Credit risk on Basel Rules

Claims on corporates

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ABSTRACT: In an uncertain economic environment and an increasingly globalized economy, a thorough risks control is necessary. Noteworthy among them, because of its importance in the banking activities, the credit risk.

The Basel Committee, is the responsible for setting the standards for measuring credit risk and with the main objective of ensuring the solvency of the banking system, proposes two measurement models: SA and IRB.

The role of banks as a lender provides the basis of economic growth for many businesses and therefore the economy of a country.

Of particular concern is the case of SMEs. Many studies reflect the importance of the implementation of internal methods for measuring MCR for these businesses and concludes that, applying internal methods is achieved levels of capital requirements lower than applying the standard method. The purpose of this work is the study of MCR measurement under the regulations established by the BIS focusing, in particular, on credit risk. Furthermore, to emphasize the importance of measuring credit risk and the difficulty of estimating the PD, an empirical application has been developed which will reveal differences in MCR using the SA as opposed to the IRB Basic Approach

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Abbreviations

AMA	Advanced measurement approaches
BIA	Basic Indicator Approach
BIS	Bank for International Settlements
CCF	Credit conversion factor
CF	Commodities finance
EAD	Exposure at default
ECB	European Central Bank
ECAI	External credit assessment institution
EL	Expected loss
HVCRE	High-volatility commercial real estate
IMF	International Monetary Fund
IMM	Internal Model Method
IPRE	Income-producing real estate
IRB	Internal ratings-based
LGD	Loss given default
M	Effective maturity
MDB	Multilateral development bank
OF	Object finance
PD	Probability of default
PF	Project finance
PSE	Public sector entity
SA	Standardized Approach
SL	Specialised lending
SM	Standard method
SME	Small- and medium-sized entity
SPV	Special Purpose Vehicle
UL	Unexpected loss

1. INTRODUCTION

Derived from the quantity and volume of activities in the banking business, entities face large variety of risks and their control must be established throughout the company. This risk control has been updated and become more conservative in the course of time. However, the process of economic globalization progresses with giant strides while changes in the regulations represent a rather slow process. The economic and financial crisis, which takes place since 2007, has shown that these regulations in the banking sector need an update as it has been revealed that the current legislation is not sufficient to stabilize the sector.

It has been proved that not only banks are exposed to large losses. Entire societies have been affected by the poor management of banking risks. The main banking activity of granting credits has slowed, almost completely, leading to a phenomenon known to everyone as "*credit crunch*", which has curbed, thereby, the economic growth of the country.

Reality shows that countries where the risk premium has increased to a greater extent, have been worst affected by the contraction of credit in the private sector. And without this funding, despite the recession seems to have been overcome in Spain, there is no possible growth (Fundación BBVA-Ivie, 2013).

Within the banking business, credit risk takes the central role as its main activity is related to credit operations. As noted before, without the role of banks in credit management there is no chance to economic growth. However, financial entities must be able to manage and measure credit risk to ensure its own continuity. In compliance with the regulations, they must keep a minimum capital that will serve in the event of default. The effect of these MCR can be seen in interest costs for the debtor and profitability for the entity. The added difficulty of credit risk management lies in the inability to identify, with certainty, whether or not there would be a default situation and when. Of the effectiveness in determining the PD, the diversification in the loan portfolio and exposure depends largely not only the solvency of the institution, but also its power within the market, since, improving risk administration constitutes a competitive advantage.

Credit risk under Basel II has been widely discussed. The Basel II Framework emerges as an improvement for the command of credit risk (Haber, 2007) and promotes the

adaptation of internal models that allow entities to apply their own models to estimate the PD (Herring, 2007). Using internal models, institutions get a more precise calculation of the MCR through an improved adaptation of these patterns to the bank's lending portfolio (Haber, 2007). One of the most used techniques for predicting PD are the statistical scoring models (Matias and Amaral, 2012). Studies on the prediction of PD which formed the basis for a more accurate measurement were those of Beaver (1967) and Altman (1968). And more specifically, the Altman Z-Score (1968) pattern who, through MDA, analyzed and selected the five financial ratios that best predict the PD. This model has been used by many authors until, alluding to the limitations of the model (normality and equality of the group dispersion matrices), Ohlson (1980) presented the logit model with better results in this field. Since then, more accurate models also have emerged, including neural networks, smoothing nonparametric methods and expert systems (Hand and Henley, 1997).

Of particular relevance are the studies on the credit risk in operations with SMEs since they account for a major part of the credit portfolio of banks. SMEs are, for many countries, the engine of their economies. In Spain, the 99.88 per cent of the registered companies are SMEs. In addition, they are responsible for creating most jobs assuming a total of 63 per cent of corporate employment (IPYME, 2013). SMEs are, therefore, a niche market within the banking business to which must be given particular attention. Hence, many authors advice to treat credit risk for SMEs in a differentiated manner to large enterprises as many aspects differ between one and another (Altman and Sabato, 2007).

Several factors seem to encourage this differential treatment as lending transactions to SMEs are riskier. Credits to SMEs are very small individually, but involve significant amounts of credit when analyzed in a portfolio. Moreover, the fact of not being traded on organized markets means facing greater credit risk. But not only that, also the lack of information is a barrier to a better credit risk management. However, there are criticisms of the differential treatment of credit risk for SMEs because it could result in higher capital requirements for banks and this would lead to compound the problem of the credit crunch as a result of higher costs of access to credit (Dietsch and Petey, 2002).

The purpose of this work is the study of MCR measurement under the regulations established by the BIS focusing, in particular, on credit risk. Furthermore, to emphasize the importance of measuring credit risk and the difficulty of estimating the PD, an empirical application has been developed which will reveal differences in MCR using

the SA as opposed to the IRB Basic Approach. We use, therefore, the model of Altman and Sabato (2007) in our empirical application because it develops a specific model for SMEs resulting in lower MCR. By applying this model we will estimate the PD for a portfolio of companies in the ceramic sector classified as SMEs and we will see the differences in applying the SA for calculating capital requirements towards the internal Basic IRB Approach.

The rest of the paper is organised as follows. The second section exposes the structure of Basel regulations differentiated in its three pillars and analyses the risks that banks have to deal within their operations and the methods of measurement of MCR. The third section thoroughly studies the methods of measuring capital requirements for credit risk, focusing on corporate operations; as well as collaterals as a guarantee against default and as a mechanism for risk deduction. The fourth section contains and discusses the empirical application and its results. And finally, the last section of the paper summarises the main conclusions reached.

2. THE TREATMENT OF THE RISKS UNDER THE LEGISLATION OF BASEL

Basel regulations cover the definition and measurement of all risks to which the banking system faces. It is important to revise their treatment and how changes over the years have affected MCR and the management for each type of risk.

The Basel Committee aims to estimate the minimum level of capital required to manage the risks suffered in a time of market stress and states that the main objective is to provide greater strength and stability to the financial system.

These standards have no status of law but rather recommendation and it will depend on each country supervisory authorities who decide on their application.

Basel II comes to addressing the limitations of Basel I by introducing new methods for measuring capital and incorporating new risks in the calculation. It is structured on three pillars, as explained below.

STRUCTURE OF BASEL II		
First Pillar. Minimum capital requirements	**Second Pillar. Supervisory review process**	**Third Pillar. Market discipline**
•**Operational risk** •BIA •SA •AMA •**Market risk** •SM •IMM •**Credit risk** •SA •Basic IRB Approach •Advanced IRB Approach	•Monitoring risk management techniques •Covering other risks •Supervisory Principles	•Reporting on capital structure, risk measurement and the scope of application

Graphic 1. Structure of Basel II. Own elaboration

2. 1. First Pillar. Minimum capital requirements

It seeks to apply capital requirements more sensitive to risk and there are no changes in the proportion of the equity of the entity (which will remain higher than 8% of risk-weighted assets) but including operational risk which was not considered in Basel I. Consequently, the new framework becomes stricter than the first.

Minimum Capital Requirements (MCR):

$$MCR = \frac{Equity}{Operational\ risk + Market\ risk + Credit\ Risk} \geq 8\% \quad [\mathbf{2.1}]$$

In this pillar the components of capital are established and differentiated in three levels, two of them are of vital importance for monitoring. They are:

- Tier 1 or Core Capital. Consisting of equity capital (ordinary and preferred shares) and disclosed reserves. Common to all banking institutions. Besides, equity is capable of absorbing losses based on not paying dividends.
- Tier 2 or Supplementary Capital. Composed of undisclosed and revaluation reserves, general provisions, hybrid debt capital instruments and subordinated term debt. In short, hybrid instruments with fixed and variable income.
- Tier 3. Its existence depends on the national supervisor and consists of short term subordinated debt.

The condition is established in the framework: at least 50% of the capital base should came from Tier 1 and the rest (up to a maximum of 100% of Tier 1) components composed from Tier 2. That is:

$$\frac{Tier\ 1}{Risk\ Adjusted\ Exposure} \geq 4\% \ [\mathbf{2.2}]$$

$$\frac{Tier\ 1 + Tier\ 2}{Risk\ Adjusted\ Exposure} \geq 8\% \ [\mathbf{2.3}]$$

Where:

Risk-adjusted exposure = cash adjusted exposure + risk-adjusted off balance sheet exposure.

Now, we will see in a synthesized manner how the risks are collected in this first pillar and their measurement techniques.

Operational risk can be defined as "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk". (Basel Committee on Banking Supervision, 2006: 144).

It has been introduced in Basel II as it was not taken into account in Basel I. The fact is that operational risk management is a key point because it ensures business continuity and it is mandatory.

Some of the triggers of losses related to operational risk are:

- External and internal fraud: this can include bribery, unauthorized transactions, forgery, theft, etc. E.g. the use of inside information for own benefit.
- System failures: misses arising not only from working systems of the organization, but also the fact that these systems may not be well designed.
- External consequences: such as legal contingencies, political or economic changes, terrorist attacks or natural disasters.

Operational risk minimum capital charge can be measured with three different methods depending on their exposure to risk. Regardless the chosen method, the bank must be up to date taking measures to avoid operational risk.

2.1.1.1 The Basic Indicator Approach.

Banks using this method shall estimate the capital required as an average of the last three years of positive annual income (excluding negative earnings or zero) multiplied by a fixed percentage (alpha) of 15%. Annual income is considered as the sum of net interest plus net fees and commissions.

This way of calculation has the advantage of being easy to apply but it can lead to an excess of capital requirements because it is based on income. It will require then, more capital to entities with higher revenues.

The Standardised Approach divides the activities performed by banks into eight business lines: corporate finance; trading & sales; retail banking; commercial banking; payment & settlement; agency services; asset management; and retail brokerage.

In order to calculate the regulatory capital, we will have to multiply the gross income of the lines by a factor called beta (it measures the risk exposure of a line of business) that has been assigned to each of them. The higher the beta, the higher the operational risk. We consider zero when negative results in a year.

Beta factors for each Business Lines

Business Lines	Beta Factors
Corporate finance (β_1)	18%
Trading and sales (β_2)	18%
Retail banking (β_3)	12%
Commercial banking (β_4)	15%
Payment and settlement (β_5)	18%
Agency services (β_6)	15%
Asset management (β_7)	12%
Retail brokerage (β_8)	12%

Graphic 2. Beta factors for each Business Lines. (Basel Committee on Banking Supervision, 2006).

These approaches are the most flexible as total capital charge will depend on the bank itself under the supervision of a monitor who will accompany the bank to check whether the method is suitable for determining unexpected losses or not. However, those banks interested in adopting AMA are required to establish:

- An ad hoc department to design and implement the method of measurement of operational risk. The information obtained should be used to improve risk management.
- A good system of internal control and undergo various tests of internal control and external audit. The functioning, transparency and data accessibility of the system adopted by the bank will be well appreciated.

This is a complex method as many strong requirements are necessary to set it. However, it has a flexible aspect. Institutions can set their own AMA method and apply it to certain lines of business and combine it with any of the other methods for other lines of business.

2.1.2. Market risk

Market risk is associated with changes in the market price. In order to define the capital requirements for market risk, changes in the market interest rate, currency variations and changes in commodity and equity prices are taken into account. To explain the variables that affect banks regarding market risk we distinguish between those derived from the balance sheet and trading portfolio.

I. Balance risk. It is the risk associated to losses arising from fluctuations in interest rates that may affect earnings and the equity value of the company. It is generated from the assets, liabilities and off-balance sheet positions, which do not take part in the trading book. It is a type of risk inherent in the banking business and related, also, to mismatches between the maturities of assets and liabilities.

 i. Interest rate risk. Derived from changes in interest rates affecting the assets and liabilities in the portfolio of an entity. The interest rate fluctuations can affect both positively and negatively to the bank's balance sheet and it will depend on the proportion of assets and liabilities subject to fixed rate and variable rate. To reduce the interest risk the bank should work to normalize the inputs and outputs of assets and liabilities. To measure interest rate risk, Basel rules differentiate between: investment or price risk and income risk:

  - Price risk: when talking about price risk we refer to risk subject to the volatility of prices of instruments included in the portfolios of fixed and variable income.
  - Income risk: it refers to the probability that the investor is not able to find a security with the same or better characteristics on maturity. Also known as gap risk.

Thus, changes in the interest would affect cash flows or affect the market value of the asset.

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There are two manners for measuring this risk: the Standardised Method and the Internal Model Method, explained below. The Committee argues that the best method for determining the interest rate risk is the internal method used by the bank. In order to apply this method, the bank shall inform the authorities of the risk of loss it is being assumed, in economic terms. The Committee will also consider if the bank is adjusting in a proper manner the level of risk and it will determine whether to increase its capital conservation buffer or reduce exposure to risk. The bank could reduce the risk of interest through investments that provide steady cash flows, longer-term investments, etc.

    ii.   Exchange rate risk. The exchange rate risk is the risk confronted by banks to changes in the exchange rate due to having some of their assets and liabilities in foreign currency. The revaluation of the currency would mean a loss of the asset value and an appreciation of liabilities, while devaluation would be a gain in the asset side and a loss on the liability side. To determine their regulatory capital, banks can choose between two methods:

- 1st. "Shorthand" method. With this method, is intended to convert the opened positions in other currencies into national currency by using the spot interest rate. As it is set in Basel II, capital charge will be 8 per cent of the overall net open position.
- 2nd. Internal methods for risk assessments.

Just in case the activity of the institution in foreign currency is not important, the bank may choose not to establish capital requirements (with exceptions).

II.   <u>Trading book' risk</u>. The probability of loss resulting from price fluctuations affecting products in the trading portfolio: fixed income, variable, and currencies. Simply, it is the risk related to variations in the price of assets in the portfolio (stocks, currencies, bonds, commodities).

    i.   Interest rate risk: It measures the risk of "holding or taking positions in debt securities and other interest rate related instruments in the trading book". (Basel Committee on Banking Supervision, 2006: 166).

    ii.   Equity position risk: it measures the capital required to cover the risk of holding positions in equity. As with debt securities, it is necessary to differentiate between the specific risk (which will have a requirement of 8 per cent when not diversified and 4 per cent when it is) and market risk (whose requirement is 8 per cent).

iii. Foreign exchange risk: it measures the risk of taking positions in foreign currency or gold. When a bank does not take a considerable amount of positions in a foreign currency may be able to avoid those capital requirements.

iv. Commodities' risk: it measures the risk of taking positions in commodities: agricultural products, minerals (including oil) and precious metals (excluding gold).

Turning back to market risk itself, this may affect considerably the bank's equity and its viability. At first instance, the capital requirements for market risk are set globally although there is flexibility under the supervision of national authorities.

2.1.2.1. The Standardized Measurement Method.

In the case of risk of interest, for example, this method will be used when the entity does not have an internal model that meets the conditions set by the BIS. When calculating market risk, first risk for interest rate, shares, currencies and commodities must be calculated distinguishing between the specific risk of each security and general market risk. Then, the capital required to cover market risk will be the sum of these risks.

I. Capital requirements for specific risk. Capital used to cover variations in price as a result of the characteristics of the asset itself. This capital will be sensitive to the portfolio diversification made by the bank and it will depend mainly on the rating of issuers of debt (Governments, banking corporations, securities firms, etc.). Issuers can be rated with an investment or non-investment rate.

II. Capital requirements for general market risk. It is the capital required to meet changes in market prices. Banks have two options for measuring this risk:

- The maturity method. In short, this method divides the positions affected by market risk on a scale of maturity in terms of which a weight is applied. This weighting depends on the sensitivity to changes in interest rates. Then it will proceed to a compensation of positions and necessary adjustments due to the presence of different instruments and maturities. For mismatches between positions or "vertical disallowance" a capital charge of 10 per cent will be applied.

- The duration method. Always under supervision, banks may estimate capital requirements with this method by calculating separately the sensitivity to changes in interest rates for each position. The method

consists of measuring the sensitivity of individual positions to changes between 0.6 and 1 percentage point in interest rates. Then, here too, positions are divided on a scale of maturity in terms of sensitivity. However, in this method the "vertical dismissals" receive a 5 per cent capital requirements.

Both methods are valid, but the latter is more accurate in the calculation.

2.1.2.2. The Internal Models Method

Some banks will benefit from using internal models to measure market risks if they meet the requirements imposed by the supervisor. These banks will have to submit to some tests showing that the risk measurement methods they are using are accurate and reliable (stress testing), among other requirements.

The Committee requires the daily calculation of VaR for a confidence level of 99% and a minimum holding period of 10 days. The period to be used as the reference for the calculation shall be one year.

What will be the minimum capital requirement to be covered daily?

According to the Committee, "*the sum of the higher of its previous day's value-at-risk and an average of the daily value-at-risk measures on each of the preceding sixty business days (multiplied by a multiplication factor) plus the higher of its latest available stressed-value-at-risk number and an average of the stressed value-at-risk numbers calculated according to preceding the above over sixty business days (multiplied by a multiplication factor)*". (Basel Committee on Banking Supervision, 2006: 196)

2.1.3 Credit risk

Once maturity has been reached, this is the risk of default from the borrower and it is the most usual. When discussing credit risk we can differentiate between:
- Counterparty risk: default risk basically.
- Country related risk: associated with the country where the borrower resides (political factors, legal, etc.)

Banks can choose between two methods of calculation. The Standardized Approach which relies on external ratings and The Internal Ratings-Based Approach which is

subjected to conditions and requires estimating the probability of default (PD), loss given default (LGD), exposure at default (EAD) and the maturity (M). Within this method banks can benefit from choosing the basic or advanced method. The basic method allows banks to estimate the PD but the other variables depend on the Supervisor. The advanced method, otherwise, allows banks to estimate all variables.

As the main objective of this paper is to dissect credit risk, it will be discussed more deeply in section two.

These three risks mentioned above are not the only ones covered by the risk management of banks. Under the second pillar of the Basel rules other risks are covered and we discuss them briefly.

2.2. Second Pillar. Supervisory Review Process

The second pillar comes to the importance of establishing solid and sophisticated procedures to control risks. It is important because Basel II gives banks greater freedom to establish their mechanisms for measuring minimum capital requirements, although supervisors may intervene and advise new actions.

Due to liberty of action with banks for implementing of measuring methods, the Committee proposes four basic principles that are required by the Supervisor. These are:

1. Banks will adopt the method that best fits its risk profile and capital requirements. Here the Committee establishes which risks will be subjected to the measurement: credit risk, operational, market, interest rate risk in the investment portfolio, liquidity and other (reputation and strategic).
2. The adopted method is subject to Supervisor's evaluations.
3. Banks must be objective regarding capital requirements and maintain this level above the minimum.
4. The Supervisor shall ensure the fulfillment of capital requirements and will intervene when it considers that this is at minimum levels.

2.2.1. Reputational risk

When measuring reputational risk we refer to those losses due to behaviors exceeding the ethics at work. It is difficult to measure reputational risk because it may

depend on the management of other risks such as operational or liquidity. Moreover, it depends on the perception that agents have on the financial institution. Thus, failures in the management of reputational risk could lead to the withdrawal of deposits from thousands of clients or simply reduced to uncontrollable costs from management errors.

2.2.2. Concentration risk

Concentration risk is the risk associated with credit concentration in a single geographic area (same country, county, city, etc.); same industry (construction, real estate, services) or type of credit (mortgages). In order to prevent concentration of credit, banks must demonstrate commitment to diversification.

The Committee states that banks should avoid concentration of credit risk through policies and systems that enable diversification of credit since this is one of the most serious problems affecting banks. The bank shall inform the Supervisor on the internal method that is using to measure regulatory capital. In addition, it is obligatory to apply voltage tests and see how the institution could be affected due to damages under the conditions of the area, industry or borrower where the risk is concentrated.

2.2.3. Systemic risk

Systemic risk is the one causing losses arising from a problem to a particular bank that may affect the entire financial system.

2.2.4. Liquidity risk

It refers to the possibility that a company is unable to meet its payment obligations in the short term. When it comes to liquidity risk, the bank may face two situations:

- The fact that depositors come to withdraw their deposits massively and the bank does not have liquidity to meet withdrawals.
- The case of not being able to meet its payment obligations on the date.

Liquidity is another important point in Basel rules. One of the key points is to ensure that the financial institution has high quality assets that can be converted into cash quickly.

Generally, banks have the minimum cash legally required and they avoid having idle resources and get returns on the purchase of other, more or less, liquid assets but after the explosion of the crisis and being subjected to severe liquidity problems, banks are building a more liquid asset portfolio based, basically, on sovereign debt.

With the target of ensuring liquidity, the Committee raises two distinct but complementary objectives: ensuring solid short-term liquidity using the Liquidity Coverage Ratio (LCR), and looking for more responsible investment to ensure the long-term liquidity using the Net Stable Funding Ratio (NSFR). These two objectives are explained in *Basel III: International Framework for liquidity risk measurement, standards and monitoring* (Basel Committee on Banking Supervision, 2010).

A. Liquidity Coverage Ratio (LCR):

$$\frac{Stock\ of\ high\ quality\ liquids\ assets}{Total\ net\ cash\ outflows\ over\ the\ next\ 30\ calendar\ days} \geq 100\% \quad \lfloor 2.4 \rfloor$$

As it is mentioned by the BIS *"the stock of high-quality liquid assets should at least equal total net cash outflows"* (Basel Committee on Banking Supervision, 2013: 4). That way, the bank would be able to face liquidity problems in a short-term. However, as mentioned above, the institution is expected to work on improving its ability to face liquidity problems in a long-term manner.

Legislation states that the bank must be able to cope with liquidity pressures for 30 days. It sets this period as a minimum but each entity should assess their skills and establish a longer horizon to ensure that it has a sufficiently liquid asset portfolio.

Assets classified as high quality and liquidity assets should comply with the following basic characteristics relating to the asset itself and the market (among others): low risk determined by a high credit rating, reduced duration or low legal risk; easy to assess; low correlation to risky assets; trading on a stock market.

B. Net Stable Funding Ratio (NSFR):

$$\frac{Available\ amount\ of\ stable\ funding}{Required\ amount\ of\ stable\ funding} \geq 100\% \quad \lfloor 2.5 \rfloor$$

This ratio is intended to seek greater long-term stability. It supports the LCR and aims to avoid the wholesale banking funding via bond issues, for example, when it can be funded through its customer deposits.

How might a portfolio of illiquid assets affect to banks' balance sheet in stressful situations?

As such assets are assumed to be of lower quality, it is expected that banks might be forced to sell them cheaper to obtain liquidity. Besides, they would not be able to meet its payment obligations and would face cost overruns.

Currently, we have seen how highly leveraged banks and with little liquid assets were unable to address liquidity problems selling those assets. One of the solutions that banking institutions relied on was the issuing of debt. However, this was not enough to meet its payment obligations and, finally, it has been necessary (as in the case of Spanish banks) an injection of liquidity into the banking or bank bailout.

In order to make the financial system stronger Basel III is born. The Committee focuses on establishing more stringent measures in terms of bank solvency. However, these measures explained above are not officially applicable until 2015 (LCR) and 2018 (NSFR).

2.3. Third Pillar. Market Discipline.

This last pillar sets the obligation of banks to report on the methods of measurement used, the established capital level and risks, and adds new requirements. It seeks to promote transparency and comparisons between banks. Thus, they shall inform about the methods used to measure risks so that the market can compare and have reliable information about the risk exposure of the institution. In short, they should report on: the scope of application, capital structure, capital adequacy (risk measurement).

3. CREDIT RISK UNDER BASEL RULES. CLAIMS ON CORPORATES

According to the Committee, credit risk can be defined as "the risk that the counterparty to a transaction could default before the final settlement of the transaction's cash flows" (Basel Committee on Banking Supervision, 2006: 19). The default may be due to liquidity problems of the borrower and, actually, it is usual that this borrower is declared bankrupt.

Traditionally, the main banking activity has been lending. Therefore, as financial markets have become globalized and are more sensitive to changes (e.g. political changes, speculative bubbles and others) it has been necessary to establish tough approaches for measuring risks and increases in capital requirements. Mindful of these risks, banking has gone from seeking the maximum profitability of their operations to seek high risk-adjusted returns.

In the document *International Convergence of Capital Measurement and Capital Standards* (Basel II), the Committee highlights the importance of credit risk in banking and its treatment covers much of the Pillar I.

The aim of this paper is to analyze credit risk deepening on claims on corporates[1]. The Standardized Approach and the Basic and the Advanced IRB will be discussed with respect to this aspect. These three approaches are proposed, by the Committee, to improve the measurement of the risks and encourage banks to commit to do better management.

3.1. The Standardised Approach

This is the first approach proposed to measure credit risk under Basel rules. Although it is the simplest procedure it is not the most recommended by the Committee. In short, it arises as a stage to adopt the basic or the advanced IRB approach because one of its major disadvantages is that it leads to maintain higher capital requirements for the same degree of risk as the Committee only provides few levels of risk weighting.

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[1] Insurance companies are not include.

Under the SA, positions are classified by the bank depending on their nature. They are claims on: sovereigns; corporates; PSEs; MDBs; securities firms; banks; claims included in the regulatory portfolio; claims secured by residential property; claims secured by commercial real estate; past due loans; higher risk categories; off-balance sheet items and; other assets.

The approach involves assigning to each position a weighting coefficient of 8 per cent and a different weight depending on the risk and the rating from ECAIs, commonly known as credit rating agencies[2]. Of course, not all of these agencies will be accepted and they should comply with certain requirements:

- Be objective using the same methodology and control assessments.

- Show an independent position against external, especially, political, economic or social pressures.

- International access/transparency.

- Disclosure: giving information about assessment methods, the meaning of each rating, default rates for each rating category and migration between them.

- Have sufficient resources to maintain current and accurate assessments.

- Credibility and confidence shown by investors, insurers, partners, etc.

The supervisory board will decide whether the agency meets the requirements or not. Moreover, they are responsible for assigning weights to each level of the rating scale. This process is commonly known as "mapping" and consists in linking the categories of credit issued by the entity to the probability of default given by the credit rating agency.

As mentioned before active positions are classified into different categories, so that they are assigned different weights. Here are presented:

Claims on sovereigns. Related to credits granted to sovereign states. Risk weighting may be applied based on the risk premium assigned to those countries by the ECAIs

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[2] Credit risk evaluations depend on external ratings from credit rating agencies. Financial institutionsare free to choose these rating agencies. However, the Committee does establish a set of criteria that must be met by the credit rating agency. Standing out: objectivity, independence and disclosure of credit assessment criteria.

accepted by the supervisor. Risk weighting for credits with BIS, IMF and the ECB shall be 0 per cent.

Risk weighting for claims on sovereigns

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weight	0%	20%	50%	100%	150%	100%

Graphic 3. Risk weighting for claims on sovereigns. (Basel Committee on Banking Supervision, 2006)

Claims on non-central PSEs. Related to credits granted to authorities at regional or local level, other administrative organs dependent of the central administration and business enterprises owned by the central administration. A risk-weighting similar to that of the sovereign or interbank credits can be applied depending on the Supervisor. Banks have two alternatives for the funds to PSEs:

- applying any of the two options for interbank credits; or

- applying the weightings of sovereign credits.

Claims on MDBs. Related to credits conferred to multilateral banks which base their activity in advising and financing developing countries. Here may be implemented *option 2 for interbank credits* (explained below) with some exceptions:

- there will be no preferential weighting for short-term loans; however,

- it may be applied a weighting of 0 per cent at certain positions with MDBs. For example, those highly rated or those supported by a strong shareholder structure.

Claims on banks. There are two options but the supervisor may only allow to apply one of them to all banks under its tutelage.

Option 1. Risk weight is assigned a level below that which has been given to the sovereign state with a ceiling of 100 per cent when countries have been rated BB+ to B- or not classified.

Risk weighting for claims on banks. Option 1

Credit assessment of Sovereign	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weight under Option 1	20%	50%	100%	100%	150%	100%

Graphic 4. Risk weighting for claims on banks, option 1. (Basel Committee on Banking Supervision, 2006)

Option 2. Risk weight is assigned depending on the rating given by credit rating agencies.

Risk weighting for claims on banks. Option 2

Credit assessment of Banks	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weight under Option 2	20%	50%	100%	100%	150%	100%
Risk weight for short-term claims under Option 2	20%	20%	20%	50%	150%	20%

Graphic 5. Risk weighting for claims on banks, option 2. (Basel Committee on Banking Supervision, 2006)

Regardless the chosen option, those short-period credits up to 3 months denominated in domestic currency will be assigned a less favorable level than those assigned to claims on the sovereigns.

Claims on securities firms. These credits may be treated as claims on banks or claims on corporates depending on the Supervisor.

Claims on corporates. If the Supervisor deems it necessary, a higher risk weighting can be applied to unrated claims depending on the levels of indebtedness of the country. In addition, banks can apply a 100 per cent weighting to all claims regardless their rating if it is accepted by the Supervisor.

Credit assessment	AAA to AA-	A+ to A-	BBB+ to BB-	Below BB-	Unrated
Risk weight	20%	50%	100%	150%	100%

Graphic 6. Risk weighting for claims on corporates. (Basel Committee on Banking Supervision, 2006)

Claims included in the regulatory retail portfolios. The retail portfolio will be assigned a risk weight of 75 per cent and it is subject to several criteria:

- They will be credits to individuals or small businesses.

- The product will be limited to banking loans and lines of credit, personal loans and leases, among others.

The retail portfolio will be diversified and not excessive risk will be contract with a single individual or company.

Claims secured by residential property. These loans are applied a 35 per cent risk weight as they are covered by mortgages where those goods have a residential character.

Claims secured by commercial real estate. They are given a 100 per cent risk weight although preferential weights can be achieved under the fulfillment of strict criteria that will be monitored by the authorities.

Past due loans. As stated in the regulatory framework, those over 90 days will be assigned:

- "a 150% risk weight when specific provisions are less than 20% of the outstanding amount of the loan";

- "a 100% risk weight when specific provisions are no less than 20% of the outstanding amount of the loan";

- "a 100% risk weight when specific provisions are no less than 50% of the outstanding amount of the loan, but with supervisory discretion to reduce the risk weight to 50%"

Residential mortgage loans will be applied a 100 per cent risk weight in case they have not been paid for more than 90 days. However, if they have been covered with a

minimum of 20 per cent provisions the risk weight applied may be reduced to 50 per cent.

Higher-risk categories. As stated above, those assets classified as higher risk will be charged with a 150 per cent risk weight. These assets are: claims on sovereigns, PSEs, banks, and securities firms rated below B-; Claims on corporates (below BB-) and past due loans. A 350 per cent risk weight will be enforced to securitisation tranches rated between BB+ and BB-.

Other assets. A 100 per cent risk weight will be charged to investments in equity or debt issued by banks or securities firms.

Off-balance sheet items. They are assets which, while having no effect on the bank's balance sheet, do have effect on the income statement. Some of these assets are derivatives transactions, securities, repurchase transactions, etc. When applying the SA we must first convert off-balance sheet items into credit equivalents using credit conversion factors (CCF).

The mapping process

The mapping process consists in associating the risk weights in the SA to the evaluations of the ECAI. The responsible for this process is the national Supervisor. In this process is essential to analyze the evaluations of the different eligible ECAI, the levels of qualification and the definition of default, so that the association is as consistent as possible.

Besides, the mapping process plays a fundamental role for measuring the minimum capital requirements in the SA. To take into account:

- In the event that the bank find several grades, will choose the smaller (if there are two) and the lower of the two highest rated (if there are three).

- With regard to short-term evaluations they will be limited to assess specific issues of banks and companies.

- For debt issues, the treatment will be different, not only in terms of whether it has been described or not, but also in terms of whether there has been an investment by the bank in this emission:

- o If it is qualified and there has been investment, the issuing debt will receive the weighting based on ECAIs.

- o If it is qualified and there has been no investment, the position will receive a weighting lower than an unrated credit, as long as it may be classified as similar to a rated credit.

- o If the debtor has been classified as debt issuer, the same rating (high quality) will be apply to unsecured claims

3.2 The IRB Approach

The IRB Approach is the one recommended in Basel as it is more risk-sensitive and involves capital requirements more adapted to the needs of the entity. Those banks interested in adapting this approach have to undergo assessments and are required to report on certain aspects. By applying this method the entity, may make their own estimates of credit components for the calculation of minimum capital requirements which will cover unexpected losses.

At the first step to implement an IRB measurement model, the entities have to divide their open positions in groups: corporate, sovereign, bank, retail and equity. This classification depends on the banking business model and needs, provided it is coherent. Within these groups, the one that concerns us, in particular, is related to corporates and it is going to be further studied. We begin by defining the positions the bank can take regarding companies.

Definition of corporate exposures: it refers to the rights held by the bank with regard to companies. The entity might consider separately the positions towards the SMEs. Within this category is included SL, which is divided into 5 subtypes. They are:

- Project Finance (PF). It consists of an specific type of financing for large investment projects. Typically, these projects are developed by an SPV created for this purpose. That is, the SPV obtains revenues only from the investment project and the credit risk is high. Therefore, the instruments of collateral associated to the contract are of vital importance.
- Object Finance (OF). It consists of a type of financing used by companies for the purchase of physical assets involving a large outlay (ships, planes, etc.). The company will meet its obligations through the cash flows generated by the

use of these assets in the course of its activity. Typically, the bank purchases the asset and leases it to the company, which with the payment of rent ensures the payment of the loan.

- Commodities Finance (CF). It consists of financing transactions of commodities and / or similar in organized markets. These operations are performed in a short time horizon due to the nature of the assets. The payment of the obligations depends on the result of the sale of goods. It shows a high level of credit risk and, as a general rule, the value of the good itself plays the role of collateral.

- Income-producing real estate (IPRE). It consists in the funding of properties that, by nature, generate income from the rental or sale of the asset which will be used to repay the obligations. Eg: office buildings or hotels.

- High-volatility commercial real estate (HVCRE). It consists of financing property assets with higher volatility in the rate of loss.Their classification as more volatile assets depends on the opinion of the supervisor.

These types of financing are characterized in that the obligation to pay is often placed on a company created for that sole purpose and that its ability to pay depends on the generation of resources by the assets being financed, since that the company has no capacity for refund through other activities or assets.

Definition of sovereign exposures. Here are collected all asset positions held with states, their central banks and some PSEs if they have been considered as sovereign under the SA, and some MDBs.

Definition of bank exposures. Here are collected all asset positions held with securities firms and national public companies with the same treatment as interbank loans and those MDBs not able to apply a 0 per cent weighting in the SA.

Definition of retail exposures. Here are collected: open positions with individuals, mortgage loans and positions up to € 1 million held with companies. In many cases, it is not taken into account the size of the position but the borrower. Among others: loans, overdrafts, credit cards, mortgages, etc.

Definition of qualifying revolving retail exposures. Open positions with individuals of up to € 100,000. These positions are characterized by the possibility of the borrower to vary the outstanding balance of the position up to a ceiling established by the bank.

Definition of equity exposures. To be included in this section, positions must meet certain requirements: yields can be obtained from the sale of the investment itself or the rights and from the liquidation of the issuer; there is no obligation from the issuer, but it has a claim on the assets and income of the issuer. Other instruments are also included in this category as those admitted as capital of highest quality.

The foundation and advanced approaches

Before starting to explain IRB approaches it is necessary to understand the components of risk and the factors that influence them. They are:

- Probability of default (PD). It is simply the possibility that the counterparty fails to meet its contractual obligations. Several factors may affect PD: debtor's own characteristics (leverage) and other external ones (country risk). In addition, also the probability of default is greater in the long run because the debtor's ability to pay may suffer greater variations.

- Exposure at default (EAD). It is the outstanding amount of receivables at the time that the default occurs but considering that nothing is recovered. This factor depends mainly on the type of operation. Not only because of the amortization schedule, but also the facility to determine the amount.

- Loss-given default (LGD). In the event that the loss is limited to only a portion of the outstanding amount, the LGD is the part that will not be recovered once the breach occurs. It is strongly influenced by the guarantees attached to the operation (the more guarantees lower LGD) but it also depends on the age to maturity (the longer it is the higher the LGD; and credit quality of the counterparty (the lower it is the higher the LGD).

There are two procedures for implementing IRB approach: the Basic or Foundation IRB where every entity using this method will be responsible for determining the PD of their positions but the EAD and the LGD shall be determined by the supervisor; and the Advanced IRB, where, the financial institution may determine the levels of all risk factors including migration of credit.

As it said before, in the foundation approach, the entity is responsible for estimating the PD leaving the remaining risk factors under obligation of the Supervisor. However, it may be required to calculate the effective maturity (M).

On the other hand, in the advanced approach, the entity calculates the effective maturity and all other risk factors. Nevertheless, the entity can be exempted from the calculation of M of small companies whose turnover and total assets does not exceed 500 million euros. In such cases M will be equal to 2.5 years and will be applied to all banks using the advanced approach.

Exceptions and considerations for SL

- The supervisory slotting criteria approach, which consists in mapping the internal risk ratings to five supervisory categories with their corresponding weights, will be applied when the bank can not properly estimate the PD in the foundation approach.

- Those banks that can properly estimate the PD, EAD and LGD themselves may apply the basic method for all positions with companies, except for HVCRE, whose treatment will depend on the supervisor.

The process to implement the IRB approach is complicated and progressive. It is summarized in three steps and the entity must report to the Supervisor over this process:

1. Applying the IRB approach to all active positions within each type of business.

2. Applying the IRB approach to all business units within the banking group.

3. Applying advanced IRB method to estimate certain risk factors.

There are exceptions for some assets (due to small size or low risk) and units of not very significant businesses, where it can be applied the SA. Furthermore, with respect to the positions facing companies: once adopted the IRB approach, the entity is required to apply it to all categories of SL. However, the bank may apply jointly, the

advanced or basic methods and the supervisory slotting criteria approach to solve data limitations.

A. Method of calculating the Unexpected Loss (UL) capital requirements for corporate, sovereign and bank exposures

The risk weights applied to the various assets are calculated according to the levels of the risk factors (PD, EAD, LGD and M). PD and LGD are expressed in decimals while EAD shall be expressed in currency.

Formula for derivation of risk-weighted assets.

$$Correlation (R) = 0.12 \times \frac{(1-EXP(-50 \times PD))}{(1-EXP(-50))} + 0.24 \times \left[\frac{1-(1-EXP(-50 \times PD))}{(1-EXP(-50))}\right] \quad [3.1]$$

$$Maturity\ adjustment\ (b)^3 = (0.11852 - 0.05478 \times \ln(PD))^2 \quad [3.2]$$

$$Capital^4\ requirement^5\ (k) = \left[LGD \times N\left[(1-R)^{-0.5} \times G(PD) + \left(\frac{R}{(1-R)}\right)^{0.5} \times G(0.999) - PD \times LGD\right] \times \left(1 - 1.5 \times b^{-1} \times (1+(M-2.5) \times b)\right)\right] \quad [3.3]$$

$$Risk\ Weighted\ Assets\ (RWA) = K \times 12.5 \times EAD \quad [3.4]$$

B. Firm-size adjustment for small- and medium-sized entities (SME)

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[3] In the basic method M = 2.5 years except for repurchase operations where M = 6 months. In the advanced approach, M shall be calculated for each facility. Only companies whose turnover and assets below 500 million euros may apply a M = 2.5 years.

[4] In the event of negative result in this calculation, requirements shall equal zero for this exposure.

[5] N(x) denotes the cumulative distribution function for a standard normal random variable (i.e. the probability that a normal random variable with mean zero and variance of one is less than or equal to x). G(z) denotes the inverse cumulative distribution function for a standard normal random variable.

For SMEs the "risk weighting" will be adjusted due to the size of the company.

$$Correlation(R) = 0.12 \times \frac{(1-EXP(-50 \times PD))}{(1-EXP(-50))} + 0.24 \times \left[\frac{1-(1-EXP(-50 \times PD))}{(1-EXP(-50))}\right] - 0.04 \times \left(\frac{1-(S-5)}{45}\right)$$

$$[3.5]$$

where:

S= total annual sales in millions of euros between 5 and 50 million euros.

C. Risk weights for specialized lending (SL)

In the event of inability of the entity to determine the levels of PD, the entity must use the supervisory slotting criteria approach. Under this method, a set of weights to each category are assigned by the Supervisor. In these categories, different aspects are evaluated: financial strength (degree of leverage, financial ratios), political and legal environment (degree of stability, government support, etc.), characteristics of the operation (operational risk, completion guarantees, etc.) security package or strength of the sponsor. The different risk categories are: strong, good, satisfactory, weak and default. Their risk-weights are:

Risk weights for SL positions

Strong	Good	Satisfactory	Weak	Default
70%	90%	115%	250%	0%

Graphic 7. Risk weighting for SL positions. (Basel Committee on Banking Supervision, 2006)

Usually, these categories established by the supervisor correspond to levels of external credit assessment.

Internal ratings of SL positions associated to external credit assessments

Strong	Good	Satisfactory	Weak	Default
BBB- or better	BB+ or BB	BB- or B+	B to C-	Not applicable

Graphic 8. Internal ratings of SL positions associated to external credit assessments from ECAIs. (Basel Committee on Banking Supervision, 2006)

Preferential weights can be applied to positions if the time to maturity is lower than 2.5 years or if they are "good and well secured" positions. In these cases, 50 per cent to solid positions and 70 per cent to the good ones is applied.

Risk weights for HVCRE

The entities which may not determine the PD will also associate their internal ratings to the categories of supervisor. The factors taken into account are listed in the previous section. The risk-weights are:

Risk weights for HVCRE positions

Strong	Good	Satisfactory	Weak	Default
95%	120%	140%	250%	0%

Graphic 9. Risk weightings for HVCRE positions. (Basel Committee on Banking Supervision, 2006)

Also here, preferential weights can be applied to positions under the same circumstances above. A 70 per cent will be applied to solid positions and a 95 per cent to good positions.

Banks measuring their PD, either applying the basic or advanced approach will use the following formula to calculate the risk weighted assets:

$$Correlation(R) = 0.12 \times \frac{(1-EXP(-50 \times PD))}{(1-EXP(-50))} + 0.30 \times \left\lceil \frac{1-(1-EXP(-50 \times PD))}{(1-EXP(-50))} \right\rceil \quad [3.6]$$

In addition, if the entity can not determine either LGD or EAD will use those given by the supervisor for corporate exposures.

Risk components under corporate exposures

PD

Banks must apply the higher value between 0.03 per cent and the probability of default associated to the borrower's creditworthiness. If the borrower is rated as default, it will

receive a 100 per cent weighting. This PD will be determined internally and to this end, these techniques may be applied: internal default experience, mapping to external data, and statistical default models. Regardless the technique employed, the minimum period to be observed to estimate the PD shall be 5 years (at least for one of the sources). As long as there are longer periods for which data are available, these must be used. And in case that information is limited, there will be a conservative estimation of the PD.

LGD

LGD under the basic approach

- Unsecured loans with recognized collateral LGD= 45%. Recognized collaterals are: receivables, some residential and commercial real estate and others.
- Subordinated loans LGD = 75%
- LGD in collateralized transactions

$$LGD^* = LGD \times \left(\frac{E^*}{E}\right) [\, 3.7\,]$$

where LGD= 45%

E = current value of the exposure

E* = exposure value after risk mitigation

LGD under the advanced approach

Under this method, entities are allowed to estimate the LGD. This has to be a rather conservative measure and will not be less than the long term average LGD.

As mentioned several times, banks must meet minimum requirements for estimating LGD. Some of them are: to observe the correlation between the risk of the contracting parties and the collateral and to record the historical loss rates.

When estimating the LGD one must be aware that the actual loss levels may be higher and which will be the amount that has to be covered with capital. The minimum period for which the LGD is determined must match at least a full economic cycle and will never be less than 7 years.

EAD

Defined simply, the EAD is the amount outstanding at the time failure occurs[6]. This definition can be valid for on-balance sheet items, but there are banking products widely used by companies (like cards or lines of credit) where a higher risk exposure should be represented. In these cases, as stated in the regulatory framework "exposure is calculated as the committed but undrawn amount multiplied by a CCF". (Basel Committee on Banking Supervision, 2006: 74)These CCF can be calculated using the basic or the advanced approach.

EAD under the basic approach

They will be the same as in the SA with some exceptions:

- Commitments, NIFs and RUFs regardless of the maturity of the underlying facility will receive a CCF of 75 per cent
- Facilities which are uncommitted, unconditionally cancellable, or that effectively provide for automatic cancellation at any time by the bank without prior notice will receive a CCF of 0 per cent

EAD under the advanced approach

Whenever entities are allowed to calculate their exposure at the time of default, may, at the same time, calculate the CCF. However, when under the basic method, the bank has assigned to a position a CCF equal to 100%, then, under the advanced approach the same CCF will be assigned.

D. Treatment of Expected and Unexpected Losses

Although this is a problematic matter due to the lack of agreement between national supervisors, the Committee states:
- *EL* are covered with provisions and
- *UL* are covered with equity.

Calculation of expected losses

Expected loss for exposures other than SL subject to the supervisory slotting criteria

In positions with companies that have not been unfulfilled:

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[6] For determining the EAD, provisions and partial amortizations are not taken into account.

$$EL = PD \times LGD \quad [\mathbf{3.8}]$$

On default positions on corporates, the entity will use the best estimation of expected losses (in the basic method, use the LGD of supervisor).

<u>Expected loss for SL exposures subject to the supervisory slotting criteria</u>

As stated on the regulatory framework "for SL exposures subject to the supervisory slotting criteria, the EL amount is determined by multiplying 8% by the risk-weighted assets produced from the appropriate risk weights, as specified below, multiplied by EAD". (Basel Committee on Banking Supervision, 2006: 87)

Supervisory categories and EL risk weights for other SL exposures (not HVCRE)

Strong[7]	Good[8]	Satisfactory	Weak	Default
5%	10%	35%	100%	625%

Graphic 10. Supervisory categories and EL risk weights for other SL exposures (not HVCRE). (Basel Committee on Banking Supervision, 2006)

Supervisory categories and EL risk weights for HVCRE

Strong	Good	Satisfactory	Weak	Default
5%	5%	35%	100%	625%

Graphic 11. Supervisory categories and EL risk weights for HVCRE. (Basel Committee on Banking Supervision, 2006)

Calculation of provisions

Exposures subject to IRB approach

The amount to be provisioned will be equal to sum of all provisions of the positions subject to the IRB approach. In case of the SA and the IRB being applied at the same time, the bank must make clear what portion of the provisions corresponds to each method.

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[7] Risk weighting shall be 0% (solid) in the event that the entity is allowed to assign preferential weights to other SL positions.

[8] Risk weighting shall be 10% (good) in the event that the entity is allowed to assign preferential weights to other SL positions.

Banks must compare the *EL* calculated with the total provisions. If *EL* are lower than provisions, the Supervisor will decide whether the difference can be included as Tier 2 capital. If *EL* are greater than provisions, the difference will go to offset the *EL* for non-defaulted assets if considered by the Supervisor.

Minimum requirements for IRB approach

Financial institutions must meet certain minimum requirements in order to apply the IRB approach and stay there. These requirements serve 12 different aspects, as they appear in the regulatory framework: composition of minimum requirements, compliance with minimum requirements, rating system design, risk rating system operations, corporate governance and oversight, use of internal ratings, risk quantification, validation of internal estimates, supervisory LGD and EAD estimates, requirements for recognition of leasing, calculation of capital charges for equity exposures, and disclosure requirements. As an example, entities must:

- Show ability to quantify risk accurately and consistently
- Have a ratings system design, perfectly defined, that measures the risk of default by the borrower and the specific factors of operations
- Show no concentration of positions in the same sector or borrower
- Use of long horizons for assigning ratings
- Etc.

Besides, entities will be subjected to stress tests to assess capital adequacy.

Within these requirements, the Committee also establishes at what point will be regarded as a default by the debtor. In particular, when it occurs at least one of the following facts:

1. The entity believes that the entire position will not be recovered and has no recourse.
2. The borrower is in past due for more than 90 days in significant liabilities[9].

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[9] For overdrafts, the debtor is considered in past due when exceeding the recommended limit.

Credit risk coverage is essential for the continuity of the banking business. Without it, banks could face bankruptcy if defaults became more widespread as happened in the last years of the crisis. By using these collaterals the entity seeks, besides ensuring its continuity, to reduce capital requirements.

BIS defines collateralized transactions as those in which "banks have a credit exposure or potential credit exposure ... hedged in whole or in part by collateral posted by a counterparty or by a third party on behalf of the counterparty" (Basel Committee on Banking Supervision, 2006: 32). In Basel II the objective is that the hedging instruments used by banks are rather simple, flexible and wisely used.

These collaterals or coverage may be total or partial. Thus, the entity will be allowed to reduce credit risk weight to the extent that this risk has been mitigated. That is, only one reduction shall be applied on the risk weight which corresponds to the covered part.

Credit risk mitigation
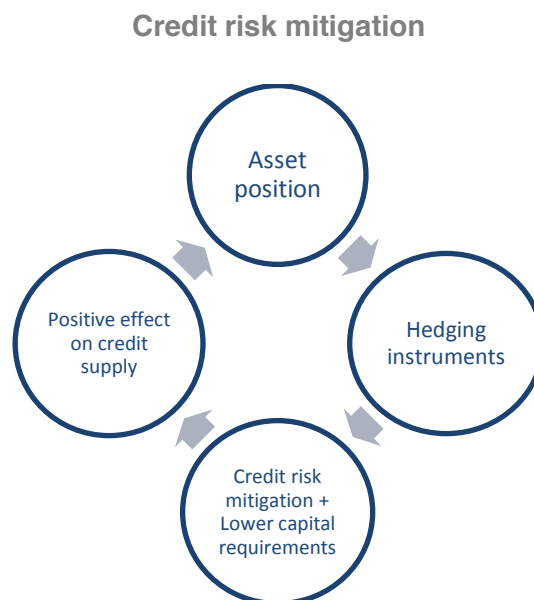
Graphic 12. Credit risk mitigation. Own elaboration

Other considerations:

- If credit has already received preferential qualification for that coverage will not get a reduction in the risk weight.

- If the same position is covered with different hedging arrangements, the credit shall be divided into as many parts as there are mechanisms and coverage requirements will be calculated separately.
- Credit risk should be covered considering that other risks may increase. For example, as a result of misallocation in the mapping process.

Eligible financial collateral

	Simple approach
a)	Cash (as well as certificates of deposit or comparable instruments issued by the lending bank) on deposit with the bank which is incurring the counterparty [10] exposure.[11]
b)	Gold
c)	Debt securities rated by a recognized external credit assessment institution where these are either: - at least BB- when issued by sovereigns or PSEs that are treated as sovereigns by the national supervisor; or - at least BBB- when issued by other entities (including banks and securities firms); or - at least A-3/P-3 for short-term debt instruments.
d)	Debt securities not rated by a recognized external credit assessment institution where these are: - issued by a bank; and - listed on a recognized exchange; and - classified as senior debt; and

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[10] Cash funded credit linked notes issued by the bank against exposures in the banking book which fulfil the

criteria for credit derivatives will be treated as cash collateralised transactions.

[11] When cash on deposit, certificates of deposit or comparable instruments issued by the lending bank are held as collateral at a third-party bank in a non-custodial arrangement, if they are openly pledged/assigned to the lending bank and if the pledge/assignment is unconditional and irrevocable, the exposure amount covered by the collateral (after any necessary haircuts for currency risk) will receive the risk weight of the third-party bank.

	• all rated issues of the same seniority by the issuing bank must be rated at least
	• BBB- or A-3/P-3 by a recognised external credit assessment institution; and
	• the bank holding the securities as collateral has no information to suggest that the
	• issue justifies a rating below BBB- or A-3/P-3 (as applicable); and
	• the supervisor is sufficiently confident about the market liquidity of the security.
e)	Equities (including convertible bonds) that are included in a main index.
f)	Undertakings for Collective Investments in Transferable Securities (UCITS) and mutual funds where: • a price for the units is publicly quoted daily; and • the UCITS/mutual fund is limited to investing in the instruments listed in this paragraph[12]
	Comprehensive approach
a)	All instruments included above
b)	Equities (including convertible bonds) which are not included in a main index but which are listed on a recognised exchange;
c)	UCITS/mutual funds which include such equities.

Graphic 13. Eligible financial collateral for simple and comprehensive approach. (Basel Committee on Banking Supervision, 2006)

These elements above must be legally enforceable, measurable, secure and payable.

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[12] However, the use or potential use by a UCITS/mutual fund of derivative instruments solely to hedge investments listed in this paragraph and paragraph 146 shall not prevent units in that UCITS/mutual fund from being eligible financial collateral.

Talking about the techniques of hedging credit risk we have to differentiate between those serving the SA and the ones serving IRB approaches.

Under the SA, an entity may elect to apply either the simple or the comprehensive approach[13]. However, when the bank has adopted the foundation IRB[14], it will be only allowed to implement the comprehensive approach to determine the risk weight applicable to positions with collateral. The minimum requirements to be met by collaterals so that a capital reduction can be applied are:

- to be documented and legally enforceable in the event of default, and
- not being positively correlated with the payment capacity of the provider of collateral. If so, this collateral is not covering the risk optimally.

The simple approach for the treatment of collateral.

It simply assigns a preferential risk weight to the part of the position that has been covered with the collateral instrument. To be applied, this method must meet certain minimum criteria among which stand out:
- to be valued at market price
- the preferential weighting received by the collateralized portion will be subject to a minimum limit of 20 per cent
- maturities of the collateral and of the underlying asset must be equal
- when the exposure and the collateral are designated in the same currency may apply a weighting of 0 per cent, provided that also occurs at least one of the following two situations:
  - the collateral is cash on deposit
  - the collateral provided is sovereign or PSE debt weighted at 0 per cent and "its market value has been discounted by 20%"

The comprehensive approach for the treatment of collateral

The company covers more properly the risks and the calculation of risk-adjusted exposure is more accurate. Once received the collateral, banks must adjust the risk

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[13] In the trading portfolio only the comprehensive approach can be applied

[14] Treatment of collateral in the IRB method is explained in section 3.2 The Internal Ratings-Based Approach of this study

weight asset considering the haircuts. These haircuts will be calculated either using the ones provided by the Committee (standard haircuts) or estimating them internally (for which the fulfillment of qualitative and quantitative criteria is required).

The haircut is, basically, the adjustment that is made to calculate the total exposure of the position once collaterals have been considered. They reduce the total amount of exposure and depend on the type of instrument to which they are associated, the position they cover and the revision of the value of assets. The higher the quality of the collateral, the lower the discount and therefore the loan portion to be provided by the bank will also be lower.

This haircut, which we call E*:

- will be assigned a risk weight appropriate to the counterparty under the SA or;
- will be used to adjust LGD on the exposure under the foundation IRB.

Calculation of capital requirement

$$E^* = \max\{0[E \times (1 + He) - C \times (1 - Hc - Hfx)]\} \ [\mathbf{3.9}]$$

where:

E* = the exposure value after risk mitigation

E = current value of the exposure

He = haircut appropriate to the exposure

C = the current value of the collateral received

Hc = haircut appropriate to the collateral

Hfx = haircut appropriate for currency mismatch between the collateral and exposure

To estimate the discount of a basket of assets:

$$H = \sum_i ai \ Hi \ [\mathbf{3.10}]$$

Where:

ai = weight of the asset in the basket (measured by units of currency)

Hi = haircut applicable to that asset

*Risk-weighted assets will equal the product of E * by the risk weighting of the borrower:*

$$RWA\ on\ collateralized\ operations\ =\ E^* \times risk\ weighting\ of\ the\ borrower$$

In this section we deal with a practical exercise of measuring regulatory capital. The objective is to implement, for a portfolio of companies, the MCR calculation methods for credit risk set by the BIS, in particular, the SA and the Basic IRB. For the latter it is necessary to estimate the PD for which Altman and Sabato's (2007) model will be applied.

The estimation of the PD is essential to design the conditions for asset operations (interest rates) and for the calculation of the MCRs. However, this estimation presents several problems, among them: the lack of historical data and a changing macroeconomic environment. Before starting the exercise explanation, it is essential to explain what methods the authors have proposed to estimate the PD and the reason for their decision.

4.1 Altman and Sabato's (2007): Prediction models of the PD

Multiple Discriminant Analysis (MDA)

This technique allows classifying borrowers into discrete groups "default" or "not default" by using explanatory variables in the form of financial ratios which, in the literature, have been shown to be the best explanatory variables. The great advantage of this model is its easy understanding of results. However, it shows tightness in the model assumptions (normality and linearity of the model).

An example of this technique is the Z.Score, Altman (2000), in which the author built a discriminant function from the five best predictor variables of PD (based on statistical evidence) to which a coefficients are applied according to their explanatory importance.

Logit Models

This is a response to the limitations of the MDA technique. In fact, logistic regression does not need a starting hypothesis and the coefficients can explain the importance of each variable. This is why Altman and Sabato decided to apply this methodology for the estimation of PD and it will be explained as we proceed in our example. In particular, we will apply to our portfolio, the model of Altman and Sabato for SMEs which, as stated by these authors, represents an improvement in the estimation of PD and greater accuracy in the calculations of the MCR.

Using a logarithmic regression technique, Altman and Sabato (2007) develop a model for predicting defaults whose main objective is to analyze its ability to reduce the regulatory capital. Furthermore, they also emphasize the benefits of calculating MCRs for SMEs separately.

The first step to build the model is the selection of variables. Based on studies of other experts, the authors arbitrarily choose two variables from five different aspects that explain a company's financial profile (liquidity, profitability, leverage, coverage and activity). Then, they apply a statistical forward stepwise selection to eliminate those variables that do not help to explain the model. Finally, the selected ratios are those shown on Graphic 14:

Explanatory variables

ACCOUNTING RATIO CATEGORY	FORMULA	DESCRIPTION
PROFITABILITY X_1	$\dfrac{EBITDA}{Total\ Assets}$	It shows to what extent is being efficient or cost-effective the use of assets for the final result of the company. The higher the ratio the better. In the case of our portfolio, although the product is similar, many companies compete in prices (their profitability responds to high turnover) and others are committed to innovation and differentiation (their profitability responds to margin)
LEVERAGE X_2	$\dfrac{Short\ term\ debt}{Equity}$	It measures the proportion of debt and equity the company is using to finance its assets. A high ratio could indicate problems meeting payments. A low ratio may indicate that a company is not properly funding its growth.
COVERAGE X_3	$\dfrac{Retained\ earnings}{Total\ Assets}$	It measures the proportion of the company's assets that have been financed by profits. The higher the ratio the better.

LIQUIDITY X₄	$\dfrac{Cash}{Total\ Assets}$	Indicates what proportion of the asset is liquid or easily convertible into liquid. The higher the ratio, the greater the ability of the company to invest in improvements or face debt payments. However, it may also indicate some inefficiencies. We can not determine which is the preferred value for this ratio because it depends on many factors such as sector or company size.
ACTIVITY X₅	$\dfrac{EBITDA}{Interest\ Expenses}$	The interest coverage ratio is used to evaluate to what extent the company is able to meet the payment of the interest arising from the debt. If this ratio is under 1, it means the company is having problems to pay its interest expenses. A ratio over 1.5 means the company easily meets its payment obligations. In our portfolio, we have companies whose economic result has been negative so we find negative values of this ratio, which is meaningless, because the company, simply, can not cope with the expenses.

Graphic 14. Explanatory variables of the prediction model for PD by Altman and Sabato. Own elaboration.

As we can see in the equation (4.1), the authors demonstrate that there is a positive relationship between the variables and the probability of default (except for leverage). These function has been built to predict the likelihood that the company *does not default* on its payment obligations.

Equation 3.11 shows the model developed with unlogged predictors

$$Log\left(\frac{PD}{1-PD}\right) = 4.28 + 0.18X_1 - 0.01X_2 + 0.08X_3 + 0.02X_4 + 0.19X_5 \qquad \lfloor 4.1 \rfloor$$

For clearing the PD incognita we have proceed in the following manner:

$$Log\left(\frac{PD}{1-PD}\right) = F(X_1, X_2, \dots, X_n)$$

$$e^{\log(\frac{PD}{1-PD})} = e^F$$

$$\left(\frac{PD}{1-PD}\right) = e^F$$

$$PD = e^F \times (1 - PD)$$

$$PD = e^F - e^F \times PD$$

$$e^F = PD(1 + e^F)$$

$$\boldsymbol{PD = \frac{e^F}{1 + e^F}} \qquad\qquad [\textbf{4.2}]$$

4.2 Empirical Application

The portfolio chosen to perform the empirical application is composed of a total of 50 domestic SMEs within the sector of ceramic tile randomly chosen from a total of 170 companies. These companies meet the requirements to be classified as SMEs (annual turnover fewer than 50 million or an annual balance sheet not exceeding 43 million euros and to employ fewer than 250 persons). For the purpose of the estimation of the MCR, it has been assumed that the bank's exposure for each company is 10% of its total debt. Thus, we are calculating the MCRs applying the SA and the IRB Basic Approach for credit risk. All the calculations have been performed in an Excel file and tables are displayed in the annexes.

4.2.1 Applying the Standardized Approach.

Due to the simplicity of this approach, which has been widely discussed in Section 3 of this paper, we summarize the calculation of MCR:

$$MCR = 10\% \times Risk\ weight \times Risk\ weighting\ for\ retail\ positions$$

where:

EAD= 10% of the total liabilities

Risk weight= 8%

Risk weight for retail positions= 75%

Annex 3 shows, for each of the companies in the sample, the exposure assumed (10% of their indebtedness) and the equity that, according to the SA, should be immobilized. In total, for the entire portfolio of companies such equity to amounts to € 2,652,809.426 which represents a 8 per cent of the total EAD.

4.2.2 Applying the IRB Basic Approach

In this case, due to the greater number of calculations we proceed to explain the process step by step.

As stated above, the first step to predict the PD is to calculate the five financial ratios[15] described by the authors as being the most accurate in predicting default situations. To do this, the annual accounts[16] for 2010 of the total listed companies have been extracted from the SABI database (Analysis System of Iberian Balances).

To estimate the PD[17] we have implemented the model developed with unlogged predictors by Altman and Sabato (2007) which has been explained above. After calculating the PD, the process consists in applying the formulas for measuring MCR as established by Basel regulations for SMEs.

First, the correlation (R), which reflects the relationship between debtors. In our example, we measure the correlation between asset positions which show some dependence, as the portfolio consists of loans within the same sector. This correlation reaches, in some cases, 22 per cent which means higher risk for the bank. In the case of claims on corporates, the Committee applies the asset correlation formula for SMEs (3.5). This correlation decreases as PD increases. The higher the PD, the more dependent it gets on the individual characteristics. The last part of the formula corresponds to the setting for SMEs. This is done because the correlation also

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[15] See Annex 2.

[16] For simplicity, only the data needed for the calculation of ratios is shown. See Annex 1.

[17] See Annex 4.

depends, to some extent, on the size of the firms. The smaller the size of the company, the less risk for banks.

Also, due to differences in the maturity of assets, it is necessary to make an adjustment to soften the effect of the mismatch on capital requirements. For the present case it is necessary to use the formula (3.2).

This adjustment is later used to finally calculate MCRs within a "maturity factor" represented by the following formula:

$$Maturity\ factor = (1 - 1.5 \times (b)^{-1} \times (1 + (M - 2.5) \times (b))$$

And finally, we applied the Capital Requirement (K) formula for corporates (3.3).

Components of UL

$Capital\ requirement\ (k)$ = UL

$$= \left[LGD \times N \left[(1 - R)^{-0.5} \times G(PD) + \left(\frac{R}{(1-R)} \right)^{0.5} \times G(0.999) - PD \times LGD \right] \times \left(1 - 1.5 \times b^{-1} \times (1 + (M - 2.5) \times b) \right) \right]$$

EL + UL VaR (99.9%)	EL	Maturity factor

Graphic 15. Components of UL

LGD under Basic Approach for unsecured loans = 45%

VaR (99.9%). The confidence interval set by the BIS is 99.9 per cent. Thereby only 0.01 per cent is considered very rare losses and remain unfilled with capital.

The EL for this type of asset operations are calculated using the formula below. The resulting percentage is applied to the total EAD and that amount must be covered with provisions.

$$EL(\%) = (PD \times LGD)$$

$$EL(\text{€}) = (PD \times LGD \times EAD)$$

For our portfolio, the quantity that must be covered with provisions amounts to €
427,963.93; and the amount to cover with capital[18] corresponds to € 2,601,663.15,
significantly less than that resulting from applying the SA.

EL and UL distribution
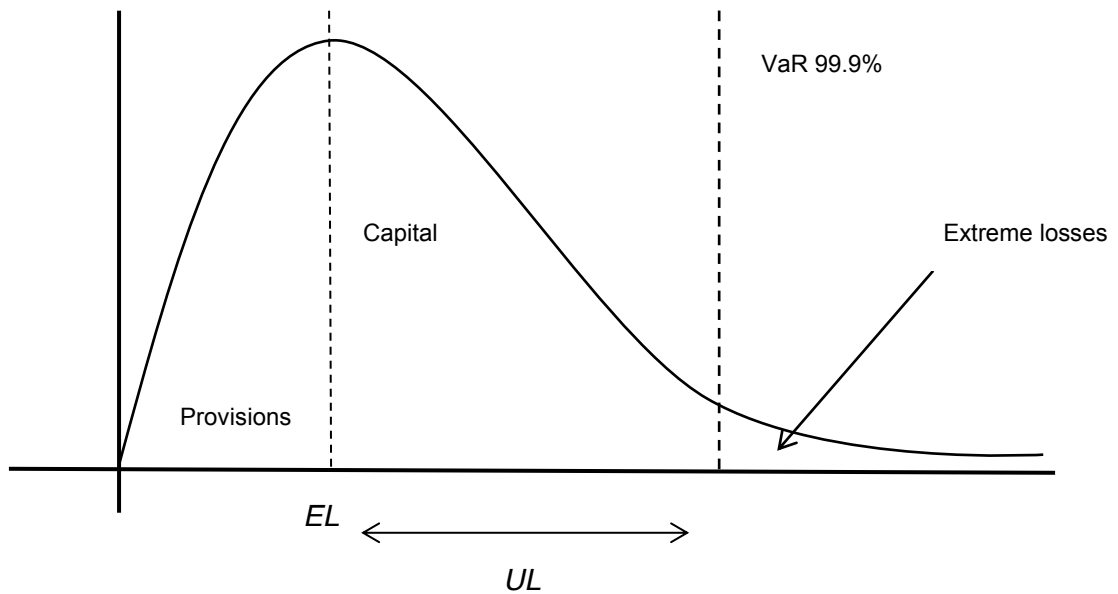
Graphic 16. EL and UL distribution. Own elaboratıon.

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[18] See Annex 5.

5. CONCLUSIONS

Over the last years, it has become more obvious the importance of ensuring banks' solvency. In the case of Spain, the insolvency of its banking system has resulted in its rescue by the European Union in return for strong restructuring measures. This solvency is achieved with the fulfillment of the minimum capital requirements set by banking regulations.

In the present work we have studied the process to calculate these minimum capital requirements on banks, in terms of their exposure to which is its principal risk: credit risk.

We have revised the methods prescribed by Basel II for estimating these MCR: SA and IRB. The basic difference between them is that, whereas with the first the Supervisor is responsible for applying standard parameters and it is necessary the use of external ratings for the calculation of the MCR, the latter involves the estimation of the fundamental parameters for the calculation of this immobilized capital by the bank.

To show how these methods work there has been carried out an empirical application on a hypothetical portfolio of loans to companies, classified as SMEs, in ceramic tile sector. In order to estimate the PD, we have applied the specific model developed by Altman and Sabato (2007) for SMEs based on the use of financial ratios.

In conclusion, it has been found that the IRB method provides a figure for minimum capital requirements lower than that provided by the SA. It also helps fixing fairer prices, avoiding overloading the price to solvent customers. These reasons provide an incentive for banks to adopt gradually this approach.

REFERENCES

Altman, E. (1968) "Financial ratios, discriminant analysis and the prediction of corporate bankruptcy". *Journal of Finance*, Vol 23, No. 4, 589-609.

Altman, E. and Sabato, G. (2007) "Modelling Credit Risk for SMEs: Evidence from the U.S. Market". *ABACUS*, Vol.43, No. 3, 332-357.

Basel Committee on Banking Supervision, 2006. *International Convergence of Capital Measurement and Capital Standards.* Bank for International Settlements (BIS).

Basel Committee on Banking Supervision, 2009. *Revisions to the Basel II market risk framework*. Bank for International Settlements (BIS).

Basel Committee on Banking Supervision, 2013. *The Liquidity Coverage Ratio and liquidity risk monitoring tools.* Bank for International Settlements (BIS).

Beaver, W.H. (1967) "Financial ratios as predictors of failure", *Journal of Accounting Research,* Vol 4, 71-102.

Choudhry, M. (2012) *The principles of banking: capital, asset-liability and liquidity management*. John Wiley and Sons Ltd. Chichester. United Kingdom.

Dietsch, M. and Petey, j. (2002) "The credit risk in SME loans portfolios: Modeling issues, pricing, and capital requirements". *Journal of Banking & Finance,* Vol 26. 303–322.

Fundación BBVA-Ivie (2013). *Informe Crecimiento y competitividad. Los retos de la recuperación*. Available at www.fbbva.es

Gomez, P.; Partal, A. (2010) *Gestión y control del riesgo de crédito en la banca.* Delta Publicaciones Universitarias. Collado-Villalba. Madrid.

Haber, G. (2007) "Basel II: International competition issues". *Atlantic Economic Journal*, Vol 35. 383-389.

Herring, R.J. (2007) "The rocky road to implementation of Basel II in the United States". *Atlantic Economic Journal*, Vol 35. 411-429.

IPYME (2013). *Retrato de las PYME en España 2013*. Available at www.ipyme.org

Matias, A.P. and Amaral H.S. (2012) "Credit risk assessment and the impact of the New Basel Capital Accord on small and medium-sized enterprises". *Management Research Review,* No. 35, 727-749. Emerald Group Publishing. United Kingdom.

Olson, J.A. (1980) "Financial ratios and the probabilistic prediction of bankruptcy". *Journal of Accounting Research,* Vol 18, No. 8, 109-131.

ANNEX 1: Financial Data

Name	NIF Code	CASH	EQUITY	WORKING CAPITAL	TOTAL ASSETS	TOTAL LIABILITIES	EBITDA	EBIT	RETAINED EARNINGS	INTEREST EXPENSES	SHORT TERM DEBT	SALES	ACCOUNT RECEIVABLE
ARAKLINKER SA	A99099277	34,759.00	1,104,119.00	1,849,564.00	11,074,290.00	9,970,170.00	2,662,526.00	258,978.00	1,043,919.00	258,992.95	536,307.00	4,909,656.00	2,029,865.00
AZULANDA AZULEJOS ARTESANOS S.L.	B91062026	8,687.00	250,190.00	88,375.00	473,407.00	223,216.00	47,212.00	9,587.00	12,168.00	8,692.00	168,415.00	273,167.00	134,416.00
AZULEJO DECORADO Y EXPORTACION SL	B12019147	112,742.00	2,391,642.00	1,867,047.00	3,993,014.00	1,601,372.00	322,771.00	284,212.00	2,291,273.00	39,004.00	1,344,003.00	3,304,288.00	1,797,563.00
AZULEJOS APEADERO SL	B12661567	39,654.00	137,594.00	148,308.00	1,079,404.00	941,810.00	90,579.00	51,335.00	61,994.00	31,212.00	346,124.00	1,335,199.00	260,958.00
AZULEJOS MALLOL SA	A12472627	1,321,304.00	17,295,596.00	3,341,671.00	18,921,077.00	1,625,481.00	1,298,801.00	1,018,724.00	16,634,474.00	21,049.00	1,509,721.00	8,045,568.00	1,811,024.00
AZULEJOS PLAZA SA	A12007647	1,756,633.00	14,006,012.00	23,139,366.00	42,801,579.00	28,795,567.00	2,134,969.00	-96,457.00	13,464,502.00	1,297,535.00	6,626,096.00	19,195,754.00	5,514,003.00
BALLESTER PORCAR SL	B12354239	118,116.00	5,157,547.00	5,583,321.00	7,370,883.00	2,213,336.00	-14,119.00	-254,750.00	4,247,435.00	66,128.00	1,369,414.00	2,400,372.00	641,755.00
BENESOL SL	B46195939	226,272.00	1,563,574.00	635,218.00	3,530,474.00	1,966,900.00	153,348.00	82,183.00	1,443,374.00	24,079.00	1,625,523.00	2,068,803.00	1,011,047.00
CALTERET SL	B46032918	6,618.00	980,780.00	686,438.00	1,804,613.00	823,833.00	35,114.00	29,291.00	860,380.00	25,762.00	437,869.00	831,917.00	76,251.00
CENIT CERAMICAS SA	B12512315	52,917.00	1,255,658.00	1,508,308.00	2,779,188.00	1,523,531.00	-14,270.00	-116,517.00	1,195,547.76	41,987.00	1,185,474.00	2,126,716.00	764,980.00
CERACASA SA	A12015707	1,221,412.00	23,272,286.00	16,703,834.00	42,536,489.00	19,264,203.00	-330,822.00	-702,124.00	22,902,056.00	934,116.00	8,644,939.00	17,979,601.00	4,746,649.00
CERAMICA CAS SL	B12017364	81.00	1,436,250.00	1,885,842.00	3,502,205.00	2,065,955.00	-719,534.00	-778,664.00	1,382,160.00	84,537.00	1,661,707.00	1,340,087.00	812,026.00
CERAMICA DECORATIVA SA	A46050464	14,990.00	1,153,829.00	1,131,099.00	6,928,699.00	5,774,870.00	-359,662.00	-493,746.00	914,932.00	238,417.00	4,580,368.00	2,503,852.00	676,682.00
CERAMICA MAYOR SL	A03108669	92,799.00	4,701,602.00	3,535,628.00	9,031,099.00	4,329,497.00	792,191.00	76,586.00	4,140,402.00	214,587.00	2,238,491.00	7,344,014.00	1,723,711.00
CERAMICA MONTOLIU SL	B12056404	13,508.00	987,334.00	752,877.00	1,370,906.00	383,573.00	32,796.00	23,676.00	957,284.00	21,585.00	355,812.00	868,462.00	147,301.00
CERAMICA RIBESALBES, SA	A12072286	114,580.00	3,031,322.00	2,409,918.00	8,466,044.00	5,434,722.00	841,507.00	589,845.00	2,971,122.00	209,286.00	5,209,666.00	10,073,670.00	3,696,386.00
CERAMICALCORA SA	A12082434	254,771.00	7,945,824.00	8,165,151.00	9,444,685.00	1,498,862.00	-955,228.00	-1,036,659.00	7,628,724.00	17,964.00	946,596.00	5,653,909.00	2,198,282.00
CERAMICAS DEL FOIX SA	A08435547	375.00	36,829.00	21,083.00	130,924.00	94,095.00	209.00	-977.00	-13,171.00	948.00	34,720.00	87,387.00	33,103.00
CERAMICAS FANAL SA	A12076972	2,249,642.00	16,927,321.00	17,194,828.00	39,908,116.00	22,980,795.00	3,846,618.00	1,610,252.00	16,354,793.00	789,192.00	12,271,676.00	25,253,602.00	10,597,724.00
CERAMICAS GAYA SOCIEDAD ANONIMA	A12010948	760,244.00	32,624,538.00	4,047,114.00	32,270,842.00	28,918,172.00	-6,474,844.00	-7,616,844.00	2,927,234.00	534,287.00	17,621,444.00	4,767,106.00	1,328,706.00
CERAMICAS MYR SL	B12007357	18,351.00	4,207,783.00	5,951,046.00	13,891,706.00	9,683,924.00	961,591.00	453,940.00	2,702,879.00	440,090.00	8,062,284.00	10,032,605.00	4,228,209.00
CERPA SL	B12027983	180,674.00	14,126,566.00	18,841,320.00	35,355,961.00	21,229,399.00	2,953,700.00	1,799,328.00	14,066,466.00	808,559.00	16,834,756.00	18,601,552.00	10,425,532.00
CEVICA SL	B12070272	31,644.00	1,701,084.00	1,983,834.00	2,963,961.00	1,262,877.00	118,955.00	20,026.00	1,671,034.00	11,001.00	1,015,750.00	3,180,314.00	297,960.00
CIMA CERAMICA SL	B12615134	19,773.00	-744,896.00	1,607,604.00	5,318,027.00	6,062,923.00	231,641.00	162,923.00	-747,906.00	9,153.00	4,796,592.00	5,254,910.00	2,688,771.00
COTTOCER SL	B12459269	3,364.00	11,427,660.00	1,105,505.00	16,059,112.00	4,631,452.00	630,425.00	84,489.00	9,588,600.00	137,834.00	2,925,420.00	11,469,115.00	2,219,452.00
EMAC COMPLEMENTOS SL	B46401675	1,681,707.00	7,595,756.00	3,085,048.00	9,095,258.00	1,499,502.00	2,394,056.00	2,309,425.00	7,572,617.00	49,211.00	1,499,442.00	8,222,776.00	1,840,115.00
EXAGRES SA	A12021390	147,068.00	18,805,400.00	9,741,548.00	35,046,710.00	16,241,310.00	1,047,548.00	-53,912.00	17,687,318.00	824,871.00	7,622,358.00	12,918,853.00	3,583,114.00
GRAUS TERRATZOS I PAVIMENTS SL	B25043290	235,676.00	903,122.00	1,680,242.00	4,219,213.00	3,316,091.00	-160,009.00	-160,009.00	546,249.00	118,984.00	1,260,122.00	4,374,547.00	626,778.00
GRES DE ANDORRA SL	B12381166	63,413.00	6,321,033.00	3,361,898.00	9,746,730.00	3,425,697.00	520,190.00	94,236.00	791,833.00	108,062.00	2,027,922.00	4,883,999.00	1,176,460.00
HIJOS DE FRANCISCO GAYA FORES SL	B12003554	824,337.00	16,253,897.00	13,832,630.00	33,100,208.00	16,846,311.00	1,591,718.00	269,906.00	16,118,672.00	426,253.00	12,298,992.00	18,242,197.00	6,041,995.00
HISPANIA CERAMICA	A12014577	308,751.00	7,017,175.00	15,553,246.00	34,471,451.00	27,454,276.00	1,720,368.00	1,170,122.00	2,309,963.00	1,223,027.00	18,871,387.00	18,260,124.00	9,516,337.00
INCOAZUL SL	B12007928	322,575.00	8,309,229.00	12,278,166.00	15,799,490.00	7,490,261.00	645,042.00	414,921.00	8,303,219.00	41,551.00	7,208,080.00	8,434,740.00	12,231,599.00
INDUSTRIAS ALCORENSES CONFEDERADAS SL	A12008025	1,246,707.00	32,372,228.00	19,187,588.00	52,761,855.00	20,389,627.00	3,725,519.00	468,067.00	28,234,343.00	293,143.00	9,355,853.00	28,682,642.00	8,332,015.00
INDUSTRIAS CERAMICAS BRANCOS SA	A17004763	244,864.00	7,132,990.00	1,942,025.00	8,503,942.00	1,370,952.00	-21,386.00	-230,024.00	7,041,636.00	6,550.00	1,074,793.00	4,199,138.00	1,040,889.00
IZARRI OKINDEGIA SL	B20474789	61,381.00	278,358.00	253,967.00	1,702,069.00	1,423,710.00	217,082.00	71,432.00	170,176.00	48,661.00	360,435.00	1,661,886.00	212,182.00
LA PLATERA SA	A12017455	440,334.00	8,789,843.00	6,483,056.00	14,067,849.00	5,278,006.00	1,168,532.00	669,240.00	8,612,368.00	124,929.00	4,167,767.00	9,568,342.00	4,328,207.00
LEVANTINA Y ASOCIADOS DE MINERALES SA	A84433515	25,542.00	193,727.00	94,647.00	439,376.00	245,649.00	15,845.00	3,837.00	93,727.00	35,599.00	69,944.00	198,401.00	49,626.00
MERCURY CERAMICA SOCIEDAD LIMITADA	B12354163	180,032.17	-3,472,757.00	5,747,642.29	35,987,579.76	39,460,336.00	-81,806.00	-2,312,520.00	-3,629,016.00	1,283,272.00	15,786,721.38	15,130,166.26	4,285,491.15
NOMAZUL SA	A12012340	569,796.00	6,223,765.00	5,237,044.00	7,316,574.00	1,092,809.00	-1,255,661.00	-1,409,616.00	5,835,715.00	48,942.00	1,085,362.00	3,986,851.00	1,731,811.00
PORCELANITE SL	B12045043	236,146.00	17,071,287.00	10,764,295.00	20,786,849.00	3,715,562.00	773,921.00	324,756.00	17,035,227.00	25,560.00	3,413,460.00	10,637,276.00	6,517,468.00
REVIGLAS SA	A20094777	444,879.00	5,755,254.00	1,449,412.00	10,057,249.00	4,301,995.00	600,981.00	721,759.00	5,154,242.00	142,802.00	873,239.00	5,147,933.00	1,060,611.00
SICHAR CERÁMICA SA	A12015152	857.00	-26,553.00	300,274.00	4,593,320.00	4,619,873.00	-53,037.00	-79,730.00	-236,252.00	173,853.00	233,943.00	17,658.00	314,192.00
SIERRAGRES SA	A14481105	11,454.00	5,115,922.00	4,708,263.00	8,456,137.00	3,340,214.00	680,073.00	146,834.00	4,183,591.00	42,711.00	2,737,418.00	4,995,671.00	1,478,802.00
STRATOS CERAMICOS SL	B12436333	71,579.00	688,442.00	1,323,922.00	3,267,708.00	2,579,266.00	154,709.00	65,888.00	628,341.00	64,908.00	1,540,780.00	2,905,973.00	1,442,019.00
TODAGRES SA	A12012514	97,282.00	-5,802,658.00	7,941,291.00	51,882,736.00	57,685,394.00	1,566,060.00	-275,350.00	-7,248,998.00	2,912,950.00	25,776,473.00	26,332,895.00	5,414,617.00
TOGAMA SA	A12075008	28,266.00	627,163.00	3,393,466.00	7,472,912.00	6,845,749.00	-108,917.00	-603,269.00	959,293.00	144,138.00	6,604,427.00	4,720,264.00	1,042,572.00
TOZETO SL	B46998308	5,363.00	448,943.00	1,521,779.00	4,795,413.00	4,346,289.00	-264,074.00	-334,451.00	1,920,664.00	40,402.00	4,295,496.00	2,783,109.00	881,101.00
UNIVERSAL CERAMICA SL	B12019865	1,627,555.00	4,017,107.00	2,448,775.00	6,883,713.00	2,866,606.00	384,845.00	225,563.00	3,993,968.00	29,048.00	1,726,732.00	5,940,547.00	1,442,540.00
VIDREPUR SA	A12094009	228,069.00	16,203,268.00	6,963,956.00	18,784,266.00	2,580,998.00	617,228.00	177,613.00	15,974,888.00	32,399.00	2,095,998.00	12,153,490.00	2,268,880.00
VITRODECOR SL	B12565388	106,432.00	885,550.00	260,653.00	1,040,453.00	154,903.00	72,011.00	36,777.00	861,550.00	4,387.00	107,115.00	1,060,384.00	297,169.00

ANNEX 2: Financial Ratios

Name	NIF Code	CASH/TA	RE/TA	EBITDA/TA	SHORT TERM DEBT/EQUITY	EBITDA/ INTEREST EXPENSES
ARAKLINKER SA	A99099277	0,0031	0,0943	0,2404	0,4857	10,2803
AZULANDA AZULEJOS ARTESANOS S.L.	B91062026	0,0183	0,0257	0,0997	0,6731	5,4317
AZULEJO DECORADO Y EXPORTACION SL	B12019147	0,0282	0,5738	0,0808	0,5620	8,2753
AZULEJOS APEADERO SL	B12661567	0,0367	0,0574	0,0839	2,5155	2,9021
AZULEJOS MALLOL SA	A12472627	0,0698	0,8792	0,0686	0,0873	61,7037
AZULEJOS PLAZA SA	A12007647	0,0410	0,3146	0,0499	0,4731	1,6454
BALLESTER PORCAR SL	B12354239	0,0160	0,5762	-0,0019	0,2655	-0,2135
BENESOL SL	B46195939	0,0641	0,4088	0,0434	1,0396	6,3685
CALTERET SL	B46032918	0,0037	0,4768	0,0195	0,4464	1,3630
CENIT CERAMICAS SA	B12512315	0,0190	0,4302	-0,0051	0,9441	-0,3399
CERACASA SA	A12015707	0,0287	0,5384	0,0078	0,3715	0,3542
CERAMICA CAS SL	B12017364	0,0000	0,3947	-0,2055	1,1570	-8,5115
CERAMICA DECORATIVA SA	A46050464	0,0022	0,1320	-0,0519	3,9697	-1,5085
CERAMICA MAYOR SL	A03108669	0,0103	0,4585	0,0877	0,4761	3,6917
CERAMICA MONTOLIU SL	B12056404	0,0099	0,6983	0,0239	0,3604	1,5194
CERAMICA RIBESALBES, SA	A12072286	0,0135	0,3509	0,0994	1,7186	4,0208
CERAMICALCORA SA	A12082434	0,0270	0,8077	-0,0051	0,1191	-53,1746
CERAMICAS DEL FOIX SA	A08435547	0,0029	-0,1006	0,0016	0,9427	0,2205
CERAMICAS FANAL SA	A12076972	0,0564	0,4098	0,0964	0,7250	4,8741
CERAMICAS GAYA SOCIEDAD ANONIMA	A12010948	0,0236	0,0907	-0,2006	0,5401	-12,1187
CERAMICAS MYR SL	B12007357	0,0013	0,1946	0,0692	1,9160	2,1850
CERPA SL	B12027983	0,0051	0,3979	0,0835	1,1917	3,6530
CEVICA SL	B12070272	0,0107	0,5638	0,0401	0,5971	10,8131
CIMA CERAMICA SL	B12615134	0,0037	-0,1406	0,0436	-6,4393	25,3077
COTTOCER SL	B12459269	0,0002	0,5971	0,0393	0,2560	4,5738
EMAC COMPLEMENTOS SL	B46401675	0,1849	0,8326	0,2632	0,1974	48,6488
EXAGRES SA	A12021390	0,0042	0,5047	0,0299	0,4053	1,2700
GRAUS TERRATZOS I PAVIMENTS SL	B25043290	0,0559	0,1295	-0,0379	1,3953	-1,3448
GRES DE ANDORRA SL	B12381166	0,0065	0,0812	0,0534	0,3208	4,8138
HIJOS DE FRANCISCO GAYA FORES SL	B12003554	0,0249	0,4870	0,0481	0,7567	3,7342
HISPANIA CERAMICA	A12014577	0,0090	0,0670	0,0499	2,6893	1,4066
INCOAZUL SL	B12007928	0,0204	0,5255	0,0408	0,8675	15,5241
INDUSTRIAS ALCORENSES CONFEDERADAS SL	A12008025	0,0236	0,5351	0,0706	0,2890	12,7089
INDUSTRIAS CERAMICAS BRANCOS SA	A17004763	0,0288	0,8280	-0,0025	0,1507	-3,2650
IZARRI OKINDEGIA SL	B20474789	0,0361	0,1000	0,1275	1,2949	4,4611
LA PLATERA SA	A12017455	0,0313	0,6122	0,0831	0,4742	9,3536
LEVANTINA Y ASOCIADOS DE MINERALES SA	A84433515	0,0581	0,2133	0,0361	0,3610	0,4451
MERCURY CERAMICA SOCIEDAD LIMITADA	B12354163	0,0050	-0,1008	-0,0023	-4,5459	-0,0637
NOMAZUL SA	A12012340	0,0779	0,7976	-0,1716	0,1744	-25,6561
PORCELANITE SL	B12045043	0,0114	0,8195	0,0372	0,2000	30,2786
REVIGLAS SA	A20094777	0,0442	0,5125	0,0598	0,1517	4,2085
SICHAR CERÁMICA SA	A12015152	0,0002	-0,0514	-0,0115	-8,8104	-0,3051
SIERRAGRES SA	A14481105	0,0014	0,4947	0,0804	0,5351	15,9227
STRATOS CERAMICOS SL	B12436333	0,0219	0,1923	0,0473	2,2381	2,3835
TODAGRES SA	A12012514	0,0019	-0,1397	0,0302	-4,4422	0,5376
TOGAMA SA	A12075008	0,0038	-0,1284	-0,0146	10,5306	-0,7556
TOZETO SL	B46998308	0,0011	0,4005	-0,0551	9,5680	-6,5362
UNIVERSAL CERAMICA SL	B12019865	0,2364	0,5802	0,0559	0,4298	13,2486
VIDREPUR SA	A12094009	0,0121	0,8504	0,0329	0,1294	19,0508
VITRODECOR SL	B12565388	0,1023	0,8281	0,0692	0,1210	16,4146

Name	NIF Code	EAD	MCR
ARAKLINKER SA	A99099277	997,017.00	59,821.02
AZULANDA AZULEJOS ARTESANOS S.L.	B91062026	22,321.60	1,339.30
AZULEJO DECORADO Y EXPORTACION SL	B12019147	160,137.20	9,608.23
AZULEJOS APEADERO SL	B12661567	94,181.00	5,650.86
AZULEJOS MALLOL SA	A12472627	162,548.10	9,752.89
AZULEJOS PLAZA SA	A12007647	2,879,556.70	172,773.40
BALLESTER PORCAR SL	B12354239	221,333.60	13,280.02
BENESOL SL	B46195939	196,690.00	11,801.40
CALTERET SL	B46032918	82,383.30	4,943.00
CENIT CERAMICAS SA	B12512315	152,353.10	12,188.25
CERACASA SA	A12015707	1,926,420.30	115,585.22
CERAMICA CAS SL	B12017364	206,595.50	12,395.73
CERAMICA DECORATIVA SA	A46050464	577,487.00	46,198.96
CERAMICA MAYOR SL	A03108669	432,949.70	25,976.98
CERAMICA MONTOLIU SL	B12056404	38,357.30	2,301.44
CERAMICA RIBESALBES, SA	A12072286	543,472.20	32,608.33
CERAMICALCORA SA	A12014577	149,886.20	8,993.17
CERAMICAS DEL FOIX SA	A12082434	9,409.50	564.57
CERAMICAS FANAL SA	A08435547	2,298,079.50	137,884.77
CERAMICAS GAYA SOCIEDAD ANONIMA	A12076972	2,891,817.20	173,509.03
CERAMICAS MYR SL	A12010948	968,392.40	77,471.39
CERPA SL	B12007357	2,122,939.90	127,376.39
CEVICA SL	B12027983	126,287.70	7,577.26
CIMA CERAMICA SL	B12070272	606,292.30	36,377.54
COTTOCER SL	B12615134	463,145.20	27,788.71
EMAC COMPLEMENTOS SL	B12459269	149,950.20	8,997.01
EXAGRES SA	B46401675	1,624,131.00	97,447.86
GRAUS TERRATZOS I PAVIMENTS SL	A12021390	331,609.10	19,896.55
GRES DE ANDORRA SL	B25043290	342,569.70	20,554.18
HIJOS DE FRANCISCO GAYA FORES SL	B12381166	1,684,631.10	101,077.87
HISPANIA CERAMICA	A12017455	2,745,427.60	164,725.66
INCOAZUL SL	B12003554	749,026.10	44,941.57
INDUSTRIAS ALCORENSES CONFEDERADAS SL	B12007928	2,038,962.70	122,337.76
INDUSTRIAS CERAMICAS BRANCOS SA	A12008025	137,095.20	8,225.71
IZARRI OKINDEGIA SL	A17004763	142,371.00	8,542.26
LA PLATERA SA	B20474789	527,800.60	31,668.04
LEVANTINA Y ASOCIADOS DE MINERALES SA	A84433515	24,564.90	1,473.89
MERCURY CERAMICA SOCIEDAD LIMITADA	B12354163	3,946,033.60	315,682.69
NOMAZUL SA	A12012340	109,280.90	6,556.85
PORCELANITE SL	B12045043	371,556.20	22,293.37
REVIGLAS SA	A20094777	430,199.50	25,811.97
SICHAR CERÁMICA SA	A12015152	461,987.30	27,719.24
SIERRAGRES SA	A14481105	334,021.40	20,041.28
STRATOS CERAMICOS SL	B12436333	257,926.60	15,475.60
TODAGRES SA	A12012514	5,768,539.40	346,112.36
TOGAMA SA	A12075008	684,574.90	41,074.49
TOZETO SL	B46998308	434,628.90	34,770.31
UNIVERSAL CERAMICA SL	B12019865	286,660.60	17,199.64
VIDREPUR SA	A12094009	258,099.80	15,485.99
VITRODECOR SL	B12565388	15,490.30	929.42

Risk weight		0.08
Risk weight for retail positions		75%
EAD		10%
TOTAL MCR	€	2,652,809.43
TOTAL EAD	€	42,187,192.10

ANNEX 4: Estimation of the PD using Z.Score (Altman)

Name	Z.ALTMAN (UNLOGGED)	PD (UNLOGGED)	PD
ARAKLINKER SA	6.27928	99.81%	0.187%
AZULANDA AZULEJOS ARTESANOS S.L.	5.32566	99.52%	0.484%
AZULEJO DECORADO Y EXPORTACION SL	5.90771	99.73%	0.271%
AZULEJOS APEADERO SL	4.82667	99.21%	0.795%
AZULEJOS MALLOL SA	16.08691	100.00%	0.000%
AZULEJOS PLAZA SA	4.62286	99.03%	0.973%
BALLESTER PORCAR SL	4.28285	98.64%	1.362%
BENESOL SL	5.52143	99.60%	0.398%
CALTERET SL	4.57623	98.98%	1.019%
CENIT CERAMICAS SA	4.23986	98.58%	1.420%
CERACASA SA	4.38862	98.77%	1.227%
CERAMICA CAS SL	2.64584	93.38%	6.625%
CERAMICA DECORATIVA SA	3.95494	98.12%	1.880%
CERAMICA MAYOR SL	5.02933	99.35%	0.650%
CERAMICA MONTOLIU SL	4.62545	99.03%	0.970%
CERAMICA RIBESALBES, SA	5.07301	99.38%	0.622%
CERAMICALCORA SA	-5.76013	0.31%	99.686%
CERAMICAS DEL FOIX SA	4.30476	98.67%	1.332%
CERAMICAS FANAL SA	5.25010	99.48%	0.522%
CERAMICAS GAYA SOCIEDAD ANONIMA	1.94367	87.48%	12.525%
CERAMICAS MYR SL	4.70404	99.10%	0.898%
CERPA SL	5.00913	99.34%	0.663%
CEVICA SL	6.38106	99.83%	0.169%
CIMA CERAMICA SL	9.14951	99.99%	0.011%
COTTOCER SL	5.20130	99.45%	0.548%
EMAC COMPLEMENTOS SL	13.63898	100.00%	0.000%
EXAGRES SA	4.56308	98.97%	1.032%
GRAUS TERRATZOS I PAVIMENTS SL	4.01518	98.23%	1.772%
GRES DE ANDORRA SL	5.20765	99.46%	0.544%
HIJOS DE FRANCISCO GAYA FORES SL	5.03004	99.35%	0.650%
HISPANIA CERAMICA	4.53489	98.94%	1.061%
INCOAZUL SL	7.27070	99.93%	0.070%
INDUSTRIAS ALCORENSES CONFEDERADAS SL	6.74779	99.88%	0.117%
INDUSTRIAS CERAMICAS BRANCOS SA	3.72450	97.64%	2.356%
IZARRI OKINDEGIA SL	5.14634	99.42%	0.579%
LA PLATERA SA	6.11699	99.78%	0.220%
LEVANTINA Y ASOCIADOS DE MINERALES SA	4.38568	98.77%	1.230%
MERCURY CERAMICA SOCIEDAD LIMITADA	4.30497	98.67%	1.332%
NOMAZUL SA	-0.56193	36.31%	63.690%
PORCELANITE SL	10.10342	100.00%	0.004%
REVIGLAS SA	5.13074	99.41%	0.588%
SICHAR CERÁMICA SA	4.30395	98.67%	1.333%
SIERRAGRES SA	7.35404	99.94%	0.064%
STRATOS CERAMICOS SL	4.73483	99.13%	0.871%
TODAGRES SA	4.42086	98.81%	1.188%
TOGAMA SA	4.01830	98.23%	1.767%
TOZETO SL	2.96460	95.09%	4.905%
UNIVERSAL CERAMICA SL	6.85414	99.89%	0.105%
VIDREPUR SA	7.97256	99.97%	0.034%
VITRODECOR SL	7.47832	99.94%	0.056%

MODEL DEVELOPED WITH UNLOGGED PREDICTORS	
Z=	4.28
0.18	EBITDA/Total assets
-0.01	Short term debt/Equity book value
0.08	Retained earnings/Total assets
0.02	Cash/Total assets
0.19	EBITDA/Interest expenses

ANNEX 5: MCR applying IRB-Basic Approach

Name	EAD	SALES (MILLIONS EUR)	PD	PD(MIN)	LGD	N [(1 − R)^-0,5 × G(PD) + (R / (1 − R))^0,5 × G(0,999)]	EL(€)	Maturity factor	K(sme)	MCR	RWA
ARAKLINKER SA	997,017.00	4.91	0.19%	0.19%	0.45	0.049421827	839.5	0.99833556	0.02220281	22,136.57	276,707.18
AZULANDA AZULEJOS ARTESANOS S.L.	22,321.60	0.27	0.48%	0.48%	0.45	0.088536002	48.6	0.998801534	0.03979345	888.25	11,103.17
AZULEJO DECORADO Y EXPORTACION SL	160,137.20	3.30	0.27%	0.27%	0.45	0.062801539	195.4	0.99852638	0.02821905	4,518.92	56,486.49
AZULEJOS APEADERO SL	94,181.00	1.34	0.79%	0.79%	0.45	0.115097118	336.9	0.999014239	0.05174265	4,873.17	60,914.68
AZULEJOS MALLOL SA	162,548.10	8.05	0.00%	0,03%	0.45	0.012959111	21.9	0.997222472	0.0058154	945.28	11,816.03
AZULEJOS PLAZA SA	2,879,556.70	19.20	0.97%	0.97%	0.45	0.129394622	12606.9	0.999094933	0.05817488	167,517.87	2,093,973.32
BALLESTER PORCAR SL	221,333.60	2.40	1.36%	1.36%	0.45	0.146981242	1356.1	0.999221536	0.06609007	14,627.95	182,849.41
BENESOL SL	196,690.00	2.07	0.40%	0.40%	0.45	0.07932389	352.6	0.998712229	0.03564978	7,011.96	87,649.45
CALTERET SL	82,383.30	0.83	1.02%	1.02%	0.45	0.129335505	377.7	0.999112892	0.05814935	4,790.54	59,881.69
CENIT CERAMICAS SA	152,353.10	2.13	1.42%	1.42%	0.45	0.149533397	973.9	0.99923683	0.06723867	10,244.02	128,050.26
CERACASA SA	1,926,420.30	17.98	1.23%	1.23%	0.45	0.143255447	10632.8	0.999183229	0.0644123	124,085.16	1,551,064.48
CERAMICA CAS SL	206,595.50	1.34	6.62%	6.62%	0.45	0.282339074	6158.7	0.999689374	0.12701312	26,240.34	328,004.23
CERAMICA DECORATIVA SA	577,487.00	2.50	1.88%	1.88%	0.45	0.167236073	4885.4	0.999334097	0.07520612	43,430.56	542,881.95
CERAMICA MAYOR SL	432,949.70	7.34	0.65%	0.65%	0.45	0.1047062	1266.5	0.998930437	0.04706739	20,377.81	254,722.68
CERAMICA MONTOLIU SL	38,357.30	0.87	0.97%	0.97%	0.45	0.126487259	167.5	0.999093932	0.05686769	2,181.29	27,266.14
CERAMICA RIBESALBES, SA	543,472.20	10.07	0.62%	0.62%	0.45	0.102682882	1522.3	0.998911912	0.04615702	25,085.06	313,563.21
CERAMICALCORA SA	149,886.20	5.65	99.69%	99.69%	0.45	0.551379902	67236.9	1	0.24812096	37,189.91	464,873.84
CERAMICAS DEL FOIX SA	9,409.50	0.09	1.33%	1.33%	0.45	0.145258202	56.4	0.999213683	0.06531479	614.58	7,682.24
CERAMICAS FANAL SA	2,298,079.50	25.25	0.52%	0.52%	0.45	0.095052512	5397.8	0.998835122	0.0427238	98,182.70	1,227,283.73
CERAMICAS GAYA SOCIEDAD ANONIMA	2,891,817.20	4.77	12.52%	12.52%	0.45	0.392364776	162984.5	0.999818055	0.17653202	510,498.34	6,381,229.30
CERAMICAS MYR SL	968,392.40	10.03	0.90%	0.90%	0.45	0.123294866	3912.1	0.999063223	0.05543071	53,678.68	670,983.54
CERPA SL	2,122,939.90	18.60	0.66%	0.66%	0.45	0.107201229	6336.1	0.998938951	0.04818937	102,303.13	1,278,789.13
CEVICA SL	126,287.70	3.18	0.17%	0.17%	0.45	0.046055511	96.1	0.998281233	0.02068936	2,612.81	32,660.14
CIMA CERAMICA SL	606,292.30	5.25	0.01%	0,03%	0.45	0.012914354	81.8	0.997222472	0.00579532	3,513.66	43,920.71
COTTOCER SL	463,145.20	11.47	0.55%	0.55%	0.45	0.096061246	1142.0	0.998856552	0.04317813	19,997.74	249,971.81
EMAC COMPLEMENTOS SL	149,950.20	8.22	0.00%	0,03%	0.45	0.012961955	20.2	0.997222472	0.00581668	872.21	10,902.65
EXAGRES SA	1,624,131.00	12.92	1.03%	1.03%	0.45	0.131970762	7544.1	0.999117921	0.05933446	96,366.93	1,204,586.68
GRAUS TERRATZOS I PAVIMENTS SL	331,609.10	4.37	1.77%	1.77%	0.45	0.163811009	2644.2	0.999314123	0.07366439	24,427.78	305,347.30
GRES DE ANDORRA SL	342,569.70	4.88	0.54%	0.54%	0.45	0.094995134	839.3	0.998853773	0.04269881	14,627.32	182,841.49
HIJOS DE FRANCISCO GAYA FORES SL	1,684,631.10	18.24	0.65%	0.65%	0.45	0.106007745	4924.5	0.998930137	0.04765245	80,276.80	1,003,459.97
HISPANIA CERAMICA	2,745,427.60	18.26	1.06%	1.06%	0.45	0.134480648	13113.2	0.999128651	0.06046356	165,998.33	2,074,979.10
INCOAZUL SL	749,026.10	8.43	0.07%	0.07%	0.45	0.024617067	234.3	0.997768747	0.01105296	8,278.96	103,486.97
INDUSTRIAS ALCORENSES CONFEDERADAS SL	2,038,962.70	28.68	0.12%	0.12%	0.45	0.03683916	1075.4	0.998078151	0.01654576	33,736.19	421,702.41
INDUSTRIAS CERAMICAS BRANCOS SA	137,095.20	4.20	2.36%	2.36%	0.45	0.182645891	1453.3	0.999407574	0.08214196	11,261.27	140,765.85
IZARRI OKINDEGIA SL	142,371.00	1.66	0.58%	0.58%	0.45	0.097810013	370.8	0.998880442	0.04396523	6,259.37	78,242.17
LA PLATERA SA	527,800.60	9.57	0.22%	0.22%	0.45	0.055319276	522.6	0.998420357	0.02485435	13,118.14	163,976.77
LEVANTINA Y ASOCIADOS DE MINERALES SA	24,564.90	0.20	1.23%	1.23%	0.45	0.140443575	136.0	0.99184309	0.06314806	1,551.23	19,390.32
MERCURY CERAMICA SOCIEDAD LIMITADA	3,946,033.60	15.13	1.33%	1.33%	0.45	0.14787027	23655.1	0.999213606	0.06648929	262,368.99	3,279,612.34
NOMAZUL SA	109,280.90	3.99	63.69%	63.69%	0.45	0.641065745	31320.4	0.999991421	0.28847711	31,525.04	394,062.98
PORCELANITE SL	371,556.20	10.64	0.00%	0,03%	0.45	0.01300073	50.2	0.997222472	0.00583408	2,167.69	27,096.10
REVIGLAS SA	430,199.50	5.15	0.59%	0.59%	0.45	0.099031317	1137.8	0.998887177	0.0445145	19,150.12	239,376.45
SICHAR CERÁMICA SA	461,987.30	0.02	1.33%	1.33%	0.45	0.145294392	2772.2	0.999213972	0.06533108	30,182.13	377,276.64
SIERRAGRES SA	334,021.40	5.00	0.06%	0.06%	0.45	0.023041221	96.1	0.997717087	0.01034488	3,455.41	43,192.65
STRATOS CERAMICOS SL	257,926.60	2.91	0.87%	0.87%	0.45	0.120505569	1010.6	0.999051046	0.05417605	13,973.44	174,668.04
TODAGRES SA	5,768,539.40	26.33	1.19%	1.19%	0.45	0.142685781	30841.2	0.999171359	0.0641554	370,082.93	4,626,036.57
TOGAMA SA	684,574.90	4.72	1.77%	1.77%	0.45	0.163683612	5442.1	0.99931308	0.07360703	50,389.52	629,869.05
TOZETO SL	434,628.90	2.78	4.91%	4.91%	0.45	0.245215568	9593.5	0.999616752	0.11030472	47,941.62	599,270.23
UNIVERSAL CERAMICA SL	286,660.60	5.94	0.11%	0.11%	0.45	0.033237273	136.0	0.998017111	0.01492712	4,279.02	53,487.70
VIDREPUR SA	258,099.80	12.15	0.03%	0.03%	0.45	0.014513416	40.0	0.997316856	0.00651351	1,681.14	21,014.21
VITRODECOR SL	15,490.30	1.06	0.06%	0.06%	0.45	0.020891359	3.9	0.997639443	0.00937892	145.28	1,816.03

EAD	10%
EL (Provision €	427,963.93
TOTAL MCR €	2,601,663.16
TOTAL EAD €	42,187,192.10

RWA	32,520,789.46

K/RWA	0.08