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Credit Ratings, CEO Entrenchment, and Turnover: The Information Content of Credit Ratings Beyond Firm Performance

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Anna Maria C. Menichini [*] **and Francesca Toscano** [**]

Abstract
We study the relationship between credit rating changes and CEO turnover beyond firm performance. Within an adverse selection framework that explicitly incorporates rating change related turnover, our model predicts that a downgrade triggers turnover, even following a good firm performance. Our empirical results support this prediction. We show that credit rating downgrades explain forced turnover risk, both internal and external, after accounting for the firm prior stock market and accounting performance. Further, we find that the relationship between credit rating changes and management turnover is stronger when the degree of managerial entrenchment is low. Our results are robust to endogeneity concerns and shed light on the idea that the information content of credit ratings goes beyond firms' performance.

JEL Classification: D82, G24, M12.

Keywords: Contracts, Ratings, CEO Turnover.

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1 Introduction

Management turnover is a phenomenon that has been largely investigated in the literature. It is likely to happen in distressed firms (Gilson, 1989) and to convey information about future performance (Hotchkiss, 1995). The turnover rate increases following mergers and acquisitions (Walsh, 1988), tender offer-takeovers (Martin and McConnell, 1991), and corporate governance reforms (Cornelli, Kominek and Ljungqvist, 2013). It is strongly affected by the managerial ownership (Denis, Denis and Sarin, 1997), the violations of GAAP (Desai, Hogan and Wilkins, 2006), the investor protection regime, and whether the firm is cross-listed on a major U.S. exchange (Lel and Miller, 2008). Further, it is almost constant along the corporate hierarchy (Fee and Hadlock, 2004).

Given managers' role in maximizing shareholder value, it is not surprising the interest of the literature on the relation between firm performance and CEO turnover (see, e.g., Coughlan and Schmidt (1985), Warmer, Watts and Wruck (1988), Weisbach (1988), Gibbons and Murphy (1990), Murphy and Zimmerman (1993), Blackwell, Brickley and Weisbach (1994), Kang and Shivdasani (1995), Kaplan and Minton (2011), Jenter and Lewellen (2014)).

However, although important, (poor) firm performance is not the sole determinant of management turnaround. As stated by Brickley (2003), "[...]while statistically significant, firm performance continues to explain very little of the variation in CEO turnover. We will have to consider other less explored issues to increase our understanding of CEO turnovers and replacements." Along these lines, Peters and Wagner (2014) and Jenter and Kanaan (2015) have shown that CEOs are more likely to be replaced after bad industry and market performance, emphasizing the role of factors unrelated to firms' current and past economic activity.

In light of the ongoing discussion about the role played by credit rating agencies (CRAs, henceforth) in corporate scandals, understanding the information content of credit ratings and their role in corporate governance decisions is of particular interest. Credit ratings are conceived to provide evaluations about the firms' credit risk, taking into account several

factors, such as the firms' past history of borrowing and paying off debts, their performance, as well as their future economic potential. However, credit ratings do not always perfectly mirror the firms' financial health and performance. Prior to the 2007-2009 financial crisis, for example, issuer-paid credit ratings were inflated, thus not reflecting firm performance (see, e.g., Jiang, Stanford and Xie (2012), Strobl and Xia (2012), and Cornaggia and Cornaggia (2013)). After the crisis, instead, the CRAs reputational concerns have resulted in lower corporate credit ratings with no significant change in firm-specific factors (see, e.g., Dmitrov, Palia and Tang (2015), deHaan (2016)).

In this paper, we investigate the role of credit rating changes on CEO turnover beyond firm performance and we argue that credit ratings affect CEO replacement decisions even when performance-related characteristics have been accounted for. We bring new evidence to the ability of credit ratings to gather firms' (and investors') attention even if the information they deliver is not exclusively tied to firms' outcomes, thus supporting the idea that CEO turnover decisions cannot be fully explained by a performance argument.

To this aim, we perform both a theoretical and an empirical analysis. Theoretically, to predict the role of rating downgrades in turnover, we construct a two-period signaling model in which a CEO, ex-ante privately informed about her characteristics, runs an investment project funded by a risk neutral investor. As in standard adverse selection models, the limited access to information about the CEO generates a problem of cross-subsidisation from the good quality to the bad quality type. To reduce informational asymmetries and signal her type, at the contracting stage the good quality CEO may offer to condition the terms of her job contract not only on the outcome realization, but also on the report that a CRA is called to produce following the outcome. This report imperfectly signals the CEO true type and gives rise to a rating change, i.e., upgrade or downgrade, which may lead to CEO firing. Thus, the high quality CEO accepts a lower protection against managerial turnover as a signaling device. In particular, an executive who is confident about her talent is willing to accept a turnover in case of a rating downgrade because she knows that a bad rating is less

likely than it would be if she were not so confident. By contrast, a less confident executive puts more weight on tenure because she knows that a bad rating is more likely. This in turn implies that a high quality CEO is relatively less entrenched than a low quality one.

Our model predicts that a downgrade may trigger a CEO turnover even upon a good firm performance. This occurs because CEOs use weak managerial entrenchment to signal their quality, thus leading to higher firing risk, an argument never explored so far in the literature.

We perform our empirical analysis using 647 U.S. public firms for a sample period that goes from 1998 until 2014. Firm-specific characteristics are collected from Compustat, while CEO-specific characteristics are collected from Execucomp. Further, following existing literature, we consult several online resources (Wall Street Journal, Bloomberg Business Journal, Company Websites, Washington Post among others) and construct a CEO turnover database by classifying a turnover as forced if the news on CEO departure mentions pressures from the board of directors, forced resignation, scandal, reorganization, demotion, policy or personality disagreement and poor performance.

We carry out three main tests. First, we study whether a rating change, be it an upgrade or a downgrade, has an effect on the probability of CEO turnover, controlling for CEO- and firm-specific characteristics, including accounting and stock market performance. According to the theoretical model such a relationship exists, and is more pronounced for rating downgrades. This finding is confirmed by our empirical results showing that, while the positive signal coming from a rating upgrade does not significantly affect the probability of management replacement, the negative signal carried by a rating downgrade has a significant impact on it. We further analyze the relation between rating changes and CEO turnover by distinguishing between internal or external turnover, i.e., whether the new CEO is chosen inside or outside the company. We find that credit rating downgrades are more likely to trigger external forced CEO turnovers rather than internal ones.

Second, the relation between managerial turnover and rating changes is likely to be affected by endogeneity problems, that is, reverse causality and omitted variables issues. In

our baseline test, we use an empirical model where rating changes and control variables are one period lagged with respect to CEO turnover. However, we are excluding the possibility that the credit rating downgrades occur as an anticipation of the firm managerial turnover, which may reflect firm instability. There is thus a potential reverse causality problem we need to address. Besides this issue, there might be other variables we are not currently including in our model that might affect both the rating downgrade and the probability of turnover. We are not considering, for instance, possible rumors about restructuring plans (e.g., tender offers-takeovers) that are likely to be correlated with our variable of interest, rating downgrades, and our outcome variable, managerial turnover.[1] To deal with endogeneity problems, we employ an instrumental variable analysis. More specifically, we use the industry analyst coverage, defined as the number of equity analysts providing equity recommendations to firms in a specific 4-digit SIC industry code, as an instrument for credit rating downgrades**.** Prior works (e.g., Fong, Hong, Kacperczyk and Dubik, 2014) have shown that equity analysts put pressure on credit rating agencies to reduce their optimism-bias in ratings. The idea is that firms that benefit from a greater analyst coverage are less likely to receive inflated ratings and thus subject to a more prudent behavior from CRAs. This in turn implies that firms (and industry sectors) with a greater analyst coverage are more exposed to a rating downgrade risk, thus supporting the *relevance* of our instrumental variable. The use of an industry-level instrumental variable together with the inclusion of several firm- and CEO-specific key variables help support the *exogeneity* of our instrument. Regarding the economic significance of our results, we find that, once instrumented, credit rating downgrades increase the probability of forced CEO turnovers by about 32 percentage points.

Last, we empirically test the relation between managerial entrenchment, credit rating downgrades and turnover. The theoretical model suggests that good quality managers, who believe in their future performance, put less weight on tenure and are more likely to

[1] As suggested by Rau and Vermaelen (1998), bidders in tender offers overperform following the acquisitions. Such rumors are thus negatively correlated with the probability of downgrade. In addition, there is enough empirical evidence suggesting that such restructuring plans may increase the turnover rate in the acquired firms. Not controlling for these restructuring rumors may thus result in a downward bias in our baseline results.

accept contracts with a high turnover risk as a way to signal their quality. Thus, they are less entrenched and the firms employing them display a higher profitability relative to firms with more entrenched CEOs. While the existence of an inverse relation between entrenchment and profitability has been corroborated by several studies (Malatesta and Walkling (1988), Berger, Ofek and Yermack (1997), among others), the link between the degree of entrenchment, credit rating downgrades, and the probability of CEO turnover has not been explored so far in the literature. To test the existence of such a relationship, we rely on a standard measure of managerial entrenchment based on the number of anti-takeover provisions (Bebchuck, Cohen and Ferrell, 2008). We then use a Heckman probit model together with a regression analysis by subgroups to account for strongly-entrenched firms (i.e., firms where the manager is highly protected via a large number of anti-takeover provisions) and weakly-entrenched firms (i.e., firms where the manager is weakly protected because of a limited number of anti-takeover provisions). Our results highlight that the link between rating downgrades and CEO turnovers is weakened for firms where CEOs are more protected by anti-takeover provisions, thus confirming the model predictions that good quality CEOs may use weak protection against turnover as a signaling device.

The paper is organized as follows. Section 2 presents a brief review of the related literature. Section 3 outlines the theoretical model. Section 4 derives some empirical predictions tested in Section 5. Section 6 concludes.

2 Related Literature

Our paper is related to different streams of the corporate finance literature.

First, we contribute to the empirical and theoretical literature on management turnover. This is an important corporate event with strong implications on the firm's investment and financing decisions. Denis and Sarin (1999) find that CEO turnover causes firms to be less diversified and smaller, with a subsequent increase in the cost of debt. Berger, Ofek and Yermack (1997) show that CEO turnover is associated with substantial increases in

leverage. Adam and Mansi (2009) prove that CEO turnover events, although beneficial to stockholders, are value decreasing to bondholders and, in general, have an insignificant impact on firm value.

A large part of the CEO turnover literature has focused on the negative relationship between CEO turnover and firm performance. The main idea behind this literature is that the CEO firing risk increases for poorly performing firms (Coughlan and Schmidt (1985), Warmer, Watts and Wruck (1988), Weisbach (1988), Gibbons and Murphy (1990), Murphy and Zimmerman (1993), Blackwell, Brickley and Weisbach (1994), Kang and Shivdasani (1995), Kaplan and Minton (2011), Jenter and Lewellen (2014)), and is likely to be tied to the CEO incentive and option compensation plan (Chakraborty, Sheikh and Subramanian (2009), Chakraborty and Sheikh (2015)).[2]

A more recent literature has argued that the CEO turnover is not uniquely determined by the firm-specific performance. Lehn and Zhao (2006) analyze the relation between M&A returns and subsequent CEO turnover for 714 firms that completed acquisitions from 1990 through 1998. They find an inverse relation between the value created by M&A activity and the probability of CEO turnover. Peters and Wagner (2014) and Jenter and Kanaan (2015) document that CEOs are more likely to be dismissed from their job after bad industry performance and, although to a lesser extent, after bad market performance. We contribute to this stream of the literature by showing that CEO turnover may be significantly affected by credit rating changes beyond the traditional firm performance channel largely investigated by prior works.

Second, by studying the sensitivity of CEO turnover to credit rating changes, our paper contributes to the growing literature studying the effects of credit ratings on corporate governance decisions. Alali, Anandarajan and Jiang (2012) show that improvements in corporate

[2]The relation between firm performance and management turnover has been analyzed in various countries. Barucci, Bianchi and Frediani (2006), for example, study CEO turnover in the Italian financial market for all listed companies during the sample period 1992-2003. The results show that CEO turnover is higher for poorly performing firms, unless the company is controlled by a family member, and that a weak internal governance, proxied by the board composition and the cash flow-voting rights wedge, is associated with a low turnover rate. Kato and Long (2006) get similar results for a sample of China's listed firms from 1998 to 2002. They find that CEO turnover is inversely related to firm profitability, but that this link is weaker for listed firms controlled by the state.

governance standards are positively correlated with improvements in credit ratings, with more pronounced effects among small companies. Kang and Liu (2009) show that rating changes have an effect on CEO equity-based compensation plans, with downgrades being more effective than upgrades. To the best of our knowledge, no paper has previously discussed the effect of credit rating changes on forced CEO turnover. We aim to fill this gap to show that credit ratings are a powerful signaling device whose information content goes beyond firm performance.

Lastly, the paper is related to the literature studying the relation between the dynamics of managerial entrenchment and firm value (see, e.g., Manne (1965), Shleifer and Vishny (1989), Zwiebel (1996), Novaes and Zingales (1995), Benmelech (2006)). This literature has described managerial entrenchment as a set of actions that managers take, in the form of investment or capital structure decisions, to keep or secure their position, while hurting shareholders. It has shown that firms with weak managerial entrenchment have a better access to capital markets, higher firm value, and significantly higher profitability relative to firms where managers are strongly entrenched (see, e.g., Malatesta and Walkling (1988); Berger, Ofek and Yermack (1997); Gompers, Ishii and Metrick (2003); Bebchuk, Cohen and Ferrell (2009)). We take a further step by arguing that weak managerial entrenchment emerges as an attempt to signal quality and as such may lead to higher firing risk.[3]

3 A model with adverse selection

In this section we set up a simple model with unobservable CEO characteristics that explicitly incorporates rating change related turnover.

A firm managed by a CEO has a risky project which lasts for two periods and has a cost

[3] At a theoretical level, the paper is related to the literature on signaling (Spence, 1973, 1974). Relative to this literature, in our paper it is the weak protection against managerial turnover that plays the role of signal. Indeed, since a good CEO is less likely to fail, she bears a lower cost from jeopardizing her job in case of failure than a bad one, thus making the degree of entrenchment an effective signaling device. Further, in focusing on the firm's firing decisions, our paper contributes to the literature on personnel economics. However, this literature has considered firing decisions as the result of some negative shock to a firm or its industry or the result of an individual proving to be significantly less productive, and has focused on the adverse consequences of such decisions on workers. Thus, all this literature considers turnover as performance related and not as a response to a negative signal, as we do.

I.[4] The project yields y in case of success and 0 in case of failure in each period. The CEO can be one of two types. A good quality CEO has probability of success equal to p_G. A bad quality CEO has probability of success p_B. The NPV of the project if undertaken by a good quality CEO is given by the expected returns across the two periods net of the investment cost I, i.e., $V^G \equiv p_G y + p_G^2 y - I = p_G (1 + p_G) y - I > 0$, while if undertaken by a bad quality CEO is $V^B \equiv p_B (1 + p_B) y - I > 0$. Assume that $p_G > p_B$, so that $V^G > V^B$. The CEO has complete private information about her quality.

Investors are competitive and demand an expected rate of return equal to 0. Under asymmetric information, not knowing whether they face a good or a bad borrower, they put probabilities α and $1 - \alpha$ on the CEO being a good or a bad type, respectively. Let $m \equiv \alpha p_G (1 + p_G) + (1 - \alpha) p_B (1 + p_B)$ denote the CEO's prior probability of success.

We first calculate the optimal contract under symmetric information. Next we introduce asymmetric information and derive the pooling contract with no firing risk. Then we introduce a rating agency and a firing risk conditional on the realized rating, and show that the information provided by the CRA and the threat of turnover can be used to assess CEO quality and separate types. So, the threat of replacement becomes a sorting device.

3.1 Symmetric information

To set a benchmark, consider first financing when the investors know the CEO's type. Since the project NPV is positive also when it is undertaken by a bad type, under symmetric information both CEOs obtain financing, getting in each period a return conditional on the project outcome reflecting their actual profitability. In particular, the contract sets type-contingent compensations so as to maximize $p_s (1 + p_s) w_s$, $s \in \{G, B\}$, subject to the investors getting non-negative returns: $p_s (1 + p_s) (y - w_s) \geq I$. Because of competition, each investor's individual rationality constraint holds with equality, whence each CEO gets $w_s = y - I / [p_s (1 + p_s)]$, $s \in \{G, B\}$, with $w_G > w_B$. In case of failure, the project yields no return and, by limited liability, each party gets zero. Using w_s in each CEO's expected

[4] The focus on two periods is necessary to introduce the firing risk upon rating collection.

return, this is equal to $V^s = p_s(1+p_s)y - I$, $s \in \{G, B\}$, the project NPV.

3.2 Asymmetric information

The symmetric information outcome is not robust to asymmetric information. Indeed, since $w_G > w_B$, the bad-type CEO will select the contract designed for the good-type**.** This implies that the investors break even on the good-type but make losses on the bad-type as $p_B(1+p_B)(y-w_G) < I$. Anticipating the loss, the investors refuse to provide a type-contingent loan and will pool the two types of CEOs who get a return conditional on the average project outcome. This implies a cross-subsidization from the good to the bad quality CEO and a cost to the former.

To see this, let us consider a contract that pools the two types of CEOs, in particular a contract that gives both CEOs a compensation $w_P \geq 0$ that maximizes their expected return mw_P, under the condition that investors break even across types, $m(y-w_P) = I$. Using $m = \alpha p_G(1+p_G) + (1-\alpha)p_B(1+p_B)$, the investors' individual rationality constraint can be written as $\alpha[p_G(1+p_G)(y-w_P) - I] + (1-\alpha)[p_B(1+p_B)(y-w_P) - I] = 0$, whence it follows that the investors make profits on the good types and losses on the bad types. There is then a cross-subsidisation from the good to the bad type. Solving the investors individual rationality constraint, the CEO compensation under a pooling contract is given by $w_P = y - I/m$, which, replaced in the objective function, gives an expected return across types equal to $V^P = my - I$.

To compute the extent of the cross-subsidy from the good to the bad quality CEO, we use the pooling compensation w_P in the good CEOs expected return under a pooling contract, $p_G(1+p_G)w_P$, and we get:

$$V^{G\text{-}P} = p_G(1+p_G)y - I - \frac{(1-\alpha)(p_G(1+p_G) - p_B(1+p_B))}{\alpha p_G(1+p_G) + (1-\alpha)p_B(1+p_B)}I \tag{1}$$

where the fraction term expresses the cost of asymmetric information for the good CEO.

3.3 Signalling through weak entrenchment

To reduce informational asymmetry and the costs related to it, the good quality CEO can try and signal her type. She can do so by using a CRA and introducing a firing risk conditional on the realized rating. In particular, she can offer an "option contract", $(C, \tilde{C})$, i.e., contractual terms for each CEO type in each period. The contract set for the good type, C, conditions the terms of the job contract on the outcome and, if positive, on a valuation about the CEO provided by a rating agency at a cost c. The valuation is positively correlated with the CEO true quality and triggers a rating change of the firm. In particular, a high valuation is obtained with probability $r_H > 1/2$, if the firm is managed by a good quality CEO, while it is obtained with probability $q_H < 1/2$, if the firm is managed by a bad quality CEO. In both cases a high valuation triggers an upgrade (U). Similarly, a low valuation triggers a downgrade (D) and is obtained with probability $r_L < 1/2$, if the firm is managed by a good quality CEO, while it is obtained with probability $q_L > 1/2$, if the firm is managed by a bad quality CEO. Let $\rho \equiv r_H q_L - r_L q_H$, with $\rho \in (0, 1]$, define the requirement of positive correlation between state and CRA valuation.[5] Under our assumptions, a good evaluation improves the chance that the CEO is actually of good quality and vice versa.

The outcome realization, along with the rating change, is used to set the contract terms. In particular, in the first-period, following an upgrade occurring upon a positive outcome, a probability of being retained (fired) K_U $(F_U = 1 - K_U)$ along with a repayment w_K (w_F) conditional on whether the CEO is retained (fired), is specified. Similarly, following a downgrade (still occurring upon a positive outcome), a probability of being retained (fired) K_D $(F_D = 1 - K_D)$ along with a repayment w_K (w_F) is specified. In the second period, a compensation conditional on having been retained in the first period and on the second period outcome is specified. In particular, a CEO who in the first period has accepted a weak protection against turnover, in the second period will get no contract (and thus zero compensation) in case she has been fired in the first period, with probability $p_G (r_H F_U + r_L F_D)$,

[5] The signal is fully informative if $r_H = q_L = 1$. In this case $\rho = 1$. Conversely, the signal is completely uninformative if $r_H = q_H = 1/2$ and then $\rho = 0$.

or the compensation upon being retained, w_K, with probability $p_G\left(r_H K_U + r_L K_D\right)$.

In the second period, conditional on having been retained in the first, the contract specifies a compensation w_K in case of high outcome, and, still by limited liability, zero in case of low outcome.[6] Thus, $C = \{C_1, C_2\}$, where $C_1 = \{K_U, K_D, w_K, w_F, 0\}$ and $C_2 = \{w_K, 0\}$

The contract set for the bad type, $\tilde{C}$, coincides with the symmetric information contract described in Section 3.1, and specifies the compensations conditional on the outcome only. Thus, $\tilde{C} = \{w_B, 0\}$ in each period.

The option contract is designed in such a way that the bad type will never have an incentive to ask for a rating, while a good type will. By introducing a firing risk upon a high outcome y, the good type CEO jeopardizes the positive and certain return that she would have obtained under a pooling contract, and this works as a signalling device. She may want to undertake such a strategy because she knows that, relative to a bad quality CEO, she has a lower chance of facing a firing risk.

The sequence of events is as follows.

First period:

1. Nature chooses the CEO type $s \in \{G, B\}$, which only the CEO observes.
2. The good CEO offers an "option contract", $(C, \tilde{C})$, that specifies contractual terms for each possible type in each period.
3. The investors accept or refuse.
4. If the investors accept, the CEO exercises her option and chooses between C and $\tilde{C}$.
5. The project is carried out and the outcome y or 0 is realized and publicly observed.
6. If C has been chosen, conditional on a favorable outcome y, a rating agency is hired to collect information $\sigma \in \{H, L\}$ about the CEO talent, and thus provide a rating $R \in \{U, D\}$, at a cost c.

[6] To simplify the analysis, we have assumed that the second period compensation of the retained CEO equals the first period one. However, endogenizing it would not affect the qualitative features of the results.

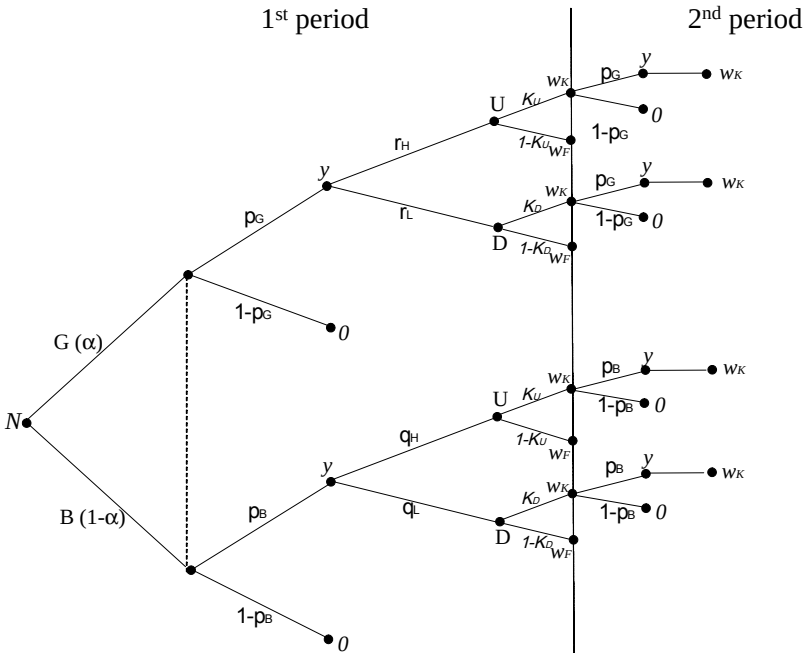

Figure 1: Fig. 1: The game tree

7. Conditional on the rating, replacement decisions, if any, are taken and first-period payoffs are distributed. In particular, if the CEO is fired, she gets the compensation w_F and the game ends. If the CEO is retained, she gets the compensation w_K and the game continues to the second period.

   Second period:

8. Conditional on having been retained in the first period, in the second period the CEO gets, in case of a good outcome, the first-period compensation w_K. In case of a bad outcome, she gets zero.

A game tree is sketched in Figure 1

We look for a separating equilibrium. The contract terms must then be set so as to allow the good CEO to credibly signal her type, namely, not appeal to a bad CEO, and allow investors to break even when they know they face a good CEO. In this scenario, weak entrenchment, i.e., the greater CEOs' exposure to the firing risk as induced by the rating downgrade, becomes a signaling device.

One last remark is in order. We have allowed for rating collection only upon a high outcome. This is because we want to focus on CEO turnover beyond firm performance. Indeed, while it might make theoretically sense to let a good type ask for a rating also in case of a low outcome due to its signaling role, it is true that firing risk is more likely upon a bad performance, as shown in many empirical works. Thus, in line with the focus of the paper, we have chosen to neglect the case in which a rating is required upon a negative outcome and captured the empirical feature of the increased firing risk upon a low managerial performance by assuming that the CEO is never retained in such circumstances.

Consider thus the problem faced by the good type CEO of choosing a probability of retention (turnover) K_U, K_D (F_U, F_D) conditional on the rating (U, D), and a compensation $w_K(w_F)$ conditional on being retained (fired), that maximizes her expected payoff. Two constraints must be satisfied; namely, the investors' breaking even on the good CEO (i.e., constraint 3 below), and the good CEO's allocation not being preferred by the bad one to her symmetric information allocation, that is, to the constraint that the bad CEO obtains no rent over her symmetric information payoff (i.e., constraint 4 below). A bad CEO, who in equilibrium is recognized by the investors, must obtain utility $V^B = p_B\left(1 + p_B\right) y - I$: she cannot obtain more and she can guarantee herself V^B by demanding her full (symmetric) information reward in case of success. This last condition guarantees that the bad type has no incentive to mimic the good type as, by choosing the contract designed for the good type, she can at most obtain her full (symmetric) information payoff. Moreover, the investors take no risk in financing the CEO since at worst she is a bad type and they still break even.

The maximization programme reads as follows (Programme $\mathcal{P}^{RA}$):

$$\max_{w_K, w_F, K_U, K_D} p_G \left\{ r_H \left[K_U w_K \left(1 + p_G\right) + \left(1 - K_U\right) w_F \right] + r_L \left[K_D w_K \left(1 + p_G\right) + \left(1 - K_D\right) w_F \right] \right\} \tag{2}$$

$$\text{st } p_G \left[1 + p_G \left(r_H K_U + r_L K_D \right) \right] y - p_G c + \tag{3}$$

$$- p_G \left\{ r_H \left[K_U w_K \left(1 + p_G\right) + \left(1 - K_U\right) w_F \right] + r_L \left[K_D w_K \left(1 + p_G\right) + \left(1 - K_D\right) w_F \right] \right\} \geq I$$

$$V^B - p_B \left\{ q_H \left[K_U w_K \left(1 + p_B\right) + \left(1 - K_U\right) w_F \right] + q_L \left[K_D w_K \left(1 + p_B\right) + \left(1 - K_D\right) w_F \right] \right\} \geq 0 \tag{4}$$

$$w_K, w_F \geq 0 \tag{5}$$

$$0 \leq K_U, K_D \leq 1 \tag{6}$$

where (2) is the good CEO's expected return, constraint (3) is the investors individual rationality condition, ensuring that they break even when dealing with a good CEO, constraint (4) is the no-mimicking condition, ensuring that the bad CEO does not want to mimic the good one, constraints (5) and (6) are the limited liability and feasibility conditions, respectively.

To introduce a role for the rating agency, we introduce the following assumption ensuring that, even in the presence of a rating agency, the project managed by a good type CEO has higher NPV relative to that managed by a bad type:

Assumption 1 *The NPV of the project across the two periods when managed by a good-type CEO net of the expected rating agency's fees is greater than the NPV of the project when managed by a bad-type CEO, i.e.,* $V^G - p_G c > V^B$.

From conditions (3) and (4) in programme P^{RA} we obtain a separating equilibrium in which the probability of being fired upon a downgrade is positive and higher than that upon an upgrade.[7] Such equilibrium is described in Proposition 1.

[7] For the sake of completeness, there is a second equilibrium with the same qualitative features, except that the probability of being fired upon a downgrade is one and the probability of being retained upon an upgrade is less than one. Since not any downgrade implies CEO turnover, we do not consider it here. We nevertheless derive and discuss its features in the Appendix.

Proposition 1 *Under the assumptions of the model, there exists a separating equilibrium in which the probability of being fired upon a downgrade is positive and strictly higher than the probability of being fired upon an upgrade. In particular,* $K_U = 1 > K_D \geq 0$. *Moreover, the compensation upon being fired,* w_F, *is zero and the compensation upon being retained,* w_K, *is positive.*

Proof. In the Appendix. ■

CEO turnover can be explained as a response to imperfect information. In particular, under asymmetric information, the willingness to accept a replacement upon a positive outcome following a downgrade serves to signal the quality of the CEO. High-quality CEOs can be identified because they are willing to condition their job on the rating agency report. The reason is that they know there is a low probability that a low valuation will be received from the rating agency. Low quality CEOs, instead, are not willing to condition their job on the rating agency report because they know there is a high probability that a low valuation will be received from the rating agency. Put differently, signalling can occur here because it is relatively more costly for a bad CEO to accept a weak protection against turnover than for a good one. Since $q_L > r_L$, it is more likely that a low valuation will arrive from the rating agency and that she will be fired upon a downgrade.[8]

4 Empirical predictions

We have shown in the theoretical model that CEO turnover can be explained as a response to imperfect information. In particular, the willingness to accept a replacement upon a positive outcome following a rating downgrade signals the quality of the CEO. This implies that one should observe turnover triggered by a rating downgrade even under a good performance. This leads to the following prediction.

Prediction 1. *CEOs of firms displaying a positive outcome have a positive probability of being fired upon a downgrade, but are always retained upon an upgrade.*

[8] The properties of exixtence and uniqueness of the separating equilibrium are derived in the Appendix.

In our model, the reason why high quality CEOs are willing to accept an increased firing risk in case of a low signal (downgrade) is because they know there is a lower probability that such a signal will be received by the rating agency. Thus, better quality CEOs should display weak entrenchment, and firms employing those CEOs should have higher profitability.

From the above, we derive Prediction 2.

Prediction 2. *Firms with strong managerial entrenchment display lower profitability relative to firms with weak managerial entrenchment.*

The existence of a negative relation between managerial entrenchment and firm profitability has been found in many empirical papers such as Malatesta and Walkling (1988) and Berger, Ofek and Yermack (1997), among others. According to such papers, firms with strongly entrenched management have lower leverage, lower value, and significantly lower profitability relative to firms where the management is weakly entrenched.

Finally, and more importantly, following the findings of the theoretical model, we should also observe a stronger relation between rating downgrades and CEO turnover in firms with less entrenched CEOs. This leads to Prediction 3.

Prediction 3. *Firms with strong managerial entrenchment display lower CEO turnover following a credit rating downgrade relative to firms with weak managerial entrenchment.*

5 Empirical Analysis

The theoretical model illustrates that the credit rating downgrade is a powerful signaling device and that the CEO turnover is more likely to be observed upon a rating downgrade than upon a rating upgrade even after a good firm performance. In our empirical test, we provide evidence of this result and prove that a credit rating downgrade affects the CEO firing risk after controlling for the prior stock market returns and return on assets ratio, thus showing that a CEO might be fired for credit rating downgrades not directly explained by the prior firm (stock market and accounting) performance. We further corroborate our result using an instrumental variable approach.

A further prediction of the theoretical model is that, conditional on a downgrade, CEO turnover following rating downgrades is more likely to happen in firms where managers are less entrenched, i.e., when managers are less tied to their position within the firm. Our rationale for this is that for those managers weak protection against managerial turnover is a signaling device. We provide empirical evidence for our theoretical finding by testing the relation between credit rating downgrades and CEO turnover for firms where managers are more protected via anti-takeover provisions.

5.1 Data

We use three databases in our analysis. First, to get data on the CEO-specific characteristics, we use the Execucomp database. We construct a set of variables that are likely to affect the probability of management turnover. More specifically, we define the variable, *Tenure*, denoting the length of the relation between the CEO and the company. This variable is constructed by taking the difference between the current year and the year in which the CEO first got her or his position in the firm. The correlation between CEO tenure and the probability of turnover can be either positive or negative. If positive, it is a signal that CEOs are close to retirement and, thus, their probability of being replaced increases. If negative, the length of the CEO relationship becomes a signal of the firm's confidence towards the CEO. Further, we define *Age*, *Compensation*, and *Salary*. CEO compensation and salary are constructed as the natural logarithm of the CEO total compensation and CEO total salary, respectively. We expect CEO compensation and salary to be negatively correlated to the probability of turnover, suggesting that CEOs that receive a higher reward are highly valuable to the firm and will less likely be replaced. The coefficient sign for CEO age is unpredictable. Weisbach (1988) and Murphy and Zimmerman (1993) find a positive correlation between CEO turnover and CEO age. However, CEO age may also be negatively correlated with the probability of CEO turnover supporting the idea that older CEOs are more experienced and, hence, have higher costs of turnover. In addition, we control for

Female, a dummy variable equal to one if the CEO is a female.

The Execucomp database is merged with the Compustat database, which provides credit ratings and firm-specific characteristics. We delete all the observations for which we do not have rating data. Following existing literature, we assign numerical values to S&P's ratings on notch basis: AAA=23, AA+=22, AA=21, AA-=20, A+=19, A=18, A-=17, BBB+=16, BBB=15, BBB-=14, BB+=13, BB=12, BB-=11, B+=10, B=9, B-=8, CCC+=7, CCC=6, CCC-=5, CC=4, C=3, D=2, SD=1. Credit rating changes are defined as *Upgrades* or *Downgrades*. Upgrades are defined by a dummy variable equal to one if the one period rating difference is positive (strictly greater than zero), while Downgrades are defined by a dummy variable equal to one if the one period rating difference is negative (strictly smaller than zero). If the one period rating difference is equal to zero, then no rating change occurs.

We control for a battery of firm-specific characteristics that are likely to affect the probability of CEO replacement, like: size, total leverage, growth opportunities, profitability and tangibility. Firm size (*Size*), or the natural logarithm of the book value of total assets, is used to capture economies of scale. Intuitively, we expect the variable Size to be positively correlated with the probability of CEO turnover. Firm total leverage (*Leverage*), or the sum of the book value of long-term debt and current liabilities to the book value of total assets, is used to control for differences in the capital structure. We expect leveraged firms to have lower CEO turnover due to lower resources available for the recruitment process. Firm growth opportunities are captured by the firm market-to-book (MTB). This variable is constructed as the ratio of the market value of assets over the book value of assets, where the market value of assets is defined as the market value of equity (close price multiplied by common shares outstanding) minus the book value of equity (total assets minus total liabilities plus deferred taxes and investment tax credit) plus the book value of total assets. Finally, we construct proxies for firm profitability and tangibility. Profitability (ROA) is constructed as the ratio of operating income before depreciation to quarterly total assets. Tangibility (*Tangibles*) is expressed as property plant and equipment over quarterly total

assets. We delete all missing values and we winsorize at 99% and 1% to deal with potential outliers. The rating database and the database containing firm characteristics are merged manually by firm ticker and fiscal year. In addition to the previously mentioned firm-specific characteristics, we control for past stock market performance, proxied by the prior firm stock market return. Data on stock prices are collected from the Center for Research in Security Prices (CRSP). More details on the construction of the stock market return variable are provided in the following analyses.

We have no information on the reasons behind the CEO turnover from the Execucomp database. We thus hand-collect data to distinguish between forced and voluntary turnovers. To this aim, following Farrell and Whidbee (2002), we review the press release (Wall Street Journal, Bloomberg Business Journal, Company Websites, Washington Post, among others) and, in line with the definition provided by Parrino (1997), classify the CEO turnover as forced when the departure mentions pressures from the board of directors, forced resignation, scandal, reorganization, demotion, policy or personality disagreement and poor performance. Conversely, we define the turnover as voluntary if the CEO resigns voluntarily, for personal reasons or to undertake new business activities, or, if aged above 60, decides to retire. If the reason for CEO departure is reported as "retirement" but the CEO is below 60 and no additional information is provided, again we classify the turnover as forced.[9] This hand-collected database provides two types of information. First, we have access to the exact date in which the turnover event has occurred so that we can establish a temporal relationship between the credit rating change and the CEO turnover. Second, we can distinguish between internal and external turnover. A turnover is internal (external) when the new CEO is chosen within (outside) the company.

In our final dataset, we have 647 U.S. public firms, covering the sample period between 1998 and 2014. Table 1 reports the frequency of forced and voluntary CEO turnovers that we

[9] For completeness of exposition, we should mention another definition of CEO turnover used in the literature that does not classify it into categories (Mikkelson and Partch (1997) and DeFond and Park (1999)). Here, the CEO turnover is simply defined as the change in the identity of the individual holding the CEO office. Since this definition does not account for the distinction between forced and voluntary turnovers, we use the definition mentioned above.

observe in our data. To analyze the frequency of the turnover data, we construct a variable, *Turnover Type*, that takes a value equal to 0, if, for each firm-year-quarter observation, no turnover event is recorded. The variable takes a value equal to 1 if a forced and internal turnover occurs, equal to 2 if a forced and external turnover takes place, equal to 3 for voluntary and internal turnovers and equal to 4 for voluntary and external ones. The total number of forced turnovers we observe in our sample is equal to 113. Of these turnovers, 81 are internal and 32 are external. The majority of the turnovers we observe in our sample (431) are classified as voluntary. Of these, 362 are classified as internal and 69 as external.

Firm- and CEO-specific information are provided in Table 2. Panel A provides summary statistics for the all sample. Panel B focus on firms that have experienced at least once a forced turnover. Panel C shows summary statistics for firms that never faced a forced turnover. Panel D is a subset of Panel C focusing on firms that experienced a voluntary CEO turnover. Our summary statistics reveal that firms that face a forced turnover at least once in their life are, on average, larger, less profitable, with more leverage, fewer growth opportunities, and lower S&P credit ratings when compared to either firms that never experienced a forced turnover or, more specifically, to firms that experienced a voluntary turnover. Turning now to the CEO-specific characteristics, it appears that firms facing a forced turnover have, on average, younger CEOs, with lower tenure and higher compensation (when compared to firms that never experienced a forced turnover or experienced a turnover classified as voluntary).

5.2 Baseline Results

Prediction (1) states a relationship between probability of turnover and rating changes. Empirically, we estimate the link between credit rating downgrades, upgrades, and CEO turnover using the following logit model:

$$\begin{aligned} Prob(Turnover)_{cit} &= \alpha_{it} + \beta_1 * Upgrades_{it-1} + \beta_2 * Downgrades_{it-1} + \\ &+ \gamma_1 X_{ct-1} + \gamma_2 W_{it-1} + \theta_{SIC} + \theta_t + \varepsilon_{cit}, \end{aligned} \tag{7}$$

Where the dependent variable is the probability of turnover for CEO c, employed in firm i, at time t.[10] The CEO turnover is defined by a dummy variable that takes value equal to one if a turnover has occurred relative to the previous year and it is classified as *forced*. X_{ct-1} captures CEO-specific characteristics (Age, Compensation, Salary, Tenure, Female). W_{it-1}, instead, refers to firm-specific controls (Size, Leverage, ROA, MTB, Tangibles). Although we are including several firm- and CEO-specific characteristics, the model we are considering is not accounting for the history, the traditions and the culture of a company, which are likely to affect the CEO turnover process. A natural way to approach this problem is to include firm-specific fixed effects in the model specification. A problem with this approach is that it ignores variation among firms and only considers within-firm variation. We have an average of 12 years for each firm and including firm-specific fixed effects lowers the amount of variation available in our data, which makes difficult to estimates effects that change slowly over time (as the CEO turnover). For this reason, we estimate model (7) using year fixed effects and industry fixed effects, with standard errors clustered at the firm level. Results are presented in Table 3. Panel A shows results for the all sample. Panel B focuses on a subset of firms classified as "Investment" (i.e., with average S&P credit rating above BBB−). Columns (1), (2) and (3) analyze the relation between CEO forced turnover and credit rating changes, upgrades and downgrades, when no controls are included, with and without year and industry fixed effects. To account for the prior stock market performance, Column (4) adds prior stock market returns.[11] Column (5) adds firm- and CEO-specific controls. Columns (6) and (7) refine the definition of forced CEO turnover to distinguish between internal and external CEO turnovers.

Let us focus on Panel A, Columns (4) and (5). Our results indicate that, following a downgrade, the probability of CEO turnover increases, even after accounting for prior

[10] Our results hold even when estimating the relationship between CEO turnover and credit rating changes using a linear probability model

[11] We compute total stock market returns one quarter and two quarters before the quarter in which the potential CEO turnover is observed. As an alternative to total stock market returns, we calculate *industry-adjusted* stock market returns. These returns are calculated by substracting from the total stock market returns the average stock market return of all firms in a given firm's 4-digit SIC code. Results are not affected by the approach we take in calculating firms' stock market returns.

stock market performance, firm- and CEO-specific controls.[12] This result is significant as it highlights how the CEO turnover probability is affected by downgrades beyond the prior accounting and stock market performance.[13] Although it is clear that downgrades reflect past firm performance, our baseline results suggest that downgrades incorporate other factors beyond the firm-specific performance that, given the importance of ratings on capital markets (on shareholders and bondholders), unavoidably affect the firm decision to dismiss the CEO. To investigate the marginal effects of our model, let us focus on model (5), where all firm- and CEO-specific controls are taken into account. Our results suggest that a credit rating downgrade in the prior period increases the probability of CEO dismissal by 0.5 percentage points, even after controlling for a set of variables that are likely to affect this probability. Upgrades have a negative effect on the probability of CEO turnover, although not statistically significant. All the controls have the expected sign. We get similar results when we distinguish between internal and external forced CEO turnovers. Interestingly, the magnitude and the statistical significance of β_2, when we estimate the effect of credit rating downgrades on forced external CEO turnovers, is magnified compared to the same coefficient when we estimate the relation between credit rating downgrades and forced internal CEO turnovers. Controlling for prior stock market performance, firm- and CEO-specific controls, our results from Column (6) suggest that a credit rating downgrade increases the probability of forced and external CEO turnover by about 0.6 percentage points.

Similar to Panel A, Panel B analyzes the relation between credit rating downgrades and CEO turnover using different model specifications for investment firms. The logic behind this test is to check whether the results still hold for firms that are not poor performing. Put differently, we need to worry about the possibility that firms unconditionally respond to credit rating changes (and, in particular, to credit rating downgrades) only if their reputation is already undermined. Panel B confirms the results obtained on the whole sample, although

[12] In un-tabulated results, available upon request, we also include past industry ratings to account for the effect of industry performance on CEO turnover. Results are not affected by the inclusion of this variable.

[13] In the regression analysis, we are accounting for return on assets (ROA), which captures the accounting profitability, and the prior stock market returns (Ret_{t-1}, Ret_{t-2}), which, instead, capture the stock market performance.

they are statistically weaker (significant at the 10% level) when we introduce firm- and CEO-specific controls and we refine the dependent variable to account for internal versus external forced CEO turnovers.[14]

5.3 Instrumental Variable Analysis

In the previous section we showed that the CEO probability of turnover depends on credit rating downgrades after controlling for a set of variables capturing the firm-specific performance at different levels (i.e. accounting and stock market). The baseline test provides thus two important intuitions: first, the decision to fire the CEO depends highly on corporate credit rating changes (especially on those conveying negative information about the firm) and, second, credit rating changes incorporate some other factors, besides firm performance, which still affect the CEO turnover probability.

Although we are controlling for several variables, the relation between managerial turnover and rating changes may still be affected by endogeneity issues, namely, reverse causality and omitted variable issues. The baseline model we use incorporates rating downgrades and control variables that are one period lagged with respect to the outcome variable (CEO turnover). However, we are neglecting the possibility that the rating downgrade occurs as an anticipation of the CEO managerial turnover, which may reflect firm instability. There is thus a potential reverse causality problem we need to consider. Besides this issue, there might be other variables we are not currently including in our model that might affect both the rating downgrade and the probability of turnover. We are not considering, for instance, possible rumors about restructuring plans (i.e. tender offers/takeovers) that are likely to be correlated with our variable of interest, rating downgrades, and our outcome variable, managerial turnover. As suggested by Rau and Vermaelen (1998), bidders in tender offers overperform following the acquisitions. Such rumors are thus negatively correlated with the

[14] Our results are also confirmed if we distinguish between small rating changes (downgrades of at most one notch) and large rating changes (downgrades of two or more notches). We find that forced external turnovers occur following large rating changes (significant at 10% level), while small rating changes do not seem to have a significant impact on CEO turnovers. We also find that internal turnovers are not affected by either large or small rating changes. Despite the reduced significance, this additional test employing large versus small rating changes illustrates the power of CEO turnover to signal a change of gear following credit rating downgrades.

probability of downgrade. In addition to that, there is enough empirical evidence suggesting that such restructuring plans may increase the turnover rate in the acquired firms. Not controlling for these restructuring rumors may generate a downward bias in our baseline results. We thus employ an instrumental variable analysis to deal with the endogeneity problem.

We need to find an instrument for rating downgrades that is "relevant" and "exogenous", meaning correlated with the variable we think is endogenous (i.e., rating downgrades), but uncorrelated with the error term (i.e., possible variables we are omitting in the analysis). To this aim, we use the industry analyst coverage (*IndCov*), defined as the number of security analysts providing equity analyst recommendations to all firms belonging to a given 4-digit SIC code, as instrument for credit rating downgrades.

As suggested by Fong, Hong and Kacperczyk and Dubik (2014), the presence of a large number of security analysts disciplines credit rating agencies. This is because they mitigate the asymmetric information problem faced by firms and, consequently, the optimism-bias in credit ratings. Firms covered by a large number of equity analysts are thus less likely to receive inflated ratings from credit rating agencies and, because of the greater monitoring exerted by equity analysts, more likely to receive downgrades. Following this argument, *IndCov* is likely to be correlated with the credit rating downgrade variable.

Besides the relevance, we want our instrument to be exogenous. We are aware of the fact that the exogeneity of the instrument is plausible only conditional on a range of control variables. Thus, as we did in the previous section, we include a number of variables that are likely to affect the CEO probability of turnover. Overall, we cannot completely exclude the possibility that unobserved variables bias the estimated effect of corporate credit rating downgrades on CEO turnover upwards or downwards, depending on the nature of the omitted variables. However, we believe that the industry-level instrumental variable and the inclusion of many key variables justify our identifying assumption.

In the first stage of the instrumental variable approach, we predict credit rating down-

grades using the industry analyst coverage in order to isolate credit rating downgrades that are caused by industry analyst coverage. In the second stage, we study the sensitivity of the CEO probability of turnover to predicted credit rating downgrades. More in detail, the first stage we estimate is:

$$Downgrade_{it} = \alpha_0 + bIndCov_{it} + \eta_1 X_{ct-1} + \eta_2 W_{it-1} + \delta_{SIC} + \delta_t + e_{it}, \tag{8}$$

where $IndCov_{it}$ is the industry analyst coverage, our instrument for credit rating downgrades. From this equation, we get the predicted values for credit rating downgrades. We use these predicted values in the second stage:

$$Prob(Turnover)_{cit} = \alpha_1 + \beta_{CR} * \widehat{Downgrades}_{it} + \gamma_1 X_{ct-1} + \gamma_2 W_{it-1} + \theta_{SIC} + \theta_t + \varepsilon_{cit}. \tag{9}$$

The estimated coefficient β_{CR} indicates how sensitive the CEO turnover probability is to credit rating downgrades that come from the industry analyst coverage, rather than firm- and CEO-specific characteristics. Note that the two-stage approach we use is quite widespread in the CEO literature. Jenter and Kanaan (2015) use industry performance as instrument for firm performance to show that bad industry and, to a lesser extent, bad market performance, increase the probability of forced CEO turnover. Bertrand and Mullainathan (2001) analyze the sensitivity of CEO pay to changes in firm performance due to luck, used as an instrument for firm performance. Similarly, Peters and Wagner (2014) use the industry volatility to predict changes in firm performance affecting CEO compensation.

Turning now to the specific characteristics of the model we use for the first and second stage, observe that, though $Downgrade_{it}$ is an indicator variable, we use a linear probability model to get the predicted values in the first stage and, consequently, the coefficient estimates in the second stage. We use the linear probability model as it yields consistent second-stage estimates (Angrist and Krueger, 2001) and simplify the calculation of standard errors (see, e.g., Bennedsen, Nielsen, Perez-Gonzales and Wolfenzon, 2007).

Results are presented in Table 4. Columns (1) and (2) estimates the probability of credit rating downgrades as triggered by industry analyst coverage, with year fixed effects (Column

1) and industry fixed effects (Column 2). Columns (3) and (4) show the second stage estimates. Column (3) considers year fixed effects. Column (4) adds industry fixed effects. All the specifications include firm- and CEO-specific controls. Standard errors are clustered at the firm level.

The first stage results illustrate that the instrument, *IndCov*, is correlated with the credit rating downgrade variable. In particular, considering the estimates in Column (1), we can observe that a one unit increase in industry analyst coverage generates an increase in the probability of credit rating downgrades equal to about 0.26 percentage points. To verify the relevance of our instrument, we perform an under-identification test (Anderson canonical correlations LM statistic). On this statistic, we get a p-value of *0.0024*, which allows to reject the null hypothesis that the model is under-identified. Further, we perform a weak identification test (Craig-Donald Wald F-statistic). Results from this test reject the null hypothesis that the model we estimate is weakly identified.

Second stage results (Columns (3) and (4)) show that the relation between credit rating downgrades and CEO turnover, once the downgrade variable has been instrumented and several firm- and CEO-specific variables included, still holds.[15] Finally, observe the magnitude of the coefficient on credit rating downgrades. Once instrumented, a credit rating downgrade increases the probability of forced CEO turnovers by 32 percentage points (when no industry fixed effects are included), which further highlights the firm response to credit rating announcements harmful to firm reputation.

5.4 The Role of Managerial Entrenchment

In the theoretical model, we show that the degree of managerial entrenchment works as a signalling device. Under asymmetric information about CEO characteristics, a good quality CEO is less likely to have a low outcome and is more willing to accept to be replaced upon a downgrade. Thus, a good quality CEO displays a higher probability of turnover upon a

[15] Note that also in the instrumental regression model we are including proxies for the accounting and stock market performance.

downgrade and a lower degree of entrenchment relative to a low quality CEO. In this section, we investigate the potential sample selection issue that arises from less entrenched CEOs, more willing to take on replacements risks and thus naturally exposed to a higher CEO replacement probability should credit rating downgrades occur.

To capture CEO entrenchment, we rely on a measure proposed by Bebchuk, Cohen and Ferrell (2008)[16]. They construct an entrenchment index (E-index) focusing on six governance provisions, which they argue to be the ones that matter the most when analyzing the corporate governance structure. Four of them - classified boards, limits to shareholder amendments of the bylaws, supermajority requirements for mergers and supermajority requirements for charter amendments - limit the extent to which a majority of shareholders can impose its will on management. Two other provisions are salient measures taken to oppose hostile offers: poison pills and golden parachute arrangements. The E-index is constructed with data taken from the *Institutional Shareholder Service* (*ISS,* formerly RiskMetrics) and is defined as the sum of the above six provisions in every firm and year. Almost 70% of the firms in our sample have two or three of the provisions listed in the E-index (on average). Less than 1% of the firms have five provisions. None of the firms has all six provisions. The average number of provisions is about three.

We perform the analysis using a two stage probit model with selection (*Heckman probit model*). The specification for the first stage model is the following:

$$\begin{aligned} Prob(Low\text{-}Entrenchment)_{cit} &= \alpha + \beta_1 Size_{it} + \beta_2 ROA_{it} + \beta_3 MTB_{it} + \beta_4 Tenure_{ct} \\ &\quad + \beta_5 Compensation_{ct} + \beta_6 Salary_{ct} + \\ &\quad + \beta_7 Female_{ct} + \theta_i + \theta_t + \varepsilon_{cit}. \end{aligned} \tag{10}$$

Low-Entrenchment is a dummy variable equal to one if the firm median number of antitakeover provisions is below the sample median. We assume that the probability of being unentrenched depends on firm size, leverage, profitability, growth opportunities and tangibility, as well as some CEO-specific characteristics like tenure, compensation, salary,

[16] We get similar results when we use the Gompers, Ishii and Metrick (2003) index.

and gender.[17] To satisfy the identification restriction for the first stage equation, we include the exclusion restriction variable *DualClass*, which captures whether the probability of being unentrenched depends on the dual class stock structure adopted by firms. Year and industry fixed effects are included. Standard errors are clustered at the firm level. The second stage is estimated as in model (14).

Our results for the Heckman model are provided in Table 5**.** Panel (A) shows results for the first stage estimation. Panel (B) reports results for the second stage. Our results from the first stage show that managers are less likely to be entrenched in large firms, with a dual class structure, and with high growth opportunities. In addition, looking at the CEO-specific characteristics, it appears that managers that receive a higher compensation are more likely to be entrenched and that tenure is an important determinant in establishing CEO degree of entrenchment.[18] The second stage estimation confirms our previously found results. Credit rating downgrades trigger a higher CEO turnover, even after accounting for the possible selection bias introduced by more skilled and less entrenched CEOs, more willing than others to face the turnover risk associated to their position.

To further test if the degree of entrenchment matters for credit rating downgrades, we divide our sample into two distinct subsamples to distinguish between firms where CEOs are strongly entrenched and firms where CEOs are weakly entrenched. Table 6 shows results for this analysis. Columns (1) and (2) show results for firms where CEOs are strongly entrenched (firm's median number of antitakeover provisions larger than sample median). Columns (3) and (4) show results for firms where CEOs are weakly entrenched (firm's median number of antitakeover provisions lower than sample median). All the specifications include firm- and CEO-specific controls, year and industry fixed effects.[19] Our results show that the effect of rating downgrades over forced CEO turnover is weakened for firms where CEOs are

[17] When estimating the first stage, we consider variables (firm size, profitability, market-to-book, ceo tenure, compensation, salary and gender) that can affect the probability of being untrenched, as evaluated at time (t). In the second stage we control for (one-period) lagged values of these variables.

[18] Let's note that to be valid, the instruments we are including in the first stage must be significant in the 1st step selection equation (but not significant in the 2nd step equation).

[19] In table 6, we are only reporting the coefficients for the main variable of interest, credit rating downgrades, with the inclusion of past S&P rating levels and stock market returns.

highly entrenched (and thus the relationship is reinforced for those CEOs that are weakly entrenched). Indeed, the coefficient for downgrades is not statistically significant in the first two columns, suggesting that the incentive power of downgrades is insufficient to trigger a turnover when CEOs are strongly protected by governance provisions. The result is not affected by the specification used and all the controls have the predicted sign.

Two remarks are in order here. First, testing for the effects of managerial entrenchment allows us to weaken the concern that credit rating downgrades only proxy for firm-specific performance. Following the standard literature on managerial entrenchment (Malatesta and Walkling (1988) and Berger, Ofek and Yermack (1997)), firms characterized by weak managerial entrenchment are overall more profitable than firms in which managers are highly tied to their position. As a consequence, if one wants to give credit to the argument that forced CEO turnover only follows bad performance, then weakly entrenched managers, due to the higher profitability of the firms they manage, should be less exposed to the risk of being replaced as triggered by credit rating downgrades. Instead, in line with the predictions of our theoretical model, we find that the relation between rating changes and management turnover is stronger for firms with less entrenched CEOs. This result provides additional support for the idea that CEO turnover goes beyond performance. Indeed, it appears that rating downgrades have an impact on the CEO replacement decision even for firms that are expected to be of greater quality due to a less entrenched CEO. This confirms that credit rating downgrades do not uniquely capture firm performance.

Second, and lastly, we recognize that testing the relation between credit rating downgrades and management turnover for firms characterized by low managerial entrenchment may hide a potential selection bias, i.e., those firms may display larger CEO turnover irrespective of the credit rating action precisely because their CEOs are unentrenched. However, this implies that we should be able to observe a forced turnover in the sample of unentrenched managers both following a downgrade and an upgrade rating change. Estimating a linear probability model (instead of a logit model that drops the upgrade rating variable) allows

us to see that, in the unentrenched managers' sample, forced CEO turnover is less likely following a rating upgrade, thus contradicting the expectation of a higher turnover rate for unentrenched managers unconnected to the rating outcome.

6 Concluding Remarks

We study the relation between CEO turnover and credit rating changes beyond firm performance. Using a simple adverse selection model that explicitly incorporates rating change related turnover, our model predicts that a negative credit rating change triggers turnover, more so the lower the managerial entrenchment. Our empirical results confirm these predictions. We show that downgrades explain forced turnover risk, internal and external, even after incorporating proxies for stock market and accounting performance. Moreover, we find that this effect is stronger for firms with weakly entrenched CEOs.

Our analysis has left some issues open. In particular, in our theoretical model the firing risk is only but one aspect of the CEO contract. Another aspect is the CEO compensation. Clearly, in the model, a higher managerial turnover is accompanied by higher levels of pay to compensate managers for the greater risk in their compensation. This is in line with Hermalin (2005), who finds that the lower job stability induced by an increased monitoring intensity of CEOs goes together with an increased level of CEO pay. This view is broadly consistent with some empirical evidence, but there is no direct evidence that changes in governance have been the determinant of the rapid rise in CEO pay of the last 30 years (Frydman and Jenter, 2010). Although this aspect has not been analyzed in our work, the theoretical analysis may be further developed to deliver predictions on the role of monitoring on CEO compensation. We leave the development of this line of analysis and the empirical verification of the predictions stemming from it to future research.

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A Appendix

Proof of Proposition 1. The proof proceeds as follows. From Programme $\mathcal{P}^{RA}$, we first prove that both constraints are binding. Then, we show that it is optimal to set w_K and w_F, K_U and K_D, far apart. Then, without loss of generality, we set w_F.to its minimum possible level, which, by limited liability is zero, and derive the remaining variables, K_U, K_D and w_K.

1. The participation and the no mimicking constraints are both binding. If not, it would be possible to raise both w_K and w_F and increase the objective function. The variation in w_K and w_F must be such that $dPC_G = dNM$

$$\begin{aligned} dPC_G &= -\left(r_H K_U + r_L K_D\right)\left(1+p_G\right)dw_K - \left[r_H\left(1-K_U\right) + r_L\left(1-K_D\right)\right]dw_F \\ dNM &= -\left(q_H K_U + q_L K_D\right)\left(1+p_B\right)dw_K - \left[q_H\left(1-K_U\right)dw_F + q_L\left(1-K_D\right)\right]dw_F \end{aligned}$$

   i.e.,

$$dw_K = \frac{\left(r_H - q_H\right)\left(1-K_U\right) + \left(r_L - q_L\right)\left(1-K_D\right)}{\left(q_H K_U + q_L K_D\right)\left(1+p_B\right) - \left(r_H K_U + r_L K_D\right)\left(1+p_G\right)} dw_F.$$

2. $w_K > w_F \geq 0$. Suppose not, i.e., suppose $w_K = w_F$, and suppose in programme $\mathcal{P}^{RA}$ to raise w_K and lower w_F in such a way to keep the CEO's profit function and the investors participation constraint unchanged:

$$dw_K = -\frac{r_H\left(1-K_U\right) + r_L\left(1-K_D\right)}{r_H K_U + r_L K_D + p_G\left(r_H K_U + r_L K_D\right)} dw_F. \tag{11}$$

$$dw_F = -\frac{\left(r_H K_U + r_L K_D\right)\left(1+p_G\right)}{r_H\left(1-K_U\right) + r_L\left(1-K_D\right)} dw_K. \tag{12}$$

   The effect of such variations in the no-mimicking condition is $dNM = -\left[q_H\left(1-K_U\right) + q_L\left(1-K_D\right)\right]dw_F - \left[p_B\left(q_H K_U + q_L K_D\right) + q_H K_U + q_L K_D\right]dw_K$, which, using (11), becomes

$$dNM = \frac{\left(r_H K_U + r_L K_D\right)\left[1 + p_G\left(1 - q_H K_U - q_L K_D\right)\right] - \left(q_H K_U + q_L K_D\right)\left[1 + p_B\left(1 - r_H K_U - r_L K_D\right)\right]}{\left[r_H\left(1-K_U\right) + r_L\left(1-K_D\right)\right]} dw_K.$$

   This is non-negative so long as $K_U \geq K_D$. Suppose for the time being this is the case. This then implies that the above variations in w_K and w_F slacken the no-mimicking condition. Thus we can keep increasing w_K and decreasing w_F all the way until w_F equals zero.

3. $1 \geq K_U > K_D \geq 0$.
   Suppose $K_U = K_D \in (0,1)$ and suppose in programme $\mathcal{P}^{RA}$ to raise K_U and lower K_D in such a way to keep the CEO's profit function and the investors participation constraint unchanged:

$$dK_D = -\frac{r_H}{r_L} dK_U \tag{13}$$

   The effect of such variations in the no-mimicking condition is to slacken it. In particular, $dNM = -q_H dK_U - q_L dK_D$, which, using (13), becomes $dNM = \left(r_H q_L - r_L q_H\right)dK_U$. Thus, $K_U > K_D$.
   Since $K_D < K_U$ and $0 \leq K_D, K_U \leq 1$, for feasibility either one or both variables must be at the corner. Two cases can then arise: a) $K_U = 1, K_D \geq 0$; b) $K_U \leq 1, K_D = 0$. In Proposition 1, we restrict attention to the first equilibrium, but in the remaining part of the proof we derive derive the properties also of second equilibrium.

4. $K_U = 1, K_D \geq 0$
   Let us define Θ as the (non-empty) subset of parameters $(y, I, c, p_G, p_B, r_H, q_H)$ such that the following

inequalities are satisfied:[20]

$$\begin{aligned}
\gamma+\sqrt{\gamma^2-4\beta p_G^2 r_L y V^B} &> 0,\\
2p_G\left(1+p_G\right)\left(q_L r_H-q_H r_L\right)V^B-q_H\left(\gamma+\sqrt{\gamma^2-4\beta p_G^2 r_L y V^B}\right) &\geq 0,\\
2p_G\left(1+p_G\right)\left(q_L r_H-q_H r_L\right)V^B-\left(\gamma+\sqrt{\gamma^2-4\beta p_G^2 r_L y V^B}\right) &< 0.
\end{aligned}$$

where $\beta=-p_G\left(1+p_G\right)p_B\left(1+p_B\right)\left(q_L r_H-q_H r_L\right)$ and $\gamma=p_B\left(1+p_B\right)\left(q_L V^G-r_L p_G^2 y-p_G q_L c\right)-p_G\left(1+p_G\right)r_L V^B$.
Using $w_F=0$ and $K_U=1$ in Programme $\mathcal{P}^{RA}$ and solving the constraints for the remaining variables, we get

$$\begin{aligned}
w_K^* &= \frac{\gamma+\sqrt{\gamma^2-4p_G^2 r_L y V^B\beta}}{2p_B\left(1+p_B\right)p_G\left(1+p_G\right)\left(q_L r_H-q_H r_L\right)},\\
K_D^* &= \frac{2p_G\left(1+p_G\right)\left(q_L r_H-q_H r_L\right)V^B}{q_L\left(\gamma+\sqrt{\gamma^2-4\beta p_G^2 r_L y V^B}\right)}-\frac{q_H}{q_L}.
\end{aligned}$$

Using K_D in the objective function, the expected profits are:

$$EP_{K_U=1}=\frac{\gamma+\sqrt{\gamma^2-4\beta p_G^2 r_L y V^B}}{2q_L p_B\left(1+p_B\right)}+\frac{r_L p_G\left(1+p_G\right)}{q_L p_B\left(1+p_B\right)}V^B. \tag{14}$$

5. $K_D=0, K_U\leq 1$
Let us define Γ as the (non-empty) subset of parameters $(y, I, c, p_G, p_B, r_H, q_H)$ such that the following inequalities are satisfied:[21]

$$p_G\left(1+p_G r_H\right)y-I-p_G c\geq\frac{r_H p_G\left(1+p_G\right)}{q_H p_B\left(1+p_B\right)}V^B>p_G y-I-p_G c$$

Using $w_F=K_D=0$ in Programme $\mathcal{P}^{RA}$ and solving the constraints, we get

$$\begin{aligned}
K_U|_{K_D=0} &= \frac{p_G r_H\left(1+p_G\right)V^B-q_H p_B\left(1+p_B\right)\left(p_G y-I-p_G c\right)}{p_B p_G^2 q_H r_H\left(1+p_B\right)y},\\
w_K|_{K_D=0} &= \frac{p_G^2 r_H y}{p_G r_H\left(1+p_G\right)V^B-q_H p_B\left(1+p_B\right)\left(p_G y-I-p_G c\right)}V^B.
\end{aligned}$$

Substituting out in the objective function, the expected profits are

$$EP_{K_D=0}=\frac{r_H p_G\left(1+p_G\right)}{q_H p_B\left(1+p_B\right)}V^B. \tag{15}$$

■

B Welfare properties of the separating contract

In the present section we analyze the welfare properties of the separating equilibrium, showing that the separating allocation derived in Proposition 1 is an equilibrium, but that it is not unique.

[20] The first inequality guarantees that $w_K>0$, the second that $K_D\geq 0$, while the third that $K_D<1$.
[21] The first inequality guarantees that $K_U\leq 1$, while the second that $w_K, K_U>0$.

To see that the separating allocation is an equilibrium, consider that the good type offers the two contracts, $C = \{C_1, C_2\}$ and $\tilde{C}$ described above Once the investors agree to finance the project, they will break even whatever the choice of each type of CEO, as the ex-post individual rationality constraints are satisfied (by construction of the contracts). Indeed, the good CEO will choose C, as she gets a return higher than what she obtains by choosing the contract designed for the bad type (and this contract satisfies the individual rationality). The bad CEO will choose $\tilde{C}$, as, by the no-mimicking constraint, she gets a return no less than the one she would obtain by choosing the contract designed for the good type.

The separating contract derived above might not be unique. In particular, it might be optimal for the good type to give up the separating contract and choose the pooling contract, instead. This happens when the cost of resorting to a rating agency plus the lost profits due to incorrectly classifying the good borrower as bad exceeds the cross-subsidisation involved in the pooling contract.

By comparing the return obtained under the separating contract, V^S (Eq. 14) with the return the good type CEO gets under a pooling contract for two periods, $V^{G\text{-}P}$(Eq. 1), we have that whether the separating contract dominates the pooling contract depends on the fraction α of good CEOs on the market. If this is sufficiently small, the cross-subsidisation required to the good types may be higher than the cost of separating. In particular, the separating allocation is the unique equilibrium if the investors' belief that the CEO is good is lower than some threshold α^*, that is, if and only if

$$\alpha \leq \alpha^* \equiv \frac{\left[\frac{1}{2}p_G(1+p_G)p_B(1+p_B)\rho D + p_G(1+p_G)p_B(1+p_B)\left(\frac{1}{2}\gamma\rho + q_L\beta y\right) - \beta p_G(1+p_G)\left(q_L I + r_L V^B\right)\right]p_B(1+p_B)}{(1+p_B+p_G)\left[\frac{1}{2}p_G(1+p_G)p_B(1+p_B)\rho D + p_G(1+p_G)p_B(1+p_B)\left(\frac{1}{2}\gamma\rho + q_L\beta y\right) - \beta r_L p_G(1+p_G)V^B\right](p_B - p_G)}$$

where $D = \sqrt{\gamma^2 - 4p_G^2 r_L y V^B \beta}$.[22]

[22] A similar threshold value of α can be obtained if the other equilibrium prevails ($K_U \leq 1, K_D = 0$). In particular, by comparing the expected profit under a separating equilibrium (15) with those obtained under a pooling equilibrium (1), it turns out that the minimum share of good type CEOs' such that a separating equilibrium exists is given by $\alpha \leq \alpha^*_{K_D=0} \equiv \frac{p_B(1+p_B)(r_H - q_H)V^B}{(1+p_B+p_G)(p_G-p_B)[(r_H-q_H)V^B - q_H I]}$.

Definitions of the variables

This section provides the variable definitions used in the analysis. Compustat item codes are provided in parentheses.

Forced Turnover: Dummy variable taking value equal to one if the managerial turnover happens because of: pressure from the board of directors, forced resignation, scandal, reorganization, demotion, policy or personality disagreement and poor performance.

Internal Turnover: Dummy variable taking value equal to one if the new appointed CEO is chosen from within the company.

External Turnover: Dummy variable taking value equal to one if the new appointed CEO is chosen outside the company.

S&P: Number from 1 to 23. The numerical conversion adopted for S&P ratings is: AAA=23, AA+=22, AA=21, AA-=20, A+=19, A=18, A-=17, BBB+=16, BBB=15, BBB-=14, BB+=13, BB=12, BB-=11, B+=10, B=9, B-=8, CCC+=7, CCC=6, CCC-=5, CC=4, C=3, D=2, SD=1. Ratings from 1 to 14 (included) are defined "speculative ratings". Ratings from 15 (included) to 23 are defined "investment ratings".

Size: Natural logarithm of the total book value of assets (atq).

Tangibility: Property plant and equipment (ppentq) to the total book value of assets (atq).

Market-to-Book: Market value of assets divided by the total book value of assets (atq). The market value of assets is defined as the market value of equity minus the book value of equity plus the total book value of assets. The market value of equity is constructed as the close price (prccq) multiplied by the number of common shares outstanding (cshoq). The book value of equity is defined as the total book value of assets (atq) minus total liabilities (ltq) plus deferred taxes and investment tax credit (txditcq).

Profitability: Return on Assets (ROA), constructed as operating income before depreciation (oibdpy) to the total book value of assets (atq).

Long-Term Leverage: Long-term (total) debt (dlttq) to the total book value of assets (atq).

Recession: Dummy variable taking value equal to one from December 2007 until June 2009 (NBER date).

CEO tenure: Number of years from when the manager was appointed CEO.

CEO age: CEO age as available in the Execucomp database.

CEO compensation: Natural logarithm of the CEO total compensation.

CEO salary: Natural logarithm of the CEO total salary.

IndCov: Number of equity analysts providing equity analyst recommendations to all firms belonging to a given 4-digit SIC industry sector.

Strong (Weak) Entrenchment: Dummy variable taking value 1 if the firm median number of anti-takeover provisions is higher (lower) than the sample median.