Sub-Optimality of Income Statement-Based Methods for Measuring Operational Risk under Basel II: Empirical Evidence from Spanish Banks

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The New Basel Capital Accord (Basel II) was created with the intention of establishing a framework in which financial entities can manage their risks in a more detailed and efficient way. Within this general reform movement, Operational Risk emerges as a fundamental variable. OR can be managed by three alternative methods: the Basic Indicator Approach, Standard Approach and Advanced Measurement Approach. The choice of which method to adopt has become of supreme interest for senior banking managers. This study analyzes the exactitude of the underlying implicit hypotheses that support each method, distinguishing between income statement based methods and the management accounting based method. In the present study the non-optimum character of the two Income Statement-based methods is empirically confirmed, in the light of the data provided by Spanish financial entities.

I. INTRODUCTION

The start of this new century opens a critical period for the regulation of financial entities, with different rules that have just come into force and others due soon, such as the International Financial Reporting Standards and Basel II, respectively. There is not much time left for the banks to prepare for applying the new rules (Aparicio and Keskiner, 2004).

Due to the special characteristics of their economic activity, accepting funds from the public and investing them through the provision of credit and participation in various different markets, instruments and transactions, banking entities present a peculiar capital structure. In particular, their ratio of own funds to total funds is much lower than that of other types of industrial or commercial organization that may be comparable in size and degree of internationalization, hence capital is a key factor for them (Rowe *et al*., 2004). As a consequence of this particularity, there exist various standards backed by regulatory authority, whose object is to measure and control minimum levels of capital sufficiency in banking entities. For the same reasons the financial sector has become one of the sectors most strictly re regulated in the general or public interest. As a result, the regulation of capital is a strategic topic for the management of these entities (Lastra, 2004). Paradoxically,

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the formal and systematic regulation of banking is relatively new (Saindenberg and Schuermann, 2003).

The Bank for International Settlements (BIS) is an international organization for cooperation between central banks for promoting international financial stability and for providing services and coordination to central banks. One of the specific concerns of the BIS has been to promote measures of control over the minimum ratio of own funds to total funds, and to try and harmonize these measures internationally, to avoid competitive distortions from the application of different ratios. Among the measures being taken are attempts to improve organizational aspects of the banking sector, such as the relationship of banks with their corresponding supervisory authorities, and the need for adequate transparency of information to meet the current requirements of the financial markets. With the object of dealing with these matters, the Basel Committee was set up within the structure of the BIS; this is formed by central bank members from Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States. The members of this Committee are basically senior personnel with responsibilities for supervision employed in the different central banks or in entities that fulfill functions equivalent to those of a central bank, such as the Federal Reserve of the United States of America. There is wide consensus on the view that the regulations proposed by the Basel Committee have important repercussions in the global economy and in the markets (Allen, 2004).

To this end, in 1988 the Basel Committee published the *International Convergence of Capital Measurement and Capital Standards*, known today as Basel I, an agreement to encourage the international harmonization of the tools and methods used for banking supervision; this agreement was destined in principle to be incorporated into the specific banking legislation of each of the countries cited above. The success of this first agreement consisted in providing an authentic common set of rules on management of risks, to be applied by the principal banks of the world (Allen, 2004). The agreement consists of the requirement for each financial entity to hold on its balance sheet an amount of own funds – represented in different accounting concepts defined as admissible funds -, equal to a minimum proportion of 8% of that entity's total assets and exposures, weighted in function of their level of risk. The figure of 8% is the well-known Solvency Ratio or Coefficient. Thus, in order to calculate its regulatory capital requirement that will enable the bank to keep the ratio above of the minimum level demanded, it should calculate an amount of risk exposures that is matched to a total amount of assets weighted according to the degree of financial security of the operations that are involved. Subsequently, once this amount (the denominator of the ratio) has been determined, the managers of the entity must assure themselves (and the regulator) that it has available amounts of own funds of the quality and quantity necessary to present a solvency ratio of at least 8%. This set of measures, designed in principle for entities with substantial transnational activity and at the consolidated level, has gradually been

incorporated into the banking legislation of many different countries, and is also becoming an important reference for smaller and less internationalized entities.

However, the first Basel Capital Accord also had unexpected consequences, such as the fact of that some gaps in the regulation could be exploited by some entities for putting into practice investment procedures that are more risky than are considered desirable (Allen, 2004). As Alexander (2003) states, the pre-eminent objective of the agreement was to maintain minimum levels of capital in the face of the increase in aggressive competition between entities, rather than to devise sophisticated means of risk measurement. The need for a reform of these rules has therefore become manifest. The documents "International Convergence of Capital Measurement and Capital Standards: A Revised Framework" and "Amendment to the Capital Accord to incorporate market risks", constitute the New Basel Capital Accord, known as Basel II (2005). They represent a sophistication of practices and the achievement of a greater degree of detail on the measures to be taken in banking supervision and management of risks, and they introduce new tools for this management. All this normative gearing would enter into force between 2006 and 2008, at the discretion of the national authority of each territory. In the text of the New Framework, banking entities are given the option of taking certain decisions in respect of the methods for measurement of risks to utilize.

The new regulatory scenario introduces the factor of Operational Risk, defined as the risk incurred by financial entities due to human or computer faults, frauds, theft and disasters. These events are highly unpredictable and very costly for banking entities, as illustrated by the following cases: in 1977, the case of Credit Suisse; in 1995, the bankruptcy of Barings Bank; and since 2001, the case of Enron and various terrorist attacks. The financial entities have suffered serious losses due to Operational Risk in past decades (Fontnouvelle *et al*., 2003), therefore the correct management of this variable has become urgent. When it comes to establishing the capital requirement to cover Operational Risk, three possible methods are proposed, graduated in line with increased sophistication and degree of security: the Basic Indicator Approach, the Standard Approach and the Advanced Measurement Approach. The first two are based on the hypothesis that the entities with higher income levels are likely to suffer greater losses from Operational Risk; for this reason, the capital requirement is determined as a percentage of this income figure. They are thus based on an approach founded on financial variables destined in principle to be reported externally. In principle, these two methods aim to quantify the Operational Risk blindly, without entering into any study or mitigation of its causes and inter-relationships with others aspects of the banking entities' structure and operations.

In the present work, the published accounts or financial statements of Spanish credit-issuing entities are analyzed. Spain's membership of the European Union, and of the Euro zone (which means that we are concerned with one of the normative regimes in which Basel II will enter into force), and the especially important role of the financial sector in the Spanish economy as a whole (as will be explained later)

are all factors that make our country an interesting scenario for the analysis that will be presented here. Given the lack of homogeneity in accounting standards and regulation, for all the period considered [2001–2005], among the different countries that make up the EU, it has not been thought advisable to utilize a European-wide sample of entities for this study. For the application of the Income Statement-based methods, it is necessary to assume the utilization of certain fixed quantifications (á = 15%, and β1 to β8 in the range 12%-18%) of the ratio between losses from Operational Risk and gross income, without the text itself of the Basel Accord making explicit the criteria that must be used to determine these fixed quantifications, or any procedure by which they could be adapted to the specific reality of each entity. However, it is possible to determine the hypotheses that implicitly underlie these quantifications. The objective of the analysis carried out is to check the degree of exactitude of the hypotheses that are implicitly accepted when the Basic Indicator Approach or the Standard Approach is adopted for the measurement of Operational Risk under Basel II; that is, the aim is to determine up to what point the cited fixed quantifications are reflected by the financial reality of the entities observed, so that this quantification could be shown to be appropriate and sufficient in all cases.

II. THE NEW BASEL II CAPITAL ACCORD: OPERATIONAL RISK

Basel II is characterized by a greater degree of detail and by the emphasis given to the internal methods of risk measurement and management that the banks can develop for themselves. The structure of the New Framework takes the form of three Pillars: (I) Capital Requirements, (II) Supervision Authority and (III) Market Discipline or Transparency.

The First Pillar contains the mechanisms and methods for determining the requirement of capital (admissible own funds) that the entity must hold on its balance sheet, for each of the three types of risk that the entity must measure

- Credit Risk: according to its credit-issuing activity, the banking entity must have available a level of capital adequate to cover eventual losses originating from defaults, delays, or insolvency of the contra-party of each operation, etc.
- Market Risk: for the positions held in the various different market places and financial instruments.
- Operational Risk: due to human and computer faults, fraud, theft and disasters: Operational Risk arises from situations in which the human systems, the internal and external rules systems, and the computer systems that constitute the productive apparatus of the entity fail, due to errors or to intentional acts of internal or external agents, such as natural disasters, acts of terrorism, etc. This risk is not reflected in specific items of the balance sheet of the bank and must be dealt with specifically.

In the Second Pillar the functions and attributes of the supervisory authorities are detailed in relation to the new capital and management requirements. The role

that the supervisory authorities play is vital, in the sense that, if the internal systems of assessment and measurement of risks are to acquire greater protagonism, the supervisory authorities should analyze them and validate them to authorize their utilization.

Finally, the Third Pillar establishes the requirements for the publication of information on risks, for the benefit of investors and depositors. The Third Pillar will enhance the flow of periodical public information that is received from these entities, increasing the transparency of the markets.

Basel II is more complete that the previous regulatory framework, in so far as the methods and measurements to be used are refined. In addition, a new variable to be managed is included: the Operational Risk, which for the first time will influence the capital measurements made by these entities (Aparicio and Keskiner, 2004).

With the appearance on the scene of the Operational Risk, a new variable becomes visible for the accounting systems of financial entities. Fraudulent irregularities, computer and human faults, theft and disasters are the types of losses that are assessed and foreseen by actively managing Operational Risk, and holding the appropriate level of capital to cover the possible losses emanating from this group of risks. According to Basel II, Operational Risk is 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 reputation risk.

This is the definition of Operational Risk with which we are working, but it differs from other previous definitions, and from approaches such as those maintained in the past by some large Japanese banks, which had argued that such risks were not susceptible of measurement (Hiwatashi and Ashida, 2002). However, the scope that this conception of risk is acquiring, and its imminent and full incorporation in various normative frameworks, makes it rather pointless for us to enter into discussion on the suitability of the definition. In fact, the attention now being given to this new variable is having considerable impact in the banking sector (Chapelle *et al*., 2004). The importance of Operational Risk can be gauged by considering the estimated contribution of each Risk listed in Pillar I to the total amount of Capital Requirement that banks will be expected to hold after the entry into force of the new standards (Aparicio and Keskiner, 2004); according to this, the total Requirement would be made up of approximately 53% for Credit Risk, 30% for Operational Risk and only 17% for Market Risk.

For a more exhaustive analysis, these losses can be divided into 7 types, according to their origin. Equally, each loss can be placed in the context of one of the 8 business lines that are established (Table 1). Forecasting the amount of losses that an entity could incur by these concepts is not a simple matter. To begin with, the accounting systems of the financial entities will have to take into account this matrix-type classification at the transactional level or in their General Ledger, to be able to manage this specific type of loss as and when it may be incurred. Despite these difficulties, Operational Risk will constitute the principal cause of increase in the Capital Requirements for the banks, as foreseen in the document *"Review*

Table 1. Operational Risk Matrix under Basel II

	Business Lines							
Event Types	Corporate Finance	Trading and Sales	Retail Banking	Payment and Settlement	Agency Services and Custody	Commercial Banking	Asset Management	Retail Brokerage
Internal Frauds								
External Frauds								
Employment practices and workplace safety						*? ? ?*		
Clients, products and business lines								
Damage to physical assets								
Business disruption and system failures								
Execution, delivery and process management								

of the Capital Requirements for Credit Institutions and Investment Firms. Third Quantitative Impact Study: EU Results" produced by the Basel Committee itself, with the collaboration of the European Union and the banking entities. In addition, external events are also part of this risk, including the effects of terrorism (Fontnouvelle *et al*., 2003). Table 1 represents the management matrix for Operational Risk that must be considered when an entity establishes the amount of capital necessary.

Basel II establishes three methods for determining the capital requirement to cover Operational Risk: the Basic Indicator Approach, the Standard Approach (that we will call the Income Statement-based methods) and the Advanced Measurement Approach (that is, a management accounting-based method).

Income Statement-Based Methods

The Basic Indicator Approach

This consists in determining the capital requirement for Operational Risk by applying a fixed factor of 15% of the mean of the gross income obtained by the entity in the last three previous accounting periods (i.e. periods when the gross income figure was not zero or negative). Any years when reported gross income is zero or negative are excluded from the calculation of both numerator and denominator.

$$K_{BIA} = \left[\sum GI_{1\ldots n} * \acute{a}\right] / n$$

where:

K_{BIA} = the capital charge under the Basic Indicator Approach
GI = annual gross income, where positive, over the previous three years
N = number of the previous three years for which gross income is positive
$\acute{a}$ = 15%, which is set by the Committee, relating the industry-wide level of required capital to the industry-wide level of the indicator. Criteria to determine this value is not included in the Basel Accord text.

The Standard Approach

This represents an increased degree of sophistication and refinement. The capital requirement is calculated similarly by applying a fixed percentage factor to the gross income, although in this case this accounting magnitude is broken down into 8 lines of business indicated above, and a different percentage factor (from β_1 to β_8) is applied for each line (Table 2):

The purpose of this procedure is to recognize that not all the lines of business necessarily have the same degree of risk (Aparicio and Keskiner, 2004). But, again, the criteria needed to determine those different values are not explicit in the Basel text.

Table 2. Breakdown of business lines and corresponding Operational Risk ratio

Corporate Finance	$\beta_1 = 18\%$
Trading and Sales	$\beta_2 = 18\%$
Retail Banking	$\beta_3 = 12\%$
Payment and Settlement	$\beta_4 = 15\%$
Agency Services and Custody	$\beta_5 = 12\%$
Commercial Banking	$\beta_6 = 18\%$
Asset Management	$\beta_7 = 15\%$
Retail Brokerage	$\beta_8 = 12\%$

Information Management Based Method

The Advanced Measurement Approach. A management accounting based method
The third and last method of measurement of the Operational Risk that Basel II offers is denominated the Advanced Measurement Approach. This method does actually involve the active management of the variables related to the particular Operational Risk faced by the entity. Although the cost of implementing this approach is higher, because it requires organizational and other kinds of changes by the entity, the greater degree of sophistication in the management of each pair of values (Type of loss, Line of business) enables the entity to supervise this Risk more comprehensively. The mere adoption of externally published financial accounting variables is abandoned, and is replaced by an informed (not blind) analysis of the various circumstances in which the entity foresees that Operational Risk may be incurred.

This is a method defined by more abstract requirements, both quantitative and qualitative, than the less sophisticated methods that precede it. For this reason, it is more flexible and adaptable to the characteristics of each entity and each country or normative area. It is "non-blind", in the sense that it is the only method that involves a direct measurement of the circumstances that may aggravate or mitigate the Operational Risk, in so far as it is founded on the utilization of business management variables, not on variables of externally disclosed financial character. In addition, it implies the need for organizational and procedural changes within the core systems of the banking entities, for it requires internal controls and structure of communication of the entity that can be considered "best practice"; therefore in the case of some entities, perhaps most, there will be a pressing need to review all the main technical and human systems. The requirements for its implementation are not only internal, since it must be a transparent method, in accordance with Pillar III of the Accord, which requires the entity to be able to explain to the market, at least in general terms, under what policies the risk control system implemented operates.

Unlike the Income Statement-based methods, the responsibility for designing the AMA is that of the entity itself, which must develop it to suit its own business

characteristics. The mission of the supervisory authority in respect of each entity's approach should be its supervision, the submission of the systems to control tests and, where applicable, the validation of the approach and systems in use.

For the design and implementation of an AMA, and for it to be validated independently by the supervisor, the principal directors of the entity should be involved in the implementation of the method; the organization should contain an independent unit responsible for the implementation and operation of the Approach; systems for internal reporting and the auditing of the procedures set up should be in place; and the bank should implement correct policies and periodically documented procedures; and it should justify in appropriate ways the adoption of thresholds of materiality when capturing data for the measurement of the Operational Risk.

The principal difficulties arise from the high cost in time and resources that can be involved in its implementation, given the changes necessary for putting it into operation. In addition to this cost, the entity must make the choice between the different incentives that arise when choosing between one or other method of measurement. The costs of implementation of the more advanced method can be so significant that the entity will not assume them if it is not convinced that its competitive position will not be harmed by doing so (Milligan, 2004).

Obviously, if a financial entity chooses one of the Income Statement- based methods, it will save the costs associated with the implementation of the AMA. Additionally, it will avoid the need to disclose information on its systems of internal control. The Operational Risk should not be managed directly. And lastly, using the less sophisticated method safeguards the entity from the possible fluctuations in the valuations of risks, compared with the use of fair value income measurement (Hirst *et al*., 2004), the approach towards which the entities in the EU are tending after the entry into force of the IFRS in 2005.

Against this, if the Advanced Measurement Approach is chosen, the entity can measure its Operational Risk directly, and can investigate its causes; this should enable it to register lower Capital Requirements, and thus allow it greater financial leverage than otherwise, and as a result be more competitive or profitable. Faced with the challenge of implementing the AMA, which in effect means deciding to implement an innovatory system of management accounting, many different organizational variables inevitably intervene; these include agency costs, perceived benefits and costs, company scale, and top management style (Davila and Foster, 2005), and must also be taken into consideration.

Lastly, the entity must choose the method that it considers, in short, provides the most quality in performance, the most capability for covering its own Operational Risk. For this reason the entity must be sure that the hypotheses on which the method is founded are the optimum, both objectively and subjectively considering its own specific circumstances; and it must consider whether the quantification of proportions suggested by the Basel Committee is admissible for its own particular characteristics. Efficiency in making this choice means having sufficient knowledge of all the various implications of the new regulation; this is an aspect that

is not always met in the banking organizations in respect of this new framework (Wilson, 2004).

III. EMPIRICAL EVIDENCE OF INCOME STATEMENT-BASED METHODS

In the Income Statement-based methods (i.e., in both the Basic Indicator Approach and the Standard Approach) the key factor of measurement of the Operational Risk is the ratio between potential losses due to Operational Risk and Gross Income. In effect, in both methods, the entity is required to hold own funds in an amount equal to or greater than a specified percentage of the gross income (á = 15% in the case of the first of the methods, or in the range between 12% and 18% in the second method [from $\beta 1$ to $\beta 8$]), accepting by implication therefore that the possible losses due to Operational Risk would never exceed this amount and the risks would thus always be fully covered. In the Basel II Accord itself the methods and criteria that the Basel Committee has adopted for specifying these coefficients are not detailed, nor does the Accord document provide detailed ways for adapting the coefficients to different normative regimes or economic circumstances, nor to significantly differentiating characteristics of the entities.

Therefore, by utilizing these coefficients, the entity is implicitly accepting a series of hypotheses in respect of the ratio of potential losses due to Operational Risk, to gross income, and in respect of the applicability of those hypotheses to its own particular financial reality; these hypotheses could be formulated as follows:

- *Hypothesis 1: There is a positive linear relationship between losses from Operational Risk and gross income in the published accounts of the entities.*

As proposed under the Income Statement-based methods, it is assumed that as an entity obtains larger gross incomes, its higher level of activity exposes it to more and larger risks of suffering losses of the kind typified under Operational Risk; hence it is expected that a positive relationship is to be found between the two accounting variables in the entities studied.

- *Hypothesis 2: The quantification of this ratio within the range 12%-18% is adequate and sufficient.*

In addition to establishing a positive relationship between the two accounting variables in question, the relationship must be quantified by means of a ratio or coefficient that falls within the values indicated, to ensure in this way that the choice of these values is adequate and sufficient in order to guarantee that the entities cover this risk.

- *Hypothesis 3: This ratio is constant over time.*

A measure that is constant over time must be utilized to ensure that the system of measurement generates stable capital requirements, in relative terms. Thus the indicator chosen would serve as an automatic control measure, making sure that the correct amount of own funds are always held for this purpose.

- *Hypothesis 4: The ratio is independent of other characterizing variables, indicative of the size and juridical nature of the entity, with a tendency to be equal in all the entities.*

Variables that characterize the particular features of each entity, such as its size and juridical nature, should not significantly influence the indicator selected for measuring Operational Risk. If the contrary were foreseen, it would be possible for the indicator to be adapted to the specific characteristics of different groups of entities.

Methodology

The first difficulty that we find when attempting to verify the hypothesis of positive relationship between gross income and losses due to OR, as defined in Basel II, and the other assumptions to be tested, is to identify the accounting items that correspond most closely to each of these variables, with the object of constructing an adequate proxy of the accounting variables in question. As previously demonstrated, the introduction of the Operational Risk as a discrete factor represents the incorporation of new considerations of accounting classification, not yet incorporated into the systems of information of the entities. However, the reading of the Basel II Accord allows us to select the closest variables from among the accounting variables available in the published accounts of the entities studied.

For the case of the gross income, Basel II establishes that the net interest income plus the net non-interest income should be taken for this magnitude. It is intended that this measure should: (i) be gross of any provisions (e.g., for unpaid interest); (ii) be gross of operating expenses, including fees paid to outsourced service providers; (iii) exclude realized profits/losses from the sale of securities in the banking book; and (iv) exclude extraordinary or irregular items as well as income derived from insurance. In the context of Spanish normative accounting, which was adapted to the IFRS at the beginning of 2005, we consider it appropriate to obtain this gross income amount as the sum of the items "ordinary profit" and "other activities profits" from the income statements.

For the case of the losses due to Operational Risk, the closest accounting item is the "extraordinary losses". In any case, this item overvalues the amount of effective losses originating from the Operational Risk, to the extent that it includes other losses of financial character not directly attributable to this risk. However, the utilization of this over-large proxy has been illustrative of some of the implicit hypotheses analyzed. It has not been possible to test the hypotheses considering the distribution of losses by lines of business, due to the absence of a break-down

in the income statements analyzed that would be consistent with that required by Basel II.

For the variable Size, the value of total assets of each entity has been selected.

For the variable Juridical Nature, we have introduced three Dummy type variables, which take the following values:

DB[Being a Bank]: yes = 1, no = 0

DS[Being a Saving Bank]: yes = 1, no = 0

DF[Being a Foreign Institution]: yes = 1, no = 0

Variables:

Each variable is, in turn, a pool type series, with each datum being referenced to one entity of the 130 studied, and to one of the 5 periods contemplated.

R = ratio of losses due to Operational Risk/gross income
P = losses due to Operational Risk
G = gross income
S = size, taken as total assets
DB = being a bank
DS = being a savings bank (caja).
DF = being a foreign institution
ε = error
θ(i.j) = parameters where i = model and j = n° of the parameter within each model.

Econometric models:

The technique of estimation utilized in the two models that are detailed is linear regression with pool data variables, where each model represents in reality a series of models in which equality is demanded in the parameters that link the same pairs of variables for a group of entities and for various different periods of time.

Model 1:

$$P = \theta(1.1) * G + \varepsilon$$

which makes it possible to test and quantify the relationship between losses due to Operational Risk and gross income (Hypotheses 1 and 2).

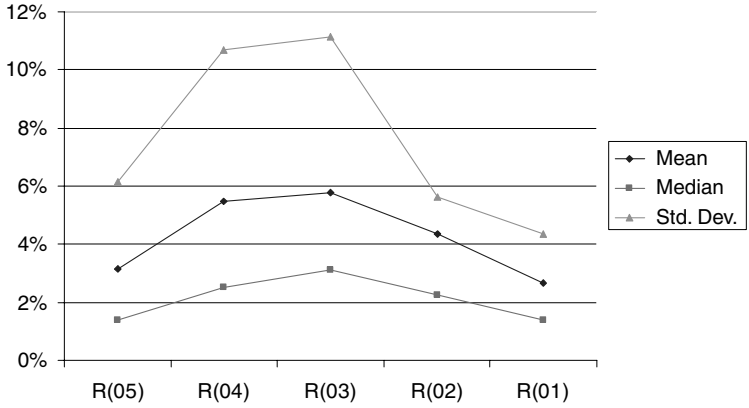
Model 2:

$$R = \theta(2.1) * S + \theta(2.2) * DB + \theta(2.3) * DS + \theta(2.4) * DF + \varepsilon$$

which explores the relationship between the value of the ratio for each period and the variables that characterize the entities (Hypothesis 4)

Table 3. Descriptive statistics of the Ratio of Losses due to OR against Gross income

	R(05)	R(04)	R(03)	R(02)	R(01)	
						Global Mean
Mean	3.17%	5.49%	5.77%	4.34%	2.66%	**4.28%**
Median	1.39%	2.50%	3.12%	2.25%	1.39%	
Std. Dev.	6.17%	10.68%	11.14%	5.64%	4.36%	



Hypothesis 3 is tested without the need for any techniques additional to descriptive statistics.

The models presented, together with the descriptive statistics generated, give a response to the hypotheses put forward. They have been tested to ensure the absence of autocorrelation, heteroscedasticity and multicolinearity, and the appearance or not of the independent coefficient has remained dependent on its individual significance in each case.

Sample:

Spanish banking has a notable importance in the European financial sector. Among the 9 entities that figure in the EuroStoxx 50 index, 2 entities (22.22%) are Spanish, despite the Spanish economy having less weight than this percentage in respect of the total economic output of all the countries that comprise the index (STOXX Limited, 2006). We have studied the 130 published accounts corresponding to the 75 banks, 47 saving banks and 8 subsidiaries in Spain of foreign entities, corresponding to the periods 2001 to 2005. It was not considered advisable to take a Europe-wide sample given the absence of homogeneity of accounting regulation, for the period considered [2001–2005], among the different countries members of the EU. The information has been structured using panel data techniques (Wooldridge, 2000).

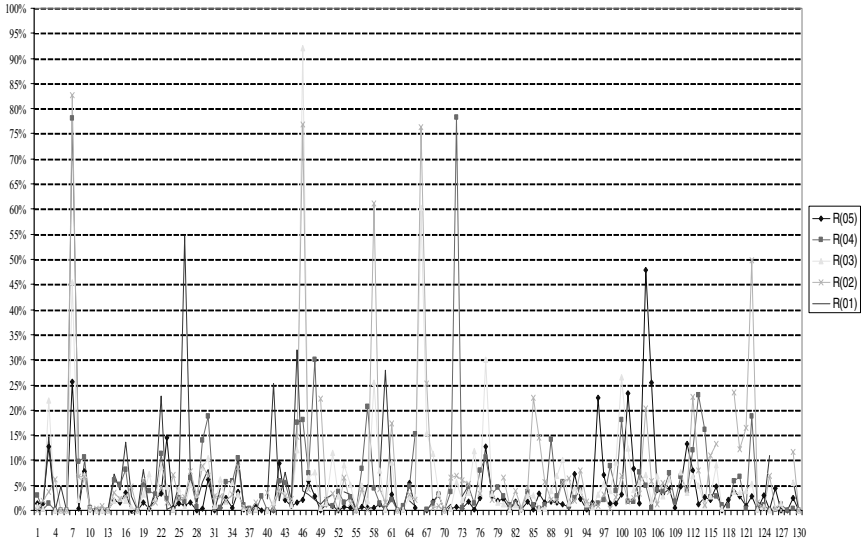


Figure 1: Ratio thorough entities and time.

Results

Initially, we find that the ratio variable presents the descriptive characteristics that are given in Table 3. A high degree of variability can be seen in the variable corresponding to the ratio of Losses due to Operational Risk, to Gross income, in the different periods, with the resulting mean value fairly distant from the expected range of 12%-18%. Specifically, the mean, of low significance, ranges between 2% and 6%. Taking into account that, for the numerator of the ratio (operational losses), it was decided to resort to an approximate accounting variable that overvalues such losses by including some amounts of clearly financial loss, these results indicate that the range proposed in the Income Statement-based methods can be considered at most excessively conservative, if most of the entities of the sample are taken into account. In contrast, the range appears insufficient if those extreme cases are considered in which very high values have been found for this ratio (Figure 1). This result lead us to reject hypothesis 2 on the suitability of the fixed range.

In Figure 1 we can compare the profile presented by the ratio in the different periods consulted in each of the 130 companies that comprise the sample (abscissa axis). A change of the cited profile can be clearly distinguished from some periods to others, from which it is evident, on the one hand, that the irregularity of the profile shows and confirms the lack of homogeneity of the indicator from entity to entity (thus rejecting in part the hypothesis 4, regarding the constant character of the ratio among entities), and on the other hand, that the profile is not maintained over time (thus rejecting hypothesis 3), which makes it rather unsatisfactory for constituting a secure measure of coverage of risks.

Table 4. ***Model 1*****. Relationship between Losses due to Operational Risk, and Gross income**

Dependent Variable: P Method: Pooled Least Squares Sample: 2001 2005 Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
G	θ (1.1) = 0.110990	0.003968	27.97380	0.0000
R-squared	0.570000			

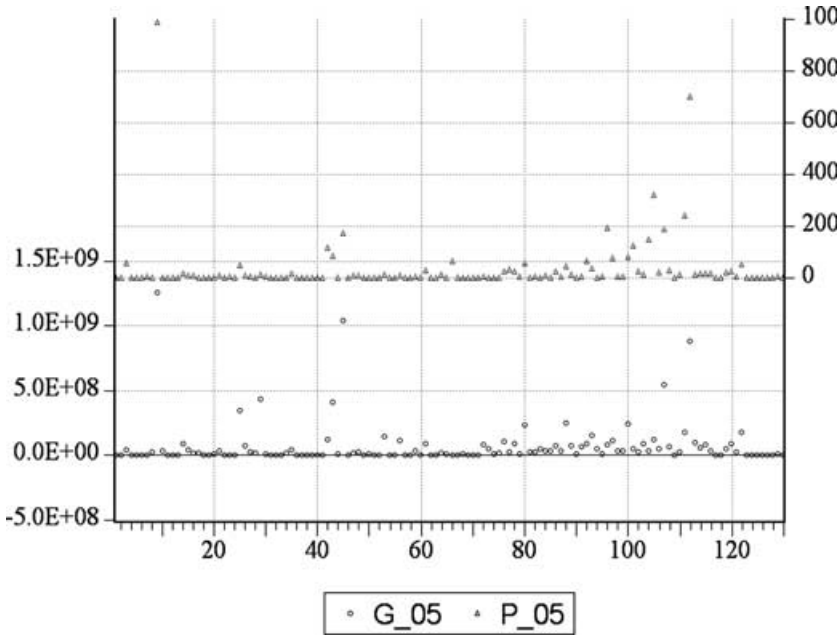


Figure 2: Positive relationship between operational losses and gross income, example for the year 2005.

What it is possible to confirm is that hypothesis 1 can be admitted, from observing the result obtained in Model 1 (Table 4, Figure 2). A significant positive relationship does in effect exist between operational losses and gross income. As an entity's gross income increases, the increase of activity makes it at the same time more vulnerable to Operational Risk. However, the coefficient that links the two variables takes a value lower than the stipulated 15%, re-affirming the rejection of Hypothesis 2.

On the other hand, the analysis of the results obtained for Model 2 (Table 5, Figure 3) admit only one weak relationship ($R^2 = 1\%$ of sampling fit) between the

Table 5. Model 2 Relationship between ratio and variables characterizing the entity

Dependent Variable: R Method: Pooled Least Squares Sample: 2001 2005 Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
S	θ (2,1) = 2.93E-13	1.52E-13	1.922542	0.0550
DB	θ (2,2) = 0.054465	0.005932	9.182232	0.0000
DS	θ (2,3) = 0.053361	0.008259	6.460605	0.0000
DF	θ (2,4) = 0.017168	0.017894	0.959449	0.3377
R-squared	0.014680			
F-statistic	2.801045	(F-statistic) Prob		0.039332

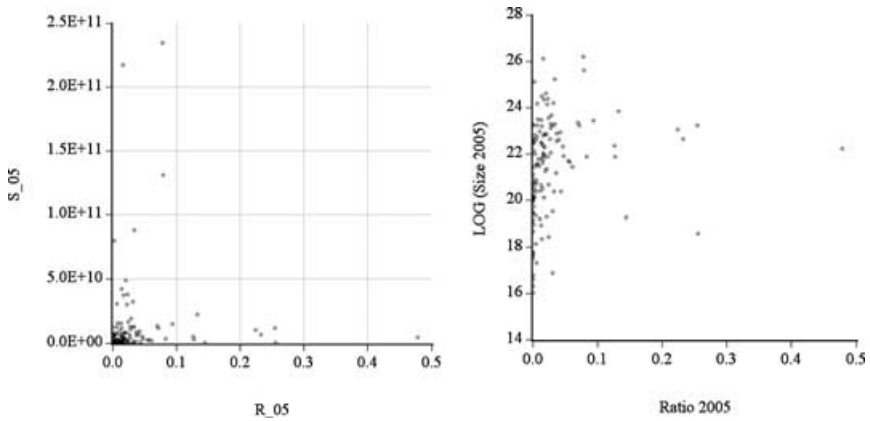


Figure 3: No relevant relationship between ratio and variables characterizing the entity, example with ratio and size of each entity for 2005.

ratio that these variables form and the group of characterizing variables indicated, with neither the sign nor the magnitude of the coefficients of estimation obtained being of interest; this confirms that, in respect of Hypothesis 4, we accept the independence of the ratio with respect to these variables, although we reject that this ratio is held constant from entity to entity.

IV. SUMARY AND CONCLUSION

As we have been able to confirm, the empirical reality is some distance from compliance with the hypotheses implicit in the Income Statement-based methods under the approach of Basel II. The key indicator in these methods, the ratio between

effective operating losses and gross income does not maintain minimum conditions of stability against factors such as the entity and the time, and is not shown to be close to the 12–18% range stipulated, despite not depending significantly on other variables that characterize the entity, like size or juridical nature. However, we have demonstrated that the effect of applying these simple methods is usually an over-weighting of the protection against Operational Risk.

Therefore, it can be seen that the Income Statement-based methods appear to represent a "blind" instrument of protection and may handicap the competitive capacity of entities by generating excessively high capital requirements in the majority of them. Neither would they be optimum for a very small group of entities that present levels of the ratio very much higher than those proposed by the Committee. These methods are limited to quantifying, non-optimally, a capital requirement intended to safeguard the entity from a risk whose real magnitude has not been studied and whose underlying causes have not been explored or mitigated.

Against these methods, the AMA is positioned as an alternative. In respect of this Approach, we have considered the advantages derived from the fact that it is based on principles of management accounting and internal control, rather than being based on variables published in the accounts of these entities. In addition, it is a tailor-made method that needs to be developed internally and flexibly within the particular business framework of each entity, adapted to its own characteristics. In fact, the Basel Committee does not explicitly stipulate the quantitative methodology to be followed under the AMA (Aparicio and Keskiner, 2004). Morrison (2004) recommends being skeptical towards merely statistical methodologies for managing Operational Risk, those that define it as a phenomenon largely endogenous to the entities. Accepting this, the advanced approach becomes clearly more applicable to differing financial and management situations, in different entities. As Horngren (1995) points out, the management accounting system of an entity has two simultaneous missions: first, the transmission of information to help reach wise economic decisions; and second, the motivation of users toward organizational goals. These types of mission cannot be fulfilled by the information published in financial statements and accounts, because this financial information is issued in pursuit of different objectives, and to a different audience. The unsuitability of the financial information for these purposes is also evident given the relatively limited usefulness of this information reported by diverse users (Mande et al., 2001), and the frequent lack of relevance or comparative value presented by this information originating from significantly different entities (Heibatollah et al., 2004); in many cases it is highly specific to particular and different normative requirements (Kang, 2003), and often the information is aggregated in different ways (Amir, 1996). The fact that this information is strongly influenced by pressures of the normative environment or by the needs of users operating in particular markets also confirms this perception (Giner, 1997). When it is on this type of information that the Income Statement-based methods are intended to rest, the sign obtained from testing the hypotheses proposed is reinforced by these perceptions. Therefore, since the AMA is closer to the field of action of management accounting, which

provides information free from these problems of external origin, it appears to be a much better alternative risk-management approach for these entities to implement. The feasibility of implementing this approach thus remains as a challenge to be overcome for those entities that do not find in the Income Statement-based methods an adequate response to the pressing need for active management of Operational Risk.

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