DISENTANGLING DISCRIMINATION ON SPANISH BOARDS OF DIRECTORS

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Abstract:

The detection of discrimination on boards of directors is an interesting issue in the study of labour market inequalities, since the presence of a discriminated group would be especially scarce and tracking the possible causes of discrimination would be easier in the last steps of a professional career. Identifying the types of discrimination is a key issue, because they are usually mixed and distorted by the presence of other elements. In order to disentangle the different causes, an extreme case such as Spain, where the percentage of women on boards ranges from 6.6% to 8.6%, becomes especially relevant.

In this study, discrete variable models are used to estimate the proportion of women on the boards of directors of the largest Spanish companies in 2005 and 2008. Some signals of discrimination have been identified. We have found evidence of the dynamics of Becker's model of *taste-based discrimination*, as time and competition can act in favour of women's presence on Spanish boards. There are *clubby* companies in which the homogeneity of the board prevails. This could also indicate traces of taste-based discrimination. When there is additional information about women's individual characteristics (i.e. family-based firms, cooperatives), statistical discrimination is reduced. Finally, we have detected the presence of companies that can systematically underestimate the abilities of women to fill these positions, a situation that tends to disappear when the companies already have female directors. We interpret this contagious factor as a signal of mistake-based discrimination.

Key words: gender discrimination, corporate governance, board of directors, glass ceiling.

Classification JEL: G34, J16, M14, C35.

1. Introduction

The causes of discrimination in the labour markets remain an open issue where no clear evidence has been found to favour one theory above the others. In fact, the characteristics of the different types of discrimination, such as the well-known taste-based discrimination (Becker, 1957) or statistical discrimination (Phelps, 1972), are usually mixed as well as distorted by elements of segregation (vertical and horizontal) in the labour market. In order to disentangle the different causes, an extreme case becomes relevant.

In this sense, the study of women's presence on boards of directors, being the last step in a professional career, is especially interesting as the presence of a discriminated group would be especially scarce and the track for possible causes of discrimination would be easier. Some studies (Adams and Ferreira, 2004; Carter et al., 2003; Farrell and Hersch, 2005) have addressed the differences in gender and race compositions of boards of directors, although none of them have connected these differences to the existing theories of discrimination.

Given the purpose of distinguishing the causes of discrimination, the Spanish case becomes especially interesting. Spanish society has traditionally relegated women to a secondary role in the labour market. This causes some social stereotypes that could lead even nowadays to taste-based discrimination. In fact, evidence shows that, although women's participation in the labour market has increased steadily in Spain from the end of the 1970s until the present day, this same increase is not observed in director positions and, especially, on boards of directors. Thus, although the 2006 data show that women's participation in the Spanish workforce is 42%, their participation in executive occupations is around 32%, while they are between just 6% and 8% on the boards of directors of the largest companies. In fact, this proportion is one of the lowest among developed countries.

This low women's representation on Spanish boards of directors, especially when compared with the proportion of women executives, can be considered as an indicator that, in the Spanish labour market, there must be some kinds of discrimination. In fact, identifying their causes is a key issue, because the type of existing discrimination would provide different conclusions about how to obtain a greater presence of women on the

boards and even about whether it is actually desirable to increase their presence. Therefore, the objective of this paper is to find indicators of the existence of discrimination against women on the boards of directors of the largest Spanish companies, through the analysis of observable firm factors related to their presence on the boards and their possible relationship with the different types of discrimination provided by the literature.

In this paper, we analyse the composition (both in 2005 and 2008) in terms of gender of the boards of directors of the top 1,000 Spanish companies with the highest operating revenues, thus expanding the number and the types of companies in the sample compared with previous studies. The number of available observations, as well as the discrete nature of the variable object of this study, allows us to use discrete outcome models, from which it is possible to estimate the probability that a director position will be held by a woman, according to the characteristics of the company. The results obtained in this paper allow the identification of significant indicators of discrimination.

In this sense, the highest proportions of female directors are found in family-owned firms, cooperatives and, in general, those companies in which the shareholders have great power when hiring directors. This can be considered as an indicator of the existence of the so-called statistical discrimination since, as the company has easier access to individual information about the board candidates, women seem to be less exposed to being judged according to the average characteristics of their group.

Other characteristics, such as the board size or the level of risk of the company, could indicate a taste-based discrimination in certain companies that have a preference for homogeneity on the board, according to which women's presence could be seen as a distorting element in the decision-making process. In fact, homogeneity would be a consequence of the CEO's search for a friendly board in order to avoid risk to his/her position (Adams and Ferreira, 2007).

Additionally, the greater presence of women found in older firms and in more dynamical and competitive sectors may well be a manifestation of the dynamics of the Becker model, which would predict that time and market competition will make discrimination disappear in the long run. In fact, when we monitor the evolution of the companies in the sample, we observe that the higher the presence of women on the

board in 2005, the lower the probability of going bankrupt in the following three years. Besides, the new model estimated for the gender composition of the boards of the remaining companies of the original sample by June 2008 shows that the firm age influence fades away, as would be expected if this effect was a consequence of Becker's discrimination.

Finally, we find that barriers encountered by women in their access to the board of directors are reduced if other females are already on the board. This latter result can be linked to the existence of mistake-based discrimination, according to which women's skills would be systematically underestimated. This highlights the benefits of incorporating women into the boards in order to eliminate stereotypes on women's lack of leadership skills or on their lack of competitive impulse in comparison with men, and thus would contribute to a better evaluation of the curricula of female candidates in the process of hiring directors.

The rest of the paper is organized as follows. In the second section, evidence of the low representation of women on the boards of directors of Spanish companies is studied, comparing it with Spain's surrounding countries, and once this evidence of low-representation has been found, an analysis of its possible causes is carried out. In section three, the sample and methodology of sampling are described. In the fourth section, the independent variables latterly used are presented. The discrete outcome models used to estimate the probability of a director being a woman are presented in the fifth section, while the sixth one presents the results and studies the effects that companies' features have on this probability, analysing the implications that these results have in terms of discrimination. In the seventh section, the sample is updated to 2008 in order to find more evidence of Becker's discrimination and confirm the robustness of the results. Lastly, the eighth section concludes the paper.

2. Analysis and implications of the low representation of women on the boards of directors of Spanish companies

2.1. The infra-representation of women on Spanish boards of directors

In order to justify the low representation of women in the highest executive positions and on boards of directors, numerous studies have found evidence of many difficulties

and obstacles to the professional development or promotion of women. This phenomenon has been named *the glass ceiling*, meaning an impassable wall or barrier made up of procedures, structures, power relations, beliefs or habits that complicate a woman's access to high directive positions (Morrison et al., 1987; Powell and Butterfield, 1994).

According to data from the Spanish *Instituto de la Mujer* (Women's Institute) for the fourth quarter of 2006, women represent 50.57% of the Spanish population, 42.26% of the active population, 40.85% of the employed population and 57.82% of the unemployed population. In terms of their participation in the labour market, the majority of women hold administrative positions (64.69%), while they also have a considerable participation in scientific and intellectual professions (52.9%). The presence of women in executive positions of companies and the public sector is 31.76%, according to data from the *Instituto de la Mujer* (Women's Institute) for the same period, but vary depending on the type of company. Therefore, while the major presence of executive women is found in companies without employees (45.06%), or companies with fewer than 10 employees (27.14%), the lowest proportion corresponds to companies with 10 or more employees (22.3%).

Although the proportion of women in executive positions is rather low (31.76% on average), the percentage of females on boards of directors found in the available consultant reports (around 4%) is even lower, which points out the existence of infra-representation on the boards of directors. An example of the low representation of women on the companies' major decision-making organs has appeared in a series of report (see Table 1).

[Table 1]

In the case of Spain, the scarce presence of women on its boards of directors is clearer when compared with other European countries. Spain has a lower percentage of representation on boards than those countries that occupy the top positions in the international field, and it does not progress at the pace of its closer neighbours.

Thus, according to the CWDI (2002), Spain has 4.6% female representation on boards of directors, only ahead of Japan's 2%. According to Ethical Investment Research Servicies (ECODES, 2004), Nordic countries (Norway, Sweden and Denmark)

appeared as global leaders, and only Italian, Portuguese and Japanese companies have a lower female presence on their boards than Spanish firms.

In the 2004 European Professional Women's Network Monitor, Spain was in the *slow-going* group, with a female representation of just 3%, which is the same figure as Belgium, and only ahead of Italy with 2%. The Heidrick & Struggles corporate-governance study of 2007 on the boards of some 300 of Europe's top listed companies showed that the worst countries regarding gender diversity on boards are (in this order): Portugal, Italy, Spain and Belgium.

Nevertheless, the above-mentioned reports are limited to a descriptive analysis, thus giving up any effort to explain exactly what causes Spanish companies to fail to reach the levels of other developed countries in terms of gender diversity on boards of directors. Additionally, the majority of them are focused on companies listed on the stock market, or in a quite reduced sample of the largest companies.

2.2 Causes of under-representation

Distinct groups of explanations could be behind this low representation. In the first place, there are differences between men and women that lead to different professional profiles between them and that causes women in few cases to fit with the profile[1] searched on the candidates to hold a position on the board of directors. So, in accordance with companies' standard criteria, most women would be excluded from the pool of potential candidates to hold these positions. The second explanation is related to the well-known *taste-based discrimination*. In this sense, if the company considers the admission of women to its board of directors to be harmful to its performance (they may consider that there are non-pecuniary or psychic costs from working with them), the individuals who decide the composition of the board would prefer either pay or forfeit income to hiring women (Becker, 1957). The third explanation is called *statistical discrimination* by Phelps (1972) and it occurs if women are judged according to the average characteristics of their group and not on the basis of their own personal characteristics as an individual. Finally, it is possible that women's ability to hold these

[1] Generally, candidates to become part of the board of directors are demanded to have, among other prerequisites, an elevated previous experience of positions of responsibility in departments such as production and finance, whereas the heads of other areas like human resources or marketing, where there are a greater presence of women, are not considered to the same degree as possible candidates to occupy a director position.

positions is systematically underestimated, or in other words, there could be *mistake-based discrimination* in respect to women's skills (Wolfers, 2006).

With respect to the first group, among the factors that explain that there are fewer "potential" women than men to hold a seat on the board, there are some explanations, such as the existence of some segregation factors, that tend to place men in financial or more technical positions within the production process. Bertrand and Hallock (2001) state that there are also unobservable differences (at least to the econometrician), such as a relative lack of long-term career commitment among women possibly induced by lower wages. Other not directly observable factors are a greater taste for fringe benefits or good working conditions, family responsibilities that, in many cases, unlike men, interrupt the development of the professional activity of the female worker or the anticipation by many women of the glass ceiling that drives them to sacrifice their professional development in favour of their family life.[2]

In this case, the limited presence of women on boards of directors would not be due so much to gender discrimination in the selection process of the board members as to the existence of socio-cultural obstacles in the stages leading up to the professional promotion of women. This is why we call this set of explanations the *reduced pool of women candidates*. Nevertheless, once a woman has reached the group of top executives, it is reasonable to assume that such unobservable differences are minimized and that men and women are likely to be similar and both share a high level of job motivation and high career ambitions, so additional causes must be explored to explain this acute under-representation.

In the case of *taste-based discrimination*, if the only reason for its appearance is the existence of prejudices among those responsible for naming board members, this will imply a clear economic cost for the company since, as it includes spurious hiring criteria, it would be renouncing the selection of those candidates best prepared for the position, independently of their gender. Thus, the Becker theory predicts that the discriminatory practices of those companies that prefer not to work with women than to suffer the subjective costs of including them in their organization would suppose higher

[2] Therefore, according to data from the Instituto de Mujer in its fourth quarter of 2006, of the total number of inactive persons who do not search for employment due to family reasons, 97.04% are women, with women also requesting maternity/paternity leave in 98.35% of cases.

costs, in terms of loss of efficiency and lower benefits, than those of companies that do not discriminate. This way in a perfectly competitive market the companies that discriminate would not survive in the long-term; therefore, time and competition among companies would finish by solving the problem of the discrimination. In spite of the numerous critiques to this theory and that, 50 years after the publication of his book, time does not seem to have solved the problem of discrimination, Heckman (1998) argues that this prediction may not be false. In fact, according to this author, discrimination will only disappear in the presence of competence[3] and even then it may take decades to fade out of the labour market.

Another type of behaviour that is occasionally found on boards of directors (Pearce and Zahra, 1992) and that could be generating this type of discrimination is the existence of a bias towards the homogeneity of the group, considering heterogeneity in the heart of boards as a potential source of conflict and of difficulties in decision-making processes. In this last case, there could be agency costs derived from the CEO's dominance over the main decision-making organs in companies (Hermalin and Weisbach, 1998).

According to *statistic discrimination* (Phelps, 1972), the company who seeks to maximize the expected profit will discriminate against women if it believes them to be less qualified on average than men and if the cost of gaining information about the individual applicants is excessive. Although this can have some economic rationality, it can also include some inefficiencies, as the a priori preference for male over female candidates might not only stem from the employer's previous statistical experience with the two groups, but also from the prevailing sociological beliefs about the abilities of women and from prejudices toward them in the society.

Finally, *mistake-based discrimination* is surely inefficient since the biased knowledge has its roots in stereotyped profiles of men and women that have no real and objective basis. Therefore, if the low representation of women on the board were caused by this type of discrimination, the companies would be inefficient in their resource allocation, which has a clear cost for them. In this kind of discrimination, we can also find other focuses like *implicit discrimination* (Bertrand et al., 2005), according to which the

[3]Specifically, Heckman states that only if the supply of entrepreneurship is perfectly elastic in the long-run at a zero price, so entrepreneurs have no income to spend to indulgence their tastes, or if there are enough non-prejudiced companies to hire all women, will discrimination disappear from Becker's model.

attitudes or implicit or unconscious feelings of the evaluators of different candidates can include a discriminatory bias against women although their explicit feelings or attitudes could be just the opposite of discrimination.

The reduced pool of female candidates could imply that the number of women prepared to hold a position on the boards of director would not be equal to that of men. Nevertheless, considering that the population of women executives (31.7% as reported by the Instituto de la Mujer) is a good proxy of directors' eligibility, a proportion higher than the actual 6.6% should be expected for women's presence on boards. Therefore, the important gap found between these figures is pointing out the possible presence of some kind of discrimination.

In fact, if there was taste-based discrimination in the sense of Becker (1957), one could expect that, as long as it would imply a less-efficient performance, the effect of competence and the passing of time would reduce it. In this sense, the percentage of women on boards should be higher among older companies, where inefficient companies have disappeared, than among younger ones, where not enough time has passed to remove them from the market. Additionally, this effect should be enhanced in the more dynamic and competitive sectors of the economy, where competition accelerates the crowding out of the inefficient companies. These effects could also be present in the productivity and profitability of the companies.

Another channel for discrimination against women could arise as a consequence of the search for homogeneity within some boards of directors. This way, some companies may value their board members being similar enough to accelerate the process of decision making. This is especially valuable if the company is confronted with a risky environment where the sooner decisions are made, the better. This preference for homogeneity is also clear when the board size is considerably reduced. In these cases, the penalization of diversity may reduce women's presence on boards as they can be seen as a disturbing element in an otherwise uniform environment. Nevertheless, this taste-based discrimination, although conscious, may have some economic rationality, so this would not disappear with the mechanism of market competition.

The presence of statistical discrimination would imply that, in those cases where nomination committees for boards of directors have some additional information about

candidates, women's presence is substantially higher. For instance, that could be the case of family-based companies, where family owners have a better knowledge of female candidates belonging to their family. This prevents them from being assigned some kind of average of a female group. On the contrary, when the appointment of a new director has to be taken as a result of a compromise among different shareholders, as is more common in larger and listed companies, statistical discrimination would have a greater role in preventing women from reaching the board.

Finally, if unconscious stereotypes bias the perception of women's abilities, as in the case of mistake-based discrimination, this bias would tend to disappear if more women are already on the board, since direct contact with people of the discriminated group could reduce the effects of social stereotypes and prejudices (Bertrand et al., 2005). In fact, Farrell and Hersch (2005) suggest that the existence of women board members can have an influence on attracting other women to the board, either by the nomination of professional colleagues or by applying pressure so that the company maintains its demand for female board members.

3. Data selection and descriptive statistics

The present study is focused on the Spanish companies whose operating revenues exceeded 100 million euros in year 2003, according to the SABI[4] database. We have chosen to analyse the largest companies given that they constitute a clear business and social reference. Additionally, this criterion corresponds with those used in other countries that usually monitor the diversity on boards as an indicator of good corporate governance, which facilitates a comparison with surrounding countries. Also, this is the criterion of economic literature for analysing diversity on boards. For example, Carter et al. (2003) use *Fortune* 1000 companies as their sample, while Farrell and Hersch (2005) base their study on *Fortune* 500 lists, as do Adams and Ferreira (2004).

[4] SABI (Analysis System of Iberian Balances) is a database that contains general and financial information about more than 800,000 Spanish companies. The information is obtained from distinct official sources, Mercantile Registries, BORME, newspapers, etc. and is updated periodically. SABI is distributed in Spain by *Informa* and *Bureau Van Dijk*. http://www.bvdep.com/SABI.html

The search showed a total of 1,148 non-financial companies once closed-down ones[5] had been eliminated. These companies had, in 2003, 1.35 million employees, representing 10% of the Spanish total workforce. They were also 65% of the companies with more 5,000 employees, 40% of those with more than 1,000 and 30% of those with more than 500. Their aggregated operating revenue was equivalent to 65% of the GDP and accounted for 78% of the return of the Spanish companies.

Information on the board members of companies was also obtained from the SABI database, updated in June 2005.[6] Nevertheless, in some cases, it was necessary to complete that data with information obtained from files from the Mercantile Registry, e-Informa database, and companies' annual reports and websites.[7]

In order to determine the gender composition of the board, the first names of the board members' were examined. Institutional board seats held by other corporations were excluded, since they are represented by a changing group of individuals whose identities and gender are unknown. That is, to measure the number of women board members, only individual direct members were counted. Since there are only 633 institutionally held board positions out of the 6,636 (9.54%) in the top 1,148 companies, the exclusion of these seats from this study has a relatively limited impact on the proportion of women on the boards of directors of these companies.[8] Thus, by focusing the study on the measurement of the presence of individual female board members among individual direct members of the board, 63 companies were eliminated, given that their boards of directors were entirely formed by institutional board members, reducing the final sample to a total of 1,085 companies.

[5] IZAR was also eliminated for being in a liquidation process and so was EMYTEC Coop. Valenciana, since, according to the annual accounts of the Community of Valencia Cooperative Registry, their operating revenues in 2003 did not exceed 100 million euros.

[6] An alternative way to obtain data about the composition of boards of directors is the use of surveys. However, survey data has low response rates that could drastically reduce the base of analysed companies. Furthermore, as Carter et al. (2003) suggest, survey data would likely be biased toward those firms wishing to "showcase" their diverse boards.

[7] In order to determine the composition of the boards of directors of the company C&A Modas, S.L., which was not included in SABI, we looked for it in the *Registro Mercantil Central* files.

[8] Additionally, under the hypothesis that the percentage of women among the total individual direct members is, or should be, approximately the same as that found among the total administrators, it should not produce significant biases to exclude institutional board seats in the calculated percentage of female participation on boards. In this sense, anecdotal evidence indicates that these institutional positions are also usually represented by men, which can be explained by the fact that the percentage of female representatives should not significantly differ from the percentage of women on boards of directors of the companies that are represented.

In addition, the functions of Commissioner (comisario)[9], Manager/Administrator, General Manager and Secretary of the Board were eliminated from the board of directors since these, by a general rule, do not qualify as board members when identified by SABI.[10] The study holds as board members the functions of President, Vice-President, Executive Director, Administrator, Joint Administrator (Member of the Board), Sole Administrator and Other functions[11]. In reference to the boards of those companies in which a sole administrator represents the board of directors, in the absence of a complete board, these companies are counted as a board formed by a single individual within the universe of board directors represented in this study.

With regard to the characteristics of the boards of directors (Table 2), we conclude that only 6.61% (397) of individual board directorships of the 6,003 in the top 1,085 Spanish companies are held by women, according to data from June 2005. The average number of direct members per board is 5.53, of which only 0.37 correspond to women, and only 255 companies (23.5%) include at least one woman on their boards.

[Table 2]

4. Independent variables

The independent variables used in our models were board size, if it is a family-based firm, if the firm is listed on the stock market, the degree of independence of the company with regard to its stockholders, firm size, firm age, firm profitability, productivity by employee, firm risk and indebtness ratio. Additionally, the association form of the company and industry control variables were included. Descriptive statistics on these variables are shown in Table 3.

[Table 3]

In order to take into account possible differences among industries, the companies have been grouped into industry classes based on the sector classification by Spanish Stock

[9] Corresponding to a unique firm: Autopistas del Atlántico, S.A.
[10] According to the information given by *Informa*.
[11] Such as the Treasurer and those on the governing boards of three cooperative companies: COFARES, COREM and ANCOOP.

Markets (Bolsas y Mercados Españoles (BME)), and industry fixed effects based on these classifications[12] have been included.

Board size is measured by the number of individual direct members on the board. We have also included the square of this variable to take into account possible non-linearities.

Three dummy variables have been included: family-based firm, listed company (quoted on a stock market) and cooperative.[13] In the case of the family-based firm variable, the dimensions of ownership and power have been used as a classification criterion (Gersik et al., 1997). Thus, a company is considered a family-based firm when various members (at least two) of the same family hold seats on the board of directors and/or a significant part of the shares of the company are possessed by the same family.[14] When a company is a subsidiary or forms part of a family group, but no member of the family is part of the board of directors of the company, this company is not classified as a family-based firm if the family is not directly implied in its management. For the verification of the family character of these 1,085 companies of the analysed sample, we have had the help of the *Instituto de la Empresa Familiar*[15] (Family Business Institute), which has made a list of the possible errors or omissions that have been committed in our classification. The final inventory offers a total of 244 family-based firms, which represent 22.5% of the studied sample.

The shareholders' control in the company is measured by the *Independence Indicator* of *Bureau van Dijk*. Through its Database of Ownership, an indicator is used to measure the degree of independence of the society in relation to its shareholders. The

[12] These six sectors are the following: Oil and energy; Commodities, industry and construction; Consumer goods; Consumer services; Financial services and real estate agencies; Technology and telecommunications.
[13] The inclusion of the cooperative variable against the remaining types of companies is due to the fact that, between the 1,085 Spanish companies studied, the representation of women in the governing organs of cooperative companies is greater than in any other type of company (i.e. public limited companies, limited liability companies). Cooperatives represent 1.47% of the sample, similar to the proportion of Spanish firms according to the Spanish *Instituto Nacional de Estadística*. The cooperatives in the sample account for 7.41% of the total employees of Spanish cooperatives in 2003, and they are the 11.85% of the cooperatives with more than 250 employees.
[14] For those companies with a sole administrator, they can be considered as a family-based firm when the family (at least two members) possesses a significant part of the shares of the company, and when the function of Sole Administrator is held by one member of the family.
[15] http://www.iefamiliar.com/

Independence Indicator of BvD[16] is designated as A, B, C and U. In order to include the variable in the model, it has been categorized with values of 1 to 6, where 1 indicates the lowest grade of independence (C) and 6 the highest (A+).

The analysis of firm size is difficult to implement because of the need to quantify it numerically and also because of the multiple ways of defining it.[17] McMahon (2001) evidenced the advantages of a single quantitative criterion over the qualitative. In this study, we have chosen a hybrid definition based on a factor analysis of the three most commonly used variables (number of employees, total assets and operating revenues). In order to avoid unusual results in one year distorting the measure, we have included in this analysis the values observed in 2002 and 2003. The results of the factorial analysis can be found in Table 4, where two factors have been extracted. The main factor can be interpreted as a measurement of firm size because it is a linear combination of the six variables used in the factorial analysis.[18]

[Table 4]

Two ratios have been selected to measure firm profitability: the mean of the return on assets (ROA) for the years 2001, 2002 and 2003, computed as the net income divided by the total assets, and the mean of the productivity by employee as the ratio of operating revenues (in thousands of euros) per employee for these years.

We have chosen two alternatives for the risk assumed by the companies. The first of these variables is the average of the company's indebtness ratio for 2001, 2002 and 2003, measured as the long-term debts of the company divided by the share capital plus reserves. The second alternative considered is the volatility of the profitability,

[16] The indicator is built as follows: the A indicator denotes the maximum independence degree and it is assigned when there are no shareholders registered with direct or complete ownership equal to or higher than 25% of the capital. It is also divided into A+, A or A- based on the criteria that the higher the number of shareholders, the more difficult it will be to control a company. The B indicator is applied to companies in which none of the registered shareholders possess 50% or more (direct or total) of the company's equity; again, this is classified as B+, B or B- depending on the identified number of shareholders. The C indicator is applied to a company with a registered shareholder who has more than 49.99% (direct or total), and also if a source indicates that there is a final ownership. Lastly, the indicator U indicates an unknown degree of independence.

[17] The most utilized quantitative criteria can be arranged in the following order (Osteryoung and Newman, 1993): number of employees, annual sales, total assets, organizational structure, power in the sector, etc.

[18] The second extracted factor is directly correlated with operating revenues and assets, and negatively correlated with the number of employees. This could be an approximation of the productivity and, in fact, the correlation between this factor and the variable of productivity that we have used in this study is higher than 90%.

measured by the standard deviation of the annual ROA computed in the period between 1991 and 2003.

In the case of financial variables (profitability, productivity, risk and indebtness, as well as firm size), they have been lagged a minimum of two years to reduce the risk of possible endogeneity between these variables and female representation. In this way, we can speak about causality in Granger's sense in such a way that financial variables could cause the distinct proportion of women on boards of directors, and not the other way around.

Another variable that can be used to characterize different attitudes toward the presence of women on boards of directors is the firm age. The firm age is introduced in the model in logarithms because the main differences are expected in the first years of the company.

5. Modelling women's presence

The gender of a director is a binary variable that takes the value "0" if he is a man and "1" if she is a woman. As the dependent variable (y_i) is binary and all the independent variables ($\mathbf{X}_i$) are referred to the whole company, and therefore common to all its directors, a grouped probit model could be specified, where p_i will be the probability of each director being a woman.

An alternative specification, appropriate here given the low frequency of women directors, would be a Poisson regression model, where the boards are the observations and the number of female directors of the board (y_i) is the dependent variable.

The presence of more companies without women on their boards of directors than those that could have been expected from the unconditional probabilities for the Poisson distribution can be incorporated into the model by the specification of a zero-inflated Poisson model. In these models, we differentiate between cases in which, with a probability q, the possibility of appointing a woman to the board of directors is not even considered (taste-based discrimination) and those in which women are considered. In the latter case, other factors could come into consideration and the probability of appointing a woman could be determined by the Poisson model mentioned above. This

type of model, therefore, could imply that there is a greater number of companies without women than that described by a simple Poisson model. The parameter *q* could be considered as an approximation of the probability that a company prefers not to have any women on its board.

A second alternative to explain the observed over-dispersion of the number of direct female members of the board variable is the mistake-based discrimination based on stereotypes about the ability of women to hold positions on boards, implying a higher rejection proportion of women during the selection process because their professional skills are underestimated. If this were the case, what we could find is that, once a woman enters the board, it tends to reduce the tendency to prejudices in the evaluation of her abilities so it is easier for those companies to appoint more women to hold other positions. In this case, the gender of each member of the council would not be independent from other members, but instead a *contagious* factor makes the presence of women on the boards more possible if there are already women on it. This said *contagious* factor can be estimated via a negative binomial distribution.

In this negative binomial model, parameter α allows us to quantify the grade of over-dispersion of variable y_i (the greater α, the greater the variance will be with respect to the mean). In this way, if $\alpha = 0$, the negative binomial becomes a Poisson distribution (equal mean and variance). However, if $\alpha \neq 0$, then there is a contagious effect, that is, having a positive case makes it more probable to have other positive cases.

Lastly, in order to test which of these two effects prevail, taste-based discrimination (*q*, obstacle) or mistake-based discrimination (α, infection), we estimate a zero-inflated negative binomial model that allows the specification of both parameters: *q* and α. If *q* is zero, the model is transformed into a negative binomial; meanwhile, if α is equal to zero, it will become a zero-inflated Poisson. A summary of all these models is presented in Table 5.

[Table 5]

Likelihood ratio tests confirm the existence of over-dispersion of the number of women on the boards of directors, and both the zero-inflated Poisson model and the negative binomial model are preferable to the simple Poisson regression model. Finally, the analysis of the zero-inflated negative binomial allows us to conclude that this model is

superior to the zero-inflated Poisson, but it is not better than the negative binomial model (in fact, we obtain the probability of an obstacle, *q*, very close to 0), that is, the contagious factor is able to explain sufficiently the observed over-dispersion.

$$\begin{matrix}\text{Negative} \\ \text{Binomial}\end{matrix} \succ \begin{matrix}\text{Zero - Inflated} \\ \text{Negative} \\ \text{Binomial}\end{matrix} \succ \begin{matrix}\text{Zero - Inflated} \\ \text{Poisson}\end{matrix} \succ \begin{matrix}\text{Poisson} \\ \text{Grouped Probit}\end{matrix}$$

From the comparison of the estimated models, we can conclude by saying that there are signs of an underestimation (mistake-based discrimination) of women's skills when considered for positions of responsibility on the boards, which implies that companies would be inefficient in terms of utility (the resources are used in an incorrect manner). This implies that companies may be inefficient in appointing their directors, since, actually, if the companies eliminated that bias, they would appoint more women to their boards of directors.

[Table 6]

6. Analysis of the results

Estimations of the models by maximum likelihood are presented in Table 6. In all of the models, two estimates have been presented. The first of them includes all of the independent variables considered, while the second ones have been obtained by eliminating one-by-one all the non-significant variables in terms of the individual likelihood ratio test until obtaining a model with only those variables that are statistically significant. From the model tests, such as the *Wald* test or the likelihood test, we can conclude that the estimated models describe the behaviour of the dependent variable (the proportion of women on boards of directors) even at a 1% significance level.

In regard to the independent variables that are finally found to be significant, it can be observed that they are always the same in all the proposed models (except the listed company variable that is replaced by the firm size for the negative binomial models). They all also have a very similar effect on the dependent variable, as could be seen in a sensitivity analysis (see Figures 1 and 2, and Table 7), which is a sign of the robustness of the results in terms of the chosen functional specification.

As we have previously commented, since the theoretical arguments focused on the characteristics of women's labour offer (which we have called the reduced pool of women candidates) cannot explain, on their own, the important gap found in women's participation on Spanish boards of directors, when trying to interpret the sign and effect of the explanatory variables we will try to state the role played by the distinct types of discrimination against women.

Thus, firm age has a positive relationship to the proportion of women on the board. This may well be a manifestation of the dynamics of the Becker model of *taste-based discrimination*. The fact that older companies have more women on their boards seems to indicate precisely that companies that have survived and are therefore the most competitive ones are those that have integrated more diversity into their boards. Time and competition seem to be playing, at least partly, an important role in favour of the elimination of taste-based discrimination that is based only on prejudices.

[Figure 1]

Furthermore, as well as prior studies suggesting that industry is significant in explaining the presence of women on corporate boards (Fryxell and Lerner, 1989; Harrigan, 1981), we have also found these industry effects. It turns out that industries with a higher presence of women (Financial services and real estate agencies, Consumer goods and Consumer services) are service-oriented, labour-intensive industries that are precisely those considered more dynamical and competitive in the Spanish economy.

Additionally, it can be observed that the number of members of the boards of directors is effectively a significant variable, in which an increase in board size implies an increase in the proportion of positions held by women, as it has been documented by Carter et al. (2003) and Agrawal and Knowber (2001). The negative sign in the variable squared board size means that the increase in the size of this probability is reduced as long as those boards begin to be large enough; therefore, a maximum is reached at 16–17 members (see Figure 2). This behaviour can indicate that there are companies that have a preference for homogeneity, which leads them to prefer small and homogeneous boards instead of large and heterogeneous ones, since the latter could have a high cost in terms of reaching agreements. This can signal an inclination towards *taste-based discrimination*.

[Figure 2]

The results also show that the *risk*, measured as the standard deviation of the ROA between 1991 and 2003,[19] helps to explain the different proportion of women directors. Given the sign of the estimated coefficient, we can affirm that companies with greater uncertainty in their results are those in which it is less probable that a woman is a director (see Table 7). This result is in accordance with Adams and Ferreira (2004),[20] who interpret it as empirical confirmation of *Kanter's hypothesis* (1977).[21] Another possible explanation is self-selection. In this sense, there is solid evidence to argue that women are more risk-averse than men (Jianakoplos and Bernasek, 1998); therefore, one could argue that women are less willing to work for companies that offer a salary too exposed to risk. In our opinion, since companies exposed to higher levels of risk usually need a quicker and easier decision-making process, they value more the homogeneity of the board. In the context of boards of directors, which are usually composed of men, some of these companies can consider women as a disturbing element and high uncertainty could cause them to recruit a higher proportion of men. This preference for homogeneity can be interpreted as an indicator of *taste-based discrimination.*

Nevertheless, the variable that has the greater impact on the presence of women on the boards of directors is family-based firm (see Table 7). Different authors maintain that family-based firms offer women abundant opportunities and advantages in their professional career (i.e. Cole, 1997), although this result can be caused by the tendency to favour family ties, independently of gender, at the time of promoting directors, which implies that women have fewer barriers to becoming a board member. In fact, this could be indicating the existence of *statistical discrimination*, since when a woman is judged on the company to which her family belongs, it seems that the hiring decision is dependent more on her individual characteristics than on the average characteristics of her belonging group. This might help her to avoid the incorrect judgments that she

[19] However, significant effects have not been found for the risk measured through the variable *indebtness ratio* (2001–2003).
[20] Nevertheless, Adams and Ferreira (2004) used the volatility of stock prices as an approximation of the uncertainty in the results.
[21] According to Kanter's hypothesis, when uncertainty is high, explicit pay-for-performance contracts are too costly and therefore the organization trusts more in the homogeneity of the group as a way to ensure the achievement of its objectives. This means that incentive pay and group homogeneity are somehow substitutes and, therefore, the variability in stock returns (or the uncertainty as a proxy for the cost of providing formal incentive schemes) and the diversity within the board have a negative relationship.

would face otherwise and that stem from stereotypes, existing prejudices or the social undervaluing of women's work.

Cooperatives are another exception to the scarce presence of women on boards of directors (see Table 7). These results can be explained by the practice of these companies to represent their partners on the board. This way, when women are valued by their own partners on the basis of a democratic voting procedure (one member, one vote), they have fewer barriers to becoming a board member.

The family-based firm and cooperative variables are related, at least partially, to the ease of partners or shareholders of the company to appoint directors. When shareholders have more control over appointing members of the board, women obtain access to the board more easily. This is confirmed by the influence that the independence indicator possesses. Therefore, it can be observed that the less power the shareholders have in the company, the smaller is the probability for the directors of being women (see Table 7). Carleton et al. (1998) and Gillan and Starks (2000) interpret the sign of this variable as an indicator of the possible existence of external pressure coming from the shareholders in demand for a greater presence of women on the boards. Given that in Spain the presence of activism in favour of diversity on the boards of directors by institutional shareholders has not been detected,[22] we consider it not probable that a positive sign in the coefficient responds to the pressure of this type. A more likely cause is that women tend to hold seats on boards as dominical members, in this case representing major shareholders.

Additionally, we found a negative relationship between the presence of women on the boards of directors and the fact of being a listed company (see Table 7), although in the models based on the negative binomial distribution, this variable is substituted by the firm size variable.[23] Both variables are correlated, since listing on a stock market is more frequent in larger companies. Usually, these types of companies (large and listed) include a smaller proportion of dominical directors on their boards while having a higher proportion of executives and independent directors where women are under-represented.

[22] Such as the one of TIAA-CREF in the United States.
[23]By contrast, Agrawal and Knowber (2001) found for the USA a positive sign that they attribute to a greater demand for diversity directed at these companies through public opinion.

There are other variables, however, that do not have a significant influence on the directors' gender. So, unlike previous studies (Adler, 2001; Carter et al., 2003; Catalyst, 2004; Erhardt et al., 2003) that found a positive relationship between female representation on the board and the company's performance, variables related to profitability (ROA) and productivity (turnover per employee) do not have an effect on the representation of women on Spanish boards. However, given that in the specification of the model, the financial variables have a two-year lag, this result does not imply that the presence of women on boards cannot have a positive effect on firm profitability. To test this hypothesis, the model specification should be the reverse, with the profitability as the dependent variable and the gender composition of the board as a lagged independent variable.[24]

7. Further evidence of Becker's discrimination

In the previous section, we have found some evidence in favour of the dynamics of the Becker model of *taste-based discrimination.* As we have stated before, Becker's theory predicts that, in a perfectly competitive market, time and competition among companies would lessen the problem of discrimination, since the companies that discriminate would not survive in the long-term as they have to support higher costs and a loss of efficiency due to their preference for not working with women.

To obtain additional evidence on this dynamic on the boards of the top Spanish companies, we have monitored the gender compositions of the companies of the original sample three years after the first inquiry. We would expect that, if the most competitive companies are the ones that survived, then, according to Becker's model dynamics, the probability of being an extinct firm would be negatively related to the number of women on its board. This way, evidence in favour of this hypothesis would strengthen the prediction of Becker's theory according to which time and competition play an important role in favour of women's presence on boards of directors.

[24] This type of study about the correlation between profitability and diversity, which is not the objective of this study, can be found in Adler (2001), Carter et al. (2003), Catalyst (2004) or Erhardt et al. (2003).

Only 1,076 companies out of the original sample of 1,148 non-financial companies were not extinct in 2008.[25] The information on board members of companies was updated in June 2008, excluding institutional board seats (there are only 675 institutionally held board positions out of the 5,952, which represent 11.34% of the total). This time, there were 84 companies whose boards were entirely formed by institutional board members, reducing the final sample to a total of 992 firms. The functions maintained as members of the board are the same as the ones considered for the sample in 2005.[26]

Referring to the new figures of the boards of directors of June 2008, there has been a slight advance in the diversity of the Spanish boards, since now 8.66% (457) of the 5,277 individual seats of the boards of sirectors in the top 990 Spanish companies are held by women.

[Table 8]

The 72 companies that disappeared between 2005 and 2008 had 3.57% of female directors in 2005, in contrast with the 6.61% of the whole sample, which seems to be in accordance with the hypothesis from Becker's model. In order to test this hypothesis, we estimate a probit/logit model on the probability of a company to be extinguished. We have chosen the specification proposed in the seminal work of Altman (1968). The estimation of such models is shown in Table 9, where the standard ratios proposed by Altman are used as predictors of bankruptcy, as well as the number of women on the board[27] and industry dummies.

[Table 9]

[25] From the original sample of 1,148 companies, 67 were extinguished, another 4 were in a liquidation process and there was one company (Pirelli Cables y Sistemas SA) that disappeared from the original sample since it was a joint venture that had been dissolved.

[26] With the exception of "Other functions", which was not present among the companies in the new sample.

[27] If we are considering Becker's discrimination, the presence of a woman on the board is a signal against this discrimination. Given the nature of our sample, considering the number of women on the board is almost a dummy variable that gives information about the lack of discrimination in the sense of Becker, an alternative specification would be to consider the percentage of women on the board. Nevertheless, given the great disparity among the board sizes of the sample (the existence of very small boards where a single woman may imply a huge increase in the percentage of women, while there are other large boards where such an increase has a more moderate effect) could distort the purpose of these estimations, we prefer the first variable.

As can be seen, the number of women on the board is a significant variable in these models, where the probability of extinguishing decreases when there are more women on the board. This evidence of worse performance among companies without women is coherent with Becker's prediction.

This effect also implies that the sample tends to be more equilibrated in terms of diversity on the boards as time goes by. Therefore, we would expect that the statistical significance of the firm age variable would tend to fade away in the negative binomial model proposed in previous sections when it is estimated from 2008 data.

[Table 10]

Therefore, we compare the estimation of the same negative binomial model applied to both 2005 and 2008 data in Table 10. We find two remarkable results. First of all, the significant variables in the 2005 sample are still the significant ones in 2008, with the same sign and a similar size in the effect. Secondly, after three years, the only variable that is not significant any more is precisely the firm age. This can be considered a consequence of Becker's dynamics since, as time goes by, discriminating companies tend to disappear.

8. Conclusions

Through this paper, we have quantified the presence of women on the boards of directors of the top 1,000 Spanish companies. It is possible to conclude that the probability of an individual director being a woman in the leading Spanish companies is very low. In fact, only 6.61% of the positions of the board held by direct members in June 2005 are held by women.

It is quite improbable that the large gap existing between this percentage and the approximately 32% of women's participation in top executive positions can only be attributed to differences in the labour offer between men and women, overall, if we consider that these differences are minimized in the group of top executives. For this reason, we have looked for signals of other explanations that could help us to explain the under-representation of women on Spanish boards of directors.

This way, through model estimations, we have detected a contagious factor, according to which the presence of women on the board facilitates the incorporation of more women into the board. This contagious factor may be interpreted as a signal of the presence of mistake-based discrimination, according to which women's curricula would be systematically underestimated in respect to those of men.

Additionally, there is evidence of the existence of *clubby* companies that have a preference for homogeneity on their boards, and see diversity not as an advantage but as a source of potential conflicts. This could be an indicator of taste-based discrimination found in the low presence of women in companies with small boards and/or in those that have a greater uncertainty in their results.

Another result is that, when there is additional information available about women's characteristics for the company, as in the case of family-based companies, cooperatives, companies with a higher control of major shareholders, non-listed companies or small ones, women seem to being judged in accordance with these and not on the basis of the average characteristics of their group. In these cases, when a woman is on a company's board of directors, it is more likely that she is holding a dominical position, where she is less exposed to the statistical discrimination that she would otherwise have to face as an executive or independent candidate.

Finally, we have also found evidence of Becker's taste-based discrimination. So, the fact that older firms and more competitive sectors have a greater presence of female directors could be interpreted as a manifestation of Becker's model according to which most competitive companies that have survived are those with more diverse boards. In this sense, we have observed that those companies with fewer women directors in 2005 were more likely to become extinct in the following three years. This is coherent with Becker's prediction, according to which time and competition could be eliminating companies with higher costs derived from having prejudices against women.

From all these results, we can conclude that there is no single way to improve the gender diversity on the boards of directors of the leading Spanish companies,. On one hand, the shortage of women with a desired profile can only be resolved in the medium- to long-term by improving the *work and family life balance* and having an equal share

in family care between men and women. Another way to mitigate the problem is to expand the selection criteria to include other talent sources usually discarded (such as human resources or customer relationships managers, or independent directors from liberal professionals, universities, research centres or non-profit organizations in which women are highly represented). Additionally, incentives toward improving *good corporate governance practices* that are usually promoted by regulating institutions (i.e. objectiveness and precision in directors' selection criteria, elaboration of training programmes for incentive and nomination committees to select and evaluate candidates, promotion of independent director figures) could be implemented. Lastly, mistake-based discrimination can only be overcome by establishing *quotas* that would banish in the medium-term biased evaluations on the curricula of female candidates to form part of the boards of directors.

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Table 1: Previous research on women's presence on the boards of directors of Spanish companies

Research	Year	Sample	Women's participation	Boards without women
Corporate Women Directors International (CWDI)	2002	300 companies ranked by operating revenues (*Fomento de la Producción 2001*)	4.6%	76%
Ethical Investment Research Services (EIRIS)	2004	FTSE All World Developed Index (24 companies)	3.8%	_
Fundación Ecología y Desarrollo (ECODES)	2004	*Ibex*-35 (35 companies)	3.57%	63%
European Professional Women's Network (EPWN)	2004	250 European companies by operating revenues	3%	60%
Spencer Stuart Index	2004	90 Spanish companies	4%	66%
Heidrick & Struggles	2005	*Ibex*-35 (35 companies)	2.6%	69%
Fundación de Estudios Financieros	2005	119 Spanish listed companies	4.04%	68.07%

Table 2: Boards of directors. Descriptive statistics

Variable	Sum	Mean	St. Dev.	VC	Min.	Max.
Number of board members	6525	6.01	4.59	0.76	1	57
Number of direct board members	6003	5.53	4.08	0.74	1	50
Number of female direct board members	397	0.37	0.82	2.22	0	6
Number of male direct board members	5606	5.16	3.89	0.75	0	47
Boards without women	830	76.5	0.42	0.01	0	1
Boards with one woman	174	16.0	0.37	0.02	0	1
Boards with two women	44	4.1	0.20	0.05	0	1
Boards with more than two women	37	3.4	0.18	0.05	0	1
% of women among direct members		6.61	13.96	2.24	0	100

Table 3: Descriptive statistics

	Total		Family-based		Listed		Cooperative	
	n=1085		n=244		n=58		n=16	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Total active th. EUR 2003	537200	2124630	343659	714461	3396491	7694358	260281	347859
Employees 2003	1278	3320	1644	5086	2685	4450	1312	2297
Operative revenue th. EUR 2003	470620	1038973	368510	839358	910521	1665452	568331	707415
ROA (2001–2003) (%)	6.48	8.34	7.77	9.40	7.99	7.49	4.02	4.40
St. dev. ROA (1991–2003)	6.72	14.30	4.97	5.02	4.45	4.57	1.92	1.68
Indebtness ratio (2001–2003)	0.69	0.20	0.66	0.20	0.62	0.15	0.65	0.10
Revenue per employee th. EUR (2001–2003)	2632	14343	948	2486	475	646	858	812
Firm age	29.3	22.0	330	20.3	52.9	30.0	43.2	16.2

Table 4: Firm size via factor analysis. Total variance explained. Communalities, factor matrix and factor loadings

Component	Initial eigenvalues			Extraction sum of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	3.848	64.130	64.130	3.848	64.130	64.130
2	1.177	19.620	83.750	1.177	19.620	83.750
3	0.645	10.753	94.503			
4	0.190	3.159	97.662			
5	0.080	1.339	99.001			
6	0.060	0.999	100.000			

	Communalities	Component matrix		Factor loadings	
		1	2	1	2
Total active th. EUR 2002 (Log)	0.805	0.864	-0.242	0.224	-0.206
Total active th. EUR 2003 (Log)	0.800	0.860	-0.245	0.224	-0.208
Operating revenues th. EUR 2002 (Log)	0.724	0.818	-0.336	0.204	-0.276
Operating revenues th. EUR 2003 (Log)	0.782	0.786	-0.325	0.213	-0.286
Number of employees 2002 (Log)	0.958	0.737	0.643	0.192	0.547
Number of employees 2003 (Log)	0.957	0.729	0.653	0.189	0.554

Extraction method: principal components analysis.
Kaiser–Meyer–Olkin measure of sampling adequacy: 0.696.
Bartlett's test of sphericity (χ^2_{15}): 6396 (significance:0.000)

Table 5: Models' specification

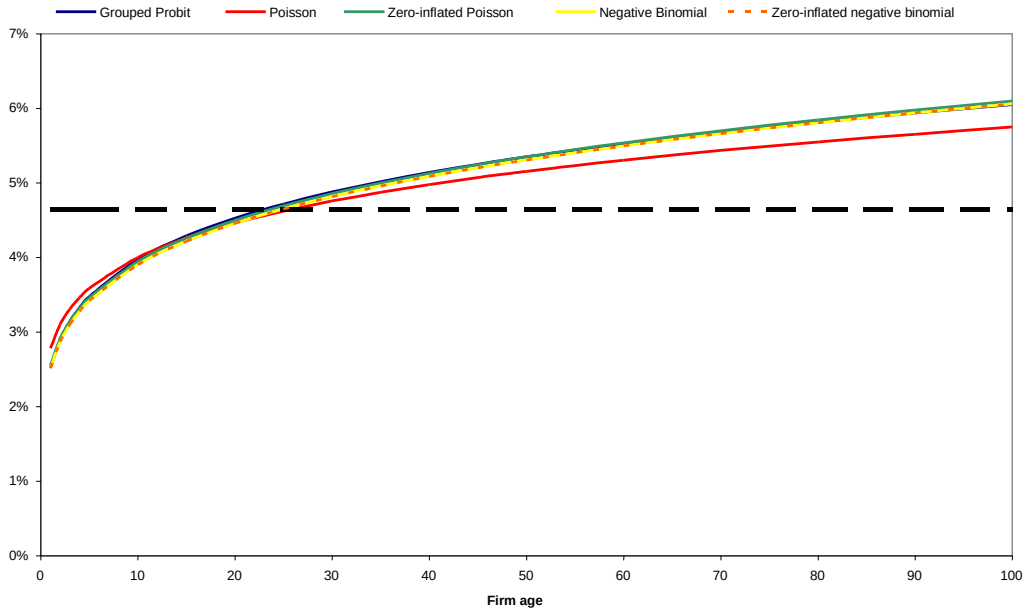
Model	Dependent variable	Function	Features
Grouped Probit	Director's gender (woman=1)	$\Pr[y_i = 1] = p_i = \int_{-\infty}^{\mathbf{x}_i\boldsymbol{\beta}} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2} dx$	Binary dependent variable Grouped data
Poisson	Number of women on the board	$\Pr[y_i = k] = \frac{(\lambda_i)^k}{k!} e^{-\lambda_i}$ $\lambda_i = n_i p_i = n_i e^{\mathbf{x}_i\boldsymbol{\beta}}$	Count data
Zero-Inflated Poisson (ZIP)	Number of women on the board	$\Pr[y_i = 0] = q + (1-q)e^{-\lambda_i}$ $\Pr[y_i = k] = (1-q)\left(\frac{(\lambda_i)^k}{k!} e^{-\lambda_i}\right) \quad k = 1,2,...$ $\lambda_i = n_i p_i = n_i e^{\mathbf{x}_i\boldsymbol{\beta}}$	Count data Over-dispersion Zero inflated (q: obstacle)
Negative Binomial	Number of women on the board	$\Pr[y_i = k] = \frac{(\nu\lambda_i)^k}{k!} e^{-\nu\lambda_i}$ $g(\nu) \sim \text{Gamma}(1/\alpha, \alpha)$ $\lambda_i = n_i p_i = n_i e^{\mathbf{x}_i\boldsymbol{\beta}}$	Count data Over-dispersion Contagion effect (α: contagion)
Zero-Inflated Negative Binomial	Number of women on the board	$\Pr[y_i = 0] = q + (1-q)e^{-\nu\lambda_i}$ $\Pr[y_i = k] = (1-q)\left(\frac{(\nu\lambda_i)^k}{k!} e^{-\nu\lambda_i}\right) \quad k = 1,2,...$ $g(\nu) \sim \text{Gamma}(1/\alpha, \alpha)$ $\lambda_i = n_i p_i = n_i e^{\mathbf{x}_i\boldsymbol{\beta}}$	Count data Over-dispersion Contagion effect (α: contagion) Zero inflated (q: obstacle)

Table 6: Grouped probit model on the probability of a board position being held by a woman and Poisson and negative binomial models on the number of women on the board

	Grouped Probit				Poisson				Zero-inflated Poisson				Negative binomial				Zero-inflated negative binomial			
	Model I		Model II (Only		Model III		Model IV (Only		Model V		Model VI (Only		Model VII		Model VIII (Only		Model IX		Model X (Only	
Variables	(All variables)		significant)		(All variables)		significant)		(All variables)		significant)		(All variables)		significant)		(All variables)		significant)	
Constant	-1.635		-1.994		-2.815		-3.652		-2.968		-3.444		-3.162		-3.831		-3.119		-3.831	
Number of direct members of the board	0.025	**	0.022	**	0.041	*	0.041	*	0.046	*	0.040	*	0.056	*	0.049	*	0.056	*	0.049	*
Number of direct members of the board (squared)	-0.001	**	-0.001	**	-0.001	*	-0.001	**	-0.001	**	-0.001	**	-0.001	*	-0.001	*	-0.001	*	-0.001	*
Listed firm	-0.176		-0.211	*	-0.382	*	-0.430	**	-0.411	*	-0.465	**	-0.306				-0.306			
Family-based firm	0.540	***	0.594	***	0.972	***	1.093	***	0.956	***	1.061	***	1.025	***	1.119	***	1.025	***	1.119	***
Independence indicator BvD	-0.071	***	-0.071	***	-0.123	**	-0.131	***	-0.126	**	-0.130	***	-0.126	**	-0.156	***	-0.126	**	-0.156	***
Cooperative	0.706	***	0.471	***	1.164	***	0.827	***	1.033	***	0.778	***	1.312	***	1.011	***	1.312	***	1.011	***
Firm size	-0.069	**			-0.115	*			-0.112				-0.167	**	-0.121	*	-0.167	**	-0.121	*
Return on assets (2001–2003) (%)	0.001				-0.001				-0.003				-0.001				-0.001			
Return on assets (1991–2003). St. deviation (Log)	-0.095	***	-0.104	***	-0.184	***	-0.194	***	-0.165	**	-0.177	***	-0.166	**	-0.189	***	-0.166	**	-0.189	***
Indebtedness ratio (2001–2003)	-0.110				-0.300				-0.133				-0.140				-0.140			
Productivity by employee (2001–2003) (Log)	-0.040				-0.089	*			-0.070				-0.077				-0.077			
Firm age (Log)	0.098	**	0.088	**	0.178	**	0.158	**	0.227	***	0.189	**	0.203	**	0.191	**	0.203	**	0.191	**
Industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Probabilidad de obstáculo									0.217	***	0.237	***					0.000		0.000	
α (contagion)													0.507	***	0.147	***	0.507	**	0.567	***
LR test [a]	177.3	***	195.6	***	162.3	***	179.32	***	111.27	***	122.9	***	114.23	***	125.32	***	112.93	***	124.39	***
Wald test [a]	181.8	***	191.5	***	143.9	***	144.47	***	145.54	***	141.31	***	151.53	***	156.2	***	154.85	***	157.79	***
Goodness of fit (deviations) [b]					731.3		898.3													
Goodness of fit (Pearson) [a]					1044.8	***	1244.3	***												
LR test against a Poisson model									12.37	***	17.46	***	21.04	***	30.68	***	21.04	***	30.68	***
LR test against a zero-inflated Poisson model																	8.67	**	13.22	***
LR test against a negative binomial model																	0.00		0.00	

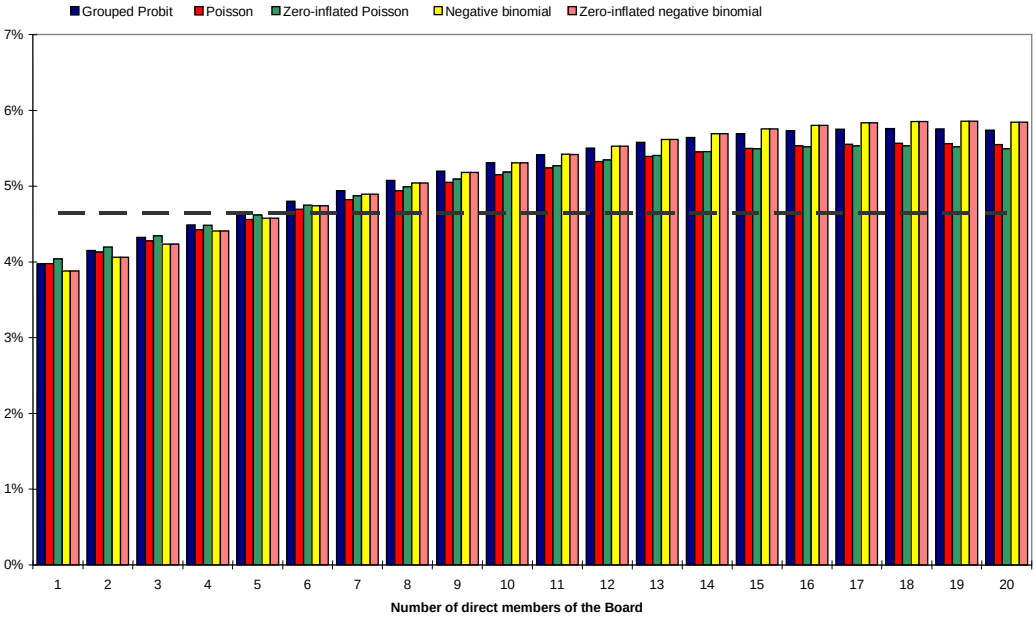
Estimations obtained with STATA v.9. A robust variance–covariance matrix is used in order to correct heteroscedasticity and correlation among directors of the same board.
For each variable, an LR test has been performed between a model with and without this variable.
Stars give the significant level of the null hypothesis rejection: 1% ***, 5% ** and 10% *.
[a] The null hypothesis is that independent variables are not jointly significant.
[b] The null hypothesis is that independent variables are jointly significant.

Figure 1: Probability of a board position being held by a woman. Firm age influence



Probabilities computed for the models in Tables 4 and 5 with only significant variables (pair models). A representative company has been considered to be a non-family-based one, non-listed and not a cooperative, with an independence indicator equal to C, mean risk and not belonging to financial services and real estates agencies nor consumer goods and consumer services industries and with five direct members of the board. The only difference is in the firm age variable.

Figure 2: Probability of a board position being held by a woman. Board size influence



Probabilities computed for the models in Tables 4 and 5 with only significant variables (pair models). A representative company has been considered to be a non family-based one, non-listed and not a cooperative, 23 years old, with an independence indicator equal to C, mean risk and not belonging to financial services and real estates agencies, nor consumer goods and consumer services industries. The only difference is in the number of direct members of the board.

Table 7: Probability of a board position being held by a woman. Independent variables' marginal effects

		Grouped probit	Poisson	Zero-inflated Poisson	Negative binomial	Zero-inflated negative binomial
St. dev. ROA (1991–2003) (Log)						
	μ–2σ	7.16%	6.83%	6.68%	6.78%	6.78%
	μ–σ	5.83%	5.61%	5.58%	5.60%	5.60%
	μ	4.70%	4.61%	4.67%	4.63%	4.63%
	μ+σ	3.76%	3.79%	3.90%	3.82%	3.82%
	μ+2σ	2.97%	3.11%	3.26%	3.15%	3.15%
Industrial sector						
Financial services and real estate agencies		8.81%	8.34%	7.91%	7.55%	7.55%
Consumer goods		4.87%	4.87%	4.80%	4.83%	4.83%
Consumer services		4.65%	4.56%	4.62%	4.58%	4.58%
Oil and energy		3.26%	3.36%	3.56%	3.23%	3.23%
Commodities, industry and construction		3.26%	3.36%	3.56%	3.23%	3.23%
Technology and telecommunications		3.26%	3.36%	3.56%	3.23%	3.23%
Family-based companies						
	No	4.65%	4.56%	4.62%	4.58%	4.58%
	Yes	13.88%	13.62%	13.35%	14.02%	14.02%
Cooperative						
	No	4.65%	4.56%	4.62%	4.58%	4.58%
	Yes	11.34%	10.43%	10.07%	12.58%	12.58%
Listed						
	No	4.65%	4.56%	4.62%	4.58%	4.58%
	Yes	2.93%	2.97%	2.97%	3.89%	3.89%
Independence indicator BvD						
	A+	2.09%	2.37%	2.42%	2.10%	2.10%
	A	2.47%	2.70%	2.75%	2.46%	2.46%
	A-	2.91%	3.08%	3.13%	2.87%	2.87%
	B+	3.42%	3.51%	3.57%	3.35%	3.35%
	B-	3.99%	4.00%	4.06%	3.92%	3.92%
	C	4.65%	4.56%	4.62%	4.58%	4.58%

In this analysis, it is considered as a *reference* company of the sample: a non-family-based firm, non-cooperative company, with an indicator of independence BvD equal to C, non-listed on the stock market (or the average-sized company for a non-listed company in the case of the binomial negative models), 23 years old, with a mean risk and not belonging to financial services and real estates agencies, nor consumer goods and consumer services sectors, and with a board of directors formed by 5 direct members.

Table 8: Boards of directors 2008 vs. 2005. Descriptive statistics

Variable	2008					2005				
	Sum	Mean	St. Dev.	Min.	Max.	Sum	Mean	St. Dev.	Min.	Max.
Number of board members	5806	5.85	4.49	1	55	6525	6.01	4.59	1	57
Number of direct board members	5277	5.32	3.98	1	47	6003	5.53	4.08	1	50
Number of female direct board members	457	0.46	0.95	0	10	397	0.37	0.82	0	6
Number of male direct board members	4820	4.86	3.66	0	42	5606	5.16	3.89	0	47
Boards without women	708	71.4	0.45	0	1	830	76.5	0.42	0	1
Boards with one woman	185	18.6	0.39	0	1	174	16.0	0.37	0	1
Boards with two women	59	5.9	0.24	0	1	44	4.1	0.20	0	1
Boards with more than two women	40	4.0	0.20	0	1	37	3.4	0.18	0	1
% of women among direct members		8.66	15.19	0	100		6.61	13.96	0	100

Table 9: Altman model

Variables	Probit model				Poisson			
	Model XI (All variables)		Model XII (Only significant)		Model XIII (All variables)		Model XIV (Only significant)	
Constant	-0.633		-0.790		-0.977		-1.280	
Number of women on the board	-0.251	**	-0.241	**	-0.529	**	-0.507	**
Equity over debt	-0.024				-0.048			
Reserves over assets	-0.316	*			-0.577	**		
Working capital over assets	-0.285				-0.479			
Income over assets	-0.047				-0.112			
Return on assets	0.010	*			0.020			
Oil and energy	-0.997	**	-0.951	**	-1.958	**	-1.876	**
Financial services and real estate agencies	-0.036				-0.091			
Commodities, industry and construction	-0.771	**	-0.760	***	-1.474	***	-1.463	***
Consumer goods	-0.901	***	-0.930	***	-1.785	***	1.861	***
Consumer services	-0.672	**	-0.724	***	-1.234	**	-1.384	***
LR test [(a)]	28.31	***	21.79	***	28.05	***	21.58	***
Wald test [(a)]	31.95	***	21.36	***	36.86	***	24.38	***
Number of observations	1078		1078		1078		1078	

Table 10: Negative binomial models (sample 2005 and 2008)

Variables	Negative binomial (board 2005)				Negative binomial (board 2008)			
	Model VII (All variables)		Model VIII (Only significant)		Model XV (All variables)		Model XVI (Only significant)	
Constant	-3.162		-3.831		-2.371		-2.773	
Number of direct members of the board	0.056	*	0.049	*	0.059	**	0.049	**
Number of direct members of the board (squared)	-0.001	*	-0.001	*	-0.001	**	-0.001	*
Listed firm	-0.306				-0.189			
Family-based firm	1.025	***	1.119	***	0.719	***	0.738	***
Independence indicator BvD	-0.126	**	-0.156	***	-0.048	*	-0.057	**
Cooperative	1.312	***	1.011	***	1.821	***	0.801	**
Firm size	-0.167	**	-0.121	*	-0.123	*	-0.131	**
Return on assets (*t*-4,*t*-2) (%)	-0.001				-0.005			
St. deviation return on assets (*t-14*,*t*-2) (Log)	-0.166	**	-0.189	***	-0.147	***	-0.096	*
Indebtedness ratio (*t*-4,*t*-2)	-0.140				-0.373			
Productivity by employee (*t*-4,*t*-2) (Log)	-0.077				-0.075			
Firm age (Log)	0.203	**	0.191	**	-0.035			
Industry fixed effects	Yes		Yes		Yes		Yes	
α (contagion effect)	0.507	***	0.147	***	0.181	***	0.247	***
LR test [(a)]	114.2	***	125.3	***	77.1	***	69.3	***
Wald test [(a)]	151.5	***	156.2	***	102.1	***	83.4	***
LR test against a Poisson model	21.0	***	30.7	***	7.9	***	15.1	***