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**Matching Firms, Managers, and Incentives**

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## **Abstract**

We exploit a unique combination of administrative sources and survey data to study the match between firms and managers. The data includes manager characteristics, such as risk aversion and talent; firm characteristics, such as ownership; detailed measures of managerial practices relative to incentives, dismissals and promotions; and measurable outcomes, for the firm and for the manager. A parsimonious model of matching and incentive provision generates an array of implications that can be tested with our data. Our contribution is twofold. We disentangle the role of risk-aversion and talent in determining how firms select and motivate managers. In particular, risk-averse managers are matched with firms that offer low-powered contracts. We also show that empirical findings linking governance, incentives, and performance that are typically observed in isolation, can instead be interpreted within a simple unified matching framework.

JEL Classifications: J24,L2

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# 1 Introduction

Personnel economics is concerned with two problems that firms face: how to find the right employees and how to motivate them. Moreover, matching and incentives are tightly related: different people pursue different goals. A firm should select a hiring policy in view of the incentive structure it has in place; and it should select an incentive structure in view of the people it wants to hire.

In a recent survey, however, Oyer and Schaefer (2010) conclude that while several studies in personnel economics have made progress on the understanding of incentive provision, much less attention has been devoted to matching. In particular, relatively little is known about the ways firms and workers generate economic surplus by matching appropriately, and on the mechanism through which firms strategically design job packages to source appropriate workers. A key obstacle to advancement in this area has been the dearth of integrated evidence, due to the fact that most datasets only contain information on one side of the match.

In this paper we shed light on the matching mechanism using a unique dataset which provides detailed information on employees, firms and the contracts that tie them. Our data, which covers a random sample of Italian managers, draws from a variety of sources: our own manager survey that contains information on contract, manager, and firm characteristics, managers' social security data on earnings throughout their career, and firm balance sheet data. The data contains direct measures of manager characteristics, like risk aversion and talent; firm characteristics, such as ownership and governance structure; contract characteristics, such as sensitivity to performance both through variable pay and implicit career incentives; and measurable outcomes, such as manager effort and firm performance. To the best of our knowledge, this is the first time that – for any category of workers – firm-level information is combined with such a rich characterization of managerial preferences and compensation data drawn from individual social security records.

Our empirical analysis is guided by a simple model where firms and managers match through the choice of incentive policies, and entry decisions, manager-firm matches, compensation schemes, effort exertion, and firm performance are endogenously determined. The model generates an array of predictions, which can be tested on our data. Our contribution is twofold. First, we show empirically for the first time that managers' risk aversion and talent are correlated with the incentives they are offered and, through these, with the characteristics of the firms that hire them. Second, we observe in our data a number of relations that have been reported, in isolation, in other works. Hence, our contribution is to show that, for the

set of workers and firms under consideration, these regularities can be understood within a parsimonious theoretical framework.

The model is based on the following primitives: a continuum of potential managers, who have heterogeneous talent and risk aversion; a continuum of potential firms, which differ by the weight their owners put on the private benefit of control vis-a-vis profits and by their idiosyncratic cost or revenue component; and a set of possible contracts that managers and firms can sign, defined by a fixed compensation and the slope of the performance-based component. The power of the contract should be viewed broadly, both as explicit incentives (bonus) and implicit incentives (promotions and dismissals).

The framework illustrates how managers and firms match through incentives. Other things equal, managers who are risk averse and have little talent prefer low-powered incentives. Other things equal, firm owners who put a higher weight on the private benefit of control rather than profits also prefer low-powered incentives, because high-powered incentives give managers a large stake in the firm's profit, and therefore increase the probability that managers will oppose owners who want to extract private benefits at the expense of profits. This means that certain owners may be willing to trade off higher profits arising from good management to contain the risk of losing control.<sup>1</sup>

An equilibrium is such that: (i) firms are active if and only if their expected payoff is non-negative; (ii) managers are employed if and only if they receive at least their reservation utility; (iii) matches between firms, managers, and contracts are stable, even taking into consideration inactive firms and managers; (iv) contracts between matched firms and managers are optimal; (v) managers exert the optimal amount of effort given their contract. It is important to stress that our model does not assume an exogenous distribution of active firms or managers. In equilibrium, only firms that generate a non-negative payoff to their owners will be active. Similarly, only managers that can create a positive surplus for some firm will be employed as managers. Thus one can think of the underlying population as containing all potential firms and all potential managers. Rather than trying ex-post to correct for a "survivor bias," our model offers a set of testable predictions on observed matches that build on equilibrium entry conditions.

We show that there exists a unique equilibrium. The equilibrium is characterized by

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<sup>1</sup>The owner/manager of an Italian firm puts it in colorful terms: "I'd rather be worth 100 million euros, have fun now, and enjoy people's respect when I am the senile chairman of my firm than be worth a billion and get paid fat dividends by a little \*\*\*\*\* with a Harvard MBA, who runs my firm and lectures me at board meetings." This comment was related to us in an email by a top-50 European CEO with a Harvard MBA. Our translation.

assortative matching and yields four testable implications: (1) In a stable assignment of managers to firms, the slope of the contract a firm offers is positively correlated to the talent of a manager and negatively correlated to his risk aversion; (2) Managerial outcomes are linked to incentives: in equilibrium managers who face steep contracts exert a higher level of effort, receive a higher expected compensation (both total and variable), and obtain a higher overall expected utility; (3) Firms whose owners put more weight on the private benefit of control are less likely to offer more performance-sensitive contracts; (4) Firms that offer more high-powered incentives have higher profits. While each individual prediction is consistent with other models, we are not aware of a framework that can account for all four of them.

The aim of our empirical analysis is to present evidence on the rich set of equilibrium correlations suggested by the theory. We base our results on a unique dataset which we created with the purpose of studying both matching and incentives. As discussed above, its defining feature is that it combines detailed information on all three components of the match, namely manager and firm characteristics, and the contracts that tie them. The survey was administered to 603 individuals sampled from the universe of Italian service sector executives. Our sample managers rank high in the hierarchy of the firms they work for: 60% report directly to the CEO and a further 28% to the board. We also observe the managers' compensation history since their first appearance on the labour market from social security records, and we have standard accounting data on the firms.

We report four key findings in line with the four theoretical predictions above.

First, we find that policies that create a tighter link between performance and reward attract managers who are more talented and more risk-tolerant. Using an index that summarizes the “contract” between firms and managers - i.e. whether firms reward, promote and dismiss managers based on their performance - we show that firms offering a one standard deviation steeper contract are 16 percentage points more likely to attract high-talent managers compared to the sample mean, and the ones they attract have a degree of risk tolerance that is 10 percent above the mean. The latter result speaks to the debate on the trade-off between risk and incentives. In line with classic agency theory but contrary to most available evidence (Prendergast 2002), measures of risk tolerance and incentive power are positively related in our data. Our findings can, however, be reconciled with the existing evidence by noting that we measure the agent's risk preferences *directly* rather than relying on proxies for risk aversion such as the agent's wealth or using variation in the riskiness of the environment instead of the agent's preferences. Our estimates therefore do not suffer from the bias correlated with unobservables or endogenous matching discussed in Prendergast (2002) and

Akerberg and Botticini (2002), respectively.<sup>23</sup>

Second, we find that managers who are offered steeper contracts exert more effort, receive higher fixed and variable pay, receive more non-pecuniary benefits, and (not obviously) are more satisfied with their job. For instance, raising our incentive index by one standard deviation is associated with an increase in the probability that the manager works more than 60 hours a week by 16% of the sample mean, an increase in variable pay by a third of the sample mean, and higher chances that he is very satisfied with his job as large as 12% of the sample mean. Reassuringly, the estimated correlation between incentives and pay is robust to using administrative (and thus objective) social security earnings data instead of our survey measures: hence, the correlation is not due to reporting errors or to survey reporting biases. Even more interestingly, when we use the time variation in social security earnings to compute the volatility of managers earnings through time, we find that steeper incentives are correlated with observed higher earnings variability, consistent with the fact that steeper contracts (as measured in the survey) implies that the managers bear more risk (as measured in observed time series of earnings).

Third, we use information on the firms' ownership structure to test whether the incentive packages offered by firms depend on the weight their owners put on the benefit of private control. More specifically, we exploit the variation between family-owned and widely-held firms. This choice is rooted in the family firms literature (discussed below), which documents how family-owners often perceive the firm as an opportunity to address family issues and frictions. In this context, owners attribute a value to the firm as an "amenities provider," even though the provision of such amenities might not be profit maximizing. In this context, direct control is extremely valuable as it minimizes the probability that other external owners might oppose the extraction of such private benefits. On the other extreme, diffused ownership makes it much harder for a single owner to extract private benefits from the firm. In line with this view,

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<sup>2</sup> Prendergast (2002) argues that delegation is more likely when the environment is more uncertain, and that because performance pay is positively correlated with delegation, this generates a spurious positive correlation between environment uncertainty and incentive power when the degree of delegation is unobservable. Akerberg and Botticini (2002) argue that a spurious positive correlation can emerge because risk-loving agents are endogenously matched to risky environments and at the same time prefer high-powered incentives. Using agents' wealth as a proxy for risk aversion does not solve the problem because the riskiness of the environment is correlated with the error through the proxy error.

<sup>3</sup> Our findings are complementary to existing evidence on executive pay that shows a negative correlation between stock volatility and pay performance sensitivity (Aggarwal and Samwick 1999). That literature focuses on endogenous variations in risk due to the characteristics of the environment, whereas we measure the characteristics of the managers that determine their preferences for performance pay.

we find that, compared to widely-held firms, family-owned firms offer flatter compensation schemes. Namely, family firms are less likely to offer bonuses as a function of individual or team performance, to promote and fire their managers based on their performance, and to use formal appraisals throughout the managers' career. Differences are sizeable: unconditionally, the difference between the percentage of widely-held and family-owned firms that offer performance bonuses is 13 percentage points, and the corresponding difference among firms that offer fast track promotions for exceptional performers is 9 percentage points. Controlling for sector and firm size, we show that the incentive index is significantly weaker for family firms – up to 30% of one standard deviation. These findings are consistent with an established view that, compared to anonymous and institutional shareholders, large individual owners use corporate resources to generate ego rents, on-the-job amenities, or asset diversion (Demsetz and Lehn 1985). Such activities are mostly non-contractible and they require effective direct control. They become more difficult when the firm is run by talented outsiders whose pay depends on firm performance – hence the comparative disadvantage of family firms in the provision of managerial incentives.

Fourth, we estimate the correlation between incentives and firm performance measures from balance sheet data and find that firms that offer high-powered incentives have higher productivity, profits, and returns on capital. This is consistent with a Demsetzian view that, in equilibrium, active but under-performing firms must offer some other form of reward to their owners.

Although some of these findings have been observed in isolation by other authors (more detail is provided in the literature section), the value added of this paper lies in showing that these relations all hold for the same set of firms and managers and can all be accounted for by our parsimonious matching model. Furthermore, while our data does not allow us to identify causal relations directly, the consistency of all the correlations we estimate with the predictions of the model strongly supports its validity. Being able to observe all sides of the match allows us to rule out alternative theories that might be consistent with a subset of the correlations we report, but not the whole set.<sup>4</sup>

The rest of the paper proceeds as follows. Section 2 discusses the theoretical model and

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<sup>4</sup>One such prominent alternative is that family firms have a more effective monitoring technology and hence they do not need to offer high-powered incentives. If that hypothesis were driving the results, however, we would expect managers who are better monitored to work harder and to have a higher fixed wage to compensate for the higher effort. Our estimates indicate that the opposite is true: managers who face weaker incentives work less hard and have a lower base wage. Section 5 discusses this and other alternative explanations in more detail.

illustrates its main testable predictions. Section 3 presents our data and shows how we map the model's variables into their empirical counterparts. Section 4 shows the evidence. Section 5 discusses the robustness of our results. Section 6 summarizes and concludes.

## 1.1 Literature Review

The main contribution of our paper is to integrate phenomena in personnel economics that are usually analyzed individually.

On the theory side, our model belongs to the manager-firm assignment literature initiated by Rosen (1982). Two recent papers (Gabaix and Landier 2008 and Terviö 2008) provide tractable CEO-firm matching models, where CEOs differ on talent and firms differ on size and productivity. Our model is particularly close to an independent paper by Edmans and Gabaix (2011), which endogenizes the contract between the CEO and the firm and obtains a concise close-form characterization of equilibrium incentives and matches. Like us, they endogenize both worker-firm matching and incentive provision. The main difference is that the main source of heterogeneity on the firm side is size in their model and governance in ours. Also, their managers differ only on talent (risk comes into play indirectly as talented managers are wealthier), while our managers differ on both talent and innate risk attitude.<sup>5</sup>

The argument that talented workers are matched to firms that offer high-powered incentives was made by Lazear (1986) and further developed by Balmaceda (2009). While in those models firms are ex ante identical, our firms differ because of ownership. Moreover, our managers differ on both talent and risk attitude.

On the empirical side, the four findings discussed above relate to four lively strands of literature that we now briefly discuss. The first set of results – equilibrium matching – is close to the large literature on firm-employee matching (see Lazear and Oyer 2007 for a review). The distinctive feature of our work is that we highlight one possible determinant of the match value, namely the firms' and the managers' preferences over high-powered incentives.<sup>6</sup>

An important determinant of matching patterns, explored by Terviö (2008) and Gabaix and Landier (2008), is firm heterogeneity in terms of size. While the main focus of this paper is governance, our empirical analysis always controls for size. Our analysis confirms

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<sup>5</sup>While Edmans and Gabaix (2011) and our paper utilize related models, the set of empirical questions that they ask is different. They calibrate their model with US data and show that the potential loss from talent allocation is much larger than the potential loss from inefficient contracting.

<sup>6</sup>Our rich data allows us to overcome the identification issue pinpointed by Eeckhout and Kircher (2000). As they show, wage data alone is not sufficient to identify matching patterns. However, we have direct information on worker and firm characteristics.



the presence of the strong complementarity between size, talent, and pay predicted by the assignment models above. In our sample, more talented managers are matched with larger firms, and the level of managerial pay increases with firm size. Friebel and Giannetti (2009) study endogenous matching between firms and workers. In their model, large firms have better access than small firms to financing, but they also investigate new ideas more thoroughly and are more likely to reject them. Workers differ in their creativity, namely in how likely they are to have promising ideas. The authors characterize the matching equilibrium and analyze the effects of relaxing individual borrowing constraints. The key predictions of the model are consistent with evidence available from the US Survey of Consumer Finances. While we consider a different set of employees – managers rather than creative workers – and we utilize a different empirical approach – a purpose-designed employee-employer survey – our paper shares Friebel and Giannetti’s goal of identifying the role of talent and risk aversion in the allocation of workers to firms.<sup>7</sup>

The second set of results relates to the vast literature (summarized in Lazear and Oyer 2007) on how incentives affect worker behavior. In line with most of that body of work, our managers appear to work harder when they face steeper contracts. The results also relate to the literature that seeks to explain the correlation between pay for performance, pay levels and inequality both for CEOs (Hall and Liebman, 1998) and workers in general (Lemieux et al 2009). We contribute to the debate by measuring contract steepness directly, as our survey records whether both pay and career progressions are related to performance. In contrast, the existing literature relies on outcome measures either by regressing total pay on firm performance or by measuring whether workers have received bonuses during their employment with the firm.

The third set of results – how ownership affects managerial practices – relates to a number of works at the intersection of personnel economics and corporate governance (Burkart, Panunzi, and Shleifer 2003, Bertrand and Schoar 2006, Bloom and Van Reenen 2007, Leslie and Oyer 2008), which study firm ownership as the key firm characteristic that drives the adoption of different managerial practices. The distinction between concentrated and diffuse ownership is a particularly salient one in that literature.<sup>8</sup>

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<sup>7</sup> Other examples of recent worker-firm endogenous matching models include Garicano and Hubbard (2007) for law firms and Besley and Ghatak (2005) and Francois (2007) for the non-profit sector.

See also Rose and Sheppard’s (1997) analysis of the link between firm diversification and CEO compensation. The authors provide evidence that managers of diversified companies appear to be paid more. By comparing the compensation of newly appointed and experienced CEOs, the paper shows that the premium is due to higher ability rather than entrenchment.

<sup>8</sup> For evidence on the relevance of family ownership see Claessens, Djankov, and Lang, 2000, Faccio and

Our findings can be seen as a validation of the “cultural” view of family firms (Bertrand and Schoar 2006). The objective function of family owners contains a non-monetary component. We interpret this as family firms valuing direct control per se, so that retaining direct control gives rise to private benefits that the owner (the family) can enjoy in addition to the utility from monetary profits. Private benefits can derive from the status associated with leading a business, from the “amenity potential” of influencing the firm’s choices (Demsetz and Lehn 1985), from the use of firm resources for personal purposes, or from the opportunity to use the firm to address family issues, for example finding a prestigious job for a low-ability offspring. Valuing direct control is not inconsistent with family ownership per se having a positive effect on performance because, for instance, trust among family members can substitute for poor governance as suggested by Burkart, Panunzi, and Shleifer (2003). Our model indeed allows for family firms to have a comparative advantage on other dimensions.

Finally, the results on the link with firm performance relate to the literature on human resources management and, more specifically, managerial practices (Black and Lynch 2001, Bloom and Van Reenen 2007, Bonin et al 2007, and Ichniowski, Shaw, and Prennushi 1997). In particular, we contribute to the literature on the effect of family ownership on performance through the choice of CEO and management (Bertrand and Schoar 2006, Pérez-González 2006, Bennedsen, Nielsen, Perez-Gonzalez, and Wolfenzon 2007, and Lippi and Schivardi 2010). Like these papers, we find that family firms may twist the choice of the manager towards less talented ones and thus provide a rationale for why they might perform worse even when not intrinsically less efficient – as the family firm owner’s quote reported earlier seems to suggest. However, while in these papers what affects firm performance is the refusal to choose from a wider set of managers and instead rely on the restricted pool of family (or social network) members, in our case performance may be affected because less able and risk-tolerant managers self-select into family businesses at any time, not only at succession. This may be the case even among family businesses that choose to be run by professional managers.

Our findings that family firms offer contracts that attract risk-averse and less talented managers and pay them less, are consistent with Sraer and Thesmar (2007) who show that, compared to widely-held firms, French family firms employ less skilled workers, offer long-run labor contracts that provide implicit insurance, and pay lower wages. Our paper is complementary with work by Cai, Li, Park, and Zhou (2008). While in our study we compare managers in non-family firms with non-family managers in family firms, they focus their

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Lang (2002), and La Porta, Lopez-de-Silanes, and Shleifer (1999).

attention on the difference between family managers and outside managers employed by family firms. Evidence from their detailed survey of Chinese family firms reveals that outside managers are offered contracts that are more performance-sensitive. Our and their papers taken together indicate that governance issues play a key role in the process of selecting and motivating managerial talent.

## 2 Theory

This short theoretical section adapts a workhorse agency model – linear contracts, quadratic payoffs, and normally distributed additive noise – to the problem at hand. Our main contribution lies in allowing heterogeneity on both sides of the managerial market and in letting the terms of the contract be decided by the two parties. While some of our results have already been discussed individually elsewhere and none of them will surprise people familiar with agency problems, it is useful to provide a unified conceptual framework to interpret the rich set of patterns that emerge from our data.

This section presents an informal analysis of the model. A formal characterization and all the proofs are available in the attached Appendix.

As the model is quite rich and non-standard – two dimensions of heterogeneity on the workers’ side, two dimensions of heterogeneity on the firms’ side, endogenous contracts – it is developed in a simple function environment that allows us to obtain close-form solutions.

### 2.1 Model

To produce, a firm requires one manager. Suppose firm  $i$  is matched with manager  $j$ . The manager generates a product

$$y_j = \sqrt{\theta_j}(x_j + \varepsilon_j),$$

where  $x_j \geq 0$  is the effort level chosen by the manager,  $\theta_j$  is the manager’s talent, and  $\varepsilon_j$  is normally distributed with mean zero and variance  $\sigma^2$  and it’s uncorrelated across firms (or managers). The parameter  $\theta_j$  will be discussed shortly.

The wage that firm  $i$  pays to manager  $j$  is a linear function of the productivity signal

$$w_j^i = a^i + b^i y_j$$

The parameter  $b^i$  represents the link between pay and performance. The compensation scheme should be interpreted broadly. Besides explicit contingent payments, such as bonuses and stock options, the manager can also be offered implicit incentives (career concerns): if

he performs well, he will be promoted. In our model, both personnel policies will result in a higher  $b^i$ .

The assumption that explicit contracts are restricted to be linear is standard in personnel economics applications. For implicit contracts, Lazear and Rosen (1981) proved an equivalence result between rank tournaments and piece-rate pay. This implies that, at least in their stylized baseline environment, the kind of implicit incentives that comes from promotions would give rise to a linear reduced-form representation like the one we use.<sup>9</sup>

The manager has a CARA utility function

$$U_j = -\exp \gamma_j \left( w_j^i - \frac{1}{2} x^2 \right),$$

where  $\gamma_j$  denotes  $j$ 's risk aversion coefficient. There is a mass of potential managers whose human capital  $\theta_j$  and risk aversion coefficient  $\gamma_j$  are uniformly and independently distributed on a rectangle  $[0, \bar{\gamma}] \times [0, \bar{\theta}]$ . The total mass is  $\bar{\gamma}\bar{\theta}$ .<sup>10</sup> To avoid difficult signaling and screening issues, we assume that the characteristics of individual managers  $(\theta, \gamma)$  are observable.<sup>11</sup>

We now turn to firms. The owners of firm  $i$  pursue the following objective:

$$V^i = \Pi^i + (1 - \phi_g) \Gamma^i,$$

where  $\Pi^i$  denotes the standard corporate profit, while  $\Gamma^i$  represents some other form of benefit that the owners may receive from the company. This benefit has to do with direct control and can be material (use of company resources for personal entertainment) or of a less tangible sort (the status that derives from managing a company, the utility of keeping the firm “in the family,” or the guarantee of prestigious jobs for friends or relatives). The expression  $1 - \phi_g$  represents the weight that the owners put on the benefit of direct control and it depends on  $g$ , the ownership form. For the sake of simplicity, in what follows we allow for two types of ownership, denoted by  $F$  and  $N$ , although the model can be extended to allow for a larger variety of ownership structures. The main difference between  $F$  and  $N$  lies in the size of parameters  $\phi_F$  and  $\phi_N$ . In particular,  $F$  firms place a greater weight on direct control than

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<sup>9</sup>Dismissals are used both to provide incentives and to reduce firm/manager mismatch (Kwon 2005).

<sup>10</sup> An important assumption here is that talent and risk aversion are independently distributed. While there is some evidence that (cognitive) ability is positively related to risk taking (Frederick 2005), in our data there appears to be no correlation between risk attitudes and measures of human capital.

<sup>11</sup> If the characteristics were not observable, the manager will have an incentive to pretend that he is more talented than he actually is. However, given  $\theta_j$ , the manager would have no incentive to misrepresent his risk attitudes because the contract that he is offered in equilibrium maximizes his expected utility given his risk-aversion coefficient  $\gamma_j$ .

$N$  firms, namely  $\phi_F < \phi_N$ .<sup>1213</sup>

The firm profit is given by:

$$\Pi^i = y_j - w_j^i + h_g - k^i,$$

where the production  $y_j$  and the compensation  $w_j^i$  have already been discussed. The third term,  $h_g$ , represents a profit base, which may vary between  $F$  and  $N$  firms. We remain agnostic as to whether the difference  $h_N - h_F$  is positive or negative and this allows our model to be consistent with arguments either in favor or against family's firm profit advantage. The fourth term,  $k^i$ , represents idiosyncratic fixed costs (or profit opportunities) faced by different firms. For any ownership type  $g$ , there is a potential mass of entrants and each entrant  $i$  is characterized by an idiosyncratic cost  $k^i$ . We assume that firms are distributed as follows: For every  $k \geq 0$ , the mass of firms with  $k^i \leq k$  is equal to  $k$ . Variation in  $k$  is needed to pin down the number of firms in equilibrium.<sup>1415</sup>

The (potential) control benefit is given by

$$\Gamma^i = \Gamma_g - b^i \theta_j,$$

where  $\Gamma_g$  is a constant, which may depend on the ownership form  $g$ . The second term,  $b^i \theta_j$ , captures one of the key ideas of this paper: granting control to an outside manager dilutes the owners' ability to extract private benefits from the firm.<sup>16</sup>

The second term is crucial for our analysis and requires a careful discussion. Why is the control benefit that an owner can extract from her firm decreasing in her manager's talent and incentive? We view the term as the reduced form of an un-modeled subgame between the owner and the manager. Suppose the owner can obtain a private benefit by misusing some of the firm's productive inputs (buying a private jet, hiring friends and family, running a pet project, etc.). Suppose that the manager can spend effort to prevent the owner from appropriating resources. How motivated will the manager be to fight back?

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<sup>12</sup> In particular, one can assume – although it is not necessary – that  $N$  firms have no direct control benefit:  $\phi_N = 1$ .

<sup>13</sup> The results would continue to hold if we assumed  $V^i = \tilde{\phi}^g \Pi^i + (1 - \tilde{\phi}^g) \Gamma^i$ .

<sup>14</sup> Qualitatively, results would be unchanged if one assumed that the distribution of potential  $F$ -firms is different from the distribution of potential  $N$ -firms.

<sup>15</sup> The entry condition could be extended to allow for the possibility of  $N$ -firms to be bought out by families and  $F$ -firms to be sold to the market.

<sup>16</sup> Even if one assumes that the benefit  $\Gamma^i$  does not depend on the manager's talent  $\theta_j$  directly (namely that  $\Gamma^i = \Gamma_g - b^i$ ), there is still an indirect complementarity between incentives and talent because firms that offer high-performance schemes attract more talented workers. Hence, one should expect all our main results to go through (albeit in a less tractable setting).

Underlying this line of reasoning is an assumption on observability. While profits are - at least in part - publicly observable, private benefits are less so. Under this premise, it is easier to offer credible incentive contracts on profit than on other dimensions. To make an extreme case, how can the outside world know if a manager in a family firm has treated the founder and his family members in an obsequious manner? The owner could still offer high-powered incentives on profits, but a Holmstrom and Milgrom (1991) logic tells us that it might hurt the owner's private benefits.

Owner appropriation reduces the pool of resources that is available to the manager. It is reasonable to expect that the amount of resources available and the manager's talent are complements in the creation of profits. The manager's bonus is then the product of resources *times* talent *times* profit share. The manager's willingness to fight resource appropriation is an increasing function of  $b^i \theta_j$ .<sup>17</sup>

To keep notation to a minimum, we set  $\Gamma_N = 0$ , and  $h_N = 0$ . These two variables do not affect matching and contract choice; they only determine the number of  $N$ -firms and  $F$ -firms that are active in equilibrium. Note that  $\Gamma_F$  and  $h_F$  can be positive or negative.

Firm entry is endogenous. In equilibrium: (i) The owners of every active firm  $i$  maximize  $V^i$ ; (ii) A firm  $i$  is active if and only if the maximized  $V^i$  is greater than the outside option (normalized at zero).<sup>18</sup>

The timeline is as follows: (i) Each firm chooses whether to become active; (ii) A matching market between firms and managers opens. Manager-firm pairs sign linear contracts; (iii) Managers who are hired by firms choose how much effort they exert.

## 2.2 Equilibrium

An equilibrium (in pure-strategies) of this model is a situation where: (a) A firm is active if and only if it receives a non-negative expected payoff; (b) All manager-firm matches are stable, namely no pair made of one manager and one firm, who are currently not matched to each other, can increase their payoffs by leaving their current partners (if any) and signing an employment contract with each other; (c) All matched pairs select the contract that maximizes joint surplus; (d) All managers choose the optimal level of effort, given the contracts they have signed.

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<sup>17</sup> One could make this argument explicit in the model. It would require adding a second dimension to the manager effort (fighting back the owner) and modeling the owner's strategic choices. The theory section would become even longer and more complex, without much gain.

<sup>18</sup> One could have different outside options for  $F$ -firms and  $N$ -firms, but that would be equivalent to a change in  $h_F$  and  $h_N$ .

The present section offers an informal analysis of the model. A formal result is provided in the end of the section and proven in the appendix.

Let us begin from the last step: effort choice. Given a contract with slope  $b^i$ , manager chooses effort

$$\hat{x}_j = b^i \sqrt{\theta_j}.$$

As the surplus created by the relationship can be allocated costlessly to the firm or the manager through the fixed compensation variable  $a$ , the contract between the two parties must maximize the sum of their expected payoffs. The surplus-maximizing contract has slope

$$\hat{b}^i(\gamma_j) = \frac{\phi_g}{1 + \gamma_j \sigma^2}.$$

The contract power decreases with the risk aversion coefficient of the manager,  $\gamma_j$ , and in the profit weight of the firm owners,  $\phi_g$ . The manager's product given the optimal contract is

$$y_j = \sqrt{\theta_j} \hat{x}_j = \frac{\phi_g}{1 + \gamma_j \sigma^2} \theta_j.$$

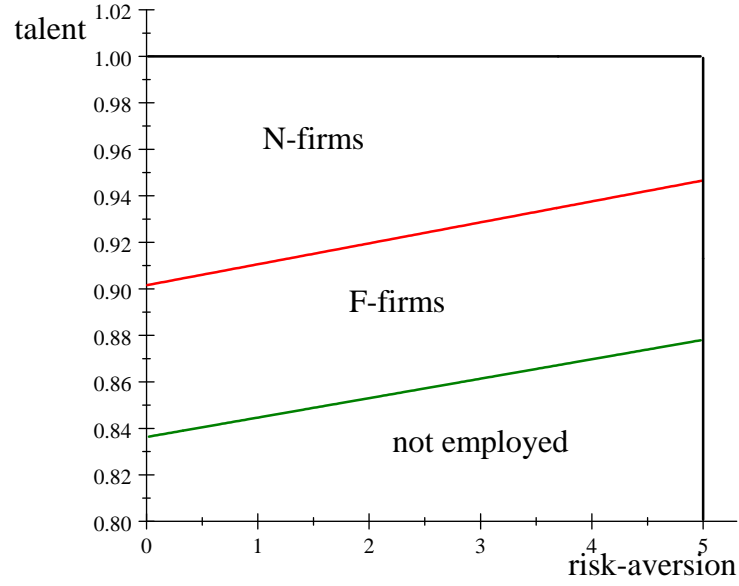
This means that there is a positive complementarity between the profit weight  $\phi_g$  and managerial talent  $\theta_j$  and a negative complementarity between  $\phi_g$  and the risk-aversion coefficient  $\gamma_j$ .  $F$ -firms have a comparative advantage for low-talent, risk-averse managers.

This comparative advantage translates into a matching equilibrium where managers with high talent and low risk aversion work for  $N$ -firms, managers with medium talent and higher risk aversion work for  $F$ -firms, and less talented managers are unemployed.

To see that this must be the case, consider two managers,  $A$  and  $B$ , and assume that  $A$  is more talented and less risk-averse than  $B$ . Suppose for contradiction that  $A$  works for an  $F$ -firm and  $B$  works for an  $N$ -firm. The total surplus (the sum of  $V^i$  and  $U_j$ ) generated by the two firms is lower than the total surplus that would be generated by the same two firms if they swapped managers. This means that either the  $F$ -firm and manager  $B$  or the  $N$ -firm and manager  $A$  can increase their joint payoff by leaving their current partners and forming a new match. The same line of reasoning applies to an unemployed manager who is more talented and risk tolerant than a manager who is currently employed.

See the figure below for an example of such a matching equilibrium. Managers are uniformly distributed on a two-dimensional space of talent and risk aversion. The space is divided into three regions. The upper left region contains talented risk-takers employed by  $N$ -firms. The middle region is made of less talented and more risk-averse managers who work

for  $F$ -firms. The managers in the remaining region are unemployed.



Equilibrium allocation of managers to firms

The regions in the figure are determined by indifference conditions. Managers on the line that separates the  $F$ -region from the unemployment region receive an expected utility equal to their outside option. Managers on the line between the  $F$ -region and the  $N$ -region are indifferent between working for an  $N$ -firm or for an  $F$ -firm.

The expected payoff of firm  $i$  is

$$\begin{aligned} E[V^i] &= E[\Pi^i + (1 - \phi_g) \Gamma^i] \\ &= \pi^i + E[h_g - k^i + (1 - \phi_g) \Gamma_g], \end{aligned}$$

where the term

$$\pi^i = E[y_j - w_j^i - (1 - \phi_g) b^i \theta_j]$$

can be seen as management-related payoff. Competition among firms guarantees that all active  $F$ -firms have the same management-related payoff  $\pi^F$  and all active  $N$ -firm have the same management-related payoff  $\pi^N$ . The comparative advantage of  $N$ -firms in incentive provision means that  $\pi^N > \pi^F$ .

The size of the  $F$ -region in the figure above corresponds to the mass of  $F$ -firms that are active,  $n_F$ . Similarly, the size of the  $N$ -region equals the mass of  $N$ -firms,  $n_N$ . The variables  $n_F$  and  $n_N$  are determined endogenously by the free entry condition. Firm  $i$  is active if and only if  $E[V^i] \geq 0$ . This means that the  $F$ -firm with the lowest payoff satisfies

$$\pi_F + h_F - k^i + (1 - \phi_F) \Gamma_F = 0$$



while the  $N$ -firm with the lowest payoff satisfies

$$\pi_N - k^i = 0.$$

### 2.3 Testable implications

The equilibrium characterization above yields an array of predictions regarding observable variables, which we group into four implications.

The first set of predictions relates to how managers are matched to incentive schemes:

**Implication 1 (Manager-Incentive Match)** *The slope of the contract that manager  $j$  faces in equilibrium is negatively correlated with his risk aversion coefficient and positively correlated with his talent.*

Implication 1 shows how managerial human capital is matched to firms in equilibrium. Managers with high risk aversion and low talent face low-powered incentives. If that was not the case, there could be gains from breaking existing pairs and forming new matches.

We can also predict how the manager's effort and his performance will be related to the incentive scheme he faces:

**Implication 2 (Manager Performance)** *Controlling for risk aversion, the slope of the contract that manager  $j$  faces in equilibrium is positively correlated with the manager's: (a) Effort; (b) Variable compensation; (c) Total compensation; and (d) Utility.*

Implication 2 describes what happens to the manager once he is matched to a firm. Managers who face steep contracts work harder. That's both because of the direct incentive effect and because they are more talented (and talent and effort are complements). As a result, they produce more output and they receive more performance-related compensation. Finally, a revealed preference argument shows that managers who are offered a high contract slope must have a higher utility than managers who are offered a less steep contract (because being talented can obtain the same product with less effort).

The third set of predictions relates to incentive power. If an  $F$ -firm and an  $N$ -firm hire managers with identical risk aversion, the  $F$ -firm will offer a flatter contract because it has a higher control premium. Formally,  $\phi_F > \phi_N$  implies:

$$\hat{b}_F(\gamma_j) = \frac{\phi_F}{1 + \gamma_j \sigma^2} < \frac{\phi_N}{1 + \gamma_j \sigma^2} = \hat{b}_N(\gamma_j).$$

We can write this result as:

**Implication 3 (Firm-Incentive Match)** *F-firms offer less steep contracts than N-firms.*

This result constitutes a third testable implication: *F*-firms offer contracts that are less performance-sensitive. Note that this prediction holds a fortiori if we do not condition for the manager's characteristics, as more risk-averse managers work for *F*-firms.

An additional prediction of our theory is that managers do not have an intrinsic productivity advantage in *F* or *N*-firms. Implications 1 and 2 imply that all the effects on manager characteristics and performance come from the incentive structure. Once controlling for incentives, the data should display no residual firm ownership effect.

The model also makes some predictions on the link between incentive provision and firm performance. Before getting into that, it is important to stress that our theory does not say whether performance will be higher in *N*-firms or in *F*-firms. This is for two reasons. First, *F*-firms may have some intrinsic business advantage or disadvantage, captured by  $h_F$ . Second, the fixed component of  $\Gamma_F$  determines endogenously the threshold of idiosyncratic cost  $k^i$  that induces *F*-firms to be active and hence endogeneously determines their performance. As a result, we can construct numerical examples where profits are higher in *F*-firms and numerical examples where they are higher in *N*-firms.

However, our model makes predictions on the correlation between firm performance and incentive provision, conditional on ownership:

**Implication 4 (Firm Performance)** *Controlling for ownership, the slope of the contract is positively correlated with the firm's profit  $\Pi^i$ .*

The intuition for this last prediction is immediate. As an increase in the contract slope  $b^i$  reduces control benefits, the firms who choose a higher slope must in equilibrium be compensated with a higher expected profit.

### 3 Empirical Analysis: Data Description

#### 3.1 Data Sources

Our empirical analysis exploits three data sources: (i) a novel survey of Italian managers that we designed to collect detailed information on their characteristics, the firms they work for and the incentives they face, (ii) Amadeus and the Italian Company Accounts Database, which contain information on the firms' balance sheets, demographics, and employment levels,<sup>19</sup> and (iii) the Social Security Database, which contains longitudinal information from

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<sup>19</sup> Amadeus is an extensive accounting database covering more than 9 million public and private companies across Europe, of which approximately 580,000 are in Italy. The Company Accounts Database is based on

administrative records on the managers' job position, pay, and employer since they joined the labor force.

The distinctive and unique feature of our survey is that it collects information on both sides of the market: the firms and the managers they employ. In particular, we collect measures of the firms' ownership structure and details on their incentive policies on three dimensions: bonus pay, promotion, and dismissal decisions. On the managers' side, we collect information on the managers' risk aversion, talent, work effort, compensation package, and job satisfaction.

One advantage of using data from a continental European country like Italy is that all-encompassing rules about collective labor bargaining result in unambiguous job definitions. The job title of "manager" (*dirigente* in Italian) applies only to the set of workers that have a manager collective contract, a fact that is recorded by social security data.<sup>20</sup> Italy has four managerial collective agreements: manufacturing, credit and insurance, trade and services, and public sector.

To avoid dealing with sector-specific contractual provisions, we focused on the managers in the trade and service sector. Managers in our sample are selected from the members directory of Manageritalia, an association of professional managers operating in the Italian trade and services sectors. Importantly, Manageritalia members account for 96% of all managers in the trade and service sectors. Hence, by sampling from the Manageritalia directory we are sampling from almost the full population of managers in that sector. These, in turn, make up 20% of all Italian managers.<sup>21</sup> The Manageritalia members directory contains 22,100 managers employed by 8,739 firms. To make sure we obtain balance sheet data, we sample from the 2,012 firms that can be matched with Amadeus and the Italian Company Accounts Database. The balance sheet datasets and, a fortiori, our sampling universe are skewed towards large firms. To maintain comparability across managerial tasks we focus on managers information provided by commercial banks that covers all the banks' largest clients. The data is collected by Centrale dei Bilanci, an organization established in the early 80s by the Bank of Italy and Italian banks with the purpose of recording and sharing information on borrowers.

<sup>20</sup> There is a very clear distinction between being a manager and the closest collective contract job title, which corresponds to "clerical employee" (*quadro* in Italian). Indeed the two categories are represented by different trade unions and have different pension schemes. The difference in terms of social status is also immediately perceived.

<sup>21</sup> Social security data indicate that in 2006, the number of individuals employed on a "manager contract" in the private sector was 117,000. Of these, 23,000 belong to the trade and private service sectors, and 22,100 belong to Manageritalia. Managers working for Italian branches of multinational firms belong to the trade and service sectors even if the firm itself is classified as industry—e.g. car manufacturers—as long as no production plants are located in Italy.

employed in the three main operational areas – general administration, finance, and sales. We randomly assign each firm to one of the three areas and randomly select one manager within each firm. The final sampling universe contains 605 each of general directors, finance directors, and sales directors, for a total of 1,815 observations.<sup>22</sup>

The administration of the survey was outsourced to Erminero & Co. – a well-established survey firm located in Milan, Italy. The 1,815 sample managers were contacted by phone to schedule a subsequent phone interview administered by a team of 35 analysts trained by Erminero & Co. and closely monitored by our research team. The response rate was 33%, with an average duration of 21 minutes per interview. Thus, our final sample contains 603 observations, equally split across the three operational areas.<sup>23</sup> Our sample managers are highly ranked in the firm hierarchy: most of them (60%) report only to the CEO and a further 28% report directly to the board. Only 2% rank three levels below the CEO. Moreover, 97.5% of sample managers are outsiders; namely, they do not belong to the family when the firm is family-owned. Reassuringly, respondents and non-respondents are employed by observationally identical firms. Indeed we find no evidence that the probability of participating in the survey is correlated to firm size, labor productivity, profits, return on capital employed, or sector (Table A1 in the Appendix). Respondents also look similar to non-respondents on demographics (gender and age) and tenure on the job. Respondents, however, have lower wages, but the difference, while precisely estimated, is small as the median weekly wage for respondents is 8% lower than for non-respondents (€1648 vs. €1786). This is consistent with non-respondents having a higher opportunity cost of time, as expected. Reassuringly, however, the pay distributions have considerable overlap, and, as discussed below, there is considerable variation within our sample. Moreover, despite this compensation level difference, respondents and non-respondents have a similar career path, as we find no difference in the average yearly rate of pay growth. Finally, while social security data do not contain information on incentive policies, we can proxy sensitivity of pay to performance by calculating the standard deviation of pay of the same manager across years in the same firm. Table A1 shows that respondents and non-respondents do not differ on this dimension.

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<sup>22</sup> We do not sample from the 197 firms for which the Manageritalia member list does not contain managers employed in the main three operational areas.

<sup>23</sup> In our regressions we always include controls for manager operational area. We also collected detailed information on the interview process, including information on the interviewees' tenure in the company, tenure in the post, seniority, gender, and interviewer identifiers. We use these variables to account for measurement error in the survey variables across some specifications.

### 3.2 Firm Characteristics and Performance

The main characteristics of our sample firms are summarized in Table 1, Panel A. The table shows that family ownership is the most common ownership structure: 47% of the firms are owned by the founder (19%) or their family (28%). The percentage of family firms is in line with the findings of La Porta, Lopez-de-Silanes, and Shleifer (1999), who report that 60% of Italian medium-sized publicly traded firms belong to a family (including both founders and second generation firms). Widely-held firms account for 30% of the sample.<sup>24</sup> The remaining 23% is divided between cooperatives and firms owned by the state (8%), firms owned by their management (2%), and firms owned by a group of private individuals (13%). As there is no a priori reason to believe that the importance attached to the “amenity potential” of control by these firms is similar to either family firms or widely-held firms, we keep this category separate in the analysis that follows.

The survey also contains information on firm size, sector, and multinational status. Over 90% of the sample firms employ less than 500 people. In more detail, 39% are small firms with 49 or fewer employees, a further 20% have between 50 and 100 employees, and the remaining 41% have more than 100 employees. All sample firms belong to the service sector, within which the three most frequent categories are Wholesale (45% of the sample), Business Services (11%), and Retail and Specialized IT Services (4%). Finally, 58% of the firms in our sample are subsidiaries of a multinational company, and in 21% of the cases the multinational’s headquarters are in Italy.<sup>25</sup>

The last three rows of Table 1, Panel A report measures of firm performance from Amadeus. For each firm we use the last year for which data is available, which is 2007 for 62% of the sample firms and 2006 for 35% of them. We use three measures of performance: labor productivity (defined as operating revenues divided by the number of employees), profits per worker (computed as earnings before interests and tax divided by the number of employees), and ROCE (operating income scaled with capital employed). For each measure we drop the top and bottom 1%, to remove outliers possibly due to measurement errors. Table 1 shows that the distribution of productivity and profits is heavily skewed to the left, the median is much smaller than the mean, indicating that there is a long tail of firms that perform

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<sup>24</sup> Widely-held firms are companies for which no party owns more than 25% of the shares. We also include in this category private equity firms (8% of the sample), but the results are qualitatively similar once we include private equity in the residual ownership category.

<sup>25</sup> Most sample firms are incorporated in the region of Lombardy (58%), followed by Emilia (9%), Lazio (9%), Veneto (8%), Piedmont (5%), and Tuscany (5%). This reflects the uneven geographical distribution of firms across the country.

considerably better than most of the sample. Finally, we observe considerable heterogeneity along all three measures – the standard deviation is between 1.3 and 2.3 times the mean.

### 3.3 Incentive Policies

The model in Section 2 makes it precise how the choice of incentive policies attracts different types of managers. To provide evidence on this issue we collected information on three types of firm policies that can be made conditional on manager performance: pay, promotions, and dismissals. This way we obtain a detailed picture of the firms' incentive policies and can exploit variation along all three dimensions. For each type of policy we ask whether the outcome depends on the manager's performance and whether this is evaluated through a formal appraisal system. The latter is crucial to ensure that managers know the exact mapping from performance to reward, which determines the effectiveness of the incentive scheme. In fact, our data shows that two thirds of the managers who are formally appraised know exactly how bonus payments are calculated, whereas the corresponding share in firms that do not have a formal appraisal system is one half.

To measure the sensitivity of pay to performance, we asked whether managers can earn a bonus, whether this is a function of performance, and whether it is awarded through an established appraisal process. We summarize this information into two variables, *bonus 1* (equal to 1 if bonus is conditional on performance and zero otherwise) and *bonus 2* (equal to 1 if bonus is based on formal appraisal; zero otherwise). Half of the firms in our sample offer bonuses as a function of individual or team performance targets that are agreed in advance;<sup>26</sup> in 33% of firms, bonuses are awarded through a formal appraisal system (Table 1, Panel B).<sup>27</sup>

To measure the effect of performance on the manager's career prospects within the firm we asked whether fast promotion tracks for star performers exist, whether promotions depend on performance (as opposed to tenure or good relationships with the owners), and whether they are decided through formal appraisals. The variable *promotion 1* equals one when fast

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<sup>26</sup> Overall, 70% of the firms offer a bonus scheme, but for 20% the bonus is either a function of firm-wide performance or awarded at the discretion of the owners. All the findings that follow are robust to including firm-wide or discretionary bonuses in the measure of performance pay.

<sup>27</sup>It is important to note that the fact that formal appraisal systems may have implications for the bonus does not necessarily imply the existence of bonuses related to individual performance. Managers report that formal appraisal systems may have implications for the bonus in 201 cases of of 603. The vast majority of the times (77%) in which appraisals may have implications for the bonus, and the bonus exists, the bonus is linked - albeit not always exclusively - to individual or team performance. The rest of the times the bonus is independent of individual performance, but it is linked to firm performance and/or the discretionary judgement of the owners.

tracks exist and zero otherwise. We define *promotion 2* to equal one if performance is an important factor for promotion. Finally, *promotion 3* equals one if promotions are decided within a well-defined system of formal appraisal. On average, 37% of sample firms report to have fast tracks for star performers, promotions depend on performance in 74% of the cases, and 34% of firms have a formal appraisal system to determine promotions (Table 1, Panel B).

Finally, we measure whether poor performance can be cause for dismissal and, again, whether dismissals are decided through a formal appraisal system. The variable *firing 1* is equal to 1 if in the past five years managers have been dismissed due to failure in meeting their performance objectives and 0 otherwise. Overall, only 11% of firms have dismissed managers in the last five years, and 5% report doing so because of poor performance.<sup>28</sup> Finally, *firing 2* equals one when dismissals are decided through a formal appraisal system, and this happens in 23% of the sample firms (Table 1, Panel B).

For parsimony, we combine the various incentive policies in a sole index that equals the sum of the measures described above. The findings are qualitatively unchanged if we use other summary measures, such as the first principal component. The resulting index takes values between 0 and 7, with higher values denoting policies that create a tighter link between reward and performance. The median firm adopts 2 out of the 7 incentive policies we consider, and the standard deviation of the index is 1.74. Just under 10% of the sample firms offer no explicit reward for performance, while only 0.5% adopt all seven measures.

### 3.4 Manager Characteristics, Pay, and Performance

The manager survey provides a wealth of information on manager characteristics that are summarized in Table 1, Panel C. Managers are on average 47 years old, and 90% of them are male.<sup>29</sup>

The theoretical model of Section 2 implies that a key variable driving the firm-manager match is the manager’s attitude towards risk. To shed light on this, we follow an emerging literature that tries to elicit individual risk preference parameters and characterize their heterogeneity by using large-scale surveys (e.g. Barsky et. al. 1997, Guiso and Paiella 2008, and Dohmen et al 2006). Our approach differs from most of the literature that analyzes

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<sup>28</sup> The other non-exclusive reasons given for dismissals are “poor market conditions” (4%) and “disagreement with the owners” (6%).

<sup>29</sup> This is in line with the figures for the manager population as a whole from social security records. In the last available year (2004), average age was 47 and the share of males was 88%. See Bandiera et al (2008) for details.

the risk-incentive trade-off using measures of the riskiness of the environment or agents' wealth as a proxy for their risk aversion. As such, it does not suffer from the bias caused by omitted variables and endogenous matching discussed by Prendergast (2002) and Akerberg and Botticini (2002).

We collected a measure of risk attitudes that aims to measure the managers' own preference for risk. Measures of this sort have been shown to correlate with actual risk taking in a field experiment by Dohmen et al (2006).

To measure the managers' own risk preference we ask them to choose between a prospect that yields 1 million euros for sure (the safe choice) and a binary risky prospect that yields 0 with probability  $p$  and 10 million with the complementary probability  $(1-p)$ , where  $p$  varies between 0.01 and 0.8 at intervals of size 0.1. Suppose that for very low probability of zero return (and thus a very high probability of making 10 million) the manager prefers the risky prospect to 1 million euro for sure. We take as our risk attitude measure  $p^*$ , defined to be the level of  $p$  at which the manager switches from the risky to the safe prospect. Obviously  $p^*$  is inversely related to risk aversion, that is risk averse managers are willing to bear losses only if the probability is low. Table 1 shows that the average manager prefers the safe prospect when the risky one fails with probability 0.2 or higher. More interestingly, Table 1 also shows that managers' risk attitudes are quite heterogeneous – the standard deviation of our measure is 18.94.<sup>30</sup>

The next set of variables aim to proxy for manager talent. The first two refer to the

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<sup>30</sup>We also collect two other measures of the manager risk attitude. The first is an index of the managers' choice of risk when acting on behalf of the firm. This is obtained from the answers to the following question: "We would now like you to think of some important decisions you have taken or might take on behalf of your firm. These are strategic decisions with uncertain outcomes and a positive correlation between expected earnings and risk. On a scale from 0 to 10, where 0 means you would choose the safest option with the lowest expected earnings while 10 refers to very risky projects that have a very high rate of return in case of success, what would you choose?" The average manager is just above the midpoint (5.7) and again there is considerable heterogeneity across managers.

The second proxy was obtained from a question asking the manager to state what would be the ideal proportion between fixed and variable pay linked to individual performance, if he could choose among a menu of combinations where a higher proportion of variable pay corresponded to higher total average pay.

Interestingly, these two risk attitudes measures are strongly correlated with our main indicator of risk tolerance (correlation coefficients 0.24 and 0.19, respectively and both highly statistically significant). However, compared to the managers' own risk tolerance, these two alternative measures may have some shortcomings. First, answers to the first question might reflect the type of incentives faced by the manager. Even for the second question, the chosen mix may also reflect the riskiness that the manager faces in the firm rather than preferences for risk. Therefore, we use these measures only for robustness checks (see footnote 36).



managers' human capital, as measured by college and executive education degrees. In our sample, 50% of the managers hold a college degree, and 56% hold an executive degree.<sup>31</sup> To capture additional aspects of managerial quality beyond education, we measure “desirability” by asking managers whether they received any job offer during the three years prior to the interview; 71% reported that this was the case.

It is important to note that the measures of risk attitudes and talent exhibit independent variation: no correlation between any two measures is higher than 0.06. This is crucial for our purposes as it allows us to identify matching on risk and talent separately.<sup>32</sup>

Finally, Table 1, Panel D reports measures of the managers' effort, remuneration, and job satisfaction. We proxy managerial effort by the number of hours worked over a week. In our sample 37% of managers work 60 hours or longer.<sup>33</sup> The average annual fixed salary of a manager is approximately 100,000 Euro, while the bonus amounts, on average, to 15% of the fixed salary. On average, managers in our sample receive 4.2 non-monetary benefits out of a list of seven potential benefits.<sup>34</sup> Finally 50% of the managers in our sample report to be “extremely satisfied” with their job. Only 5% report to be “unsatisfied,” while the remaining part of the sample is “satisfied.”

## 4 Empirical Analysis: Findings

We organize the empirical evidence in four parts that match the set of four predictions obtained in Section 2. We start by estimating the relation between the firms' incentive policies and the risk and talent of the managers they hire in equilibrium. We will show that firms offering stronger incentives attract managers who are more risk tolerant and more talented. Second, we estimate the correlation between the strength of incentives and managers' outcomes. We will show that managers who are offered stronger incentives exert more effort, receive higher fixed and variable pay, receive more non-pecuniary benefits, and are more satisfied with their job. Third, we estimate the correlation between the weight given to keeping direct control of the firm (as proxied by ownership) and the strength of managerial incentives.

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<sup>31</sup> This relatively low figure is consistent with the information arising from existing surveys of Italian managers (see Bandiera et. al. 2008).

<sup>32</sup> We discuss in more detail the validity of the risk aversion variable in the robustness section.

<sup>33</sup> To minimize measurement error due to the choice of a particular week, the survey asks managers to pick the number of hours they work in the “typical” week out of five possible choices: (i) 40 hours or fewer, (ii) about 40 hours, (iii) about 50 hours, (iv) about 60 hours, (v) 60 hours or more.

<sup>34</sup> The list of benefits include: company car (available to 83% of our sample managers), flexible hours (85%), telecommuting (27%), training (71%), sabbatical periods (6%), health insurance (74%), and life insurance (74%).

We will show that family ownership, which in our setting reveals a stronger preference for direct control, is negatively correlated with the adoption of bonus systems related to individual or team performance and with the adoption of practices that promote and fire employees based on their performance. Fourth, we estimate the correlation between incentives and firm performance. We will show that firms that offer high-powered incentives have higher productivity, profits, and returns on capital.

It is important to make precise that our aim is to present evidence on a rich set of equilibrium correlations that are suggested by the theory. We do not, at any stage, aim at identifying the causal effect of ownership on incentives or incentives on performance, as neither varies exogenously. However, at the end of this section we discuss a number of alternative interpretations of our findings and argue that, when taken together our evidence while consistent with the matching model, is not consistent with any of these alternatives.

#### 4.1 Incentives and Managers' Characteristics

We begin by testing Implication 1, namely that high-powered incentives attract managers who are less risk averse and, conditional on risk aversion, more talented. Starting with risk aversion, we estimate the conditional correlation:

$$R_i = \eta^R I_j + \mathbf{X}_j \boldsymbol{\zeta}^R + \mathbf{Y}_i \boldsymbol{\sigma}^R + \epsilon_{ij}^R \quad (1)$$

where  $R_i$  is a measure of the manager risk aversion and  $I_j$  is the incentive policies index. Throughout the empirical analysis,  $\mathbf{X}_j$  includes the firm's multinational status, employment levels, and SIC2 industry codes.  $\mathbf{Y}_i$  includes the manager's tenure, seniority level, whether he belongs to the owner family, and his operational area (general administration, finance, sales).<sup>35</sup> Finally we add interviewers' dummies and control for the duration of the interview to account for potential noise in the measurement of the incentive policies.

Columns (1) and (2) of Table 2 estimate (1) for our measure of the manager's own risk preferences with and without the control vectors  $\mathbf{X}_j$  and  $\mathbf{Y}_i$ . Recall that our risk preference measure – the maximum probability of failure of the risky project that the manager is willing to bear – is inversely related to risk aversion. Columns (1) and (2) then show that risk-tolerant managers are more likely to be offered high-powered incentives. The estimates of  $\eta^R$

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<sup>35</sup> On average, managers have 6.6 years of tenure (standard deviation is 3.6). Seniority is characteristic of the standardized managerial contract. In our sample 7% have a lower management contract, 72% a middle management contract, and 21% an upper management contract. Only 2.5% of our sample managers belong to the family who owns the firm. Finally, by construction, managers are equally split between the three operational areas.

are positive and significantly different from zero at conventional levels. The coefficient estimated in Column (2) implies that one standard deviation increase in the index is associated with a 1.75 increase in the risk preference measure, or 10% of a standard deviation of the risk tolerance measure. This result is robust to adding as a control a measure of manager compensation, thus making sure that the correlation with the power of incentives does not just reflect a correlation of the latter with income.

It is important to note that the interpretation of the findings is qualitatively unaffected if our measure captures the manager’s risk attitudes when he takes a decision on behalf of his firm instead of his individual risk aversion parameter  $\gamma_j$ . If so, our measure effectively captures  $b^i\gamma_j$ , namely the portion of the risk taken by the firm that goes to the manager through his incentive scheme. Note that the finding that  $b^i\gamma_j$  is smaller when  $b^i$  is higher implies a fortiori that  $\gamma_j$  is smaller when  $b^i$  is higher.<sup>36</sup>

The second part of Implication 1 indicates that, conditional on risk aversion, high-powered incentives attract more talented managers. To test this, in Table 2, Columns (4) to (8), we estimate the conditional correlation:

$$T_i = \eta^T I_j + \lambda^T R_i + \mathbf{X}_j \boldsymbol{\zeta}^T + \mathbf{Y}_i \boldsymbol{\sigma}^T + \epsilon_{ij}^T \quad (2)$$

where  $T_i$  are measures of the manager’s talent,  $R_i$  is the measure of the manager’s own risk tolerance, and all the other variables are defined above. The findings provide broad support for the prediction that “better” managers are attracted by steep incentives. For all our measures of talent,  $\eta^T$  is positive and significantly different from zero at conventional levels. Namely, managers who work under high-powered incentives are more likely to have a college degree, to have attained executive education, and to be “desirable,” defined as having received job offers from other firms in the last three years. Using the estimates with the full set of controls, we find that one standard deviation increase in the incentive index increases the probability that the manager has a college degree by 0.08 (16% of the unconditional mean), that he has an executive education degree by 0.10 (18% of the mean), and that he has received outside offers by 0.08 (17% of the mean). Finally, we note that there is a positive correlation between firm size and managerial talent: larger firms are more likely to hire more skilled managers. This is in line with the prediction of a large class of manager-firm matching

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<sup>36</sup>The results shown in Columns (1) and (2) of Table 2 are robust to the use of the other two measures of risk tolerance discussed in footnote 30. One standard deviation increase in the incentive index is associated with a 0.17 increase in the variable measuring risk aversion using the manager’s own account of the risks he takes on behalf of the firm, or 10% of its standard deviation. Similar results are found when we proxy  $R_i$  with the manager’s desired share of variable pay.

models, from Lucas (1978) to Rosen (1982) and Terviö (2008).

## 4.2 Incentives and Managers' Outcomes

Implication 2 links the firms' incentive policies to managers' effort, pay, and job satisfaction. It predicts that, holding constant their risk tolerance, managers who are offered steeper incentives work harder, receive higher fixed and variable pay, and have higher utility. To provide evidence on this, Table 3 reports estimates of the conditional correlation:

$$O_i = \eta^O I_j + \lambda^O R_i + \mathbf{X}_j \boldsymbol{\zeta}^O + \mathbf{Y}_i \boldsymbol{\sigma}^O + \epsilon_{ij}^O \quad (3)$$

where  $O_i$  are measures of manager outcomes and all the other variables are defined above. Proxying effort by hours worked, Columns (1) and (2) show that managers who are offered steeper incentives work longer hours. The estimate of  $\eta^O$  is positive and statistically and economically significant. One standard deviation increase in the incentive index is associated with a 0.06 increase in the probability that the manager works more than 60 hours per week, which corresponds to 16% of the sample mean.

Columns (3) to (6) show that managers who are offered steeper incentives receive higher fixed and variable pay. The estimates of  $\eta^O$  with the full set of firm and manager controls indicate that one standard deviation increase in the incentive index is associated with an increase of 2,900 euros in fixed pay and an even larger amount of 4,375 euros in variable pay. These correspond to 10% and 25% of one standard deviation in fixed and variable pay, respectively. In line with the predictions of Zabojnik and Bernhardt (2001), we find that fixed pay is positively correlated with firm size.

Managers who are offered steeper incentives also receive a larger number of job benefits. The estimates in Column (8) imply that one standard deviation increase in the incentive index is associated with 0.24 more benefits, equal to 17% of a standard deviation of the number of benefits in the sample.

Finally, to measure the managers' level of utility we ask them to report their level of satisfaction on the job. Only 5% report to be unsatisfied, while 45% are satisfied and 50% are very satisfied. Columns (9) and (10) show that managers who are offered steeper incentives feel happier. According to the estimate in Column (10), one standard deviation increase in the incentive index is associated with a 0.06 increase in the probability that the manager reports to be very satisfied, which is as large as 12% of the sample mean.

### 4.3 Firm Ownership and Incentives

Implication 3 predicts that firms attaching a higher weight to direct control ( $F$ -firms in our notation) will tend to offer a weaker link between reward and performance than  $N$ -firms. We exploit the difference between family firms and firms owned by disperse shareholders to proxy for the  $F$  and  $N$ -firms described in our model. In particular, our key assumption is that families put more weight on direct control than shareholders of widely-held firms, such that  $\phi_F < \phi_N$ .

This choice is rooted in the family firms literature (discussed in the Introduction), which documents how family-owners often perceive the firm as an opportunity to address family issues and frictions. In this context, owners attribute a value to the firm as an “amenities provider,” even though the provision of such amenities might not be profit maximizing (Kets de Vries 1993). Alternatively, since the boundaries of the firm and those of the family are less clearly defined in family firms, the transfer of these amenities from the firm to the family is more efficient in family firms and thus more of these amenities are transferred. In either case,  $\phi_F < \phi_N$ .

Unconditionally we find that family firms do offer a weaker link between reward and performance than dispersed shareholders firms. Family firms are less likely to offer bonuses based on individual performance (44% versus 57%), to have promotion fast tracks (32% versus 41%), and to have dismissed managers for failure to meet performance targets (3% versus 6%). Family firms are also less likely to award bonuses, decide on promotions, and fire employees through a formal appraisal process and in all cases the gap between the two types of firms is not only statistically significant (see last column) but also substantial. Only performance seems to matter for promotions regardless of ownership.

In Table 4 we test whether these differences are robust to controlling for a rich set of manager and firm characteristics, which might create a spurious correlation between firm ownership and incentive policies. We estimate the conditional correlation:

$$P_{ij} = \alpha^F D_j^F + \alpha^O D_j^O + \mathbf{X}_j \boldsymbol{\beta} + \mathbf{Y}_i \boldsymbol{\delta} + \varepsilon_{ij} \quad (4)$$

where  $P_{ij}$  are the different incentive policies adopted by firm  $j$  as reported by manager  $i$ ,  $D_j^F = 1$  if firm  $j$  belongs to its founder or a family and 0 otherwise and  $D_j^O = 1$  if the firm belongs to the government, a cooperative, or its managers and 0 otherwise. The coefficient of interest is  $\alpha^F$ , namely the difference in incentive policies between family-owned and dispersedly owned firms, and  $\mathbf{X}_j$  and  $\mathbf{Y}_i$  are the vectors of firm, manager, and interview controls defined above.

Table 4 shows that the difference in personnel policies between family firms and firms owned by disperse shareholders are robust to the inclusion of this rich set of controls. The first two columns estimate (4) for the aggregate index built as the sum of all seven policy measures. Both in Columns (1) and (2)  $\alpha^F$  is negative and significantly different from zero at conventional levels. The magnitude of the coefficient indicates that the differences between family and dispersed shareholder firms are large: with the full set of controls the incentive index is 0.51 points smaller in family compared to dispersedly owned firms. This difference amounts to 18% of the sample mean and 30% of a standard deviation of the incentive index. The remaining columns estimate (4) for the three subcomponents of the index: bonuses, promotions, and dismissals. Throughout,  $\alpha^F$  is negative and significantly different from zero at conventional levels, indicating that family firms choose low powered incentives on all dimensions.

Table 4 also shows that high-powered incentives are more likely to be offered by firms that are part of multinational corporations. None of the other controls are correlated with incentive policies. Namely, the strength of incentives is not correlated with firm size or industry sector, or with the managers' tenure, seniority, and operational area.<sup>37</sup>

While the findings are consistent with Implication 3, and hence with the assumption that family firms put more weight on the "amenity value" of control,  $\varepsilon_{ij}$  contains all other unobservable characteristics that differ by ownership and could be driving the results. For instance, family firms might have better monitoring technology and hence less need to of-

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<sup>37</sup>The lack of correlation between the steepness of the incentive scheme and firm size is at odds with the findings reported in Schaefer (1998), which shows that the incentives of US CEOs fall in strength roughly with the square root of firm size. There are many possible reasons behind this discrepancy. First, Schaefer (1998) is based on a sample of very large (with assets worth \$3,775 million on average) and listed US firms, while we look at much smaller firms (\$3.3 million in assets on average and only 1.4% listed on the stock market). Second, our size measures (dummies for the average number of employees in the firm) might simply be too rough to estimate the effects reported by Schaefer. Third - and perhaps more importantly - Schaefer focuses exclusively on CEOs and top managers, while our sample also includes managers lower down the hierarchy. Interestingly, when we restrict the sample to the set of 126 managers who report to be "Top Managers" (i.e. reporting directly to CEOs), we find some evidence that the strength of managerial incentives declines with firm size. In fact, when we repeat the regression shown in Table 5, Column (2), relating the incentive index with firm ownership and firm characteristics the coefficient (standard error) on the dummy denoting firms with 50 to 100 employees is -0.670 (0.690), and the coefficient (standard error) on the dummy denoting firms with 100 employees or more is -1.076 (0.584) (with the omitted category being firms with less than 50 employees). This finding is driven by all components of the incentive index, and in particular by the set of questions measuring the presence of monetary bonuses linked to individual performance, and awarded through formal appraisal systems.

fer performance incentives. We will discuss this and other alternative explanations in the robustness section.

#### 4.4 Incentives and Firm Outcomes

The final step of our analysis presents evidence on Implication 4, which suggests a positive correlation between incentive policies and firm performance. Though, as previously stated, our data does not allow us to identify a causal relationship, we are nevertheless interested in establishing whether the data are consistent with this model prediction.

In Table 5 we estimate the conditional correlation over a repeated cross section:

$$Z_{jt} = \theta I_j + \mathbf{X}_{jt}\vartheta + \boldsymbol{\kappa}_t + \omega_{jt} \quad (5)$$

where  $Z_{jt}$  measures the performance of firm  $j$  in year  $t$ ,  $\boldsymbol{\kappa}_t$  are year fixed effects, and all other variables are as defined above. We consider three alternative measures of firm performance: a) labour productivity (log of sales/employees); b) profits per employee; and c) return on capital employed, all measured yearly for the period 2004 to 2007. To account for the fact that error terms  $\omega_{jt}$  are correlated within firms across years we cluster the standard errors at the firm level. Firm performance measures are obtained by matching our survey data with Amadeus, an extensive accounting database covering more than 9 million public and private companies across Europe, of which approximately 580,000 are in Italy.<sup>38</sup> Once we clean the accounting data dropping the first and the bottom percentiles of the performance variables and taking into account missing observations for some items, we end up with a sample of 554 observations.<sup>39</sup>

The estimation results are reported in Table 5. Two points are worth noting. First, the incentive index carries a positive coefficient significant at conventional levels for all measures of productivity. A one standard deviation increase in the incentive index is associated with a 5%, 8%, and 9% of a standard deviation increase of log-productivity, profits, and return on capital, respectively. Second, this finding is robust to controlling for ownership structure; namely, it is not merely due to the incentive index capturing systematic differences in performance directly due to different ownership structures. The estimates of the coefficient on family ownership is negative throughout but only precisely estimated for labor productivity. Thus, once differences in the power of incentives are accounted for, we find no evidence of a systematic difference in profits between family and shareholder owned firms, a feature itself

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<sup>38</sup> To match the two datasets we use the unique company identifier *Codice Cerved*.

<sup>39</sup> The results are qualitatively similar without these cleaning procedures.

in line with the implications of our model with endogenous firm entry.

## 5 Robustness and Alternative Interpretations

### 5.1 Unobserved Heterogeneity in Manager Characteristics

The residuals in (1), (2), and (3) contain unobservable manager characteristics that can generate a spurious correlation between the incentive index and the outcome of interest. This concern is particularly serious in survey data because unobservable psychological characteristics of the respondent may lead to systematic misreporting. For instance, managers who are more self-confident might be more likely to overestimate their control over their pay, hence more likely to report facing high-powered incentives and at the same time more likely to take risks and to overestimate their earnings. Unobservable self-confidence could therefore generate a spurious correlation between incentive power and risk tolerance and between incentive power and earnings.

We note that this concern is relevant for all the findings that rely on self-reported measures on the left and right-hand side of the equation, namely those in Tables 2 and 3. Findings that rely on variation in firm ownership or performance (Tables 4 and 5) are unaffected as these are not subject to reporting bias.

We can probe the robustness of our survey data directly using social security records that contain detailed information on the managers' pay and occupation since the beginning of their careers. Hence we can estimate (3) using the social security administrative earnings data that are not affected by perception errors or other managers' unobservable traits, which could in turn contaminate self-reported variables. Table 6 reports the estimates of:

$$Q_i = \varphi I_j + \lambda^Q R_i + \mathbf{Y}_i \psi + \zeta_i \quad (6)$$

where  $Q_i$  is the logarithm of manager  $i$ 's pay,  $R_i$  is the measure of the manager's own risk tolerance, and the vector of controls  $\mathbf{Y}_i$  includes the manager's seniority level, whether he belongs to the owner family, his tenure in the current firm, firm category (general administration, finance, sales), overall tenure since his first job, the number of firms he has worked for, the average number of weeks worked in a year, duration of the interview, and interviewer dummies. For comparison, Columns (1) and (2) report the estimate of (6) using pay data from the survey, whereas in Columns (3) and (4) we use pay data from the social security records. Throughout,  $\varphi$  is positive and precisely estimated. Moreover, the estimates of  $\varphi$  obtained with our survey data or with the social security records are quantitatively similar,



reassuring us directly on the reliability of our survey earnings and indirectly on our incentive index.

Since the social security records contain information on the managers' entire careers, we can further refine the evidence that incentive policies are matched to the managers' type by regressing managerial pay in *previous* jobs on current incentives. Under the plausible assumption that managers' risk attitudes and ability are stable traits, one should find that a given manager matches with firms that offer similar types of incentive contracts. Consistent with this, Columns (5) and (6) show that managers who currently face high-powered incentives, had higher levels of pay throughout their career.

Furthermore, while the social security records do not contain information on the managers' risk preferences, they allow us to measure earnings variability, which, by revealed preference, is an indicator of the risk the manager is willing to bear. To provide further evidence on the validity of our incentive measure, we exploit the time variation in earnings in the social security records and test whether high-powered incentives result in a higher earnings variability, as they should if the managers who face steep incentives bear more risk in equilibrium.<sup>40</sup> We estimate the same specification as in (6) with the standard deviation of yearly pay computed over the managers' time at the firm on the left hand side. Columns (7) to (10) show that earnings variability and the power of incentives are correlated: managers hired by firms that offer high-powered incentives face more earnings variability and have done so throughout their careers. This is additional evidence in support of our matching model: throughout his career, a bold, talented manager tends to be matched with firms that offer steep incentives.

Another potential concern is that our risk aversion measure is correlated with other unobservable personal characteristics, which in turn may determine matching and incentive preferences. While this hypothesis cannot be verified within our dataset, we can explore this question using another survey of 2,295 Italian entrepreneurs and managers, which is focused on the measurement of risk aversion (measured in the very same way used in this paper) and its link with other managerial characteristics (Guiso and Rustichini 2010). In line with our results, risk aversion is not statistically correlated with measures of cognitive ability. Reassuringly, the risk aversion measure is also not statistically correlated with managerial personality traits that could affect the matching process, such as optimism, confidence and

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<sup>40</sup> In our model, earnings variability can be computed directly. The realized wage variance is

$$Var(w) = Var(b^i y_j) = (b^i)^2 \sigma^2.$$

Hence the realized standard deviation is linear in the power of the incentive contract faced by the manager.

the ability sustain effort. On the other hand, we find evidence that our risk aversion measure is correlated with actual risk taking behavior of managers outside their work environment. Appendix 2 discusses data and results of the external validation analysis in more detail.

A final cause for concern is that the incentive structure faced by an individual manager might not be representative of all managers in the firm. Two points are of note. First, to the extent that different managers within the same firm face different incentive structures, so that the structure reported by the managers we interview is a noisy proxy for the firms' "average" policy, all correlations between the incentive index and firm level variables (ownership and performance) are biased downwards because of measurement error. Second, managers can only report about their own incentives on dimensions they have experienced; that is, bonuses and promotions. Their report on dismissal policies, however, must reflect the firm's average practices as the managers themselves have not been dismissed by the current firm. The fact that our findings are robust to using only the dismissal dimension provides reassurance on the practical relevance of this concern.

## 5.2 Alternative Interpretations

Taken together our findings are consistent with the rich set of equilibrium correlations suggested by the model outlined in Section 2. Incentive policies are correlated with the type of managers hired in equilibrium: the strength of incentives is positively correlated with the managers' risk tolerance and with their talent. Incentive policies are also correlated with managers' effort, their compensation package, and their utility: managers who face stronger incentives work harder, receive higher fixed and variable pay, and (not obviously) are happier. Ownership type is correlated with incentive policies: compared to firms owned by disperse shareholders, family firms offer lower powered incentives. Finally, stronger incentives are positively correlated with firm performance.

Although some of these results have already been observed in isolation in previous work, this is the first time that specific personnel policies are analyzed in conjunction with such a rich array of firm and manager characteristics. Compared to prior studies, this gives us the unique opportunity to explore the validity of alternative theories that have been proposed in the past, especially with regards to the understanding of the difference between family firms and other types of ownership.

For example, similarly to what we show in Table 4, Bloom and Van Reenen (2007) report that family-owned firms are less likely to adopt "modern" management practices, which include basic practices related to the provision of performance incentives and the adoption

of practices that promote and dismiss workers based on their performance. The absence of detailed information on workers' effort and characteristics, however, complicates the interpretation of this finding. First, family firms may have better monitoring technology and hence less need to offer explicit performance incentives (Roe 2003, Mueller and Philippon 2006). This would explain the observed correlation between ownership and incentives. A related hypothesis is that family firms may have access to other technologies to motivate managers, e.g. non-taxable benefits, and hence do not need to offer explicit monetary incentives to reward performance, so that effective performance is better rewarded even if incentives are low.

Having data on all sides of the match, we are able to show that both hypotheses - the family firm advantage in monitoring and motivating their employees - are actually not supported by the data. For example, if family firms were better at monitoring their employees, this would imply a comparative advantage in incentive provision, which in turn would lead to three conclusions, which are all falsified in the data. First, managers who face better monitoring should work harder. To the extent that hours worked are a proxy for effort, the estimates of (3) indicate that the opposite is true: managers who face weaker explicit incentives work less hard.<sup>41</sup> Second, better monitoring implies higher productivity. In a competitive labor market, where firms are competing to hire managers, then more productive managers should be paid more. The findings suggest that the opposite is true: both fixed and variable pay are lower in family firms. Third, if effort and talent are complements in the production function (as it is standard to assume), a comparative advantage in monitoring should translate into a comparative advantage in employing talented managers. But the estimates of (2) suggest the opposite: managers who face stronger incentives are more talented. Similarly, if family firms were better at motivating their employees, we should observe low powered incentives to be correlated with higher managerial talent and effort. The estimates of (2) and (3) indicate the opposite.

As a further check, we investigate whether family firms might offer flatter incentives as they happen to be in sectors where managerial effort is less relevant. To shed light on this hypothesis we estimate (4) without industry controls, then with SIC2 industry codes, and finally with SIC3 industry codes. The estimated coefficient of family ownership in the three specifications is -.57, -.53, and -.59, significantly different from zero at the 5% level. The fact that the estimated coefficient of family ownership remains constant as we add increasingly fine

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<sup>41</sup> Of course, one can always argue that the number of hours and weekends worked is not a good proxy for effort.

industry controls rules out the possibility that family-owned and widely-held firms sort into different sectors. While it remains possible that firms sort within each three digit industry, for instance different types of beauty salons or dry cleaners, the extent to which the returns to managerial effort can differ within such narrowly defined groups is likely to be limited.

## 6 Conclusions

Personnel economics models produce an array of testable predictions on how workers and firms match, how firm characteristics drive incentive schemes, how incentives determine worker behavior, and how worker behavior determines firm performance. Due to data limitations, previous empirical work focused on individual predictions.

This paper has explored the potential of utilizing integrated personnel data, combining information about the worker's characteristics, the firm's characteristics, and the terms of the (implicit and explicit) contract linking the worker and the firm. A wide array of empirical regularities can be accounted for by a simple model where incentives and matches are endogenously determined.

The combination of novel and comprehensive data and a simple theory that features widely shared heterogeneity in firms governance has allowed us to make progress along two lines. First, we have showed the key relevance of manager's willingness to bear risk as well as talent as key factors in driving matching with firms. Highly talented and risk-tolerant managers tend to match with firms that value these characteristics the most. Second, we have offered a unified account of several findings in the literature treated so far in isolation and sometimes thought to be independent instead of stemming from the same problem.

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## 7 Appendix 1: Formal Result and Proofs

The model presented above yields the following equilibrium characterization:<sup>42</sup>

**Proposition 1** *Suppose that  $\bar{\gamma}$  is sufficiently small. In equilibrium,  $N$ -firms and  $F$ -firms use contracts with slopes*

$$\begin{aligned}\hat{b}_N(\gamma_j) &= \frac{\phi_N}{1 + \gamma_j \sigma^2} \\ \hat{b}_F(\gamma_j) &= \frac{\phi_F}{1 + \gamma_j \sigma^2}\end{aligned}$$

*Manager  $j$  is matched with an  $N$ -firm if and only if*

$$\theta_j \geq \frac{2(\pi_N - \pi_F)}{\phi_N^2 - \phi_F^2} (1 + \gamma_j \sigma^2) \quad (7)$$

*and, if not, he is matched with an  $F$ -firm if and only if*

$$\theta_j \geq \frac{2\pi_F}{\phi_F^2} (1 + \gamma_j \sigma^2) \quad (8)$$

where

$$\begin{aligned}\pi_F &= \frac{\phi_F^2 (2 + \bar{\gamma} \sigma^2) \bar{\gamma} \bar{\theta} \bar{\gamma}}{D} \\ \pi_N &= \frac{\phi_N^2 (2 + \bar{\gamma} \sigma^2) \bar{\gamma} + \phi_F^2 (\phi_N^2 - \phi_F^2) \bar{\theta} \bar{\gamma}}{D}\end{aligned}$$

With

$$D = (\phi_F^2 + \phi_N^2) (2 + \bar{\gamma} \sigma^2) \bar{\gamma} + (2 + \bar{\gamma} \sigma^2)^2 \bar{\gamma}^2 + \phi_F^2 (\phi_N^2 - \phi_F^2)$$

Equation (7) is the condition that determines the boundary between the  $N$ -region and the  $F$ -region. Similarly, (8) describes the boundary between the  $F$ -region and the unemployment region. The proposition also provides precise expressions for the management-related equilibrium payoffs  $\pi_F$  and  $\pi_N$ , which in turn pin down the region boundaries. It is immediately visible that the management-related payoff is greater in  $N$ -firms than in  $F$ -firms, which – as we discussed above – is due to the comparative advantage that  $N$ -firms have when it comes to incentive provision.

The proof of Proposition 1 follows the informal discussion above, with the addition of a somewhat laborious computation of the actual fixed point of the matching problem.

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<sup>42</sup> The technical condition that  $\bar{\gamma}$  is sufficiently small (i.e. there is more heterogeneity in talent than in risk aversion) guarantees that the regions depicted in Figure 1 are trapezoids rather than triangles. If the condition fails, one would have a different characterization but with similar properties.

## 7.1 Proof of proposition 1

Given the CARA assumption, if  $w$  is normally distributed, the manager's expected payoff can be written as

$$E[u] = E[w] - \frac{1}{2}\gamma V[w] - \frac{1}{2}x^2.$$

Given  $a$  and  $b$ , the manager chooses  $x$  to maximize  $E(u)$ :

$$\begin{aligned} \hat{x} &= \arg \max_x E[w] - \frac{1}{2}\gamma V[w] - \frac{1}{2}x^2 \\ &= \arg \max_x a + bE[y] - \frac{1}{2}b^2\gamma V[y] - \frac{1}{2}x^2 \\ &= \arg \max_x a + bE\left[\sqrt{\theta_j}(x + \varepsilon)\right] - \frac{1}{2}b^2\gamma V\left[\sqrt{\theta_j}(x + \varepsilon)\right] - \frac{1}{2}x^2 \\ &= \arg \max_x a + b\sqrt{\theta_j}x - \frac{1}{2}b^2\gamma\theta_j\sigma^2 - \frac{1}{2}x^2 \end{aligned}$$

The first-order condition on  $x$  yields

$$\hat{x}_j = b^i \sqrt{\theta_j}.$$

The manager's expected payoff is hence

$$\begin{aligned} E[U_j] &= a^i + b^i \sqrt{\theta_j} \hat{x} - \frac{1}{2} (b^i)^2 \gamma \theta_j \sigma^2 - \frac{1}{2} \hat{x}_j^2 \\ &= a^i + (b^i)^2 \theta_j - \frac{1}{2} (b^i)^2 \gamma \theta_j \sigma^2 - \frac{1}{2} (b^i)^2 \theta_j \end{aligned}$$

The expected payoff for a firm that employs manager  $j$  at wage  $(a, b)$  is

$$\begin{aligned} E[V^i] &= E[y_j - w_j^i + h^g - k^i] + (1 - \phi_g) (\Gamma - b^i \theta_j) \\ &= b^i \theta_j - a^i - (b^i)^2 \theta_j + h^g - k^i + (1 - \phi_g) (\Gamma - b^i \theta_j) \end{aligned}$$

Let  $S_j^i = E[U_j] + E[V^i]$  denote the total surplus generated by the match between firm  $i$  and manager  $j$ . As the fixed component can be used to distribute the surplus between the firm and the worker, it is easy to see that the firm will always want to maximize surplus and pay the manager her reservation wage (determined in equilibrium by what she could get if she worked for another firm).

The surplus is

$$\begin{aligned} S_j^i &= E[U_j] + E[V^i] \\ &= \left( \phi_g b^i - \frac{1}{2} (1 + \gamma \sigma^2) (b^i)^2 \right) \theta_j + (h^g - k^i + (1 - \phi_g) \Gamma) \end{aligned}$$

Differentiating the surplus function with respect to  $b^i$  we obtain the optimal contract slope:

$$b^i = \frac{\phi_g}{1 + \gamma_j \sigma^2}$$

Hence, the maximal surplus is

$$\begin{aligned} S_j^i &= \left( \phi_g \frac{\phi_g}{1 + \gamma_j \sigma^2} - \frac{1}{2} (1 + \gamma_j \sigma^2) \left( \frac{\phi_g}{1 + \gamma_j \sigma^2} \right)^2 \right) \theta_j + (h^g - k^i + (1 - \phi_g) \Gamma) \\ &= \frac{1}{2} \frac{\phi_g^2}{1 + \gamma_j \sigma^2} \theta_j + (h^g - k^i + (1 - \phi_g) \Gamma) \end{aligned}$$

Restrict attention to the first term of  $S_j^i$ , which can be thought of as the management-related component of the match surplus. It depends on  $\phi_g$ . We let:

$$\begin{aligned} S_F(\theta_j, \gamma_j) &= \frac{1}{2} \frac{\phi_F^2}{1 + \gamma_j \sigma^2} \theta_j \\ S_N(\theta_j, \gamma_j) &= \frac{1}{2} \frac{\phi_N^2}{1 + \gamma_j \sigma^2} \theta_j \end{aligned}$$

Next, we examine match stability. Note that for all  $\theta_j$  and  $\gamma_j$ ,

$$S_N(\theta_j, \gamma_j) > S_F(\theta_j, \gamma_j)$$

Also, given  $\theta_j \geq \theta_k$  and  $\gamma_j \leq \gamma_k$  (with at least a strict inequality), the following three inequalities hold

$$\begin{aligned} S_N(\theta_j, \gamma_j) &> S_N(\theta_k, \gamma_k) \\ S_F(\theta_j, \gamma_j) &> S_F(\theta_k, \gamma_k) \\ S_N(\theta_j, \gamma_j) - S_F(\theta_j, \gamma_j) &> S_N(\theta_k, \gamma_k) - S_F(\theta_k, \gamma_k) \end{aligned}$$

Given two managers  $j$  and  $k$  with  $\theta_j > \theta_k$  and  $\gamma_j < \gamma_k$ , the following three statements are always false (because they contradict, respectively, one of the three inequalities just stated – a new match could be formed with a higher surplus):

- Manager  $k$  works for an  $N$ -firm and manager  $j$  is unemployed
- Manager  $k$  works for an  $F$ -firm and manager  $j$  is unemployed
- Manager  $k$  works for an  $N$ -firm and manager  $j$  works for an  $F$ -firm

This restricts the shape of the regions of manager types that work for  $N$ ,  $F$ , or are unemployed. It is easy to see that if  $\bar{\gamma}$  is sufficiently small, the regions must be trapezoids, as in Figure 1.

Note that we can write

$$\begin{aligned} S_F(\theta_j, \gamma_j) &= E[U_j] + \phi_F b^i \theta_j - a^i - (b^i)^2 \theta_j \\ S_N(\theta_j, \gamma_j) &= E[U_j] + \phi_N b^i \theta_j - a^i - (b^i)^2 \theta_j \end{aligned}$$

Perfect competition among firms means that all  $F$ -firms must have the same management-related payoff

$$\pi_F = \phi_F b^i \theta_j - a^i - (b^i)^2 \theta_j$$

and all  $N$ -firms must have the same management-related payoff

$$\pi_N = \phi_N b^i \theta_j - a^i - (b^i)^2 \theta_j$$

A manager  $j$  who is employed by an  $F$ -firm receives expected utility

$$u_j = S_F(\theta_j, \gamma_j) - \pi_F$$

and every manager  $j$  that is employed by an  $N$ -firm receives utility

$$u_j = S_N(\theta_j, \gamma_j) - \pi_N$$

The managers on the line that separates the  $F$  region from the unemployment region receive their outside option: zero. Hence all the surplus goes to the firm

$$S_F(\theta_j, \gamma_j) = \pi_F$$

The managers on the line that separates the  $F$  region and the  $N$  region are indifferent between working for an  $N$ -firm and an  $F$ -firm. Hence

$$S_N(\theta_j, \gamma_j) - \pi_N = S_F(\theta_j, \gamma_j) - \pi_F$$

These two indifference conditions can be applied to the extreme cases:  $\gamma_j = 0$  and  $\gamma_j = \bar{\gamma}$ , yielding

$$S_F(t_F, 0) = \pi_F$$

$$S_F(s_F, \bar{\gamma}) = \pi_F$$

$$S_N(t_N, 0) - S_F(t_N, 0) = \pi_N - \pi_F$$

$$S_N(s_N, \bar{\gamma}) - S_F(s_N, \bar{\gamma}) = \pi_N - \pi_F$$

We can re-write the first four equations as

$$\begin{aligned} \frac{1}{2} \phi_F^2 t_F &= \pi_F \\ \frac{1}{2} \frac{\phi_F^2}{1 + \bar{\gamma} \sigma^2} s_F &= \pi_F \\ \frac{1}{2} \phi_N^2 t_N - \frac{1}{2} \phi_F^2 t_N &= \pi_N - \pi_F \\ \frac{1}{2} \frac{\phi_N^2}{1 + \bar{\gamma} \sigma^2} s_N - \frac{1}{2} \frac{\phi_F^2}{1 + \bar{\gamma} \sigma^2} s_N &= \pi_N - \pi_F \end{aligned}$$

That is

$$\begin{aligned}
t_F &= \frac{2\pi_F}{\phi_F^2} \\
s_F &= \frac{2\pi_F}{\phi_F^2} (1 + \bar{\gamma}\sigma^2) \\
t_N &= \frac{2(\pi_N - \pi_F)}{\phi_N^2 - \phi_F^2} \\
s_N &= \frac{2(\pi_N - \pi_F)}{\phi_N^2 - \phi_F^2} (1 + \bar{\gamma}\sigma^2)
\end{aligned}$$

The area of the regions (trapezoids) correspond to the mass of firms in business. Hence

$$\begin{aligned}
\frac{(t_F + s_F) \bar{\gamma}}{2} &= \bar{\theta} \bar{\gamma} - n_F - n_N \\
\frac{(t_N + s_N) \bar{\gamma}}{2} &= \bar{\theta} \bar{\gamma} - n_N
\end{aligned}$$

Then

$$\frac{\pi_F}{\phi_F^2} (2 + \bar{\gamma}\sigma^2) \bar{\gamma} = \bar{\theta} \bar{\gamma} - n_N - n_F \quad (9)$$

$$\frac{\pi_N - \pi_F}{\phi_N^2 - \phi_F^2} (2 + \bar{\gamma}\sigma^2) \bar{\gamma} = \bar{\theta} \bar{\gamma} - n_N \quad (10)$$

Finally, the entry condition on  $F$ -firms implies that the expected payoff of the least profitable  $F$ -firm (let's call it  $\bar{i}$ ) is zero:

$$\begin{aligned}
E[V^i] &= E[y_j - w_j^i + h_F - k^i] + (1 - \phi_F) (\Gamma_F - b^i \theta_j) \\
&= b^i \theta_j - a^i - (b^i)^2 \theta_j + h_F - k^i + (1 - \phi_F) (\Gamma_F - b^i \theta_j) \\
&= \pi_F + h_F - k^{\bar{i}} + (1 - \phi_F) \Gamma_F = 0
\end{aligned}$$

implying

$$k^{\bar{i}} = \pi_F + h_F + (1 - \phi_F) \Gamma_F$$

As there are  $k^{\bar{i}}$   $F$ -firms with a lower  $k$ , the mass of active  $F$ -firms is

$$n_F = \pi_F + h_F + (1 - \phi_F) \Gamma_F$$

Similarly, the mass of active  $F$ -firms is

$$n_F = \pi_F$$

Hence (9) and (10) become

$$\begin{aligned}
\pi_F (2 + \bar{\gamma}\sigma^2) \bar{\gamma} &= \phi_F^2 (\bar{\theta} \bar{\gamma} - \pi_N + h_N + (1 - \phi_N) \Gamma - \pi_F - h_F - (1 - \phi_F) \Gamma) \\
(\pi_N - \pi_F) (2 + \bar{\gamma}\sigma^2) \bar{\gamma} &= (\phi_N^2 - \phi_F^2) (\bar{\theta} \bar{\gamma} - \pi_N)
\end{aligned}$$

Let  $G_F = h_F + (1 - \phi_F) \Gamma_F$ ,  $H = (2 + \bar{\gamma}\sigma^2) \bar{\gamma}$ ,  $F \equiv \phi_F^2$  and  $N \equiv \phi_N^2 - \phi_F^2$ . Then,

$$\begin{aligned}\pi_F H &= F (\bar{\theta}\bar{\gamma} - \pi_N - \pi_F - G_F) \\ (\pi_N - \pi_F) H &= N (\bar{\theta}\bar{\gamma} - \pi_N)\end{aligned}$$

with solution

$$\begin{aligned}\pi_F &= F \frac{H\theta\gamma - (H + N)G_F}{2FH + FN + HN + H^2} \\ \pi_N &= \frac{FH\theta\gamma + FN\theta\gamma + HN\theta\gamma - FHG_F}{2FH + FN + HN + H^2}\end{aligned}$$

which can be written as

$$\begin{aligned}\pi_F &= \frac{\phi_F^2 (2 + \bar{\gamma}\sigma^2) \bar{\gamma} - (2 + \bar{\gamma}\sigma^2 + \phi_N^2 - \phi_F^2) G_F \bar{\theta}\bar{\gamma}}{D} \\ \pi_N &= \frac{\phi_F^2 (2 + \bar{\gamma}\sigma^2) \bar{\gamma}\bar{\theta}\bar{\gamma} + \phi_F^2 (\phi_N^2 - \phi_F^2) \bar{\theta}\bar{\gamma} + (2 + \bar{\gamma}\sigma^2) \bar{\gamma} (\phi_N^2 - \phi_F^2) \bar{\theta}\bar{\gamma} - \phi_F^2 (2 + \bar{\gamma}\sigma^2) \bar{\gamma} G_F}{D} \\ &= \frac{\phi_F^2 (\phi_N^2 - \phi_F^2) \bar{\theta}\bar{\gamma} + \phi_N^2 (2 + \bar{\gamma}\sigma^2) \bar{\theta}\bar{\gamma}^2 - \phi_F^2 (2 + \bar{\gamma}\sigma^2) \bar{\gamma} G_F}{D}\end{aligned}$$

with

$$\begin{aligned}D &= 2FH + FN + HN + H^2 \\ &= 2\phi_F^2 H + \phi_F^2 (\phi_N^2 - \phi_F^2) + H (\phi_N^2 - \phi_F^2) + H^2 \\ &= \phi_F^2 H + \phi_F^2 (\phi_N^2 - \phi_F^2) + \phi_N^2 H + H^2 \\ &= \phi_F^2 (2 + \bar{\gamma}\sigma^2) \bar{\gamma} + \phi_N^2 (2 + \bar{\gamma}\sigma^2) \bar{\gamma} + (2 + \bar{\gamma}\sigma^2)^2 \bar{\gamma}^2 + \phi_F^2 (\phi_N^2 - \phi_F^2) \\ &= (\phi_F^2 + \phi_N^2) (2 + \bar{\gamma}\sigma^2) \bar{\gamma} + (2 + \bar{\gamma}\sigma^2)^2 \bar{\gamma}^2 + \phi_F^2 (\phi_N^2 - \phi_F^2)\end{aligned}$$

## 7.2 Proof of implication 1

Manager  $j$  is characterized by talent  $\theta_j$  and risk aversion  $\gamma_j$ . An increase in the risk-aversion coefficient  $\gamma_j$  leads to a decrease in

$$\hat{b}^i(\gamma_j) = \frac{\phi_g}{1 + \gamma_j \sigma^2},$$

both because  $\frac{\phi_g}{1 + \gamma_j \sigma^2}$  is decreasing in  $\gamma_j$  and because, for  $\gamma_j$  large enough, the value of  $\hat{b}^i(\gamma_j)$  jumps from  $\frac{\phi_N}{1 + \gamma_j \sigma^2}$  down to  $\frac{\phi_F}{1 + \gamma_j \sigma^2}$ .

The contract slope  $\hat{b}^i$  is non-decreasing in  $\theta_j$ : while  $\frac{\phi_g}{1 + \gamma_j \sigma^2}$  does not depend on  $\theta_j$ , for  $\theta_j$  large enough, the value of  $\hat{b}^i(\gamma_j)$  jumps from  $\frac{\phi_F}{1 + \gamma_j \sigma^2}$  up to  $\frac{\phi_N}{1 + \gamma_j \sigma^2}$ .

### 7.3 Proof of implication 2

For (a), note that the manager's effort is  $\hat{x}_j = b^i \sqrt{\theta_j}$ . Hence, it is positively correlated to  $b^i$  both directly and indirectly (because by implication 1 the contract slope is positively correlated with  $\theta_j$ ).

Part (b) is immediate as the (expected) variable compensation is  $b^i \hat{x}_j$ . Hence, it is increasing in  $b^i$  both directly and indirectly (through  $\hat{x}_j$ , as per (a)).

It is useful to show (d) before (c). The proof relies on a revealed preference argument. Consider two employed managers with the same risk-aversion coefficient  $\gamma$ , but different talent levels:  $\theta'' > \theta'$ . In equilibrium, the first manager has contract  $(a'', b'')$  while the second receives  $(a', b')$ . We already know that  $b'' \geq b'$ , but we cannot say anything about the fixed part.

The two managers have, respectively, the following expected utilities

$$\begin{aligned} U'' &= a'' + (b'')^2 \theta'' - \frac{1}{2} (b'')^2 \gamma \theta'' \sigma^2 - \frac{1}{2} (b'')^2 \theta'' \\ U' &= a' + (b')^2 \theta' - \frac{1}{2} (b')^2 \gamma \theta' \sigma^2 - \frac{1}{2} (b')^2 \theta' \end{aligned}$$

If the  $\theta''$ -manager were offered contract  $(a', b')$  and exerted the same effort as the other manager, he would still have a higher utility because he is more productive. By a revealed preference argument, if the manager chooses to work for a firm that offers contract  $(a'', b'')$  and chooses a higher level of effort, he must get a utility level that is at least as high.

For (c), consider the same two managers as in point (d) and note that  $U'' \geq U'$  implies that the difference between the expected total compensation of the two managers can be written as:

$$\begin{aligned} (a'' + (b'')^2 \theta'') - (a' + (b')^2 \theta') &\geq \left( \frac{1}{2} (b'')^2 \gamma \theta'' \sigma^2 + \frac{1}{2} (b'')^2 \theta'' \right) - \left( \frac{1}{2} (b')^2 \gamma \theta' \sigma^2 + \frac{1}{2} (b')^2 \theta' \right) \\ &= \frac{1}{2} (\gamma \sigma^2 + 1) \left( (b'')^2 \theta'' - (b')^2 \theta' \right) \\ &\geq 0 \end{aligned}$$

### 7.4 Proof of implication 4

As we saw in the proof of proposition 1, in equilibrium all  $F$ -firms have the same management-related payoff  $\pi_F$  and all  $N$ -firms have the same management-related payoff  $\pi_N$ .

Recall that management-related payoff is defined as

$$\pi_g = \phi_g b^i \theta_j - a^i - (b^i)^2 \theta_j$$

Hence, if  $\pi_g$  is constant and the direct-control part of the payoff, namely  $-(b^i)^2 \theta_j$ , becomes more negative, the profit part  $\phi_g b^i \theta_j - a^i$  must increase.



## 8 Appendix 2: Risk Aversion Measures: External Validation

In this section we provide some support for the risk aversion measure we use, in order to address the main concern that it raises: that it may reflect attributes that we do not observe and cannot control for, which happen to be correlated with the matching between the manager and the firm. We have already provided evidence that elicited risk attitudes are unlikely to reflect skills, as measured by educational attainment. In this section we use an external validity test in order to support our contention that answers to our lottery measures do indeed reflect risk preferences of the managers and not other potentially matching-relevant traits.

To this end, we rely on a sample of 2,295 Italian entrepreneurs and managers who participated in the Ania Survey on Small Companies, conducted in 2008 using face to face interviews. This survey targeted the CEO of the company, and elicited a large number of relevant traits including measures of risk attitudes and abilities. A detailed description of the data is available in Guiso and Rustichini (2010).

The managers were asked the exact same investment lottery question that we employ in this paper, i.e. they were asked to reveal their preferences over a lottery. The average level of the risk tolerance indicator is 20.06 which is very similar to the one in our sample; the standard deviation is 26.6, a bit larger than that in our sample. The Ania survey also provides additional measures of business relevant personality traits and ability: a) optimism; b) an indicator of (over)confidence; c) an index of obstinacy and will power; and d) a measure of ability to sustain enduring effort. Additionally, the survey provides a rich set of information on managers' physical traits and job experience. Finally, matching may be related to some dimension of personal connections, which could in turn be correlated with risk attitudes. For instance, firms may have a preference for a manager born in the same area where the firm is located. If there is a systematic relation between place of birth and risk preferences, our correlations may reflect matching on networking and not on risk preferences. We test this hypothesis including dummies for the region where the manager was born.

In this appendix we analyze the correlation between our risk aversion measures and these additional variables. The results of these regressions, controlling also for CEO demographics and education (a dummy for college degree), are shown in Table A2. Risk tolerance is decreasing in age and higher for males, a pattern that has been found in many other studies of risk attitudes (e.g. Barsky et. al. (1999); Dohmen et. al. (2009)). Reassuringly, other measures of managerial ability which could in principle be relevant for the matching mechanism are in fact uncorrelated with risk aversion. For example, job experience, measured

by the number of years the CEO has been in control of the firm and the year he started working, is uncorrelated with risk tolerance. We also do not find evidence of any statistical correlation between our measure of risk aversion and CEO height (which has been found to capture economic success by Persico et al 2004), whether the manager was the firstborn, and whether the father was an entrepreneur (proxying for inherited entrepreneurial ability). We cannot reject the hypothesis that region of birth fixed effects have some explanatory power - we cannot reject them being jointly equal to zero - but their size is small.

The second column adds to the specification the grade obtained by the manager at the end of secondary school (*Esame di Maturità*), a possibly more precise proxy for cognitive ability which we do not have in our main sample (since some managers have not completed secondary school the sample size is slightly smaller). Even this more sophisticated measure of cognitive ability turns out not to be correlated with risk attitudes.

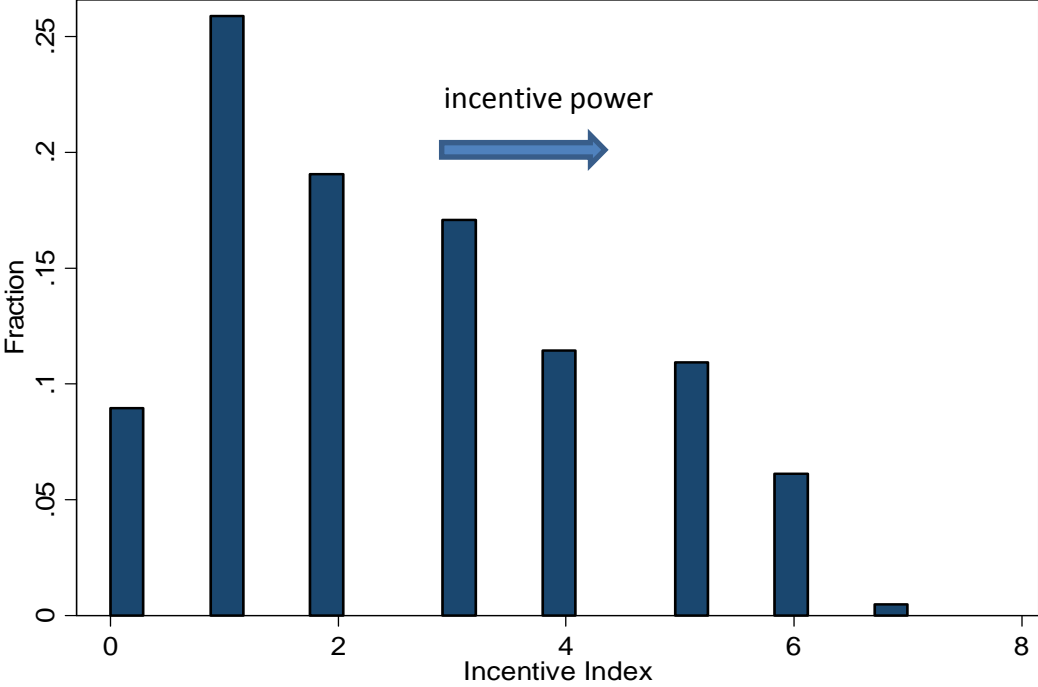
In the third column we include as additional regressors the managerial personality traits described above. Three of the four measures – optimism, confidence, and ability to sustain effort – are not statistically correlated with risk tolerance. The only variable that appears to be correlated with our measure of risk preferences is obstinacy. CEOs that do not give up easily when faced with an unanticipated problem are more risk tolerant. In so far this attitude is important in the matching mechanism, our measure of risk preferences captures it as well. On the other hand, obstinacy may be regarded as a dimension of a person's risk attitudes, in so far as being less afraid of obstacles because of high persistence means one is also more prepared to take risks.<sup>43</sup>

Finally, the Ania survey allows us to verify whether the elicited measure of risk tolerance is able to capture actual risk taking behavior even outside the manager's workplace using information on the portfolio allocation of their private wealth. Table A3 shows the results of a probit regression, where the dependent variable is a dummy for whether the CEO has any stock of listed companies – an indicator of willingness to take extra risk in addition to those involved in managing the firm (and owning shares of private business wealth). Measured risk tolerance is strongly and positively correlated with stock ownership, suggesting that our lottery question is indeed capturing managerial preferences for risk. Interestingly, obstinacy has no predictive power once we control for risk attitudes.

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<sup>43</sup>The obstinacy indicator is based on the following question: "If you are trying to achieve an objective and all of a sudden you are faced with an obstacle, would you give up as the first difficulties show up or would you never give up? Provide your answer on a scale between 0 and 10, with 10 meaning that you would never give up and zero that you would give up immediately.

**Figure 1. Incentive index.**



**Notes:** The incentive index is computed as the sum of seven policy indicators. These are equal to 1 if there is a bonus based on individual or team performance (bonus 1); if the bonus is based on formal appraisals (bonus 2); if the firm has fast tracks for star performers (promotion 1); if promotions depend on performance (promotion 2); if promotions are based on formal appraisals (promotion 3); if managers were fired in the last 3 years due to poor performance (firing 1); if the decisions to dismiss is based on formal appraisals (firing 2).

**Table 1 - Summary Statistics**

<b>Panel A - Firm Characteristics</b>				
	<b>Obs</b>	<b>Mean</b>	<b>Median</b>	<b>Standard Deviation</b>
Ownership: Family of Founder	603	0.47	0	0.50
Ownership: Widely Held	603	0.30	0	0.46
Ownership: Other	603	0.23	0	0.42
Size: between 50 and 100 employees	603	0.20	0	0.27
Size: over 100 employees	603	0.41	0	0.49
Multinational (=1 if firm is a subsidiary of a multinational)	603	0.58	1	0.49
Productivity (x 1000 USD)	547	1720.14	895.80	2310.40
Profits (x 1000 USD)	561	74.90	32.29	169.80
ROCE	541	17.04	15.71	23.36
<b>Panel B - Incentive Policies</b>				
	<b>Obs</b>	<b>Mean</b>	<b>Median</b>	<b>Standard Deviation</b>
Bonus depend on team or individual performance (bonus 1)	603	0.50	1	0.50
Bonus based on formal appraisals (bonus 2)	603	0.33	0	0.47
The firm has fast tracks for star performers (promotion 1)	603	0.37	0	0.48
Promotions depend on performance (promotion 2)	603	0.74	1	0.44
Promotions based on formal appraisals (promotion 3)	603	0.34	0	0.47
Managers fired in the last 3 years due to poor performance (firing 1)	603	0.05	0	0.22
Decisions to dismiss based on formal appraisal (firing 2)	603	0.23	0	0.42
Incentive Index (Sum across variables listed in Panel B)	603	2.56	2.00	1.74
<b>Panel C - Manager Characteristics</b>				
	<b>Obs</b>	<b>Mean</b>	<b>Median</b>	<b>Standard Deviation</b>
<b>Demographics</b>				
Age	603	46.98	46	7.12
Gender (1=men)	603	0.90	1	0.30
<b>Risk and Insurance</b>				
Risk preferences (investment lottery)	603	20.36	20	18.94
Risk choices	603	5.70	6	1.74
Father has College Degree	603	0.16	0	0.37
<b>Talent</b>				
College Degree	603	0.50	1	0.50
Executive Education	603	0.56	1	0.50
Manager has received offers over past 3 years	603	0.71	1	0.46
<b>Panel D - Manager Outcomes</b>				
	<b>Obs</b>	<b>Mean</b>	<b>Median</b>	<b>Standard Deviation</b>
Works 60 or more hours per week	603	0.37	0	0.48
Fixed pay (Euros x Week)	603	1903.70	1682.7	568.2
Variable pay (Euros x Week)	603	299.60	216.3	325.6
Number of benefits	603	4.20	4	1.38
Manager is very satisfied about his job (=1 if yes)	603	0.50	0	0.50
<i>from Social Security Records</i>				
Total pay, current firm, last available year (Euros x Week)	572	1830.10	1658.7	877.30
Average total pay, all past firms and years (Euros x Week)	527	588.90	521.9	324.3
Yearly standard deviation of pay, current firm	419	443.30	333.9	526.88
Average yearly standard deviation of pay, all firms and years	465	221.69	159.7	282.46

**Notes:** All variables are from the ManagerItalia survey, with the exception of Productivity, Profits and ROCE, from AMADEUS and Compensation data in Panel D from INPS (Social Security) records. Other ownership includes: government owned, cooperatives, manager owned and firms owned by a group of private individuals. Productivity is defined as operating revenues over the number of employees. Profits are defined as earnings before interests and taxation over the number of employees. ROCE is defined as operating income over capital employed. The number of observations for Social Security records variables is smaller due to missing values. The last available year is 2004 for 75% of the sample, 2005 for 2.5%, 2006 for 2.5% and 2007 for the remaining 20%. The average fixed compensation is computed over all years and firms the manager has worked for (including non-managerial positions). The standard deviation is computed only if the manager has worked for at least 3 years in the same firm.

**Table 2 - Incentives, Manager Risk Preferences and Manager Talent**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Risk: Individual Preference		Manager College Degree (=1 if yes)		Manager Executive Education (=1 if yes)		Desirability (=1 if Manager has received job offers in past three years)	
<b>Incentive Index</b>	0.868** (0.423)	0.989** (0.481)	0.045*** (0.012)	0.043*** (0.013)	0.060*** (0.011)	0.050*** (0.013)	0.050*** (0.010)	0.043*** (0.012)
<b>Risk: Individual Preference</b>			0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002*** (0.001)	0.002** (0.001)
<b>MNE</b>		-0.157 (1.852)		-0.013 (0.047)		0.118** (0.048)		0.014 (0.044)
<b>50-100 employees</b>		-0.686 (2.187)		0.060 (0.060)		0.098 (0.061)		-0.003 (0.057)
<b>100+ employees</b>		2.407 (2.200)		0.100* (0.052)		0.117** (0.051)		0.063 (0.045)
<b>Constant</b>	18.141*** (1.317)	14.132* (8.152)	0.360*** (0.040)	0.301 (0.300)	0.380*** (0.040)	0.072 (0.381)	0.532*** (0.038)	1.440*** (0.317)
<b>Observations</b>	603	603	603	603	603	603	603	603
<b>Controls</b>	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Robust standard errors in parenthesis. \*\*\* (\*\*) (\*) indicates significance at the 1%, 5%, and 10% level, respectively. Controls include the manager's seniority level, whether he belongs to the owner family, his tenure and category (general administration, finance, sales), indicators for the firm's SIC 2 codes, duration of the interview and interviewer dummies. Risk preference is the probability of failure the manager is willing to bear to choose a risky investment project that yields 10 million euros if successful and 0 if not, instead of a safe project that yields 1 million with certainty.

**Table 3 - Incentives and Manager Behavior**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Works more than 60 hours per week		ln(Fixed Pay)		ln(1+Variable Pay)		Number of Benefits		Job satisfaction (=1 if very happy)	
<b>Incentive Index</b>	0.036***	0.035***	0.025***	0.019**	0.328***	0.306***	0.160***	0.136***	0.030***	0.035***
	(0.011)	(0.013)	(0.007)	(0.008)	(0.028)	(0.032)	(0.031)	(0.036)	(0.011)	(0.013)
<b>Risk: Individual Preference</b>	-0.000	-0.000	0.001	0.001**	0.008***	0.007**	0.002	0.002	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)
<b>MNE</b>		-0.060		0.014		0.507***		0.208		-0.020
		(0.045)		(0.027)		(0.130)		(0.129)		(0.049)
<b>50-100 employees</b>		-0.042		0.074**		0.241		0.093		-0.028
		(0.059)		(0.036)		(0.163)		(0.155)		(0.060)
<b>100+ employees</b>		0.093*		0.093***		0.181		0.056		-0.034
		(0.050)		(0.030)		(0.134)		(0.138)		(0.054)
<b>Constant</b>	0.285***	-0.263	0.512***	-0.190	-2.882***	-4.896***	3.745***	7.099***	0.401***	1.498***
	(0.039)	(0.259)	(0.025)	(0.172)	(0.107)	(0.957)	(0.110)	(0.862)	(0.041)	(0.359)
<b>Observations</b>	603	603	603	603	603	603	603	603	603	603
<b>Controls</b>	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Robust standard errors in parenthesis.\*\*\* (\*\*) (\*) indicates significance at the 1%, 5% ,and 10% level, respectively. Controls include the manager's seniority level, whether he belongs to the owner family, his tenure and category (general administration, finance, sales), indicators for the firm's SIC 2 codes,duration of the interview and interviewer dummies. Risk preference is the probability of failure the manager is willing to bear to choose a risky investment project that yields 10 million euros if successful and 0 if not, instead of a safe project that yields 1 million with certainty.

**Table 4 - Firm Ownership and Personnel Policies**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Incentive Index		Bonus Index		Promotions Index		Dismissal Index	
<b>Family or Founder Ownership</b>	-0.640*** (0.164)	-0.527*** (0.186)	-0.272*** (0.072)	-0.178** (0.084)	-0.250*** (0.087)	-0.197** (0.100)	-0.118** (0.047)	-0.152*** (0.055)
<b>Other Ownership</b>	-0.203 (0.194)	-0.240 (0.216)	-0.063 (0.085)	-0.051 (0.097)	-0.118 (0.103)	-0.109 (0.116)	-0.021 (0.056)	-0.080 (0.064)
<b>MNE</b>		0.836*** (0.159)		0.417*** (0.072)		0.309*** (0.086)		0.110** (0.047)
<b>50-100 employees</b>		-0.220 (0.199)		-0.060 (0.090)		-0.059 (0.107)		-0.102* (0.059)
<b>100+ employees</b>		-0.035 (0.172)		0.018 (0.077)		0.027 (0.092)		-0.080 (0.050)
<b>Constant</b>	2.910*** (0.129)	0.196 (2.556)	0.978*** (0.056)	-0.303 (1.149)	1.590*** (0.068)	0.346 (1.375)	0.343*** (0.037)	0.153 (0.752)
<b>Observations</b>	603	603.00	603	603	603	603	603	603
<b>Controls</b>	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Robust standard errors in parenthesis. \*\*\* (\*\*) (\*) indicates significance at the 1%, 5% and 10% level, respectively. The incentive index is the sum of all seven incentive policies listed in Panel B, Table 1. The bonus index is the sum of *bonus1* and *bonus2*, as defined in Table 1. The promotions index is the sum of *promotion1*, *promotion2*, *promotion3*. The dismissal index is the sum of *firing1*, *firing2*. Controls include the manager's seniority level, whether he belongs to the owner family, his tenure and category (general administration, finance, sales), indicators for the firm's SIC 2 codes, duration of the interview and interviewer dummies.

**Table 5- Incentives, Ownership and Performance**

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Sales/Employees)	Profits/Employees	Roce	Ln(Sales/Employees)	Profits/Employees	Roce
<b>Incentive Index</b>	0.044*	7.606**	1.185**	0.038*	7.287**	1.225**
	(0.023)	(3.717)	(0.574)	(0.023)	(3.705)	(0.575)
<b>Family or Founder Ownership</b>				-0.221**	-15.406	0.956
				(0.100)	(13.051)	(2.191)
<b>Other Ownership</b>				-0.082	-26.486*	-1.239
				(0.121)	(14.816)	(2.993)
<b>MNE</b>	0.059	12.536	-3.074*	-0.011	8.677	-2.709
	(0.080)	(10.578)	(1.764)	(0.083)	(10.634)	(1.817)
<b>50-100 employees</b>	0.153	42.616***	6.934***	0.154	43.345***	6.969***
	(0.108)	(13.162)	(2.334)	(0.108)	(13.133)	(2.328)
<b>100+ employees</b>	0.746***	77.305***	5.461**	0.727***	77.194***	5.629**
	(0.119)	(19.358)	(2.427)	(0.118)	(19.311)	(2.436)
<b>Constant</b>	8.827***	65.308	-12.018	8.911***	65.505	-11.970
	(0.365)	(50.027)	(7.626)	(0.356)	(50.376)	(7.833)
<b>Observations</b>	1813	1851	1792	1813	1851	1792
<b>Number of firms</b>	557	568	567	557	568	567
<b>Controls</b>	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors clustered at the firm level in parenthesis.\*\*\* (\*\*) (\*) indicates significance at the 1%, 5%, and 10% level, respectively. The number of observations varies due to the different availability of the performance measures. In all columns we drop the top and bottom 1% firms ranked by performance. Controls include indicators for the firm's SIC 2 codes, duration of the interview and interviewer dummies.



**Table 6- Incentives and Managerial Pay (Social Security Data)**

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	In(Pay) Survey Data		In(Pay) INPS Records				In(Standard Deviation Pay)			
Statistics computed over	Current Firm		Current Firm-Last Available Year	Average over past jobs		Current Firm		Average over past jobs		
<b>Incentive Index</b>	0.026*** (0.007)	0.028*** (0.008)	0.038*** (0.012)	0.033*** (0.012)	0.046*** (0.015)	0.037** (0.015)	0.070*** (0.021)	0.055** (0.025)	0.059** (0.023)	0.062** (0.029)
<b>Risk: Individual Preference</b>	0.001 (0.001)	0.001** (0.001)	0.001 (0.001)	0.002** (0.001)	0.002 (0.001)	0.000 (0.001)	0.000 (0.002)	0.001 (0.002)	-0.000 (0.002)	-0.002 (0.002)
<b>MNE</b>		-0.006 (0.028)		0.066 (0.040)		0.101* (0.056)		0.035 (0.092)		0.031 (0.094)
<b>50-100 employees</b>		0.072** (0.035)		0.060 (0.051)		0.043 (0.075)		0.064 (0.115)		0.022 (0.118)
<b>100+ employees</b>		0.090*** (0.031)		-0.004 (0.043)		0.042 (0.057)		0.045 (0.099)		0.072 (0.103)
<b>Constant</b>	0.510*** (0.026)	0.288 (0.266)	0.149*** (0.040)	-0.900*** (0.295)	-0.833*** (0.052)	-1.279*** (0.421)	5.631*** (0.074)	4.682*** (0.848)	4.930*** (0.079)	5.040*** (0.958)
<b>Observations</b>	573	573	573	573	528	528	420	420	466	466
<b>Controls</b>	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Robust standard errors in parenthesis.\*\*\* (\*\*) (\*) indicates significance at the 1%, 5%, and 10% level, respectively.

The number of observations is smaller due to missing values in the Social Security records. The last available year is 2004 for 75% of the sample, 2005 for 2.5%, 2006 for 2.5%, and 2007 for the remaining 20%. The average compensation in columns (5) and (6) is computed over all years and firms the manager has worked for (including non-managerial positions). The standard deviation in columns (7) and (8) is computed over the years worked in the current firm. The dependent variable in columns (9) and (10) is computed as the mean of the standard deviations of yearly earnings in all the firms the manager has worked for. All standard deviations are computed only if the manager has worked for at least 3 years in the same firm. Controls include: the manager's seniority level, whether he belongs to the owner family of the current firm, his tenure in the current firm and category (general administration, finance, sales), overall tenure since his first job, the number of firms he has worked for, and the average number of weeks worked in a year, duration of the interview and interviewer dummies.

**Table A1 Sample Selection****Panel A: Firm Characteristics**

Probit Estimates

Dependent variable equals 1 if the firm is in the sample, 0 otherwise

Log (Employment)	-0.032 (0.024)	-0.041 (0.026)	-0.034 (0.024)	-0.033 (0.024)
Log (Sales/Employees)		-0.027 (0.033)		
Profits/Employees			-0.000 (0.000)	
ROCE				-0.001 (0.001)
Observations	5500	5286	5389	5202
Time Period	2004-2007	2004-2007	2004-2007	2004-2007
Number of Firms in Population	1660	1660	1660	1649
Number of Firms in Sample	560	560	560	557
Sic2 dummies	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes

Notes: \*\*\* (\*\*) (\*) indicates significance at the 1%, 5% and 10% level, respectively. Robust standard errors clustered at the firm level in parenthesis. The number of firms is lower than the population we sampled from (1815) due to missing values in the balance sheet data.

**Panel B: Manager Characteristics**

Probit Estimates

Dependent variable equals 1 if the firm is in the sample, 0 otherwise

Log (Age)	-0.149 (0.220)	-0.097 (0.227)	0.205 (0.237)	0.185 (0.239)	0.138 (0.295)
Gender (1=men)	0.145 (0.099)	0.141 (0.099)	0.191* (0.101)	0.191* (0.101)	0.221* (0.115)
Log (tenure in current firm)		-0.032 (0.035)	-0.028 (0.035)	-0.030 (0.035)	0.000 (0.078)
Log (current pay)			-0.298*** (0.072)	-0.286*** (0.073)	-0.223* (0.128)
Log (mean yearly pay growth)				-0.046 (0.065)	-0.052 (0.083)
Log (standard deviation of pay)					-0.068 (0.079)
Observations	1731	1731	1731	1731	1295
Number of Managers in Population	1731	1731	1731	1731	1295
Number of Managers in Sample	572	572	572	572	419

Notes: Robust standard errors in parenthesis.\*\*\* (\*\*) (\*) indicates significance at the 1%, 5% and 10% level, respectively.

The number of observations (1731) is smaller than the number of managers we sampled from (1815) due to missing values in the Social Security records. Tenure is the number of years the manager has been working for the current firm. Current pay is equal to total annual pay divided by weeks worked in 2004. Mean yearly pay growth equals the mean yearly change in pay since the manager's first job until 2004. The standard deviation of pay is computed over the years worked in the current firm if the manager has worked for at least 3 years.

**Table A2 - Risk Preference, Demographics, Psychological Traits and Talent**

Dependent Variable	Risk Preference		
Age	-0.109*	-0.177**	-0.140*
	(0.099)	(0.041)	(0.050)
Age started working	0.132	0.238	0.232
	(0.450)	(0.303)	(0.216)
N. of years in control	-0.067	-0.045	-0.072
	(0.230)	(0.535)	(0.239)
Male	6.913***	8.462***	7.653***
	(0.000)	(0.000)	(0.000)
Height (cm)	-0.052	-0.177	-0.073
	(0.591)	(0.140)	(0.474)
First born	-0.806	-2.500	-0.662
	(0.513)	(0.114)	(0.614)
Father entrepreneur	1.154	0.727	0.844
	(0.367)	(0.647)	(0.533)
College degree	3.344**	3.126	1.478
	(0.049)	(0.126)	(0.410)
Grade at secondary school diploma		0.011	
		(0.908)	
Optimism			0.008
			(0.984)
(Over)confidence			2.383
			(0.133)
Obstinacy			0.961**
			(0.020)
Ability to stand effort			-0.133
			(0.598)
Constant	20.412	65.291**	29.004
	(0.255)	(0.012)	(0.191)
Observations	1952	1290	1738
Regional dummies includes (F-test)	4.21	4.35	3.68

**Table A3 -Financial Risk Taking and Risk Preference**

Dependent Variable	Financial Risk Taking	
<b>Risk tolerance</b>	0.001*** (0.000)	0.001*** (0.000)
<b>Age</b>	0.003** (0.012)	0.002* (0.059)
<b>Age started working</b>	0.003 (0.310)	0.004 (0.122)
<b>N. of years in control</b>	0.001 (0.252)	0.001 (0.313)
<b>Male</b>	0.032 (0.213)	0.031 (0.262)
<b>Height (cm)</b>	0.002 (0.191)	0.002 (0.210)
<b>First born</b>	-0.000 (0.983)	0.005 (0.814)
<b>Father entrepreneur</b>	0.023 (0.223)	0.013 (0.542)
<b>College degree</b>	0.089*** (0.000)	0.066** (0.013)
<b>Optimism</b>		-0.002 (0.756)
<b>(Over)confidence</b>		0.027 (0.246)
<b>Obstinacy</b>		0.008 (0.214)
<b>Ability to stand effort</b>		0.002 (0.585)
<b>Observations</b>	1952	1738

Notes: Robust standard errors in parenthesis. \*\*\* (\*\*) (\*) indicates significance at the 1%, 5%, and 10% level, respectively. Financial risk taking is a dummy equal to 1 if the manager has stocks of listed companies in his personal portfolio besides owning any stock of his firm . Risk tolerance is the probability at which the manager switches from choosing the risky prospect yielding 10 million euros with that probability (and 0 otherwise) to the safe prospect that yields 1 million with certainty.

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