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Controlling shareholders and CEO pay monitoring: A panel threshold approach on the degree and seniority of control¹

Lionel Almeida²

ABSTRACT

The intensity of monitoring and its effects on the design of CEO pay can vary depending on the degree of ownership and the seniority of controlling shareholders. This study uses a panel threshold model to identify threshold effects in these two dimensions of control in French listed companies. The results show firms can be deemed to be non-controlled below a threshold of 10% of equity; above that, three regimes of controlled firms are identified: influential (10% to 33%), dominant (33% to 45%) and majority (above 45%) controls. One threshold point in the seniority of control – at about eight years after taking control – separates out new and long-term controls. *Non-* and *newly-*controlled firms are found to rely on optimal contracting to deal with agency and retention issues, while *influential* and *majority* controlling shareholders bring better governance and effective monitoring. Located at an intermediate level of control, *dominant* controlling shareholders show evidence of entrenchment.

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

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 and Vishny, 1986). Hence they may influence major corporate decisions and have a significant impact on the firm's strategy and performance. Selecting CEOs and designing their management pay packages are among the major corporate decisions large shareholders can influence: as they engage in monitoring, they improve the governance of the firm and can deal with a number of issues such as agency costs and rent extraction (Core et al., 1999; Chhaochharia and Grinstein, 2009).

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Nevertheless, the necessary conditions to be met for assigning the monitoring of the firm to one or several large shareholders need further investigation. As pointed out by Bhagat et al. (2004) and Holderness (2003; 2009), there is little guidance in the literature as to the level of equity holdings or voting rights required to exert a significant influence on a firm's governance. For instance, the literature dealing with the effects of large shareholdings mostly relies on an exogenously-set legal threshold of 5% of equity, and assumes that blockholders above this threshold have either a homogeneous impact (as measured by one indicator variable) or a simple linear impact (as measured by the percentage of shares).

The present paper seeks to refine our knowledge of the way in which various degrees of large shareholdings can have varying effects on the intensity of monitoring, as evidenced by the effects of ownership on the design of CEO compensation packages. The methodological approach of this study relies on the panel threshold regression (PTR) model developed by Hansen (1999). The PTR model can endogenously identify an initial threshold – as opposed to an exogenous legal threshold usually found in the literature – above which large shareholders can be deemed to monitor effectively. The model can then further investigate whether controlling shareholders behave homogeneously above the initial threshold, or if there are other thresholds that define various regimes of control.

The study also introduces an original criterion to gauge the quality of monitoring, using the seniority of control. This involves the number of years a controlling shareholder has been in a position to monitor the firm. Although a number of studies evaluate the impact of CEO tenure over the years (Hambrick and Finkelstein, 1995; Cyert et al., 2002), it is, to the best of my knowledge, the first time the effect of time and experience has been applied to controlling shareholders. The rationale behind this criterion is that controlling shareholders may acquire monitoring experience and firm-specific knowledge over time that can help reduce informational asymmetries with CEOs, improve their ability to supervise them, and evaluate their skills.

According to the literature, the way a firm is controlled can have various effects on the design of CEO compensation. Starting with firms that are diffusely-held, the absence of controlling shareholders may enable CEOs to gain power and become entrenched, leading to rent extraction and the maximization of managerial pay (Gomez-Mejia et al., 1987; Hambrick and Finkelstein, 1995; Bebchuk et al., 2002). However, from a principal-agent

perspective, outside minority shareholders pressure the firm to design optimal compensation packages, notably through equity-based plans that give CEOs incentives to maximize shareholders' wealth (Jensen and Murphy, 1990). But these plans also result in higher levels of total pay, since risk-averse CEOs demand pay premiums for bearing more risk in their compensation packages (Beatty and Zajac, 1994; Haubrich, 1994).

In firms that are closely held, controlling shareholders are in a position to watch over their executives and improve the governance of the firm. They can offset the influence CEOs may have over their own pay, which leads to lower rent extraction (Dyl, 1988; Lambert et al., 1993; Hambrick and Finkelstein, 1995; Cyert et al., 2002; Chhaochharia and Grinstein, 2009). They can also reduce agency issues with managers, resulting in a lower recourse to equity-based plans and thereafter lower levels of total pay (Beatty and Zajac, 1994; Lippert and Moore, 1995; Mehran, 1995; Core et al., 1999).

The downward effects of monitoring on CEO compensation suggest that controlling shareholders bring better governance. Yet controlling shareholders may also try to use their dominant position to entrench and extract private benefits at the expense of outside minority shareholders (Grossman and Hart, 1988; Claessens et al., 2002). This can be especially expected from controlling shareholders who bear the full cost of monitoring but only hold a minority share of cash flow rights: extracting private benefits allows them to increase the cash flow return from monitoring activities (Shleifer and Vishny, 1997; Holderness, 2003). In this entrenchment view, controlling shareholders are expected to grant higher levels of CEO pay (Morck et al., 2005; Masulis et al., 2009), either because the CEO is part of the group of owners, or as a mean to buy CEO loyalty and induce him/her to take corporate decisions that allow for private benefits.

The effect of time and experience, as measured by the seniority of control, may also have some specific impact on the quality of monitoring and the design of CEO pay. Controlling shareholders who are in their first years of control may know little about their CEO's ability to meet performance targets. This lack of knowledge would make it necessary to rely on performance-based plans, since such compensation schemes are more informative of CEO actions (De Angelis and Grinstein, 2015).

Another potential effect of more engaged and experienced monitors is related to the labor market for CEOs. Better governance allows the selection

of CEOs whose skills are more specific to the firm (Chaigneau and Sahuguet, 2018) and who will receive fewer external job opportunities. By contrast, poorly-governed firms tend to hire generalist CEOs with greater retention issues, making it necessary to set higher levels of pay (Murphy and Zábojník, 2007; Custódio and Metzger, 2013).

Overall, the literature suggests that large shareholders engage in monitoring and improve the governance of the firm, resulting in lower levels of CEO compensation. But if large shareholders try to use their dominant position to extract private benefits, this may instead lead to higher levels of pay.

In the present paper the effects of large shareholdings on CEO compensation are used to gauge the intensity and quality of monitoring. More specifically, controlling shareholders may have varying effects on the design of CEO compensation as they cross thresholds in the degree and seniority of control. They may improve the governance of the firm and have interests aligned with outside shareholders in some regimes of control, but entrench and try to extract private benefits in others. Where they bring better governance they may also have differing levels of impact on the design of CEO pay.

The present study uses the PTR model to test for such threshold effects. The results show that there are four regimes in the degree of control, separated out by three threshold points at about 10%, 33% and 45% of equity shares; and two regimes in the seniority of control, separated out at about eight years after large shareholders have taken control of the firm.

The four regimes in the degree of control are denoted as follows: firms with no large shareholder owning more than 10% of ownership are *non-controlled* firms; while above 10% of ownership there are three regimes of controlled firms: those with *influential* (between 10% and 33%), *dominant* (33% to 45%) and *majority* (above 45%) controls.

With respect to the seniority of control, the threshold point separates a regime of *new* control (below eight years of seniority) and a regime of *long-term* control (above eight years).

CEOs receive the highest levels of pay (all other things being equal) in non-controlled firms, consistent with poorer governance and stronger agency and retention issues in the absence of controlling shareholders. Management compensation packages in controlled firms with low seniority of control

are found to be similar to those in non-controlled firms, showing evidence of poorer governance for *new* controlling shareholders.

In firms with *influential* control, CEOs receive significantly lower levels of pay, and this downward effect is significantly strengthened in firms with *majority* control, showing evidence of effective monitoring and improved governance in these two regimes of controlled firms.

Dominant controllers, occupying an intermediate position in the degree of control (33% to 45% of equity), exhibit a specific pattern. They provide their CEOs with significantly higher levels of pay compared with other controlled firms. This excess pay is not explained by higher performance-based plans, distinguishing it from higher levels found in non- and newly-controlled firms that deal with agency and retention issues. Instead, it provides evidence of entrenchment on the part of controlling shareholders located at an intermediate level of control.

Finally, this study employs methodologies from the managerial ownership literature (continuous piecewise and polynomial specifications) to test whether they provide a better estimate of the effects of ownership on CEO pay. The results show that the discontinuous specification with threshold effects of the PTR model is more appropriate than continuous specifications with nonlinear effects.

The remainder of this paper is organized as follows: Section 1 is a review of the metrics found in the literature dealing with large and managerial ownership, and the effects on CEO compensation. 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 contains descriptive statistics. Section 4 presents empirical results. Section 5 discusses the relevance of a discontinuous specification as against a continuous one, and the last section provides concluding remarks.

1. Review of the literature

1.1. Metrics for large shareholdings

The literature on large shareholdings has so far provided little guidance for choosing metrics capable of assessing effective corporate control and gauging the intensity of management monitoring. Table 1 supports this

statement by providing a survey of the metrics found in the literature dealing with the effects of ownership. *Survey A* in the table specifically provides a review of large shareholding measurements found in some seminal and reference studies. At first glance, there is a broad and heterogeneous range of alternative metrics. The first major option is to focus either on ownership concentration and the existence of blockholders (*Survey A1* – blockholders defined as shareholders owning more than five percent of equity), or on the controlling interest held by the largest or ultimate largest shareholder (*Surveys A2 and A3*).³

An alternative lies in the measure of the degree of control as displayed in the second column of the table. 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 and Lehn, 1985; Dyl, 1988). However, most authors measuring ownership concentration first identify the companies that have at least one blockholder, then they choose either a discontinuous metric (an indicator variable takes value one when at least one blockholder exists, and zero otherwise) or a continuous one (the portion of equity shares held by all blockholders). Other authors have introduced a discontinuous and dichotomous viewpoint: between “owner-controlled” companies with at least one blockholder, and “management-controlled” companies with no blockholders and hence 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 variable (Holderness and Sheehan, 1988) or a continuous one. Among the studies listed in *Survey A*, only Dyl (1988) and Hambrick and Finkelstein (1995) discuss the choice between continuous and discontinuous specifications. Dyl contends that a continuous metric is more appropriate in an “agency” context, but provides no rationale or empirical evidence to support this assertion. Conversely, Hambrick and Finkelstein assert that a discontinuous metric is more appropriate for the assessment of monitoring. They argue that as soon as a major shareholder holds a significant position an increase by a few percentage points in equity shares should not substantially

3 Table 1 only reports the studies that suggested new or adjusted metrics for ownership. Other subsequent studies were also reviewed but are not reported since they use similar methodologies, including *Survey A1* (Mikkelsen and Ruback, 1985; Core et al., 1999; Chhaochharia and Grinstein, 2009), *Survey A2* (Gomez-Mejia et al., 1987; Kraft and Niederprüm, 1999), and *Survey A3* (Faccio and Lang, 2002; Croci et al., 2012; Lins et al., 2013) and *Survey B* (Hermalin and Weisbach, 1991; Lambert et al., 1993; Mehran, 1995; Faccio and Lasfer, 1999; Himmelberg et al., 1999; Demsetz and Villalonga, 2001).

increase its vigilance. The authors run a test for the respective impact of a discontinuous vs. a continuous metric (see metrics on Table 1) on CEO pay and conclude that a threshold effect in shareholdings is more relevant than a continuous relationship.

Table 1. Survey of ownership influence metrics

References	Measure of the degree of control	Thresholds	Subject of study
Survey A: Large shareholders			
<i>Survey A1: Ownership concentration / Blockholders</i>			
	Concentration measures:		
Demsetz and Lehn (1985)	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 \geq 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	• \geq 5% • $<$ 5%	CEO pay
Hambrick and Finkelstein (1995)	Dichotomous (indicator vs. equity shares): • Owner-controlled • Management-controlled	• \geq 5% • $<$ 5%	CEO pay
Shleifer and Vishny (1997)	Definition of: • Large minority shareholders • Large shareholders	• 10%/20%-50% • \geq 51%	Survey of corporate governance
<i>Survey A2: Largest shareholder</i>			
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 corp. 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)
<i>Survey A3: Largest ultimate shareholder</i>			
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 Investment (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)

Large shareholders are in most cases defined as blockholders – i.e. shareholders owning at least 5% of the common stock – or as shareholders crossing a threshold of 10% or 20% ownership (see column 3). However, these thresholds have no theoretical or empirical rationale, and they mostly rely on the regulatory thresholds that trigger the mandatory public reporting of ownership positions. This threshold is 5% in the regulations of the American SEC and other stock exchange authorities around the world; although in some other countries the threshold 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% or 25%. For instance, Holderness and Sheehan (1988) put forward a maximum threshold of 20% to define their category of diffusely-held firms – they suggest that below this threshold shareholders would not have sufficient voting power to affect firm policies. 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”. The reported studies do not provide any theoretical or empirical support for this assumption. Hence the thresholds used in the literature regarding large shareholders are based essentially on mandatory disclosures or anecdotal evidence. To the best of my knowledge there is no study that proposes defining the appropriate level of ownership required to have effective control over a firm.

A potential explanation for this absence of investigation could lie in the ownership structure of large American listed firms, which are perceived to be mostly diffusely-held. Because blockholders would be rare and typically holding small blocks of equity shares, a simple 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 (as in Mehran (1995) or Konijn et al. (2011)) would be considered sufficient. However, Holderness (2009) demonstrates that the conception that the ownership pattern of U.S. companies is diffuse is essentially a “myth”. La Porta et al. (1999) and Faccio and Lang (2002) also show in their seminal studies that large shareholdings are a widespread ownership pattern all over the world. As pointed out by a number of authors (Shleifer and Vishny, 1997; Bhagat et al., 2004; Holderness, 2009), and in spite of a growing literature on large shareholders, very little is known about the forms taken by their influence, and how this can be measured.

1.2. *Continuous metrics for managerial ownership*

By contrast, the literature on managerial ownership is more insightful in its investigation of the impact of different levels of shareholdings (Survey B in Table 1) and provides relevant references for comparison with large shareholders' levels of control. The issue of managerial ownership arise 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 according to which top managers are the agents of the equity holders and should manage the firm in the interests of the latter: this would be achieved in particular by providing the agents with equity shares. On this basis, a large number of studies investigated the amount of shareholdings a manager should acquire to have a positive impact on the market value of the equity. Morck et al. (1988) show that the firm value as measured by Tobin's Q has a non-monotonic relationship with insider ownership:⁴ 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%.⁵ 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%.

Some subsequent studies use polynomial specifications for identifying the values of change points. First, McConnell 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. They find an inverted U-shaped relationship with a maximum value at around

4 In the literature, insider ownership usually refers to shares held by officers (top management) and directors. Managerial ownership refer to insiders as a whole in some studies, or to the CEO alone in others.

5 Other studies tested this specification but did not find similar results: Hermlin 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 impact, or an impact not different from zero, above 5% and above 25%. Margaritis and Psillaki (2010) also apply the piecewise specification to assess the impact of the largest shareholder (Survey A2); to the best of my knowledge, this is the only study that applies a methodology reported in Survey B in the context of large shareholdings.

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.⁶ They find significant coefficients for their quintic equation, and define four turning points and five regimes. These polynomial specifications provide a better estimate of the turning points, compared to the piecewise regression of Morck et al. (1988), because the point values are defined endogenously in the model. However, they are still limited, since 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 a continuous relationship with turning points.

These studies show that the impact of managerial shareholdings on firm value is positive at low and high levels of equity shares, and negative at intermediate levels (Morck et al., 1988; Short and Keasey, 1999; Davies et al., 2005). The authors interpret these results as evidence of alignment of interests at low and high levels of ownership, and of managerial entrenchment at intermediate levels. In the context of the present study this non-monotonic effect of managerial shareholdings on firm value suggests that the monitoring behavior of controlling shareholders, and the way they design compensation packages, may vary in a similar way, depending on their degree of control.

1.3. Controlling shareholders and CEO pay

In the absence of a major shareholder on the board of directors CEOs may have sufficient power to influence the board and maximize their own pay. The level of pay is then solely limited by an “outrage” constraint (Bebchuk and Fried, 2003), which involves not drawing the attention of public opinion and outside minority shareholders. In this managerial power perspective risk-averse CEOs bargain for high levels of salary rather than over significant elements of variable remuneration (Harris and Raviv, 1979; Beatty and Zajac, 1994).

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

Firms with poor governance and little effective monitoring have to deal with agency costs, including rent extraction, and with retention issues. Hence they need to design optimal compensation contracts that include performance-based plans. In particular, equity-based pay provides CEOs with an incentive to maximize firm value and shareholders' wealth (Jensen and Murphy, 1990). Also, in the absence of a large shareholder engaged in monitoring and able to evaluate their CEO's ability to reach performance targets, firms have to rely on compensation packages that are *a posteriori* sensitive to performance and informative of CEO's actions (De Angelis and Grinstein, 2015). These higher shares of contingent-based pay in firms with poor governance result in higher levels of total pay, because risk-averse CEOs seek pay premiums to compensate for their bearing more risk (Beatty and Zajac, 1994; Haubrich, 1994; Hall and Murphy, 2002).

Firms with no large shareholder and with poor governance may also be more sensitive to conditions in the labor market for CEO talent. Chaigneau and Sahuguet (2018) predict that widely held firms are more subject to retention issues, since they have less ability to select and monitor specific CEOs for their firm. An absence of engaged monitors with insight into the specific managerial skills needed for the firm leads to the selection and hiring of generalist CEOs. These are much sought after in the labor market, and they have high reservation wages (Murphy and Zábojník, 2007). Once they are appointed poorly-governed firms have to deal with retention issues, since their generalist CEOs are more likely to receive outside offers. As stated by Oyer (2004), the need to retain CEOs leads to their being rewarded not only for their impact on firm-level performance, but also for industry-level performance unrelated to their actions. Compensation packages that include a large variable component are therefore more effective in keeping levels of pay competitive because they provide more flexibility in times of good business conditions, when CEOs may receive better outside offers (Campbell and Thompson, 2015).

In summary, firms with no large shareholders are expected to design compensation packages with higher salaries and higher performance-based components. Higher salaries can be explained by the fact that in these firms CEOs can gain more power and are able to bargain for higher fixed pay, and because they tend to have more generalist skills with higher reservation wages. Higher shares of performance-based components are a substitute for monitoring in these firms, so that the interests of a CEO can be aligned

with those of outside shareholders; they also circumvent the lack of *a priori* knowledge about a CEO's ability to reach performance targets; and they help retain generalist CEOs when they receive improved outside offers.

In firms with concentrated ownership, large shareholders are expected to monitor the management directly and improve governance in the firm. Empirical studies find that large shareholders do play a monitoring role. They are able to curb the influence of powerful CEOs on the design of their own pay, and they reduce agency costs in the form of lower levels of CEO pay (Dyl, 1988; Lambert et al., 1993; Hambrick and Finkelstein, 1995; Cyert et al., 2002; Chhaochharia and Grinstein, 2009). They are also less likely to have recourse to alternative mechanisms of monitoring, such as performance-based pay (Beatty and Zajac, 1994; Lippert and Moore, 1995; Mehran, 1995; Core et al., 1999).

The aforementioned literature implies that performance-based remuneration in firms with poor governance is a substitute for direct monitoring by large shareholders. It also implies that the interests of large shareholders are *aligned* with those of outside shareholders, and that they monitor their CEOs with respect to the maximization of firm value. But large shareholders may also have their own agenda and try to use their dominant position to extract private benefits (Claessens et al., 2002; Morck et al., 2005), leading to a new type of agency conflict between *entrenched* large shareholders and outside minority shareholders (Shleifer and Vishny, 1997). Several empirical studies show that, in the context of large shareholders that use excess voting rights to reinforce their dominant position, entrenchment translates into higher levels of CEO pay (Masulis et al., 2009) and a lower sensitivity of pay to performance (Haid and Yurtoglu, 2006; Cao et al., 2011). In this perspective CEOs are rewarded for pursuing the private benefits of entrenched shareholders, at the expense of maximizing outside shareholders' wealth.

In the context of the present study and the search for various potential regimes of control it is to be expected that some of these regimes are associated with the alignment and optimal-contracting hypothesis, although other regimes may be associated with the entrenchment hypothesis. For instance, large shareholders may be in a contestable position at some levels of ownership – where they fear being subject to hostile takeovers – and it is in their interest to align with other shareholders; while at other levels they would have a sufficiently protected position to enable the extraction of private benefits.

Another way the present paper seeks to identify the manner in which large shareholders engage in monitoring is associated with the seniority of control. The greater seniority of large shareholders controlling a firm is suggestive of more experience, and has implications for monitoring. Drawing on the view that better quality monitoring allows for the better evaluation of a CEO's inherent ability (Hermalin, 2005) and that monitors learn more about a CEO's ability in the year following his/her hiring (Chaigneau and Sahuguet, 2018), it can be expected that large shareholders improve their knowledge of the incumbent CEO in the years after they themselves take control of the firm. If they do not have enough firm-specific experience to efficiently scrutinize a CEO's actions they would need to rely on performance-based plans that are *a posteriori* informative of a CEO's ability (De Angelis and Grinstein, 2015). Also, in the case where new controlling shareholders want to hire a new CEO, they would lack sufficient experience to select CEOs with firm-specific skills; and they would tend to hire, as in firms with diffuse shareholding, generalist CEOs with higher reservation wages and greater retention issues. In either case, incumbent or hired CEOs, it is anticipated that new controlling shareholders are associated with higher levels of pay.

2. Methodology

2.1. *The controlling shareholder*

A preliminary step in this study concerns the appropriate identification of controlling shareholders; and so different metrics for controlling shareholding are tested. First, the broadest measure of controlling shareholdings is the percentage of equity held by all blockholders. A distinction can then 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 as the largest shareholder represented on the board of directors, or as the largest external shareholder if no more significant shareholder is represented on the board. Third, the largest shareholder can increase its control with devices such as shareholder agreements (having other shareholders acting in concert) and deviations from the "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 differing possible effects on its monitoring role. Most of these alternative metrics can be found in articles listed in Table 1. The

literature provides no empirical or theoretical support for differentiating between these various alternatives, nor for proposing a hypothesis regarding the most relevant measure of controlling shareholdings. The following specification includes a set of measures aimed at empirically identifying and isolating large shareholding patterns that are associated with control:

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

The subscript *j* is equal to {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, ..., 123}) and year (*t* = {1, ..., 10}). The *Holdings* variable is 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

Variable	Description
<i>CEO compensation:</i>	
Cash compensation	Salary + Bonus
Total compensation	Cash compensation + Long-term incentives (stock-options, restricted stocks, and deferred compensation)
<i>Large shareholdings:</i>	
Holdings:	Equity shares held by:
1. Largest sh. on BoD	• the largest shareholder (≥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 other 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/it 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 Seniority	Share of voting rights in excess of equity share. Number of years the largest shareholder has been represented on the BoD.
Control variables:	
<i>Firm characteristics:</i>	
Size	Sales; and Market value of equity
Age of company	Years since foundation of the firm x Years since firm is listed
Leverage	Net debt / Market value of equity
Capital intensity	Tangible assets (gross property, plant and equipment) / Total assets
Average ROA	Return on Assets (EBIT/Total assets) averaged over the past five years.
<i>CEO characteristics:</i>	
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.
<i>Type of control:</i>	
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).

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.

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. The above-specified equation aims to estimate the impact of differentiated ownership patterns on CEO compensation from one firm-year to another, and not the impact of ownership variations within each firm over the sample period, as a fixed effect model would do.

2.2. Firm and CEO characteristics

Firm and CEO characteristics are control variables listed and described in Table 2. According to the literature, one of the most influential determinants of CEO pay is *firm size* (Murphy, 1999; Cyert et al., 2002). According to the standard labor market perspective, the marginal contribution of CEO talent to firm value is greater in larger firms and justifies higher levels of pay (Terviö, 2008; Gabaix and Landier, 2008). Also as firm size grows, the complexity of the organization and the number of hierarchical levels increases and pushes top compensation upwards (Lazear and Rosen, 1981; Lambert et al., 1993). Similarly, the *age of the company* denotes the complexity and maturity of a firm's organization. *Leverage* refers to the weight of debt in the capital structure of the firm. A higher degree of leverage is expected to reduce reliance upon elements of incentive-based pay because of the disciplinary role and agency costs of debt (John and John, 1993). *Capital intensity* is a proxy for measuring the asymmetry of information between CEOs and shareholders regarding growth opportunities: a high proportion of tangible assets reduces uncertainty about growth opportunities, resulting in a lower need for flexibility in compensation contracts and lower CEO incentive-based pay (Kole, 1997; Margaritis and Psillaki, 2010). *Average ROA* stands for profitability of the firm and is expected to have an inverse relationship with CEO pay: low profitability 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 and Zajac, 1994).

CEO tenure is expected to have a nonlinear impact on compensation: tenure may have a positive impact on pay increases in the first years because of experience and increased CEO bargaining power, but in subsequent years long-tenured CEOs develop firm-specific human capital and lose attractiveness in the managerial labor market, which in turn reduces their bargaining power in the pay-setting process (Hambrick and Finkelstein, 1995; Cyert et al., 2002). In addition, CEOs may accumulate stock ownership over the years that reduces the need for additional equity-based pay for long-tenured

CEOs (Chourou et al., 2008). This nonlinear impact is taken into account by adding the square value of *CEO tenure* in Equation (1). *CEO age* may also influence the setting of pay, but it is not included here because it results in information correlated to *CEO tenure* and is redundant (Crocchi et al., 2012).

Hambrick and Finkelstein (1995) 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 (*investment companies* and *passive families*),⁷ 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.

2.3. 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). The PTR model 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, denoted CS , is the percentage of 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. The *Holdings* variable that represented a percentage of shares in (1) is herein replaced by a set of $M + 1$ indicator variables that represents the distinct regimes in the degree of control. The equation takes the following form:

⁷ *Investment companies* refer to a type of control in which financial institutions hold a controlling position in non-financial companies. *Passive families* are families that hold a controlling position in a firm and that are "passive" in the sense that no member of the family is or has been in an executive position inside the controlled firm.

$$\begin{aligned}
 \text{Comp}_{j,i,t} = & \alpha_j + \sum_{m=1}^{M+1} \theta_{j,m-1} I\{\gamma_{m-1} \leq CS_{i,t} < \gamma_m\} \\
 & + \sum_{k=1} \beta_{j,k} X_{k,i,t} + \varepsilon_{j,i,t}
 \end{aligned} \quad (2)$$

where $I\{\cdot\}$ denotes the indicator function that takes value one for $\gamma_{m-1} \leq CS_{i,t} < \gamma_m$ and 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 the degree of control is homogeneous in a given regime. In other words, controlling shareholders have a fixed effect from one threshold point up to the next one, irrespective of the relative percentage of holdings within each regime.

The first regime, denoted $I\{\gamma_0 \leq CS_{i,t} < \gamma_1\}$, includes firms with no large shareholder (i.e., $CS_{i,t} = 0\%$), plus firms with large shareholders below the first threshold value (i.e., $1\% \leq CS_{i,t} < \gamma_1$).⁸ Below this γ_1 threshold, large shareholders design compensation schemes similar to the ones offered by firms with no large shareholders. Hence firms falling within this first regime can be considered to be diffusely-held or non-controlled. The PTR specification seeks 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 ($M = 1$); the first step involves one iteration aimed at determining the value of γ_1 that minimizes the sum of squared errors of the following equation (where γ_2 is set to a share of 100%) :

$$\text{Comp}_{j,i,t} = \alpha_j + \theta_{j,1} \{ \gamma_1 \leq CS_{i,t} < \gamma_2 \} + \beta_{j,k} X_{k,i,t} + \varepsilon_{j,i,t} \quad (2')$$

The second step involves testing the significance of the single-threshold model as compared to the null hypothesis of a zero-threshold model, based on an F-statistic. Under the null hypothesis, the sum of squared errors ignores the presence of a threshold point γ and Hansen (1996) shows

8 Large shareholders are defined as shareholders with a minimum of 1% ownership, so CS has no values between 0% and 1%.

that this creates a nuisance in the F-statistic; he then suggests a bootstrap procedure to approximate p-values.

If the single-threshold model is validated, the second stage consists in taking the estimated $\widehat{\gamma}_1$ as given, and looking for a second threshold value γ_2 . Following Bai (1997), the first threshold is estimated again at this stage (“refinement estimation”, denoted $\widehat{\gamma}_1^r$) by repeating the latter procedure, taking $\widehat{\gamma}_2$ as given and looking again for the value of γ_1 . At the end of this process both threshold estimates $\widehat{\gamma}_1^r$ and $\widehat{\gamma}_2^r$ are asymptotically efficient. The validity of a double-threshold model as compared with a single-threshold model is tested using an F-statistic, with critical values obtained from the simulated bootstrap distribution of F_2 .

These stages are repeated as long as the alternative hypothesis of M against the null of $M - 1$ threshold points is not rejected. Ultimately, the procedure defines the relevant number of thresholds and regimes for the sample, and the estimated values of the thresholds.

In the final stage confidence intervals are constructed around the true values of the refined estimated points. The construction of the confidence interval for each $\widehat{\gamma}_m^r$ consists in the identification of a “no-rejection region” around this estimated point. It is determined by the likelihood ratio (LR) test and the critical values defined by Hansen (1999).

2.4. Seniority of control and the PTR model

A controlling shareholder effectively monitors the firm’s top management when it holds more than $\gamma_1\%$ of the equity, and the results derived from the methodology described above may define different degrees of control beyond this point. 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 the levels of cash and total compensation upwards.

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, denoted X , are the same as in Equation (2).

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

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. The addition of coefficients τ and θ_m provides the effect of a “new” controlling shareholder within the m^{th} regime of control as compared to the first regime of non-controlled firms (omitted, and associated with $\theta_0 = 0$). The indicator variable for controlling shareholders with a seniority of more than ω years – “long-term” controlling shareholders – is not included in (3), and their impact is as measured by θ_m alone.

The threshold value ω for the seniority of control is estimated based on the PTR model (Hansen, 1996). 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 panel. The test of no thresholds against one threshold is based on the same F-statistic and bootstrap p-values as described in the previous section. Similarly, LR-statistics are eventually calculated to define confidence intervals for ω .

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 SBF 120 index consists of the 120 companies with the highest traded stock activity at Euronext Paris. The sample is restricted to public limited companies headquartered in France⁹ and to firms that have fully available data for at least four years. This produces a sample of 1,119 firm-year observations for 123 firms from 2003 to 2012. CEO characteristics and compensation

9 This omits foreign companies (i.e., not headquartered in France) in order to avoid country-specific effects; it also omits companies that are limited partnerships with shares (“société en commandite par actions”), in which CEOs have a specific legal status and specific pay schemes (e.g., in the form of a percentage of sales).

data are manually collected from annual reports, and firm characteristics are extracted from *Datastream*. The percentages of equity held by shareholders are extracted from *Thomson One Banker – Ownership* database.

The shares held by blockholders (*i.e.*, shareholders holding more than a five-percent share) are cross-checked with ownership data provided in annual reports, and corrected when necessary.¹⁰ Based on the information about directors disclosed in annual reports, blockholders that are directly or indirectly represented on the board of directors are identified. If no blockholder is represented on the board, I identify the largest shareholder represented on the board and owning more than one percent of equity.¹¹ Shareholders that are part of a shareholder agreement and act in concert with the largest shareholder are also identified. Lastly, voting rights are hand-collected when company bylaws provide for double voting rights.¹²

As for the seniority of control, ownership databases do not provide this information. I therefore collected information about 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 in the first year that a representative was nominated to the board. The seniority takes into account the various directors who 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, since 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. In specific cases, the first year of control coincides with the founding of the firm¹³ for

10 A number of errors in the ownership database require some attention. Shareholders who have disposed of their shares are often maintained unaltered for two fiscal years in the database. Also, because of multiple sources of data, the database may include some duplication.

11 Largest shareholders below 1% ownership are not taken into account because annual reports do not provide exhaustive or detailed data for such shareholders, even if they are represented on the board.

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

13 In the case of a firm created by a spin-off and still controlled by the historical mother company, 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.

founding shareholders, with nationalization for governmental shareholders, or with a takeover in other cases.

3.2. Descriptive statistics

Table 3 gives some descriptive statistics for the data, based on the variables defined in Table 2. On average, the sample firms have sales amounting to €11,764 million and a market capitalization of €9,477 million, in constant 2007 euros. The average firm has a leverage of 0.80, 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/she is a new CEO for 21% of the firm-year observations, including 12% as an insider and 9% as an outsider. He/she is also the board chairperson in 54% of firm-year observations, and is the founder of the company but not a blockholder in 4% of instances. His/her mean cash and total compensation are respectively €1.27 million and €2.10 million. The value of stock-options is based on the fair value that firms disclose in their annual reports. This disclosure has been mandatory since 2008. Before that time many firms did not disclose fair value; in such cases it is estimated by the option pricing model of Black and Scholes (1973), using the number of options granted, the exercise price and time until exercise, historical volatility and dividend yield of the company, and the annual risk-free interest rate based on government bond yields. Other stock-based pay is estimated by the value of the stock on the day it is granted.

In the final decile of total compensation there is significant dispersion and high relative values. This can be explained by the fact that companies do not provide equity-based compensation according to any standard timetable. Some grant it on an annual basis, others from one year to another, or it is triggered by a specific event (newly nominated CEO, IPO, an exceptional operating or financial success...); other firms do not provide any stock-based pay. Hence the regressions of the following sections will be based on two-year averaged equity-based compensation in order to attenuate differing practices in making these grants. This does not however completely eliminate the very high relative values for a number of these grants. Equity-based compensation is then *winsorized* so that the ratio of equity-based to total compensation is trimmed to the top decile value of the sample (*i.e.*, 56% – not reported in the table).

Table 3. Descriptive statistics

Variable	Mean	Median	Min	1st decile	9th decile	Max
<i>Firm characteristics:</i>						
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
Leverage	0,80	0,24	-2,31	-0,08	1,52	40,30
Capital intensity	23,39%	16,58%	0,03%	2,30%	53,90%	98,32%
Average ROA (over five years)	3,01%	3,29%	-2,29,39%	-1,12%	9,11%	28,99%
Years since foundation	87,3	78,0	3,00	23,0	161,0	348,0
Years since listed	22,7	19,0	1,00	6,0	38,0	128,0
<i>CEO characteristics:</i>						
Tenure	9,8	6,0	1,0	1,0	24,0	47,0
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
<i>CEO compensation:</i>						
Cash compensation (€ 000)	1 274	1 136	29	362	2 431	7 478
Total compensation (€ 000)	2 100	1 518	29	391	4 063	22 811

<i>Blockholders:</i>						
% All blockholders	43,09%	46,72%	0,00%	8,24%	72,64%	94,22%
% Blockholders on BoD	36,18%	37,03%	0,00%	0,00%	70,29%	89,22%
% Largest shareholder	32,41%	29,17%	1,10%	6,75%	66,25%	89,22%
% Largest sh. on BoD	31,13%	28,93%	0,00%	0,00%	66,25%	89,22%
% Largest sh. on BoD + Concert	33,89%	32,58%	0,00%	0,00%	68,32%	93,40%
% (voting rights) Largest sh. on BoD + Concert	38,62%	39,11%	0,00%	0,00%	73,51%	93,40%
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
Seniority of largest sh. on BoD	33,4	19,0	0,0	0,0	92,2	309,0
<i>N. = 1119 firm-year obs.</i>						

Note: Amounts in Euros are expressed in constant 2007 Euros. Tenure is expressed in years and other CEO characteristics are indicator variables. Seniority is expressed in years.

In the average sample firm about 2.1 blockholders hold 43.09% of the common stock. Out of these 2.1 blockholders, 1.3 are insiders (*i.e.*, they are represented on the board of directors) and hold an average of 36.18% of equity. The largest shareholder holds on average 32.41% of equity¹⁴ and is in most instances represented on the board of directors, with an average equity holding of 31.13% for the largest insider shareholder. Other shareholders that concluded an agreement with the latter (*i.e.*, those acting in concert) add an average control of 2.76%, reaching a combined interest of 33.89%.¹⁵ Another device for increasing control involves conferring double voting rights on certain categories of shares. This gives nearly 5% of additional interest to the average largest insider shareholder, alone or in concert, who thus reaches a voting control of 38.62%.¹⁶ The largest insider shareholder has on average 33.4 years of seniority.

The data show a number of alternative ways of identifying which shareholders may exert effective control over the firm, and of measuring that control. Out of the 1,119 firm-year observations, 190 firm-years have no blockholders represented on the board, and 119 of these do not have large insider shareholders either (not reported). Among firms that have a large insider shareholder, some also have other insider and/or outsider blockholders, and some outsider blockholders may hold greater positions than the largest insider. Also, some of the largest insider shareholders act in coalition with other shareholders, and some have additional control with double voting rights. The following section aims to separate the respective influences of each of these various categories of shareholder by estimating their impact on CEO compensation.

14 As a comparison, Holderness (2009) finds that on average blockholders own 39 % of equity and the largest shareholder 26 % in a representative sample of American listed companies. These figures are slightly lower compared with our sample of French listed companies, but of a rather similar magnitude.

15 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.

16 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 compared to 48.14% of the voting rights.

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. Table 4 presents the results after running Equation (1), with cash compensation as a dependent variable in columns 1 to 3, and total compensation in columns 4 to 6. The respective first two columns (columns 1 and 2, and columns 4 and 5) look for the relevant metrics for large shareholdings, as presented in Table 2, that are associated with a significant impact on CEO pay, and hence with effective monitoring.

Overall, the results are consistent with the previous literature, as they show a negative relationship between the levels of CEO pay and the percentage of large shareholdings.

Among the various ways of measuring large shareholdings, 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 (i.e., those acting in concert with the largest shareholder), present a significant negative relationship with cash and total compensation (Table 4, columns 1 and 4). The holdings of other blockholders, whether represented on the board or not, have no impact. A largest shareholder that is not represented on the board also has no impact on the compensation scheme.

The results then suggest that, among the various categories of shareholders, only those that can have their interests represented on the board of directors are able to monitor the CEO pay-setting process, and the effects of other large shareholders are not significant.¹⁷

¹⁷ This result might differ if outsider shareholders are categorized by type of control and include minority shareholders, notably to account for the influence of outsider activism (see for instance Croci et al. (2012) for the effects of minority institutional investors in family firms). This is however beyond the scope of the present study.

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	p-value	coef	p-value	coef	p-value	
<i>Alternative measures of contr. sh.:</i>							
% Largest sh. not on BoD	-0,19	(0,70)		0,33	(0,56)		
% Other block. not on BoD	0,12	(0,72)		-0,10	(0,80)		
% Largest sh. on BoD	-0,42	(0,00)		-0,69	(0,00)		
% Concert with largest sh.	-0,63	(0,08)	-0,61	(0,09)	-0,93	(0,03)	
% Other block. on BoD	0,05	(0,87)		0,02	(0,95)		
% Largest sh. on BoD:							
* Ultimately controlled			-0,39	(0,00)		-0,71	(0,00)
* Ultimately diffusely-held			-0,41	(0,08)		-0,72	(0,04)
% Excess in voting rights			-0,18	(0,66)		-0,03	(0,95)
% Largest sh. on B. + Concert			-0,43	(0,00)		-0,74	(0,00)
<i>Firm characteristics:</i>							
Ln(Sales)	1,35	(0,00)	1,34	(0,00)	1,49	(0,00)	
Ln(Sales) ²	-0,04	(0,00)	-0,04	(0,00)	-0,05	(0,00)	
Ln(Market capitalization)	0,16	(0,00)	0,15	(0,00)	0,23	(0,00)	
Leverage	-0,01	(0,11)	-0,01	(0,13)	-0,02	(0,07)	
Age of company	0,08	(0,00)	0,08	(0,00)	0,08	(0,01)	
					0,08	(0,01)	
					1,48	(0,00)	
					-0,05	(0,00)	
					0,23	(0,00)	
					-0,02	(0,10)	
					0,08	(0,01)	
					0,08	(0,01)	

Capital intensity	-0,36	(0,01)	-0,36	(0,01)	-0,35	(0,01)	-0,40	(0,04)	-0,42	(0,03)	-0,40	(0,04)
Av. ROA	-1,45	(0,00)	-1,44	(0,00)	-1,42	(0,00)	-1,64	(0,00)	-1,64	(0,00)	-1,60	(0,00)
<i>CEO characteristics:</i>												
Tenure ²	-0,004	(0,00)	-0,004	(0,00)	-0,004	(0,00)	-0,001	(0,00)	-0,001	(0,00)	-0,001	(0,00)
New insider CEO	-0,09	(0,03)	-0,088	(0,03)	-0,09	(0,03)	-0,10	(0,06)	-0,10	(0,05)	-0,10	(0,05)
New outsider CEO	0,07	(0,21)	0,065	(0,23)	0,07	(0,22)	0,13	(0,04)	0,14	(0,03)	0,14	(0,03)
I(CEO is Chairman)	0,11	(0,03)	0,11	(0,02)	0,11	(0,02)	0,09	(0,11)	0,09	(0,10)	0,09	(0,10)
I(CEO is founder)	0,71	(0,00)	0,71	(0,00)	0,71	(0,00)	0,91	(0,00)	0,92	(0,00)	0,92	(0,00)
<i>Type of control:</i>												
I(Investment companies)	0,22	(0,00)	0,21	(0,00)	0,22	(0,00)	0,31	(0,00)	0,31	(0,00)	0,30	(0,00)
I(Passive families)	0,51	(0,00)	0,50	(0,00)	0,51	(0,00)	0,75	(0,00)	0,74	(0,00)	0,74	(0,00)
Intercept	-7,13	(0,00)	-7,06	(0,00)	-7,01	(0,00)	-8,71	(0,00)	-8,74	(0,00)	-8,65	(0,00)
Industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
Firm-year obs.	1119		1119		1119		1119		1119		1119	
Adj. R ² (%)	78,16		78,15		78,10		78,05		78,02		77,99	

Note: Pooled panel regressions with standard errors clustered at the firm level, as specified in Equation (1). The dependent variables are cash and total compensation (expressed in thousands of constant euros and log-transformed) in models 1 to 3 and in models 4 to 6, respectively. Alternative measures of controlling shares are expressed as a percentage of equity shares, except if *voting rights* is mentioned. *BoD* stands for Board of directors. Control variables include firm and CEO characteristics, the type of control, and industry specific effects. All variables are as defined in Table 2. *I(.)* denotes the indicator function. The adjusted R² is expressed in percentages.

The largest shareholders are then 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. The results (Table 4, columns 2 and 5) show that both have a significant negative impact on cash compensation, although that of the former is more significant than that of the latter. This result is consistent with previous studies showing that controlling shareholders have similar effects, whether they are themselves controlled or diffusely-held (Claessens et al., 2002). The largest insider shareholders that are ultimately diffusely-held are then kept as a measure of effective control, together with those that are ultimately controlled.

The regression in columns 2 and 5 also includes the percentage of voting rights in excess of equity rights held by the largest insider shareholder, plus those acting in concert with it. The results show no significant impact from these excess voting rights. This contradicts previous studies showing that shareholders who enhance their control through excess voting rights tend to entrench and extract private benefits (Claessens et al., 2002), notably in the form of higher managerial pay (Masulis et al., 2009). This contradictory result can however be explained by the fact that these previous studies involved dual-class shares, which yield much larger excess voting rights compared with the device of double voting rights used in the French context.

Columns 3 and 6 present 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. The holdings of these shareholders are hereafter referred to as “controlling shareholdings”, and will serve as the measure of the degree of control in the following section.

4.2. Firm and CEO characteristics

As for firm characteristics, the size effect is positive and significant as measured both by sales and market capitalization (see Table 4). Unreported results show that both sales and market capitalization contribute independently to the levels of CEO compensation: sales explain the base salary component better, and market capitalization the contingent components of pay; hence both measures are retained in the base specification. 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. The

coefficients associated with leverage are negative, consistent with the disciplinary role of debt and the negative impact on CEO incentive-based pay found in previous studies (Masulis et al., 2009; Conyon et al., 2011); but it is not significant at the usual thresholds, except for one specification for total 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 requires less monitoring through contingent pay (Kole, 1997). Average ROA is also negatively and significantly related to CEO compensation. An explanation for this relationship is that average ROA is highly negatively correlated with the standard deviation of ROA (not reported), so that low performance is associated with increased risk for the firm, and CEOs in these 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, type of control, in the form of investment companies or 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 are among those who pay the highest amount of cash and total compensation, while regulated industries (utilities, banks and insurance companies) are among those who pay the lowest amount of cash and total compensation (not reported).

4.3. Estimation of thresholds in the degree of control

This section follows the PTR methodology presented earlier so that one or more thresholds in the controlling shareholdings can be identified (denoted *CS*). Following the results of the previous section, controlling

shareholdings are defined as the equity shares held by the largest shareholder, alone or in concert, represented on the board of directors. 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, based on the differing effects of the two regimes on CEO pay monitoring.

In order to have a sufficient number of observations in each regime and to avoid regimes driven by outliers, the iteration is applied with values of γ starting with the lowest decile of controlling shareholdings in the sample, incremented by 1% up to the top decile. γ can thus 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 in looking for the second, third, etc. threshold, while taking the thresholds previously found as given, and as long as the m^{th} 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 118.95 vs. 12.12 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 2%, 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 21%, respectively.

In the single- and double-threshold models, the estimate values are respectively 46% and 11% both for cash and total compensation. These two values are used in the triple-threshold model to find the third threshold, which is 34% for both dependent variables. The first two values were estimated while ignoring the existence of a second or third threshold point. The refined estimation consists in 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.

As a test of robustness, 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.

Table 5. Tests for an m^{th} threshold given $m - 1$ threshold(s)

	First	Second	Third	Fourth
<i>Cash compensation</i>				
Threshold estimate ($\widehat{\gamma}_m$)	46%	11%	34%	8%
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)
<i>Total compensation</i>				
Threshold estimate ($\widehat{\gamma}_m$)	46%	11%	34%	5%
F-stat. for m vs. $m - 1$ thresholds	118,95	52,03	12,83	7,58
p-value (bootstrap)	0,00	0,00	0,02	21,00
(10%, 5%, 1% critical values)	(6.89, 8.39, 12.12)	(8.35, 10.05, 12.05)	(8.48, 9.95, 14.42)	(8.95, 9.84, 12.33)

Note: Looking for the relevant number of thresholds in controlling shareholdings, based on a panel threshold regression (PTR) model as developed by Hansen (1999), and based on its impact on CEO cash and total compensation. The first column shows the first threshold estimate $\widehat{\gamma}$ based on a single-threshold model (see Equation (2')) and using all possible integer values of γ between 1% and 68% (the top decile of controlling shares on the panel). The null hypothesis of a zero-threshold model against the alternative of a single-threshold model is tested, based on an F-stat. The asymptotical distribution of the F-stat requires a bootstrap procedure (Hansen, 1999), which is run with 400 iterations and leads to p-values and critical values presented in the table. The null of zero threshold is rejected. The null of a single-threshold (column 2) and of a double-threshold (column 3) are similarly rejected, both for cash and total compensation. The existence of a fourth threshold (column 4) is not accepted with p-values of 0.97 and 0.21 for cash and total compensation, respectively.

Table 6. Threshold estimates in a triple threshold model

	$\hat{\gamma}_1^r$	$\hat{\gamma}_2^r$	$\hat{\gamma}_3^r$
<i>Cash compensation</i>			
Refined threshold estimates	11%	34%	46%
95% confidence interval	[10%, 16%]	[31%, 42%]	[45%, 46%]
99% confidence interval	[9%, 17%]	[27%, 42%]	[45%, 48%]
<i>Total compensation</i>			
Refined threshold estimates	11%	34%	46%
95% confidence interval	[10%, 14%]	[31%, 42%]	[46%, 48%]
99% confidence interval	[9%, 15%]	[28%, 45%]	[45%, 48%]

Note: Threshold values found in Table 5 are re-estimated (*refined* estimates) in the framework of a triple-threshold model: $\hat{\gamma}_1^r$ is estimated taking $\hat{\gamma}_2$ and $\hat{\gamma}_3$ as given, and so on. Refined estimates $\hat{\gamma}^r$ confirm the initial estimates of $\hat{\gamma}$. Following Hansen (1999), the confidence interval

of $\hat{\gamma}_1^r$ is constructed as follows: $LR_1 = \frac{S_3(\gamma) - S_3(\hat{\gamma}_1^r)}{\sigma^2}$ is calculated for each possible integer value of γ (i.e. [1%; 68%]), S_3 being the sum of squared errors of the triple threshold model (with $\hat{\gamma}_2^r$ and $\hat{\gamma}_3^r$ taken as given); by construction $LR_1 = 0$ when $\gamma = \hat{\gamma}_1^r$. The confidence interval is determined as a “no-rejection” region around the null point of LR_1 , where LR-stats are below the critical values defined by Hansen (i.e. 7.35 and 10.59 for the 5% and 1% critical values, respectively). The same procedure is applied to $\hat{\gamma}_2^r$ and $\hat{\gamma}_3^r$.

Table 6 also displays the confidence interval for the three refined threshold estimates, based on the LR-test as specified by Hansen (1999). The confidence intervals for the 11% and 46% threshold values are quite tight, and are reassuring about the estimated 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.

4.4. 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. The present section aims to specify effective control more precisely, 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 improve the quality of the monitoring of CEO compensation.

Among the controlling shareholders above the 11% threshold in degree of control, the lowest and highest deciles of seniority are three years and 107 years respectively. 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. It thus accounts for the specific effect of “new” controlling shareholders among the three effective-control regimes identified in the previous section.

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 14 or 16 years.

This leads to the identification of a threshold of about eight years, six at the minimum, in the seniority of a controlling shareholder, after which it significantly changes the way it monitors the CEO pay-setting process.

Table 7. Estimation of seniority thresholds

	Cash comp.	Total comp.
Threshold ($\hat{\omega}$)	8 years	8 years
F-stat. for 1 vs. 0 threshold	31,19	30,64
p-value (bootstrap)	0,00	0,00
(10%, 5%, 1% critical values)	(7.27, 8.85, 11.26)	(76.78, 8.46, 11.61)
Threshold estimates	8 years	8 years
95% confidence interval	[6, 14]	[6, 9]
99% confidence interval	[6, 14]	[6, 16]

Note: The threshold denoted ω is estimated by minimizing the sum of squared errors in a single-threshold model as specified in Equation (3); the iteration is run with a range of integer values from 3 to 107 years (the lowest and highest deciles of seniority among controlled firms). The F-stats, and their bootstrap estimated p- and critical values, lead to reject the null of a zero-threshold against the alternative of a single-threshold model, both for cash and total compensation. Then the values of the LR-stats are calculated for each integer value of ω in [3; 107]; the confidence interval for $\hat{\omega}$ is defined as the range of ω values for which LR-stats lie below the 1% and 5% critical values defined by Hansen (1999).

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 are also 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 but is not quite precise, since the 95% confidence interval is large (from 36 to 87 years), and the 99% confidence interval cannot be defined: all seniority values have LR-statistics below the 1% critical value. This leads to a rejection of the double threshold model for seniority in the sample. However, a second threshold may be further investigated in future research, notably within a sub-sample of family firms and with respect to generational issues in family control.

4.5. Thresholds for the degree 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 regime of control 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 32% lower level of total compensation in the latter.

Controlling shareholders in the fourth regime, holding 46% or more of the common stock, have a substantially stronger impact on CEO pay: cash and total compensation are respectively about 31% and 50% lower as compared with the first regime. Unreported Wald tests for the equality of the coefficients show that the negative impact from the fourth control regime is significantly stronger than the negative impact from the second regime (confidence levels of 98% and 99.7% for cash and total compensation, respectively).

Table 8. Regression of CEO compensation on control regimes

	Ln(Cash comp.)		Ln(Total comp.)		Ln(Cash comp.)		Ln(Total comp.)	
	(1)	(2)	(3)	(4)	(3)	(4)	(3)	(4)
	coef	p-value	coef	p-value	coef	p-value	coef	p-value
<i>Controlling shareholders:</i>								
I(Seniority of control < 8 years)					0,22	0,00	0,26	0,00
Degree of control:								
1st regime: I(0% to 11%) – omitted								
2nd regime: I(11% to 34%)	-0,17	(0,00)	-0,32	(0,00)	-0,25	(0,00)	-0,42	(0,00)
3rd regime: I(34% to 46%)	-0,03	(0,64)	-0,15	(0,05)	-0,07	(0,30)	-0,19	(0,02)
4th regime: I(\geq 46%)	-0,31	(0,00)	-0,50	(0,00)	-0,32	(0,00)	-0,52	(0,00)
Intercept	-7,16	(0,00)	-8,50	(0,00)	-6,81	(0,00)	-8,07	(0,00)
Control variables	Yes		Yes		Yes		Yes	
Firm-year obs.	1119		1119		1119		1119	
Adj. R ² (%)	78,40		78,82		79,01		79,44	

Note: Pooled panel regressions as specified in Equation (2), with standard errors clustered at the firm level. The dependent variables are either cash (columns 1 and 3) or total (columns 2 and 4) compensation, expressed in thousands of constant euros and log-transformed. The regime of non-controlled firms (degree of control below 11% of shareholdings) is omitted and serves as a benchmark for the other regimes. Columns 1 and 2 include indicator variables (denoted I(.) for the three regimes of controlled firms. In columns 3 and 4, an indicator for the regime of new control (below eight years of seniority) is added, as specified in Equation (3). Control variables (firm and CEO characteristics, type of control, industry specific effects) are the same as in Table 4. The adjusted R² is expressed in percentages.

The third regime of control has a specific pattern. Controlling shareholders who hold between 34% and 46% of equity behave no differently from the first regime of non-controlled firms as concerns cash compensation, and only have a 15% downward effect on total compensation (with significance at the 5% level). Higher levels of pay in this intermediate class of controlled firms, as compared with the second and fourth regimes, seem to be mostly in the form of non-equity components of pay. To check for robustness I run a regression specifically for equity-based compensation (not reported) – based on a Tobit model, since this is a limited dependent variable. The results show that the level of this component is actually lower than in the first regime of non-controlled firms (with a 97% confidence level) and similar, *ceteris paribus*, to that found in the second regime of

control. Consequently the higher level of total compensation in the third regime, by comparison with that in the second and fourth regimes, mainly takes the form of higher cash compensation.

4.6. Thresholds for the seniority of control

In columns 3 and 4 of Table 8 an indicator for controlling shareholders with fewer than eight years of seniority is added to the specification (see Equation (3)). 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 “long-term” controlling shareholders.

These coefficients should be added to those associated with the regimes of control so that the effect of these new controlling shareholders, as compared with CEO pay practices found in non-controlled firms, can be evaluated. Unreported regressions that separate out new and long-term controlling shareholders are also run in order to test for statistical significance. They show that new controlling shareholders provide similar cash compensation but lower total compensation compared with non-controlled firms.

Unreported regressions of the two components of cash compensation, namely base salary and bonuses, reveal that higher cash pay found for new control compared to long-term control is mostly in the form of bonuses rather than base salary. Another unreported regression restricted to long-term incentives as a dependent variable confirms that new controlling shareholders grant significantly more equity-based compensation than long-term ones, though it remains lower than in non-controlled firms.

Newly controlled firms, compared with long-term ones, mostly provide their CEOs with higher levels of pay in the form of variable components of pay. Compensation packages in firms with low seniority of control are thus quite similar to those found in non-controlled firms, although they rely slightly less on equity-based pay.

These results provide evidence that new controlling shareholders have to deal with agency and retention issues, and so reveal some similarity with the poor governance found in non-controlled firms.

By contrast, the results show that controlling shareholders are able to improve the quality of their monitoring after about eight years of presence on the board, and then exert a downward pressure on the levels of CEO pay.

4.7. *Estimated impacts of the control regimes*

The results for the degree and seniority of control are also significant in terms of their economic impact on CEO compensation. The first three rows of Panel A in Table 9 display mean values of firm size and of cash compensation within each degree of control regime. The differences in the levels of pay observed from one regime to another are mainly explained by the size effect, which is controlled for in the base specification. The two following rows provide an estimate for the impact of the degree of control. The *regime effects* are the coefficients of the indicator variables found in Table 8. These fixed effects are then used to estimate the gap, in thousands of euros, between the actual level of CEO pay in a given control regime and the level he/she would receive in a non-controlled firm (the omitted first regime), all other things being equal. The last three rows provide the same estimate for total compensation.

The average CEO in the second class of firms receives a cash compensation of €1.20 million and a total compensation of €1.76 million, which is about 17% and 32% lower respectively than the cash and total compensation the CEO would receive if he/she served in a non-controlled firm, all other things equal. This would represent about €225,000¹⁸ more for cash compensation and €664,000 more 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 €1.48 million, and would receive an additional €357,000 in the form of cash and €965,000 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 €301,000 for total compensation.

18 $\text{Exp}(\ln(1,198) + 0.17) - 1,198 = 225$.

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)

	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	0	225	n.s.	357
Total compensation	2 785	1 764	1 860	1 484
Regime effect	Benchmark	-0,32	-0,15	-0,50
Estimated gap	0	664	301	965
<i>N (firm-year obs.)</i>	284	296	144	395

Note: Mean cash and total compensation for each degree of control regime. The average values of sales and market capitalization hint at the non-linear size effect that partly explains the differences in the levels of pay from one regime to another. The “regime effect” corresponds to the specific impact of controlling shareholders in a given regime, as estimated in Table 8 – “n.s.” stands for non-significant coefficients. The first regime serves as a benchmark and the “estimated gap” in other regimes measures the variation of pay the CEO would have if he/she served in a firm from the first regime, *ceteris paribus*. It is measured as: $\exp[\ln(\text{Cash or Total compensation}) - \text{Regime effect}] - \text{Cash or Total compensation}$. For instance, CEOs receive an average of €1,198,000 cash compensation in firms falling in the second regime; they would receive €225,000 more if they served in a firm falling in the first regime, all other things equal. The last row presents the number of firm-year observations in each regime.

Panel B: Seniority of control (sub-sample)

Sales	Market cap.	Cash comp.	Regime effect	Estimated gap	Total comp.	Regime effect	Estimated gap
9 605 012	5 246 163	1 273	0,22	-246	1 803	0,26	-418

Note: Sub-sample of controlled firms (i.e. 2nd to 4th regimes) with new controlling shareholders (i.e. seniority <8 years). N=175 firm-year observations. The “regime effect” corresponds to the coefficient found in Table 8. The “estimated gap” is calculated as in Panel A. For instance, CEOs in newly-controlled firms receive an average of €1,273,000 cash compensation, they would receive €246,000 less if they served in a long-term controlled firm (i.e. seniority of control ≥8 years), all other things equal.

Panel B of Table 9 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 eight years of seniority. The

mean cash and total compensation are close to those found in the second control regime (see panel A), although the size of the firms in the former is smaller than in the latter; this already illustrates the higher relative pay received by CEOs when controlling shareholders have a low seniority. Specifically, CEOs would be paid €246,000 less cash compensation, and €418,000 less in total compensation, if they served in a similar firm with a more experienced monitor.

4.8. *Interpretation of threshold effects*

The second and fourth regimes in the degree of control – controlling shareholders holding, respectively, between 11% and 34% and above 46% of equity – grant significantly lower levels of cash and total pay, with a significantly stronger effect for the fourth regime. This provides evidence of an “optimal governance” effect as these large shareholders engage in monitoring. Specifically, controlling shareholders in the fourth regime hold a majority share of equity, and they are the ones who can better counterbalance managerial power, and deal with agency and retention issues.

Comparatively, controlling shareholders in the third regime, holding between 34% and 46% of equity, are associated with higher levels of pay, mostly in the form of non-equity components. This latter pattern is consistent with the “entrenchment” hypothesis: on the one hand, entrenched controlling shareholders tend to provide higher salaries to their CEO in order to buy his/her loyalty and, on the other hand, they are not willing to provide equity-based incentives that might align the CEO’s interests with those of outsider shareholders. This also has some similarity with previous studies of the impact of managerial ownership on firm value, which find evidence of entrenchment on the part of CEOs at intermediate levels of ownership (Morck et al., 1988; Short and Keasey, 1999; Davies et al., 2005).

Entrenchment on the part of controlling shareholders can here be explained because of the way that, at intermediate levels in the degree of control, they bear the full cost of monitoring activities – external minority shareholders being presumably free-riding (Shleifer and Vishny, 1997) – but they do not receive all of its benefits, since they hold minority cash flow rights. They may then try to use their dominant position to extract private benefits at the expense of external minority shareholders, in order to increase their cash-flow return from monitoring activities.

Controlling shareholders in the second regime could also try to entrench, since they are the principal monitors but receive less than one third of cash flow rights. The results showing “alignment” for these monitors is however consistent with their more contestable position. Some authors refer to anecdotal evidence suggesting that controlling shareholders would be protected from attempted hostile takeovers only above ownership levels of 25% or 30% (Weston, 1979; Holderness, 2003). Below these levels bad governance is likely to lower the value of the firm and increase the risk of hostile takeovers. Controlling shareholders with a low degree of control are therefore oriented towards aligning with and pursuing the same interest as outside minority shareholders, contrary to those in the third regime who can entrench because they are sufficiently dominant and protected from hostile takeovers.¹⁹

Controlling shareholders in the fourth regime hold a majority equity position that provides them with a majority share of the cash flow return from their monitoring activities. This can explain why their interests are more aligned with those of external shareholders, so that they do not try to entrench. In addition, their high degree of control produces a higher intensity of monitoring, with a stronger downward pressure on the level of CEO pay compared with the second regime.

As far as the seniority of control is concerned, the results show that shareholders who take control of a firm tend to pay higher bonuses and long-term incentives to their CEOs during approximately the first eight years of control, compared with shareholders with higher seniority. Higher levels of pay in the form of higher variable and performance-sensitive components of pay do not provide support for an “entrenchment” hypothesis for these new controlling shareholders. Instead, the results show that these shareholders are subject to higher asymmetries of information with respect to top management, and to stronger agency and retention issues. As a consequence, new controlling shareholders need to have recourse, as in non-controlled firms, to “optimal contracting” in order to enhance their monitoring: they rely on compensation packages that are sensitive to market value, *a posteriori* informative of CEOs ability and prone to retain CEOs in case of increased outside opportunities.

19 In the specific 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 over every decision related to capital transactions or mergers and acquisitions.

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

The estimations presented above assume a threshold effect at certain points in the controlling holdings and homogeneity of the degree of control within a given regime. 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) instead use a continuous ownership measure, taking the percentages of equity held rather than indicator variables. These alternative specifications, including piecewise linear forms and polynomial functions, are applied and presented in the appendix. They provide a basis for discussion about the relevance of continuous vs. discontinuous ownership metrics, and they also provide robustness checks for the previous results.

The tests presented in the appendix provide results that are consistent with those found with the PTR model. They also show that threshold effects in the PTR model have a stronger explanatory power than continuous specifications to account for the effects of ownership on the design of CEO pay.

Based on the results presented in Table 11 in the appendix, Figure 1 presents simultaneously the polynomial and the threshold models for, respectively, excess cash compensation (Panel A) and excess total compensation (Panel B).²⁰ The graph first illustrates some previous findings. The discontinuous functions show that non-controlled firms (first regime) and firms with “entrenched” monitors (third regime) provide higher pay to their CEOs, while the second and fourth classes of firms provide lower pay packages to their CEOs, with the latter having a much stronger effect.

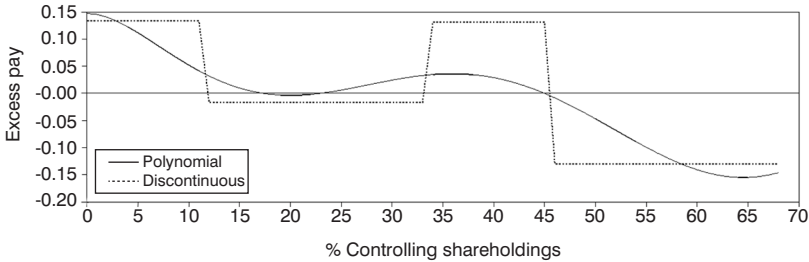
The polynomial functions also illustrate the shareholders’ behavior in terms of equity-based pay. The superposition of panel A and panel B (not displayed) shows that the excess total compensation curve is above the excess cash compensation curve up to 17% of holdings, and below beyond that point. Higher excess total pay compared to excess cash pay shows evidence of higher equity-based pay up to 17% of holdings, and specifically in firms with no controlling shareholders. It illustrates the need to rely on market-based mechanisms of control in the absence of effective direct monitoring

²⁰ Excess pay is defined as the residuals of the base specification (Equation 2) after excluding the shareholdings variables, i.e. as deviations of CEO compensation from its expected value according to its economic determinants.

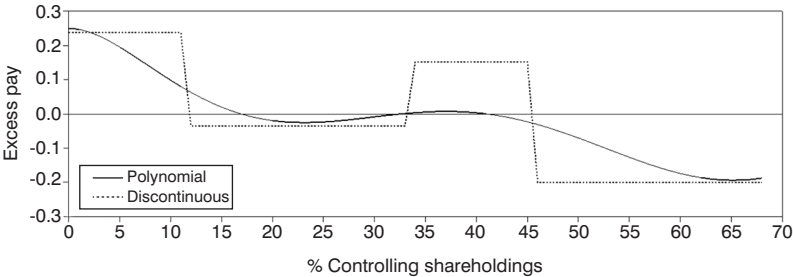
and, reciprocally, the lower equity-based compensation received by CEOs in the presence of a controlling shareholder – including under the intermediate regime associated to “entrenchment”.

Figure 1. Discontinuous vs. polynomial continuous relationship between excess CEO pay and degree of control

Panel A: Excess cash compensation



Panel B: Excess total compensation



Note: The threshold model and the polynomial function are both displayed on Panel A and Panel B for *excess cash compensation* and *excess total compensation*, respectively. *Controlling shareholdings* refer to the equity shares held by the largest shareholder represented on the Board, alone or in concert. The polynomial function is graphed according to the coefficients found in columns 1 and 2 of Table 11. The discontinuous relationship is based on the results found in columns 3 and 4 of Table 11: the coefficient for the first regime is the intercept, and the coefficients for the other regimes are the addition of the intercept and of the regime-specific effect.

For the purpose of comparing discontinuous and continuous specifications, one interesting exercise is to compare the threshold point estimates from the PTR model with the shape of the polynomial function. In the literature on managerial ownership 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. If one relies on the methodology used in the literature to interpret continuous specifications, the change points would here be the extreme values of the functions – i.e. 20%, 36%, and 65% for cash compensation, and 23%, 37%, and 66% for total compensation²¹ – 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. The negative slope between 0% and 20% ownership would here be interpreted as effective monitoring within the whole range (each 1% increase in holdings being associated with 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, taking the perspective of a threshold effect, there is indeed a flat positive impact up to the 11% threshold.

The interpretations found in the literature also lead to the proposition, based on Figure 1, that shareholders holding between about 20% and 36% of equity are bad monitors, since each one per cent increase in ownership increases excess pay. Conversely, the PTR model implies that, above 20% and up to about 33% of equity, monitoring and the downward pressure on the levels of CEO pay are still effective.

Most importantly, the graph representation with excess pay shows that, even though the slope of the polynomial function is positive in the [20%-36%] bracket, shareholders are still better monitors than those below 10% of equity, since excess pay in the ordinate axis remains lower. Nevertheless, previous studies tended to rely only on the value of the coefficients and would state that shareholders below 10%, associated with a negative slope, are better monitors than those in the [20%-36%] bracket.

This observation may question some results found in earlier studies when using a spline or polynomial specification to account for the effects of ownership. It also suggests that future research could benefit from using the PTR model to reevaluate the impacts of ownership on other major issues such as firm value.

21 The abscissa axis is limited to 68% (the top decile of controlling shareholdings on the sample panel), as in the PTR model and in order to avoid defining non-representative upper regimes. The polynomial function has actually a positive slope up to 81% of controlling holdings (both for cash and total compensation, and excess pay reaches -0.04 and -0.13 , respectively), and a negative slope beyond. Consequently, the effect above 68% remains negative, and it does not challenge the higher degree of control above the 46% threshold compared to other regimes.

6. Concluding comments

In its investigation of the effect of monitoring on CEO pay design, the present study first tests for the relevant metric that might account for effective monitoring by controlling shareholders, and then tests for the effects of the degree and seniority of control.

The study is based on a panel of French listed companies that offers a wide diversity of ownership patterns and allows various shareholding traits to be disentangled. Large shareholders may be represented directly or indirectly on the board, may act in combination with other shareholders, or benefit from double voting rights. There may also be several blockholders who are, or are not, represented on the board. Among these various ways of holding a significant ownership interest, the results show that the metric associated with effective pay monitoring is the percentage of equity held by the largest shareholder represented on the board of directors, plus the percentage held by shareholders acting in concert with him/her/it. This metric is used to define *controlling shareholdings*.

The empirical study integrates the *controlling shareholdings* variable in a panel threshold model so as to identify the point at which the shareholder has sufficient influence to monitor effectively, 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 and above. Below this threshold, firms can be considered as “non-controlled”. Intensity of control reaches its highest level above about 46% ownership, and an intermediate level of control is identified between about 34% and 46% of ownership.

For simplicity, these three estimated thresholds are hereafter approximated as thresholds of 10%, one-third and 45% of the common stock, and the three regimes of controlled firms are respectively termed as “influential”, “dominant”, and “majority” controls.

Firstly, “influential” shareholders hold between 10% and one-third of the equity, which is enough to give voice to their interests and apply for representation on the board. CEO compensation packages show evidence of better governance and an alignment effect in this influential regime. Since they hold low levels of controlling positions they are quite vulnerable to

takeover bids. They have thus an interest in alignment with external minority shareholders for fear that an attempt to entrench could lower firm value and trigger hostile takeovers.

Secondly, “dominant” shareholders, who hold more than one-third but less than about 45% of the equity, provide higher cash pay to their CEOs as compared with the two other regimes of control. This is interpreted as entrenchment on the part of these controlling shareholders. At their level of ownership they are relatively protected from takeover threats. Since they bear all of the monitoring costs but receive less than half of the cash flow returns, extracting private benefits can be a mean to increase their cash-flow return. Hence providing their CEOs with higher cash pay can be a means of buying their loyalty and inducing them to permit private benefits.

Thirdly, “majority” shareholders hold more than about 45% of the equity. Their equity position makes them invulnerable to hostile takeovers, although they show no evidence of entrenchment. They have sufficient bargaining power to monitor management effectively, and they provide the lowest levels of CEO pay, all other things equal. Actually their major share of cash flow rights can compensate for the costs incurred by monitoring activities, and is compatible with the alignment of their interests with those of minority shareholders.

Beyond the degree of control, a controlling shareholder may have a varying capacity to effectively monitor the management according to another criterion: *seniority of control*, measured by the number of years of control. This criterion is to the best of my knowledge used here for the first time in the literature. The rationale for this criterion is that the controlling shareholder needs experience and firm-specific knowledge before it has the insight and skills to monitor effectively. The panel threshold model finds that a large shareholder needs about eight years, six at the minimum, to exert a significant downward pressure on the levels of CEO pay. In their first years of control *new* controlling shareholders tend to provide their CEOs with higher variable components of pay, revealing higher agency and retention issues than in firms with *long-term* control.

The criteria and methodology used to define controlling shareholders and the forms of control suggest that future research on corporate governance could benefit from including these characteristics of corporate control, by comparison with the dichotomous or broad measures usually

found in the literature. Beyond the impact on CEO compensation, these criteria might also provide insights into the effects of corporate control on issues such as the characteristics of the board of directors, financial policies, R&D expenditures, or takeover activity; together with the other corporate decisions that controlling shareholders are able to influence.

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Appendix

This appendix discusses the relevance of continuous vs. discontinuous ownership metrics, comparing the PTR model used in this study with continuous specifications usually found in the literature. It also provides robustness checks for the results found in the study.

Thresholds effects vs. continuous share of equity

If a continuous measure is better in capturing the degree of control, indicator variables would be too restrictive, since 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 0.7873 vs. 0.7882 for cash and total compensation, respectively).

The additional information provided by a continuous variable – i.e., the percentage held by the controlling shareholder within one regime – does not then improve the measurement of the degree of control.

Piecewise linear forms

The literature concerning managerial ownership, as presented in Table 1, relies on other continuous specifications to estimate the impact of executives' shareholdings on firm value. The results found with the PTR model are hereafter compared with these continuous 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 the creation of the following variables:

$$\begin{aligned}
 1st \text{ regime} & \begin{cases} = CS\%, & \text{if } CS\% < 11\% \\ = 11\% & \text{if } CS\% \geq 11\% \end{cases} \\
 2nd \text{ regime} & \begin{cases} = 0, & \text{if } CS\% < 11\% \\ = CS\% - 11\% & \text{if } 11\% \leq CS\% < 34\% \\ = 34\% - 11\% & \text{if } CS\% \geq 34\% \end{cases} \\
 3rd \text{ regime} & \begin{cases} = 0, & \text{if } CS\% < 34\% \\ = CS\% - 34\% & \text{if } 34\% \leq CS\% < 46\% \\ = 46\% - 34\% & \text{if } CS\% \geq 46\% \end{cases} \\
 4th \text{ regime} & \begin{cases} = 0, & \text{if } CS\% < 46\% \\ = CS\% - 46\% & \text{if } CS\% \geq 46\% \end{cases}
 \end{aligned} \tag{4}$$

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 results²² show that the coefficients for the second and fourth regimes are not significant (19% and 12% p-values, respectively) for cash compensation 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 and support previous results.

However, the quality of the regression, as measured by the R^2 , is slightly lower, in spite of a finer measure of the continuing increase in the degree of control. This specification does not minimize the unexplained variations in the dependent variable, and it does not support a continuous metric instead of a threshold effect.

22 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%.

Table 10. Continuous measures with percentage of holdings per regime and piecewise linear form

	Continuous (% CS per regime)		Piecewise linear form					
	Ln(Cash comp.)		Ln(Total comp.)		Ln(Cash comp.)		Ln(Total comp.)	
	(1)	(2)	(3)	(4)	(3)	(4)	(3)	(4)
	coef	p-value	coef	p-value	coef	p-value	coef	p-value
1st regime (0% to 11%) – omitted								
2nd regime (11% to 34%)	-0,61	(0,00)	-1,19	(0,00)	-0,49	(0,19)	-1,24	(0,00)
3rd regime (34% to 46%)	-0,02	(0,88)	-0,29	(0,12)	-0,32	(0,66)	0,17	(0,85)
4th regime ($\geq 46\%$)	-0,46	(0,00)	-0,75	(0,00)	-0,54	(0,12)	-0,87	(0,04)
Intercept	-7,23	(0,00)	-8,57	(0,00)	-7,37	(0,00)	-8,72	(0,00)
Control variables	Yes		Yes		Yes		Yes	
Firm-year obs.	1119		1119		1119		1119	
Adj. R ² (%)	78,30		78,73		77,57		77,83	

Note: Pooled panel regressions with standard errors clustered at the firm level. Dependent variables are cash and total compensation (log-transformed). CS stands for controlling shareholdings and refers to equity shares held by the largest shareholder (alone or in concert) represented on the board. The regressions in columns 1 and 2 are specified based on Equation (2), but with percentages of CS instead of the indicator function, for each regime. The regressions in columns 3 and 4 are also based on Equation (2), but the regimes take the piecewise linear form defined in Equation (4) instead of the indicator function. The control variables are the same as those displayed in Table 4.

Polynomial functions

Lastly, referring to studies of managerial ownership by McConnel and Servaes (1990), Short and Keasey (1999) and Davies et al. (2005), I also use 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 regimes compared with 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 shareholdings* variable. The residuals of this regression 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,²³ as follows:

$$\begin{aligned} \text{Excess comp}_j = & \alpha_{j0} + \alpha_{j1} CS + \alpha_{j2} CS^2 + \alpha_{j3} CS^3 + \alpha_{j4} CS^4 \\ & + \alpha_{j5} CS^5 + \alpha_{j6} CS^6 + \varepsilon_j \end{aligned} \quad (5)$$

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 (i.e. when $CS = 0\%$).

The estimated coefficients α_{j0} to α_{j6} that define the polynomial function are displayed in columns 1 and 2 of Table 11. The first degree of the function was not different from zero and was therefore dropped. The other coefficients are significant and are, as expected, alternatively positive and negative. This nonlinear continuous measure of the degree of control accounts for about 7% of the deviations between cash compensation and its estimated values, and about 12% of the deviations for total compensation.

The issue is whether this 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 3 and 4 of Table 11 are run using the same dependent variables as in the polynomial function (i.e., excess cash and total compensation) but on the four rough indicator variables for each regime, as found in the framework of the PTR model. It appears that the discontinuous threshold specification slightly enhances the quality of the estimates for both dependent variables compared with the continuous polynomial function (adjusted R^2 of 0.083 vs. 0.072, and 0.123 vs. 0.117, respectively).

It is also interesting to focus on the intercept: it has a similar value in columns 1 and 3, and in columns 2 and 4. In other words, excess pay in firms with no large shareholders on the board (intercepts in columns 1 and 2)

23 A two-stage procedure is used because it will allow for a direct reading of the positive or negative impact of controlling interests on the ordinate axis in Figure 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.

is very similar to excess pay in firms with either no large shareholder, or large shareholders holding less than 11% of equity shares. This observation supports the existence of a threshold effect and a homogeneous impact of shareholdings between 0% and 11%, instead of a continuous impact of each incremented percentage point in shareholdings.

Table 11. Regression of excess pay on polynomial vs. threshold specifications

	Polynomial function				Discontinuous (indicator per regime)			
	Excess cash comp.		Excess total comp.		Excess cash comp.		Excess total comp.	
	(1)	(2)	(3)	(4)	(3)	(4)	(3)	(4)
	coef	p-value	coef	p-value	coef	p-value	coef	p-value
CS ²	-20,59	(0,03)	-30,72	(0,00)				
CS ³	145,15	(0,03)	201,08	(0,005)				
CS ⁴	-386,43	(0,02)	-510,09	(0,006)				
CS ⁵	442,24	(0,02)	566,40	(0,005)				
CS ⁶	-182,94	(0,02)	-230,05	(0,00)				
1st regime: $I(0\% \text{ to } 11\%)$ – omitted								
2nd regime: $I(11\% \text{ to } 34\%)$					-0,15	(0,007)	-0,25	(0,00)
3rd regime: $I(34\% \text{ to } 46\%)$					-0,00	(0,98)	-0,08	(0,31)
4th regime: $I(\geq 46\%)$					-0,26	(0,00)	-0,40	(0,00)
Intercept	0,15	(0,00)	0,25	(0,00)	0,13	(0,00)	0,22	(0,00)
Firm-year obs.	1119		1119		1119		1119	
Adj. R ² (%)	7,16		11,67		8,35		12,25	

Note: Pooled panel regressions with standard errors clustered at the firm level. The dependent variables are *Excess cash compensation* and *Excess total compensation*, they are defined as the residuals of Equation (2) run without the CS variable. In columns 1 and 2, excess compensation is regressed on a six-degree polynomial function (Equation (5)) where CS stands for “controlling shareholdings”, i.e. shareholdings of the largest shareholder represented on the board, alone or in concert. The first degree of the polynomial function is dropped because it was found to be non-significant (not reported). In columns 3 and 4, excess compensation is regressed on the indicator variables for the three regimes of controlled firms (the first regime of non-controlled firms is omitted). In columns 1 and 2, the intercept can be interpreted as excess pay when CS is equal to zero (i.e. when there is no large shareholder with at least 1% of equity shares represented on the board), and in columns 3 and 4, as excess pay in the first regime of control (i.e. CS ranging from 0% to 11%). The R² is expressed in percentages.

Another reason why the PTR model outperforms continuous specifications is that it allows the identification of the relevant number of thresholds – as compared with the polynomial function, which requires in the first place that a number of regimes are assumed, so as to determine the number of degrees in the function.

However, in case a polynomial function is used instead of a threshold model, the comparison between the polynomial and threshold models in Figure 1 (see section 5) prompts the following comment. The maxima and minima of the polynomial function are usually used in the literature to reveal changes in ownership patterns, but they do appear to be approximate “midpoints” for each regime. The change points between regimes appear to be approximated more accurately by the inflexion points of the polynomial function, i.e. the points where the concavity of the curve changes (calculated as the roots of the second derivative). The inflexion points of the polynomial function are 7%, 28%, and 52% for cash compensation, and 8%, 30%, and 53% for total compensation. These points are quite consistent with the threshold estimates found in the panel threshold analysis.

It may still be questioned whether these inflexion points are a better estimate of changes in the behavior of the controlling shareholders than those found in the PTR model. As a robustness check, I re-run the regressions presented in columns 3 and 4 of Table 11, but with these inflexion points instead of the panel threshold points (not reported). This yields an R^2 of 0.045 and 0.087, respectively. They are of markedly lower quality, and this test does not indicate that a polynomial function to determine change points in controlling shares would be better.