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Discounting in agro-industrial complex. A methodological proposal for risk premium

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Abstract

The estimation of the discount rate is decisive for a reliable economic valuation. The discount rate has to be adjusted for the risks related to the company, the sector which the company has its market, and the risks related to the investment project. We present a proposal to incorporate the risk premium to the discount rate. The novelty of the methodology is that difference risk groups according to activity as a factor to adjust the cost of capital to companies. The study applies the methodology to the Agro-Industrial Complex (AIC) in Spain. The AIC is formed by industries that add value to farming production. This sector's economic success demands financial management techniques that assess risk. The conventional method responds neither to the heterogeneity of the economic activities that make up the AIC, nor to differentiating risk by groups. The proposed methodology distinguishes activity groups in accordance with the NACE (National Code of Economic Activities) and uses net profitability variability to distinguish the risk in each group. Our results demonstrate the various levels of risk per group. The results show that among all the groups that form the AIC there are wide differences between levels of risk; thus, the risk neutral groups present risk levels on the order of 150 times lower than the groups extreme risk levels.

Additional key words: discount rate; cash flow discount; capital asset pricing model agro-industry.

Abbreviations used: AIC (Agro Industrial Complex); ANP (Average Net Profits); APT (Arbitrage Pricing Theory); CAPM (Capital Asset Pricing Model); CF (Cash Flow); CFO (Chief Financial Officers); NACE (National Code of Economic Activities); RFR (Risk-Free Rate); ROI (Return of Investment); SABI (Iberian Balances Analyses System).

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Introduction

Corporate management techniques in companies are a key element for success in the market. Financial tools allow companies to keep their products or to expand them in markets, and for firms to make profits. Financial planning helps companies achieve their objectives. It is, therefore, necessary to apply several techniques to forecast and assess future financial variables.

In both the capital budgeting process and the methodology for company's assessment, we can appreciate a robust significant relationship with the discount rate. Both are based on the updated cash flow (CF). The value of an investment project depends on both its expected CF and the discount rate. The most

widely used valuation methodology by companies, recognised by the International Valuation Standards Council, is based on the CF discount (Rojo-Ramírez & García-Pérez de Lema, 2006; Chastenet & Jeannin, 2007; Fernández, 2008). As with investment appraisals, using the CF discount method means having to formulate hypotheses about the parameters on which the current value depends, where the accuracy of these hypotheses is a determining factor for the resulting value (Caballer-Mellado & Moya-Clemente, 1998) as value estimations are very sensitive to the discount rate.

There are theoretical equilibrium and arbitrage models for the estimation of the cost of equity. Distinction between both is not very important; all

these models provide a mathematical relation for a rate of required return (Dragotă *et al.*, 2013).

Thus Fernández (2008) point out by valuating companies, determining the discount rate is one of the important issues. It is carried out by taking into account the risk, the historical volatility and, in practice, quite often the minimum discount rate, which is marked by shareholders (sellers and buyers who are not willing to invest or sell below a certain profitability).

The discount rate to update CF must consider the risk-free rate in the economy, and a risk premium depending on the economic sector in which the target-company operates. The risk premium reflects investors' perceptions, and is reflected in how much risk a potential investor sees in a company's expected CF, and what price we attach to that risk (Damodaran, 2013). The risk premium is added to value companies in order to measure the sector volatility associated with obtaining CF.

Estimation of premium risk is not a simple procedure; its modelling has been at the core of the modern finance theory. Dragotă *et al.* (2013) differentiate three elements in the build-up discount rate, called as "systematic risks": 1) the risk-free rate (in a less complex approach can be considered the rate of return for long-term government bonds), 2) the equity risk premium (that yields, along with the average markets rate of return on large public company stocks) and 3) the size premium. In addition to systematic risks, the discount rate includes unsystematic risks, which fall into two categories: industry risk premium and specific company risk. So the discount rate must be adjusted with a premium risk accord to the macroeconomic or industry conditions, in order to obtain a relevant cost of equity.

Capital Asset Pricing Model (CAPM), formulated by Sharpe (1964), is the one that financial managers use most often for assessing the risk of the cash flow from a project and for arriving at the appropriate discount rate to use in valuing the project (Graham & Harvey, 2012). It considers regression among profits of a given security compared to those on the market, in which the slope of the resulting straight line represents systematic risk. At the same time some research show that the model fails to adequately explain the cross-sectional distribution of returns, and propose alternative, albeit under-theorised models. However researchers have no yet definitive conclusions about any alternative models (Toms, 2014).

The literature on risk measures including not only market numbers, but also accounting numbers, it is not very large. Following arguments from Toms (2012), as a consequence of the small number of studies that have examined the joint and complementary effects of operating and financial gearing, the quantitative impacts of differing categories of fixed costs on a systematic basis

have been neglected. But for this author it is possible to build up discount rate from firms' accounting and cost data. In this paper we herein propose taking expected profits as the explanatory variable by considering their volatility to contemplate a given activity's uncertainty and risk, but using explanatory market value models for companies listed on the Stock Exchange to companies that are not, but whose economic-financial structure may share similar characteristics (*e.g.* sector and/or size, etc.), and in accordance with the above discussion.

Generally, coping with business risks in agro-industrial firms consists primarily in studying product price variations and their yield uncertainty. Eliminating risks is usually neither feasible nor viable, and may also entail fewer profits. Thus, the estimate of the discount rate for companies is an essential tool for appropriate corporate management.

Using the conventional methodology to calculate risk premium from financial profitability, we can only consider the risk associated with each activity class (unsystematic risks), or by aggregating these activities to the premium for the global sector this activity is part of (systematic risks). Thus we propose a new methodology to calculate risk premium using the CAPM theoretical framework, in agro-industrial firms, which considers the systematic and unsystematic risks. So, we define the AIC. The basis of the methodology is to measure the risk of all the activity classes that we can distinguish in a sector of economic activity, by weighting it with the economic sector's risk premium, calculated as the difference between the economic sector's expected profitability rate and the interest-free rate. This can be estimated as the difference between the sector's financial profitability and the risk-free interest rate. So the risk of each economic sector activity class is its contribution to the economic global sector.

The AIC comprises those companies that add value to farming production which is directly or indirectly destined to human consumption. We herein present the from the value chain perspective, which includes basic post-harvest handling and conditioning in order to be sold as fresh products, to production and industrial processing, commercialisation, being made available to consumers, as well as the industry of fertilising and phytosanitary products, and the seed treatment industry. The AIC also includes activities that offer added value to primary products, such as slaughterhouses, sawmills, fruit and vegetable plant manufacturing; food processing; the meat-processing industry with egg products, food and vegetable processing industries, dairy industry, bakery industry, beverages (wine, beer, fruit juices, etc.); the agrochemical industry, and other similar ones. The degree of their interrelation allows the Complex to be considered.

The AIC is formed by companies, as emphasised in the academic literature (Moya-Clemente & Oltra-Mestre, 1993; Caballer-Mellado & Moya-Clemente, 1998; Irusta-Llano, 2009; Chen *et al.*, 2014), present a series of outstanding characteristics as a result of adapting to today's economic reality in Spain and elsewhere. These characteristics include: a) adapting to extending the economic environment and the sector's internationalisation; b) adapting to changes in consumption and commercial structures; c) influx of foreign-owned capital and risk capital. As a result, the AIC has built some business models that have been adapted to consumer demands and to customers in general.

The European food industry, including the AIC in Spain, has witnessed significant and rapid changes towards the formation of a more concentrated internationalised structure. Some countries and food sectors have undergone this trend to a greater extent than others, but no country or industry sector has remained unaffected. The new stage of the world economy, which stems from the effects of the global economic crisis that began in 2008, has brought new implications for the food industry, although it is impossible to predict its mid-long-term impact. Yet no-one can deny a selection process where only the most efficient companies will remain and will increase. During periods of change, broad discussion, research, academic analysis and synthesis are necessary for the successful renewal of different enterprise types (Baourakis *et al.*, 2002; Bahamonde, 2009).

The AIC, in Spain, is made up of mainly the food and drink companies, which represent more than 95% of the companies in the AIC. The AIC produces 20% of the industry's sales, and the food and drinks industry alone represents 18% of Gross Added Value. In employment terms, the AIC sector embraces 20% of workers in the industrial sector, or 3% of national employment. In it unemployment rates are lower than in other industrial sectors, and the AIC is the main livelihood of many rural areas. The business dimension is wide, and ranges from small farmer or ranchers who sell directly to consumers, to large listed companies with major multinational partners like Campofrío, Osborne, Nutrexpá, Deoleo, Navidul or Revilla. The legal form of the AIC companies includes all types of businesses, and individual entrepreneurs like small farmers, cooperatives, agricultural processing companies or corporations.

Financial management and planning techniques are needed in the AIC companies, as they are in any other sector of the economy, and decision making about valuing assets, analysing investment projects or analysing company costs are a determining aspect to help

companies survive and to be successful. In order to meet this objective, investors require a risk-taking measure. A profound study into risk premium should investigate the elements that induce the changes it undergoes, as and when they appear, along with their time dimension. Of all the factors that affect risk premium, there are those related to the economic activity sector and those that correspond to a company's particular situation in the market. Measuring risk will reflect the complexity of the activities (processes, technology, replenishment, commercialisation), which condition not only the economic results that this can generate, but also the interrelations between activities and the economic environment which, in turn, can influence results. So, it is expected that the equity risk premiums to vary with the business cycle and to be highest in the recession periods and lowest during the recovering ones.

In this paper we propose a methodological to calculate the Risk Premium, by a variability analysis of each activity's economic results. The use of this variable is justified because it incorporates uncertainty into the generation of the company's CF. We apply this methodology to Spanish AIC. Using the proposed methodology, we measure the risk of each activity class and weighted this with the AIC's risk in the economy as a whole. The result is the total risk premium for each activity class, and the premium that best matches the reality of each activity class in the sector of economic activity is obtained. The advantages of such activity class disaggregation include access to sources of finance at a lower cost compared to using a global risk premium for the sector, which supports the risk of other activities. The advantage of the methodology based on the average net profit is that it is not dependent on the price volatility but on the characteristics of companies that include each activity.

Material and methods

Background of the risk premium

For the valuation of companies and/or investment it is required to know the financial cost of the resources of the company. The Weighted Average Cost of Capital (WACC) is widely used in academic literature. Fernández (2008) takes into account the different CF that can be generated by companies. He groups CF according to its origin in relation to their valuation and suggests a discount rate for each group. When CF is used, applying the WACC is recommended. According to Damodaran (2010), "the cost of capital is the weighted average of the costs of the different components of financing used by a firm to fund its investments:

$$k = \frac{E \cdot k_e + D \cdot k_d \cdot (1-t)}{E+D} \quad [1]$$

where k : weighted average cost of capital (WACC); k_d : cost of others' resources (borrowing); t : tax effect; E : own funds; D : borrowing. The cost of own resources (k_e) or the profitability demanded by owners is defined as the sum of the risk-free rate (r_f), plus a risk premium (π):

$$k_e = r_f + \pi \quad [2]$$

and can be calculated for the companies that are listed on the Stock Exchange using the CAPM, or by calculating the sector's financial profitability (Caballer-Mellado, 1998).

CAPM was formulated by Sharpe (1964), and it considers regression among profits of a given security compared to those on the market, in which the slope of the resulting straight line, known as " β ", represents systematic risk, which is the only measure of risk needed to explain the performance expected of a security:

$$\pi = E[r_m - r_f] \beta_i \quad [3]$$

where β_i : systematic risk

$$\beta_i = \frac{cov(R_i, R_m)}{\sigma_m^2} \quad [4]$$

σ_m^2 is variance in the market's profitability; $E[r_m - r_f]$ is the risk premium of the asset in this market. This risk premium of the asset in the market is the difference between the profitability rate expected on the market, r_m , and the interest rate with no risk r_f . Work tends to be done with historical data from several years.

In accordance with the hypotheses upon which CAPM is based, and with most financing models, expectations are similar for all investors (Fernández & Carabias, 2007). It is assumed that all investors have the same profitability and risk expectations for all assets: the marginal investor, who has a very varied portfolio, invests in a given asset. Risk is measured in this way; that is, as the risk of an investment that is added to a varied portfolio whose risk must be measured and compensated. It is true that not all investors share the same expectations, not all investors have portfolios with identical shares, and not all investors have portfolios that comprise all market shares. From this risk viewpoint, separating the risk related to any investment into two components is more than justified: the market risk measured with beta (β), which if multiplied by the risk premium of equity securities, results in a total risk premium for a risk asset (Damodaran, 2012).

CAPM has been strongly criticized (Gebhardt *et al.*, 2001; García-Padrón & García-Boza, 2005; Fernández & Carabias, 2007; Lado-Sestayo, 2013) for the initial hypothesis posed because it is based on perfect competition markets given its poor applicability and practical validity as it is difficult to attract the individual risk of a security, or because it is based on past data used to determine the cost of future capital. Subsequent research conducted to overcome some of CAPM's conceptual limitations has introduced other explanatory variables: the PER ratio (Price-to-Earnings Ratio), equity gearing, the accounting/market value of shares ratio, etc.

An alternative model to CAPM for valuing financial assets is the Arbitrage Pricing Theory (APT). This theory was developed according to the «arbitrage» concept introduced by Miller & Modigliani (1961), whose argument defends that a company's value does not depend on its financial structure, nor on its dividends policy, but on expected profits, and for each risk class.

In order to apply explanatory market value models that can be obtained in companies listed on the Stock Exchange to companies that are not, but whose economic-financial structure may share similar characteristics (*e.g.* sector and/or size, etc.), and in accordance with the above discussion, we herein propose taking expected profits as the explanatory variable by considering their volatility to contemplate a given activity's uncertainty and risk. Thus we propose calculating risk premium similarly to β , which measures the risk of all the activity classes that we distinguish in the AIC by weighting it with the AIC's risk premium, calculated as the difference between the AIC's expected profitability rate and the interest-free rate. This can be estimated as the difference between the sector's financial profitability and the risk-free interest rate. So the risk of each AIC activity class is its contribution to the AIC's overall risk.

Using the conventional methodology to calculate risk premium from financial profitability, we can only consider the risk associated with each activity class (identified with the corresponding NACE heading), or by aggregating these activities to the premium for the global sector. Using the proposed methodology, the risk of each activity class is measured with β , and is weighted with the AIC's risk in the economy as a whole. The result is the total risk premium for each activity class, and the premium that best matches the reality of each activity class in the AIC is obtained. The advantages of such activity class disaggregation include access to sources of finance at a lower cost compared to using a global risk premium for the sector, which supports the risk of other activities.

Calculation methodologies for the risk premium

Some activities are subject to higher price variability in both inputs and final product prices. Volatility is a directionless measure of the extent of the variability of a price or quantity (Gilbert & Morgan, 2010). Such volatility may place it in an uncertainty context, with some risk in generating CF. So many authors use it as an indicator of either the risk of obtaining CF or the volatility of market prices (Jin & Kim, 2012).

According to the academic literature on volatility, we propose a methodology based on estimating and comparing the sales price volatility and prices received by the related economic activity sector. Due to the nature of many AIC companies, it is not possible to identify a single reference price. Some companies produce more than one product, and with different volumes and selling prices. So it is not easy for companies to estimate and decide on one reference price to estimate the activity risk.

According to the arguments put forward by Miller & Modigliani (1961), who defend that a company's value depends on the expected profits for each risk type, variability of CF can be studied in an uncertainty context over net profits. Damodaran (2001) states that the sector's mean beta is employed for assets in business units or for companies not listed on the Stock Exchange. However, the sector's mean could mask peculiar situations of risks of certain activities.

Therefore, it would be very interesting to compare the relation between the variability of the net profits of each activity class and the AIC, and also the relation between the variability of the Average Net Profits (ANP) of an activity class and that of the ANP (covariance between both) with the mean volatility of the AIC's ANP. The relation between them both measures the sensitivity of the net profits of each activity class when variations appear in the sector as a whole. The most sensitive activity classes to variations in the sector are those with a higher risk: so their β is higher than 1, which means that these activities are more dispersed in net profits; and if their β is lower than 1, they are activities that have no risk other than that of the sector.

If the result for β_i is around 1, then the activity under study has no risk higher than that of the AIC. If $\beta_i > 1$, or $\beta_i < 1$, then the aftermath is that the activity under study is more risky or less risky than that of AIC. Hence the risk can be estimated with π_i . The ANP in the activity class [i] within a specific timeframe (2003-2013) is:

- Average net profits of N companies in activity class [i] in year [j]:

$$[ANP_j^{iCNAE}] = \frac{1}{N} \sum_{n=1}^N ANP_n \quad [5]$$

- Annual change in average net profits (acANP) in activity class [i] in year [j]:

$$[acANP_j^{iCNAE}] = \frac{[ANP_j^{iNACE}] - [ANP_{j-1}^{iNACE}]}{ANP_{j-1}^{iCNEA}} \quad [6]$$

- Standard deviation of the change in the average net profits within a specific timeframe:

$$\sigma_{allCNAE} = \sqrt{\frac{\sum_{j=2003}^{2013} [acANP_j^{allNACE} - \overline{acANP^{allNACE}}]^2}{10}} \quad [7]$$

- Covariance between annual change in the average net profits in activity class [i] and annual change in the average net profits in the AIC within a specific timeframe:

$$Cov(acANP^{iNACE}, acANP^{allNACE}) = \frac{\sum_{j=2003}^{2013} (acANP_j^{iNACE} - \overline{acANP^{iNACE}})(acANP_j^{allNACE} - \overline{acANP^{allNACE}})}{10} \quad [8]$$

- β in activity class [i]:

$$\beta_i = \frac{Cov(acANP^{iNACE}, acANP^{allNACE})}{\sigma_{allNACE}} \quad [9]$$

The market's risk premium, calculated as the difference between the market's expected profitability rate and the risk-free interest rate, can be estimated as the difference between the sector's financial profitability and the risk-free rate.

As the academic literature shows, ROI (Return of Investment) is a comprehensive measure of real firm performance that relates income to capital employed. It accounts for all costs including strategic and managerial resources, research and development, marketing, and overhead not allocated to firm business segment markets (Bjornson & Sykuta, 2002; Graham & Harvey, 2012). For this reason, a mean of the sector's financial profitability has been considered for several years, as has the mean that relates to the last accounting years that correspond to the risk-free rate. The academic literature indicates that a consensus has been reached (Rojo-Ramírez & García-Pérez de Lema, 2006; Guaita-Pradas *et al.*, 2016) about identifying the risk-free rate with 10-year Premium Bonds. We used data from the last 10 years:

$$E[r_m - r_f] = \frac{\sum_{j=1}^{10} (ROI_j - RFR_j)}{10} \quad [10]$$

where RFR is the risk-free rate.

- AIC's expected profitability rate: ROI

Thus the risk assumed by the investor in the AIC is quantified when the sector's financial profitability is above the base risk, which means a 10-year government borrowing financial asset.

The risk premium is:

$$\pi_i = E[r_m - r_f] \beta_i \quad [11]$$

$$\pi_i = \left[\frac{\sum_{j=2003}^{2013} (\text{ROI}_j - \text{RFR}_j)}{10} \right] \frac{\text{Cov}(acANP^{iCNEA}, acANP^{allCNAE})}{\sigma_{allCNAE}} \quad [12]$$

If we follow the conventional methodology to calculate the risk premium from financial profitability, we can consider only the risk associated with each subsector, identified by the corresponding NACE heading, or by aggregating the premium for the global sector from these. Using the expression set out in Equation [12], the overall sector's risk component is introduced into the calculation of the risk premium for the AIC. The risk component is corrected with the β calculated specifically for each activity class, and the risk premium for each activity class is obtained and weighted with the Agro-food sector's global risk.

Results and discussion

To estimate the risk premium of AIC we need differentiated activities in the complex. The AIC is made up of all the companies in the industrial sector whose activity adds value to farming production, including companies that undertake post-harvest handling activities, the food and drinks industry, the tobacco industry, and those industries destined to improve land productivity: producing fertilisers or pesticides, and treating and preparing seeds. This Spanish industrial complex is especially important for its historic farming tradition, and also for its outstanding value in Spain's economy. According to data provided by the Spanish National Statistics Institute (INE, 2015), there were 23,784 industrial food companies and 4,978 drinks companies in Spain in 2013, which represented almost 14% of the Spanish industrial fabric. Production of food industries, and of drinks and tobacco industries, made 136,575 million euros and created almost 500,000 job posts in 2013, which represented around 21% of all Spanish industrial activity.

The AIC includes numerous activities and companies which, despite presenting relevant interrelations, may face pressures and market forces of very different kinds depending on the technology status, replenishment problems in markets or commercialisation policies

tied to agreements or treaties, etc. This implies major disagreements about measuring the risk in the Complex. With a view to proposing risk values in accordance with each activity, the activities in the AIC have been disaggregated from it according to NACE in Spain.

NACE's classification of companies has been devised according to the conditions set out in EC Regulation 1893/2006 (EC, 2006) on the Statistical Nomenclature of Economic Activities of the European Community. NACE group's activities into divisions and subdivides divisions into groups.

Of all the NACE divisions, the following were selected for the AIC: the Food Industry divisions (division 10) and the Production of Drinks divisions (division 11) with all their groups. From division 01 (Agriculture, Livestock and Hunting), groups 01.63 and 01.64 were chosen given their relation with preparing land for harvests and seeds. From division 20 (the Chemical Industry), groups 20.15 and 20.20 were selected as they are related with the production of fertilisers and pesticides. Finally, the complete division 12.00 (Tobacco Industries) was taken as it has no more groups. According to this criterion, information about companies was taken from the SABI (Iberian Balances Analyses System) database, which provides information on companies' financial status and allow, among other actions, companies to be grouped according to NACE activity codes. Table 1 lists the NACE's groups included in the AIC.

The sample of companies' financial status used to make risk premium estimations was used from 2003 to 2013. The companies included in the database and their financial characteristics are provided in Table 2. We calculate annual ROI over the 10-year interval for companies included in the database.

Although there were 15,340 companies in 2013, a similar number to those in 2004 (15,121), the number in the Complex has vastly varied in the last 10 years from almost a maximum of 17,000 in 2011 to a minimum of 14,841 in 2007. Profits, like the volume of own funds invested in the Complex, have gradually increased since 2004. However, the profit made in 2011 is somewhat strange if compared with the annual volume of profits indicated by SABI for all the other years of our sample, as is their trend in variation. As a result of imbalance in profits, the financial profitability rate for 2011 differed from the usual values recorded in the sector, and was around 6%.

Regarding the structure of the sample, the companies included in groups 1.63 and 1.64 represent only 0.84% of the whole AIC. The most relevant part of the AIC is made up of these divisions: 10 (Food Industry) and 11 (Production of Drinks). Only division 10 is split into 28 groups that represent 85.34% of the AIC. In turn, groups are represented differently in each division.

Table 1. NACE's groups in AIC

NACE	Description group
0164	Treating seeds for reproduction
1011	Processes and conserves meat
1012	Processes and conserves fowl
1013	Producing meat and fowl products
1021	Processing of fish, crustaceans and molluscs
1022	Producing tinned fish
1031	Processing and preserving of potatoes
1032	Prepares fruit and vegetable juices
1039	Other processing and conservation of fruit and vegetables
1042	Produces margarines and edible fats
1043	Manufacture of olive oil
1044	Produces other fats and oils
1052	Manufacture ice cream
1053	Cheesemaking
1054	Preparing milk and dairy products
1061	Produces milling products
1062	Manufacture of starches and starch products
1073	Manufactures pasta products, couscous and similar products
1081	Manufacture of sugar
1082	Manufacture of cocoa, chocolate and confectionery products
1083	Manufacture of coffee and tea
1084	Manufacture of spices, sauces and seasonings
1085	Manufacture of prepared foods
1086	Manufacture of homogenised food preparations and dietetic food
1089	Manufacture of other food products
1091	Manufacture of feeding farm animals
1092	Manufacture of feeding pets
1101	Distils, rectifies and mixes alcoholic drinks
1102	Wine-making
1103	Manufactures cider and other fermented drinks made from fruit
1104	Prepares other non-distilled fermentation-based drinks
1105	Brewing
1106	Produces malt
1107	Manufacture of soft drinks; production of mineral waters and other bottled waters
1200	Industry snuff

Table 2. The AIC's financial characteristics

Year	Number of companies	Net profit (millions of €)	Own funds (millions of €)	Financial profitability
2013	15,340	2.159.87	44.301,92	4.88%
2012	17,005	3.044.05	43.685,85	6.97%
2011	16,925	9,226.37	43,175.68	21.37%
2010	16,787	2,582.23	38,861.91	6.64%
2009	16,843	2,777.47	38,402.04	7.23%
2008	16,232	2,190.37	36,099.97	6.07%
2007	14,841	1,948.62	33,674.23	5.79%
2006	16,109	1,670.30	32,701.27	5.11%
2005	15,587	1,772.90	32,015.70	5.54%
2004	15,121	1,762.80	30,635.15	5.75%

Source: The authors based on the data provided by the SABI (Iberian Balances Analyses System) database.

In division 10, the most important groups are 1071 (Bread Making; 30.60%) and producing meat products or fowl (14.33%). The smallest groups are formed by companies that produce starch (0.05%) or margarines and edible fats (0.05%).

Division 11 (Production of Drinks) contains 11.50% of the AIC. The most representative group in this division is the wine-making group with 62.24% of its companies, while the smallest group produces malt.

The tobacco industry (division 12) is formed by 19 companies. Chemical industries that produce fertilisers and pesticides in the AIC correspond to division 20. This division has two groups, group 2015 (production of fertilisers) with over 75% of companies, while all the rest correspond to group 2020 (production of pesticides).

To estimate the risk premium of AIC companies, we calculated and analysed the trend shown by each factor involved in this estimation:

A) With the AIC's ANP data grouped according to NACE divisions and groups, the annual variation rate is calculated for the 2003-2013 study period. Figure 1 shows the variation rate for the 42 studied groups.

i. We can see how the groups follow the same variation trend in their results for the annual growth rate of the ANP, but significant differences among them can be observed in the shorter time intervals or sporadically for some years. These results are also noted when separately studying divisions. Figure 2 depicts the annual growth rate of division 10's ANP (the food industry), where groups 1013, 1022, 1031, 1042, 1043, 1044, and 1053 display a slightly different trend. When these groups are removed, Figure 3 shows how the growth rate of the ANP is more in line with the represented groups.

ii. The results of the companies in Division 11 (Production of Drinks, Fig. 4) varied, which we can group as two similar trends: the group that includes activity classes 1101, 1102 and 1103; all the others.

iii. When calculating the risk premium, the differences in the growth rate of the ANP are expected to result in differences in the perception of the risk and in the risk premium estimations.

B) The next step centres on calculating the covariance between the interannual variation rate of an activity class and the Agro-Food Complex as a whole. A poor correlation is observed between the variability of each activity class and the Agro-Food Complex as a whole. After calculating each activity group's β_i , the values vastly varied.

i. Some activity groups obtain a value that comes very close to the unit, as it is shown in Table 3. This suggests that the variability in these activity groups' results is similar to those of the Agro-Food Complex as a whole; e.g., 1022, 1039, 1054, 1102, 0164.

ii. The results of only a few activity groups do not match the Complex's variability results at all, with values close to 0: 1073, 1103 (Table 3). These groups manufacture pasta products, and cider and fermented drinks; they represent a small number of companies in their corresponding division: 1073 and 1103 represent 0.60% and 4.91% of all the companies, respectively.

iii. The vast majority of sectors have a β above the unit and, therefore, show a higher systematic risk than the sector as a whole, which extends its movements. Table 3 provides details of some groups with greater variability.

C) Fernández *et al.* (2011) use a risk-free rate (RFR), and associates it with the interest rate of Spanish Premium Bonds over a 10-year time horizon (2004-2013). Table 4 indicates the RFR that has been used and corresponds to 10-year Premium Bonds in the Spanish loans market.

i. The sector's historical profitability was analysed with the cost of own resources. The calculation methodology employed is that of historical financial profitability's, and the group of companies obtained from the SABI database is taken as a reference. The sector's mean profitability is calculated for each study year (2004-2013). The estimated calculations are shown in Table 2.

D) The Agro-Food Complex's risk premium is estimated as the differences between the sector's ROI and the RFR. Calculating the average value for the 10-year historical series (2004-2013) provides the following as the sector's risk premium:

$$E [r_m - r_f] = 1.67\%$$

E) Each activity group's risk premium is obtained with the sector's risk premium weighting and with the β calculated according to the activity group. The calculated premium values range from very small values close to zero for groups 1103, 1073, and 1084 (0.11, 0.16 and 0.31, respectively), to higher values over 20% for groups 1101, 1032, 1061, 1044 and 1106. Figure 5 represents the risk premium of all the Agro-Food Complex groups. As expected, most groups present an additional risk to the sector as a whole; that is, they have a moderate, high or extreme risk premium.

i. The 6% risk premium encompasses 25% of the observed values range, and the 12% one encompasses roughly 50%. According to the academic literature, specifically Damodaran (2009), several levels of risk were defined: neutral risk: premium values up to 0.5%, considered insignificant; low risk: values between 0.5-1.67%; moderate risk: values >1.67% to 4.75; high risk: values > 4.75% to 8%; extreme risk: >8%.

ii. Table 5 shows the NACE groups which have a low or moderate risk in the agro-food sector because they are all in division 10 (Food Industry) and division 11 (Production of Drinks).

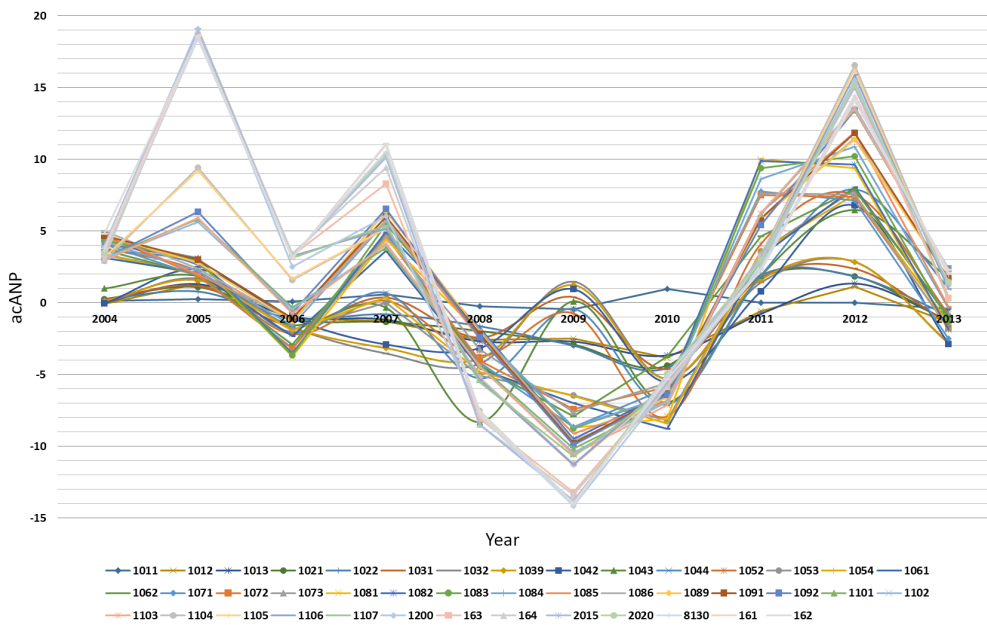


Figure 1. The annual change in average net profits (acANP) of all the activity groups included in the agro industrial complex (AIC)

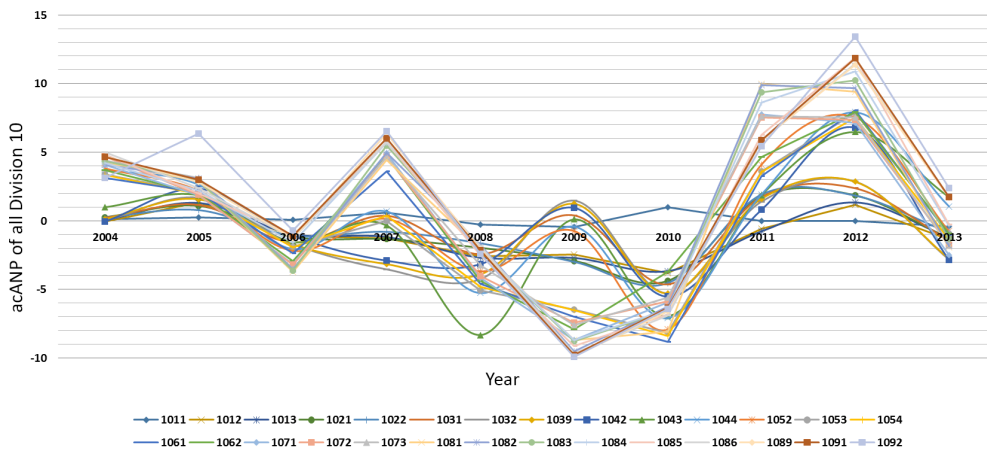


Figure 2. The annual change in average net profits (acANP) of all activity classes in Division 10

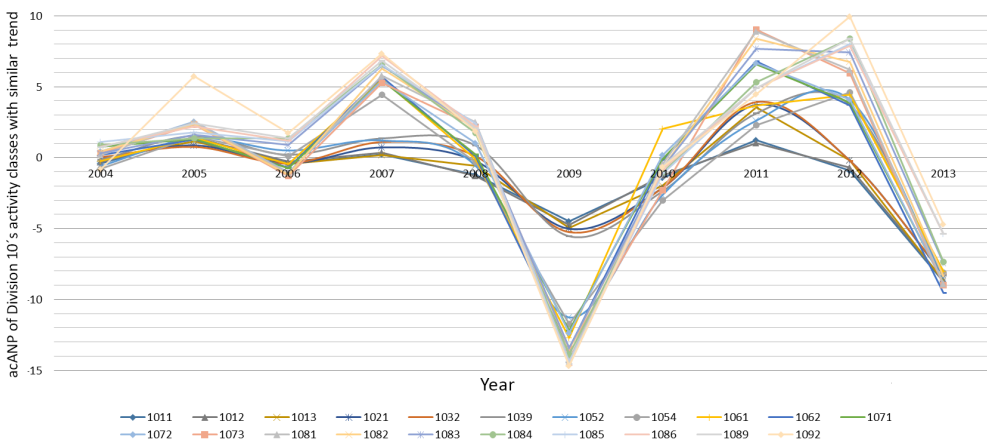


Figure 3. The annual change in average net profits (acANP) of division 10's activity classes that follow the same trend

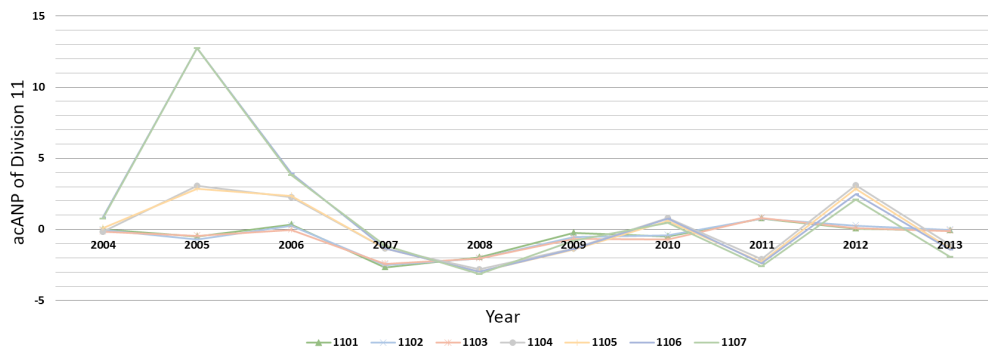


Figure 4. The annual change in average net profits (acANP) of the activity classes in Division 11

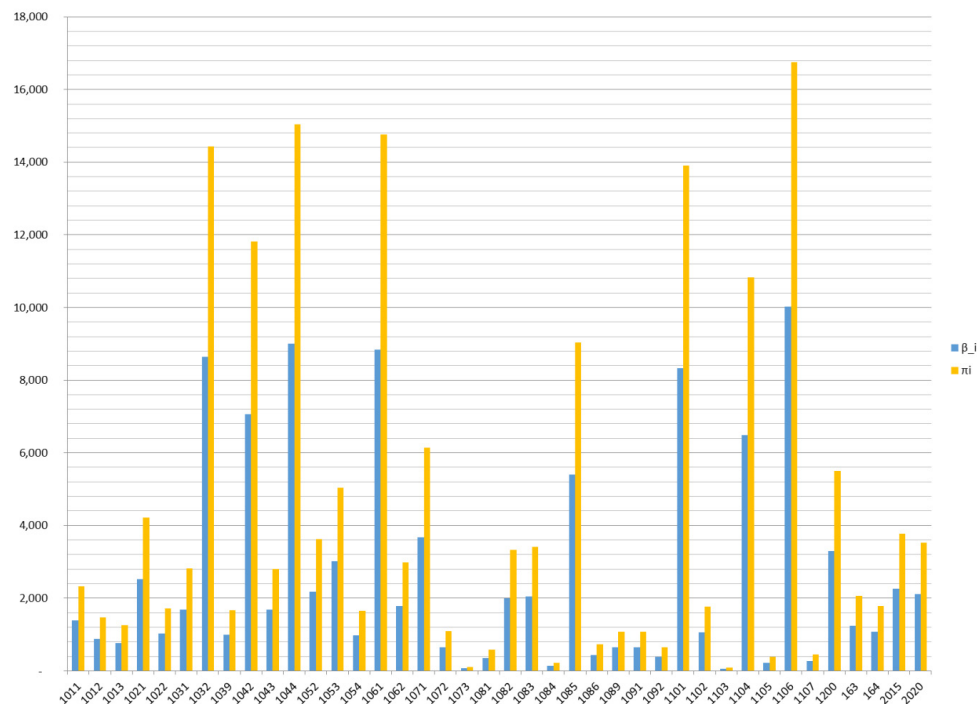


Figure 5. Risk premium values per NACE group

iii. Table 5 provides also details of the groups that show a high and extreme risk. Generally speaking, industrial prices are closely linked to the prices of consumables, which in recent years have generally presented considerable volatility. The companies that produce fertilisers and pesticides present a high risk. Manufacturing these products requires the replenishment of raw materials whose market listings fluctuate as they are affected by export policies of the countries that produce these raw materials, like China which produces urea, and also by the way the demand of large consumer countries like the USA or India performs. Hence the internal prices of these products follow international pricing performance, it is not in the same proportion, but they lead to a wider variability in the results, which creates more uncertainty when estimating CF. Consequently, the risk premium rises.

iv. The sectors that include by-products like dishes

and pre-cooked food, production of malt, or mixing alcoholic drinks, which are flexible products with very high demand, display much higher volatilities in prices, CF, and consequently have a higher risk premium. Conversely we find less flexible sectors, such as meat production (1011) and meat products (1012, 1013), milk (1054), tinned fish (1022), wine-making (1102) or oil (1043), which generally perform better in turnover and job terms in low economic cycles. Their price volatility is lower, as is variability of CF, while the risk premiums of these sectors tend to be moderate (see Table 5).

v. Sectors such as bread making encompass many companies, most of which are small in size and have much higher employability levels than other sectors, but also present lower productivity. According to the data obtained from the sector (Muñoz & Sosvilla, 2013), whereas their sales represent 7.4% of all sales in the food and drinks industry, the percentage of the

Table 3. The β_i results per NACE group. Groups with a low systematic risk (close to 1, close to 0)

NACE	Description	β_i
	Groups with a low systematic risk (close to 1)	
1054	Preparing milk and dairy products	0.98
1039	Other processing and conservation of fruit and vegetables	0.99
1022	Producing tinned fish	1.02
1102	Wine-making	1.05
164	Treating seeds for reproduction	1.07
Groups with a neutral risk (close to 0)		
1103	Manufactures cider and other fermented drinks made from fruit	0.05
1073	Manufactures pasta products, couscous and similar products	0.07
Groups with a high systematic risk		
1085	Manufacture of prepared meals and dishes	5.41
1104	Prepares other non-distilled fermentation-based drinks	6.48
1042	Produces margarines and edible fats	7.07
1101	Distils, rectifies and mixes alcoholic drinks	8.33
1032	Prepares fruit and vegetable juices	8.64
1061	Produces milling products	8.84
1044	Produces other fats and oils	9.00
1106	Produces malt	10.03

sector's employability is 21.6%. According to SABI, the companies in this sector represent 22.3% of the firms that make up the study sample. The small size of the companies in this group makes their competitiveness difficult, which means they are very vulnerable in low economic cycles, which makes the variability of CF wider.

Damodaran (2009) examined why different approaches yield distinct values for the equity risk premium, and how to choose the "right" number to be used. He collected the results of various research works conducted on capital risk premium and the premium values that they propose. This author classifies them as two groups: research works that make estimations with the premium from historical premium values; research works that aim to estimate an equity risk premium through surveys done with investors, managers, and even academics. Some of the outstanding results found by Damodaran (2009) include those of Mehra & Prescott (1985) about the historical risk premium used in the USA. According to these authors, the premium employed by investors for several decades in the 20th century was around 6%. These authors also considered that this premium value would present improbable aversion to the investors' risk because the historical risk premium came closer to 4% than to 6%, according to the statistical analyses done with real market values. Moreover, the lower risk premium would still be too high if we assumed reasonable risk aversion coefficients. Graham & Harvey (2012) conducted annual surveys of Chief Financial Officers (CFOs) or companies for the

last decade to estimate what these CFOs think are a reasonable equity risk premium (for the next 10 years over the 10-year bond rate). In the 2009 survey, they reported an average equity risk premium of 4.74% across survey respondents and a median premium of 4.3%, up from 3.8% and 4.2% from the previous year. They also reported significant dispersion with the expected return on the market that ranged from 1.27% to 12.4% at the tenth percentile at each end of the spectrum.

Welch (2000) surveyed 226 financial economists as to the magnitude of the equity risk premium and reported interesting results. On average, economists forecast an average annual risk premium (arithmetic) of about 7% for a 10-year time horizon and 6-7% for 1 to 5-year time horizons. Like the other survey

Table 4. Risk-free rate (RFR), 10-year premium bonds (2004-2012)

Year	RFR (%)
2004	4.0230
2005	3.4390
2006	3.7820
2007	4.2440
2008	4.4740
2009	3.9910
2010	4.5130
2011	5.5450
2012	5.7160
2013	4.7610

Table 5. Risk premium

Level of risk	NACE	Risk premium values
Acceptable values		
Neutral	1103	0.08
	1073	0.11
	1084	0.22
	1105	0.38
	1107	0.45
Low	1081	0.58
	1092	0.65
	1086	0.73
	1091	1.07
	1089	1.07
	1072	1.08
	1013	1.76
	1012	1.46
	1054	1.64
	1039	1.66
Moderate	1022	1.71
	1102	1.76
	0164	1.79
	0163	2.07
	1011	2.32
	1043	2.80
	1031	2.81
	1062	2.99
	1082	3.32
	1083	3.40
	2020	3.53
	1052	3.63
2015	3.77	
1021	4.21	
Critical values		
High	1053	5.03
	1200	5.50
	1071	6.15
Extreme	1085	9.03
	1104	10.82
	1042	11.81
	1101	13.91
	1032	14.43
	1061	14.76
	1044	15.03
1106	16.75	

estimates, a wide range of estimates was found, with premiums ranging from 2% at the pessimistic end to 13% at the optimistic end. Interestingly, the survey also indicated that economists believed that their estimates were higher than the consensus believed and tried to adjust premiums downwardly to reflect that view. Fernández (2009) examined widely used textbooks in corporate finance and valuation, and noted that equity risk premiums varied widely across books and that the moving average premium had declined from 8.4% in 1990 to 5.7% in 2008.

Damodaran (2009) suggested three reasons why the risk premiums being estimated to be used in investment appraisals and valuations can differ from more or less real values: 1) the historical series from which they are calculated: the longer it is, the more data there are, and the smaller the error shown, and the premium can be calculated with data from periods whose economic reality has very little to do with the projection period; 2) taking values that are considered the risk-free cost, to which the risk premium is added, since government borrowing values differ according to the period they remain in force (3 months, 6 months, 19 months, or 10 years, etc.); 3) how we calculate mean historical values (with the arithmetic mean or the geometric mean).

Another reason to consider, according to Damodaran (2009), is market maturity when estimates are made. In the EU, the risk premiums calculated as the arithmetic mean of 25-year premiums (1976-2001) are lower (approx. 6%) than in countries with an emerging economy, like India (8.11%), Chile (10.23%) and Brazil (15.73%).

Based on these authors' conclusions, we herein define risk level intervals for the AIC.

The results show that the AIC in Spain is formed by firms with variable risk levels. One quarter of the analysed subsectors present a risk premium below that of the sector (1.67%), while the rest present a higher one. The most numerous group includes the sectors that present a moderate risk as they encompass almost 40% of the studied groups. One of the groups encompasses 20% of the studied sectors and has extremely high risk premiums, the most relevant of which are: 1071, bread making and fresh bread and cake products, given the disparate nature of the companies that comprise it, which range from small family-run bakeries and cake shops to large firms in the bread-making sector, like Europastry SA or Panrico SAU, whose turnover is around 300 million euros; 1061, production of milling products, which is closely related to the bread- and cake-making sector; 1101, distilling, rectifying and mixing alcoholic drinks. Of the companies with a moderate or low premium, the following stand out: 1105 (production of beer) and 1081 (production of sugar). Finally, the

following sectors present moderate risk premiums: meat-processing and related sectors (1011, 1012, 1013), fish-processing (1022), milk-preparation (1054), wine-making (1102) and production of olive oil (1043).

What the methodology proposed herein and its results contribute to company valuations is extremely interesting, especially when we consider the difficulties that applying conventional valuation methods entails since they require forecasts on parameters being made: results, discount rate, growth, etc.

For the purposes of our research, the sample includes different activities in the agro industry. The source of empirical research was activities performed in Spain. The common characteristic shared by the groups is that they all belong to the same industrial sector.

Sample selection was also performed based on the idea that the methodology suggested herein can be applied to different business forms that function more or less in the same economic and business environment, and face almost the same levels of financial risk and market uncertainty. Yet the sector's data, obtained by analysing each subsector (Muñoz & Sosvilla, 2013), indicate the growing importance of the meat industry, which presents over one fifth of the net sales of the food and drinks sector (21.6%). Other sectors also stand out: production of drinks (15.6%), animal feed (10%); fats and oils (9.3%), and milk/dairy products (9.2%). As a set, the production of these five sectors accounted for around 61% of the food and drinks sector in 2012. Given the economic relevance here, it would be useful to conduct larger studies to examine in-depth the weightings of each group's relevance in the AIC, and to calculate the weighted risk premiums.

The values obtained with this methodology, and which are set out herein, offer temporary and local validity as they were calculated from activity data from the Spanish Agro-food industry over the last 10 years. If for the period considered to make calculations we use historical data for future risk premium forecasts, it will be important to contemplate the years of the historical series taken. To guarantee stability of the resulting risk premiums, financial analysts suggest longer historical timeframes (Pratt, 2003). However, market conditions vary over time, sometimes substantially, and the results can become obsolete. Our work considered a 10-year period. If we include more years, and if we assume a 20% annual standard deviation, the standard error in the risk premium will lessen, but taking premium values that have nothing to do with the reality that is to be forecast makes no sense. A possible solution is to use data from year-one-year periods, *e.g.* months (by increasing the amount of data, but not the number of years, and using short series of 5-10 years; the number of years increases and the error lessens). Another solution is weighting

more recent data that are more relevant in the estimation. Future research can investigate longer historical series.

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