portfolio reaches 67% in the case of Spain (Chart 8.1). The exposure volume in the total sample is slightly above 6,000€ billion, whereas Spanish banks have an exposure volume of 730€ billion. As shown in Section 2, the corporate portfolio can be divided into sub-portfolios: SME, specialized lending and other corporate. The latter sub-portfolio presents an exposure volume above 4,200€ billion and it represents the greatest portion of the corporate portfolio.

Examining the method used for computation of RWAs, the volume of exposure under the IRB approach in the total sample (approx. 4,600€ billion) is higher than that under the SA approach (approx. 1,700€ billion), showing that advanced models are widely used for this type of exposures. RWA density for the total sample reaches 48% for IRB exposures and 84% for SA exposures (Chart 8.2). The observed average RWA densities in Spain are similar to those of the total sample and take values of 56% for IRB exposures and 82% for SA exposures. The exposure volumes (approx. 400€ billion) under each method are relatively close in Spain, unlike in the rest of countries, where the predominance of the IRB method is clear (Chart 8.2).

3.4 RETAIL PORTFOLIO

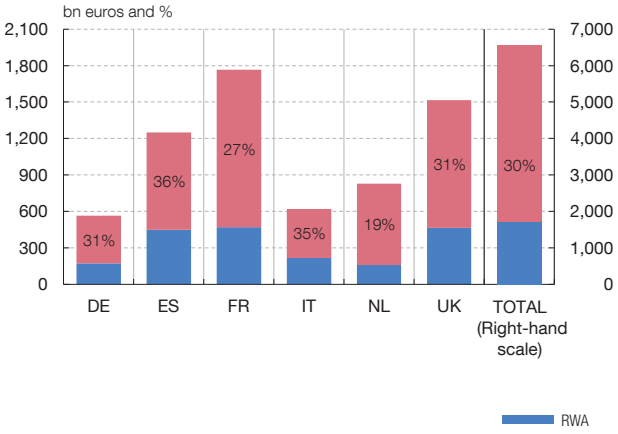
In the total sample, the RWA density for the retail portfolio is 30%. With 1,200€ billion, Spain is among the countries with the highest credit volume concentrated in this portfolio, just behind France and the United Kingdom (Chart 9.1). RWA density is 36% for retail exposures in Spain, higher than that observed for the total sample. Credit exposures secured on real estate property (approx. 4,500€ billion in the total sample) dominate the retail portfolio and they are analyzed separately in the following section.

Breaking down the total exposure volume by the type of computation method for RWAs, exposures under the IRB approach (approx. 5,000€ billion) more than double the exposure volume under the SA approach (approx. 1,600€ billion). RWA density in the total sample is 21% for exposures under the IRB approach and 55% for exposures under the SA approach. In Spain, the volumes of SA and IRB exposures are closer (approx. 600€ billion), but differences remain in terms of RWA densities: 51% for SA exposures and 23% for exposures under the IRB approach.

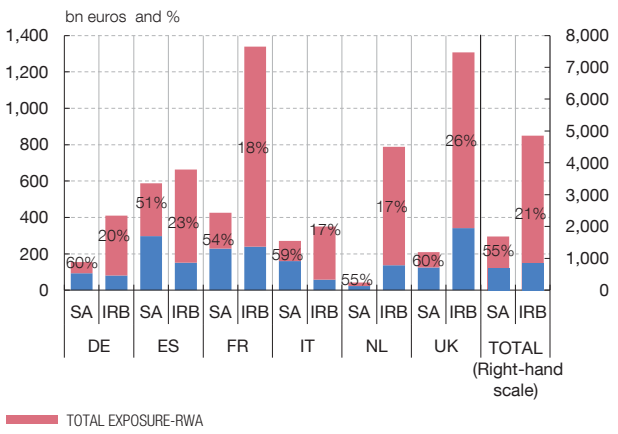
RETAIL PORTFOLIO

CHART 9

1 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
December 2013



2 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY BY IRB AND SA
December 2013



SOURCE: European Banking Authority.

3.5 RETAIL EXPOSURES SECURED ON REAL ESTATE PROPERTY

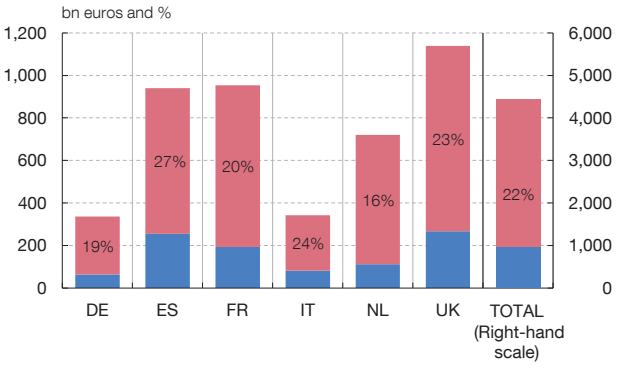
For retail exposures secured on real estate property, we observe a RWA density of 22% in the total sample (Chart 10.1). Spain is among the countries with the highest amount of exposure in this portfolio with nearly 1,000€ billion, which is only below the volume observed for France and the UK. The average RWA density is 27% in Spain, above the RWA density in the total sample. Most of the retail portfolio secured on real estate property originates from exposures to individuals through home mortgages (approx. 4,200€ billion) rather than SMEs (approx. 200€ billion).

Chart 10.2 shows that the volume of exposure under the IRB approach in the total sample (approx. 3,500€ billion) is far higher than the volume of exposure under the SA approach (less than 1,000€ billion). For the total sample, RWAs density is only 17% in exposures under the IRB approach and 42% in exposures under the SA approach. In Spain, the volumes of SA exposures (approx. 400€ billion) and IRB exposures (approx. 600€ billion) are different, although the relative distance is less than that observed in the total sample. For the Spanish case, the RWA density under the SA approach (40%) doubles the RWA density observed on IRB exposures (20%).

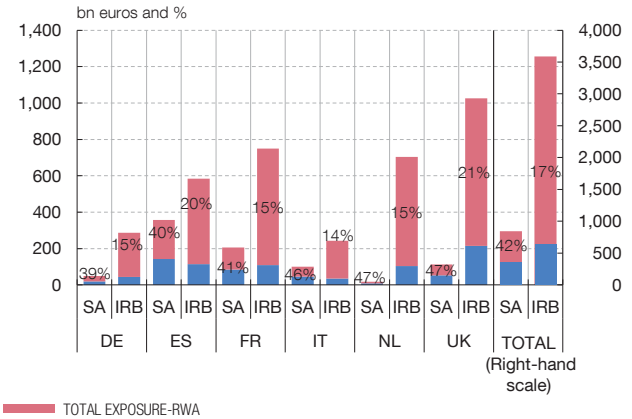
RETAIL PORTFOLIO-SECURED ON REAL ESTATE

CHART 10

1 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
December 2013

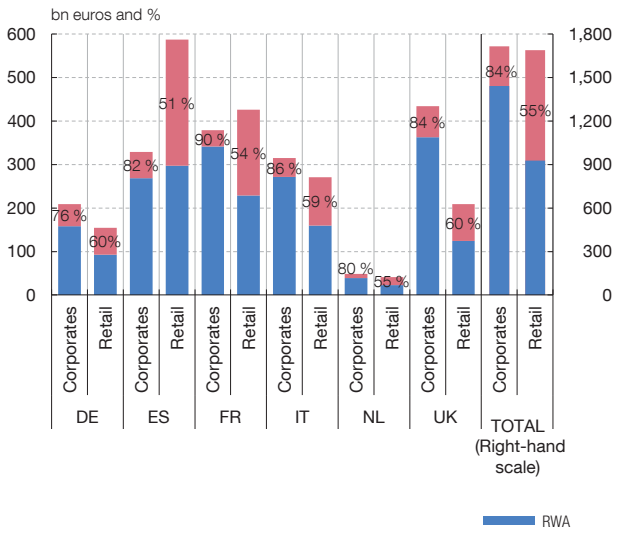


2 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY BY IRB AND SA
December 2013

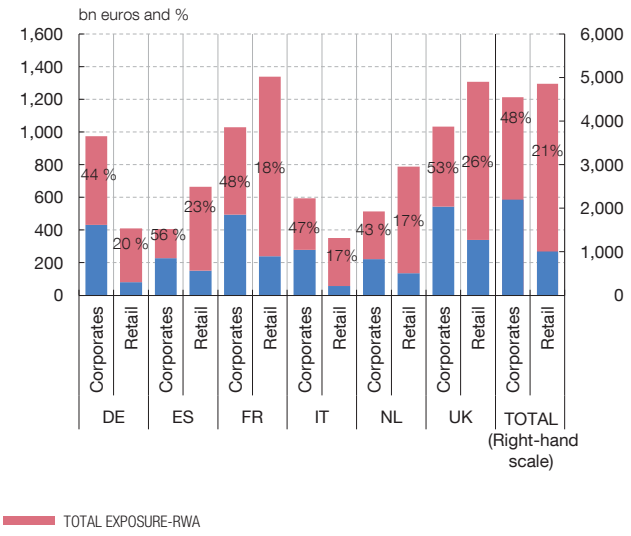


SOURCE: European Banking Authority.

1 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
EXPOSURES SUBJECT TO THE SA METHOD
December 2013



2 EXPOSURE AMOUNTS, RWAs AND RWA DENSITY
EXPOSURES SUBJECT TO THE IRB METHOD
December 2013



SOURCE: European Banking Authority.

3.6 COMPARISON OF THE CORPORATE AND RETAIL PORTFOLIOS

The corporate and retail portfolios represent a significant fraction of the exposure volume in the total credit portfolio of Spanish banks. Therefore, it is worth conducting a direct comparison of these two portfolios in terms of total exposure, RWAs and RWA density.

In the first place, we analyze the exposures under the SA approach (Chart 11.1). Spain has the highest exposure under the SA method in the retail portfolio among the countries in the sample (approx. 600€ billion). As regards RWA density, the Spanish corporate portfolio is similar to those of other countries (RWA densities over 80%), while the RWA density for the retail portfolio is slightly below that of the total sample, 51% versus 55% and relatively lower than that of Germany and the United Kingdom, 60%.

For exposures subject to the IRB approach (Chart 11.2), France and the UK have the highest volume of exposure in the retail and corporate portfolios. In terms of RWA density, there are important differences with respect to the SA approach, both in the corporate and retail portfolios. In the total sample, the density of RWAs is 84% for the corporate exposures under the SA method and 48% for the corporate exposures under the IRB approach. For the retail portfolio, RWA densities are, respectively, 55% and 21% for exposures subject to the SA and IRB approaches (see Charts 11.1 and 11.2). Comparing the RWA density in Spain and in the total sample for exposures subject to the IRB approach (Chart 11.2), we observe that the corporate portfolio has a RWA density of 56% for the Spanish banks compared with 48% in the total sample. The RWA density of the retail portfolio under the IRB approach is slightly higher for Spanish banks (23%) than in the total sample (21%).

4 International Exposures of European Banks

This section examines the international exposures of the banks in the selected sample. Section 3 focused on the study of total credit exposures, which provide information on the global distribution and treatment of banks' RWAs. However, major European banks are internationally active and diversified, and we would expect to find non-negligible international exposures for some banks in our sample. It is then of interest to identify whether international exposures present distinctive patterns in terms of IRB use or RWA density.

For each country in the sample, we analyze in this section the geographical locations in which its banks concentrate the largest foreign credit exposures. The total volume of international exposures covered by this analysis is substantial, with a total exposure size of 4,700€ billion euros, which represents around 25% of the approx. 20,000€ billion euros of total exposures that were analyzed in sections 2 and 3 (see charts 4 and 5). The proportion of IRB exposure over total exposure is 66% in the international portfolio, which is above the IRB proportion of 62% observed in the overall portfolio.

For each country in the sample, Chart 12 presents data on the five largest cross-border exposures: total volume of exposure disaggregated according to the method used to calculate the RWAs, SA or IRB, total amount of RWAs, and RWA density. For each country of exposure, the blue bar provides total RWAs, the pink bar provides the excess of credit exposure over RWAs and the piling up of the two bars informs of the total credit exposure in the corresponding country. The figure within each bar shows the RWA density

The five highest cross-border exposures for Germany, as shown in panel 1 of Chart 12, are located in the USA, UK, France, Italy and the Netherlands. The largest exposure (298€ billion euros in the USA) more than triples the smallest exposure (78€ billion euros in the Netherlands). The majority of these exposures falls under the IRB approach. The use of the IRB approach is especially intense in the USA, UK and France. The density of RWAs under the SA approach is higher than that of the IRB in the USA, the UK and the Netherlands, whereas the reverse holds for France and Italy. The savings in RWAs are largest for the sizeable exposure in the USA, with RWA densities of 48% and 21% for SA and IRB exposures in that country.

The five most relevant cross-border exposures for Spain, as shown in Chart 12 (panel 2), are located in the UK, the USA, Brazil, Mexico and Chile. SA exposures amount to 453€ billion euros, whereas IRB exposures stay at 306€ billion euros. The prevalence of the SA approach that we observed in the total exposures of Spanish banks also holds in their international portfolio. For the UK, the RWA density of SA exposures more than doubles the RWA density of IRB exposures, but this level of RWA savings is not observed in other countries. For example, RWA density is similar for IRB and SA exposures in the USA and Brazil, and the RWA density of IRB exposures is 30 percentage points above the RWA density of SA exposures in Mexico.

As in the case of German banks, the largest cross-border exposure of French banks in our sample is concentrated in the USA (425€ billion euros). As shown in panel 3 of Chart 12, the majority of the credit exposure in the USA is subject to the IRB approach (77% of the USA credit exposure) and there is a big difference in the RWA density of exposures under the SA (52%) and the IRB (17%) approaches. French banks have also significant exposures in other European countries (Italy, Belgium, UK, Germany), where we generally observe lower RWA density in IRB exposures.

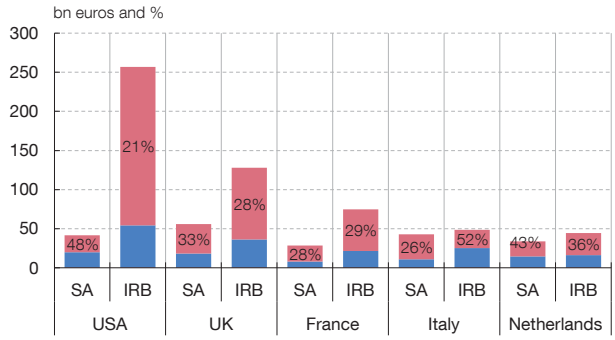
The panel 4 of Chart 12 reveals that Italian banks present a somewhat differentiated pattern with respect to the countries already commented. The exposure to the US is just the fifth largest for Italian banks, with a total size of 27€ billion euros, which is less than 10% of the total international portfolio of these banks. Italian banks have higher exposures in central Europe (Germany, Austria), Poland and Turkey. We do not find either a clear pattern of low RWA density associated with IRB international exposures of Italian banks. IRB exposures in Germany, Austria and Turkey are actually higher than SA exposures for the Italian banks.

The five largest international exposures of the Dutch banks present a pattern that is more comparable to the cases of Germany and France. The list of the largest exposures of

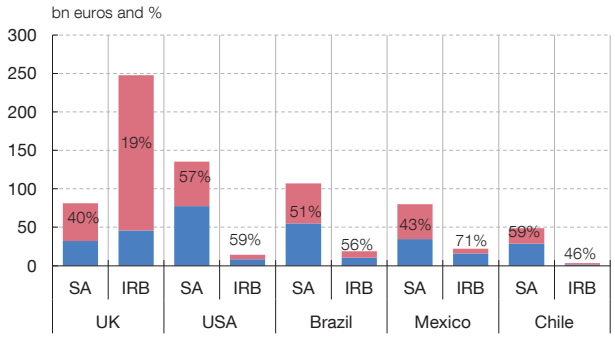
EXPOSURE AMOUNTS, RWAs AND RWA DENSITY INTERNATIONAL CREDIT PORTFOLIO
December 2013

CHART 12

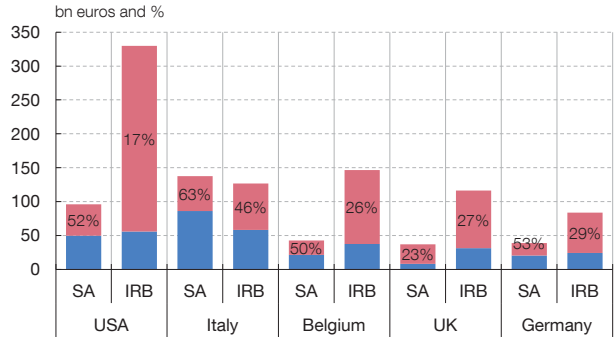
1 GERMANY – FIVE HIGHEST INTERNATIONAL EXPOSURES



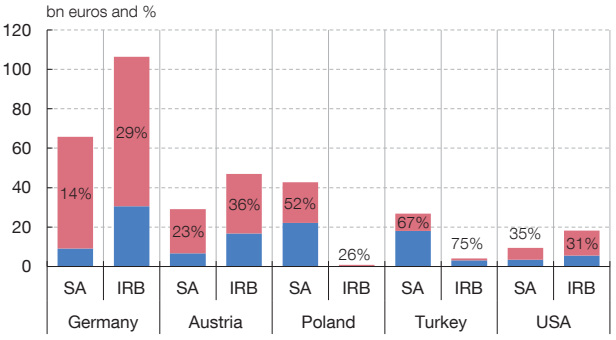
2 SPAIN – FIVE HIGHEST INTERNATIONAL EXPOSURES



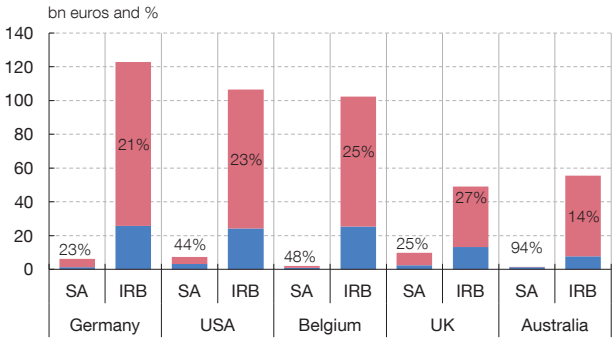
3 FRANCE – FIVE HIGHEST INTERNATIONAL EXPOSURES



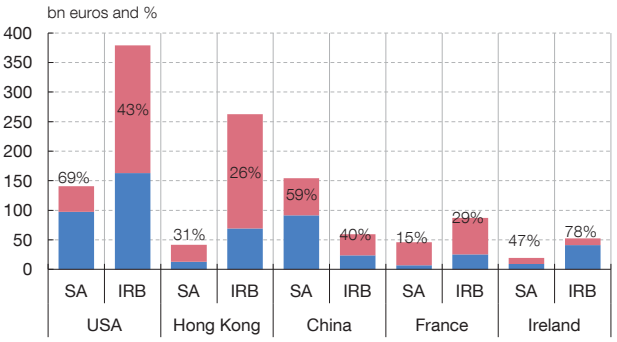
4 ITALY – FIVE HIGHEST INTERNATIONAL EXPOSURES



5 NETHERLANDS – FIVE HIGHEST INTERNATIONAL EXPOSURES



6 UNITED KINGDOM – FIVE HIGHEST INTERNATIONAL EXPOSURES



RWA TOTAL EXPOSURE-RWA

SOURCE: European Banking Authority.

Dutch banks in panel 5 of Chart 12 reveals a high exposure to the USA (114€ billion euros) and to a mix of European countries (Germany, Belgium, UK). The significant exposure to Australia is unique to the case of the Netherlands. As in the total portfolio, the IRB approach is applied practically to the entire portfolio. The RWA density of SA exposures is generally higher than that of IRB exposures, with the exception of UK.

The most significant international exposures for UK, as shown in panel 6 of Chart 12, are located in the USA, Hong Kong, China, France and Ireland. The majority (66%) of these exposures is located in the USA (520€ billion euros) and Hong Kong (304€ billion euros).

For the three largest countries of exposure (USA, Hong Kong and China), the RWA density associated with IRB exposures is clearly lower than that of SA exposures. On the contrary, RWA density of IRB exposures exceeds that of SA exposures in France and Ireland, which represent a much smaller fraction of the international portfolio of British banks.

The examination of the international portfolio of the banks in our sample provides then results comparable to the analysis of the total portfolio, with the prominence of the IRB approach across the sample and savings in RWAs associated with the use of this methodology. Countries that presented higher than average use of the SA approach (Spain) or the IRB approach (Netherlands) in the total portfolio also do so in the international portfolio. The USA and Western Europe concentrate international exposures of the banks in our sample, but we also observe other geographical patterns, such as the sizeable exposure to Latin America of Spanish banks or the presence of UK banks in Asia Pacific. The IRB method is more likely to be applied to exposures in advanced economies than in emerging countries, such as China or countries in Latin America.

5 Analysis of the Capital Policy of European Banks: The Link between the RWA Density of SA and IRB Exposures and the Intensity of Use of the IRB Approach

In this final section, we present a tentative analysis of banks' choices of computation methods of RWAs in different countries and portfolios. To this end, we study the link between the savings obtained by use of the IRB approach instead of the SA method and the percentage of credit exposures that banks have actually computed under the IRB approach.

We analyze the total portfolio of each country, the private sector portfolio, and its individual components: the retail portfolio and the corporate portfolio.[2] We conduct this separate study of the private sector portfolio because it represents the highest fraction of the credit portfolio in most countries. Additionally, we also aim to avoid distortions in the conclusions about the credit exposures in the private sector portfolio by filtering out the particular behavior of other portfolios (central banks, central governments and banks).

For each portfolio, we present two different figures. The first one is a scatter plot showing the relationship between the lower cost (savings) in terms of RWAs produced by the use of the IRB approach rather than the SA method, and the percentage that IRB exposures represent over total exposure. Each observation (point on the graph) refers to a portfolio (identified by the shape of the point) of a particular country (identified by the color of the point).[3]

The second figure shows a bar chart displaying four magnitudes for each country: (i) the weight that the portfolio under consideration represents over the total credit exposure of the country of its location; (ii) the relative savings in terms of RWA density produced by the use of the IRB approach instead of the SA; (iii) the weight of the exposures under the IRB approach over the total exposure of the portfolio, and, finally, (iv) an indicator that reflects the incentives for use and the actual intensity of use associated with the IRB approach in each country (the indicator is referenced to the right axis). The indicator combines and summarizes the information in the other three magnitudes in the graph. Countries are ordered in this diagram in terms of the RWA savings associated with the IRB approach.

2 In the corporate and private sector portfolios, specialized lending exposures are not included because they represent a very small percentage of total exposures (see Chart 2) and can distort the analysis of general trends. The portfolio of other exposures is also excluded from the total portfolio, as it covers credit products that are not comparable to those in other portfolios.

3 We do not plot the outliers observed for central banks and public sector (Spain, Germany and the United Kingdom), banks (Germany) and retail revolving and other retail (Italy), which distort the general pattern. Being only six extreme cases, it is possible to analyze them individually.

The indicator for RWA savings depends on three factors. The first factor, f_1, is defined as the relative savings in terms of RWA density produced by the use of the IRB approach instead of the SA:

$$f_1 = \frac{(\text{Density}_{SA} - \text{Density}_{IRB})}{\text{Density}_{SA}}$$

The second factor, f_2, is the percentage of exposure that it is not subject to the IRB approach, i.e., the percentage of exposure that falls under the SA approach:

$$f_2 = 1 - \%\text{Exposure}_{IRB}$$

The third factor, f_3, is the weight of the exposure under consideration over the total portfolio:

$$f_3 = \frac{\text{Exposure}_{Portfolio}}{\text{Exposure}_{Total}} = \text{Portfolio\_Weight}$$

For the study of the total portfolio, this factor is set to 100%.

The I indicator is then obtained as:

$$I = \frac{f_1}{f_2} \times f_3 = \frac{\dfrac{\text{Density}_{SA} - \text{Density}_{IRB}}{\text{Density}_{SA}}}{1 - \%\text{Exposure}_{IRB}} \times \text{Portfolio\_Weight}$$

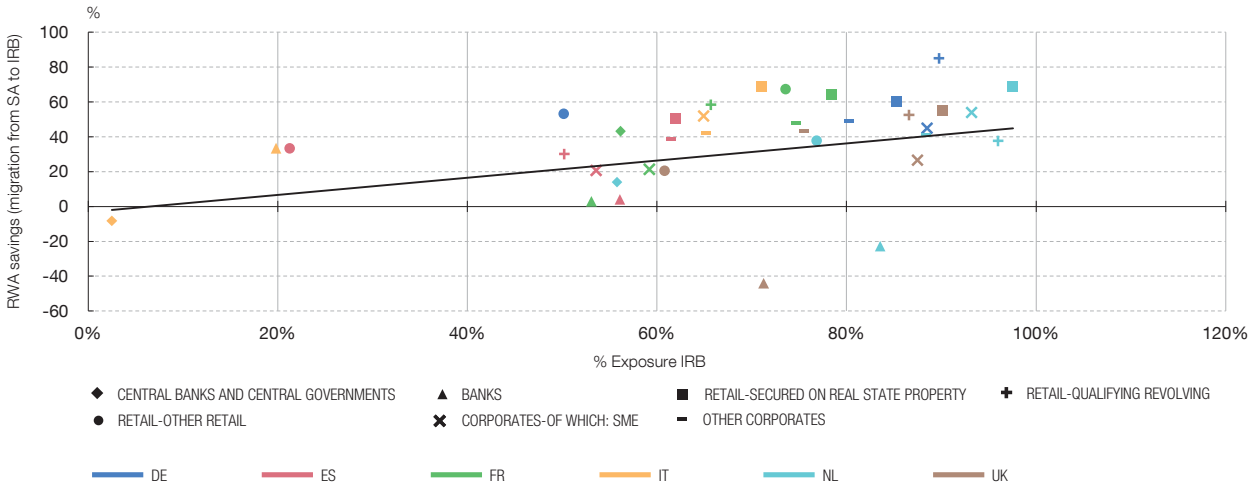
This indicator will be higher when the savings in RWA density for the IRB method are higher, the weight of the IRB approach within the type of exposure considered is higher, and the weight of the type of exposure considered over the total portfolio exposure is also higher. Similarly, low values of the indicator will be obtained if the RWA density savings for the IRB method are small, the weight of the IRB approach is reduced and the portfolio considered represents a small portion of the total exposure. The indicator informs about the incentives for using the IRB approach (f_1), as well as the intensity of effective use within the portfolio considered (f_2) and the total volume of exposure (f_3).

5.1 TOTAL PORTFOLIO

For the total portfolio (Chart 13), we observe a positive relation between the RWA savings produced by the use of the IRB approach, and the percentage that IRB exposures represent of the total portfolio. The correlation coefficient between these two variables is 0.38.

RELATION BETWEEN SAVINGS FOR THE IRB METHOD AND IRB USE
TOTAL CREDIT PORTFOLIO
December 2013

CHART 13



SOURCE: European Banking Authority.

PORTFOLIO WEIGHT, SAVINGS FOR THE IRB METHOD, IRB USE, AND INDICATOR FOR IRB SAVINGS
TOTAL CREDIT PORTFOLIO
December 2013

CHART 14

SOURCE: European Banking Authority.

Further analysis of RWA savings through IRB use in the total portfolio (Chart 14) reveals that countries that get higher savings by using the IRB approach, France (40%) and the UK (26%), have a high percentage of IRB exposure, 67% and 75%, respectively, only surpassed in volume by the Netherlands. Additionally, France and the UK are also the countries that score the highest values for the indicator.

The case of Germany is also worth noting, since it is the only country for which the IRB approach produces higher RWA density than the SA method, and this country concentrates 61% of its exposure under the IRB approach. This result is mostly due to the significant weight in the German credit portfolio of the central banks, central governments, and bank portfolios. The pattern of higher RWA density in IRB exposures does not appear if we examine exclusively the German private sector portfolio.

Spain presents relatively high RWA savings of 16% for use of the IRB approach instead of the SA method, but these savings are still seven percentage points below the average of the countries included in the study. Additionally, the weight of the Spanish portfolio under the IRB approach (approx. 45%) is 21% below the figure obtained for the total sample of countries (approx. 62%). The value of the indicator for Spain is the lowest in the sample after Germany, whose particular case was discussed above.

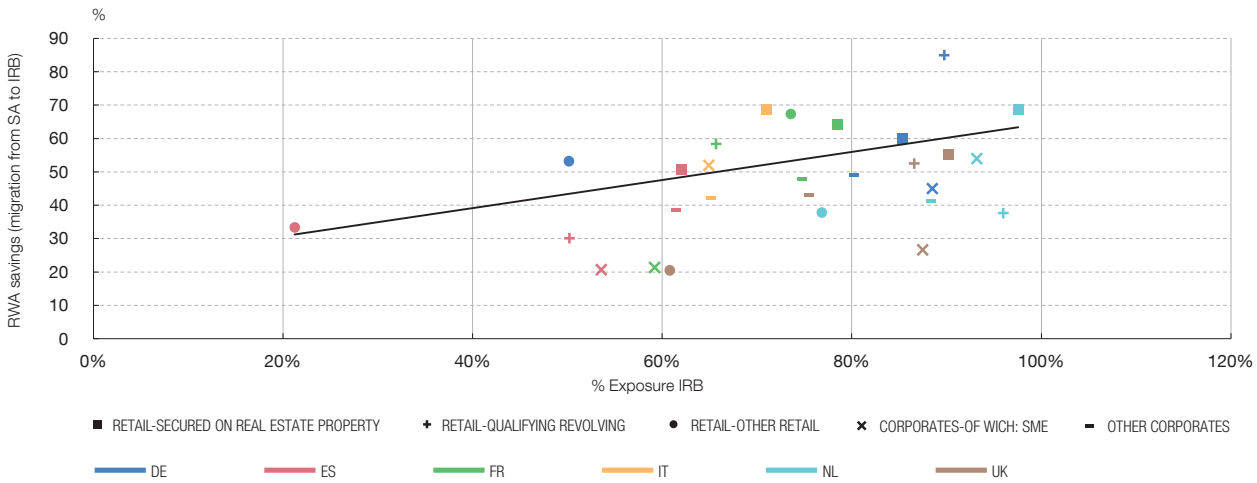
5.2 PRIVATE SECTOR

In the scatter plot in Chart 15 for the private sector portfolio (excluding central bank, central government and bank portfolios), we observe a positive relation between RWA savings and the intensity of use of the IRB approach. This positive relationship is more marked than that observed for the total portfolio. In fact, the correlation coefficient between these two variables is in this case 0.43.

In the private sector portfolio, the countries that obtain higher savings by using the IRB approach are the Netherlands, France and Italy, with relative RWA savings of 62%, 56% and 53% (Chart 16). The Netherlands has the vast majority of its private sector exposure subject the IRB approach (93%). For France and Italy, the percentages of exposure under the IRB approach are respectively 74% and 61%, both being surpassed slightly by Germany, which has 78% of its exposure under this approach (with relative RWA savings of 52% associated with the use of the IRB method). In terms of the value of the indicator, the case of the Netherlands stands out, followed by the UK and France.

RELATION BETWEEN SAVINGS FOR THE IRB METHOD AND IRB USE
PRIVATE SECTOR PORTFOLIO
December 2013

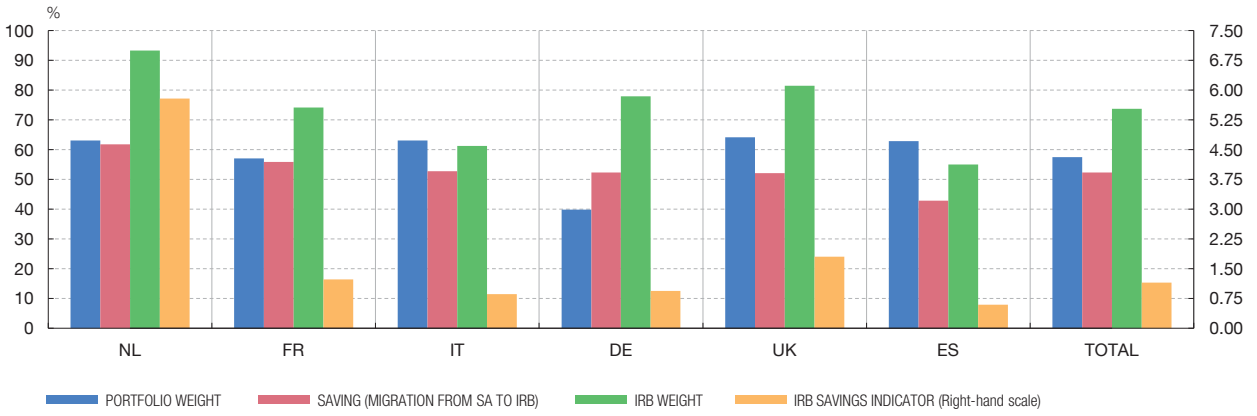
CHART 15



SOURCE: European Banking Authority.

PORTFOLIO WEIGHT, SAVINGS FOR THE IRB METHOD, IRB USE, AND INDICATOR FOR IRB SAVINGS
PRIVATE SECTOR PORTFOLIO
December 2013

CHART 16



SOURCE: European Banking Authority.

Spain presents relative RWA savings of 43% associated with the use of the IRB approach instead of the SA method, nine percentage points below the average RWA savings of 52% for all the countries in the sample. Additionally, the weight of the portfolio of Spanish banks under the IRB approach (approx. 55%) is nineteen percentage points below the average weight of the IRB portfolio for all the countries of the sample (approx. 74%). The value of the indicator for Spain is the lowest among all countries in the sample.

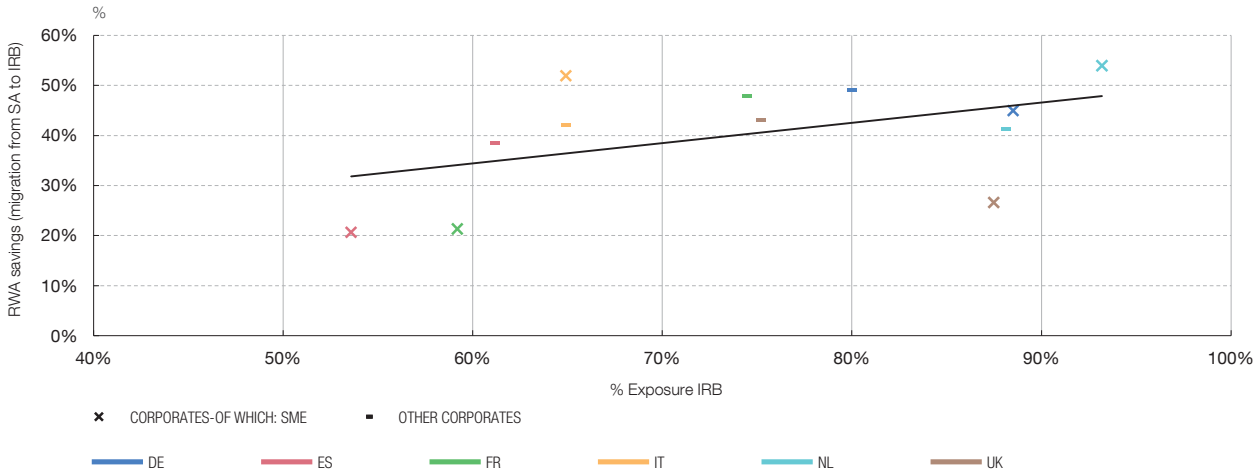
5.3 CORPORATE PORTFOLIO

In the corporate portfolio (Chart 17), we also observe a positive relationship between the RWA savings produced by using the IRB approach instead of the SA method, and the percentage of total exposure subject to the IRB approach. For this portfolio, the correlation coefficient between these variables is 0.47.

In the bar chart for the corporate portfolio (Chart 18), we find that the countries that present higher RWA savings associated with the use of the IRB approach are Germany, the Netherlands and Italy with 48%, 47% and 46%, respectively. Again, the Netherlands is the country that presents the highest use of the IRB approach, which represents 90% of

RELATION BETWEEN SAVINGS FOR THE IRB METHOD AND IRB USE
CORPORATE PORTFOLIO
December 2013

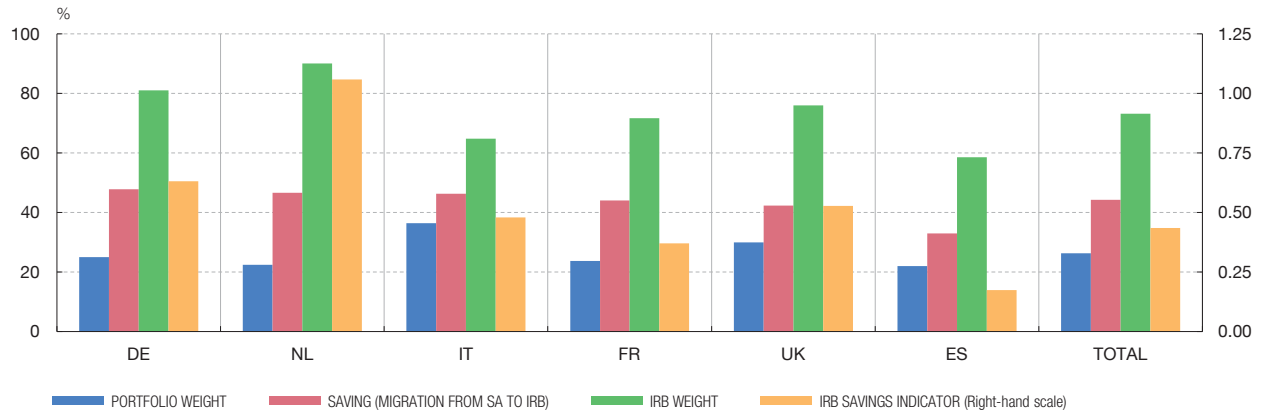
CHART 17



SOURCE: European Banking Authority.

PORTFOLIO WEIGHT, SAVINGS FOR THE IRB METHOD, IRB USE, AND INDICATOR FOR IRB SAVINGS
CORPORATE PORTFOLIO
December 2013

CHART 18



SOURCE: European Banking Authority.

its corporate exposure, followed by Germany with 81% and France with 72%. The indicator also takes maximum values for the Netherlands and Germany.

In the case of Spain, the relative RWA savings of 33% are eleven percentage points below the average of the countries in the sample (approx. 44%). The weight of the portfolio under the IRB approach in Spain is 59%, which is fifteen percentage points lower than that of the total sample (73%). Again, the value of the indicator for Spain is the lowest of all countries in the sample.

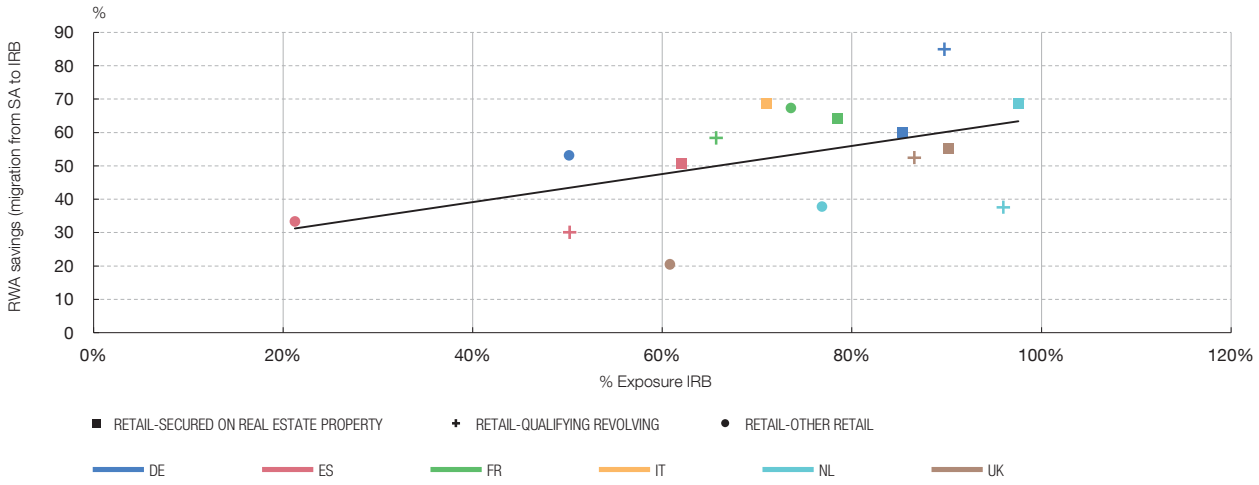
5.4 RETAIL PORTFOLIO

In the retail portfolio (Chart 19), we initially found that the relationship between the RWA savings produced by use of the IRB approach and the percentage of the portfolio under this method, although positive, was slightly flatter than in the corporate portfolio. However, after eliminating two Italian specific portfolios, which are outilers, we observe that the relationship is similar or even stronger than that found in the corporate portfolio.[4] In the retail portfolio, the correlation coefficient between these variables is 0.5.

4 As mentioned above, Italy presents observations that depart from the general trend in its revolving retail and other retail portfolios.

RELATION BETWEEN SAVINGS FOR THE IRB METHOD AND IRB USE
RETAIL PORTFOLIO
December 2013

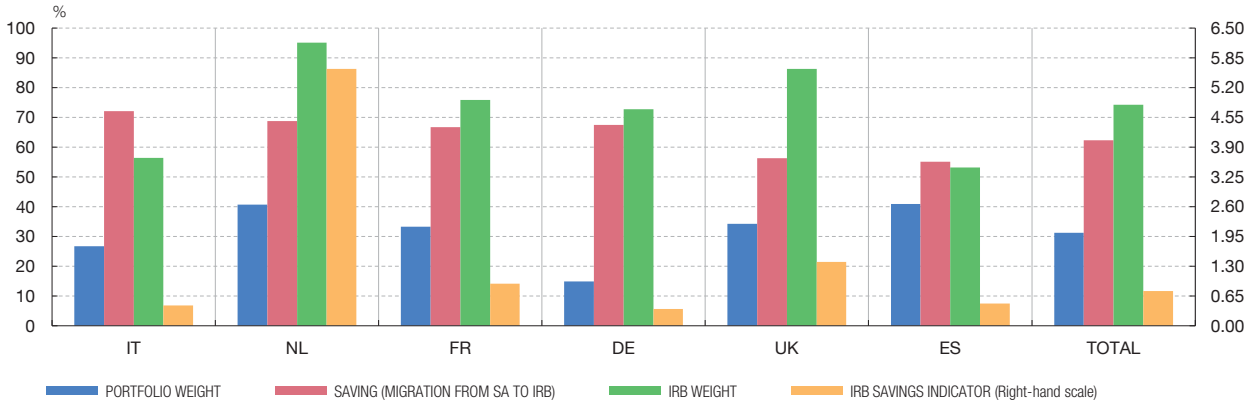
CHART 19



SOURCE: European Banking Authority.

PORTFOLIO WEIGHT, SAVINGS FOR THE IRB METHOD, IRB USE AND INDICATOR FOR IRB SAVINGS
RETAIL PORTFOLIO
December 2013

CHART 20



SOURCE: European Banking Authority.

In the bar chart of the retail portfolio (Chart 20), it appears that the countries that get higher RWA density savings by using the IRB approach are Italy and the Netherlands, with 72% and 69%, respectively. Again, the Netherlands is the country that has the highest percentage of exposure under the IRB approach, 95%, followed by the UK with 86% (which gets a relative RWA savings of 56% using the IRB approach) and France with 76% (whose relative RWA savings is 67%). As in previous portfolios, the indicator score stands out in the case of the Netherlands, followed by the UK and France.

In Spain, we observe a relative saving of 55% in RWA density, which is seven percentage points below the average of the countries in the sample. The weight of the portfolio under the IRB approach in Spain (53%) is twenty one percentage points below the average of all countries (74%). The value of the indicator in Spain is the lowest of all countries in the sample, along with Germany. The result for Germany is less significant given the low weight of the retail portfolio in this country (approx. 15%).

6 Concluding remarks

We have provided in the present work descriptive analysis of the dataset on credit exposures and RWAs disclosed by the EBA as a result of the comprehensive assessment of European banks in 2014. This analysis represents a first exploratory effort on the

methodological options of banks for RWA computation and the impact of these decisions on the measurement of credit risk through risk weights. Further analytical work is indeed necessary to determine precisely if the use of IRB is a cause for lower RWA density even after controlling for risk quality of exposures. However, the description of the data is exhaustive and it reveals a series of consistent patterns that must be examined with care.

The implementation of the IRB approach is in an advanced state for our sample of banks from the major European economies. More than half of the total credit exposure of these banks is subject to this method, which is also prominent in their largest international exposures. In particular, the IRB approach is generally prevalent in the corporate and retail portfolios that cover the majority of private sector exposures. Spain appears as an exception in the sample, as its banks present a more even distribution of their exposure between SA and IRB methods.

The IRB method is generally associated with lower RWA density for all sub-portfolios covering private sector exposures. This does not hold for exposures to the public sector or other banking firms, where exposures subject to the IRB method present, typically, higher RWA density than those associated with the SA approach. This result could be anticipated as an outcome of the implementation of advanced internal rating based models, where banks adopt the IRB approach if it provides an amelioration of their risk profile. This article contributes, however, with a quantitative measure of that improvement in terms of RWA density that was not available from that qualitative argument. Furthermore, we also find positive correlation between the intensity of use of the IRB method and the magnitude of the savings in terms of RWAs associated with this approach, which provides stronger evidence of the existence and influence of the incentives created by the regulatory introduction of advanced internal models.

We interpret these results firstly as a call for further research with more disaggregated data to better identify the effects of the introduction of the IRB methodology for the computation of RWAs and the corresponding capital requirements. Additionally, prudent evaluation and careful supervisory monitoring of the further extension of IRB methodology seems justified given the observed differences in RWA density resulting from the application of the IRB approach in private sector portfolios and the large size of the exposures concerned.

The regulation that introduced the IRB method did not foresee a permanent RWA density saving associated with this computation method, either globally or in specific portfolios. Even if an initial saving in RWA density could be expected as part of the adoption of the method, the finding of substantial differences in terms of RWA densities between SA and IRB exposures is significant. This calls for careful consideration of whether the IRB method affects the measurement of credit risk not only through fundamental risk factors, but also through methodological assumptions. This article and other studies performed by different regulatory authorities point out that this question is relevant and it has not been fully answered yet.

REFERENCES

ARROYO, J. M., I. COLOMER, R. GARCÍA-BAENA and L. GONZÁLEZ-MOSQUERA (2012). "Comparing Risk-Weighted Assets: The Importance of Supervisory Validation Processes", *Estabilidad Financiera,* No. 22, p.10, Banco de España.

BASEL COMMITTEE ON BANKING SUPERVISION (2013). *Regulatory Consistency Assessment Programme (RCAP): Analysis of Risk-Weighted Assets for Credit Risk in the Banking Book,* Bank for International Settlements, Basel, Switzerland.

BEHN, M., R. HASELMANN and V. VIKRANT (2014). *The Limits of Model-Based Regulation,* Working Paper.

BELTRATTI, A., and G. PALADINO (2013). *Why Do Banks Optimize Risk Weights? The Relevance of the Cost of Equity Capital,* MPRA Paper 46410.

BRUNO, B., G. NOCERA and A. RESTI (2015). *The Credibility of European Banks' Risk-Weighted Capital: Structural Differences or National Segmentations?,* BAFFI CAREFIN Centre Research Paper No. 2015-9.

EBA (2013a). *Interim Results of the EBA Review of the Consistency of Risk-Weighted Assets, Top-Down Assessment of the Banking Book.*

— (2013b). *Interim Results Update of the EBA Review of the Consistency of Risk-Weighted Assets - Low Default Portfolio Analysis.*

— (2013c). *Third Interim Report on the Consistency of Risk-Weighted Assets, SME and Residential Mortgages.*

FINANCIAL SUPERVISORY AUTHORITY (2010). *Results of 2009 Hypothetical Portfolio Exercise for Sovereigns, Banks and Large Corporations,* FSA Prudential Risk Division.

LEDO, M. (2011). "Towards more consistent, albeit diverse, risk-weighted assets across banks", *Estabilidad Financiera,* No. 21, p. 49, Banco de España.

LE LESLÉ, V., and S. AVRAMOVA (2012). *Revisiting Risk-Weighted Assets,* IMF Working Paper 12/90, International Monetary Fund, Washington D. C.

MARIATHASAN, M., and O. MERROUCHE (2014). "The Manipulation of Basel Risk-Weights", *Journal of Financial Intermediation,* Vol. 23, pp. 300-321.