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Who are the controlling shareholders? Degree and seniority of control, and CEO pay monitoring

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Abstract

Based on CEO pay monitoring in French listed companies, this study first searches for the relevant metric of *controlling shareholdings*. The equity share held by the largest shareholder directly or indirectly represented on the board of directors, plus shareholders acting in concert with it, is associated with effective control – while other blockholders, whether or not they sit on the board, and deviations from "one share-one vote", do not enhance monitoring. Second, a panel threshold regression (PTR) model allows to identify various regimes of control. Four regimes are found in the *degree of control*. A threshold at about 10% of equity separates out "non-controlled" from effectively-controlled firms; three regimes of effective control are then identified. They are termed as "influential" (from about 10% to one-third of equity), "dominant" (up to about 45%), and "majority" (over 45%) controls. Specifically, CEO pay packages provide evidence of entrenchment for dominant controlling shareholders. Then, this study introduces *seniority of control* as a second criterion for effective control. The PTR model allows to distinguish two regimes termed as "new" and "long-term" control: new controlling shareholders need about six to eight years to reduce asymmetries of information and no longer rely on alternative monitoring devices. The study lastly discusses the relevance of discontinuous threshold effects compared to some continuous specifications found in the literature on ownership. (*JEL*: G32; G34; L22)

Keywords: Corporate control, CEO compensation, Panel threshold regression (PTR)

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1. Introduction

Large shareholders may have the voting power to influence the governance of a firm and the monetary incentive to engage in management monitoring activities (Shleifer & Vishny, 1986). Hence they may influence major corporate decisions and significantly impact the firm's strategy and performance. Nevertheless, very little is known about the necessary conditions for assigning the monitoring of the firm to one or several large shareholders. In the first instance, as pointed out by Bhagat et al. (2004) and Holderness (2003; 2009), there is no guidance in the literature as to the portion of shares or votes required to exert a significant influence on a firm's governance, and no consideration is given to the effects of time and large shareholders' experience on the control of a firm. There is also no consensus as to the relevant measure for the identification of the controlling shareholders among the major shareholders in a given firm. Because concentrated ownership and large shareholdings are essentially the rule around the world (La Porta, et al., 1999; Faccio & Lang, 2002), and because financial markets have developed tremendously in many countries in recent decades (bringing about major, rapid changes in ownership structures), the questions of how and to what degree a firm is controlled need further investigation.

So far, the literature about large shareholdings provides few evidence of the relevant metrics to assess whether a firm is controlled or diffusely-held, and few identification criteria to gauge the extent to which top managers may be monitored. Table 1 supports this statement by providing a survey of ownership influence metrics found in the literature. *Survey A* of the table specifically provides a perspective on the measurements of large shareholdings found in some seminal and reference studies. At first glance, there is a broad and heterogeneous range of alternative measures for assessing the effects of large shareholdings. The first major alternative is to focus either on ownership concentration and the existence of blockholders[1] (*Survey A1*), or on the controlling interest held by the largest or ultimate largest shareholder (*Surveys A2 and A3*)[2]. However, none of these studies attempt to define the most relevant metrics for determining control. Some studies test the impact of all blockholders and then, that of the largest shareholder as a robustness check (Dyl, 1988), others control for the existence of internal and external blockholders while

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[1] Blockholders are shareholders that individually hold more than 5% of equity.

[2] Studies are classified into sub-surveys according to the main variable of interest. Some of these studies also use other ownership measures (for instance, the existence of outside blockholders in Surveys A2 or B), but only as control variables and not for the purpose of disentangling their respective impacts.

testing the impacts of equity shares held by the largest shareholder (Cyert, et al., 2002). These studies thus use various metrics of corporate control for the purpose of robustness checks or as control variables. As such, none of them attempt to separate out the relative influence of each metric and its specific role in monitoring[3].

A second alternative lies in the measure of the degree of control as displayed in the second column of the table. The authors either choose a continuous or discontinuous measure of large shareholdings. Among the set of studies focused on ownership concentration and blockholders (*Survey A1*), two early studies rely on the weight and concentration of the top five shareholders (Demsetz & Lehn, 1985; Dyl, 1988). Still, most authors that measure ownership concentration first identify the companies that have at least one blockholder, then some authors choose a discontinuous measure (an indicator variable takes value one when at least one blockholder exists, and zero otherwise) and others a continuous measure (the portion of equity shares held by all blockholders). Other authors introduce a discontinuous and dichotomous perspective between "owner-controlled" companies with at least one blockholder, and "management-controlled" companies with no blockholders that are supposedly controlled by their managers. Among the set of studies focused on the largest or ultimate largest shareholder (*Surveys A2 and A3*), the authors adopt similar approaches by choosing either a categorical discontinuous measure (Holderness & Sheehan, 1988) or a continuous one. Among all studies in *Survey A*, only Dyl (1988) and Hambrick and Finkelstein (1995) discuss the choice between continuous or discontinuous measures. Dyl contends that a continuous measure is more appropriate in an "agency" context but does not provide a rationale or empirical test for the validity of this assertion. Conversely, Hambrick and Finkelstein assert that a discontinuous measure is more appropriate to assess the vigilance of a major shareholder. They argue that as soon as he/she/it holds a significant position, an increase by a few percentage points in equity shares should not substantially increase his/her/its vigilance. The authors run a test for the respective impact of a discontinuous vs. a continuous measure (see Table) on CEO pay and conclude that there is a threshold effect rather than a continuous relationship with ownership.

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[3] Table 1 only reports the studies that suggested new or adjusted metrics for ownership. Subsequent studies that used similar methodologies were also reviewed, for Survey A1 (Mikkelson & Ruback, 1985; Core, et al., 1999; Chhaochharia & Grinstein, 2009), Survey A2 (Gomez-Mejia, et al., 1987; Kraft & Niederprüm, 1999; Cyert, et al., 2002), Survey A3 (Faccio & Lang, 2002; Croci, et al., 2012; Lins, et al., 2013) and Survey B (Hermalin & Weisbach, 1991; Lambert, et al., 1993; Mehran, 1995; Faccio & Lasfer, 1999; Himmelberg, et al., 1999; Demsetz & Villalonga, 2001). The comments in this section take into account these other studies.

Table 1: Survey of ownership influence metrics

References	Measure of the degree of control	Thresholds	Subject of study
Survey A: Large shareholders			
Survey A1: Ownership concentration / Blockholders			
Demsetz and Lehn, 1985	Concentration measures: Log(Top5 equity shares / (100 - Top5 eq.sh.)); Herfindahl index (HHI)	0%	Determinants of ownership
Dyl, 1988	Concentration measure: Log(Top5 equity shares)	0%	CEO pay
Beatty and Zajac, 1994	Indicator for the presence of an outside blockholder	5%	CEO pay
Mehran, 1995	Equity shares of outside blockholders	5%	CEO pay and perf.
Holderness, 2009	Equity shares of blockholders (voting rights≥5%); Indicator for the presence of a blockholder	5%	Ownership patterns
Konijn et al., 2011	Equity shares of blockholders; Dispersion measure: HHI (scaled) for 5 largest blockholders	5%	Firm value (Q)
Tosi and Gomez-Mejia, 1989	Dichotomous (indicator): ▫ Owner-controlled ▫ Management-controlled	 ▫ ≥5% ▫ <5%	CEO pay
Hambrick and Finkelstein, 1995	Dichotomous (indicator vs. equity shares): ▫ Owner-controlled ▫ Management-controlled	 ▫ ≥5% ▫ <5%	CEO pay
Shleifer and Vishny (1997)	Definition of: ▫ Large minority shareholders ▫ Large shareholders	▫ 10%/20%-50% ▫ ≥51%	Survey of corporate governance
Survey A2: Largest shareholder			
Shleifer and Vishny 1986	Equity shares of one non-manager large shareholder (+ a fringe of risk-neutral atomistic shareholders)	5%	Firm value (theoretical model)
Cyert et al., 2002	Equity shares of largest sh., non-CEO/CEO; Indicator for internal/external blockholder	5%	CEO pay and market for corporate control
Holderness and Sheehan, 1988	Dichotomous (paired categories): ▫ Diffusely held equity ▫ Majority shareholders	 ▫ <20% ▫ ≥ 50%	Inv. policy, Corp. control, Firm perf., CEO pay
Margaritis and Psillaki, 2010	Equity shares, in piecewise linear form: Low / Intermediate / High concentration	25% and 50% (3 regimes)	Firm performance (technical efficiency)
Survey A3: Largest ultimate shareholder			
La Porta et al., 1999	Sub-samples by category: ▫ Widely held ▫ Voting shares by type of ultimate control	 ▫ <10%/20% ▫ ≥10%/20%	Corporate ownership (intern. comparison)
Claessens et al., 2002	Equity shares of ultimate owner; Voting minus equity shares; Indicator for "Control exceeds ownership"	10%	Firm value (Q)
Survey B: Insider or managerial ownership			
Morck et al., 1988	Equity shares, piecewise linear regression	5% and 25% (3 regimes)	Firm value (Q)
Cho, 1998	Equity shares, piecewise linear regression	7%/10% and 34%/38% (3 regimes)	Firm value (Q) and Investestment (CapEx; R&D)
McConnel and Servaes, 1990	Equity shares, quadratic/curvilinear relationship (+ control for equity shares held by blockholders and largest shareholder)	5% and 40%/50% (2 regimes)	Firm value (Q)
Short and Keasey, 1999	Equity shares, cubic relation	13% and 42% (3 regimes)	Firm performance (RSE and VAL)
Davies et al., 2005	Equity shares, quintic relation	7%, 26%, 51% and 76% (5 regimes)	Firm value (Q)

In almost all instances, large shareholders are defined as blockholders, i.e. shareholders owning at least 5% of the common stock (see column 3). The studies which focus on the effects of the largest shareholder similarly take into account the first shareholder provided he/she/it crosses a given shareholding threshold. However, the threshold of 5% that is used in almost all of the cited studies has no theoretical or empirical rationale. The 5% cutoff is widely found in the literature because it triggers the mandatory public reporting of ownership positions under the SEC regulations[4]. This minimum threshold is also found under the regulations of other stock exchange authorities around the world; although in some countries this level is 10% and this explains the minimum level of ownership found in the international survey of La Porta et al. (1999). Some other studies use a threshold of 20%, starting with Holderness and Sheehan (1988). These authors want to compare majority-controlled firms with diffusely-held firms. For this purpose, they arbitrarily put forward a maximum threshold of 20% and mention that below this threshold, shareholders would not have enough voting power to affect firm policies[5]. They do not yet provide any theoretical or empirical support for this assertion. La Porta et al. (1999) also use a 20% cutoff to define the chain of control of the ultimate largest shareholder based on a similar assumption that "this is usually enough to have an effective control of a firm". Shleifer and Vishny (1997), and Margaritis and Psillaki (2010) also use a 20% or 25% threshold and distinguish majority shareholders (above 50%) on similar grounds. Hence the thresholds used in the literature regarding large shareholders are essentially based on mandatory disclosures or anecdotal evidence. To the best of my knowledge, there is no study that intends to define the proper level of ownership required to have effective control over a firm.

A potential explanation for this absence of investigation may lie in the ownership structure of large listed U.S. firms which are perceived to be mostly diffusely-held. Because blockholders would be rare and typically hold small blocks of equity shares, a simple

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[4] The authors generally refer to this mandatory disclosure rule and to previous studies to justify the 5% cutoff, Holderness (2009) provides a more thorough discussion about this issue, and notably states the following: "The 5% cutoff seems appropriate for several reasons. First, there is no theoretical reason why either 10% or 20% ownership is significant. To be sure, there is no theoretical reason why 5% ownership is significant, but that is the level at which shareholders are typically required to reveal their ownership stakes. Given the lack of an accepted theory on block ownership, the prudent course of action is to have as broad a sample of large shareholders as possible." The author then also quotes anecdotal evidence and previous empirical results to support his choice of a 5% threshold. Interestingly though, this statement stresses the lack of knowledge we have about relevant ownership thresholds.

[5] Firms with an intermediate level of control, between 20% and 50%, are dropped in their study.

indicator for their existence (as in Beatty and Zajac (1994), Tosi and Gomez-Mejia (1989), and others listed in Table 1) or a simple linear relationship (e.g. Mehran (1995)) would be considered sufficient. However, Holderness (2009) demonstrates that the diffuse ownership pattern of U.S. companies is essentially a "myth", as Holderness and Sheehan (1988) already suggested in their earlier study of majority-controlled companies. Until the 1990s, most studies focused on the U.S. partly because of the lack of ownership data transparency in other countries. Since then, the increasing transparency in this matter has paved the way for a growing body of literature on worldwide ownership patterns, starting with the seminal studies of La Porta et al. (1999) and Faccio and Lang (2002). Both studies actually showed that large shareholdings are a widespread ownership pattern in most financially developed countries. The survey by Shleifer and Vishny (1997) also contributed to highlight the role of large shareholders, while corporate governance studies focused essentially on managerial ownership. Still, as these latter authors pointed out and in spite of the growing literature on large shareholders, very little is known about the forms their influence takes and how this can be measured.

By contrast, the literature on managerial ownership investigates more insightfully the impact of different levels of shareholding (Survey B in Table 1) and provides relevant references for the study of large shareholders' degree of control. The issue of managerial ownership arose from Berle and Means' (1932) vision of a modern corporation with no large controlling owners, leaving the effective control of the firm in the hands of the management. Later, Jensen and Meckling (1976) developed a theory under which the top manager should be the agent of the equity holders and manage the firm in their interests: this would notably be achieved by providing the agent with equity shares. Then much literature was produced on the amount of interest in the company a manager should acquire to have a positive impact on the market value of the equity. Morck et al. (1988) showed that the firm value as measured by Tobin's Q had a non-monotonic relationship with managerial and insider ownership[6]: they specify a piecewise (or spline) regression and find a positive impact up to 5%, then negative up to 25%, and slightly positive above 25%[7].

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[6] Managers and insiders refer to officers and directors in this literature.

[7] The positive impact between 5% and 25% is interpreted as "entrenchment" and the negative impact as an "alignment" of interests. Other studies tested this specification but did not find similar results: Hermalin and Weisbach (1991) find a negative impact between 1% and 5%, positive up to 20% and negative above. McConnell and Servaes (1990) find a consistent positive impact up to 5% but a positive or not different from zero impact above 5% and above 25%.

However, their two break points are predetermined and are not provided endogenously in their model. The 5% and 25% points are respectively explained by the mandatory disclosure level, and by the suggestion in Weston (1979) that hostile bids cannot succeed when a shareholder holds more than 20-30% of equity. Cho (1998) uses the same piecewise linear regression with two break points but defines the values of the points using an "iterated search technique". He finds a first point ranging between 7% and 10% and a second between 34% and 38% conditional on the dependent variable used. Some subsequent studies used polynomial specifications for identifying the values of change points. First, McConnel and Servaes (1990) hypothesize a curvilinear relationship between managerial ownership and firm value. Their specification takes the form of a quadratic function allowing for one turning point (i.e. the extreme value of the function) and two regimes. This leads to the authors finding an inverted U-shaped relationship with a maximum value at around 40% to 50%. Then Short and Keasey (1999) refer to the spline regression of Morck et al. to specify a cubic function allowing for two turning points and three regimes. Finally, Davies et al. (2005) assert that a cubic specification is too restrictive because it cannot represent the more complex evolution of managerial behavior[8]. They find significant coefficients for their quintic equation, and define four turning points and five regimes. These various specifications provide a better estimate of the turning points compared to Morck et al. (1988), because the point values are defined endogenously in the model. However, they are still limited because the number of regimes is predetermined by the number of degrees initially hypothesized in the polynomial function. Furthermore, these investigations do not discuss the possibility of threshold effects in managerial shareholdings instead of continuous relationships with turning points.

Another way these studies on the relationship between managerial ownership and firm value are limited relates to the issue of endogeneity in the causal relationship. Demsetz and Lehn (1985) and Himmelberg et al. (1999) show that ownership structure is endogenously determined by certain firm characteristics and that ownership, either by large or managerial shareholders, has no unilateral and direct causal effect on firm value. First, firm value and performance may be influenced by multiple firm- and industry-specific effects, or by the economic and legal environment of the firm. Hence these firm

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[8] The authors hypothesize that there are two other turning points in addition to the two turning points below 50% already exhibited with cubic specifications: they think managers become entrenched again at the 50% level because they control the firm but still do not have aligned interests with other shareholders, and that only at "very high" levels of ownership do they have aligned interests.

characteristics may also in turn determine the interest some investors are willing to take in a firm's equity (Demsetz, 1983; Himmelberg, et al., 1999). Second, Cho (1998) argues that there is actually a reverse causation between managerial ownership and firm value. Then, the impact of ownership structure on firm performance is biased because the present value of firm performance is influenced by its past values which may also have influenced the current ownership structure. Demsetz and Villalonga (2001) demonstrate the endogeneity of ownership structure and argue that measuring the impact of ownership on performance is bound to be biased.

The present study aims to identify the various regimes of control that may be associated with certain large shareholding patterns. The methodology developed for this purpose will address the two fundamental limitations of large and managerial ownership studies as pointed out above, namely predetermined thresholds or change points, and the endogeneity issue. First, instead of using a 5% minimum regulatory threshold and predetermined break points above that point, I rely on shareholding data starting at a 1% ownership level and I then use the panel threshold regression (PTR) model developed by Hansen (1999). The PTR model not only allows to determine the values of shareholding thresholds, but it also allows to empirically determine the relevant number of thresholds and thus the number of control regimes. Second, to address the endogeneity issue between ownership and firm value, I use CEO compensation as a dependent variable, rather than firm value or performance. CEO compensation is indeed much less likely to be endogenous as it is directly determined by the firm's monitors. A shareholder who takes control of a firm, and consequently takes control of its board of directors, has the power to oust the incumbent management and/or to redefine management pay packages on an annual basis. Then, an argument of endogeneity with reverse causality – stating some investors may acquire or sell controlling equity positions in a firm because of past CEO pay values – would not hold, and the current ownership structure cannot be deemed as influenced by past CEO pay values. The current CEO compensation schemes can then provide a suitable yearly measurement for the existence of effective management monitoring.

This latter assertion is also supported by extensive literature on the effects of monitoring on management compensation. The existence of effective management monitoring, measured by the presence of outside or independent directors (Allen, 1981;

Lambert, et al., 1993; Core, et al., 1999), or ownership concentration (Dyl, 1988), or the existence of blockholders (Beatty & Zajac, 1994; Mehran, 1995; David, et al., 1998; Core, et al., 1999; Cyert, et al., 2002; Chhaochharia & Grinstein, 2009), is consistently found to exert a negative impact on the level of management pay and the proportion of incentive-based pay.

Building on this relationship between management compensation and the control of a firm, I investigate the impacts and threshold effects of large shareholdings in three ways. First, this study identifies which of the large shareholders exert control. Second, it looks for threshold effects in the degree of control and, third, it looks for threshold effects in the seniority of control.

Usually, the control of a firm is approached in the literature according to two criteria, namely the degree of control, as aforementioned, or the type of control. The type of control refers to the identity of the main shareholders (i.e. families, governments, financial or nonfinancial companies…); this criterion is outside the scope of this paper and will merely be accounted for as control variables. Yet, this study suggests a third criterion for considering the exercise of control on a firm. This criterion is referred to as *seniority of control* and is measured by the number of years the controlling shareholders have been in a position to monitor the firm. It aims to gauge the time needed to acquire enough experience and firm-specific knowledge before the controlling shareholder is able to effectively monitor the management. To the best of my knowledge, this is the first time this criterion is used in the ownership literature.

Based on a panel database that I constructed for a sample of 123 listed French companies between 2003 and 2012, I find as a first and preliminary result that the relevant measure of *controlling shareholding* is the equity position held by the largest shareholder represented, directly or indirectly[9], on the board of directors, plus the interests held by shareholders also represented on the board that have concluded a shareholding agreement

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[9] In the studies cited above, the criteria about board characteristics and blockholders are most often treated with separate explanatory variables, and indirect representation of blockholders is most often not identified. As noted by Holderness (2003), ownership databases include the individual holdings of officers and directors in the "insider ownership" category. The positions of a blockholder in the form of a company, bank, or holding company, represented indirectly by one of its employees on a board of directors, would not be included with insider ownership, and would be considered as an "outside blockholder" in the surveys. Thus, the equity interests represented indirectly on the board of directors require manually-collected data about the links between directors and blockholders.

with the former. Conversely, the interests held by other blockholders, whether or not they are represented on the board, are not found to be relevant to measuring the exercise of control.

Second, based on this preliminary result and using a PTR model, I look for the relevant thresholds and regimes for the *degree of control*, starting with a minimum threshold of 1% in equity. I find three significant thresholds and four regimes. First, firms with large shareholders holding from 1% to about 10% of the equity provide the same compensation schemes as firms with no large shareholders on the board[10]. Together, these define the regime of "non-controlled firms". Second, a large shareholder starts exerting effective control on CEO compensation when it crosses the threshold of about 10% with a homogeneous threshold effect up to one-third of the equity, these controlling shareholders define a regime of "influential" control. Third, the control exerted is significantly stronger above a 45% threshold and this control regime is defined as "majority control". Fourth, the intermediate control regime, under which controlling shareholders hold between about one third and 45% of the equity, is defined as "dominant control". Majority shareholders exert the highest degree of control and pay the lowest levels of cash and equity-based compensation to their CEOs, followed by "influential" controlling shareholders. Dominant shareholders pay higher cash compensation to their CEOs compared to majority shareholders, and, more surprisingly, compared to influential shareholders. This is interpreted as an "entrenchment" effect on the part of these shareholders holding enough of the controlling interest to be protected from hostile takeovers but receiving less than half of the cash flow returns on their monitoring activities.

Third, *seniority of control* is introduced as a criterion for measuring the effectiveness of control. Based on the same PTR model, this study finds that a "new" controlling shareholder needs about eight years, six at the minimum, to design compensation schemes that rely significantly less on alternative mechanisms of control than in non-controlled firms. This result suggests that a monitor needs about six to eight years to effectively monitor the top management and that it takes that amount of time to significantly reduce the asymmetries of information with the management. Also, this seniority may define the minimum horizon of investment before a controlling shareholder can be considered to be long-term oriented. In this perspective, a "long-term" controlling shareholder is a monitor

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[10] i.e. firms in which no shareholder with more than 1% of equity is represented on the board.

who defines long-term strategies and goals, and who has the ability to supervise their implementation; all together, this makes it unnecessary to tie CEO compensation to short- or medium-term measures of performance.

Finally, this study will use the methodologies found in the managerial ownership literature (namely, piecewise and polynomial specifications), first as a robustness test for the identified regimes in the degree of control, second as a basis for discussion about the relevance of a discontinuous and threshold effect as opposed to the continuous and nonlinear impact of ownership patterns. These tests establish the relevance of threshold effects in the degree of control. Plus, a comparison between the PTR model and the polynomial specification shows that the spline and polynomial functions may approximate the change points from one regime to another by calculating the *inflexion points* of the functions, but not by calculating the *extremums* of the functions. This contradicts the earlier studies on managerial ownership that used *maxima* and *minima* to estimate their change points, which might have led to misidentifications in the piecewise and nonlinear managerial ownership effects.

The remainder of this paper is organized as follows: Section 2 presents the methodology for measuring controlling shareholdings and identifying the degree and seniority of control thresholds. Section 3 describes the sample data and provides descriptive statistics. Section 4 presents empirical results, and the last section provides concluding remarks.

2. Methodology

2.1. The controlling shareholder

In the absence of management monitoring, top managers may have enough influence over the board of directors to determine their own pay (Gomez-Mejia, et al., 1987; Hambrick & Finkelstein, 1995; Bebchuk, et al., 2002). Accordingly, as the degree of control by large shareholders and/or the board increases, the level of cash compensation (Core, et al., 1999; Chhaochharia & Grinstein, 2009) and equity-based compensation (Cyert, et al., 2002) decreases significantly. This inverse relationship between the control of a firm and the level of management compensation is consistently supported in the literature. However, the methods used to measure control are inconsistent from one study to another

or imprecise in various ways: the identification of the monitor, the levels of required holdings or voting rights, the links between the so-called "external" shareholders and the directors. The surveys use one measure or another, but none attempt to separate out their respective effects or identify the most relevant way to measure controlling shareholdings.

A preliminary step in this study relates to the appropriate measure of controlling shareholdings. For this purpose, I test the effects of different measures on CEO compensation. First, the broadest measure of controlling shareholdings is the percentage of equity held by all blockholders. A distinction can be made between blockholders that are directly or indirectly represented on the board of directors and those that are not. Second, the largest shareholder may have a specific influence, either among other shareholders represented on the board of directors, or as an external largest shareholder if no greater shareholder is represented on the board. Third, the largest shareholder can increase his/her/its control with devices such as shareholder agreements and deviations from one share-one vote principle. Fourth, the largest shareholder may be a company or any type of organization that may itself ultimately be controlled or diffusely-held with possibly different effects on its monitoring role. Most of these alternative measures can be found in some articles listed in Table 1. Nevertheless, the literature provides no supporting references to differentiate between these many alternatives and draw up a hypothesis on the most relevant measure of controlling shareholdings. Also, I adopt an empirical approach using a set of measures aimed at identifying and isolating the large shareholding patterns that are associated with control. This is based on the following specification:

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\begin{aligned}
Comp_{j,i,t} = \alpha_j + \sum_{k=1}^{8} \vartheta_{k,j} Holdings_{k,i,t} + \sum_{k=1}^{9} \beta_{k,j} Firm\ \&\ \text{CEO}\ characteristics_{k,i,t} \\
+ \sum_{k=1}^{10} \rho_{k,j} Industry_{k,i} + \sum_{k=1}^{2} \mu_{k,j} Type\ of\ control_{k,i,t} + \varepsilon_{j,i,t}
\end{aligned}
\tag{1}
$$

where the subscript $j = \{1,2\}$ and stands for, alternatively, cash compensation or total compensation, as defined in Table 2. The subscripts i and t respectively stand for firms ($i = \{1, \dots, 123\}$) and year ($t = \{1, \dots 10\}$). The holdings of the largest shareholders are subdivided into eight categories as presented in Table 2. These variables are aimed at identifying the large shareholders that effectively play a management monitoring role and providing a relevant definition of controlling shareholdings.

Table 2: Description of variables

Note: Large (Largest) shareholders are shareholders owning at least 1% of the common stock. Blockholders are shareholders owning at least 5% of the common stock.

Variable	Description
CEO compensation:	
Cash compensation	Salary + Bonus
Total compensation	Cash compensation + Long-term incentives (stock-options, restricted stocks, and deferred compensation)
Large shareholdings:	
Holdings:	Equity shares held by:
1. Largest sh. on BoD	- the largest shareholder ($\geq 1\%$) represented on the board of directors (BoD)
2. Concert with largest sh.	- shareholders that have concluded an agreement with the "largest sh. on BoD"
3. Other block. on BoD	- all blockholders represented on the board who are neither a "largest sh. on BoD", nor in "concert with largest sh."
4. Largest sh. not on BoD	- the largest shareholder, if he/she owns more shares than "largest shareholder on BoD"
5. Other block. not on BoD	- all blockholders not represented on the board, who are not a "largest sh. not on BoD"
6. Largest sh. on BoD is ultimately controlled	- the largest shareholder represented on the board who is not a diffusely-held company or organization
7. Largest sh. on BoD is ultimately diffusely-held	- the largest shareholder represented on the board who is a diffusely-held company or organization
8. Excess voting rights	Share of voting rights in excess of equity share.
Seniority	Number of years the largest shareholder has been represented on the BoD.
Control variables:	
Firm characteristics:	
Size	Sales; and Market value of equity.
Age of company	Years since foundation of the firm x Years since firm is listed
Capital intensity	Tangible assets (gross property, plant and equipment) / Total assets
Av. ROA	Return on Assets (EBIT/Total assets) averaged over the past five years.
CEO characteristics:	
Tenure	Number of years the CEO has served as a CEO.
New insider CEO	Takes value 1 if the CEO was appointed less than two years ago and had been in the firm for more than 2 years before his/her appointment.
New outsider CEO	Takes value 1 if the CEO was appointed less than two years ago and had been in the firm for less than 2 years before his/her appointment.
CEO is chairman	Takes value 1 if the CEO is also the chairman of the board.
CEO is founder	Takes value 1 if the CEO is the founder of the company and is not the main shareholder.
Industries	Ten industries from the ICB classification (dummy variables).
Nature of control:	
Investment company	Takes value 1 if the largest shareholder is an investment company.
Passive families	Takes value 1 if the largest shareholder is a passive family (family conglomerate, or family with no incumbent or past executive member).

Firm and CEO characteristics are control variables listed and described in Table 2. One of the most influential determinants of CEO pay according to the literature is *firm size* (Gabaix & Landier, 2008; Cyert, et al., 2002). As firm size grows, the complexity of the organization and the number of hierarchical levels increase and push the top compensation upwards. Similarly, the age of the company denotes the complexity and maturity of a firm's

organization. Capital intensity is a proxy for measuring the asymmetry of information between the CEO and the shareholders regarding growth opportunities: a high proportion of tangible assets would reduce such asymmetries (Margaritis & Psillaki, 2010) and thus have a negative impact on CEO pay. Earlier studies suggest that low profitability, as measured by the *average ROA*, is associated with higher risk for the firm, which in turn increases the contingent portion of pay and the level of total compensation for risk-averse CEOs (Beatty & Zajac, 1994).

According to Hambrick and Finkelstein (1995), *CEO tenure* has a positive impact on pay raises in the first years because of experience and increased CEO bargaining power over time (Cyert, et al., 2002). But long-tenured CEOs may have lower pay raises because they develop firm-specific human capital and lose attractiveness in the managerial labor market, which in turn reduces their bargaining power (Hambrick & Finkelstein, 1995). Also, CEOs may accumulate stock ownership over the years, reducing the need for equity-based and contingent compensation (Chourou, et al., 2008). Hence CEO tenure should have a nonlinear impact on compensation that is taken into account by adding its square value in Equation (1). CEO age is not included among the control variables because it results in information correlated to CEO tenure (Croci, et al., 2012). Next, Hambrick and Finkelstein (1995) predict and show that newly-nominated CEOs are paid less than their predecessors if they are promoted internally (*new insider CEO*), conversely *new outsider CEOs* are paid a premium so as to attract them and are expected to have at least the same level of compensation as their predecessors. Lastly, other control variables include indicator variables that control for the positive impact expected from CEOs who also chair the board (Core, et al., 1999; Cyert, et al., 2002), for the premium provided to CEOs who are firm founders but do not hold a large share of equity, and for industry-specific effects (Gomez-Mejia, et al., 2003; Cyert, et al., 2002).

Beyond the degree of control, the type of control as defined by the identity of the largest shareholder can also influence CEO compensation schemes. Two specific types of control, characterized by their diversified or passive involvement in firms (namely, *investment companies* and *passive families*), were found to be significantly associated with higher levels of compensation in an earlier study (Almeida, 2014). The effects of these two categories are then controlled for with an indicator variable in order to avoid biased analyses of the degree of control.

Equation (1) is specified for pooled panel data, with robust errors clustered at the firm level in order to account for correlations within the firms. Panel data with fixed individual effects would not be a relevant alternative in the present study, notably because CEO compensation and ownership patterns mostly vary from one firm to another rather than within each firm. Thus, the above-specified equation aims to estimate the impacts of differentiated ownership patterns on CEO compensation from one firm-year to another, and not only the impacts of ownership variations within each firm over the sample period, as a fixed effect model would do.

2.2. Degree of control and the PTR model

To define the different degrees of control, I use the panel threshold regression (PTR) model developed by Hansen (1999). It derives from the earlier literature on time series structural changes with unknown change points and provides an extension to panel data with threshold effects. The procedure described by Hansen provides testing techniques to measure the relevant number m of thresholds that allows for $m+1$ regimes to be significantly differentiated, and to determine a confidence region or interval for each point estimate (for γ_1 to γ_m). Here, the threshold variable is the percentage of the equity held by the controlling shareholder. The control variables included in Equation (1), namely firm and CEO characteristics, industry-specific effects and type of control, are unchanged and are denoted as X in the following equations. But the *Holdings* variable in (1) is replaced by a set of $M+1$ indicator variables representing the $M+1$ distinct regimes in the degree of control. The equation takes the following form:

$$Comp_{j,i,t} = \alpha_j + \sum_{m=1}^{M+1} \theta_{j,\mathrm{m}-1}\, \mathrm{I}\{\gamma_{\mathrm{m}-1} \leq Holdings_{i,t} < \gamma_{\mathrm{m}}\} + \sum_{k=1} \beta_{j,k} X_{k,i,t} + \varepsilon_{j,i,t} \qquad (2)$$

where $\mathrm{I}\{.\}$ denotes the indicator function equal to one for $\gamma_{\mathrm{m}-1} \leq Holdings_{i,t} < \gamma_{\mathrm{m}}$ and to zero otherwise, M is the number of thresholds tested, and the smallest and highest thresholds are set to zero and one ($\gamma_0 = 0, \gamma_{M+1} = 1$). This discontinuous measure assumes that the degree of control has a homogeneous effect in each regime. In other words, it assumes that the effect does not depend on the relative percentage of holdings in each regime, but that the fixed effect of the control regime is measurable as soon as the controlling shareholder crosses a given threshold point. This specification with threshold effects per controlling regime is another reason why the panel regression could not include

firm-specific fixed effects: such fixed effects would capture the impacts of the threshold variable in case it is time-invariant within firms. The percentage of equity is yet not strictly time-invariant, but some degrees of control may be more stable than others. Specifically, a shareholder with a majority control (above 50% of the shares) may maintain his/her/its majority position throughout the sample period more often than a shareholder with large minority control, whose positions may vary more widely over time. In that case, firm-specific fixed effects would, at least partially, capture the effects of the more stable class of control whereas the effects of less stable classes of control would be over-estimated in the framework of the PTR model. A firm-specific effect would then create biases among the classes of control the PTR procedure is purposely intended to isolate.

The first regime, denoted $I\{\gamma_0 \leq Holdings_{i,t} < \gamma_1\}$, includes firms with no large shareholder (i.e., $Holdings_{i,t} = 0\%$), plus firms with large shareholders below the first threshold value (i.e., $1\% \leq Holdings_{i,t} < \gamma_1$). Below this γ_1 threshold, large shareholders design compensation schemes similar to the ones offered by firms with no large shareholders. Hence firms falling in this first regime can be considered to be diffusely-held or non-controlled. The PTR specification notably aims to identify this first threshold above which large shareholders are deemed to effectively monitor the management. This regime of diffusely-held or non-controlled firms also serves as a benchmark for the specific effects of the other control regimes. For this reason, it will be omitted in the estimations, which is equivalent to imposing a constraint making $\theta_{j,0}$ equal to zero.

The procedure for estimating the threshold values starts with a single-threshold model ($M = 1$) and first consists of one iteration aimed at determining the value of γ_1 that minimizes the sum of squared errors of the following equation:

$$Comp_{j,i,t} = \alpha_j + \theta_{j,1} \{\gamma_1 \leq Holdings_{i,t} < \gamma_2\} + \beta_{j,k} X_{k,i,t} + \varepsilon_{j,i,t} \tag{2'}$$

where $\gamma_2 = 1$. The sum of squared errors is denoted S_1 and the least-square estimator of γ_1 is as follows:

$$\hat{\gamma_1} = \underset{\gamma}{argmin}\, S_1(\gamma)$$

As recommended by Hansen (1999) and in order to avoid defining regimes by picking out outliers, γ should take such values that a sufficient number of observations lie in each regime; the iteration will thus be applied with values of γ starting with the lowest decile of controlling shareholdings in the whole sample and incremented by 1% up to the top decile.

The second step consists of testing the significance of the single-threshold model with the estimated point as compared to the null hypothesis of a zero threshold model; in other words, it consists of testing the alternative hypothesis of the existence of a threshold effect in controlling shareholdings, as opposed to the null hypothesis of a CEO compensation scheme that is similar in every firm whatever the level of shareholdings, all other things equal. The null hypothesis is then represented by the following constraint:

$$H_0: \theta_{j,1} = \theta_{j,0}$$

where, as stated above, $\theta_{j,0}$ is set to zero. The sum of squared errors under the null hypothesis is denoted S_0 and the test statistic takes the following form[11]:

$$F_1 = \frac{S_0 - S_1(\hat{\gamma})}{\widehat{\sigma^2}}$$

where $\widehat{\sigma^2}$ is the residual variance under the alternative hypothesis[12]. Under the null hypothesis, the sum of squared errors ignores the presence of a threshold point γ. Hansen (1996) shows that this creates a nuisance in the F-statistic if the null hypothesis is to be rejected, consequently the asymptotic distribution of the test statistic is non-standard and does not follow a chi-squared distribution. Hansen (1999) shows that a bootstrap procedure can approximate the asymptotic distribution of F_1, and its p-values, in the context of panel data. The bootstrap procedure is based on random resamplings of the residuals returned under the H_0 specification[13]. The H_1 specification and the test statistic are simulated under each of these resamplings. The estimated p-value of F_1 is the percentage of draws for which the simulated statistic is higher than the actual above-defined F_1 statistic. The null hypothesis of a "zero threshold model" is thus rejected for a p-value under a chosen α % significance level.

If the single-threshold model is thus validated, the second stage consists of testing for a double-threshold model. An iterative procedure can search simultaneously for the two threshold points, γ_1 and γ_2, that minimize the sum of squared errors of Equation (2). Nevertheless, Bai (1997) demonstrated for multiple change point models that a sequential search is also consistent and Hansen (1999) extended this argument to multiple-threshold

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[11] It can be noted that the iterative process described in the first step is equivalent to looking for the highest value of this test statistic.

[12] Calculated as: $\widehat{\sigma^2} = \frac{S_1(\hat{\gamma_1})}{n(T-1)}$, where n denotes the number of firms and T the number of periods on the panel.

[13] The number of draws for resampling will be set in the present study to 400.

models. This sequential procedure will also prove necessary to estimate the confidence intervals in the last stage. Thus, the iterative grid search takes the threshold value $\hat{\gamma}_1$ found in the first stage as given, and looks for a second threshold value γ_2 that minimizes the sum of squared errors. If this threshold value proves to be significant, $\hat{\gamma}_1$ is asymptotically inefficient because the presence of this second threshold point was ignored when it was estimated. Following Bai (1997), the first threshold is estimated again at this stage ("refinement estimation") by repeating the latter procedure taking $\hat{\gamma}_2$ as given this time and looking for the value of γ_1. At the end of this process, both threshold estimates are asymptotically efficient. The validity of a double-threshold model against a single-threshold model is tested based on the following statistic:

$$F_2 = \frac{S_1(\hat{\gamma}) - S_2(\hat{\gamma})}{\widehat{\sigma^2}}$$

The null hypothesis of a single-threshold model is rejected for large values of F_2[14], with critical values obtained from the simulated bootstrap distribution of F_2.

If the alternative hypothesis of a double-threshold model is not rejected, the next stage consists of looking for a third threshold point γ_3, following the same steps as for the previous stages: a grid search iteration taking $\hat{\gamma}_1$ and $\hat{\gamma}_2$ as given looks for the estimated value of $\hat{\gamma}_3$, followed by a refinement estimation of these first two thresholds and by a test for a triple- against a double-threshold model with bootstrap estimated p-values. These stages are repeated as long as the alternative hypothesis of *M* threshold points against *M-1* threshold points is not rejected. At the end, the procedure defines the relevant number of thresholds and regimes that are significant for the sample, and the estimated values of the thresholds.

In the final stage, confidence intervals are constructed around the true values of the estimated points. For clarity, the number of significant thresholds *M* found in the previous stages is set to three and this paragraph describes the confidence interval construction for a triple threshold model. The construction of the confidence interval for $\hat{\gamma}_1$ is based on the determination of a "no-rejection region" around this estimated point. Taking the

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[14] A large value of F_2 means that the sum of squared errors for the single-threshold model ($S_1(\hat{\gamma})$) is much higher than the sum of squared errors for the double-threshold model ($S_2(\hat{\gamma})$): the higher the value of the test statistic, the better the latter model is estimated compared to the former.

values of $\widehat{\gamma_2}$ and $\widehat{\gamma_3}$ as given, the triple threshold regression is re-estimated for all possible values of γ instead of $\widehat{\gamma_1}$. The sum of squared errors for each re-estimate is kept in $S_3(\gamma_1)$ and the test statistic takes the form of the following likelihood ratio test:

$$LR_1 = \frac{S_3(\gamma_1) - S_3(\widehat{\gamma_1})}{\widehat{\sigma^2}}$$

By construction, the LR-statistic takes value zero when γ_1 is equal to $\widehat{\gamma_1}$. The confidence interval is defined by the set of LR_1 values that are around its null point and below the critical value. This statistic is free of nuisance parameters (both sums of squared errors are obtained from specifications with the same number of threshold points) and does not require a bootstrap-estimated critical value. However, Hansen (1999) shows it has a non-standard asymptotic distribution and he provides a distribution function that returns the following fixed critical values[15]: 6.53, 7.35 and 10.59 for, respectively, the 10%, 5% and 1% confidence levels. Thus, at the 5% level of confidence, LR values below 7.35 define the "no-rejection region" (or confidence interval) for the true value of γ_1. The same procedure is then run for $\widehat{\gamma_2}$ taking $\widehat{\gamma_1}$ and $\widehat{\gamma_3}$ as given, and eventually for $\widehat{\gamma_3}$ taking $\widehat{\gamma_1}$ and $\widehat{\gamma_2}$ as given, which constructs the confidence intervals for the true values of γ_2 and γ_3, respectively.

2.3. Seniority of control and the PTR model

A controlling shareholder is identified as a shareholder holding more than $\gamma_1\%$ of the equity, and the regimes derived from the methodology described above define different degrees of control. Among these control regimes, new monitors may behave differently because they have not yet acquired enough firm-specific knowledge and experience in monitoring the firm. There may be a number of years of control, denoted ω, below which the controlling shareholder still relies on alternative mechanisms of control in the form of contingent remuneration, so as to mitigate their asymmetry of information with the CEO. In this case, the use of higher ratios of bonuses and other incentive-based pay would also push upwards the levels of cash and total compensation.

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[15] The critical value at the $1 - \alpha$ confidence level is given by: $c(\alpha) = -2\log(1 - \sqrt{1-\alpha})$.

The following specification assumes that there is one threshold ω of seniority below which the controlling shareholder behaves differently, all other things being equal including a given regime for the degree of control. Other control variables are the same as in Equation (2).

$$
\begin{aligned}
Comp_{j,i,t} = \alpha_j + \tau_j\, I\{Seniority_{i,t} < \omega\} + \sum_{m=1}^{M+1} \theta_{j,m-1}\, I\{\gamma_{m-1} \leq Holdings_{i,t} < \gamma_m\} \\
+ \sum_{k=1} \beta_{j,k} X_{k,i,t} + \varepsilon_{j,i,t}
\end{aligned}
\tag{3}
$$

Seniority of control only concerns controlling shareholders holding more than $\gamma_1\%$ of the firm's equity and coefficient τ is expected to be positive for the aforementioned reasons. Let M be equal to three and the number $M+1$ of regimes to four. The addition of coefficients τ and θ_1 provides the effect of a "new" controlling shareholder in the degree of control's second regime as compared to the first regime of non-controlled firm-years (omitted, and associated to $\theta_0 = 0$). The additions of τ and θ_2, and of τ and θ_3 provide the same information for "new" controlling shareholders in the degree of control's third and fourth regimes.

The threshold value ω of seniority of control is estimated using the same procedure based on the PTR model described in the previous section. The minimum value of the sum of squared errors is searched for by iterating on integer values of seniority from the lowest to highest deciles of seniority on the whole panel. The test of no thresholds against one threshold is based on the same F-statistic and bootstrap p-values as above described. If the null of no thresholds is rejected, the LR-statistics are calculated for each tested value of ω between the lowest and highest deciles of seniority, and they are used to define the 95% and 99% confidence intervals defined as the ω values for which the LR-statistics are respectively below the critical values of 7.35 and 10.59.

This specification assumes that there is only one threshold point and two regimes; there is *a priori* no rationale for the existence of a higher number of seniority thresholds in the context of controlling shareholders. The existence of other thresholds will still be tested as a robustness check.

3. The data

3.1. Sample data

The sample firms are selected from 180 French firms listed on Euronext Paris and members of the SBF120 Index for at least one year between 2003 and 2012. The sample is restricted to public limited companies headquartered in France[16] and to firms that have fully available data for at least four years. This leaves a sample of 1,119 firm-year observations for 123 firms from 2003 to 2012. CEO characteristics and compensation data are manually collected from annual reports, and firm characteristics are extracted from *Datastream. Thomson One Banker – Ownership* database provides the annual percentages of equity held by shareholders. Blockholders (i.e. shareholders holding more than a five-percent share) are isolated, cross-checked with ownership data provided in annual reports, and corrected when necessary[17]. Based on the identities of directors and the lists of their mandates disclosed in annual reports, I discriminate between blockholders that are directly or indirectly represented on the boards of directors, and those who are not. If no blockholder is represented on the board, I identify the largest shareholder represented on the board, provided there is at least one large shareholder (i.e., shareholders with at least one percent of ownership) represented on the board[18]. Shareholders that are part of a shareholder agreement with the largest shareholder are also identified. Lastly, the voting rights of the largest shareholder, and of shareholders that are part of a shareholder agreement with him/her/it, are hand-collected when company bylaws provide for double voting rights for certain shareholders[19].

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[16] This omits foreign companies in order to avoid country-specific effects, and companies that are not public limited ("société anonyme"), namely limited partnerships with shares ("société en commandite par actions") where CEOs have a specific status and, most often, specific pay packages.

[17] A number of errors need some attention in the ownership database. Specifically, shareholdings that are not updated are maintained unaltered for two fiscal years in the database, some of these blockholders have to be retrieved; these time differences can also create significant inaccuracies in the event of a capital transaction (splitting or combining of shares, capital increases…) in the meantime. Also, because of multiple sources of data, the database may include some duplicates. Apart from inaccuracies related to the measuring of equity shares, the database is quite comprehensive in terms of the number of identified blockholders; this can be checked by comparing with ownership data in annual reports, where companies are legally required to disclose the equity shares of their blockholders.

[18] Annual reports and the Thomson database do not provide exhaustive or detailed data for shareholders represented on the board having less than 1% of equity.

[19] In France, the deviation from one share-one vote principle takes the form of shares with double voting rights, allocated to shareholders that have been registered for more than, typically, two or four years.

As for the seniority of control, ownership databases do not provide such information. I therefore collect this information for the largest shareholder represented on the board of directors from firm's annual reports. For each largest shareholder represented on the board, seniority of control starts on the first year when a representative was nominated to the board. This takes into account the several directors that may have succeeded each other as representatives of a given shareholder. In cases where a shareholder was already nominated to the board prior to becoming the largest shareholder, seniority as a non-first shareholder on the board is also taken into account, as the shareholder is considered to have acquired experience and firm-specific knowledge in those previous years. The available data from annual reports allows this information on the first year of nomination to the board to be collected back to the late 1990s. The seniorities prior to this period are obtained from the history of the company provided in annual reports or on company websites, or from other sources found in the press[20]. The first year of control may coincide with the founding of the firm[21] for founding shareholders, to nationalization for governmental shareholders, or to a takeover in other cases.

3.2. Descriptive statistics

Table 3 displays some descriptive statistics for the data. The average size of firms is €11,764 million in terms of sales and €9,477 million in terms of market capitalization, in constant 2007 euros. The average firm has a capital intensity of 23.39% and a five-year average ROA of 3.01%, was first established 87 years ago, and went public 23 years ago. The average CEO has served as CEO for 10 years, he is also the board chairperson for 54% of the firm-year observations, and is the founder of the company but not a blockholder for 4% of the firm-year observations. His/her mean cash and total compensation are respectively €1.27 million and €2.16 million. Following previous studies (Finkelstein & Boyd, 1998; Gomez-Mejia, et al., 2003), the value of stock options is estimated as the number of options multiplied by 25 percent of the exercise price. Other stock-based pays are estimated based on the value of the stock on the day it is granted.

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[20] The historical data provide quite comprehensive information regarding seniority of control, except for one shareholder for which the oldest known year of control was entered by default.

[21] In the case of a firm created by a spin-off and still controlled by the historical mother company, the control is actually prior to the creation of the spun-off independent company, in these instances, the first year of control is considered to be the year when the mother company first acquired the spun-off subsidiary or the year when the mother company started to develop its specific business or activity.

Table 3: Descriptive statistics

Note: Amounts in Euros are expressed in constant 2007 Euros.

Variable	Mean	Median	Min	1st decile	9th decile	Max
Panel A: All firms						
Firm characteristics:						
Sales (€000)	11,764,045	2,621,648	2,133	458,232	35,900,500	167,610,992
Market capitalization (€ 000)	9,477,162	2,894,800	6,904	396,368	26,301,308	148,470,400
Capital intensity	23.39%	16.58%	0.03%	2.30%	53.90%	98.32%
Average ROA (over five years)	3.01%	3.29%	-229.39%	-1.12%	9.11%	28.99%
Years since foundation	87.3	78.0	3.00	23.0	161.0	348.00
Years since listed	22.7	19.0	1.00	6.0	38.0	128.00
CEO characteristics:						
Tenure	9.8	6.0	1.00	1.0	24.0	47.00
New insider CEO	0.12	0.00	0.00	0.00	1.00	1.00
New outsider CEO	0.09	0.00	0.00	0.00	0.00	1.00
CEO is chairman	0.54	1.00	0.00	0.00	1.00	1.00
CEO is founder	0.04	0.00	0.00	0.00	0.00	1.00
CEO compensation:						
Cash compensation (€ 000)	1,274	1,136	29	362	2,431	7,478
Total compensation (€ 000)	2,164	1,556	29	394	4,372	22,976
Blockholders:						
% All blockholders	43.09%	46.72%	0.00%	8.24%	72.64%	94.22%
% Largest shareholder	32.41%	29.17%	1.10%	6.75%	66.25%	89.22%
Seniority of largest sh. on BoD	33.4	19.0	0.0	0.0	92.2	309.0
Num. blockholders	2.1	2.0	0.0	1.0	4.0	7.00
Num. blockholders on BoD	1.3	1.0	0.0	0.0	2.0	7.00
N. = 1119 firm-year obs.						
Panel B: Firms with at least one blockholder on BoD						
% All blockholders	49.40%	51.01%	5.00%	22.28%	75.10%	94.22%
% Blockholders on BoD	43.58%	45.51%	5.00%	14.35%	71.98%	89.22%
% Largest shareholder	37.42%	35.70%	5.00%	10.17%	68.38%	89.22%
% Largest shareholder on BoD	37.24%	35.70%	5.00%	9.99%	68.38%	89.22%
% Largest sh. on BoD + Concert	40.56%	41.81%	5.00%	10.72%	70.86%	93.40%
% (voting rights) Largest sh. on BoD + Concert	46.16%	46.36%	5.00%	14.25%	75.10%	93.40%
Seniority of largest sh. on BoD	38.6	22.0	1.0	3.0	101.0	309.0
Num. blockholders	2.3	2.0	1.0	1.0	4.00	7.00
Num. blockholders on BoD	1.6	1.0	1.0	1.0	3.00	7.00
N. = 929 firm-year obs.						
Panel C: Firms with no blockholder on BoD						
% All blockholders	12.26%	8.39%	0.00%	0.00%	32.09%	63.90%
% Largest shareholder	7.90%	7.34%	1.10%	3.95%	11.62%	33.30%
% Largest shareholder on BoD	1.24%	0.00%	0.00%	0.00%	4.11%	4.96%
Seniority of largest sh. on BoD	8.2	0.0	0.0	0.0	40.0	55.0
Num. blockholders	1.6	1.0	0.0	0.0	4.0	6.00
N. = 190 firm-year obs.						

Companies do not provide their CEOs with equity-based compensation on any standard timetable. Some grant it on an annual basis, others from one year to another, or triggered by a specific event (newly nominated CEO, IPO, an exceptional operating or

financial success…), and some firms do not provide any stock-based pay. This accounts for a large dispersion of the total compensation and high relative values in the last decile. Hence, the regressions of the following sections will be based on two-year averaged equity-based compensation in order to mitigate the irregular practices in these grants (the averaged equity-based pay included in the total compensation for 2003, i.e. for the first year in the sample period, is thus the average of the options granted in 2002 and 2003). Still, this does not attenuate the very high relative values for a number of these grants. Equity-based compensation is then *winsorized* in the following way: the ratio of equity-based to total compensation has a top decile of 56%, the value of equity-based pay is then trimmed so as to represent a maximum of 56% of total compensation.

In the average sample firm, about 2.1 blockholders hold 43.09% of the common stock, and 32.41% is held by the largest shareholder. Out of these 2.1 blockholders, 1.3 are *insiders* – i.e., they are represented on the board of directors – and the largest insider shareholder has on average 33 years of seniority. Panel B in Table 3 is made up of the 929 firm-year observations in which at least one blockholder is represented on the board. In these firms, an average of 2.3 blockholders hold about half of the company's equity, including 43.58% held by insider blockholders. The largest shareholder holds on average 37.42% of the equity share compared to 37.24% for the largest insider shareholder: the slight difference between these shareholdings is explained by the 55 firm-years (not reported) in which the largest shareholder is an *outsider* shareholder – i.e., not represented on the board – holding more shares than the largest insider shareholder. Shareholders that concluded an agreement with the largest insider shareholder add an average control of 3.32%, reaching a combined interest of 40.55%[22]. Another device for increasing control consists of conferring double voting rights on certain categories of shares. This gives nearly 6% of additional interest to the average largest insider shareholder, alone or in concert, who thus reaches a voting control of 46.16%[23].

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[22] More specifically, the largest shareholder acts in concert with other shareholders in 184 firm-years. In this sub-sample (not reported in Table 3), the largest shareholder owns an average 28.13% of equity shares, and the shareholders acting in concert with it add 16.74%, together totaling an average of 44.87% of equity control.

[23] On Panel B, a sub-sample of 556 firm-years provides double voting rights to shares that have been registered under the same shareholder's name for more than two or four years. In this sub-sample (not reported), the average largest shareholder holds, by itself or in concert, 38.79% of the common stock and 48.14% of the voting rights.

Panel C in Table 3 presents descriptive data for the 190 firm-years where no blockholder is represented, directly or indirectly, on the board. For the average firm in this sub-sample, about 1.6 outsider blockholders still hold 12.26% of the shares, but 42 of these firm-years (not reported) have no blockholders at all. Most of the largest shareholders in this sub-sample (180 out of 190, not reported) are outsider shareholders holding a larger share of equity than the largest insider shareholder. Consequently, the average share of the former is 7.90% compared to 1.24% for the latter. The seniority of the largest shareholder represented on the board is about 8 years on average, but the median value is zero: in more than half of this sub-sample (119 firm-years, not reported), there are no large shareholders (i.e., holding more than 1% of the share equity) represented on the board.

To sum up, some firms have no large insider shareholder represented on the board but have outsider blockholders; among firms that have a large insider shareholder, some also have other insider and/or outsider blockholders, and some outsider blockholders may hold higher positions than the largest insider. In addition, some of the largest insider shareholders act in coalition with other insider shareholders and some have additional control with double voting rights. These various patterns leave a variety of alternatives for measuring and identifying which shareholders exert effective control on the firm. The following section aims to separate the respective influences of each of these various categories of shareholders by estimating their impacts on CEO compensation monitoring.

4. Empirical results

4.1. Alternative measures of controlling shares

A number of studies provide evidence of a negative relationship between the level of CEO compensation and the existence of monitoring by large shareholders. I also find this relationship to be significant for the French sample, either with the synthetic measurement of control (i.e. the shares held by the top five shareholders such as in Dyl (1988)), or with an indicator for the presence of a blockholder, such as in Tosi and Gomez-Mejia (1989) or in Hambrick and Finkelstein (1995). These results with the synthetic measurements are not reported here as they provide no insight into who precisely exerts control. Instead, I split the synthetic measures into variables measuring the holdings of the large shareholders

according to the criteria presented in Table 2. Regarding the effect on cash compensation (Table 4, column 1), only the holdings of the largest shareholder represented on the board of directors, plus the holdings of the shareholders that have concluded an agreement with him/her/it, present a significant negative relationship with the salary and bonus levels granted to the CEO. The holdings of the other blockholders, either represented on the board or not, have no impact. A largest shareholder that is not represented on the board has also no impact on the cash compensation scheme.

The effect of the holdings of shareholders acting in concert is retained, and the largest shareholders are subdivided between those that are ultimately controlled (including, by definition families and the State, and companies or institutions that are themselves controlled) and those that are not (Table 4, column 2). The results show that both have a significant negative impact on cash compensation, although the former's is more significant than the latter's. The striking result is that both exert an effective control over cash compensation. This justifies keeping shareholders that are ultimately diffusely-held companies or institutions as a measure of effective control, together with ultimately controlled shareholders. The regression in column 2 also includes the percentage of voting rights in addition to cash flow rights for the largest shareholder on the board plus the shareholders acting in concert. Two opposite results may be expected for this variable. Double voting rights may increase the degree of control and have an additional negative impact on compensation. Conversely, in an "entrenchment" situation, the effect of this variable may be positive because shareholders are expected to use their additional influence to extract private benefits (Claessens, et al., 2002) and pay higher salaries to their CEOs, as a form of private benefit (Core, 1997) or as a means to buy his/her loyalty. The results show no significant impact of double voting rights, and neither alternative expected effect is confirmed.

Column 3 presents the regression with the relevant measure of the degree of control, i.e. the portion of equity held by the largest shareholder represented on the board of directors and by the shareholders acting in concert with him/her/it. Columns 4 to 6 present the same regressions with total compensation as the dependent variable. The relevant measure of controlling shareholdings is similar to that of cash compensation, i.e.

Table 4: Regression results for CEO compensation on alternative measures of controlling shareholdings

	Ln(Cash compensation)						Ln(Total compensation)					
	(1)		(2)		(3)		(4)		(5)		(6)	
	coef	*t-stat.*	*coef*	*t-stat.*	*coef*	*t-stat.*	*coef*	*t-stat.*	*coef*	*t-stat.*	*coef*	*t-stat.*
Alternative measures of controlling shares:												
% Largest sh. not on BoD	-0.33	-0.77					-0.03	-0.06				
% Other block. not on BoD	0.20	0.65					0.12	0.28				
% Largest sh. on BoD	-0.44	-3.53***					-0.80	-5.98***				
% Concert with largest sh.	-0.59	-1.77*	-0.59	-1.74*			-0.93	-2.23**	-0.95	-2.24**		
% Other block. on BoD	-0.02	-0.06					-0.09	-0.25				
% Largest sh. on BoD:												
* Ultimately controlled			-0.41	-3.26***					-0.82	-5.66***		
* Ultimately diffusely-held			-0.42	-1.71*					-0.75	-2.1**		
% Excess in voting rights			-0.13	-0.31					0.20	0.41		
% Largest sh. on BoD + Concert					-0.44	-4.06***					-0.82	-6.19***
Firm characteristics:												
Ln(Sales)	1.37	10.24***	1.36	10.23***	1.35	10.76***	1.41	7.54***	1.41	7.57***	1.40	7.78***
Ln(Sales)^2	-0.04	-8.4***	-0.04	-8.35***	-0.04	-8.75***	-0.04	-6.54***	-0.04	-6.54***	-0.04	-6.75***
Ln(Market capitalization)	0.16	6.13***	0.16	5.91***	0.16	5.99***	0.26	8.61***	0.25	8.33***	0.25	8.56***
Age of company	0.07	3.09***	0.07	3.08***	0.08	3.25***	0.08	2.83***	0.08	2.7***	0.08	2.79***
Capital intensity	-0.36	-2.59***	-0.36	-2.66***	-0.35	-2.59***	-0.35	-2.25**	-0.35	-2.28**	-0.35	-2.37**
Av. ROA	-1.45	-4.94***	-1.45	-5.01***	-1.41	-4.79***	-1.42	-3.93***	-1.42	-3.94***	-1.40	-3.9***
CEO characteristics:												
Tenure^2	-0.0004	-4.75***	-0.0004	-4.79***	-0.0004	-5.69***	-0.001	-7.16***	-0.001	-7.65***	-0.001	-7.75***
New insider CEO	-0.09	-2.13**	-0.0873	-2.2**	-0.09	-2.16**	-0.11	-2.11**	-0.11	-2.19**	-0.11	-2.14**
New outsider CEO	0.07	1.22	0.0618	1.14	0.06	1.16	0.15	2.25**	0.15	2.27**	0.15	2.22**
I(CEO is Chairman)	0.12	2.43**	0.12	2.48**	0.12	2.48**	0.09	1.6	0.09	1.6	0.09	1.64
I(CEO is founder)	0.71	7.72***	0.71	8.21***	0.71	8.32***	0.91	14.69***	0.91	14.7***	0.91	14.55***
Type of control:												
I(Investment companies)	0.22	4.87***	0.22	4.9***	0.22	4.85***	0.32	4.96***	0.32	4.93***	0.31	4.88***
I(Passive families)	0.51	4.77***	0.51	4.75***	0.52	4.93***	0.70	5.32***	0.71	5.31***	0.70	5.36***
Intercept	-7.30	-6.74***	-7.23	-6.62***	-7.17	-6.9***	-8.32	-5.59***	-8.34	-5.54***	-8.25	-5.68***
Industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
Firm-year obs.	1119		1119		1119		1119		1119		1119	
Adj. R² (%)	77.72		77.67		77.70		77.32		77.35		77.38	

I(.) denotes the indicator function.   *; **; ***: denotes significance at 10%, 5% and 1% levels.

the shares held by the largest shareholder represented on the board, either ultimately controlled or not, alone or in concert. The impact of these shareholders on total compensation is presented in column 6. The holdings of these shareholders will be referred to as controlling shareholdings, and will serve as the measure of the degree of control in the following section.

The results show that only the large shareholders represented on boards of directors carry out management monitoring activities in France. This tempers the results found in earlier studies regarding the effects of "outsider" shareholders. Core et al. (1999) and Cyert et al. (2002) find that the existence of large outsider shareholders and the holdings of the largest external shareholder, respectively, have a negative impact on the level of CEO compensation for U.S. firms. As previously stated, these studies are based on databases that do not take into account the indirect representation of large shareholders on the board. Such shareholders are then bound to be categorized as outsider or external shareholders while they might be indirectly represented on the board. Although the sample data are based on different countries, the results presented above suggest that within these broad categories of shareholders, only those that can have their interests voiced on the board of directors may effectively exert such monitoring and that the effect of other large shareholders is not significant[24].

As for firm characteristics, the size effect is positive and significant both as measured by sales and market capitalization[25]. The age of the firm, in relation to the size and the maturity of the firm's business, is positively and significantly associated with the levels of CEO pay. Capital intensity has a significant negative coefficient, consistent with the prediction that in firms with a high ratio of tangible assets, the top manager has less discretion and needs less monitoring through contingent pay. Average ROA is also negatively and significantly related to CEO compensation: low five-year averaged accounting performance is associated with higher pay, which may be explained by the need to provide incentives in order to improve performance. Low average ROA is also highly

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[24] This result may be different if other large shareholders are categorized by type of control (see for instance, Croci et al. (2012) for the effects of minority institutional investors in family firms). However, the influence of outside activism from certain categories of shareholders is beyond the scope of this study, which focuses on the degree and seniority of control.

[25] Both measures are correlated, but each contributes independently to explain the levels of CEO compensation: unreported regressions show that sales better explain the base salary component and market capitalization better explains the contingent components of pay, hence both measures are kept in the base specification.

negatively correlated with the standard deviation of ROA (not reported), which can be a proxy for firm's risk: CEOs in riskier firms may receive a higher level of compensation to compensate for uncertain contingent pay (Cyert, et al., 2002).

Regarding CEO characteristics, the square of CEO tenure has a negative impact on the levels of pay, which is consistent with the nonlinear relationship found by Hambrick and Finkelstein (1995). During their first two years of tenure, CEOs coming from outside the firm (*New outsider CEO*) are paid the same as their predecessors in terms of cash compensation, but they receive higher equity-based compensation resulting in higher total compensation; CEOs recruited from inside the firm (*New insider CEO*) are paid less both in terms of cash and total compensation. This is also consistent with the predictions of Hambrick and Finkelstein (1995). CEOs who also chair the boards of directors receive higher cash compensation but do not receive higher long-term incentives. CEOs who are also firm founders but do not hold large blocks of shares are paid significantly more.

Lastly, the type of control in the form of investment companies and passive families has a significant positive impact on CEO pay, as expected for diversified or passive largest shareholders. Industry fixed effects are also accounted for: consistent with the analysis of Demsetz and Lehn (1985), the media pay among the highest cash and total compensation while regulated industries (utilities, banks and insurance companies) pay among the lowest cash and total compensation (not reported).

4.2. Estimation of thresholds in the degree of control

This section follows the methodology presented earlier to identify one or more thresholds in the controlling shareholdings (the threshold variable). In the first stage, I look for the value of γ that best discriminates between a first class of non-controlled firms (including firms with no large shareholders on the board) and a second class of controlled firms, estimated by the differing effects of the two regimes of controlling shareholdings on CEO pay monitoring. Following the results of the previous section, controlling shareholdings are the equity shares held by the largest shareholder, alone or in concert, represented on the board of directors. γ can take all integer values from the lowest to the highest deciles of the controlling shareholding distribution, i.e. from 1% (actually above the first decile, as 119 out of 1,119 firm-years have no large shareholders on the board) to 68%. If the threshold effect is significant, the next step consists of looking for the second,

third, etc. threshold, while taking the previously found thresholds as given and as long as the mth threshold is significant. Table 5 displays the results of this sequential iterative procedure. The first threshold found for cash and total compensation has an F-statistic that is much higher than the bootstrap 1% critical value (84.71 vs. 11.40 for cash compensation, and 141.32 vs. 12.10 for total compensation); the same applies for the second threshold found. Thus, the zero- and the single-threshold models are successively rejected. The existence of a third threshold point is also validated for cash and total compensation at the 1% and 5% levels of confidence, respectively (bootstrap p-values are 0.8% and 4%, respectively). Finally, the tests for a quadruple-threshold model against a triple-threshold model are rejected for both dependent variables, with bootstrap confidence levels of 97% and 13%, respectively.

In the single- and double-threshold models, the estimate values are 11% and 46% both for cash and total compensation (not reported). These two values are used in the triple-threshold model to find the third threshold, which is 34% for both dependent variables. The two first values were estimated while ignoring the existence of a second or third threshold point. The refined estimation consists of first taking the 34% and 46% thresholds as given and looking again for the first threshold, and then taking 34% and 11% as given and looking again for the second threshold. The refined estimates confirm the 11% and 46% threshold points found in the single and double threshold models, and are displayed in Table 6 [26].

Table 6 also displays the confidence interval for the three refined threshold estimates, based on the LR-test described in section 2 (see also Graph A-2, in Appendix A)[27]. The confidence intervals for the 11% and 46% threshold values are quite tight and provide good confidence in the value of the break points separating one regime of the degree of control from another. The confidence interval for the 34% threshold value is wider: [31%, 42%] at the 5% level of significance. The specific pattern of this regime, which presents a CEO pay design similar to the omitted regime, further described below, may account for such a relaxed confidence interval.

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[26] As a robustness test, I also run a simultaneous search for γ values in the triple threshold model, i.e. looking for the three threshold values that simultaneously minimize the sum of squared errors in Equation (2), instead of the described sequential procedure. The results provide the same three estimate points as the refinement estimates, i.e. 11%, 34%, and 46% both for cash and total compensation.

[27] The graphs in the appendix illustrate the LR test, and provide the LR stats values for the whole range of γ-tested values (i.e. from 1% to 68%). The confidence interval at the 5% level of significance is defined as the "no rejection" region beneath the dotted line in the graph (which is the 5% critical value set at 7.35).

Table 5: Tests for an mth threshold given m-1 threshold(s)

	First	Second	Third	Fourth
Cash compensation				
F-stat. for *m* vs. *m-1* thresholds	84.71	46.15	12.87	2.30
p-value (bootstrap)	0.00	0.00	0.008	0.97
(10%, 5%, 1% critical values)	(7.13, 9.03, 11.40)	(8.08, 9.29, 11.34)	(8.40, 9.63, 12.75)	(9.48, 10.71, 12.80)
Total compensation				
F-stat. for *m* vs. *m-1* thresholds	141.32	53.55	11.37	8.54
p-value (bootstrap)	0.00	0.00	0.04	0.13
(10%, 5%, 1% critical values)	(6.92, 9.33, 12.10)	(7.99, 8.98, 11.96)	(8.63, 10.95, 15.38)	(9.00, 10.16, 13.19)

Table 6: Threshold estimates

Cash compensation			
Refined threshold estimates	11%	34%	46%
95% confidence interval	[10%, 16%]	[31%, 42%]	[45%, 46%]
99% confidence interval	[9%, 17%]	[27%, 42%]	[45%, 48%]
Total compensation			
Refined threshold estimates	11%	34%	46%
95% confidence interval	[10%, 14%]	[31%, 42%]	[46%, 48%]
99% confidence interval	[9%, 15%]	[28%, 45%]	[45%, 48%]

4.3. Estimation of seniority thresholds

The previous section narrows the definition of controlling shareholders to the largest shareholders on the board holding, alone or in concert, at least 11% of the equity share. Below the threshold of 11%, they belong to the same class of control as firms where no large shareholder is represented on the board, hence their control is deemed to be non-effective. The present section aims to more precisely specify effective control using the criterion of the number of years of control. The assumption is that the largest shareholder on the board needs time to acquire firm-specific knowledge and to be able to effectively monitor the top management. Among the controlling shareholders above the 11% threshold in the degree of control, the lowest and highest deciles of seniority are, respectively, three years and 107 years. The same iteration as in the previous section is applied for each integer value in this range. For each tested value, an indicator variable takes value one when the seniority is below the tested threshold, and zero if not, and thus results in a specific effect for "new" controlling shareholders among the three effective-control regimes identified in the previous section.

Table 7: Estimation of seniority thresholds

	Cash comp.	Total comp.
F-stat. for 1 vs. 0 threshold	31.19	29.42
p-value (bootstrap)	0.00	0.00
(10%, 5%, 1% critical values)	(7.27, 8.85, 11.26)	(7.20, 9.01, 11.71)
Threshold estimates	8 years	8 years
95% confidence interval	[6, 14]	[6, 9]
99% confidence interval	[6, 14]	[6, 10]

The threshold that yields the minimum sum of squared errors is eight years both for cash and total compensation, as reported in Table 7. The F-statistic is considerably higher than the bootstrap-estimated 1% critical value, leading to the rejection of the null of a zero-threshold model against the alternative of a single-threshold model, both for cash and total compensation. The values of the LR-statistic lying below the critical values of 5% and 1% define a confidence interval with a minimum value of six years for both compensation measurements, and a maximum value of 10 or 14 years (see also Graph A-3 in Appendix A). Thus for a given degree of control, the controlling shareholders exert homogeneous, effective control after about eight years of presence on the board, and after six years at the minimum.

The specification tests for a unique threshold for seniority of control, as there is no rationale for the existence of two or more break points in the acquisition of monitoring insight by the controlling shareholders. As a robustness check, a second point estimate and a test for a double-threshold model against a single-threshold model were processed (not reported), this check rejects the existence of a second threshold for total compensation. For cash compensation, the alternative hypothesis of a double-threshold model is not rejected with a p-value of 3%. The point estimate is 47 years of control. However, the 95% confidence interval is very large (from 36 to 87 years), and the 99% confidence interval cannot be defined: all of the LR-statistics calculated in the range of three to 107 years are below the 1% critical value. In the end, this results into rejecting the double threshold model for cash as for total compensation, and supports the assumption that there is one unique threshold for seniority.

4.4. Thresholds for the degree and seniority of control

The dummy variables for the degree of control regimes are integrated into the base regression specified in Equation (2) and displayed in columns 1 and 2 of Table 8. As the dependent variable is log-transformed, the coefficients of the dummy variables can be interpreted as approximated deviations in percentage from the omitted regime of non-controlled firms. Firms falling into the second monitoring regime with controlling shareholdings ranging from 11% to 34% pay about 17% less cash compensation to their CEOs. After adding the long-term incentives, the discrepancy between the first and second regimes increases with an approximately 31% lower level of total compensation in the latter. Controlling shareholders holding 46% or more of the common stock exert significantly stronger CEO pay monitoring: the cash and total compensation are about 32% and 54% lower compared to the first regime, respectively[28].

The intermediate class of control presents a specific pattern. Controlling shareholders who hold between 34% and 46% of equity behave no differently from the first regime of non-controlled firms. However, in the class of non-controlled firms, higher CEO compensation may be interpreted as higher influence of the CEO over the board of directors in the absence of a controlling shareholder. In the third class of firms, similarly high CEO compensation may instead be interpreted as an "entrenchment" effect of the controlling shareholder. This result presents some similarities with the literature on the relationship between management ownership and firm value: the impact of managerial shareholdings is positive at low and high levels of equity shares, but is negative at intermediate levels (Morck, et al., 1988; Short & Keasey, 1999; Davies, et al., 2005), which the authors interpret as an entrenchment of managers at these levels. This can also make sense in the context of controlling ownership at the threshold level of 34%. Some authors refer to anecdotal evidence suggesting that above an ownership level of 25% or 30%, a hostile takeover attempt cannot succeed (Weston, 1979; Holderness, 2003), hence controlling shareholders would no longer be disciplined by this threat and they gain enough influence to make major strategic corporate decisions[29]. Also, they bear the full

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[28] The difference between the estimated impact of the second and fourth control regimes are statistically significant. A Wald test for the equality of the coefficients is rejected with a level of confidence of 98% and 99.7% for cash and total compensation, respectively.

[29] In the context of French listed companies, control over one-third of the voting rights provides shareholders with a blocking minority in extraordinary general meetings, which thus give them control

Table 8: Regression of CEO compensation on control regimes

	Ln(Cash comp.) (1)		Ln(Total comp.) (2)		Ln(Cash comp.) (3)		Ln(Total comp.) (4)	
	coef	*t-stat.*	*coef*	*t-stat.*	*coef*	*t-stat.*	*coef*	*t-stat.*
Controlling shareholders:								
I(Seniority of control < 8 years)					0.22	3.14***	0.25	2.99***
Degree of control:								
1st regime: I(0% to 11%) - omitted								
2nd regime: I(11% to 34%)	-0.17	-2.91***	-0.32	-4.39***	-0.25	-3.43***	-0.41	-4.64***
3rd regime: I(34% to 46%)	-0.03	-0.47	-0.16	-1.85*	-0.07	-1.04	-0.20	-2.24**
4th regime: I(≥ 46%)	-0.31	-5.05***	-0.54	-7.91***	-0.32	-5.18***	-0.56	-8.07***
Intercept	-7.16	-7.11***	-8.15	-5.79***	-6.81	-6.88***	-7.70	-5.61***
Other control variables	Yes		Yes		Yes		Yes	
Firm-year obs.	1119		1119		1119		1119	
Adj. R² (%)	78.40		78.14		79.01		78.69	

*; **; ***: denote significance at 10%, 5% and 1% levels.

cost of monitoring activities – with other minority shareholders being presumably free-riding (Shleifer & Vishny, 1997) – but they do not receive all of the benefits from these costs because of their minority cash flow rights. Thus, in this intermediate position, a controlling shareholder that is not restricted by external threats and only benefits from minority cash flow returns may decide to increase the cash flow return on monitoring activities, potentially at the expense of other shareholders. In this context, the controlling shareholder may pay a higher cash compensation in order to induce the CEO into managing the firm in the interest of the monitor. High levels of equity-based compensation in this regime would contradict this interpretation, as the entrenched controlling shareholder would not be willing to provide market-based incentives that might align the interests of the CEO with those of outside shareholders. The coefficient found in this third regime for total compensation is higher than the ones for the second and fourth regimes but is significantly negative (column 2), which shows that these shareholders indeed pay lower equity-based compensation to their CEOs compared to non-controlled firms[30]. Thus, the higher level of total compensation in the third regime is mainly

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over every decision related to capital transactions or mergers and acquisitions. In addition, under the Paris stock exchange authority rules, a shareholder who crosses the threshold of 33% (30% since 2012) has the obligation to launch a public bid for all remaining outstanding shares, this with the purpose of protecting other minority shareholders from a potentially undesired change of control. The market authority's choice of 30% or 33% provides complementary anecdotal evidence that this threshold is deemed sufficient to substantially influence the governance of a firm.

[30] I also ran a regression specifically for equity-based compensation (not reported), this is a limited dependent variable and requires a Tobit model. I find that the level of this component is lower than in the first regime (with a 97% level of confidence) and similar, *ceteris paribus*, to the one found in the second class of firms.

comprised of higher cash compensation, which is consistent with the "entrenchment" interpretation.

In columns 3 and 4 of Table 8, an indicator for controlling shareholders with less than eight years of seniority is added to the specification. The indicator variable takes value one if the controlling shareholder holds, alone or in concert, at least 11% of the equity and has been represented on the board of directors for less than eight years, and zero if not. The coefficients are significantly positive both for cash and total compensation. This means that "new" controlling shareholders provide their CEOs with higher pay than "old" controlling shareholders. These coefficients should be added to those associated with the second, third and fourth control regimes to measure the impact of these shareholders compared to non-controlled firms. Cash compensation in firms with low seniority of control is similar to or even higher than that received by CEOs in non-controlled firms. Regressions of the two components of cash compensation, namely base salary and bonuses (not reported), reveal that higher pay is mostly in the form of bonuses rather than base salary. Except for the third regime, total compensation is still lower than that received by CEOs in non-controlled firms. A regression restricted to long-term incentives as a dependent variable (not reported) reveals that this pay component is lower in all firms with low seniority of control compared to non-controlled firms, but higher than in firms of the second and fourth regimes with high seniority of control. In summary, shareholders who take control of a firm tend to pay higher bonuses and long-term incentives to their CEOs during the approximately eight first years of control compared to shareholders with higher seniority in the control of the firm. This result is consistent with the prediction that these shareholders suffer higher asymmetries of information with the top management and need to rely on alternative mechanisms of control – especially in the form of higher bonuses but also higher equity-based pay (although this latter component is still lower than in non-controlled firms).

4.5. Estimated impacts of the control regimes

The results on the degree and seniority of control are also significant in terms of their economic impact on CEO compensation. Panel A of Table 9 displays the mean values of firm sizes and levels of cash and total compensation within each degree of control regime.

Table 9: Mean size and compensation for each regime and estimated excess compensation.

(in €,000, except for regime effects)

Panel A: Degree of control (entire sample)

Note: "Regime effect" as found in Table 8. "*n.s.*" stands for non-significant.

	1st regime (0% to 11%)	2nd regime (11% to 34%)	3rd regime (34% to 46%)	4th regime (≥46%)
Sales	18,620,497	12,112,069	7,643,961	8,075,550
Market capitalization	16,182,464	7,282,453	6,344,203	7,443,256
Cash compensation	1,718	1,198	1,310	998
Regime effect	Benchmark	-0.17	*n.s.*	-0.31
Estimated gap[1]	0	225	*n.s.*	357
Total compensation	2,923	1,816	1,948	1,528
Regime effect	Benchmark	-0.32	-0.16	-0.54
Estimated gap[1]	0	692	344	1,097
N (firm-year obs.)	*284*	*296*	*144*	*395*

[1] Estimated gap if the CEO served in a firm in the first regime (*ceteris paribus*) = exp(ln(Cash or Total compensation)-Regime effect) - Cash or Total compensation.

Panel B: Seniority of control (sub-sample)

Note: Sub-sample of controlled firms (i.e. 2nd to 4th regimes), and seniority <8 years. N=175 firm-year obs. "Regime effect" as found in Table 8.

Sales	Market cap.	Cash comp.	Regime effect	Estimated gap[1]	Total comp.	Regime effect	Estimated gap[1]
9,605,012	5,246,163	1,273	0.22	-246	1,840	0.25	-403

1: Estimated gap if the CEO served in a controlled firm with seniority of control ≥8 years (*ceteris paribus*).

The differences in the levels of pay observed from one regime to another are mainly explained by the size effect that is controlled for in the base specification[31]. The regime effects correspond to the coefficients of the indicator variables presented in Table 8. The average CEO in the second class of firms receives a cash compensation of €1.20 million and a total compensation of €1.82 million which is about 17% and 32% lower than the cash and total compensation, respectively, the CEO would receive if he/she served in a firm under the first regime, all other things being equal. This would represent a higher pay by about €225,000[32] for cash compensation and €692,000 for total compensation. Similarly, the average CEO in the fourth class of firms receives a cash compensation of €998,000 and a total compensation of €1.53 million, and would receive an additional

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[31] The differences between size and levels of compensation are not proportional from one regime to another because the relationship has a concave shape (captured by the log transformation plus the square of ln(sales) in the base specification).

[32] Exp(ln(1,198)+0.17)-1,198 = 225.

€357,000 in the form of cash and €1.10 million in the form of cash plus equity-based pay if he/she served as a CEO in the first class of firms. The cash compensation gap is not significantly different from zero between the first and third regimes (see column 1 in Table 8), but is about €344,000 for total compensation.

Panel B displays the mean values of size and compensation for the sub-sample of firm-years that are controlled (degree of control greater than 11% of ownership) with less than 8 years of seniority of control. The mean cash and total compensation are close to the ones found in the second control regime (see panel A) although the sizes of the firms in the former are smaller than in the latter; this already illustrates the higher relative pay received by CEOs when the controlling shareholder has monitored the management for only a few years. Specifically, CEOs would be paid €246,000 less cash compensation if they served in a similar firm (*ceteris paribus*) but with a more experienced monitor. Similarly, they would be paid €403,000 less in total compensation were they monitored by an experienced monitor.

4.6. Continuous vs. discontinuous measures of the degree of control

The estimations presented above assume a threshold effect at certain points of the controlling holdings and homogeneity in each regime's degree of control. This assumption shaped the base specification (Equation (2)) where the measures of the degree of control are indicator variables. The literature on managerial ownership and a number of studies concerning ownership concentration and large shareholders (see Table 1) use instead a continuous ownership measure taking the percentages of equity held rather than indicator variables. This section discusses the relevance of such measures against a discontinuous ownership measure with a threshold effect. If a continuous measure is better to capture the degree of control, indicator variables would then be too restrictive because they do not account for varying degrees of control within one regime. A specification that includes the percentage of controlling shares for each regime should then raise the quality of the estimate. I then re-estimate Equation (2) using the percentages of controlling shareholdings in each regime instead of indicator variables. These results are displayed in columns 1 and 2 of Table 10. The coefficients for each regime have the same level of significance and the adjusted R^2 are slightly lower than the ones previously found in Table 8 (0.7830 vs. 0.7840 and 0.7811 vs. 0.7814 for cash and total compensation, respectively):

thus the percentage held by the controlling shareholder in each regime does not improve the measurement of the degree of control in spite of the additional information provided by a continuous rather than a discontinuous variable. The absence of an improved estimation provides support for the hypothesis of a discontinuous threshold effect.

The literature concerning managerial ownership, as presented in Table 1, relies on specific continuous measures to estimate the impact of executives' shareholdings on firm value. The results from the panel threshold model are then compared to the ones provided by the methods used in this literature, first in the form of a spline function, second with a polynomial function. In the first instance, Morck et al. (1988) and Cho (1998) use a spline function in the form of a piecewise linear regression which requires to create the following variables:

$$1st\ regime \quad \begin{cases} = CS\ \%, & if\ CS\ \% < 11\% \\ = 11\% & if\ CS\ \% \geq 11\% \end{cases}$$

$$2nd\ regime \quad \begin{cases} = 0, & if\ CS\ \% < 11\% \\ = CS\ \% - 11\%, & if\ 11\% \leq CS\ \% < 34\% \\ = 34\% - 11\%, & if\ CS\ \% \geq 34\% \end{cases}$$

$$3rd\ regime \quad \begin{cases} = 0, & if\ CS\ \% < 34\% \\ = CS\ \% - 34\%, & if\ 34\% \leq CS\ \% < 46\% \\ = 46\% - 34\%, & if\ CS\ \% \geq 46\% \end{cases}$$

$$4th\ regime \quad \begin{cases} = 0, & if\ CS\ \% < 46\% \\ = CS\ \% - 46\%, & if\ CS\ \% \geq 46\% \end{cases}$$

where $CS\ \%$ stands for the percentage held by the controlling shareholders. The regressions in columns (3) and (4) of Table 10 apply this approach for the present sample panel with the change points found in the PTR model. The first regime is omitted consistent with the base specification for the PTR model. The coefficients for the second and fourth regimes are not significant (19% and 12% p-values, respectively) for cash compensation[33] but are significant for total compensation. The coefficients for the third regime are not statistically different from zero as in the discontinuous specification. Overall, the results are not very different from the discontinuous specification. However, the R^2 are slightly lower and this specification does not minimize the unexplained variations in the dependent variable. Then, it does not support a continuous metric instead of a threshold effect.

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[33] The coefficients in column (3) should be interpreted as follows: a controlling shareholder holding for instance 50% of the common stock first has a negative impact of 0.49 for each percentage point between 11% and 34%, a negative impact of 0.32 for each percentage point between 34% and 46%, and a negative impact of 0.54 for each additional percentage point above 46%.

Lastly, referring to studies of managerial ownership by McConnel and Servaes (1990), Short and Keasey (1999) and Davies et al. (2005), I also used a polynomial equation to estimate the continuous impact of the degree of control on CEO compensation. According to the results of the triple-threshold model, the polynomial specification should account both for the negative impact of controlling shareholdings in the second and fourth regime compared to the first regime, and for the positive impact in the intermediate third regime where CEO compensation again reaches the levels of the first regime. Contrary to the aforementioned studies that used quadratic, cubic or quintic functions, the relationship found in the PTR models requires a six-degree function, with negative and positive coefficients alternatively at each degree. For this purpose, I first run the base specification (Equation (2)), with no controlling shareholding variable. The residuals can be interpreted as deviations of CEO compensation from its expected value according to its economic determinants. I then denote the residuals as "excess compensation" and regress it on the six-degree polynomial function[34], as follows:

$$Excess\ comp_j = \alpha_{j0} + \alpha_{j1}CS + \alpha_{j2}CS^2 + \alpha_{j3}CS^3 + \alpha_{j4}CS^4 + \alpha_{j5}CS^5 + \alpha_{j6}CS^6 + \varepsilon_j$$

where $j = 1$ denotes cash compensation, $j = 2$ denotes total compensation; CS stands for the percentage of controlling shareholdings with a minimum value of 1%. The intercept α_{j0} can be interpreted as an approximation for the average excess compensation in firms with no large shareholders on the board of directors. The estimated coefficients α_{j0} to α_{j6} that define the polynomial function are displayed in Panel B of Table 10. The first degree of the function was not different from zero and was therefore dropped. The other coefficients are significant and this nonlinear continuous measure of the degree of control accounts for about 7% of the deviations between cash compensation and its estimated values. Similarly, it accounts for about 12% of the deviations for total compensation.

This function, as exhibited in Graph 1, also illustrates the threshold effects found in the PTR model. The non-controlled firms (first regime) and firms with "entrenched" monitors (third regime) provide higher pay to their CEOs (positive residuals or "excess

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[34] A two-stage procedure is used because it allows for a direct reading of the positive or negative impact of controlling interests on the ordinate axis in Graph 1. The polynomial function can be directly integrated into the base specification, as has been done in previous studies, and it yields similar coefficients with the same statistical significance.

Table 10: Continuous measures of the degree of control

Panel A: Continuous vs. discontinuous measures of the degree of control

	Continuous (% Holdings per regime)		Piecewise linear form		Discontinuous (indicator per regime)	
	Ln(Cash comp.)	Ln(Total comp.)	Ln(Cash comp.)	Ln(Total comp.)	Excess Cash comp.	Excess Total comp.
	(1)	(2)	(3)	(4)	(5)	(6)
	coef t-stat.	*coef t-stat.*	*coef t-stat.*	*coef t-stat.*	*coef t-stat.*	*coef t-stat.*
Degree of control:						
1st regime (0% to 11%)	omitted	omitted	omitted	omitted	0.13 3.45	0.24 5.67***
2nd regime (11% to 34%)	-0.61 -2.84***	-1.24 -4.59***	-0.49 -1.32	-1.30 -2.63***	-0.15 -2.7***	-0.27 -4.09***
3rd regime (34% to 46%)	-0.02 -0.15	-0.34 -1.62	-0.32 -0.45	0.01 0.01	0.00 -0.02	-0.09 -1.05
4th regime (≥ 46%)	-0.46 -4.4***	-0.83 -6.89***	-0.54 -1.57	-0.95 -2.31**	-0.26 -4.64***	-0.44 -7.01***
Intercept	-7.23 -6.67***	-8.21 -5.25***	-7.37 -7.01***	-8.35 -5.42***	n/a	n/a
Other control variables	Yes	Yes	Yes	Yes	No	No
Firm-year obs.	1119	1119	1119	1119	1119	1119
Adj. R² (%)	78.30	78.11	77.57	77.16	8.35	13.45

*; **; ***: denote significance at 10%, 5% and 1% levels.

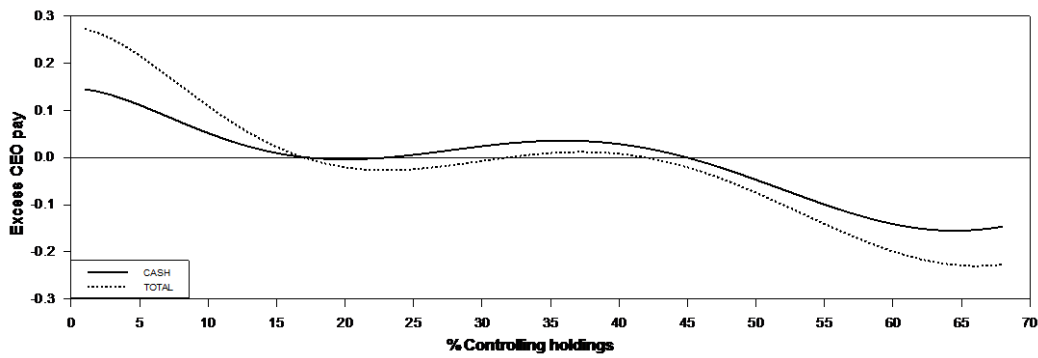### Panel B: Polynomial continuous relationship between excess compensation and degree of control

Note: "*cs*" stands for "% Controlling shareholdings"

	Excess cash compensation							Excess total compensation					
Polynomial function:	*Intercept*	cs^2	cs^3	cs^4	cs^5	cs^6		*Intercept*	cs^2	cs^3	cs^4	cs^5	cs^6
Coef.	0.15	-20.59	145.15	-386.43	442.24	-182.94		0.28	-33.77	220.30	-555.59	612.05	-246.34
t-stat.	3.35***	-2.21**	2.21**	-2.27**	2.35**	-2.42**		5.62***	-3.06***	2.89***	-2.86***	2.87***	-2.90***
Firm-y. obs.:			1119							1119			
Adj. R² (%):			7.16							12.32			

*; **; ***: denote significance at 10%, 5% and 1% levels.

Graph 1: Polynomial function for cash and total compensation

CEO pay"), while the second and fourth classes of firms provide lower pay packages to their CEOs, with the latter having a much stronger effect. Up to 17% of holdings, the excess total compensation is higher than the excess cash compensation (the total compensation curve is above the cash compensation curve) and is lower beyond that. This illustrates the higher equity-based compensation provided to CEOs in the absence of a monitor and as an alternative to control (as found previously). Above 17%, the excess total compensation is invariably below the excess cash compensation, illustrating the lower equity-based compensation received by CEOs under the other regimes, including the intermediate one.

One interesting exercise is to compare the threshold point estimates from the PTR models with the shape of the graph. In the literature on managerial ownership, the authors interpret the curve maxima and minima as change points in the behavior of owner-executives, and the slope between extrema is used to define a positive or negative impact of an incremental 1% holdings between change points. Here, the change points would be 20%, 36%, 65% and 81% for cash compensation, and 23%, 37%, 66% and 81% for total compensation[35], and the impact of a 1% increase in ownership between each change point would be interpreted as negative if the slope is negative, and positive otherwise. This interpretation of the coefficients in the piecewise specification is very misleading because the negative slope between 0% and 20% ownership would be interpreted as a negative impact of controlling shareholders in this whole range (each 1% increase in holdings would

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[35] The higher value of holdings taken for the PTR procedure was 68%, i.e. the top decile. The values above this point that are presented here cannot be supported by the PTR procedure because there are not enough observations to identify a significant regime. Notwithstanding, the effect above 68% is still negative in the polynomial function (curves are largely below the abscissa axis after 68%) and does not question the higher degree of control above the 46% threshold compared to other regimes.

entail a reduction in excess CEO pay), which is not representative of what actually happens: the excess compensation is still positive in this range (as can be seen in the ordinate axis), and, in the perspective of a threshold effect, there would be indeed a flat positive impact below the 11% threshold.

Compared with the results of the earlier threshold analysis, the maxima and minima of the polynomial function indeed appear as approximate "midpoints" for each regime. The change points between regimes appear to be instead approximated by the inflexion points of the polynomial function, i.e. the points where the concavity of the curb changes (calculated as the roots of the second derivative). The inflexion points are 7%, 28%, and 52% for cash compensation, and 8%, 30%, and 53% for total compensation[36]. These points are consistent with the threshold estimates found earlier in the panel threshold analysis. The question is whether these inflexion points are a better estimate of changes in the behavior of the controlling shareholders. In other words, the point is whether a smooth and continuous measurement of the change from one regime to another is better than a sudden break point between regimes. The regressions in columns 5 and 6 of Table 10 (panel A) are run using the same dependent variables as the polynomial function (excess cash and total compensation) but on the four rough indicator variables for each regime instead of the nonlinear continuous function. The former enhances the quality of the estimate, based on the R^2s, compared to the polynomial function (0.083 vs. 0.072 and 0.135 vs. 0.123). As a robustness check, I also use the four inflexion points found above and regress the excess compensation on the five associated indicators per regime. This yields an R^2 of 0.045 and 0.096, respectively (not reported), which are of even lower quality. In the end, if one uses a piecewise or polynomial specification to measure the nonlinear effects of ownership, the most appropriate estimate of the change points are inflexion points rather than the maxima and minima found in previous studies. As for the degree of control, a nonlinear continuous measurement may approximate the changes in monitoring behavior, but with less precision and quality than a discontinuous panel threshold analysis.

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[36] The fourth inflexion point for both polynomial functions is 75%, it is dropped because it is above the already mentioned top decile of 68% and has not enough firm-year observations to be conclusive.

5. Conclusive comments

Large shareholdings and ownership concentration are usually measured using rough variables such as the interest held by all blockholders or the weight of the top five shareholders. Some studies also distinguish between outsider blockholders and insider shareholders, but use databases that do not account for blockholders indirectly represented on the board of directors (i.e. companies or other organizations sitting on the board not as a legal entity but via an individual representative). Based on a panel of French listed companies, this study uses hand-collected data regarding largest shareholders (above 1% ownership) represented directly or indirectly on the board, information on whether or not they act in combination with other shareholders, and whether they benefit from double voting rights. The data also include information regarding the direct or indirect representation of all identified blockholders (over 5% ownership) on the board. These various ways of holding a significant ownership interest in a firm were tested for based on their respective influence on CEO compensation monitoring. The results show that the only metric associated with effective control is the percentage of ownership of the largest shareholder represented on the board of directors, plus the percentage held by the shareholders acting in concert with him/her/it. These *controlling shareholdings* were then used in the framework of a panel threshold model so as to identify the point at which the shareholder has enough influence to effectively monitor, and other points at which the degree of control may vary.

Three threshold points in the *degree of control* are found. The largest shareholder on the board, alone or in concert, exerts effective management monitoring from about 11% ownership. Below this threshold, firms can be considered as non-controlled. The degree of control reaches its highest level above about 46% ownership, with a significant negative impact on CEO pay in the form of cash and equity-based compensation. An intermediate level of control was identified between about 34% and 46% of ownership. In this regime equity-based compensation is still lower than for non-controlled firms, but CEOs receive higher cash compensation. This may be interpreted as a means to induce CEOs to act in the interest of an "entrenched" shareholder.

These three estimated thresholds can be approximated as thresholds of 10%, one-third and 45% of the common stock and the three regimes of controlled firms are here termed as "influential", "dominant", and "majority" control. Firstly, "influential" shareholders hold between 10% and one-third of the equity which is enough to voice their

interests and apply for representation on the board. Yet they are in a vulnerable position in a takeover market, and other large shareholders may already hold positions close to theirs. Secondly, large shareholders holding more than one-third but less than about 45% of the equity are in a "dominant" position. Under French law, they benefit from a "minority blocking" interest that enables them to veto any decision in extraordinary general meetings, hence they do not fear takeover threats. Also, in this position, they may incur all of the monitoring costs of the firm – other minority shareholders are presumably free-riding – while receiving less than half of the cash flow returns. These "dominant" shareholders may then be tempted to provide their CEOs with higher pay so as to secure the CEO's loyalty so that he/she acts first in their interest and not in that of other minority shareholders. Thirdly, "majority" shareholders are defined as shareholders holding more than about 45% of the equity. They are not vulnerable to hostile takeovers and they have enough bargaining power to effectively monitor the management. They also benefit from a major share of cash flow rights, which may compensate for the costs incurred from monitoring activities and is expected to limit "entrenched" behaviors.

Beyond the degree of control, a controlling shareholder may have varying skills to effectively monitor the management according to another criterion termed as *seniority of control* and measured by the number of years of control. This criterion is used for the first time in this literature, to the best of my knowledge. The rationale for this criterion is that the controlling shareholder needs experience and firm-specific knowledge before it will have the insight and skills to effectively monitor the firm. Using the design of CEO compensation in a panel threshold model, this study finds that a large shareholder needs about eight years, six at the minimum, to behave as an experienced monitor. Experience may reduce or eliminate information asymmetries with the management and may be associated with higher involvement in governance. Hence, experienced monitors can restrict the levels of CEO pay and they do not need to rely on alternative mechanisms of control such as high levels of bonuses and of equity-based incentives to monitor their CEOs. Above the threshold of six to eight years of seniority, controlling shareholders rely less on short-term incentives in the form of bonuses or on medium-term market value incentives in the form of equity-based pay, and they can be considered as "long-term" oriented. The stability of their involvement in the control of the firm also argues for a long-term investment strategy. Conversely, controlling shareholders with little experience provide higher pay to their CEOs mostly in the form of annual bonuses which tend to vary according to short-to-medium term performance criteria. Firms with a controlling

shareholder below six to eight years of seniority fall into a regime here termed as "new control" – it may actually include different types of investors with various time horizons, from parent companies that recently took over a firm with a long-term industrial outlook, to investment companies with a medium-term strategy of capital gains.

The criteria and methodology used to define controlling shareholdings and the forms of control suggest that future research on corporate governance could benefit from including such characteristics of corporate control that contrast with the dichotomous or broadest measures usually found in this literature. Beyond the impacts on CEO compensation, these criteria might also provide insights into the effects of corporate control on such issues as characteristics of the board of directors, financial policies of the firm, R&D expenses, or takeover activity, among other corporate decisions controlling shareholders may influence.

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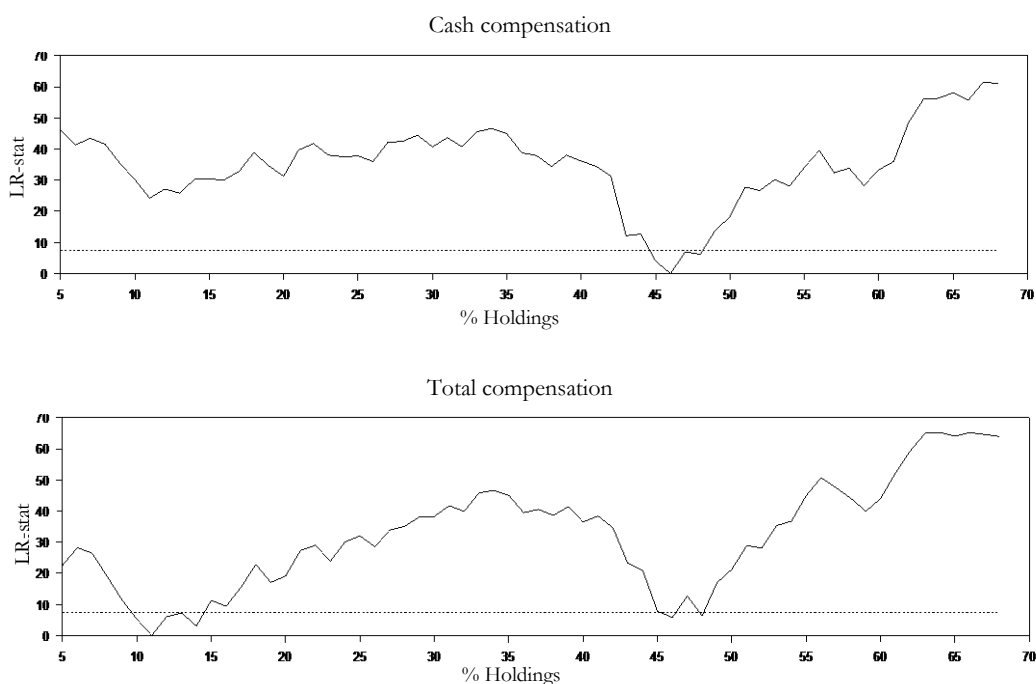
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Appendix A

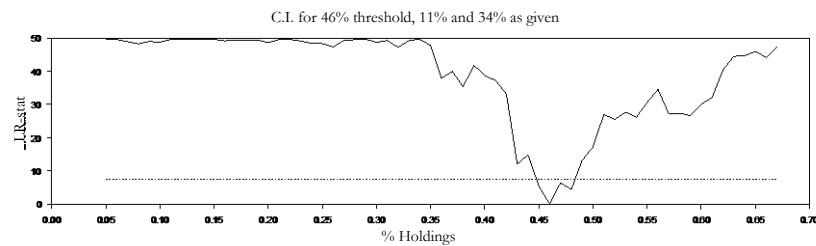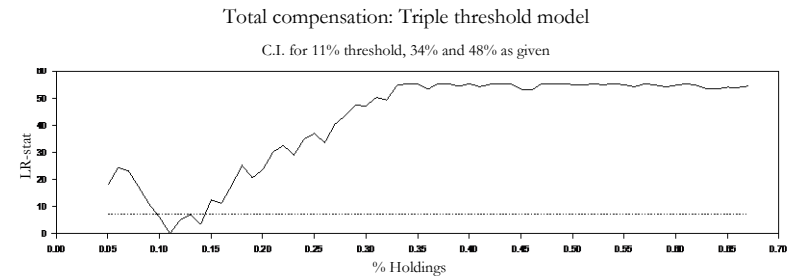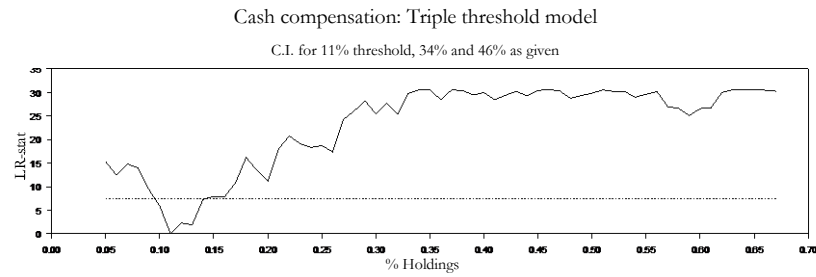## Confidence interval construction

Graph A-1: Degree of control: LR-stats for the confidence interval construction in a single threshold model

Note: The single threshold model is rejected in the study and its LR-stats are not used for the results. Tough, the LR-stat values associated to the single threshold model are interesting to look at as they provide some hints about the number and values of thresholds to be found (see extrema values at around 11%, 34%, and 46%).
The dotted line is the 5% critical value (7.35).

Cash compensation

Total compensation

Graph A-2: Degree of control: Confidence interval construction in a triple threshold model

Notes: LR-stat values below the *critical value* dotted line define the "no-rejection region" or confidence interval. The critical value at the 95% level of confidence equals 7.35.

Cash compensation: Triple threshold model

Total compensation: Triple threshold model

C.I. for 11% threshold, 34% and 46% as given

C.I. for 11% threshold, 34% and 48% as given

C.I. for 34% threshold, 11% and 46% as given

C.I. for 34% threshold, 11% and 48% as given

C.I. for 46% threshold, 11% and 34% as given

C.I. for 48% threshold, 11% and 34% as given

Graph A-3: Seniority of control: Confidence interval construction in a single threshold model

Note: LR-stat values below the dotted line (5% critical value, equal to 7.35) define the "no-rejection region" or confidence interval for the "8 years" threshold.

Cash compensation

Total compensation