Title:

Does stock market beta pick up accounting information published by companies? Study with panel data from the Spanish Capital Market 1992-2004

Authors*:

Dra. Carlota Menéndez Plans

Universitat Autònoma de Barcelona. Departamet d'Economia de l'Empresa

Dra. Neus Orgaz Guerrero

Universitat Autònoma de Barcelona. Departament d'Economia de l'Empresa

Dr. Diego Prior Jiménez

Universitat Autònoma de Barcelona. Departament d'Economia de l'Empresa

* Alphabetic order

Summary

An empirical study has been carried out into the relationship that exists between stock market beta and all of the published accounting information incorporating productivity indices and macroeconomic information. Regression analysis with panel data is applied to analyse a sample of 69 Spanish capital market firms between 1992 and 2004. The results show that there is a certain connection between the (41) independent variables and the (4) dependent variables but that this is different depending on the market portfolio used and depending on the sample analysed. For the overall sample, the best model was obtained when the market beta was estimated from the index that contains the greatest number of shares, the IGBM (Madrid Stock Exchange General Index). Macroeconomic indicators and indicators of productivity are also significant explicative variables of the systematic risk of the Spanish market.

1- Introduction

Decision making in the financial world is basically founded on two types of information: the expected profitability and the risk of investment. Knowing investment risk allows knowing the minimum profitability needed for the investor or cost of capital, which is a basic piece of information for calculating the market value of a company, the market value of the stocks or for deciding on the feasibility of a new investment. The minimum profit needed compared with expected profit allows us to state whether an investment is efficient or not.

Whether it is a stock, a business or a portfolio, having a measure of investment risk is essential for making efficient investment decisions. Currently, the most popular measure of risk, and the most used, is the beta, which only measures the systematic risk of stocks. It other words it measures the risk that cannot be eliminated with correct diversification. It is through the Securities Line Market, one of the main results of the Capital Asset Pricing Model, that the beta is transformed into a capital cost or required minimum rate of return.

Nevertheless, only businesses that form part of the capital market have a beta available to them. For this reason, in those situations where the capital market cannot provide the corresponding risk measurement, it is essential to have an alternative mechanism available that more objectively quantifies the risk. In conclusion, quantifying the risk of an investment without having a beta is still an important question to be resolved.

Studies previous to this establish a relationship between the market beta and certain accounting information, called accounting measures of risk. However, there is no homogeneity in what accounting information best explains systematic risk. The search for a connection between the financial world and that of accounting has set in motion a line of research such as demonstrated in the recent works of Naceur and Goaied (2004), Elmoatasem (2005), Chen and Zhang (2007), Brimble and Hodgson (2007) and Agusman, Monroe, Gasbarro and Zumwalt (2008).

The professional needs to have a methodology to objectively measure risk as well as the lack of homogeneity in the results obtained in previous research to justify interest in continuing this line of research. On the other hand, looking to see if there is a connection between stock market beta and accounting information enables us to determine up to what point the latter is useful in the decision making process of financial markets. There are many works that investigate how to improve the quality of the accounting information for the purpose of making it more useful and thus improving the efficiency of the market. Among them, Cabedo and Tirado (2004), Feltham, Robb and Zhang (2007), Lambert, Leuz and Verrecchia (2007),

The purpose of this work is to take another step in the search for an objective procedure for quantifying risk[1], but by using data from a growing and expanding market: the Spanish Capital Market.

We start with the works of Ismail and Kim (1989), Azofra, Rodríguez and Vallelado (1997) and Giner, Laffarga and Larrán (1999), although the objective is, if possible, to go a bit further. In this way, various innovative factors are contributed: a) the breadth of

[1] Previous works in this area are Menéndez, Orgaz and Pinyol (2007) and Menéndez, Orgaz and Pinyol (2008).

the period under study, thirteen business years (from 1992 to 2004) and a full range of dependent and independent variables, b) the definition of the three different samples: financial business sample, non-financial business sample and the overall sample (that includes a total 69 companies), c) in accordance with Elgers and Murray (1982), the use of the two different market indices to measure the market portfolio and to estimate stock market beta d) the use of estimating techniques of panel data regression, and e) to traditional accounting measures and cash flow, productivity measures and macroeconomic indicators are added.

The case study analysed (the Spanish Capital Market) is interesting for a series of reasons: a) it is a constantly growing market and undergoing modernization, where knowing what information is useful to measure risk can contributing to substantially improving its efficiency, b) the relationship between the market risk and the accounting information can differ by country. In this context, this work proposes to establish the relationship indicated in a Mediterranean country, away from Anglo-Saxon influence, which is the medium in which these types of works are usually analysed, c) the Spanish economy is one where small and medium sized firms represent an important part of business activity and, therefore, there are many businesses that need a methodology for estimating risk without using the capital market, and d) knowing the degree of the relationship between the accounting information and the market beta will allow better evaluation of Spanish accounting reform, which is in effect for all commercial corporations starting in 2008.

The article is organised in the following way: after the introduction we present a review of the existing literature and the hypotheses that we wish to demonstrate. We then define each of the dependent and independent variables to be analysed. Afterwards, in the empirical part, we describe the data and the methodology used, present the results and finally we give our conclusions.

2- Review of the existing literature and hypotheses that are going to be contrasted.

We find many works that attempt to find an accounting methodology for measuring systematic risk. However, we will only cite those that we consider the most relevant for justifying the focus of this article. We can consider as truly pioneering works in this line of research the contributions of Ball and Brown (1968 and 1969) and that of Beaver, Kettler and Scholes (1970). The Studies by Ball and Brown confirm that accounting information incorporates useful data for measuring and estimating market risk. Beaver, Kettler and Scholes highlight, through correlation coefficient analyses, a positive relationship between market beta and debt, growth, earnings variability and accounting beta and a negative relationship with payout, size and liquidity.

Afterwards, we find, among others, the works of Breen and Lerner (1972), Melicher (1974), Lev and Kunitzky (1974), Bildersee (1975) and Eskew (1979). The shared objective is to go deeper into the study of the connection between market risk and accounting information by introducing some variations with respect to the early studies. Breen and Lerner (1972) use as independent variables the relationship of debt (debt/equity), earnings growth, stability of earnings growth, the size of the firm, the payout relationship and the number of shares in circulation. The results of the studied models are discouraging since unanimity is not observed in either the variables that explain risk or in the evidence of the relationship[2].

Melicher (1974) incorporates traditional independent variables such as indebtedness, the size of the firm and stability of earnings, the efficiency of operation, the financing policies, the yield on investment and market activity. The most significant variables are size, payout, return on equity, level of market activity (measured through the relationship between negotiated shares and shares in circulation) and the relationship of debt, obtaining an adjusted R^2 of 0.34.

Lev and Kunitzky study the relationship of stock market beta to accounting variables that are reflected from a wide variety of business decisions: production, investment and financing. The independent variables are "smoothing" variables and the results give evidence that the "smoothing" variables of sales, dividends, investment and returns significantly explain, and with a positive sign, the total systematic risk of the stocks.

[2] So, for example, the relationship of indebtedness is a significant variable only in some periods, by being sometimes positive and sometimes negative.

Nevertheless, the average payout ratio explains the total and systematic risk of the stocks but with a negative sign.

Bildersee introduces in the regression model independent variables related to business decisions such as the decision to modify the dividend policy, reducing the dividend to zero and the capacity of the business in order to pay interest and the preferred stock dividends. The inclusion in the same model of accounting variables and non-accounting variables (decision variables) generate better results than when only considering accounting variables. The incorporation of both variables improves the explicative power of the model by achieving an adjusted R^2 of 0.85, where the three accounting indicators and one decision variable explain the risk of the stock.

A new step forward in the knowledge of the relationship between accounting and the systematic risk is found in the work of Ismail and Kim (1989) who introduces cash flow analyses as a better measure of systematic risk. The empirical study reveals that the different ways of calculating cash flow contain more information than that included in the reported earnings. Along the same lines, we find the work of Rayburn (1986) that justifies that operating cash flow is one the pieces of information used to determine the market value of the stocks. However, Bowen, Burgstahler and Daley (1986) conclude that the correlation between the reported earnings and the traditional measurements of cash flow is high and that, therefore, it is not likely that the information provided by cash flow will be different than that provided by the reported earnings.

Charitou and Ketz (1991) examine the association between cash flow coming from operations, financing and investment and the market price of the stocks. The results of the study show a significant positive relationship between the market value of the stocks and each of the prior cash flows.

In 1996, Sloan looks into whether the market price of the stocks reflects the information contained in the cash flows. The analysis concludes that the independent cash flow variable explains the future earnings of the stock. Nevertheless, the prices of the stocks behave as if the investor is focused only on earnings, forgetting to consider information contained in the cash flows.

Along the same lines as Ismail and Kim, we find the work of Giner, Laffarga and Larrán (1999), whose results indicate that cash flows do not contain more information on the risks of the stocks than the reported earnings.

Elgers and Murray (1982) empirically show that the choice of the Market Index, as a market portfolio, influences the accounting measures that explain stock market beta. The results indicate that the capacity of the accounting measures of risk to explain the difference between the betas of the stocks is different depending on the market index chosen.

Another new focus in the search for accounting information that explains market risk is the work of Karpik and Belkaoui (1990) who studied whether the variables of gross and net value added better explain systematic risk than strictly accounting variables or cash flows. The empirical analyses show that the combination of gross and net value added, earnings and cash flow considerably improve the explicative power of the model while going from an R^2 of 0.04 to 0.44.

Bowman (1979 and 1981) establishes, from the theoretical point of view, a relationship between systematic risk and the debt relationship. However, not all of the existing works confirm this relationship[3], which originated a current of studies that search for justifying the role of debt ratio as an explicative variable of systematic risk. Among them are Hill and Stone (1980), Mandelker and Rhee (1984), Muldford (1986), Callahan and Mohr (1989), Huffman (1989), Henderson (1991), Lord (1996) and Retief, Affleck-Graves and Hamman (2002). All the works cited, except Lord, confirm the explicative power of the financial debt and a positive sign of the relationship. Lord's research cannot confirm the positive relationship between systematic risk and the level of the debt, but it does confirm a positive relationship between level of debt and the specific risk of stocks. Most of the aforementioned works also look at whether operating debt is an explicative independent variable of systematic risk. Mandelker and Rhee (1984) and Huffman (1989) show that operating debt is a significant variable but without obtaining the same relationship sign. The work of Mandelker and Rhee show evidence of a positive relationship between operating debt and systematic risk of stocks

[3] In the works of Breen y Lerner (1973), Jeong-Bon Kim and Lipka (1991) and Reeb, Kwok and Baek (1998) debt is not always a significant variable and the sign of relationship is not always positive.

and Huffman's study obtains a negative relationship. Lord's research finds positive and significant relationship between total risk, systematic risk, non-systematic risk and operating debt.

More recent works like Almisher and Kish (2000), Naceur and Goaied (2004), Elmoatasem (2005), Chen and Zhang (2007), Brimble and Hodgson (2007) and Agusman, Monroe, Gasbarro and Zumwalt (2008) show continuing interest in finding accounting information that explains the systematic risk of stocks. Almisher and Kish study the relationship between initial profitability of the firms that appear for the first time on the market and the accounting beta by concluding that the accounting betas can be used, in these types of firms, as an ex ante measure of the risks of the stocks. Naceur and Goaied investigate, using the technique of panel data, the connection between the market price of the stocks and the accounting information in the Tunisian market. The results show that the earnings, the book value and the dividends are significant independent variables, unlike the firm's debt. Elmoatasem uses the regression model to examine the relationship between the market beta and certain accounting information: debt, size, liquidity, variability of returns, and growth of returns, payout and the covariance of the returns with the S&P500. The model shows that size, growth, liquidity and the payout ration are highly significant variables. The work of Chen and Zhang analyse the relationship between profitability of the stocks and accounting information. This work finds that the profitability of equity is primarily related to the profitability in returns, investments in assets, changes in profitability and opportunities for growth. Brimble and Hodgson, using data in the Australian market, find that there are nine accounting indicators that explain market beta of the stocks, even though size, as highly significant, acquires a positive sign in contrast to what is expected. Agusman and others analyse the connection between total, systematic and non-systematic risk of the stocks of 46 Asian banks and six accounting ratios by using the methodology of panel data. The period analysed goes from 1998 to 2003 and the results show that no independent variable keeps a significant relationship with systematic risk of the stocks.

The review of the literature performed in this section demonstrates the lack of homogeneity in the results and in the accounting information analysed. It thus confirms the need for continued research with the objective of defining a methodology that allows estimating the risk of a stock or a firm from the accounting information. In this sense, this work attempts to verify a total of six hypotheses that compare accounting information with systematic risk. To do so, a representative panel of data will be used of all traded Spanish corporations for a broad period of time, thus guaranteeing that the contrast of the hypotheses is performed with a stable and very representative sample.

The research of Rayburn (1986), Ismail and Kim (1989), Charitou and Ketz (1991), Sloan (1996) , Giner, Laffarga and Larrán (1999) considers the advantage of cash-flow indicators over accounting-profit variables. This would be an indirect way of checking up to what point there is evidence of manipulation of the book profit numbers. In this context, we define the following hypothesis:

> H_1: *The cash flow variables explain the systematic risk of the stocks better than the book profit indicators.*

In order to improve the explicative power of the estimates, the work of Karpik and Belkaoui (1990) justifies the incorporation of added value as an independent variable. Nevertheless, the empirical evidence is not conclusive because, in the better known adjustment, gross added value appears significant with a negative sign, while net added value appears significant with positive sign. Thus:

> H_2: *Added value is a significant variable in the determination of systematic risk.*

Research such as Mandelker and Rhee (1984), and also Lord (1996), find a positive and significant relationship between systematic risk and operating debt. However, Huffam (1989) finds a negative relationship between operating debt and systematic risk and the study by Kim and Lipka (1991) show a relationship that is sometimes positive and other times negative. Thus, by taking the basis of the financial theory, we define the following hypothesis:

> H_3: *There is a significant and positive relationship between the beta and operating leverage.*

There is sufficient previous literature that shows the relationship between indicators of overall productivity of the factors and the operating profits (Kaplan and Atkinson (1989)). There is also an abundant amount of literature connecting profits and risks (Wats and Zimmerman (1986)). Nevertheless, as far as we know, the relationship between productivity and systematic or market risk have never been directly looked at. This causes us to formulate the corresponding hypothesis:

> H_4: *Productivity of the firm is a significant and explicative variable in the relationship between market beta and the firms' account information.*

In addition to the traditional accounting measurements of risk, Melicher (1974) introduces in his model measures of efficiency of use, profitability of investment and market activity. They find that it is not only strictly accounting information that explains stock beta. Bildersee (1975) introduces variables in their research that are not strictly accounting variables called decision variables that capture other types of information on the firm. The results show that the connection between beta and accounting are analysed better when non-accounting variables are incorporated into the study. In addition, Brealey, Myers and Allen (2006) clearly establish that the beta measures market risk, that is to say, the risk related to macroeconomic factors. Taking the aforementioned into account, it appears reasonable to formulate the following hypothesis:

> H_5: *The construction of a model that combines accounting measurements of risk and of cash flow with measures of productivity and with measurements of macroeconomics improves the explicative capacity of the model.*

Brealey, Myers and Allen [2006] indicate that there are different levels of market efficiency and that a high efficiency (or strong efficiency) is achieved when the prices of the stocks collect all of the information that can be obtained by a meticulous analysis of the firm and the economy. We put forward, then, hypothesis number 6:

H_6: *The accounting information that the Spanish firms publish and the Spanish market information are collected in the value of the beta that supplies the capital markets.*

3. Variables and samples that are going to be used in the contrasting of the hypotheses

3.1. Dependent variables

The dependent variable, the main objective of the study, is the systematic risk of the stocks represented through the market beta that we estimate through the following regression[4] :

$$\widetilde{R}_{it} = \alpha_i + \beta_{iS}\widetilde{R}_{Mt} + \mu_{it} \qquad [1]$$

where:

i = 1, ..., 69, refers to firms included in the sample.

t = 1, …, 120, gathers the number of active days of the stock market for the half-year period s.

s = 1, …, 26, represents the number of half-year periods for which information is available.

$\widetilde{R}_{it}$ symbolizes profitability of the stock i at the time t.

α_i is the intersection of the straight line of regression with the coordinates axis.

β_{is} corresponds to the beta coefficient of the stock i in the half-year period s.

$\widetilde{R}_{Mt}$ expresses the profitability of the market portfolio at the time t.

μ_{it} collects the random residual of the regression, with $E(\mu_{it}) = 0$ and constant variance.

The daily return of each stock, R_{it}, has been calculated taking into account the payment of dividends and the value of the Subscription Rights . That is:

$$\widetilde{R}_{it} = \ln\left[\frac{P_{it} + DIV_{it} + SR_{it}}{P'_{it-1}}\right] \qquad [2]$$

[4] In agreement with Sharpe (1964).

where:

P_{it} is the final price of the stock *i* at the time *t*.

DIV_{it} is the dividend paid by the stock *i* at the time *t*.

SR_{it} is the theoretical value of the preferential subscription rights of the stock *i* at the time *t*.

P'_{it-1} is the final price of the stock *i* in the period *t-1* adjusted by the splits carried out by the firm in the period *t*.

For their part, profitability of the market portfolio is calculated using the following expression:

$$R_{Mt} = \ln \frac{I_t}{I_{t-1}} \qquad [3]$$

where:

I_t is the market index chosen as the market portfolio at the end of the period *t*.

I_{t-1} is the market index chosen as the market portfolio at the end of the period *t-1*.

Given that we use two market indices for measuring the profitability of the market portfolio: the IGBM (Madrid Stock Exchange General Index, that, in 2008, included 125 companies grouped in 6 large sectors and 28 sub-sectors) and the IBEX-35 (an index that includes the 35 traded companies with greatest capitalization), we have two market betas for each firm: β_{IGBM} and $\beta_{IBEX\text{-}35}$.

In addition to the market beta, measurement of additional risks have been estimated: a) the specific risk of the stock (ξ) resulting from calculating the typical six-month deviation of the random residuals of the equation (1), b) the total risk of the stock (σ), that is, the typical six-month deviation of the daily return of the stocks, and finally c) the beta of the asset or investment plan, $\beta_{A,it}$, determined from the following equation[5]:

$$\beta_{A,it} = \frac{\beta_{FP,it} \times BVE_{it}}{P_{it}} \qquad [4]$$

where:

[5] The calculation of the beta of the assets coincides with the expression (9) of Bowman (1979), which determines the value of the beta of the stocks of an indebted company. It is also the expression used in Brimble and Hogdson (2007), although they use market values and we use accounting values.

β_{FPit} is the market beta of the stocks of the firm *i* in a six-month period *t* (actually, that estimated in equation [1]).
BVE_{it} is the book value of the firm's equity *i* in the six-month period *t.*
P_{it} is the book value of all the firm's liabilities *i* in the six-month period *t.*

Since we use two market indices, we therefore have two different measures of the specific risk and the asset beta. We have, therefore, a total of seven dependent variables.

3.2. Independent Variables

There are 19 independent variables in total, extracted from the accounting information. However, given that 4 different denominators are used for transforming the information to relative values (the book value of the equity –*BVE*- sales –*SAL*-, total assets –*TA*- and financial expenditures –*FE*-) and that the debt relationship is determined in three different ways, the total of independent variables reached is 41.

In addition, to check to see if the surrounding economic information affects the risk indicators, 7 macroeconomic variables were considered (*VM*): the Euribor (*EUR*), the type of legal interest (*LINT*), the consumer price index (*CPI*), the unemployment rate (*UR*), the variation in the Gross Domestic Product index (*GDPI*), the Dow-Jones (*DJ*) and Standard and Poor's (*S&P 500*) stock indices.

Next, accounting indicators are presented in three groups:

a) Balance variables (*VB*)

Liquidity (*LI*). Calculated as the relationship (Floating Asset/ Floating Liability). This relationship does not appear significant in the work of Beaver, Kettler and Scholes (1970) and in Thompson (1976). Nevertheless, it is a significant variable with positive sign in the work of Farrelly, Ferris and Reichenstein (1985) and in Elmoatasem (2005).

Leverage (*LEV*). Three definitions are used: i) *LEV1* (Total Debt/Total Assets), ii) *LEV2* (Long Term Debt/Long Term Financing), and, finally, iii) *LEV3* (Long Term Debt/Equity).

Ryan (1997) notes that the debt ratio calculated with market values maintains a tight relationship with market risk. However, in our research, accounting values are used for calculating the debt relationship because, in fact, the research question puts forward the usefulness of accounting information for determining systematic risk. On the other hand, determining the debt relationship with market values is easy in the firms that form part of the capital markets, but difficult for small and medium sized businesses, precisely the ones most in need of alternative methods for quantifying risk[6].

Size (*SZ*). Calculated by the Neperian logarithm of total assets. A negative sign appears in the work of Breen and Lerner (1973), and it is not an explicative variable in the study by Reeb, Kwok and Baek (1998). However, in Melicher (1974) and in Brimble and Hodgson (2007)[7] the sign of the independent variable is positive sign.

Payout (*PA*). The calculation of *payout* corresponds to the ratio between the dividend paid and the earnings of the stockholder. It is one of the common accounting measures of risk. It appears as a explicative variable of systematic risk, with a negative sign, in the works of Beaver, Kettler and Scholes (1970), Breen and Lerner (1973), Farrelly, Ferris and Reichenstein (1985) and Elmoatasem (2005). It is not, however, significant in the empirical analysis of Thompson (1976).

Growth (*GR*). Is calculated through the Neperian logarithm of the ratio between the total assets at the end of the business year and the total assets at the beginning of the same business year. Thompson (1976) and Brimble and Hodgson (2007) find that growth is a positive sign explicative and significant variable.

[6] There is also contradictory evidence with the use of market values. Thus, Nunthirapakorn and Millar (1987) conclude that the explicative capacity of the information calculated at historical cost is the same – or better –than the information obtained from market prices.
[7] Both use market value of equity for the calculation of the independent variable and this can influence the sign of the relationship.

Gross Added Value (*GAV*). Is the result of subtracting the amount of the intermediate expenditures from operating income. Karpik and Belkaoui (1990) show that the incorporation of value added improves the explicative power of the model. The gross added value is an explicative variable of market beta, although the same sign is not presented in all of the models.

Net Added Value (*NAV*). Is the gross value added after depreciation allowances. In Karpik and Belkaoui (1990) an explicative and significant variable appears of the market beta, with positive sign.

Operating Leverage (*OL*). Corresponds to the ratio between earnings before interest and taxes (*BAIT*) and sales. Callahan and Mohr (1989) confirms a positive relationship between the market beta and the operating leverage from a theoretical standpoint. Lord (1996) and Brimble and Hodgson (2007) also obtain a positive sign. Nevertheless, Huffman (1989) finds a negative relationship between systematic risk and operating leverage.

Financial Leverage (*FL*). Is defined as the ratio between the net or shareholder earnings *(IAT)* and the earnings of the operation (*EBIT*). Huffman (1989) shows evidence of a positive and significant relationship with market beta, while in Lord (1996), a positive and significant relationship appears with total and non-systematic risk, but not significant with market beta.

Income After Taxes (*IAT*). Net earnings directly provided by the outcome accounts.

Earnings Before Interest and Taxes (*EBIT*). Earnings resulting from subtracting operating expenses and depreciation allowances from operating income.

The ratio between net earnings and the accounting value of the equity is the profitability of the stockholder, and the ratio between the operating result and the total assets is the profitability of the operation. The ratio between the operating results and sales is the operating leverage.

b) Cash-flow variables (*CFV*)[8]

<u>Cash flow 1</u> (CF1). Operating cash flow corresponds to the flow of cash of the activities of the Operating Cash Flow Statements, in accordance with the NIIF.

<u>Cash flow 2</u> (CF2). Corresponds to CF1 plus the positive or negative variations of cash flow investment.

<u>Cash flow 3</u> (CF3). Is obtained by taking away economic depreciation allowances from CF1.

There are various studies that incorporate Cash Flow as an independent variable. Nevertheless, the definitions of it are varied and the market beta is not always the dependent variable. The results of the different research are dispersed since they do not reflect unanimity in the sign of the relationship. The results are summarized below:

Author/s	Dependent variable	Sign of the coefficient estimated for the independent variable (Cash Flow)
Bildersee (1975)	Market beta	-
Rayburn (1986)	Annual profitability of the stocks	+
Ismail and Kim (1989)	Market beta	+
Karpik and Belkaoui (1990)	Market beta	-
Chariton and Ketz (1991)	Market price of the stocks	+
Sloan (1996)	Market price of the stocks	+
Brimble y Hodgson (2007)	Market beta	-

It is helpful to point out that Ismail and Kim (1989), Karpik and Belkaoui (1990) and Brimble and Hodgson (2007) use the same dependent variable and a definition of Cash Flow very similar, while obtaining, nevertheless, different signs.

[8] For financial entities of the sample, the definitions are calculated taking document FASB-95 into account.

We have always quantified the denominators, equity and total assets, used for defining independent variables in accounting values[9]. Using market values is only easy for firms that are part of the Stock Exchange and that have, therefore, a market price of each one of its financial assets. In addition, using the market value to define the independent variables influences the study of the relationship due to the influence that the beta has on the cost of capital[10] and this, on the market price of the stocks.

c) Variables of productivity (VPR)

They are indicators of overall productivity of the factors that are estimated in the area of the non-parametric model evaluation methods. A brief analysis of the estimating method and interpretation that is assigned to these indicators is presented in the appendix.

3.3. Sample

The sample is made up of 69 firms on the Spanish capital market, of which 14 are financial in nature and the rest are representative of different sectors of the economy. Given the difficulty in identifying comparable definitions, the sample does not include insurance and investment firms. Loss taking has not excluded any firm. The period studied includes the years from 1992 to 2004. This period is, as far as we know, broader than any previous study on financial risk in the Spanish capital market.

The data has been obtained from:

a) Sociedad de Bolsas
b) Madrid Stock Exchange Library
c) Appendix to the Boletín de Cotización (Bulletin of the Official List of Prices) and Trading Volumes: Half-year information on the entities traded on the Stock Exchange edited by the Barcelona Stock Exchange
d) The web page of the Madrid Stock Exchange

[9] Despite that previous studies use market values to explain the connection between the market beta or the market price of the stocks and accounting.

[10] See the work of Giner and Reverter (2006)

e) The web page of the Comisión Nacional del Mercado de Valores (National Commission on Market Values)

f) The Comisión Nacional del Mercado de Valores through the acquisition of an accounting database for 1992-1995.

4. Methodology and Results

To analyse the relationship between the different measurements of risk and the accounting variables listed, we estimate data panel models[11]. We use this methodology because it is better for adjusting the data structure and because it offers the possibility of observing permanent cross and longitudinal sections of phenomena. As usually happens in static type panel estimates, the Hausman test is used to determine what type of estimate is preferable: fixed effect or random effect models.

The equation to be estimated is:

$$R_{it} = \alpha_0 + \sum_{j=1}^{k} \alpha_j (VB_{ijt}) + \sum_{f=1}^{k} \alpha_f (VCF_{ift}) + n\sum_{p=1}^{k} \alpha_p (VPR_{ipt}) + \sum_{m=1}^{k} \alpha_m (VM_{mt}) + \mu_i + \varepsilon_{it}$$

Where:

R_{it} identifies the dependent variable (the market beta, total risk, specific risk and asset risk) of the firm *i* in the half-year *t*,

VB_{jit}, CFV_{ift}, VPR_{ipt}, VM_{mt}, are the previously mentioned accounting variables, belonging to the group of balance, cash flow, productivity and macroeconomic variables,

μ_i represents the error among the unit of the sample,

ξ_{it} symbolizes the error for each firm considering the period.

The previous model is applied in 7 different scenarios in accordance with the 7 defined dependent variables: two market betas, two specific risks, two asset betas and one total risk[12].

[11] We use the STATA version 10.0 statistical program for it.

[12] We have two measures of specific risk and beta because we start from different indices in order to estimate the market beta.

Next, the descriptive statistic of the independent variables is presented for the total sample (the descriptive statistics corresponding to the sample of the financial and non-financial firms are not separated from the corresponding values of the total sample).

[Table 1 around here]

These must be emphasized from the information contained in Table 1: a) minimum values of the debt relationship 1 and 2, a fact reflected in the existence in the sample of firms practically without debt, which would be the opposite postulated from financial theory, b) the statistics from the IAT/TA indicator, that shows evidence of some very reduced values and with little dispersion, c) the high typical deviation of financial leverage and of the ratios between the three cash flows and the financial expenses, and d) the average negative of the CF2/SAL indicator[13].

4.2. Results and discussion

We next present the results of the analysis of panel data for the three samples studied. As a starting point, two different techniques were used to determine the independent variables: a) to choose significant independent variables after performing a factorial analysis in order to take, within each factor, the most weighted indicator, and b) choose the significant independent variables after estimating a simple regression with each variable. The models that are shown are the models obtained with the second technique, since the first offers a poorer fit. In the first place, as often happens in these type of estimates, the Hausman test determines what type of model (of the fixed and random effects) are more recommended (in general, the fixed effect model appeared to be clearly superior). Secondly, the robustness of the results improved once the problems of heteroskedasticity and autocorrelation were corrected[14].

4.3. Results of the empirical study for the total sample

[13] To avoid co-linearity problems in the building of the different models, the coefficients of correlation between the independent variables have been calculated for the three samples (these statistics have not been included in the work).

[14] The problems of contemporaneous correlation, heteroskedasticity and autocorrelation (Wooldridge, 2002) have been solved through the estimation of Panel Corrected Standard Errors or PCSE. See Beck and Katz (2001). We have always selected the best estimate and depending on the correction done, we have or do not have a value of R^2

Table 2 pulls together the better model for each of the dependent variables analysed. The total risk dependent variable does not appear since the model does not reveal any significant independent variable. Although we have two measures of specific risk, only one of them appears since the coefficient of correlation between both risks equals 0.998. In each cell, the value of the coefficient is indicated first and in parentheses the value of the statistic z.

[Table 2 around here]

The data obtained does not allow us to state that there is a clear connection between the accounting information divulged by Spanish firms, and the risk measurements calculated with information coming from the Spanish Capital Market, both for the market beta and other measures of risk. The best results are achieved when the market beta is estimated from the IGBM, since 4 accounting indicators and 3 macroeconomic variables are significant, the R^2 being only 6.7%.

There are few independent variables that explain each one of the measures of risk and there are few independent variables that appear to be significant in more than one model. Only 2 accounting indicators and 3 macroeconomic variables are explicative variables of risk in the two different models. So, for example, the rate of employment (T_PARO) explains the systematic risk of the stocks (when the market portfolio is the IGBM) and the total risk of the stocks.

It is important to emphasize the dissimilarity between model 1 and model 2, despite the IBEX-35 theoretically being a representative portfolio of the IGBM. The reason for this is that the beta estimated from the IBEX-35 would have to be practically the same as that of the beta estimated from the IGBM[15]. The data from the sample clearly demonstrate that the coefficient of correlation between both betas is equal to 0.014, a surprisingly low value. As a consequence, it is reasonable to consider that the beta estimated from the IBEX-35 is not the best measure of risk of the Spanish capital market and that, therefore, the results obtained in model 2, which do not coincide with the ones expected, are a result of the scarce representation of the index.

[15] Through the IBEX-35, what happens in all of the Spanish capital markets is represented. The IBEX-35 has to measure the market risk from 35 stocks. Nevertheless, if we considered that traditionally 5 of the 35 firms represent more than 50% of the index, it does not seem strange to note that the correlation between the two market betas are not very high.

Three significant independent variables appear in model number one, whose sign does not correspond with the expected one from a theoretical point of view. The EBIT/BVE indicator shows a positive sign when the expected one would be negative (that is, a reduction of risk when the operating results by equity unit increase). Nevertheless, we must consider that the EBIT is an earnings before considering the financial charges arising from the debt. Therefore, elevated EBIT does not have reason to automatically mean a greater Shareholder Earnings (IAT) nor greater profitability for the investor. The positive sign obtained explains that, in the sample studied, high EBIT is associated with a high level of debt and, as a consequence, a greater stock risk.

The CF1/SAL ratio shows a positive sign, even though the expected sign is negative. It is logical to expect that greater cash flow for the shareholder by unit sold, the less risk the stock represents, even though the sample analysed indicates the opposite. A possible explanation would be the association that exists between the level of invoicing (sales) and systematic risk of the stocks; that is to say, the greater the level of invoicing, the greater risk of the stock. The positive sign found coincides with that obtained by Ismail and Kim (1989), who obtain a positive relation between the beta and cash flow, and that obtained by Giner et al, who find a positive relation between the market beta and the ordinary return[16]/equity relationship, which is also the opposite of what is theoretically expected. In addition, as has already been pointed out, the results of previous studies show very little homogeneity in the sign of the relationship.

The Consumer Price Index (CPI) reveals a negative sign (that is to say, the greater the CPI the lesser the beta). A possible explanation would be that an increase in the CPI could have a positive effect on the yield accounts of the firms in the sample, since that a certain level of inflation signifies a growing economy. The combination of an increase in the CPI with a very low rate of interest[17], that gives an incentive to household debt for the consumer, translates into an improvement in business returns and, therefore, in a reduction of stock beta.

[16] Defined as the sum of the operating result and the financial result.
[17] Established by the European Central Bank.

It should be emphasized from model 3 the fact that size and debt relationship are significant variables that explain specific risk of the stock, the sign of the relationship being the expected one[18]. In model 4, the Gross Value Added is an explicative variable of the asset beta so that the greater the GAV/TA, the greater the risk of the investment project. Model 5 shows a debt relationship, debt 2, as a significant and explicative variable of risk but with a negative sign. Even though this sign does not have a coherent financial explanation, a mathematic justification can be offered since the asset beta has been estimated from the expression (4), so that the greater the debt, the less BVE/P ratio and, therefore, greater stock beta.

4.4. Results of the empirical study for the sample of the non-financial firms.

In Table 3 we find the results obtained from the study of the sample of non-financial firms (55 in total). The results of the study are very similar to those obtained in the overall sample, perhaps somewhat better, since, although we do not find a clear relationship between the independent variables and the measures of risk, the explicative power of the model will improve a bit on R^2 being 7.3%. Again, the best model is number 1, exhibiting five accounting indicators and two significant macroeconomic measures that explain the systematic risk of the stocks.

[Table 3 around here]

The analysis of the non-financial sample introduces few new aspects with respect to the results of the previous section. The main differences from model 1, with respect to the former, are that now, the independent variables GAV/SAL and the Euribor (EUR) are shown as significant and explicative variables, and that the Consumer Price Index variable disappears. The sign of the GAV/SAL indicator is negative, which is in line with Karpik and Belkaoui (1990)[19].

[18] Although there are works that justify that size reduces systematic risk of the stocks, among them Elmoatasem (2005), in the study by Brimble and Hodgson (2007) a positive sign is found.
[19] It should be remembered that the variables are significant and explicative of risk but that the sign does not stay constant in the different models that are exhibited in the study.

Since the coefficient of correlation between β_{IGBM} and $\beta_{IBEX-35}$ acquires an overly low value (0.0287), we again consider that model 2 is not the best qualified for analysing the connection between the accounting information and the market beta of the stocks, since the IBEX-35 is not a good representation of the IGBM.

The differences observed between the remaining models are very few. In models 4 and 5, the most notable differences are that there is only one independent variable that explains the asset risk calculated using the IGBM and that LEV2 stops being an explicative variable of the asset beta estimated using IBEX-35.

4.5. The results of the empirical study for the sample of financial firms.

The models obtained with the study of the sample of financial firms are even worse than those previously indicated. Therefore, to separate the samples with the purpose of achieving greater homogeneity between the accounting information studied[20] did not mean an improvement in the results. This is perhaps due to the number of firms that make up the sample is reduced and that the bank risk is more difficult to observe from the mere consideration of the Annual Reports. Despite the financial system being a highly regulated sector, there is not any better representation of the accounting data in the market beta of its stocks. When the market beta is calculated using the IGBM, only 2 independent variables, actually the macroeconomic ones, are significant. Nevertheless, the results obtained are consistent with the results of the research developed by Agusman and others (2008) where no accounting indicator is explicative of systematic risk of Asian banks.

[Table 4 around here]

In this scenario, the model that best explains the relationship between the independent variables and the systematic risk is model number 2, since R^2 acquires the highest value of the models presented here and in all of the research. In model 2, three accounting

[20] To minimize the dispersion of accounting criteria.

indicators explain the systematic risk of the bank stocks and the signs agree with the expected ones.

Like that of the previous samples, the coefficient of correlation between β_{IGBM} y $\beta_{IBEX-35}$ is very low and therefore, the result is surprising since the IBEX-35 is not an index representative of the IGBM. It is possible that the IBEX-35 is more representative of the financial firms than the non-financial ones, since the main financial entities of the country make up part of it, usually representing more than 25% of the weight of the index.

The remaining models in Table 4 reflect some very weak results. Only one independent variable explains the asset beta and only two independent variables explain the specific risk of the stocks, but with one of them showing evidence of an opposite sign of what is expected. With respect to total risk of stocks, level of unemployment explains this but with an opposite sign of what is expected An explanation of the sign found could be that, by measuring the overall risk of the stocks through the typical deviation of monthly profitability of the stocks when unemployment rises, the economy is braked, the variability of profitability is reduced, and therefore, its typical deviation.

As a general conclusion, despite not obtaining a model that clearly explains the market risk of the stocks, the results confirm some of the initially established hypotheses. The analysis of the total sample and of the sample of non-financial firms allows confirmation of hypotheses one, two, four and five. For the financial firms, the results allow for hypotheses two and five.

The research allows us to confirm that it is not only the strictly accounting information that explains stock beta. Certain macroeconomic variables and some productivity indicators are explicative variables of systematic risk: the S&P500 and productivity 2 *(PROD2)* in the overall sample and the sample of non-financial firms, and productivity 1 in the financial firm sample.

5- Conclusions.

We study in this article the relationship that exists between the market beta of stocks and a group of accounting and macroeconomic information for the purpose of finding an objective methodology that enables the quantification of the risk of stocks of the companies that do not make up part of the capital market. We study the connection between the market beta, specific risk, total risk and asset beta with information obtained from the company and surroundings.

The results obtained in this study are found along the same line as those obtained in previous studies, both for the Spanish market as well as other markets. A strong connection is not demonstrated between the accounting information and the main measurement of risk that the Stock Exchange offers us, the market beta. Therefore, neither the application of the data panel technique, the broadening of the accounting information, the combination of accounting information with macroeconomic information, nor the study of a broad period of time reasonably improves the results achieved before. The model with the greater explicative power is obtained with the financial samples and when the beta has been estimated using IBEX-35, where an R^2 of 0.23 is obtained.

Not achieving a clear and strong relationship between the Spanish capital market betas and accounting information, despite the extension of the time period analysed and of the breadth of the dependent and independent variables studied, lead us to reflect on the role that accounting information plays in the characterization of financial risk. Thus, the absence of some good results puts the efficiency of our markets in doubt.

A high level of efficiency is achieved when the prices of the stocks incorporate not only the information obtained from a detailed analysis of the accounting information but also from an in depth analysis of the sector and the economy. In this sense, if the accounting information was poor because some overly restrictive regulations prevail and they had little economic foundation, a direct effect could be that the economic agents took their decisions without paying attention to the accounting information, with which the paradigm of utility would be in doubt. Thus, the recent changes introduced in the Spanish accounting proceedings could alleviate this problem because the application of new International Accounting Regulations advance the improvement of the quality of accounting information.

The study shows that the separation of the financial and non-financial firm samples does not improve results and the connection between the capital market and accounting is not convincing. The results are very similar for the overall sample and for the non-financial sample. For the financial firms' sample, only three indicators are significant.

Although, in accordance with the theoretical framework, a significant relationship is justified between systematic risk and debt relationship, size and payout, in none of the samples analysed do these relationships appear as significant. The debt relationship is a significant variable when the dependent variable is specific risk and the sample is the overall sample and non-financial firms.

The results confirm the importance of the choice of the market portfolio to calculate the beta of the stocks. The results are different depending on the portfolio chosen with the best results obtained when the portfolio is the Índice General de la Bolsa de Madrid. The correlation between the estimated beta using the IGBM and the beta estimated from IBEX-35 for the three samples also turns out to be surprisingly low.

Although the study performed does not allow us to advance very far in the search for accounting information that explains market risk, the results obtained demonstrate the disconnection between the financial market and accounting information along with the need for taking steps to improve this relationship. Improvement that we expect can be seen in the International Accounting Regulations used by the companies on the Spanish Capital Market since 2005. In this sense, a potential future line of research is, specifically, to look at up to what point the application of these regulations improve the connection between market beta of the stocks and accounting information.

Another future extension of the line of research is to determine to what extent the accounting information revealed is of quality: studying the phenomenon of creative accounting as a way of manipulating results and their link to the risk of stocks. It seems reasonable to suppose that the investors, conscious of a certain amount of manipulation, will make their decisions by eliminating from the accounting numbers those magnitudes that they estimate can be influenced by strictly discretional criteria.

Appendix

Here Data Envelopment Analysis (hereafter, *DEA*) frontier analysis is used. The concept of frontier appears when a sample of production units is evaluated in such a way that, out of the total analysed, those presenting the best values can be identified. These constitute the best performers with which the other units are to be compared; this process is also well known as *benchmark analysis*.

DEA models appear with the seminal paper by Charnes, Cooper and Rhodes (1978), adapting the proposal of Farrell (1957) to multiple outputs and multiple inputs technology. *DEA* models adopt a convex technology assumption; i.e., they are based on the belief that, if two units of production are efficient, it is possible to achieve another feasible unit by combining these two.

Linear programming models needed for *DEA* frontier evaluation, in the special case of output-oriented maximisation and variable returns to scale technology, are defined. For the particular case of one input and one output, this evaluation process is synthesised in Figure A1. Here we observe how the unit under analysis (unit *i*) in year *t* is inefficient because the frontier exhibits a better productivity, say: $\left[\left(y_{it}^{*}/x_{it}\right) > \left(y_{it}/x_{it}\right)\right]$. In the same figure the value corresponding to the time period t+1 is also presented. This means that we are able to compute two efficiency coefficients for the same frontier: for time t and time t+1. In the output oriented version, this inefficiency can be corrected by expanding the observed output β_i times, just to reach the output level in the frontier$\left[\beta_i \cdot y_{it} = y_{it}^{*}\right]$. In summary, in the output-oriented version, the more β implies the more the firm is inefficient.

[Figure A1 about here]

The specific output-oriented *DEA* efficiency score is calculated by solving the following linear problem:

$$
\begin{aligned}
& \max . \beta_i \\
& subject\ to: \\
& x_{in} - \sum_{k=1}^{K} z_k \times x_{k,n} \geq 0 \qquad n = 1,\ldots,N, \qquad [A1] \\
& -\beta_i \times y_{im} + \sum_{k=1}^{K} z_k \times y_{k,m} \geq 0 \qquad m = 1, \ldots, M, \\
& \sum_{k=1}^{K} z_k = 1.
\end{aligned}
$$

where:

$x_i = \left[x_{i,1}, \quad x_{i,2}, \quad \cdots, \quad x_{i,N} \right] \in R_+^N$ is the vector of the observed inputs corresponding to the unit under evaluation (unit *i*),

$y_i = \left[y_{i,1}, \quad y_{i,2}, \quad \cdots, \quad y_{i,M} \right] \in R_+^M$ is the vector of the observed outputs corresponding to the unit under evaluation (unit *i*),

$x_k = \left[x_{k,1}, \quad x_{k,2}, \quad \cdots, \quad x_{k,N} \right] \in R_+^N$ is the vector of the observed inputs corresponding to unit *k*, forming part of the sample containing *K* units,

$y_k = \left[y_{k,1}, \quad y_{k,2}, \quad \cdots, \quad y_{k,M} \right] \in R_+^M$ is the vector of the observed outputs corresponding to unit *k*, forming part of the sample containing *K* units, and

$z = \left[z_1, \quad z_2, \quad \cdots, \quad z_K \right]$ is the activity vector used to construct the linear segments of the frontier.

The coefficient β_i indicates the technical efficiency level of each of the units evaluated. When $\beta_i = 1$, the unit under evaluation is efficient in the Farrell-Debreu notion. In other words, no other peer has been found that yields the same output vector with a smaller consumption of inputs. Otherwise, $\beta_i > 1$ indicates the presence of technical inefficiency. Here, we follow the well-known Farrell-Debreu notion of efficiency. There is, however, another more demanding one: the Pareto-Koopmans definition of efficiency. See Färe, Grosskopf and Lovell (1994) for a detailed study of its characteristics.

In program [A1] all the variables are supposed to be situated in the same time period (*t*). In a panel data context, the unit under analysis and the frontier can correspond to time periods *t* and *t+1*. Combining these characteristics, the indicators PR1 through PR5 appear.

Table 1. Descriptive Statistics
Balance Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
LI	1794	2.07	10.14	0.02	416.46
LEV1	1794	0.58	0.22	0.00	0.99
LEV2	1794	0.28	0.25	0.00	0.86
LEV3	1794	1.83	3.29	-9.36	55.02
SZ	1794	11.91	1.96	2.93	17.78
PA	1794	0.28	1.44	-52	11.69
GR	1794	0.04	0.32	-6.91	6.91
GAV/BVE	1794	0.30	0.56	-4.45	8.28
NAV/BVE	1794	0.25	0.47	-3.65	6.23
GAV/SAL	1794	0.46	0.63	-11.09	16.74
NAV/SAL	1794	0.36	0.71	-11.57	15.50
GAV/TA	1794	0.13	0.96	-0.32	40.32
NAV/TA	1794	0.09	0.24	-0.52	9.17
GAV/FE	1426	19.11	41.27	-386.15	771.05
NAV/FE	1426	16.02	36.07	-355.28	546.56
OL	1794	0.13	0.52	-11.48	9.36
FL	1794	3.12	105.81	-228.33	4469.71
IAT/TA	1794	-0.002	0.69	-29.49	0.41
IAT/FE	1430	3.69	16.63	-87.66	428
IAT/BVE	1794	0.04	0.88	-11.79	33.65
IAT/SAL	1794	0.10	0.80	-7.51	17.26
IAT/TA	1794	0.002	1.017	-43	0.23
EBIT/FE	1426	5.52	20.70	-123.24	435.61
EBIT/BVE	1794	0.06	0.45	-13.42	9.59
EBIT/SAL	1794	0.13	0.52	-11.48	9.36

Cash-Flow Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
CF1/BVE	1794	0.09	0.82	-19.59	8.72
CF2/BVE	1794	0.08	1.09	-14,.	12.89
CF3/BVE	1794	0.03	0.75	-17.2984	8.44
CF1/SAL	1794	0.09	2.37	-33.8249	37.61
CF2/SAL	1794	-0.03	4.52	-123.3258	39.38
CF3/SAL	1794	0.01	2.31	-35.0604	37.52
CF1/TA	1794	0.08	1.34	-1.3407	56.83
CF2/TA	1794	0.07	1.61	-6.0203	67.13
CF3/TA	1794	0.04	0.61	-1.3644	25.68
CF1/FE	1426	10.98	49.31	-426	1111.44
CF2/FE	1426	9.47	73.73	-426	2151.83
CF3/FE	1426	7.89	44.22	-428	982.94

Productivity Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
PR1	1793	2.05	1.08	1	34.51
PR2	1793	2.03	1.08	1	34.51
PR3	1791	1.02	0.88	0.01	35.81
PR4	1792	1.00	0.32	0.09	13.83
PR5	1794	1.01	0.58	0.01	25.40

Macroeconomic Variables

Variable	Obs	Mean	Std.Dev.	Min	Max
EUR	1794	4.58	2.04	2.01	10.31
LINT	1794	6.63	2.38	3.75	10.00
CPI	1794	1.67	0,75	0.30	2.93
UR	1794	17.18	4.91	10.46	24.38
GDPI	1794	3.39	0.67	1.07	4.98
D-J	1794	0.03	0.07	-0.10	0.15
S&P500	1794	0.04	0.08	-0.12	0.16

Table 2. Estimation of the model for the overall sample

Var. depend. / Var. independ.	Expected Sign	Model 1 β_{IGBM}	Model 2 $\beta_{IBEX-35}$	Model 3 ξ	Model 4 $\beta_{A(IGBM)}$	Model 5 $\beta_{A(IBEX-35)}$
α_0		-0,015 (-0.38)	-0,024 (-0.17)	0.04 (15.78)	0.237 (5.02)	0.153 (14.95)
EBIT/BVE	-	0,077 (4.10)	-0,069 (-2.47)			
CF2/BVE	-	-0,015 (-2.19)				
CF1/SAL	-	0,007 (2.39)				
GAV/BVE	+/-	-0,033 (-1.35)			-0.016 (-1.65)	
UR	+	0,0088 (4.27)		0.0005 (6.89)		
CPI	+	-0,026 (-2.17)		-0,002 (-3.90)		
S-P500	+	0,634 (5.47)			0.246 (7.23)	
PROD2	+	0,015 (1.82)	0,008 (0.72)			
EBIT/FE	-		-0.001 (-1.38)			
SZ	+/-		0,046 (3.85)	-0.003 (-14.76)		
PA	-		-0.017 (-2.90)			
LEV1	+			0.009 (5.73)		
LEV2	+					-0.303 (-25.16)
GAV/TA	+/-				0.108 (3.03)	
EUR	+					0.021 (12.75)
DJ	+		0.312 (1.58)			0.337 (7.02))
R^2		0.067	0.07	-	-	-
N		1793	1425	1794	1794	1794

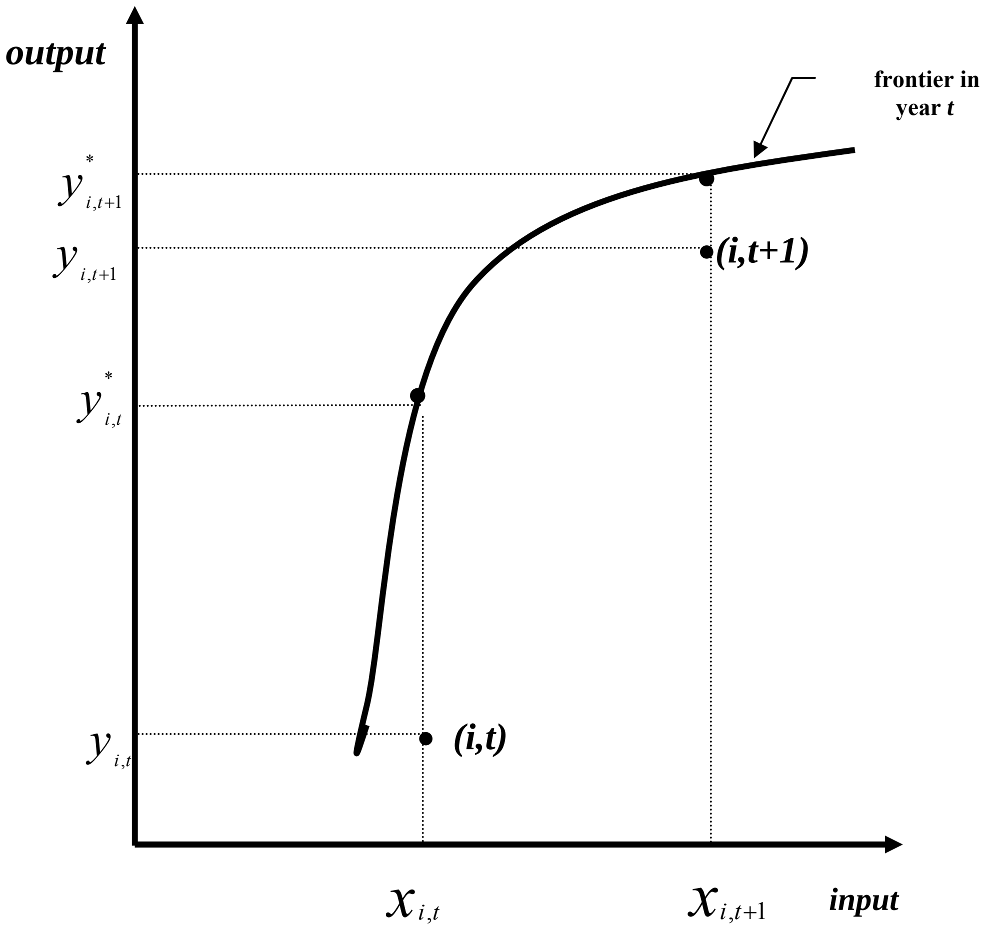
Table 3. Estimation of the model for the sample of non-financial firms

Var. depend. / Var. independ.	Expected Sign	Model nº1 β_{IGBM}	Model nº2 $\beta_{IBEX-35}$	Model nº3 ξ	Model nº4 $\beta_{A(IGBM)}$	Model nº5 $\beta_{A(IBEX-35)}$
A_0		0.006 (0,19)	0.533 (17.26)	0.039 (14.44)	0.050 (10.20)	0.013 (0.82)
EBIT/BVE	+/-	0.078 (4,14)				
CF2/BVE	-	-0.034 (-2,23)				
CF1/SAL	-	0.009 (2.30)				
GAV/SAL	+/-	-0.035 (-2.85)				
GAV/FE	+/-		-0.001 (-2.65)			
IAT/BVE	-		-0.025 (-2.49)			
OL	+		-0.022 (-1.16)			
UR	+			0.001 (6.91)		
CPI	+			-0.001 (-3.23)		
S-P500	+	0.953 (8.04)			0,442 (9.45)	
PROD2	+	0.015 (1.95)	-0.006 (-0.54)			
SZ	-			-0.003 (-14.56)		
LEV1	+			0.011 (5.97)		
LEV2	+					-0.012 (-0.33)
GAV/BVE	+/-			0.002 (2.18)	-0.009 (-1.39)	
EUR	+	0,017 (3.30)				0.04 (15.86)
DJ	+		0.392 (1.98)			0.747 (9.77)
R2		0.073	0.055	-	-	-
N		1429	1425	1430	1430	1430

Table 4. Estimation of the model for the sample of the financial firms

Var. depend. / Var. indepd.	Expected Sign	Model nº1 β_{IGBM}	Model nº2 $\beta_{IBEX\text{-}35}$	Model nº3 σ	Model nº4 ξ	Model nº 5 $\beta_{A(IGBM)}$	Model nº6 $\beta_{A(IBEX\text{-}35)}$
A 0		0.212 (1.20)	0,944 (8.83)	0,012 (29.59)	0.0144 (1.42)	-0.004 (-0.55)	-0.018 (-2.35)
UR	+	0.014 (3.55)		-0,001 (-3.52)			
CPI	+	-0.064 (-2.80)					
PROD5	+	-0.239 (-1.70)					
PROD1	-	-0.000 (-0.01)	-0.46 (-8.76)				
LEV3	+	0.005 (0.57)					
GAV/TA	+/-		7,77 (2.96)	-0.022 (-2.79)			
IAT/TA	-		-4.22 (-1.88)				
IAT/BVE	-						-0.016 (-0.64)
EBIT/BVE	-			-0.002 (-1.94)			
GAV/BVE	+/-			0.001 (1.70)			
GR	+			0.000 (0.13)			
EUR	+				-0.002 (-2.05)		
PROD2	-				0.01 (1.91)	0.009 (1.89)	
LINT	+						0.006 (6.09)
DJ	+		0.346 (1.22)				
R2		0,056	0.23	-	0.024	-	-
N		364	364	364	364	364	

FIGURE A1
DEA EVALUATION PROCESS



References.

AGUSMAN, Agusman; MONROE, Gary S.; GASBARRO, Dominic; ZUMWALT, J.K. "Accounting and capital market measures of risk: Evidence from Asia banks during 1998-2003".*Journal of Banking &Finance.*2008, nº32, p. 480-488.

ALMISHER, Mohamad A.; KISH, Richard J. "Accounting Betas-an ex anti proxi for risk within the IPO Market" .*Journal of Financial and Strategic Decisions.*(2000), vol.13, nº3, p. 23-34.

ARAGONÉS, José R.; BLANCO, Carlos "Crisis financieras y gestión del riesgo de mercado" *Universia Business Review.*(2004), cuarto trimestre, p. 78-87.

AZOFRA, Valentin; RODRÍGUEZ, Juan Antonio; VALLELADO, Euleterio. "Determinantes del riesgo de las empresas industriales españolas" *Revista Española de Financiación y Contabilidad.* 1997, vol. 26, nº 92, p. 749-775.

BALL, R.; BROWN, P. "An Empirical Evaluation of Accounting Income Numbers". *Journal of Accounting Research.* 1968.

BALL, R.; BROWN,P. "Portfolio Theory and Accounting Theory". *Journal of Accounting Research.*1969, vol.7, p.300-323.

BARTON, Sidney L. "Diversification Strategy and Systematic Risk: Another Look". *Academy of Management Journal.* (1988), vol.31, nº1, p.166-175.

BEAVER, William; MANEGOLD, James "The Association Between Market-Determined and Accounting-Determined Measures of Systematic Risk:Some Further Evidence. *Journal of Financial and Quantitative Analysis.*(1975), p. 231-284.

BEAVER,W.; KETTLER,P.; SCHOLES,M. "The Association Between Market Determined and Accounting Determined Risk Measures". *The Accounting Review.*1970, October, p.655-682.

BECK,N.; KATZ,J ."Time –Series-Cross-Section Data: What have we learned in the past few years?. *Annual Review of Political Science.*(2001), vol.4, p.271-293

BERKOWITZ, Michael K. "Estimating the Market Risk for Nontraded Securities: An Application to Canadian Public Utilities". *International Review of Financial Analysis.* (1998), vol.7,nº2, p. 171-179.

BILDERSEE, John S.; "The Association Between a Market Determined Measure of Risk and Alternative Measures of Risk". *Accounting Review.*1975, vol.50, nº1, p. 81-98.

BOTOSAN, Christine A.; PLUMLEE, Marlene A. "Assessing Alternative Proxies for the Expected Risk Premium". *The Accounting Review.*(2005), vol.80, nº1, p. 21-53.

BOWEN, Robert M.; BURGSTAHLER, David; DALEY, Lane A. "Evidence on the Relationships Between Earnings and Various Measures of Cash Flow" *The Accounting Review.*1986, vol 61, nº4, p. 713-725.

BOWMAN, Robert G. "The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables". *The Journal of Finance.* 1979, vol. 34, nº3, p. 617- 630.

BOWMAN, Robert G. "The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables: Reply". *The Journal of Finance.* 1981, vol.36, nº3, p. 749-750.

BREALEY, Richard A.; MYERS, Stewart C.; ALLEN, Franklin *Principios de Finanzas Corporativas.* 8a edición. Madrid: Mc Graw Hill, 2006.ISBN: 84-481-4621-2

BREEN, William J.; LERNER, Eugene M. "Corporate Financial Strategies and Market Measures of Risk and Return". *The Journal of Finance.*1972,December 28-30, p. 339-351.

BRIMBLE, Mark; HODGSON, Allan. "Assessing the risk relevance of accounting variables in diverse economic conditions" *Managerial Finance*. 2007, vol. 33, nº 8, p. 553-573.

CABEDO, J.David; TIRADO, José Miguel. "The disclosure of risk in financial statements" *Accounting Forum.* 2004, nº 28, p.181-200.

CALLAGAN, Carolyn M.; MOHR, Rosanne M."The Determinants of Systematic Risk: A Synthesis". *The Financial Review.* 1989, vol.24, nº2, p. 157-181.

CANO, Manuel; NÚÑEZ, Manuel. "El impacto de la relación negativa entre rentabilidad y riesgo medidos contablemente en la rentabilidad del mercado". *Revista de Contabilidad.* (2004), vol.7, nº13, p. 113-136.

CHARITOU, Andreas; KETZ, Edward. "An Empirical Examination of Cash Flow Measures" *Abacus.*1991, vol.27, nº1, p. 51-64.

CHEN, Peter; ZHANG, Guochang "How do accounting variables explain stock price movements? Theory and evidence". *Journal of Accounting and Economics.*2007,nº 43, p. 219-244.

CREADY, William M.; MYNATT, Patricia G. "The Information Content of Annual Reports: A price and Trading Response Analysis". *The Accounting Review.* (1991), vol.66, nº2, p.291-312.

DAMODARAN, Aswath "Value and Risk: Beyond Betas". *Financial Analysts Journal*. (2005),vol.61, nº2, p.38-43.

DHALIWAL, Dan; HEITZMAN, Shane; ZHEN LI, Oliver. "Taxes, Leverage, and the Cost of Equity Capital". *Journal of Accounting Research.* (2006), vol.44, nº4, p. 691-723.

DUGAN, Michael T. ; SHRIVER, Keith A. "An Empirical Comparison of Alternative Methods for the Estimation of the Degree of Operating Leverage". *The Financial Review.* 1992, vol.27, nº2, p. 309-321.

ELGERS, Pieter T.; MURRAY, Dennis. "The Impact of the Choice of Market Index on the Empirical Evaluation of Accounting Risk Measures" *The Accounting Review*. 1982, vol. 57, nº2, p. 358-375.

ELMOATASEM, Khaled. "Disclosure of market risk or accounting measures of risk: an empirical study". *Managerial Auditing Journal.* 2005, vol.20, nº 8, p.867-875.

ESKEW, Robert K. "The Forescasting Ability of Accounting Risk Measures: Some Additional Evidence". *The Accounting Review.*1979, vol. 54, nº1,p. 107-118.

ESPINOSA, Mónica; TROMBETTA, Marco. "Disclosure Interactions and the Cost of Equity Capital: Evidence From the Spanish Continuous Market". *Journal of Business Finance & Accounting.*2007, vol.34, nº9-10, p. 1371-1392.

FARRELLY, Gail E.; FERRIS, Keneth R.; REICHENSTEIN, William R. “Perceived Risk, Market Risk, and Accounting Determined Risk Measures”. *The Accounting Review.*(1985), vol. 60, nº2, p. 278-288.

FELTHAM, Glenn; ROBB, Sean; ZHANG, Ping. “Precision in Accounting Information, Financial Leverage and the Value of Equity” *Journal of Business Finance & Accounting.* 2007, vol. 34, nº 7&8, p.1099-1122.

GIGLER, Frank; KANODIA, Chandra; VENUGOPALAN, Raghu. “Assessing the Information Content of Mark-to-Market Accounting with Mixed Attributes: The Case of Cash Flow Hedges”. *Journal of Accounting Research.*(2007), vol45, nº2, p. 257-276.

GINER, Begoña.; REVERTE, Carmelo. “The Risk-Relevance of Accounting Data: Evidence From the Spanish Stock Market”. *Journal of International Financial Management and Accounting.*(2006), vol.17, nº3, p.175-206.

GINER, Begoña; LAFFARG, Joaquina; LARRÁN, Manuel. “Asociación entre flujos de fondos contables y beta de mercado: un estudio empírico” *Revista Española de Financiación y Contabilidad.* 1999, vol. 28, nº 98, p. 105-136.

GONEDES, Nicholas J. “Evidence on the Information Content of Accounting Numbers: Accounting-based and Market-based estimates of Systematic Risk”.*Journal of Financial and Quantitative Analysis.*(1973), June, p. 407-443.

GONEDES, Nicholas J. “The Capital Market, The Market for Information, and External Accounting”.*The Journal of Finance.*(1976), vol.31, nº2, p.611-630.

HAMADA, Robert S. “The Effect of the Firm’s Capital Structure on the Systematic Risk of Common Stocks”. *Journal of Finance.* (1972), vol 27, nº2, p.435-458.

HENDERSON, Glenn V. ”Combined Leverage and stock risk”. *Quarterly Journal of Business and Economics.*1991, vol.30, nº1.

HILL, Ned C.; STONE, Bernell K. “Accounting Betas, Systematic Operating Risk, and Financial Leverage: A Risk-Composition Approach to the Determinants of Systematic Risk”. *The Journal of Financial and Quantitative Analysis.* 1980,vol.15, nº3, p.595-637.

HIRSCHEY,Mark; SPENCER, Richard S. “Size Effects in the Market Valuation of Fundamental Factors”. *Financial Analysts Journal.*(1992), vol. 48, nº2, p.91-95.

HUFFMAN, Stephen P.”The Impact of the Degrees of Operating and Financial Leverage on the Systematic Risk of Common Stocks: another look” *Quarterly Journal of Business and Economics.*1989, vol28,nº1,p.83-100.

ISMAIL, Badr E.; KIM Moon K. “On the Association of Cash Flow Variables with Market Risk: Further Evidence” *The Accounting Review.* 1989, vol. 64, nº 1, p. 125-136.

ISMAIL,Badr E.; KIM,Moon K.; KIRK, Florence R. “Accounting Data and the Prediction of Risk in the Extremes”. *Review of Financial Economics.* (1994), vol.4, nº1, p. 55-68.

JORGENSEN, Bjorn N.; KIRSCHENHEITER, Michael T.”Discretionary Risk Disclosures”. *The Accounting Review.*(2003), vol.78, nº2, p. 449-469.

KALLUNKI, Juha-Pekka.”Using accounting variables as instrumental risk measures in event studies:evidence from a thinly traded stock market”. *Journal of Multinational Financial Management.* (1997), vol.7, p. 189-202.

KANNIAINEN, Juho" Rothschild-Stiglitz's definition of increasing risk and the relationship between volatility and risk premium". *Review of Financial Economics*. (2007), nº16, p.363-374.

KAPLAN, Robert S.; ATKINSON, Anthony A. *Advanced Management Accounting.* 2a edición, Prentice Hall, 1989.

KARELS, Gordon V.; SACKLEY, William H."The Relationship Between Market and Accounting Betas for Commercial Banks".*Review of Financial Economics.*(1993), vol2, nº2, p. 59-72.

KARPIK, Philip; BELKAOUI, Ahmed."The Relative Relationship Between Systematic Risk and Value Added Variables". *Journal of International Financial Management and Accounting.*1990, vol.1, nº3, p. 259-275.

KIM, Jeong-Bon; LIPKA, Roland. "Effects of Accounting of the Market Risk in the oil and gas industry".*Journal of Business Finance &Accounting.*(1991), vol.18, nº1, p. 61-84.

KRAFT, Arthur; LEONE, Andrew J.; WASLEY, Charles E. "Regression-Based Tests of the Market Pricing of Accounting Numbers: The Mishkin Test and Ordinary Least Squares". *Journal of Accounting Research.* (2007), vol.45, nº5, p. 1081-1114.

LAMBERT, Richard; LEUZ, Christian; VERRECCHIA, Robert E. "Accounting Information, Disclosure, and the Cost of Capital" *Journal of Accounting Research.*2007,vol. 45, nº2, p. 385-413.

LEV, Baruch "On the Association Between Operating Leverage and Risk". *Journal of Financial and Quantitative Analysis.* (1974), p. 627-641.

LEV, Baruch; KUNITZKY, Sergius. " On the Association Between Smoothing Measures and the Risk of Common Stocks". *Accounting Review.*1974, vol.49, nº2, p. 259-271.

LORD, Richard A."The Impact of Operating and Financial Risk on Equity Risk".*Journal of Economics and Finance.*1996, vol.20, nº3, p. 27-38.

LUI, Daphne; MARKOV, Stanimir; TAMAYO, Ane." What Makes a Stock Risky? Evidence From Sell-Side Analysts'Risk Ratings".*Journal of Accounting Research.*(2007), vol.45, nº3, p. 629-665.

MANDELKER, Gershon N.; RHEE, S.Ghon."The Impact of the Degrees of Operating and Financial Leverage on Systematic Risk of Common Stock".*Journal of Financial and Quantitative Analysis.*1984, vol. 19, nº1, p. 45-57.

MELICHER, Ronald W. "Financial Factors which Influence Beta Variations within an Homogeneous Industry Environment". *The Journal of Financial and Quantitative Analysis.*1974,vol. 9, nº2, p. 231-241.

MENÉNDEZ, Carlota; ORGAZ, Neus; PINYOL, Conxita. "Empresas financieras y no financieras: información contable que explica su riesgo de mercado y evidencia en el mercado de capitales español". *Anàlisis Financiero Internacional.* 2007, nº 128, p. 17-37.

MENÉNDEZ, Carlota; ORGAZ, Neus; PINYOL, Conxita."Indicadores contables para medir el riesgo. Utilidad de la información contable en el mercado español". *Contabilidad y Tributación.* 2008, nº 47, p. 97-118.

MULDORF, Charles W.”The Uselfuness of Current-Cost Measures of Debt in Assessing Systematic Risk: Extending the Provisions of SFAS No.33”.*Journal of Accounting and Public Policy.*1986, vol.5, nº 21-29, p. 21-29.

NACEUR, Samy Ben; GOAIED, Mohamed. “The value relevance of accounting and financial information: panel data evidence”. *Applied Financial Economics.*2004,vol 14, p.1219-1224.

NUNTHURAPAKORN, Thakol; MILLAR, James A.”Changing Prices, Accounting Earnings and Systematic Risk”.*Journal of Business & Accounting.*(1987), vol.14, nº1, p. 1-25.

O’BRIEN, Thomas J. ; VANDERHEIDEN, Paul A. “Empirical Measurement of Operating Leverage for Growing Firms”.*Financial Management.*(1987), sumer, p. 45-53.

O’HANLON, John; STEELE, Anthony. “Estimating the Equity Risk Premium Using Accounting Fundamentals”. *Journal of Business Finance & Accounting.* (2000), vol. 27, nº 9, p. 1051-1083.

PRIOR, Diego. “”El flux de lliure de tresoreria com a instrument de control. Aplicació a l’empresa Catalana”. *Revista Econòmica de Catalunya.*(2000), nº 38, p. 11-24.

PRIOR, Diego. *Generación de tesoreria, eficiencia y competitividad en la empresa catalana.* Barcelona. 2002. Fundació Empresa i Ciència (Centre d’Economia Industrial). ISBN: 84-932761-2-X.

PRIOR, Diego. “Rentabilidad y generación de tesoreria en la empresa industrial catalana.” *Perspectiva Econòmica de Catalunya.* (2003), nº 217, p. 63-69.

RAYBURN, Judy. ”The Association of Operating Cash Flow and Accruals with Security Returns”. *Journal of Accounting Research.*1986, vol.24, supplement, p.112-133.

REEB, David M.; KWOK,Chuck C.; BAEK, H.Young.”Systematic Risk of the Multinational Corporation”.*Journal of International Business Studies.*(1998), vol.29, nº2, p.263-279.

RETIEF, J.le R.; AFFLECK-GRAVES, J.F.; HAMMAN, W.D.” Leverage Risk?”. *The Investment Analysts Journal.* 2002, nº24, p.

RODRÍGUEZ, Francisco; MARAZUELA, Enrique. “Anàlisis de la influencia de las variables contables en el riesgo sistemático de las empresas del nuevo mercado” *XI Congreso de AECA, (Madrid septiembre 2001),* 2001.

ROSENBERG, Barr; MCKIBBEN, Walt “The Prediction of Systematic and Specific Risk in Common Stocks”. *Journal of Financial and Quantitative Analysis.*(1973), p. 317-333.

RYAN, Stephen G.”A survey of Research Relating Accounting Numbers to Systematic Equity Risk, with Implications for Risk Disclosure Policy and Future Research” *Accounting Horizons.*(1997), vol.11, nº2, p. 82-95.

SALMI, Timo; VIRTANEN, Ilkka; YLI-OLLI, Paavo; KALLUNKI, Juha-Pekka “Association between Accounting and Market-Based Variables”. *Advances in Financial Planning and Forescating.*(2000), vol.9, p.97-114.

SHARPE, W.F. ”Capital Asset Prices: A theory of Market Equilibrium under Conditions of Risk”.*Journal of Finance.*(1964), vol.19, p.425-442.

SLOAN, Richard G.”Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings” *The Accounting Review.*1996, vol.71, nº3, p. 289-315.

SWAD, Randy “Discount and Capitalization Rates in Business Valuations”. *The CPA Journal.* (1994), vol.64, nº10, p.40-44.

THOMPSON, Donald J .”Sources of Systematic Risk in Common Stocks”. *The Journal of Business.*(1976), vol.49, nº2, p. 173-188.

WATTS, Ross L.; ZIMMERMAN, Jerold L. *Positive Accounting Theory.* Prentice Hall, 1986.

WOOLDRIDGE, J.M.*Econometric Analysis of Cross Section and Panel Data.*Cambridge: MA:MIT Press, 2002.

ZHANG, Guochang “Accounting information, Capital Investment Decisions, and Equity Valuation: Theory and Empirical Implications”. *Journal of Accounting Research.* (2000), vol.38, nº2, p. 271-295.