On directors' compensation:
A multi-level analysis of Spanish listed companies.

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Abstract:

This study analyzes the determinants of the annual compensation of directors belonging to the boards of the Spanish companies that constitute the IBEX 35 stock index. We investigate the importance of observed and unobserved heterogeneity in explaining director compensation. Based on a three-level mixed effect model, our analysis includes time-invariant random effects at company and manager level as determinants of director pay. We find that company effects explain 30% of the variation in director pay, while company and director effects explain 77% of that variation. The findings of the study suggest that the characteristics of the company, in terms of activity sector, size and financial performance, and the professional attributes of the director (especially the role within the board), influence the compensation received. In addition, some directors and companies show random effects (either positive or negative) that significantly separate them from the expected compensation estimated from the fixed part of the model. This study provides empirical support for the hedonic theory of wages whenever the existence of different levels of efficiency among individuals is accepted. The results achieved in this research might be of interest both to the companies and to top-level professionals. Companies are offered a tool to find out if they are overpaying their directors or if, on the contrary, they might be at risk of losing them. Workers can use our approach to focus their education and experience towards those sectors and firms in which they can obtain better conditions.

Keywords: Director Compensation, Mixed Effects Model, Firm and Director Levels, IBEX 35.

1. Introduction.

Director remuneration is a recurrent topic of discussion among workers, trade unions and political parties. On the one hand, it is easy to criticize the large amounts of money these individuals receive compared to average salaries, while on the other hand, it seems fair that the people who have made value creation possible, receive a part of it.

Perhaps, due to this permanent controversy, there is a vast literature on executive compensation. This literature has spanned several important topics in economics, such as contract theory, corporate finance, corporate governance, labor economics, and income inequality, and is the object of a sizable number of surveys such as, for example, Rosen (1992), Murphy (1999, 2013), Abowd and Kaplan (1999), Johnston (2002), Core et al. (2003), Jensen et al. (2004), Aggarwal (2008), Bertrand (2009), Edmans and Gabaix (2009, 2016), Frydman and Jenter (2010), Frydman and Saks (2010) and Edmans et al. (2017). These studies cover theoretical issues, empirical evidences, historical and institutional perspectives, and directions for future research.

Most of this literature on executive compensation refers to the US case, although there are some studies for other countries, such as Kaplan (1994) (comparison of Japan and the United States), Kato (1997) (Japan), Eriksson (1999) (Denmark), Kato et al. (2007) (Korea), Nakazato et al. (2011) (Japan), Gabaix and Landier (2008) (survey with 17 countries), Llense (2010) (France), Croci et al. (2012) (14 countries of Continental Europe), and Desfontaines (2018) (Australia and South Africa), among others. The empirical studies cover a temporal span of approximately the last eighty years –Frydman and Saks (2010), Sonenshine et al. (2016).

Following this empirical line, this study tries to measure the main determinants of directors' compensation in the Spanish economy during the period 2015-2017. The mixed model proposed to estimate the compensation received by an individual member of a board of directors (BoD) as a function of his/her personal attributes and the firm characteristics, can be derived from the hedonic theory of wages (see, for example, Cahuc et al. 2014) rooted in the seminal work of Rosen (1974). Like Eisfeldt and Kuhnen (2013), we view executives as hedonic goods with multidimensional skill bundles, whose wages are determined analogously to the prices of the hedonic goods. Chiappori et al. (2010) show that hedonic models are canonically equivalent to matching models.

In the literature that analyzes the effect of personal and firm characteristics on executive compensation, the relation between the individual's talent, the firm´s size and the firm´s performance occupies a prominent place. For example, Cahuc et al. (2014, p. 184) state that when there is positive assortative matching, the most efficient CEOs are hired by the largest firms, which enables them to benefit from higher wages. They also point out that small differences in talent between very talented individuals give rise to wide differences in remuneration. As Rosen (1981) points out, this property is characteristic of the remuneration of superstars,

whether they are CEOs of large companies, sports figures, journalists or lawyers. The aforementioned relation also appears in Himmelberg and Hubbard (2000), Terviö (2008), Gabaix and Landier (2008), Chen (2017), Jung and Subramanian (2017) and, from a more critical point of view, in Elson and Ferrere (2013). Sonenshine et al. (2016) offer a review on this issue.

According to Frydman and Saks (2010), Gabaix et al. (2014), and Edmans et al. (2017), from the mid-1970s, both executive compensation and firm size grew rapidly before the financial crisis, decreased during the crisis, and rebounded afterwards, always at quite similar rates. Previously, since 1936, compensation grew at a slower rate than the firm´s size. Under the optimal contracting view, there is a positive correlation between executive compensation and firm size because larger firms attract more talented executives and can pay them more because their productivity is amplified by firm size (Edmans and Gabaix, 2016). In addition, Bebchuk and Grinstein (2005) find an asymmetry between increases and decreases in size: while increases in firm sizes are followed by higher executive pay, decreases in firm sizes are not followed by reductions in such pay. Alternatively, under the rent extraction view, larger firms are harder for the board to monitor and offer more opportunities for executives to skim (Bebchuk and Fried, 2003).

Falato et al. (2015) have studied, for CEOs, the relation between executive compensation and talent. They construct some measures ("credentials") which reflect publicly-observable signals of CEO skills based on the quality of CEOs' educational and professional track records and on their external reputations. These authors find that better credentials are positively correlated with CEO compensation and firm performance. For its part, Matveyev (2017), following Bloom and Van Reenen (2007), reports a positive correlation among wages, skills and the quality of management practices. Another discussion arises on the generalist or specific nature of executives' talent, abilities and skills, and its relation with compensation, which points to a pay premium for generalist talents; see, for example, Murphy and Zabojnik (2006), Elson and Ferrere (2013), Cremers and Grinstein (2014), Liu and Guo (2017) and Frydman (2019).

The relation between executive compensation and firm performance has also been subject to debate, being possible to identify two points of view: "pay for performance" and "pay without performance". For instance, Sonenshine et al. (2016, p. 1475) state that the financial crisis appears to have altered the determinants of CEO compensation toward pay for performance versus other factors (such as, for example, firm size). Rosen (1992), Hall and Liebman (1998), Core et al. (2003), Bertrand (2009), Frydman and Jenter (2010) and Essen et al. (2012) seem also close to the "pay for performance" standpoint, whereas Bebchuk and Fried (2004, 2005), Djankov et al. (2008), or Bell and Van Reenen (2016) place the emphasis on the "pay without performance" perspective; for example, for Bebchuk and Fried (2005), managerial power has played a key role in shaping executive pay. Related to the control of this managerial power, other papers such as Jensen and Murphy (1990), Jensen et al. (2004), Essen et al. (2012), Sonenshine et al. (2016) and Bell and Van Reenen (2016) stress the importance of strong shareholder governance, and the development of formal and informal institutions protecting investors, to align executives' with shareholders' interests.

Another concept framed within the pay-performance topic, is the one of "pay for luck" (introduced by Bertrand and Mullainathan, 2001), where luck is defined as observable shocks on performance that are beyond the executive's control –Cremers and Grinstein (2014), Bell and Van Reenen (2016) and Chen (2017), among others, have also employed this concept. As we will show throughout this work, our multilevel methodological scheme allows us to identify these types of shocks which, in our opinion, may even be beyond company's control.

Although in the literature there are different opinions about the fair/unfair compensation to the BoD, today nobody doubts their contribution to the growth and development of companies. Therefore, beyond compensation, aspects such as the role and contribution of the boards of directors are important themselves. In this field, Nicholson and Newton (2010) analyze the effectiveness of the board from the perspective of directors and senior managers, identifying the impact of board members' profiles and the way in which boards operate, on their performance. Meanwhile, Valero and Lucas (2011) state that a board providing professional and highly qualified executives provides confidence to markets, which facilitates access to both credit and new commercial markets.

As we could expect, linked to the empirical side of hedonic theory, there are an abundant number of references that include regressions of executive compensation on firm and executive characteristics, such as Core et al. (1999), Johnston (2002), Cordeiro and Veliyath (2003), Frydman and Saks (2010), Graham et al. (2012), Sonenshine et al. (2016), Matveyev (2017) and Edmans et al. (2017), among others. Frequently, they are panel, mixed or pooled regressions with data of different time periods, often including fixed or random effects; as we will see later, we focus on mixed models in this study. Usually, executive compensation is expressed in logarithms, and so the coefficients of the regressors (for example, size, gender dummy, etc.) are interpreted as elasticities or semi-elasticities depending on whether the corresponding explanatory variable is expressed in logarithms or in levels. Frequently, these regressions use lagged variables, for example as measures of past firm performance.

In these references using regression analysis, one or more variables indicate the executive category (CEO, Chairman, CFO, internal-external directors, etc.). The most widely measure used for firm size is the market capitalization; however, assets, sales (or revenues) and number of employees are also considered. Regarding size, some regressions also use variables associated with mergers and divestitures. The executive talent is measured using indicators such as career paths, public reputation, educational attainments, and so on. As measures of firm performance, we find the return on assets (ROA), the return on equity (ROE), the stock market return, and the market-to-book ratio, among others. In addition to the level of firm performance, executive compensation is also related to its volatility, usually measured by the standard deviation of returns over a period of time. Executive compensation is also related to different measures which try to reflect the quality of corporate governance, such as the structure of the board (board size, proportion of external directors, independent or affiliated status, etc.), the ownership structure (percentage of executive and other

director's ownership, external blockholders, etc.), the number of directorships the executive holds in other firms, the use of external peer benchmarking in setting executive compensation, etc. Regressions also consider other executive characteristics such as age, tenure, internal or external promotion, gender and board attendance, and other firm characteristics such as industry classification, diversification and R&D intensity.

In addition to hedonic/regression models, the literature on executive compensation has made use of other models which are not in the focus of this paper, but that have an important relation to our hedonic approach. Successive developments of assignment models applied to the executive labor market have explained the positive assortative matching in the relation between individual talent, firm size and firm performance, to which we referred earlier –see, for instance, Rosen (1981, 1982), Terviö (2008) and Gabaix and Landier (2008). Frydman and Saks (2010) and Gabaix et al. (2014) reassess the validity of this model from a long-term perspective and make an update after the crisis, respectively. Two-sided matching models have been employed by Matveyev (2016) to estimate the mutual preferences of firms and executives, and by Pan (2017) to analyze match specificities, driven by complementary elements of firm and executive attributes. According to Roth (2015), the process of finding the best professionals responds to a two-sided matching process with asymmetric information, since the applicants (potential directors) have a lot of information on the companies (revenue, employees, debt, sector, ROE, etc., including the remuneration to their current BoD), while the companies do not know all the characteristics of the potential directors (training, experience, economic aspirations, personal interests, etc.), creating a problem of unrevealed asymmetric preferences. This asymmetry is the base of the head-hunting firm´s business.

Extensive literature on optimal contracting and principal-agent models analyzes the relation between executive compensation and firm performance mentioned above. Edmans and Gabaix (2009, 2016) and Edmans et al. (2017) survey this literature, whereas Frydman and Jenter (2010) survey the empirical evidence. In addition, Jensen et al. (2004) review history, analyses and recommendations related to institutional aspects and, finally, Rosen (1992) combines the assignment and contract-agency-incentive issues.

Our work is part of the reduced set of studies that employs multilevel regression analysis to explain the compensation of a board member (in the Spanish economy). This kind of analysis is relevant for listed companies, since if their directors are being compensated below the model prediction, they could become the target of head-hunting firms, which will make them proposals to change their boards for other more interesting and lucrative ones, thereby depriving the company of their talent and contribution. If, on the contrary, companies are overpaying, they will be reducing their bottom line unnecessarily, thus increasing overheads. The model is also important for top-level executives who are seeking to develop their careers in the field of listed company boards, since it provides them with information on the value of their personal and professional features, as well as on how to complete their experience and qualifications in order to increase their success in the boardroom.

To estimate the determinants of directors' compensation, a three-level model has been applied. This kind of econometric model assumes that the data has a hierarchical structure; the model recognizes the existence of such data hierarchies by allowing for random components at each level in the hierarchy. In our estimation, the fixed portion of the model is based on the characteristics of both the company and the directors currently holding the positions, while the random portion considers the existence of individual effects at the company and director level. Six different models have been proposed, depending on the structure of the random portion. The preferred specification has served to analyze the effect of the different regressors considered on directors' compensation and to measure intraclass correlations. Our flexible model let us combine directors and CEOs in the same analysis, since we control for the category within the board and for unobserved heterogeneity at the company and individual level.

The main contributions of this article are three: (1) to contrast the non-validity of the hedonic remuneration model with equally efficient workers through a mixed econometric model; (2) to show that unobserved heterogeneity at the level of companies and individuals must be controlled when explaining director compensation; (3) to use data from the Spanish economy, unexplored to date; the fixed coefficients of the mixed model (on observable characteristics of the companies and their directors) are compared with the existing international literature. The model has been applied to the largest Spanish listed companies (IBEX 35), which has been possible thanks to the transparent information on directors' remuneration in Spain in the recent past. This information comes from public and accessible sources, such as companies' annual reports and the annual transparency reports published by the *Comisión Nacional del Mercado Valores* (CNMV, National Stock Market Commission).

The rest of the paper is structured as follows. After this introduction, section 2 briefly develops the theoretical background of our empirical study, while section 3 describes both, the data sample, with variables at individual and company level, and the multilevel methodology. Section 4 applies the multilevel framework to the compensation of the directors of Spanish listed companies. Finally, section 5 highlights the main conclusions.

2. Theoretical background.

Perfect competition in the labor markets is compatible with wage heterogeneity as long as some jobs are more demanding than others (for example, because they require more skills) and some workers are more willing to accept this kind of high-demanding jobs than others. Perfect competition assures that these requirement differences are compensated by wage differentials. This is the essence of the hedonic theory of wages, in which there is a market for each kind of job corresponding to a certain batch of labor conditions and required skills.

Following Cahuc et al. (2014), in this section we briefly describe a hedonic model of remunerations which can be applied to the BoD. Let be an economy where there exists a continuum of jobs, each requiring one unit of labor but a different combination of features *v*. This variable *v* is a synthetic measure of the required skills and the non-wage conditions of the jobs, conditions such as accident risk, hours of work, environment, etc. Mathematically, *v* can be seen as a vector with as many coordinates as characteristics has the job position. For the sake of simplicity, let us divide *v* into environment characteristics *e*, routine skills *r*, and cognitive skills *c*, and keep the first two {*e*, *r*} constant. The productivity of each type of job *y* is an increasing and concave function of the job cognitive skill requirements *c*, $y = f(c)$, with $f'(c)>0$, $f''(c)<0$, and $f(0)=0$. Productivity (*y*) has a particular definition: it corresponds to the maximum or efficient production associated with each set of attributes {*e*, *r*, *c*} net of any costs occasioned by employment, except those related to remuneration. For example, if we interpret *c* as a measure of managerial competences, jobs more demanding of those competences have higher productivity in our model. A worker with information about all job vacancies, and enjoying perfect mobility, is able to search in different markets and choose the vacancy which provides the greatest utility or satisfaction. The optimization problem is as follows (where θ is the level of aversion to cognitive effort):

$$\max_{c} U(f(c), c, \theta) = f(c) - c\,\theta \qquad s.t. \quad w(c) = f(c) \quad (Perfect\ comp.condition) \qquad (1)$$

According to the so-called "effort aversion" phenomenon, some workers can avoid to choose effortful well-paid jobs even when they recognize that they will provide them with a better working experience. This aversion, applied to cognitive tasks, is named θ in our model –developing cognitive tasks can be unpleasant and/or tiring for some workers. The optimal solution, given by $f'(c) = \theta$ (first order condition), indicates that a job seeker chooses the job, i.e., the value of *c*, in which the marginal return to cognitive effort $f'(c)$ is equal to the disutility θ derived from the aversion to cognitive effort. As $f'(c)$ is decreasing with *c*, the optimal choice of cognitive effort c^* increases when effort aversion θ decreases.

Our model is compatible with the relatively high remuneration received by the directors of the BoD. Given that the equilibrium wage received by a worker of type θ amounts to $w[c(\theta)] = f[c(\theta)]$, it is true that: $w[c(\theta_1)] > w[c(\theta_2)]$ if $\theta_1 < \theta_2$. Every listed company may be thought of as a productive unit requiring one unit of labor (one director) to cover a job position with a particular high-demanding combination of attributes different from remuneration, especially cognitive skills. Only workers with a low aversion to (cognitive) effort will be suitable for this kind of vacancies.

The usual way to contrast the hedonic theory of wages consists of using microdata to estimate a regression model of the remuneration received by an individual as a function of personal characteristics and the non-remuneration characteristics of the job. In the hedonic model, remuneration differences reflect differences in working conditions {*e*, *r*, *c*} with all workers showing the same efficiency, and all jobs having identical productivity $y = f(c)$ if the work performed is identical. Breaking these assumptions about equal efficiency

affects the relation $y = f(c)$ as a technological shift-parameter and can generate contradictory results within the model, such as that of a negative relationship between effort and remuneration –Cahuc et al. (2014, p. 175). In empirical and econometric terms, the differences in efficiency between individuals (or firms) exist but are hardly observable –although proxy variables can be proposed. For example, in a BoD, individual efficiency depends on factors such as motivation and talent, features which are usually unobserved in empirical data. If the motivation of the director is not statistically controlled, and if it influences in the relation $y = f(c)$ as a shift-parameter, the regression model does not permit us to estimate correctly the impact of working conditions on remuneration, generating biased coefficients. For example, it could happen that a very motivated (efficient) director earned more than another less motivated (all other personal attributes equal), even holding a less demanding position in the board; this positive effect of the motivation variable would be hidden in the error term of the regression model. The need to correct biases in the regression model (linked to the existence of unobserved variables) justifies the use of multilevel models to estimate hedonic remunerations.

3. Data and methodology.

This section begins with a detailed description of the microdata sample under study (directors of the IBEX 35 companies in the period 2015-2017). The microdata corresponds to the directors of 34 out of the 35 companies that comprise the IBEX 35 stock index; we have 1458 sample observations with information about 531 directors and 34 firms (no complete data was found for the IBEX 35 company ARCELORMITTAL). The data has been obtained from official and public sources: National Securities Market Commission (CNMV), Iberian Balance Analysis System (SABI), corporate websites and Spanish Exchanges and Markets (BME).

The analyzed variables can be divided into two groups: one that corresponds to individual attributes of the directors, and a second one that describes the characteristics of the companies. The endogenous variable in our subsequent multilevel analysis will be the annual compensation of each director which is composed of several components: Remuneration = Salary + Fixed rem. + Allowances + Short-term variable rem. + Long-term variable rem. + Rem. for belonging to board committees + Compensations + Other concepts. According to available literature, director compensation may depend on personal attributes and firm-level features. In our data, the annual remuneration paid to the BoD as a whole represents a percentage of firms' annual revenue that ranges between 2.2% and 0.007%, the mean value being 0.2%.

Table 1 shows a statistical summary of the quantitative variables in the sample. At individual (director) level, the average payment observed in the sample is € 473.9 thousand per year, being the standard deviation of this variable € 964.5 thousand –the highest remuneration observed is € 12,170 thousand, which corresponds to the CEO and Chairman of INDITEX group. The average age of the directors (in the year 2017) is 64 years, and the average age in the year of admission to the board is 54 years. In general, the percentage of ownership presents very reduced values: less than 1% of the directors have a property in their company that

exceeds 1% –an exception is the president of MELIA-HOTEL, who holds 52% of the company's property. On the other hand, just over 10% of the directors belong to more than four boards (including the one registered in the sample), boards of directors that do not necessarily have to be from the IBEX 35 group.

Information about companies in Table 1 basically refers to their size and economic performance. In terms of size, it must be taken into account that IBEX 35 contains companies with high, medium and low free-float market capitalization. The companies with the greatest weight (in terms of capitalization) are INDITEX (textile sector), SANTANDER (financial sector), BBVA (financial sector) and TELEFÓNICA (communications), with a capitalization in the year 2017 of € 90.5, € 88.4, € 47.2 and € 42.1 billion, respectively. The smallest companies in 2017 are MELIA-HOTEL (€ 2.6 billion; hotels), INDRA (€ 2 billion; electronics and software) and TÉCNICAS UNIDAS (€ 1.47 billion; energy infrastructures).

Table 1. Statistical summary of quantitative variables. Directors and firms. 2015-2017.

Variable	Mean	Std. Dev.	Min	Max
Characteristics of the director				
Compensation (thousand €)	473.9	964.5	1	12,170
Year of birth	1954.8	8.9	1931	1980
Year of entry on the board	2009.3	6.6	1976	2017
Year of entry into the firm	2006	10.1	1956	2017
Ownership (%)	0.21	2.85	0	52
Attendances to board meetings per year	1	0.1	0.2	1
Belonging to other boards of directors	2.1	1.1	1	6
Characteristics of the company				
Annual revenues (thousand €)	14,922,289	15,631,603	216,781	54,916,000
Level of capitalization (thousand €)	17,520,761	20,477,438	1,422,865	101,073,024
Number of employees	46,173	56,300	120	202,251
ROI (%)	4.59	7.17	-18.89	31.16
5-year average ROI (%)	4.33	6.44	-5.06	29.08
ROE (%)	14.53	25.5	-123.56	123.1
5-year average ROE (%)	11.94	22.48	-76.68	77.78
Debt ratio (%)	98.62	118.86	0	559.2
Export sales (%)	54.43	33.85	0.1	99.9

In terms of financial performance, the rates ROI and ROE, for each firm and year (from 2015 to 2017), take the mean values of 4.6% and 14.5% respectively, although the standard deviations of these financial rates are relatively high. The correlation between ROE and ROI rates is high (0.71), with INDITEX being the company that shows the highest ROI values (which are greater than 25% in the years analyzed), and DIA-2015 (retail trade) and AMADEUS-2015 (IT solutions for the travel industry) being the companies that show the highest ROE (123.1% and 91.8% respectively); note that both companies have a high debt ratio. Furthermore, we observe that the correlation between ROI and ROE indicators and the company size (capitalization) is positive although relatively weak: 0.18 and 0.1 respectively. Looking at the 5-year average rates for the sample period (2015-2017), very different behaviors are observed. Thus, companies such as AMADEUS and INDITEX have obtained, in the analyzed period, 5-year average ROE values larger than 60%, and 5-year average ROI values greater than 17% and 27% respectively; meanwhile, other companies

have obtained negative 5-year average ROE and ROI, as is the case of INMCOLONIAL (real estate), SGAMESA (wind power) or INDRA (consultancy), among others.

Table 2 summarizes those qualitative variables in the sample. In terms of gender, it is observed that women represent 19% of the sample and have a remuneration that does not reach half of that received by men. The lower representation of women on the boards of directors does not seem to be justified by their academic background. This could be related, in our opinion, to the recent incorporation of women into management positions, as well as their limited presence, some decades ago, in the degree and master programs that most frequently feed the boards of directors today.

As for the variables "Category" and “Position” on the board, we start by clarifying the taxonomy of both terms. First of all, a director is any person who belongs to the BoD of the company. The mission of the BoD is to define the long-term strategy of the company, establishing the necessary control mechanisms to ensure that it is accomplished. On the other hand, the Steering or Executive Committee (EC), whose members are called executives, is responsible for resolving company's operational or tactical issues, which must align company's operation with the mandates set by the board. Regarding the BoD categories, those directors who are also members of the EC (performing executive functions) are called “Executive directors” or, simply, “executives”. The remaining members of the BoD (non-executive directors) can be classified into three groups: those who represent the ownership of the firm, called "Dominicals", a name that comes from the Latin word *domine*, which means owner; those independent professionals of recognized prestige who watch over the good governance of the company, named “Independents” –they protect small and unrepresented shareholders–; and those cases difficult to classify in the previous categories according to the information available on the director, called “Ordinary directors”.

Regarding the BoD positions, there is at least one person in the company who is simultaneously member of the BoD and the EC, reporting to the BoD about the performance of the company, and transmitting BoD's mandates to the EC. This relevant and demanding role is assumed by the Chief Executive Officer “CEO”, the person in charge of ensuring the transmission of the company strategy to day-to-day operations. The “Chairman” of the company has the responsibility to lead the BoD. In some cases, this individual may be simultaneously a member of the EC, in which case is called “Executive Chairman” or “Chairman & CEO”.

Table 2. Director's categorical attributes.

Accumulated data 2015-2017	Frequency	Percentage	Average compensation (thousand €)
Gender			
Male	1,103	80.87	532.7
Female	261	19.13	223.4
Category			
Independent dir.	709	51.98	159.5
Dominical dir.	310	22.73	149.8
Executive dir.	223	16.35	1978.2
Others	122	8.94	373.3
Position			
Ordinary dir.	1,198	87.83	257.9
Chairman	70	5.13	1546.7
CEO	67	4.91	1857.7
Chairman & CEO	29	2.13	3596.4
Higher education			
Economics or Business Adm. or Law	929	68.11	471.5
Engineering or Architecture or	274	20.09	541.8
Others	95	6.96	316.8
Without higher education	35	2.57	487.6
Engineering and Economics	31	2.27	409.3
Master			
Without Master	874	64.08	494.2
Business Administration	275	20.16	490.2
General Management Program	120	8.8	410.4
Economics	48	3.52	402.8
Others	39	2.86	241.0
Engineering	8	0.59	211.4
Ph.D.			
Without Ph.D.	1,161	85.12	480.8
Economics	70	5.13	504.8
Law	49	3.59	210.1
Engineering	40	2.93	615.2
Others	26	1.91	604.2
Business Administration	18	1.32	123.1

According to our data, Independent (52%) and Dominical (22.7%) categories are those that predominate in the sample; for their part, Executive directors represent only 16.3% of the sample and have an annual average compensation close to € 2 million, far superior to that earned by the rest of the categories –the category Others is grouping the rest of external directors.

Looking at the vertical position within the board, Chairman and CEO directors represent around 12% of the sample; those directors who combine both positions have an annual average remuneration that exceeds € 3.5 million –position Ordinary directors includes: Director, 1st, 2nd and 3rd Vice Chair, Vice Chair and CEO, Independent Coordinating Director, and Secretary Counsellor.

Our sample also contains information about the individual's higher education. We can assume that director's qualification and, to a certain extent, director's talent are positively related to their level of education. Qualification is defined as "the formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards" (European Commission, 2018, p. 7), while talent is more related to a person's natural ability to do something well. In our database, the degrees in Economics, Business Administration, and Law represent almost 70% of the sample, followed by studies in Engineering, Architecture, and Mathematics (20%). Only 36% of the directors have a master degree (mainly in Business Administration), and only 15% of the sample has Ph.D. studies (which are mainly in Economics).

The following graphs, Figures 1 and 2, relate the average compensation with the firm size and the activity sector respectively. The firm size is measured in terms of capitalization level, revenues and number of employees (annual average values for the period 2015-2017). In general, it is observed that larger companies tend to offer higher remuneration to their directors, which is a result usually observed in relevant literature (see, for example, Sonenshine et al. 2016, and Liu and Guo, 2017) –the R^2 coefficients range around 50% in the three scatters represented in Figure 1.

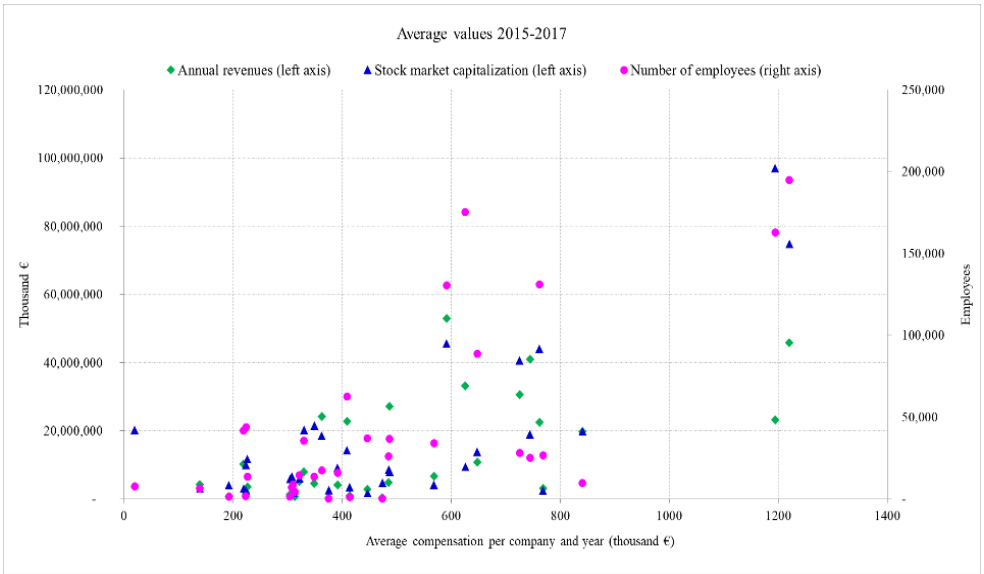

Figure 1. Relation between company size and average compensation.

The relation between the average compensation by activity sector and the weight of each sector in the IBEX 35 index (measured through the percentage of the total number of directors in the index belonging to each sector) is slightly positive (Figure 2). Some sectors show relatively high payments, as for example, the wholesale trade (€ 1190 thousand), metallic products (€ 768 thousand), oil refining (€ 740 thousand), building (€ 610 thousand), or financial services (€ 580 thousand); the directors of this last sector represent more than 20% of the IBEX 35 directors.

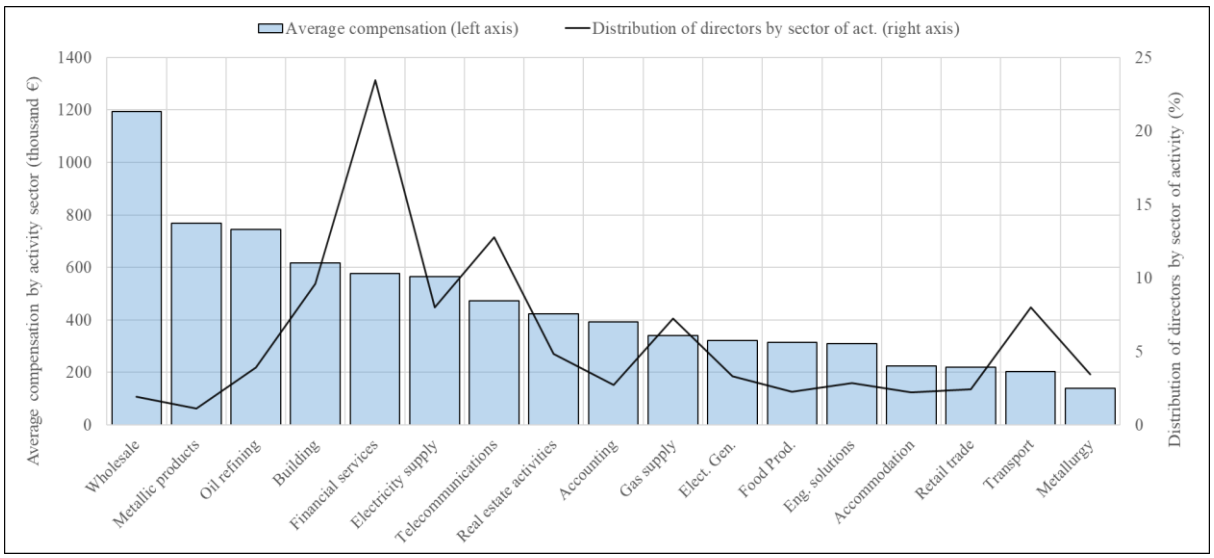

Figure 2. Relation between company's activity sector and average compensation.

Our descriptive analysis concludes with Figure 3, which explores the relation, for each company, between the annual financial performance, measured by the ROE and ROI indicators, and the annual average compensation. Although it is difficult to draw a clear conclusion from the figure, it seems that the relation between director compensation and shareholder profitability (ROE) is slightly negative, while the opposite happens if the performance indicator is the return on investment (ROI); our econometric analysis will shed more light on these relations.

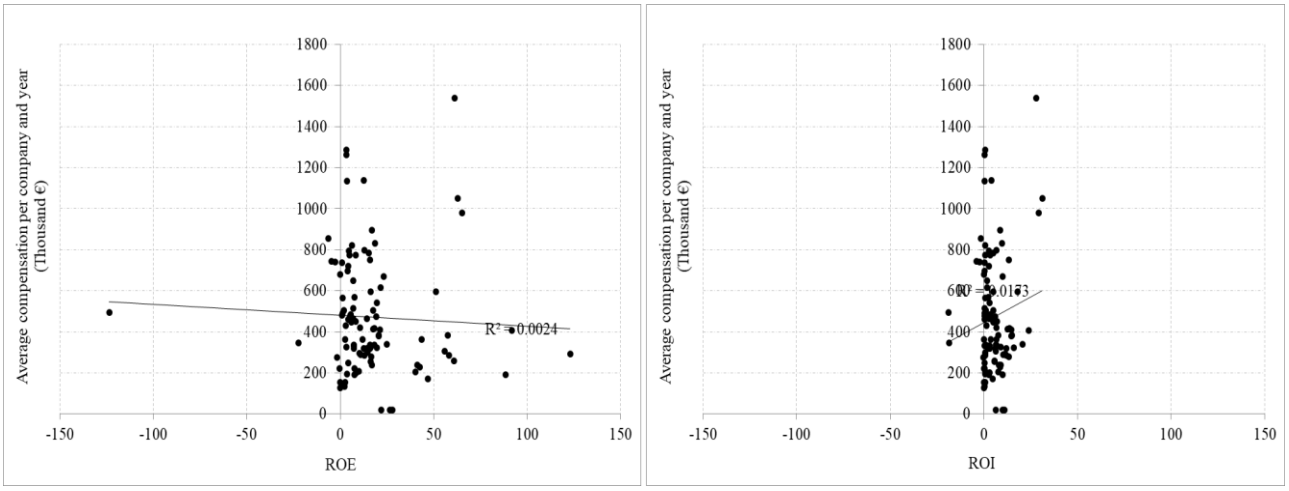

Figure 3. Relation between performance (ROI and ROE) and annual average compensation by firm.

An important feature of our data is that they have a hierarchical structure. Under hierarchical data structures, there is an exact nesting of each lower-level unit in one and only one higher-level unit. To understand this nested structure let us develop the following general example, with three levels, applied to a worker's salary: in a 3-level scheme, temporary observations of wages (which constitute the level one of the hierarchical structure) are nested in the upper level formed by the occupied workers who earn them (which constitutes the level two) –temporary observations of the wage of the same individual tend to be more alike than

observations chosen randomly from the occupied population. At the same time, the employees can be nested in their respective companies or employers (which form the level three) –employees of the same company tend to be more alike in their labor conditions (including salaries) than employees chosen randomly from the occupied population. Multilevel models recognize the existence of such nested structure by allowing for idiosyncratic variance components at each level in the hierarchy.

A specific case in which the random effects affect the intercept of a 3-level model can be represented as follows[1]:

Level 1 model: $Y_{tij} = \beta_{0ij} + \beta_1 X_{1tij} + \beta_2 X_{2ti} + \beta_3 X_{3tj} + u_{tij}$ **Level 2 model:** $\beta_{0ij} = \gamma_{00j} + \gamma_{01} Z_{ij} + v_{0ij}$ **Level 3 model:** $\gamma_{00j} = \alpha_{000} + \alpha_{001} W_j + w_{00j}$	(2)
u_{tij} iid~ $\mathrm{N}(0, \sigma_u^2), v_{0ij}$ iid~ $\mathrm{N}(0, \sigma_v^2), w_{00j}$ iid~ $\mathrm{N}(0, \sigma_w^2)$ $cov(u_{tij}, v_{0ij}) = 0, cov(u_{tij}, w_{00j}) = 0, cov(v_{0ij}, w_{00j}) = 0$	

Integrating the three models, we have:

$$Y_{tij} = \alpha_{000} + \alpha_{001} W_j + \gamma_{01} Z_{ij} + \beta_1 X_{1tij} + \beta_2 X_{2ti} + \beta_3 X_{3tj} + (v_{0ij} + w_{00j} + u_{tij}) \quad (3)$$

In this 3-level model, the mean prediction of the endogenous variable Y_{tij} depends on time-varying variables at different levels (X_{1tij}, X_{2ti} and X_{3tj}) and on the group *ij* average (β_{0ij}); this group-specific average, in turn, is composed of the global average of the group *j* (γ_{00j}) plus the part explained by the (continuous or factor) variable Z_{ij} plus the net specificity of the group *ij* (v_{0ij}). At the same time, the group *j* average (γ_{00j}) is composed of the global average (α_{000}) plus the part explained by the (continuous or factor) variable W_j plus the net specificity of the group *j* (v_{00j}).

4. Results and discussion.

Equation (4) exposes the 3-level model that we implement to study the determinants of the annual compensation of directors from the selected listed companies (*t* indexes years, *i* indexes directors, and *j* indexes firms).

[1] More complex mixed models, for example containing random slopes, can be consulted in Cameron and Trivedi (2005) or Goldstein (2011).

$$
\begin{aligned}
&\log(\text{compensation})_{tij} = \\
&= \alpha_{000} + (\alpha_1 \dots \alpha_{N-1}) \begin{pmatrix} D_{\text{SECTOR } 1_j} \\ \dots \\ D_{\text{SECTOR } N-1_j} \end{pmatrix} + \gamma_1 \, \text{GENDER}_{ij} \\
&+ (\beta_{1,1} \, \beta_{1,2}) \begin{pmatrix} \text{Year16}_{tij} \\ \text{Year17}_{tij} \end{pmatrix} + (\beta_{2,1} \, \beta_{2,2}) \begin{pmatrix} \text{AGE}_{ti} \\ \text{AGE}_{ti}^2 \end{pmatrix} + \beta_3 \, \text{TALENT}_{tij} \\
&+ \beta_4 \, \text{INDEMN}_{tij} + (\beta_{5,1} \, \beta_{5,2} \, \beta_{5,3}) \begin{pmatrix} D_{\text{EXECUTIVE}_{tij}} \\ D_{\text{INDEPENDENT}_{tij}} \\ D_{\text{OTHERS}_{tij}} \end{pmatrix} \\
&+ (\beta_{6,1} \, \beta_{6,2} \, \beta_{6,3}) \begin{pmatrix} D_{\text{CEO}_{tij}} \\ D_{\text{CHAIRMAN}_{tij}} \\ D_{\text{CHAIRMAN\&CEO}_{tij}} \end{pmatrix} + \beta_7 \, \text{ACCRUAL}_{tij} + \beta_8 \, \text{OWNERSHIP}_{tij} \\
&+ (\beta_{9,1} \, \beta_{9,2}) \begin{pmatrix} \text{SENIORCOMP}_{tij} \\ \text{SENIORCOMP}_{tij}^2 \end{pmatrix} + (\beta_{10,1} \, \beta_{10,2}) \begin{pmatrix} \text{SENIORBOARD}_{tij} \\ \text{SENIORBOARD}_{tij}^2 \end{pmatrix} \\
&+ \beta_{11} \, \text{LOG}(\text{REVENUE}_{tj}) + \beta_{12} \, \text{LOG}(\text{CAPITALIZ}_{tj}) + \beta_{13} \, \text{LOG}(\text{EMPLOYEES}_{tj}) \\
&+ \beta_{14} \, \text{ROI}_{tj} + \beta_{15} \, \text{ROE}_{tj} + \beta_{16} \, \text{DEBT}_{tj} + \beta_{17} \, \text{SIZEBOARD}_{tj} \\
&+ (v_{0ij} + w_{00j} + u_{tij})
\end{aligned}
\qquad (4)
$$

Following the literature on director's compensation, the endogenous variable of our model is the director compensation expressed in logarithms. As for explanatory variables, at the company level, we control for the activity sector; for the company size measured through annual revenues, capitalization, and number of workers; and for the economic performance measured through ROI, ROE and debt ratio. At the worker level, we control for personal attributes such as gender, age and talent; and for professional attributes such as the category and position on the board, the seniority in the company and on the board, the percentage of firm ownership, the annual accrual in the board, and the possible existence of indemnifications. Finally, a temporary dummy variable allows control for the year to which each sample observation corresponds.

All this observed heterogeneity constitutes the fixed part of the mixed model, which allows us to obtain the mean prediction of the dependent variable conditioned on the values of the regressors. The coefficients of the dummy variables (which are activity sector, gender, talent, category and position on the board, indemnification, and year) condition the global intercept of the model, while the coefficients of the continuous variables (the rest of regressors) refer to the model slopes or marginal effects.

The mixed model incorporates in this fixed portion a random portion that allows us to control for unobserved heterogeneity through the existence of three levels of residuals: the one due to differences between companies (level 3, w_{00j}), the one due to differences between workers (level 2, v_{0ij}) once we control for the (observed and unobserved) differences between companies, and the one due to differences between years (level 1, u_{tij}) once we control for the (observed and unobserved) differences between companies and

between workers. These random effects condition, not the mean prediction or expected value of the dependent variable (as $E(v_{0ij}) = E(w_{00j}) = E(u_{tij}) = 0$), but its variance; allowing us to obtain, in addition, individual predictions that take into account that unobserved heterogeneity.

Our 3-level model has to be estimated by using maximum likelihood techniques (or by Bayes methods) since it comprises a composite error term whose variance is partitioned into a between-company variance component (the variance of the level 3 residuals), a between-worker variance component (the variance of the level 2 residuals), and a between-year variance component (the variance of the level 1 residuals). Table 3 shows the different specifications that have been estimated, which differ depending on whether the various levels represent fixed or random intercepts and whether some intercept dummy variables are allowed to have random coefficients.

Table 3. Model comparison. Models on directors' compensation. IBEX 35 companies. 2015-2017.

Endogenous variable: Director's compensation (log)	(1) OLS	(2)	(3)	(4)	(5)	(6)
Level 3 random effects			Activity sector		Company	Company: Category and Position
Level 2 random effects		Activity sector	Company	Company	Director	Director: Category and Position
Level 1 random effects	annual compensation	annual compensation	annual compensation	annual compensation	annual compensation	annual compensation
Number of observations	1363	1363	1363	1363	1363	1363
Log-likelihood function	-1200.29	-1240.62	-1077.44	-1064.18	-868.56	-822.87
AIC	2486.57	2539.24	2214.87	2218.36	1829.11	1741.73
BIC	2710.93	2690.55	2371.4	2453.14	2069.11	1992.17
LR test vs. linear model (Prob > chi2)		0.00	0.00	0.00	0.00	0.00

Respective likelihood-ratio tests confirm that all multilevel models –models from (2) to (6)– offer a significant improvement over the linear regression model (1). Models (2) and (3) explore the possibility of including random intercepts linked to the activity sector of the company. Model (2) only considers the activity sector as a random intercept, while model (3) also includes another random term linked to the company level. The likelihood-ratio χ^2 test for the null hypothesis of "no different in fit between nested models" allows the rejection of that hypothesis for models (2) and (3), favoring the more complex model (3). Moreover, the variance of the random intercept of the activity sector is non-significant in model (3), the variance of the random intercept for the company level being significant; therefore, we have chosen to introduce the activity sector in the fixed part of the model (through dummy variables) and the company level as a random intercept, which gives rise to model (4). Model (4) is nested in model (5) which, in turn, is nested in model (6). Model (5) introduces a second source of variation in model (4) by introducing the level of the director (level two) into the model, while model (6) extends model (5) by allowing some dummy coefficients to be affected by the two nested director and company levels; specifically, random coefficients

have been estimated for the factor variables category and position on the board[2] –the rest of the regressors coefficients do not show random behavior at the two levels considered. The likelihood-ratio χ^2 test of "no different in fit between nested models" favor model (5) over model (4) and model (6) over model (5). Moreover, Akaike's and Schwarz's Bayesian information criteria (AIC and BIC) favor model (6), which therefore provides a better representation of the data than the rest of the models.

Table 4 shows the estimated results of models (5) and (6), and also of regression model (1) in order to compare the coefficients obtained. Regarding the fixed part of the model, specifications (5) and (6) offer similar results. Thus, in both models, the payments to directors in years 2016 and 2017 are approximately 7% higher than those earned in 2015; this percentage moves between 9% (2017) and 12% (2016) in the OLS regression (model 1). We must bear in mind that the average annual inflation in the Spanish economy in the three years analyzed has been approximately 1%, and the growth rate was relatively high. This procyclical behavior is also observed in the recent past in the United States –see, for instance, Frydman and Saks (2010), Gabaix et al. (2014) and Sonenshine et al. (2016)–; the evidence of this last study also suggests that CEO compensation became more closely linked to firm performance after the 2008 financial crisis.

[2] Note that model (5) is the one that corresponds to equation (4), with model (6) incorporating in model (5) purely random effects in the coefficients of dummy variables for Category $\{\beta_{5,1}, \beta_{5,2}, \beta_{5,3}\}$ and Position $\{\beta_{6,1}, \beta_{6,2}, \beta_{6,3}\}$ on the board.

Table 4. Estimation results. Models on director´s compensation. IBEX 35 companies. 2015-2017.

Endogenous variable: Director's Compensation (thousand €) (log)			(1)	(5)	(6)
Period (level 1)	dummy of the year (reference: 2015)	2016	0.12*** *0.000*	0.07*** *0.000*	0.07*** *0.000*
		2017	0.09** *0.020*	0.07*** *0.010*	0.06*** *0.010*
Time-varying personal attributes (level 1)		Age	0.07*** *0.000*	0.07*** *0.000*	0.07*** *0.010*
		Age^2	-0.0006*** *0.000*	-0.0006*** *0.000*	-0.0006*** *0.010*
		Talent (dummy) (ref.: without)	0.16*** *0.000*	0.040 *0.480*	0.040 *0.520*
Time-constant personal attributes (level 2)		Gender (dummy) (ref.: women)	0.060 *0.180*	0.10* *0.070*	0.040 *0.460*
Professional attributes (level 1)	Category (ref.: Dominical dir.)	Executive dir.	1.75*** *0.000*	1.60*** *0.000*	1.76*** *0.000*
		Independent dir.	0.060 *0.180*	0.080 *0.130*	0.040 *0.610*
		Other external	0.31*** *0.000*	0.21*** *0.010*	0.28** *0.020*
	Position (ref.: Ordinary dir.)	CEO	0.5*** *0.000*	0.47*** *0.000*	0.49*** *0.000*
		Chairman	0.9*** *0.000*	0.99*** *0.000*	0.94*** *0.000*
		Chairman & CEO	1*** *0.000*	0.79*** *0.000*	0.72*** *0.000*
		Annual accrual	0.005*** *0.000*	0.005*** *0.000*	0.005*** *0.000*
		Ownership (%)	-0.010 *0.110*	0.01** *0.040*	0.016*** *0.000*
		Indemnification dummy (ref.: without)	1.02*** *0.000*	1.46*** *0.000*	1.05*** *0.000*
	Seniority in the company	SeniorityCompany	0.05*** *0.000*	0.04*** *0.000*	0.037*** *0.000*
		$SeniorityCompany^2$	-0.001*** *0.000*	-0.001*** *0.000*	-0.0008*** *0.000*
	Seniority on the board	SeniorityBoard	-0.025*** *0.010*	-0.020 *0.120*	-0.011 *0.370*
		$SeniorityBoard^2$	0.001*** *0.000*	0.00*** *0.010*	0.001 *0.130*
Company characteristics (level 3)		Revenues (log)	0.26*** *0.000*	0.23*** *0.010*	0.22*** *0.002*
		Capitalization (log)	-0.19*** *0.000*	0.070 *0.370*	0.070 *0.310*
		Number of employees	0.00*** *0.000*	0.000 *0.770*	0.000 *0.920*
		ROI (%)	-0.02*** *0.000*	-0.001 *0.840*	0.001 *0.680*
		ROE (%)	-0.001 *0.530*	-0.001 *0.150*	-0.002** *0.030*
		Debt ratio (%)	0.0007** *0.010*	0.0007** *0.010*	0.0005** *0.040*
		Number of members on the board	-0.06*** *0.000*	-0.010 *0.270*	-0.006 *0.270*
Company activity sector	Dummies for activity sector (ref.: Transport)	Real estate activities	1.47*** *0.000*	1.58*** *0.000*	1.60*** *0.000*
		Oil refining	1.6*** *0.000*	1.48*** *0.000*	1.55*** *0.000*
		Food products	1.26*** *0.000*	1.60*** *0.000*	1.30*** *0.000*
		Wholesale	1.31*** *0.000*	1.30*** *0.010*	1.26*** *0.000*
		Electricity supply	1.53*** *0.000*	1.30*** *0.000*	1.18*** *0.000*
		Eng. solutions	0.62*** *0.000*	1.14** *0.010*	1.10*** *0.010*
		Accounting	1.14*** *0.000*	0.93** *0.030*	1.08*** *0.000*
		Gas supply	1.38*** *0.000*	1.04*** *0.000*	1.07*** *0.000*
		Financial services	0.97*** *0.000*	1.11*** *0.000*	1.07*** *0.000*
		Telecommunications	0.94*** *0.000*	0.98*** *0.000*	1.01*** *0.000*
		Metallic products	0.43** *0.010*	0.93* *0.050*	0.97*** *0.010*
		Elect. Gen.	1.07*** *0.000*	1.15*** *0.010*	0.94*** *0.010*
		Building	0.35*** *0.000*	0.85** *0.010*	0.89*** *0.000*
		Accommodation	0.26* *0.070*	0.78* *0.090*	0.580 *0.160*
		Metallurgy	0.56*** *0.000*	0.470 *0.290*	0.410 *0.260*
		Retail trade	0.190 *0.240*	0.30 *0.520*	0.32 *0.420*
		Constant	-0.310 *0.730*	-4.79*** *0.000*	-4.62*** *0.001*
var(Residual). Estimate (Std. Err.)			0.35	0.1*** (0.005)	0.08*** (0.004)
Random-effects Parameters. 3rd level: firm. Estimate (Std. Err.)		var(random intercept) var(random slope of category) var(random slope of position)		0.12*** (0.036)	 0.06*** (0.03) 0.1*** (0.04)
Random-effects Parameters. 2nd level: director. Estimate (Std. Err.)		var(random intercept) var(random slope of category) var(random slope of position)		0.2*** (0.017)	 0.13*** (0.03) 0.07*** (0.03)

- Time-varying personal attributes (level 1 variables):

The effect of a change in the director age on compensation fits (in the three models) to the semi-elasticity $\partial \log(payment)/\partial Age = 0.007 - 0.0012\, Age$, which takes negative values in the age range of the sample; for example, an age change from 49 to 50 years reduces the compensation by approximately 5%, while a change from 59 to 60 years old reduces it by 6.4%. Johnston (2002) shares our result and states that younger CEOs earning more than their older counterparts may be identifying high-fliers.

To check the hypothesis of Cahuc et al. (2014), according to which the most efficient CEOs are hired by the largest firms, which enable them to benefit from higher compensations, we have built a dummy variable (called "Talent" in the models) that takes value 1 if the director has a master degree and is also in a company located above the median of firms in terms of capitalization (these directors represent 16.2%, 18.5% and 19.1% of the sample in the years 2015, 2016 and 2017, respectively). If this interaction effect were significant, it could indicate that, between two individuals with master degree (i.e., a proxy of efficient or highly-talented directors), the one in a larger company receives a higher compensation for talent (once we control for the other characteristics). The coefficient is clearly significant and positive in the OLS model, with payments 17.4% ($\exp(0.16)-1$) higher for those talented directors who are in large companies, but this coefficient loses its significance in multilevel models (5) and (6), which would indicate that the compensation premium observed in model (1) is absorbed in those mixed models by the individual and/or company random effects; of course, the unobserved heterogeneity underlying these effects may have to do with director´s talent, requiring further information apart from master studies.

- Time-constant personal attributes (level 2 variables):

The dummy variable for gender is significant in mixed model (5), indicating that men earn 10% more than women solely for being men; however, this effect is diluted in model (6) when random coefficients are introduced in the factor variables category and position on the board; consequently, the overpayment of males observed in model (5) seems to be related to those factor variables, and not so much to director's gender. This non-significant result of gender in model (6) contrasts with the data presented in Table 2 (where one might conclude that female directors have a compensation 60% lower than that of male directors) and agrees, for example, with the results by Edmans et al. (2017) and Graham et al. (2012); moreover, these last authors point out that observable time-invariant characteristics (such as a gender dummy) can be absorbed into the manager or firm effects.

- Time-varying professional attributes (level 1 variables):

Professional attributes of the directors play an important role in the models. In the most complete specification, model (6), category and position on the board determine both the expected value of the

remuneration and its variance. For example, in terms of expected value, those directors who hold the category of Executive director are expected to earn more than five times what a Dominical director earns, while those directors who hold the position of Chairman (or Chairman and CEO) are expected to earn more than twice what other directors receive –similar results are offered, for example, by Graham et al. (2012)[3] and Core et al. (1999); as in our case, the last authors observe that CEO compensation is higher when the CEO is also the board chair.

Other professional attributes showing influence on compensation are the annual accrual (measured in days on the board in each year), with a semi-elasticity of 0.005; the ownership percentage, with a semi-elasticity of 0.016 (this result contrasts with those of Core et al. (1999) and Cordeiro and Veliyath (2003); according to this last article, there exists a substitution effect (not observed in our data) between CEO cash compensation and incentives furnished via stock ownership); receiving indemnification, which multiplies the payment by 2.9; and seniority in the company (measured in years), which affects compensation following the expression $\partial log(payment)/\partial seniority\ in\ firm = 0.037 - 0.0016\, Seniority$, which implies that the maximum remuneration is reached after 23 years in the company. Ma and Pan (2017) state that better matched executive-firm pairs last longer and that job tenure can be indicative of human capital investment; both effects can explain the positive relationship between seniority in the firm and director's payment, at least up to a certain level of seniority. Finally, seniority on the board is non-explanatory in the more complete model (6).

- Time-varying company characteristics (level 3 variables):

Three characteristics of the company, apart from its sector of activity, have been explanatory of the director compensation: sales (or revenues), ROE and debt ratio. The company revenue shows an elasticity somewhat higher than 0.2 –value within the range found in some studies (see, for example, Sonenshine et al. 2016, and Liu and Guo, 2017)[4] but somewhat greater than the elasticity between 0.06 and 0.11 obtained by Cordeiro and Veliyath (2003) for the U.S. economy. The ROE index coefficient implies a small negative semi-elasticity of –0.002, which could mean that some kind of trade-off exists between remuneration to shareholders and board; this negative relation is also obtained by Aduda (2011) for the Kenyan banking sector, but contrasts with the positive ROE effect observed for the U.S. by Ma and Pan (2017) and Edmans et al. (2017). Finally, the debt ratio, calculated as: $(Noncurrent\ liability\ +\ Financial\ debts)100/Equity$, shows a very small positive semi-elasticity of 0.0005.

[3] According to these authors, the dummies for position on the board potentially capture two influences that determine compensation: a person-specific effect (i.e., skilful persons become Chairman or CEO) and a job promotion effect (a pay increase as a result of a non-CEO or Chairman being promoted to CEO and/or Chairman). In models without manager-fixed or random effects, these dummies might be capturing both influences.

[4] As Sonenshine et al. (2016), we also tested the market capitalization for firm size (and also the number of employees), but the specification with sales has shown a better fit.

- Time-constant company characteristics (level 3 variables):

In terms of activity sectors, companies in real estate activities and oil refining pay their directors about five times more than those firms in the transport sector (reference sector in the estimation), while the food products, wholesale, electricity supply and engineering solutions sectors pay about 3.5 times more than the reference sector, and the accounting, gas supply, financial services, telecommunications, metallic products, electricity generation, and building sectors are paying about 2.5-3 times more. Finally, accommodation, metallurgy and retail trade sectors show a pattern similar to that of the reference sector.

The analysis of the random portion of the models begins with the ICC (Intraclass Correlation Coefficient) estimation. Our 3-level nested models (5) and (6) present two intraclass correlations. The first is the level-3 intraclass correlation at the company level (the correlation between payments in the same firm), and the second is the level-2 intraclass correlation at the within-firm level (the correlation between the payments for the same director and company). Correlations among observations in the same company is 0.3, while for the same company and director is 0.77 –in other words, 77% of the overall variation in the response variable is explained simply by clustering the data in three levels. This result contrasts with that obtained by Ma and Pan (2017), which give more relative importance to the firm effect in relation to the director effect –these authors also control for a "match effect" to consider the compensation consequences of increased productivity from positive assortative matching between "good managers" and "good firms".

Mixed-modelling research often focuses on the fixed effects, with random effects included only to control for unobserved heterogeneity in the data. However, random effects can themselves be values of interest. Mixed model estimations offer the possibility of estimating the best linear unbiased predictions (BLUP) of random effects. Figure 4 depicts the random intercepts for companies and workers in mixed model (5). For example, as can be seen in panel (a), at any level of the explanatory variables in model (5) director's compensation (in logarithms) averaged about 1.4 points lower among AENA directors and about 0.7 points higher among IAG-IBERIA directors. At the same time, panel (b) shows that, controlling for observed heterogeneity and for the random effect of the company, director's compensation (in logarithms) ranges between -2.2 and 1.8 among directors; i.e., some directors earn more (or less) money than others for reasons that are not explained by the company effect and the fixed part of the model.

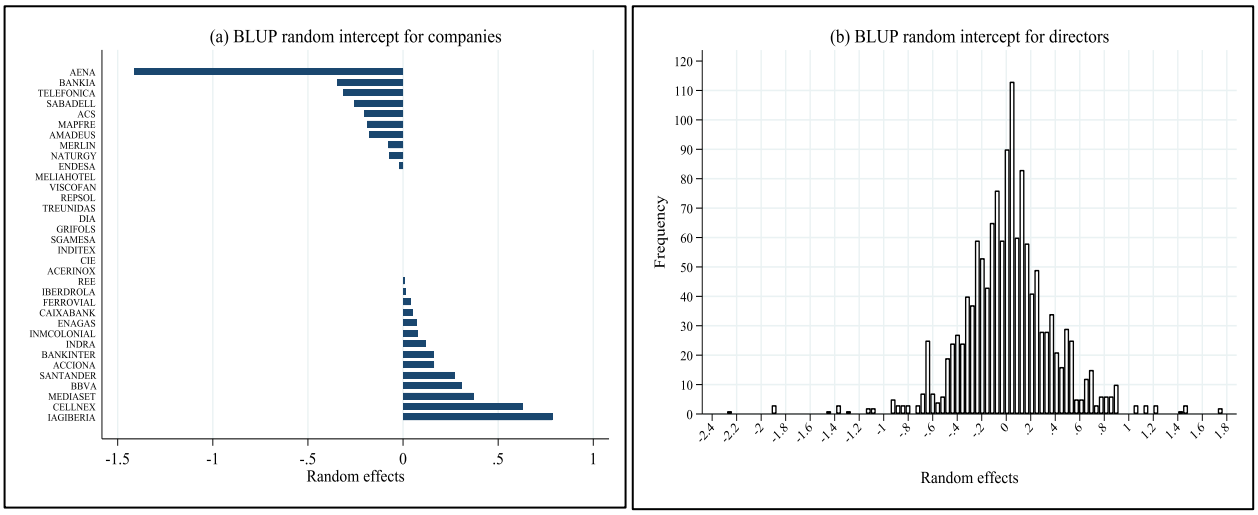

Figure 4. Level 2 and 3 random intercepts of mixed model (5).

Model (6) supports the hypothesis that random intercepts estimated in model (5) may depend on the position and category of the director within the board[5] –also, other random effects (both intercepts and slopes) have been tested within the model but without significant results. Table 5 shows how the random intercepts at firm-level and director-level vary across positions and categories on the board. Indeed, there are significant differences between the different labels of those variables. For example, the differences between companies and between directors are accentuated if the position of the director is Ordinary (mainly Vice Chairman) or Chairman –this could be due to the different roles that these kinds of directors can assume in their companies. Additionally, the executive category shows a larger standard deviation, in relative terms, at the individual level than at the company level; in other words, being an Executive director generates more significant differences (in relation to the other categories) among directors than among companies.

Table 5. Descriptive analysis of random intercepts in model (6).

(a) Random intercepts by levels and position

Random intercepts		Obs.	Std. Dev.	Min	Max
Company	Ordinary directors	1,197	0.29	-1.09	0.56
	Chairman and CEO	29	0.26	-0.66	0.35
	Chairman	70	0.20	-0.32	0.50
	CEO	67	0.14	-0.39	0.25
Director	Ordinary directors	1,197	0.13	-0.86	0.60
	Chairman	70	0.13	-0.32	0.29
	Chairman and CEO	29	0.11	-0.21	0.23
	CEO	67	0.09	-0.25	0.17

(b) Random intercepts by levels and category

Random intercepts		Obs.	Std. Dev.	Min	Max
Company	Dominical	309	0.34	-1.09	0.56
	Independent	711	0.28	-1.09	0.56
	Other external	120	0.23	-0.43	0.43
	Executive	223	0.21	-1.09	0.43
Director	Executive	223	0.17	-0.72	0.60
	Other external	120	0.15	-0.31	0.48
	Dominical	309	0.12	-0.55	0.60
	Independent	711	0.11	-0.86	0.58

Our empirical analysis concludes by comparing the individual predictions of models (1), (5) and (6) with our real data –see Figure 5. The points below the bisector imply predicted payments below the observed values, and vice versa; these gaps would be the level 1 residuals in the mixed models. As expected, the model (6) –black dots in the figure– is the one that shows a better adjustment to the bisector, which does not prevent it

[5] The coefficients of variables category and position have been estimated as random slopes in model (6), but given their character of dummy variables (0 or 1), they end up conditioning the intercept of the mixed model.

from showing positive and negative level 1 residuals. For example, recovering the levels of the actual and predicted compensation (model (6)), it is observed (and hardly explainable) that some directors are earning 2, 3 and up to 6 times more than the expected value generated by the fixed-portion linear prediction plus the contributions based on predicted random effects. Level 2 and 3 residuals of models (5) and (6) may be related to unobserved variables that are relatively stable over time (in the short run), such as the talent, education level, skills and political background of the director, at level 2 (directors), or the degree of internationalization, corporate governance and R&D expenditure of the company, at level 3 (firms). Moreover, the level 1 residuals are linked to more isolated or infrequent events. In our opinion, the existence of malpractices by some individuals might not be ruled out as explanatory of level 2 and level 1 perturbations –however, we do not think that unfair practices are common at company level, at least in Spain.

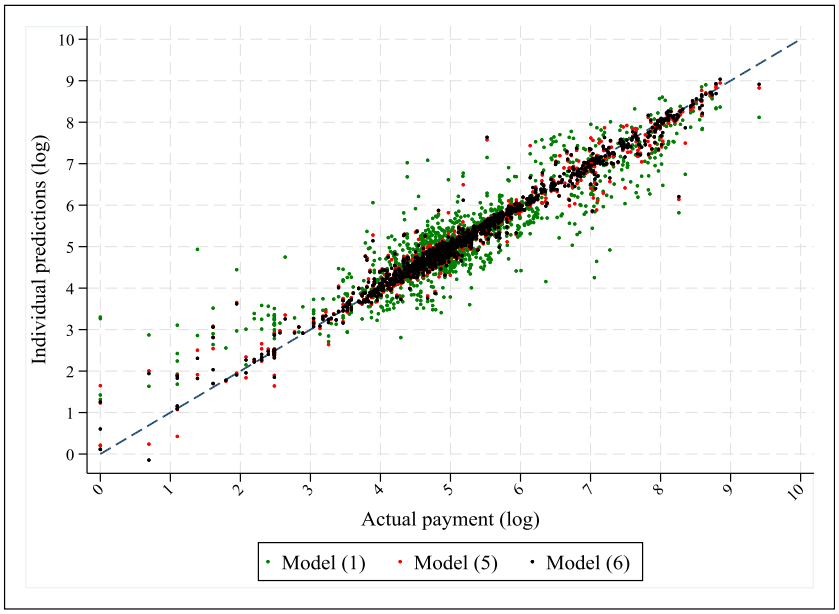

Figure 5. Individual predictions vs. actual data.

5. Conclusions.

This paper aims to explain directors' compensation of a sample of Spanish listed companies. It is worth noting the scarcity of this type of study in the Spanish market. Our empirical analysis has been possible due to the recently established transparency programs of the national regulators, which provide detailed information on both, the companies and directors' curricula vitae.

The model proposed is based on a multilevel econometric approach, which uses three random levels (years, directors and firms) to take into account the hierarchical structure of the data. Six specifications have been evaluated with different configurations of the random portion of the model. The results obtained point to significant determinants at both firm and director level.

The fixed portion of the mixed model begins by showing a 7% increase in remuneration between 2015 and 2016, but payment stability between 2016 and 2017. This payment evolution above overall inflation might be due to the recent focus of companies in Spain on modernizing and professionalizing the governance structures of listed companies, in order to adapt them to codes of best practice.

Regarding company's features, a significant and positive relation is observed for the revenue of the company, presenting an elasticity of about 0.2. This means that the directors of a company that generates double the revenue of another one will have a 20% higher compensation, all other factors being equal.

As for the financial structure of the company, it seems to have a small but significant effect on compensation. Thus, companies with higher debt ratios pay a little bit more to their directors –it must be borne in mind that access to credit markets can be a sign of a company's progress. On the other hand, a greater ROE negatively affects compensation, which could imply a conflict of interest between shareholders and directors, although in practical terms, as we have shown, these values have no impact on directors' compensation.

Another significant determinant that has been identified for companies is the sector in which they operate, where the real estate, oil refining and food product sectors are highly paid, while, on the other hand, transport, retail trade, metallurgy and accommodation sectors obtain below-average remunerations. One would expect that the highest paid sectors are also those where the knowledge, network and influence of directors have greater impact on the results.

Concerning the influence of the personal attributes of the directors, the position they hold on the board is particularly relevant, with executives (CEOs and Chairmen) enjoying a significant higher remuneration. The fact that the gender variable is not significant is particularly relevant, so the apparent imbalance in average earnings is not mainly due to gender, but to other explanatory variables.

As for the random portion of the model, we find that a considerable proportion of the variation in director compensation is explained by the unobservable heterogeneity. Level 2 and 3 residuals may be related to unobserved variables that are relatively stable over time (in the short run), such as the talent, education level, skills and political experience of the director, at level 2 (directors), or the degree of internationalization, corporate governance and R&D expenditure of the company, at level 3 (firms). However, the level 1 residuals are linked to more isolated or uncommon events. In our opinion, the existence of malpractices by some individuals could be explanatory of level 2 and level 1 perturbations; as previously mentioned, we do not think that unfair practices have been common in the period following the crisis. The unequivocal existence of unobserved heterogeneity at two levels validates the hedonic theory of remuneration once we break the model assumption of equal efficiency; this is, if we admit that different individuals (directors) can present different levels of efficiency while performing the same job position.

The results achieved in this research might be of interest both to the companies (to find out if they are overpaying their directors or if, on the contrary, they might be at risk of losing their best directors), and to top-level professionals, who as a result of our approach could focus their education and experience on those sectors and firms in which they can obtain better conditions.

Additional research would be welcome in this important field of study, for instance explaining what underlies the unobserved heterogeneity revealed by our analysis or identifying the random effects that change over time. In addition, we think that the multilevel approach deployed in this work has potential applications in the areas of finance, economics and accounting, given that disentangling both manager and firm effects is relevant and meaningful.

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