

The Effect of Competition on Executive Compensation and Incentives: Evidence from a Quasi-natural Experiment*

Ana P. Fernandes
Priscila Ferreira
L. Alan Winters

ABSTRACT

This paper studies the effect of increased product market competition on executive compensation and incentives. We use a reform that simplified firm entry regulation in Portugal as a quasi-natural experiment, and exploit its staggered implementation across municipalities for identification. Using employer-employee data, we find that increased competition following the reform raised total pay but reduced the sensitivity of pay to firm performance. This is consistent with theoretical results showing that a fall in entry costs weakens managerial incentive provision. Entry deregulation also increased performance-induced CEO turnover and firms' probability of exit, suggesting that competition provides direct incentives for managerial effort.

Key Words: Entry Deregulation, Executive Compensation, Managerial Incentives, Performance-related Pay, Product Market Competition.

JEL Classification: J31, J33

* Ana P. Fernandes is a senior lecturer at the University of Exeter (United Kingdom). Email: a.p.o.fernandes@exeter.ac.uk. Priscila Ferreira is assistant professor of economics at the University of Minho (Portugal) and research fellow at NIMA. L. Alan Winters is a professor of economics at the University of Sussex (United Kingdom) and research fellow at CEPR, GDN and IZA. The authors are grateful to two anonymous referees for valuable comments that contributed to improve the paper. They also thank participants at the EALE 2014 conference for suggestions and acknowledge data access from the Portuguese Ministry of Labor and Social Solidarity and the Office for National Statistics (INE). The research was partially funded by Fundação para a Ciência e a Tecnologia through the Applied Microeconomics Research Unit [NIMA], award no. PEst-OE/EGE/UI3181/2014.

1. Introduction

The pay of CEOs and other top executives has received wide attention recently from both policymakers and academic researchers. The main reason is the sharp increase in top executives' pay relative to that of other workers in the firm (Bertrand, 2009). The key question for many is whether top executives are really worth so much. This frequently comes down to the link between their pay and the performance of the firms they manage. The empirical research reviewed in Murphy (1999) and in Bertrand (2009) suggests that executive pay is correlated with measures of firm performance, but that there is more to CEO pay than just this - Bertrand and Mullainathan (2001), for example, show that CEOs are also rewarded for luck.

In this paper we take an empirical approach to a relatively neglected aspect of performance-related pay - the way in which it is affected by product market competition. The link between competition and managerial incentives has attracted significant theoretical attention (see, for example, Hart, 1983; Hermalin, 1992; Schmidt, 1997; and Raith, 2003) but has not been fully explored empirically.¹ Moreover, the theoretical predictions from this literature are largely ambiguous. To the extent that competition increases the probability of liquidation, it has a positive effect on managerial effort, whereas a reduction in firm size reduces the value of inducing managerial effort. The starting point for our empirical analysis is the insight of Raith (2003). He develops a theoretical model where product market competition and the provision of managerial incentives are jointly determined. The link between competition and incentive provision depends on the way in which competition

¹ Our results regarding the effect of firm entry deregulation on executives' performance-related pay complement those in Hubbard and Palia (1995) and Cuñat and Guadalupe (2005, 2009, 2009b). Hirsch and Macpherson (2000) and Black and Strahan (2001), among others, study the link between deregulation and wages. We review the empirical literature in the next section.

increases. Greater substitutability between varieties or increased market size lead to stronger managerial incentives, whereas reducing barriers to firm entry weakens the provision of managerial incentives. Determining which of these mechanisms dominates remains an open empirical question. The aim of this paper is to examine the firm entry channel empirically, by studying an episode of comprehensive entry deregulation across industries.

We investigate the effect of firm entry deregulation on both the fixed and the variable components of executives' pay, focussing particularly on the latter, which is a function of firm performance. We assess whether the sensitivity of pay to firm performance changes with product market competition, for top executives and department managers, relative to other workers in the firm. We do so using linked employer-employee data for the universe of private sector firms and workers in Portugal, and by exploiting the "On the Spot Firm" program. Introduced in 2005, the explicit aim of the "On the Spot Firm" program was to reduce the cost of firm entry by eliminating the bureaucracy required to register a new firm. Prior to 2005, an entrepreneur would need to visit several public offices to register a business; it took on average 78 days to complete the 11 required procedures and cost around 13.5 percent of GDP per capita. The "On the Spot Firm" program created one-stop shops where entrepreneurs can register a company in a single visit, reducing the cost of registering a firm to less than 3 percent of GDP per capita.²

The "On the Spot Firm" offices were initially opened in a few municipalities and in subsequent years the program was expanded to municipalities across the country.³ We exploit the cross-time and cross-municipality variation in the implementation of the reform to estimate its effects on executives' compensation structure. Using the roll-out of the program as an exogenous source of increased firm entry and product market competition, we provide

² As a result, between 2005 and 2010, Portugal rose from 113th to 26th in the World Bank's "Doing Business" ranking.

³ By the end of 2009 there were 164 one-stop shops dispersed throughout Portugal (see Figure 1).

quasi-natural experimental evidence on the effect of entry deregulation on executives' pay-performance sensitivity, as well as on the fixed component of compensation.

To estimate the slope of the pay-performance relationship, and determine how it changed after the deregulation of firm entry, we merge the linked employer-employee data with balance sheet information on firm performance. The fact that our data cover the universe of private sector firms and all of their workers is a significant advantage relative to most existing studies which have focussed on top executives in the largest, publicly traded firms. Additionally, by using the "On the Spot Firm" program as a quasi-natural experiment we are able to identify the causal link between competition and performance-related pay of executives cleanly, avoiding the caveats associated with common measures of competition. Concentration ratios or the Herfindahl-Hirschman index face a number of limitations, including potential endogeneity, correlation with omitted variables and non-monotonicity of their effects on outcome variables (Sutton, 1991).

Our main finding is that the increase in competition following the "On the Spot Firm" reform increased top executives' and department managers' overall pay, but decreased their dependence on firm performance. That is, after the firm entry deregulation firms changed the structure of managerial compensation, substituting away from performance-based pay and towards fixed pay. This empirical result is in line with the notion that competition mitigates managerial slack (Hart, 1983). Competition enforces discipline on managers, and induces owners to provide flatter marginal incentive schemes, as there is less need to rely on monetary incentives. Our novel evidence on the link between increased competition and the pay-performance sensitivity of executives supports Raith's theoretical prediction that lower entry costs weaken the provision of monetary managerial incentives.

To rationalise the estimated effects on the wage structure and further assess the provision of managerial incentives, we investigate how increased competition following the reform

affects top executives' performance-induced turnover, and firms' probability of liquidation. We find that following the "On the Spot Firm" program lower firm performance is associated with an increased risk of CEOs' job-exit. Thus, firms appear to use management changes as an incentive mechanism to induce managerial effort, and their use is encouraged by increased competition. We also find that the probability of firm exit increases. Since the threat of liquidation imposes discipline on managers and reduces managerial slack, an increase in competition provides a direct incentive for the manager to exert more effort. This is consistent with the lower sensitivity of pay to firm performance, as owners have less need to rely on compensation-based incentives. Finally, in line with the view that competitive environments require more capable CEOs (e.g., Hubbard and Palia, 1995), we find that the reform is associated with an increased probability that firms employ CEOs with greater talent. This helps rationalise the overall increase in salary, required to attract more talented managers.

The linked employer-employee data that we use (*Quadros de Pessoal*) has unusually rich and detailed information, such as the workers' gender, age, education, occupation, type of contract of employment, hiring date in the firm, hours of work and earnings, split into each component (salary and bonus); and the firms' industry, location, total employment, number of establishments, sales volume, legal and ownership structures. The data thus allow us to obtain estimates that control for observed worker and firm characteristics, as well as for unobserved worker or firm-worker (match) specific heterogeneity, and for changes in industry composition and regional characteristics. Controlling for firm-worker fixed effects, we are able to identify the effects from individuals that stay in the same firm after the deregulation, and not from those that move to other firms, with potentially different structures of compensation.

Overall, our results have important implications for policy that aims to improve competition through deregulation: increased competition within industries may mitigate managerial slack and reduce the need to rely on incentive-based pay schemes. As argued in Giroud and Mueller (2010, 2011), by enforcing discipline on managers, increased competition may also reduce inefficiencies associated with weak corporate governance which are shown to be prevalent in less competitive industries.

The role of barriers to firm entry is also of considerable practical importance. Many countries have sought over the last decade to increase product market competition through entry deregulation, and as cash-strapped governments seek ways of stimulating growth without additional public expense, this trend is likely to continue.⁴ Moreover, within the banking industry, in which performance-related pay is sometimes thought to have got out of hand, there is also great concern about barriers to entry restricting competition. Our results show how reducing entry barriers in Portugal affected the strength of the link between pay and firm performance, hinting that perhaps the two issues are related.

The paper proceeds as follows. The next section reviews the related literature. Section 3 describes the data used, the “On the Spot Firm” quasi-natural experiment and the identification strategy. Section 4 studies the effect of the reform on firm entry. Section 5 presents the results and discusses the effects of the deregulation on the fixed and performance-based components of executive compensation. Section 6 investigates the effect of the reform on performance-induced executive turnover. Section 7 explores how increased competition following the reform affects firms’ employment decision regarding executives’ talent. Section 8 studies the effects on firm size and probability of liquidation. The last section concludes.

⁴ A number of studies have shown that entry and competition induce productivity growth and innovation (e.g. Blundell et al., 1999; Djankov et al., 2006; and Aghion et al., 2009).

2. Theoretical background and related literature

The aim of our paper is to measure how, following a reduction in firm entry costs, increased product market competition affects the explicit and implicit incentives that firms provide to their managers. In this section we discuss the theoretical literature that studies the relationship between competition and managerial incentives, and review the empirical studies of that relationship.

The theoretical link between competition and managerial incentives is analyzed in a principal-agent setting. Given asymmetric information about the manager's (agent's) effort, it is optimal for shareholders (principals) to offer performance-based pay. It is in this vein that Schmidt (1997) and Raith (2003) investigate how changes in product market competition affect the optimal managerial incentive scheme.⁵

In Schmidt (1997) the competitive environment in which the firm operates affects the contract between the shareholder and the manager. On the one hand, an increase in product market competition increases the probability of liquidation. This has a positive effect on managerial effort as owners provide steeper incentives to the manager. On the other hand, if competition reduces the firm's size, it also reduces the value of a given cost-reduction to the owner, and owners are induced to provide flatter marginal incentive schemes. The overall effect of competition on managerial incentives is ambiguous.

Raith (2003) allows for an endogenous market structure through the free entry and exit of firms. In this setting, product market competition and the provision of managerial incentives are jointly determined. His model predicts that firms will provide stronger incentives to their managers insofar as increased competition operates through changes in market size or the elasticity of substitution, and leads to higher firm-level output. Since increased competition

⁵ Vives (2008) provides a more general analysis, for any fixed expense that reduces marginal costs and different competition modes.

also forces some unprofitable firms to exit, the first of Schmidt's (1997) effects dominates, eliminating the ambiguity. In contrast, if competition increases through a reduction in the cost of firm entry, such as the "On the Spot Firm" program we analyze, new firms enter the market and firm-level output decreases. This reduces the value of a cost reduction and so firms provide weaker managerial incentives, or flatter incentive schemes.

Other theoretical papers, including Hart (1983), Scharfstein (1988) and Hermalin (1992), study how competition affects managerial slack through increases in information about market conditions. If there is a common component to costs across firms, increased competition gives managers, who need to achieve profit targets, less scope to engage in managerial slack than if costs are independent across firms. This can alter the slope of incentive contracts. However, in general, this literature delivers ambiguous results regarding the effect of competition on incentive pay.

Although an empirical literature has investigated the effect of competition on performance-related pay, the evidence is still very limited. Our results complement those in Hubbard and Palia (1995), Burgess and Metcalfe (2000) and Cuñat and Guadalupe (2005, 2009, 2009b), who study the implications of increased product market competition on the sensitivity of pay to performance for executives.⁶

Hubbard and Palia (1995) and Cuñat and Guadalupe (2009b) study the effects of US commercial banking industry deregulation on the pay of CEOs. They find evidence of a stronger pay-performance relation after deregulation. However, whilst Hubbard and Palia (1995) find that the overall level of pay increased, estimates from Cuñat and Guadalupe (2009b) suggest that it fell. Cuñat and Guadalupe (2005, 2009) study the effect of changes in foreign competition on the structure of compensation, and in particular on the pay-

⁶ Aggarwal and Samwick (1999) use Herfindahl indices and measures of own-firm and rival firms' performance to study how strategic interaction between firms affects executive compensation. In some specifications their estimates of both own and rival pay-performance sensitivities are positive.

performance sensitivity for executives and workers.⁷ They show that a higher level of foreign competition is associated with increased sensitivity of pay to firm performance for executives. Burgess and Metcalfe (2000) use questionnaire data for around 2000 UK firms, in which managers report whether they use performance-related pay, and their perceived degree of market competition. They find that perceived competition has a positive effect on the probability that the firm will use performance-related pay. However, their cross-sectional data does not allow explicit estimation of the sensitivity of pay to firm performance.

In this paper, we find that following the “On the Spot Firm” reform, the sensitivity of top executives’ pay to firm performance decreases. Taken together, these two sets of findings lend support to the main theoretical prediction from Raith (2003). Increases in competition that occur through a change in market size or elasticity of substitution increase incentive provision, while increases in competition through lower entry costs (as with the “On the Spot Firm” program) have the reverse effect, leading to flatter incentive schemes.

Our paper is distinct from previous empirical research in several respects. First, while studies of deregulation and managerial pay have focused on the banking industry in the US (Hubbard and Palia, 1995; Cuñat and Guadalupe, 2009b), we exploit an episode of comprehensive entry deregulation across industries. As such, our natural experiment allows us to obtain results that can be interpreted more generally than in that industry, where the structure of executive compensation is likely to have been marked by idiosyncrasies. Second, rather than relying on aggregate data or on a sample of workers or firms, particularly the largest publicly traded firms, we use matched employer-employee data. This allows us to control for unobserved heterogeneity, and to benchmark the findings for top executives and department managers with those for other workers in the firm. Finally, our results provide

⁷ Cuñat and Guadalupe (2005) exploit the 1996 appreciation of the British pound as a quasi-natural experiment, while Cuñat and Guadalupe (2009) use import penetration, instrumented by exchange rates and tariffs, for the US.

novel evidence that the sensitivity of executives' pay to firm performance decreases after a reduction in firm entry costs.

Our study is also related to a broader literature that focuses on executives' performance-related pay (e.g., Jensen and Murphy, 1990; Hall and Liebman, 1998; and more recently Bell and Van Reenen, 2011). Another stream of related literature investigates performance-induced CEO turnover (see, for example, Coughlan and Schmidt, 1985; Jensen and Murphy, 1990; Hubbard and Palia, 1995; Huson et al., 2001; Kaplan and Minton, 2012; and Jenter and Lewellen, 2014). Those studies document an inverse relation between firm performance and CEO turnover, with some evidence that competition strengthens that relation (Hubbard and Palia, 1995; DeFond and Park, 1999). We investigate that link and find consistent evidence that following the "On the Spot Firm" program performance-induced CEO turnover increases.

Finally, studies on corporate governance and product market competition show that weak corporate governance increases the opportunity for managerial slack, reducing firm performance in less competitive industries, where the absence of competition fails to impose discipline on managers (Giroud and Mueller, 2010, 2011).⁸ In the context of our results, the reduction in the pay-performance slope following the "On the Spot Firm" deregulation suggests that increased competition may keep managers incentivized, reducing the need for monetary incentive provision. Good governance can work as an alternative to monetary-based incentives.

⁸ Guadalupe and Pérez-González (2011) find that increased competition lowers the private benefits of control, particularly in countries with a weak rule of law.

3. Data and identification strategy

3.1 Data and descriptive statistics

The main data source used for our analysis is the Portuguese longitudinal linked employer-employee data (LEED) *Quadros de Pessoal* (QP). These data have been collected annually, since 1985, by the Portuguese Ministry of Labour and Social Solidarity and include information on workers and their employers. All private sector firms with at least one employee are required by law to answer the survey. The information in general refers to the situation observed in the month when the survey is collected (October, since 1994), and it covers the firm, each of its plants and each of its workers. Each firm and each worker has a unique registration number which allows them to be traced over time. The survey is administrative and the legal requirement that the firm has it available for public consultation results in an unusually high coverage and reliability.⁹

Firm-level information in the QP data include, for example, the year of creation, industry, location, total number of workers employed in the firm, number of establishments, sales volume, legal setting of the firm, and ownership structure (equity breakdown among domestic private, public or foreign). Information on workers includes, for example, gender, age, education level (schooling), level of skill, occupation, type of contract of employment, hiring date in the firm, promotions, monthly hours of work (normal and overtime) and earnings, split into each component (base wage, seniority payments, regular and irregular bonuses and overtime pay).

Although the QP data include information on salary and bonuses, they do not include long term incentive plans (LTIP) or stock options as most firms are not publicly traded. Hence, our empirical analyses will consider the real monthly pay of the worker. This variable is

⁹ The legal requirement that the data is publicly available at the firm is related to the monitoring by the Ministry of Labor that labor relations within the firm conform to the law.

constructed by summing: (i) the base pay, or gross wage for the normal hours of work; (ii) tenure related payments; and (iii) regular and irregular bonuses. Our results are therefore to be interpreted as the effect of competition on the structure of short-term compensation (salary and bonus).

Other studies that have also used salary and bonus, the short-term component of pay, to study executives' compensation include Murphy (1986), Hall and Liebman (1998), Aggarwal and Samwick (1999), and Bell and Van Reenen (2011). They show that the salary and bonus sensitivity to firm performance is positive and statistically significant. For example, Hall and Liebman (1998) estimate the elasticity of CEO compensation to firm performance separately for salary and bonus and for stock holdings and options, and find that the salary and bonus elasticities are positive and statistically significant, although significantly smaller than those generated by stock holdings and options. Therefore, insofar as we have information only for regular pay and bonuses, our estimates reflect the effect of the “On the Spot Firm” deregulation on the sensitivity of pay to firm performance for short-term compensation.

Our analysis focuses on the period between 2002 and 2009. The linked employer-employee sample contains information on 440,544 distinct firms (contributing 1,881,740 firm-year observations) and 3,694,017 workers (contributing 15,340,574 worker-year observations) over the period. We identify new firms using the reported year when the firm was constituted.¹⁰ The distribution of firms (all firms and entrants) and workers by year for the full matched employer-employee sample is shown in Table 1. We observe that 20 percent of entrant firms were created in municipalities with “On the Spot Firm” offices in 2005, rising to 76 percent within 4 years.

[Table 1 about here]

¹⁰ A firm is an entrant in year t if the reported year of creation is t . Because the survey is collected in October, we recover information on firm births if the reported year of creation is $t-1$ but the firm is observed for the first time in t . In these cases, we set the year of creation of the firm to t .

To investigate the effects of the deregulation on the compensation structure of CEOs, department managers and other workers, we exploit information on the occupational category of each worker. Occupations are recorded in the data according to the International Standard Classification of Occupations of 1988 (ISCO-88).¹¹ The 3-digit level ISCO-88 occupations that we use distinguish between top executives (category 121), department managers (categories 122 and 123) and other workers (all other occupational categories).¹²

Our regressions control for observable characteristics of the worker: gender, age and tenure (and their squares), type of contract of employment (open-end or closed-end) and educational level.¹³ We also control for firm characteristics: the log of size (number of employees), ownership status (private, public or foreign owned), whether the firm is an exporter or multi-plant and the profits of rival firms.¹⁴

The measure of firm performance is the firm's annual accounting profit before tax. Since our data includes large and small firms, most are not publicly traded and as such, we are unable to use stock-market returns to measure firm performance, as in most previous

¹¹ We limit the sample period to end in 2009 for consistency of the classification of occupations since a new classification was introduced in 2010 which affected the managerial categories.

¹² The definition of the ISCO88 categories for executives is as follows: ISCO88 121 - "Directors and Chief Executives"; ISCO88 122 - "Production and Operations Department Managers"; ISCO88 123 - "Other Department Managers" (including Finance and administration, Personnel and industrial relations, Sales and marketing, Advertising and public relations, Supply and distribution, Computing services, Research and development, Other). Although the category "Directors and Chief Executives" can include top executives other than the CEO, firms in our sample have on average (and median) one individual in that category; we refer to individuals in that category as top executives or CEOs.

¹³ The level of education is recorded according to the UNESCO 1997 International Standard Classification of Education (ISCED). The correspondence between ISCED levels and years of schooling in Portugal is: ISCED 1 - first and second stages of basic education (up to 6 years of schooling); ISCED 2 - lower secondary education (9 years of schooling); ISCED 3 - upper secondary education (12 years of schooling); ISCED 5/6 - higher education (more than 15 years of schooling, corresponding to university degrees). In Portugal, there is no equivalence to ISCED level 4; and it is not possible to distinguish between ISCED levels 5 and 6 from the data.

¹⁴ Information on exporters is from the International Trade dataset, collected by the Portuguese Office for National Statistics (INE). This dataset includes the universe of monthly export and import transactions by Portuguese firms.

studies.¹⁵ Profit data is from the Sistema de Contas Integradas das Empresas (SCIE; Enterprise Integrated Accounts System), a census of firms since 2004, providing detailed information on firms' balance-sheet; and from its predecessor for the period prior to 2004, the Inquerito Anual as Empresas (IAE; Annual Survey of Enterprises), which covers a representative sample of around 40,000 firms. Both datasets are collected annually by the Office for National Statistics and have a firm identifier compatible with that of the QP-LEED. Our analysis uses private sector manufacturing and services firms, excluding those in agriculture, fishing and mining, covering 46 industries.

We merge the employer-employee data with the IAE-SCIE data with information on firms' profit. Online Appendix Table 1 reports the description, and percentage distribution of observations, for the merged sample, across SIC 2-digit industries.¹⁶ For estimation purposes, for the regressions on the structure of compensation, we exclude very small firms, with fewer than 10 workers, and trim outliers on the 1 percent tails of the profit distribution.¹⁷ Detailed descriptive statistics for logged pay by occupation, for the final merged estimation sample, are reported in Table 2, while Online Appendix Table 2 reports summary statistics for all variables.¹⁸

¹⁵ Previous work has shown the relevance of using profit to measure performance in the analysis of compensation schemes (see Blanchflower and Oswald, 1988; Bushman and Smith, 2001; Cuñat and Guadalupe, 2005).

¹⁶ The online appendix can be found at <http://jhr.uwpress.org/>.

¹⁷ The results remain robust whether or not those observations are included.

¹⁸ Due to the sampling nature of the IAE-SCIE in the years prior to 2004, the resulting merged sample has a lower number of observations than that reported in Table 1 for the QP-LEED data. After dropping observations with missing data for some variables (e.g., pay or region), we have 13,677,986 worker-year observations. Merging with the profit data results in 10,251,266 observations matched. After dropping micro firms (with less than 10 workers throughout) and accounting for observations present in the data only once, we are left with 8,689,993 worker-year observations. Trimming outliers of the 1 percent tails of the profit distribution, 8,489,026 observations remain in the final estimation sample, shown in Table 2.

As shown in Table 2, CEOs are the group of workers with higher average real monthly pay (In monthly pay of 8.2, around 3650 euros), followed by department managers (with average monthly pay of 7.7 log points, around 2208 euros); the “other workers” group has significantly lower average monthly pay (6.64 log points, around 765 euros). Online Appendix Table 2 shows that only 17.5 percent of CEOs in our sample are women; and 74 percent of CEOs hold a university degree. CEOs are more likely than other workers to be employed by foreign owned firms (19 percent) or by export-oriented firms (72 percent). On the other hand, “other workers” are generally younger (37 years on average), have lower levels of educational attainment (only 8.4 percent hold a university degree, and 51 percent have only attained ISCED level 1) and the rate of female labor market participation in this group is significantly larger (44 percent). These workers are mostly employed by private national firms (83 percent). Regarding the “On the Spot Firm”, 36 percent (39 percent) of observations in the CEOs (“other workers”) group are in municipalities with one-stop shops during the period of analysis.

[Table 2 about here]

3.2. Identification strategy and the “On the Spot Firm” program

This section describes the “On the Spot Firm” business registration reform and our identification strategy. Prior to 2005, the bureaucracy associated with setting up a new firm in Portugal was extensive, with several Ministries involved, requiring an entrepreneur to fulfil 11 procedures and complete 20 forms. In all, it took around 78 days and fees equivalent to around 13.5 percent of GDP per capita.¹⁹ In May 2005, the newly elected government created the Unit for Coordination of Administrative Modernization (UCMA) to coordinate across ministries, which in turn led the Ministry of Justice to introduce the “On the Spot Firm”

¹⁹ This compares with an average of 6.8 percent in the OECD (World Bank, 2006).

(Empresa na Hora) program.²⁰ The program was intended to reform public services and improve their efficiency, in order to reduce the red tape associated with setting up a new firm, decreasing the time and complexity of the process. The goal was to promote national and foreign investment by reducing the costs of registering a firm below the EU average. This initiative was unannounced and unanticipated.

The program established one-stop shops where entrepreneurs can register a company in less than an hour (the average time in 2007 was 47 minutes), at a single office desk and at a cost of around 3 percent of GDP per capita. In the one-stop shops, the legal and commercial registration is completed and the company's identification card, corporate tax payer number and social security number are all handed over in the same day. The one-stop shops are non-profit seeking government offices of the Ministry of Justice in cooperation with the Ministries of Finance, Economy and Labor and Social Security. Before the program was introduced, to register a new business an entrepreneur would need to visit separate offices of each of these Ministries to obtain the necessary documents and approvals. Now the information is internally exchanged and sent electronically by the registry authorities to all ministries and authorities involved in the process.²¹

[Figure 1 about here]

The “On the Spot Firm” program was not introduced simultaneously in all locations due to resource constraints and uncertainty about its success. Pilot one-stop shops were launched in

²⁰ <http://www.empresanahora.pt/ENH/sections/EN>.

²¹ The program allows registration of all firms, except state-owned firms or firms in industries with industry-specific requirements or permits. These are mainly in the finance, insurance and transportation sectors. We exclude observations in these industries from our analysis. An entrepreneur can register a new company in any of the one-stop shops across Portugal. However, as documented by Branstetter et al. (2014), the fraction of firms registered outside their local municipality is trivially small.

July 2005 in four municipalities.²² The program was then expanded over time to municipalities across the country, and by the end of 2009 there were 164 one-stop shops dispersed throughout Portugal. Figure 1 shows the opening year and geographical dispersion of the one-stop shops between 2005 and 2009. As shown, the program was progressively rolled-out randomly across municipalities.²³ Figure 2 shows average pre-reform firm entry by municipality (new firms/incumbents and new firms/100K inhabitants) and year of adoption of the reform. Online Appendix Table 3 reports summary statistics for the same variables. As shown, average pre-reform firm creation is not systematically higher in municipalities that adopted the reform early (this is also confirmed in Table 3 below).²⁴ Therefore, important for our identification, the program was not introduced in a systematic way, correlated with pre-existing average municipality firm entry.

[Figure 2 about here]

Our identification strategy exploits the cross-municipality-specific and cross-time variation in the implementation of the “On the Spot Firm” program to estimate the effect of the reform on the provision of managerial incentives. As discussed above, the policy change was unanticipated, and exogenous.²⁵ Exploiting the variation in the timing of adoption across municipalities for identification, we obtain difference-in-differences estimates of the effect of the reform on our outcomes of interest, in particular the pay-performance sensitivities.

²² Coimbra, Aveiro, Barreiro and Moita. None of these municipalities had above-average rates of business creation prior to the reform; average business creation in each of these four municipalities was below the mean and median across all municipalities in the pre-reform period.

²³ Administratively, Portugal is divided into 308 municipalities which are the seat of local administrative and executive power.

²⁴ Figure 2 and Online Appendix Table 3 use the period 2002-2004 as pre-reform; they remain robust if we compute the statistics extending the pre-reform period to 1996-2004.

²⁵ Although there were local elections in October 2005 for the municipality chief executive, the introduction of “On the Spot Firm” offices seems unrelated with political affiliation. As discussed in Branstetter et al. (2014), 40 percent of the municipalities with one-stop shops had heads from the main opposition Social Democrat party.

Therefore, the treatment variable in our empirical specifications below, $Spot_{mt}$, takes the value of 1 in the years when and after a one-stop shop was introduced in municipality m , and 0 otherwise. Firms and individuals in municipalities that introduced the “On the Spot Firm” offices are the treatment group.

This empirical strategy relies on the assumption that the introduction of the program was not systematic. Specifically, that it was not correlated with pre-existing trends in the outcome variables of interest across municipalities. Our empirical specifications control for municipality fixed effects and for pre-existing trends by municipality, as well as for a host of other factors that might affect the outcomes. However, as an initial test of our identification strategy, we assess whether the order in which municipalities adopted the “On the Spot Firm” is correlated with prior trends in the variables used in our analysis. We test whether growth trends prior to the policy change differ between municipalities that adopted the reform in the first years (2005 and 2006) and those that adopted in subsequent years (from 2007 until 2009).²⁶ In Table 3, we report pre-reform average growth (over 1996-2004) in the outcomes of interest for the group of municipalities that adopt the reform late (column 1) and for the group that adopt early (column 2), as well as the difference between the two and the p-value for the null hypothesis that the means are equal for both groups of municipalities. As shown, there are no statistically significant differences for any of the variables. This provides strong evidence that the order in which municipalities introduced the program is not correlated with pre-reform trends in those variables.²⁷

[Table 3 about here]

²⁶ This test of the identification strategy follows Bruhn (2011).

²⁷ The findings from Table 3 remain similar for different definitions of “early” and “late” adoption. Online Appendix Table 4 reports statistics using the cut-off year of 2007 instead of 2006 – as shown, the findings remain robust.

4. Effect of the “On the Spot Firm” program on firm entry

This section investigates the effect of the “On the Spot Firm” program on firm entry. This assesses the validity of the reform as a source of increased entry, for the main analysis of the paper on the effect of competition on managerial incentive provision. In particular, the next section investigates the prediction in Raith (2003), that competition through lower entry costs, and higher firm entry, leads to flatter managerial incentives and thus lower pay-performance sensitivity. We studied the effect of the “On the Spot Firm” program on firm entry in previous work (Fernandes et al., 2014) and this section is based on that work.

To study the effect of the reform on firm creation, we estimate the following specification, for the period from 2002 to 2009, using a negative binomial model:

$$Nb.NewFirms_{mst} = \delta Spot_{mt} + d(\cdot) + \epsilon_{mst} \quad (1)$$

Where the dependent variable is the number of new firms by municipality-industry-year (mst).²⁸ $Spot_{mt}$ is the “On the Spot Firm” experiment dummy variable, which takes the value of 1 in the years when and after a one-stop shop was established in municipality m , and 0 otherwise. We control for different sets of fixed effects in $d(\cdot)$, including industry indicators to parse out any industry characteristics that may affect firm entry (d_s); year dummies to account for aggregate shocks (d_t); and municipality fixed effects to control for municipality time-invariant characteristics (d_m). We cluster the standard errors by municipality.

Table 4 reports the results, with different sets of fixed effects included across the columns. We find that the entry deregulation reform increased the number of new firms within industries and municipalities. The coefficient on the $Spot_{mt}$ variable is always positive and statistically significant (at the 1 percent level). In particular, the difference in the logs of the

²⁸ Results remain robust if we use a linear specification instead of the negative binomial, for the same count variable.

expected counts of new firms is estimated to be between 0.08 and 1.21 higher following the adoption of the reform. The estimates imply that the number of entrants increased by 4.2 by industry and year (see the marginal effect in column 2). Controlling for municipality fixed effects reduces the estimate but it remains positive and statistically significant at the 1 percent level. This shows that the “On the Spot Firm” program increased firm creation significantly within a municipality-industry cell.²⁹ Branstetter et al. (2014), show that the same deregulation episode increased the number of new firms per 100,000 inhabitants by around 17 percent. Therefore, the reform has an economically meaningful effect on firm entry.

[Table 4 about here]

5. Effect of the “On the Spot Firm” program on executive compensation: Quasi-natural experimental evidence

The previous section shows that the “On the Spot Firm” deregulation reform led to increased firm entry and hence more competition. In this section, we use the deregulation reform as a quasi-natural experiment that exogenously increased competition, to study how it affected the structure of compensation of top executives and department managers, relative to other workers in a corporation. In what follows, we present and discuss the results obtained for the effects of the introduction of one-stop-shop offices on the overall level of pay as well as on the sensitivity of pay to firm performance.

²⁹ Our results on firm entry following a reform that simplifies business registration are consistent with those reported by Bruhn (2011), who explores a firm entry deregulation episode in Mexico, and by Branstetter et al. (2014).

5.1 Effect of the “On the Spot Firm” program on executives’ total pay

We start by investigating the relative effect of the “On the Spot Firm” program on total pay of top executives and department managers in treated municipalities, relative to those in other municipalities. We estimate the following specification:

$$\ln w_{ijmt} = \alpha + \beta_1 Spot_{mt} + \beta_2 Manager_{it} + \beta_3 (Manager_{it} \times Spot_{mt}) + \gamma X'_{it} + \lambda Z'_{jt} + d(\cdot) + d_m \times t + \epsilon_{ijmt} \quad (2)$$

where the dependent variable is the log of real monthly pay of worker i , in firm j , municipality m and year t . $Spot_{mt}$ is our treatment dummy for municipalities with one-stop shops; as explained above, it takes the value of 1 in the years when and after the “On the Spot Firm” was introduced in municipality m , and zero otherwise.³⁰ $Manager_{it}$ is a vector of dummy variables for whether the worker is a top executive, a department manager, or other; “other workers” is the omitted category. X'_{it} is a matrix of individual characteristics, including age and tenure and their squares, and type of employment contract. To account for the effect of the reform on the returns to education, we also include interactions between educational levels and the reform variable. Z'_{jt} is a matrix of firm characteristics, including the log of size (employment), ownership structure (domestic private, public or foreign), and dummies for whether the firm is an exporter, or multi-plant. Controlling for firm size is important in the narrative above, because the larger the firm the larger the pay-off to a given reduction in costs. It has also long featured in theoretical and empirical work on executive compensation, which showed that executive pay is positively correlated with firm size (see, for example, Rosen, 1982, 1990; Kostiuk, 1990; and Baker and Hall, 2004).

³⁰ Some municipalities have more than one one-stop shop. Our treatment dummy is set to 1 when the first shop is opened.

The nature of the linked employer-employee data that we use allows us to include worker or worker-firm (match) fixed effects in our specifications, d_i and d_{ij} , respectively. These help to control for potential biases arising from individual heterogeneity on the patterns of job mobility, and for different compensation policies and sorting of workers across firms. Industry-year fixed effects (d_{st}) are also included in all specifications to account for unobserved time-varying industry characteristics that may affect compensation. Although the policy reform was unexpected and, as shown above, early adopting municipalities are not statistically different from late adopters in terms of pre-reform trends in compensation, we saturate the model even further with municipality-specific linear trends, $d_m \times t$. These absorb any potential trends in compensation at the municipality level. We also include region-year fixed effects (d_{rt}) to control for time-varying regional factors. In alternative specifications, we account for time-invariant unobserved municipality characteristics (d_m). ϵ_{ijmt} is an error term assumed to be white noise. Standard errors are clustered at the municipality level in all our specifications to account for potential correlation between observations within the same municipality, the level of introduction of the policy.

The coefficients of main interest are those in vector β_3 , on the interaction term between the reform variable and the dummies for the occupational categories. Each element of β_3 captures the differential effect of the deregulation on total pay of CEOs and department managers in treated municipalities, relative to those in other municipalities. A positive β_3 implies that the “On the Spot Firm” reform is associated with a differential increase in total pay.

Table 5 reports the results from estimating Eq. (2), with different sets of fixed effects included across the columns. The coefficient on the interaction between the reform variable and the CEO dummy is positive and statistically significant across all specifications. It is estimated at around 0.03 when we include match (worker-firm) fixed effects. In those specifications, the effect is thus identified from individuals that stay in the same firm after the

reform, and is therefore not arising from changes in the composition of employment. This result suggests that the reform increased the relative level of CEOs' pay in treated municipalities by about 3 percent. Similarly, the introduction of the reform is associated with increased relative pay of department managers in affected municipalities by around 3 percent. Although the magnitude of these estimates seems modest, our dependent variable is salary plus cash bonuses, and thus our results are interpreted as the effect of competition on short-term compensation, also found to be small in previous studies. Moreover, if the reform is associated with lower pay-performance sensitivity, as we postulate, managers' pay becomes less variable, and risk-averse managers would need lower overall pay increases. Hence, the effect of increased competition is not expected to be very large.

The coefficient on the stand-alone CEO term is identified from individuals that are promoted to the position during our sample period, and implies an increase in pay of between 6 percent and 11 percent, depending on the sets of fixed effects included. We also account for the effects of the reform on the returns to education in all specifications. We find that the increased competition following the reform is associated with increased returns to education, particularly university degrees, in line with existing evidence (see Guadalupe, 2007; Fernandes et al., 2014). The coefficient on the $Spot_{mt}$ variable, β_I , suggests that the reform had a negative effect, of around 1 percent, on the least educated of "other workers", the omitted category. In addition to these program effects, Table 5 also reinforces the importance of firm size, estimated to have a positive and statistically significant effect on the level of pay.

[Table 5 about here]

In sum, the results from Table 5 show that the reform, and the extra competition it induced, increased the total pay of CEOs and department managers, and marginally reduced that of other workers. Higher total pay may result from increased demand for managerial talent

following the increase in competition (Hubbard and Palia, 1995; Cuñat and Guadalupe, 2009). However, our main topic of interest is whether competition affects the link between executive pay and firm performance. In the next section, we test whether the increased competition from lower firm entry costs led to weaker monetary managerial incentives, and thus flatter incentive schemes, in line with the prediction from Raith (2003).

5.2 Effect of the “On the Spot Firm” program on executives’ fixed and performance-related pay

In the previous section we estimated the effect of the “On the Spot Firm” program on executives’ total pay. However, executive compensation is generally comprised of a fixed component and of a variable component, which is a function of firm performance. In this section, we analyze the effect of the firm entry deregulation on both the fixed and the performance-related components of managerial pay. We are particularly interested in examining the theoretical prediction in Raith (2003) that a reduction in entry costs leads firms to provide weaker managerial incentives. We investigate whether the pay-performance sensitivity decreases following the “On the Spot Firm” program, by estimating the following specification:

$$\begin{aligned}
\ln w_{ijmt} = & \alpha + \beta_1 Spot_{mt} + \beta_2 Profit_{jt} + \beta_3 Manager_{it} + \beta_4 (Manager_{it} \times Spot_{mt}) \\
& + \beta_5 (Manager_{it} \times Profit_{jt}) + \beta_6 (Profit_{jt} \times Spot_{mt}) \\
& + \beta_7 (Manager_{it} \times Profit_{jt} \times Spot_{mt}) + \gamma X'_{it} + \lambda Z'_{jt} + d(\cdot) + d_m \times t \\
& + \epsilon_{ijmt}
\end{aligned} \tag{3}$$

The dependent variable is the (ln of) real monthly pay of worker i (in firm j , municipality m) in year t . $Spot_{mt}$ is the treatment dummy for municipalities with one-stop shops, as explained above. $Profit_{jt}$ is the firm’s real accounting profit (in millions of Euros), the measure of

performance.³¹ X'_{it} includes the individual's age and tenure and their squares, and type of employment contract; and Z'_{jt} includes the firm's (ln of) size, ownership structure, whether the firm is an exporter or multi-plant, and the profit of rival firms. ϵ_{ijmt} is a white noise error term. We continue to cluster the standard errors by municipality in all specifications.

To study the effect of the reform on the structure of compensation across the corporate hierarchy, and to provide an additional benchmark against which to gauge the effects on CEOs' and department managers' pay, we interact the reform variable, $Spot_{mt}$, with the indicators for the workers' occupational category, $Manager_{it}$. The elements of β_4 in Eq. (3) are the difference-in-differences estimates of the effect of the "On the Spot Firm" deregulation on the fixed component of compensation of CEOs and department managers in treated municipalities, relative to other workers. The effect on other workers' fixed pay is given by β_1 , the coefficient on the stand-alone reform variable. To estimate pay-performance sensitivities, we interact the performance measure with the occupational categories, thus allowing for different types of workers to have different degrees of sensitivity of pay to performance. The elements of β_5 capture the differential sensitivity of pay to firm performance of CEOs and department managers, while the coefficient on the performance measure, β_2 , captures the baseline pay-performance sensitivity in the sample.

Our main interest lies in the triple interaction term between the reform dummy, firm performance and the occupational category of the worker, $Manager_{it} \times Profit_{jt} \times Spot_{mt}$. The elements of β_7 measure the effect of the "On the Spot Firm" deregulation on the pay-performance sensitivity of CEOs and department managers in affected municipalities. A negative estimate of β_7 would be consistent with the theoretical prediction in Raith (2003). That is, firms in municipalities that experience an increase in competition reduce the slope of

³¹ Profit has been used as the measure of firm performance in previous studies, e.g. Cuñat and Guadalupe (2005) and Blanchflower and Oswald (1988).

their executives' pay-performance schemes. The interaction of firm performance with the program dummy allows for general changes in the pay-performance relationship induced by the program, with the effect on "other workers" given by β_6 .

The results from estimating Eq. (3) are reported in Table 6. In column (1) we control for worker fixed effects (d_i) and include industry \times year (d_{st}) and municipality dummies (d_m), as well as linear trends by municipality ($d_m \times t$), thus accounting for individual heterogeneity and absorbing any time-varying industry or regional factors and common trends, such as economic shocks. In column (2) we replace worker and municipality fixed effects with firm-worker (match) fixed effects (d_{ij}), and region \times year effects; we continue to control for municipality-time trends. Aggarwal and Samwick (1999) suggest that the performance of rival firms may also affect performance-based incentives offered by the firm. To take such effects into account, columns (3) and (4) include the same progression of fixed effects and additionally control for a measure of the performance of rival firms, and its interactions with the reform variable and with the occupational categories. The measure of rival firms' performance is calculated as the average return on assets (profits/assets) of all other firms in the same 2-digit sector, multiplied by the firm's own assets.³²

The results in Table 6 show that the sensitivity of pay to firm performance for CEOs is positive and statistically significant, and estimated at around 0.003. The estimate implies that a ten million euro increase in profit increases the relative pay of CEOs by 3 percent. The magnitude of the estimate is relatively small, suggesting that compensation-based incentive mechanisms are relatively weak. This result is consistent with previous findings of very small pay-performance sensitivities (see e.g. Bell and Van Reenen, 2011), especially for short-term compensation (salary and bonus). The estimate of the sensitivity of pay to performance for

³² This can be interpreted as the firms' profit if it had the same size but profit equal to the average of all other firms in its industry (see Cuñat and Guadalupe, 2005).

department managers implies a 1 percent increase in pay for the same profit increase, suggesting that the link between pay and firm performance is stronger for CEOs. We also find that firm size is a significant determinant of pay, with larger firms paying more on average.

[Table 6 about here]

The coefficients of main interest in Table 6 are the difference-in-differences estimates of the effect of the “On the Spot Firm” reform on the sensitivity of pay to firm performance for top executives. In columns (2) and (4), we identify the effect from workers that remain in the same firm after the reform, not from those that move between firms with potentially different structures of compensation. The differential effect of the reform on the pay-performance slope for CEOs in affected municipalities is negative and statistically significant at the 1 percent level across specifications. The estimates show that the reform reduced CEOs’ pay-performance sensitivity by 0.003.

Overall, the results imply that the pay of CEOs in affected municipalities becomes essentially unresponsive to firm performance following the reform. This is in line with previous work which has found that there is little correlation between firms’ performance and the compensation of their CEOs (e.g., Jensen and Murphy, 1990). It is also consistent with the hypothesis that competitive forces external to the corporation, such as the “On the Spot Firm” program, provide managerial incentives and impose constraints that reduce the pay-performance sensitivity. We obtain a small negative effect of the reform on department managers’ pay-performance sensitivity, while no statistically significant effect is found for “other workers”. Controlling for rivals’ performance does not significantly affect the coefficient estimates.³³

³³ We have also estimated specifications that include current year as well as lagged profit, and their interactions with our variables of interest. The results are reported in Online Appendix Table 5. We find that the coefficients

Our result of a negative effect of increased competition on executives' pay-performance sensitivity is consistent with the view that competition imposes discipline on managers, reducing managerial slack and incentivizing owners to rely less (if at all) on compensation-based incentive schemes. The finding of a weaker relationship between pay and firm performance for department managers than for CEOs, and of a lower effect of the deregulation on that slope, is consistent with the fact that since department managers are not involved in defining the firm's general policy and strategy, as CEOs are, their pay is likely to be less sensitive to firm performance and less affected by increased competition than CEOs' pay.

The coefficients on the interaction terms between the reform variable and the CEO and department manager indicators, respectively, capture the differential effect of the reform on the fixed component of compensation – strictly the part that is independent of profits in the short-run. We obtain positive and statistically significant coefficients, showing that the reform increased the fixed component of CEOs' and department managers' pay by around 3 percent, consistently with the results from Table 5. Our findings thus show that the reform is associated with a relative increase in the fixed component of pay, and with a decrease in the pay-performance sensitivity of CEOs and department managers in treated municipalities. This suggests that the reform changed the structure of managerial compensation, with firms substituting into fixed pay and away from the variable, performance-related, component. Finally, we continue to obtain, as in Fernandes et al. (2014), positive coefficients on the interactions between the reform variable and the dummies for educational levels, suggesting

on the main interactions with current year profit are statistically significant and similar in magnitude to those reported in Table 6. Overall these results suggest that short-term compensation is more responsive to current performance, and as such we use current year profits in our baseline estimations. This is also in line with existing studies of managerial compensation that use current performance to estimate pay-performance sensitivities, e.g. Murphy (1986), Bertrand and Mullainathan (2001), Cuñat and Guadalupe (2005, 2009), amongst others.

that the reform increased the returns to education, while the least educated of “other workers” experience a modest decrease in pay (captured by the coefficient on the stand-alone $Spot_{mt}$ term).

To obtain treatment impacts at each year, we estimate a specification similar to Eq. (3) but including interactions with a set of indicators for each year from when the treatment (the “On the Spot Firm” reform) got switched on, in year t , in municipality m . We include interactions from $t-1$ onwards.³⁴ This specification estimates leads and lags of the treatment, allowing us to analyze whether the effect of the reform changes over time. Figure 3 reports the estimated coefficients for the pay-performance sensitivity, for CEOs and department managers in each year, and the confidence intervals. The coefficient on the interaction with $Spot_{t-1}$ is very close to zero, showing that there is no evidence of anticipatory effects. The lags show that the (negative) effect increases during the first year of the treatment and then remains relatively constant, increasing again after two years. The pattern of the coefficients is similar for CEOs and department managers. The results suggest that there is an effect on impact, on the year of introduction of the reform, and then after two periods the effects increase again.

[Figure 3 about here]

In sum, the results in this section show that the “On the Spot Firm” reform is associated with a change in the compensation-based incentive schemes offered to managers by firms in treated municipalities. We estimate a negative and highly statistically significant coefficient on the interaction term between the entry deregulation dummy variable and the measure of firm performance for CEOs, suggesting a decrease in the sensitivity of pay to firm performance. Our findings provide empirical support for the theoretical result in Raith (2003) that increased competition through a reduction in entry costs (as the reform we analyze) leads

³⁴ The last indicator captures the effect three or more years post-adoption. We include the same sets of fixed effects and controls as in column (4) of Table 6.

firms to provide weaker incentives to their managers. The finding that the reform is associated with increases in the fixed component of managerial pay could be the result of higher demand for these executives following increased firm entry; or increased demand for more talented CEOs, leading firms to pay them higher wages, a hypothesis we investigate below.

6. Effect of the “On the Spot Firm” program on performance-induced executive turnover

This section investigates the effect of increased competition on the relationship between firm performance and CEO turnover. Previous literature has found evidence that CEOs are more likely to lose their job if the firm performs worse (see, for example, Coughlan and Schmidt, 1985; Jensen and Murphy, 1990; Hubbard and Palia, 1995; Huson et al., 2001; and Kaplan and Minton, 2012). More recent studies have shown that the relationship between firm performance and job turnover appears to have strengthened in recent decades. In addition, it would be expected that in a more competitive environment there would be more pressure on CEOs to perform or be dismissed. The negative relation between firm performance and CEO turnover should therefore be stronger in more competitive product markets (e.g. where the “On the Spot Firm” policy is in effect), imposing stricter discipline on managers. Thus, studying the effect of the “On the Spot Firm” entry deregulation on compensation alone may underestimate the interactive impact of the reform and firm performance.

The data used in studies of CEO turnover has no direct information on whether observed departures are voluntary or involuntary. As such, most studies have focused on all CEO turnovers to test whether the probability of a change in a firm’s CEO is inversely related to firm performance. That is, whether managers are more likely to depart after bad performance

than after good performance, an indication that they are potentially disciplined by the threat of dismissal (e.g. Coughlan and Schmidt, 1985; Jensen and Murphy, 1990; Hubbard and Palia, 1995; Jenter and Lewellen, 2014).³⁵ We start by following the same approach and subsequently use the panel structure of our data, and the work history of the CEOs, to focus more narrowly on turnovers that are not voluntary due to promotion in a different firm.

To investigate this additional managerial incentive mechanism, we estimate the following job-exit probability regression for CEOs:

$$\begin{aligned} \Pr(\text{CEO turnover}_{ijmt}) = & \alpha + \beta_1 \text{Profit}_{jt} + \beta_2 \text{Spot}_{mt} + \beta_3 (\text{Profit}_{jt} \times \text{Spot}_{mt}) + \gamma X'_{it} \\ & + \lambda Z'_{jt} + d(\cdot) + d_m \times t + \epsilon_{ijmt} \end{aligned} \quad (4)$$

Where the dependent variable takes the value of one if the CEO leaves the job between t and $t+1$, and zero otherwise. We define a job-exit between t and $t+1$ if the executive is observed in the job in year t but not in $t+1$, provided that the firm continues to exist in $t+1$.³⁶ To account for potential voluntary turnover due to promotion in a different firm, we define three alternative turnover dependent variables: (i) *turnover_a*, which does not classify as (involuntary) turnover events where the departing CEO is observed as the CEO of a larger firm in the following survey year; (ii) *turnover_b*, which additionally excludes events in which the CEO moves to a smaller firm in the CEO position with a higher wage; and (iii) *turnover_c*, which also excludes departures to a larger firm in a non-CEO position and moves to a smaller firm in a non-CEO position but with higher wage.

We expect β_1 to be negative if the probability of executive turnover is inversely related to firm performance. The main hypothesis we investigate is whether the increase in competition

³⁵ Some recent studies have focussed on ‘forced’ turnovers using press reports of CEO firings (e.g. Huson et al., 2001; Jenter and Kanaan, 2015). This type of press coverage is not available in our context. Biases could still arise from the requirement that the turnover is announced in the press and from misclassifications.

³⁶ This is not defined for 2009, the last year of our sample.

following the “On the Spot Firm” reform strengthens the relation between firm performance and CEO turnover. The coefficient of main interest is therefore β_3 , on the interaction term between performance and the “On the Spot Firm” variable, $Profit_{jt} \times Spot_{mt}$, which is expected to be negative. This would also suggest that more competitive markets require more capable CEOs. We continue to include industry-year, region-year and worker-firm fixed effects in $d(.)$, as well as municipality-time trends ($d_m \times t$), which might affect job separation rates. We also continue to control for the individual and firm observable characteristics.

[Table 7 about here]

Table 7 reports the results from estimating Eq. (4). Odd columns report results from a linear probability model (LPM) while even columns report results from a random effects logit model. The dependent variable in columns (1) and (2) is the overall turnover, while in the remaining columns the dependent variables are the increasingly more narrowly defined turnover variables explained above. The logit results show that older CEOs and those with longer tenure are less likely to exit. We also obtain negative coefficients on the measure of firm performance, albeit not statistically significant. This is consistent with previous studies that found modest effects of firm performance on CEO turnover (e.g. Jensen and Murphy, 1990; Taylor, 2010). CEO entrenchment and weak corporate governance have been proposed as reasons for the low responsiveness of the turnover probability to poor firm performance.

Importantly, we obtain negative and statistically significant coefficients on the interaction between firm performance and the “On the Spot Firm” variable. That is, following the reform, lower firm performance is associated with an increased probability of CEOs’ job-exit. The magnitude of the LPM estimates implies that following the “On the Spot Firm” reform, a 10 million euro decrease in firm profits increases the probability of CEO turnover by 2 percentage points, corresponding to a 5 percent increase relative to the sample mean of 38.6

percent (Online Appendix Table 6).³⁷ Although the magnitude of the estimates seems small, it is consistent with previous empirical findings of a weak relation between CEO turnover and firm performance. However, this does not imply the absence of incentives since even a low probability of turnover can generate incentives if there are sufficiently large turnover-related losses.³⁸

The results using the more narrowly defined turnover variables, which exclude events that are likely to be promotions in another firm, remain robust. The coefficient on the interaction $Profit_{jt} \times Spot_{mt}$ remains negative and highly statistically significant across all specifications. Our findings show that the relation between firm performance and the probability of turnover is strengthened following the firm entry deregulation reform. These results support the hypothesis that the CEO turnover probability and firm performance are more strongly linked in more competitive product markets. Our results are also in line with the finding in Hubbard and Palia (1995) and DeFond and Park (1999) of higher CEO turnover in more competitive environments.

To account for voluntary management turnover due to retirement age, in Table 8 we conduct a separate test for the relation between firm performance, increased competition and executive turnover. We redefine the job-exit dependent variable, which now takes the value of one if the executive is last observed in the job in year t and is below the age of 60 when he departs, and zero otherwise.³⁹ Because job exits at younger age are less likely to be due to

³⁷ We report the coefficient estimates from logit and linear probability models and hence their magnitude is not directly comparable.

³⁸ Jensen and Murphy (1990) estimate large expected turnover-related wealth loss for CEOs.

³⁹ We performed the same analysis considering CEO job-exits at 55 years or younger and obtained similar results, available on request.

retirement decisions, this is potentially a better framework to test whether increased competition affects performance-induced management turnover.⁴⁰

[Table 8 about here]

The results remain robust in sign, magnitude and statistical significance. We continue to find that the probability of CEO turnover is higher when firm performance is worse in more competitive product markets (following the entry reform). The interactive effect of the reform and firm performance on the job-exit probability is negative and statistically significant. That is observed for all alternative definitions of the turnover dependent variable, reported across the columns of Table 8, as explained above. In sum, the results in this section suggest that in addition to changes in the structure of compensation, management changes can also be used as a mechanism to align the incentives of managers and shareholders. The use of this mechanism is encouraged by increased competition and firm performance.

7. Managerial talent and the “On the Spot Firm” program

The managerial talent hypothesis suggests that more competitive environments may require more capable executives, with better skills or talent (e.g., Hubbard and Palia, 1995). Accordingly, a higher level of pay would be required to attract more talented managers. Changes in product market competition have been found to increase the demand for managerial talent and raise CEO compensation (see e.g. Hubbard and Palia, 1995; Cuñat and Guadalupe, 2009). Our results in previous sections control for individual fixed effects, which absorb individuals’ ability or talent, thus accounting for individual heterogeneity in the compensation and job turnover specifications. In this section, we investigate how increased

⁴⁰ This age-based turnover classification is similar to that employed by Peters and Wagner (2014). Jensen and Murphy (1990) also estimate the relation between turnover and firm performance separately by CEOs’ age group.

competition following the reform affects the employment decision of firms with respect to CEO talent. We investigate whether the more competitive product market induced by the “On the Spot Firm” policy causes firms to value CEO talent more highly. More talented individuals are more likely to have higher expected total compensation, and higher salary.

Our matched employer-employee data allows us to obtain good proxies for managerial ability or talent, by estimating individuals’ fixed effects from a compensation regression, based on the method by Abowd, Kramarz and Margolis (1999). The individual fixed effect captures the fixed component of a worker’s pay that is not explained by observed characteristics (and time invariant firm characteristics), and is interpreted as the individual’s time-invariant ability or innate talent (see also e.g. Cuñat and Guadalupe, 2009). We estimate the individual’s fixed effect from the following compensation regression:

$$\ln w_{ijmt} = \alpha + \eta_i + \psi_j + d_t + \gamma X'_{it} + \lambda Z'_{jt} + \epsilon_{ijmt} \quad (5)$$

Where the dependent variable is (the ln of) short-run compensation (salary plus bonus pay), X'_{it} includes the workers’ time-varying observed characteristics (age and tenure and their squares, occupation, type of collective agreement, professional category, whether part-time and whether fixed-term contract), and Z'_{jt} includes firms’ time-varying observed covariates (ln of employment, ln of sales, whether the firm is multi-establishment, ownership type of the firm, and type of business entity).⁴¹ We also include time dummies, d_t , a firm fixed effect, ψ_j , and the individual fixed effect, η_i .

The estimated individual fixed effect, $\hat{\eta}_i$, is thus net of worker and firm characteristics and of aggregate trends. $\hat{\eta}_i$ is our talent proxy; it captures time invariant characteristics of the worker, such as talent or ability, that affect compensation and are not explained by the other regressors. Falato et al. (2010) find that estimated CEO fixed effects are highly correlated

⁴¹ Time-invariant covariates are absorbed by the fixed effects.

with talent proxies, such as good press, fast-track career and selectivity of the undergraduate college, and are a significant determinant of pay.⁴²

Using our talent proxy, $\hat{\eta}_i$, we start by assessing how executives' talent is distributed according to the existence of "On the Spot Firm" offices. Online Appendix Figure 1 shows that the distribution of CEO talent in municipalities with "On the Spot Firm" offices is located to the right of that for CEOs in other municipalities, suggesting higher talent. Online Appendix Figure 2 shows the empirical Cumulative Density Function of worker fixed effects, by occupational group and "On the Spot Firm" presence. Consistently, the upper tail of the CEO talent CDF in municipalities with "On the Spot Firm" offices is a lot longer, showing higher CEO talent in those municipalities.

[Table 9 about here]

We investigate more formally the correlation between CEO talent and the "On the Spot Firm" reform in Table 9. We regress the estimated fixed effect for individual i in firm j at period t on the reform dummy variable.⁴³ We obtain a positive and statistically significant coefficient, suggesting a significantly higher average talent in municipalities with "On the Spot Firm" offices.

The main hypothesis we investigate is whether the reform raises the probability that a firm employs a talented CEO. We estimate the following probability model:

$$\Pr(\text{talented } CEO_{jmt}) = \alpha + \beta Spot_{mt} + \lambda Z'_{jt} + d(\cdot) + d_m \times t + \epsilon_{jmt} \quad (6)$$

Where the dependent variable takes the value of one if firm j in municipality m employs a CEO with talent ($\hat{\eta}_i$) above the median of the CEO talent distribution in year t , and takes the value of zero if it employs a CEO with talent below the median. Z'_{jt} includes the same firm

⁴² Bertrand and Schoar (2003) and Graham et al. (2012) find that estimated managers' compensation fixed effects are significantly correlated with management styles, and are important for corporate decisions.

⁴³ The remaining effects are already partialled out in Eq. (5).

characteristics as before. We control for industry and region fixed effects and for municipality-time trends, as well as for firm effects in alternate specifications.

Table 10 reports the results from linear probability models (columns 1 and 3) and random effects logit models (columns 2 and 4). The coefficients on the reform variable are always positive and statistically significant at the 1 percent level. This suggests that the increased competition following the reform causes firms to value CEO talent more highly. In particular, the estimated coefficient of 0.059 in column (1) implies that firms in municipalities with “On the Spot Firm” offices are on average 6 percentage points more likely to employ a talented CEO, corresponding to a 9 percent higher probability relative to the sample mean (Online Appendix Table 6). Accounting for firm random effects, the probability of employing a talented CEO is 2.1 percentage points higher following the “On the Spot Firm” program for firms in affected municipalities (column 3), or 3 percent above the sample mean. This result is consistent with the overall increase in salary (shown in Section 5.1) required to attract more talented managers to the more competitive environment.

[Table 10 about here]

In sum, the results in this section provide evidence that firms seek to employ more talented CEOs when faced with increased competition following the reduction in entry costs. This is consistent with Hubbard and Palia (1995) and Cuñat and Guadalupe (2009) who find that higher competition leads to increased demand for managerial talent.⁴⁴ Overall, our findings show that firms use less monetary-based incentives to induce managerial effort, as shown by the lower pay-performance sensitivity (Section 5.2), but use performance-induced

⁴⁴ Gabaix and Landier (2008) relate the level of pay to firm size in a competitive market for talent. Better-skilled managers match with larger firms, which are thus willing to pay higher wages. We also find that firm size is positively related to pay in tables 5 and 6, even when controlling for worker or match fixed effects.

management turnover (Section 6), employ more talented managers (Section 7), and pay them higher overall salaries and bonuses (Section 5.1).

8. Firm size, probability of exit and the “On the Spot Firm” program

In this section we investigate the effect of the “On the Spot Firm” reform on firm size and probability of exit. In Raith (2003), lowering entry barriers leads firms to provide weaker managerial incentives as firm-level output falls with the entry of new firms. To investigate whether the output and size of incumbent firms fell as a result of the program, we regress logged firm output, size and sales on the “On the Spot Firm” variable, controlling for industry-year, region-year and firm fixed effects, and for municipality-time trends. The results are reported in Table 11. Panel A reports OLS estimates, using the “On the Spot Firm” program, which exogenously increased firm entry and product market competition, as a quasi-natural experiment. In Panel B, we report instrumental variables (IV) estimates, using the program’s introduction as an instrument for firm entry.⁴⁵ The results show that the coefficient on the reform variable is negative and statistically significant for all dependent variables and across all specifications, suggesting that the reform is associated with a reduction in output, size and sales within firms.

[Table 11 about here]

In Schmidt (1997), an increase in competition increases the probability of firm liquidation. The increased threat of liquidation unambiguously induces the manager to exert more effort to prevent liquidation and keep her job. Moreover, an indirect effect also arises since it becomes less costly for the firm owner to induce managerial effort. These effects are related to the general conjecture that increased competition decreases managerial slack. To

⁴⁵ The IV estimates require additional assumptions; i.e., that the program affects the outcomes exclusively through increased firm entry, and not through other, direct means.

investigate these mechanisms, we show in Table 12 the estimated effect of the “On the Spot Firm” program on firms’ probability of exit. The firm exit dependent variable takes the value of one if the firm is last observed in year t , and zero otherwise. Columns (1) through (4) report difference-in-differences estimates of the program’s impact. Columns (5) and (6) report IV results, where the program introduction is used as an instrument for firm entry. The coefficient on the $Spot_{mt}$ variable is positive and statistically significant in both the LPM and the logit model (columns 1 and 2). This shows that increased competition following the reform raises the probability of firm exit, controlling for firm characteristics and for the exhaustive sets of fixed effects.

In columns (3) and (4) of Table 12, we estimate the differential effect on the probability of exit for firms with pre-reform average debt-sales ratio above the median, and thus with higher risk, relative to those with debt-sales ratio below the median. We compute firms’ average debt-sales ratios over the three years prior to the reform, and define a dummy variable, I^{dr} , which takes the value of one if the firm’s debt-sales ratio is above the median across firms, and zero otherwise. The main regressors are the $Spot_{mt} \times I^{dr}$ interaction and its lower-order terms. The coefficient on the I^{dr} dummy variable is positive and statistically significant, suggesting that firms with above-median debt ratio have higher probability of exit, on average. Importantly, the coefficient on the interaction $Spot_{mt} \times I^{dr}$ is also positive and statistically significant across all specifications. That is, following the “On the Spot Firm” reform the probability of exit is higher for firms with above-median debt-sales ratio, relative to firms with below-median debt ratio.⁴⁶ We obtain consistent results from the IV

⁴⁶ The coefficient on the stand-alone $Spot$ variable captures the effect of the program on firms with below-median debt ratios. It is either statistically insignificant or negative and significant in the LPM in column (3).

specifications, with a positive and statistically significant estimated coefficient on the *Entry* variable, in column (5), and on the $Entry \times I^{dr}$ interaction, in column (6).⁴⁷

[Table 12 about here]

These results are consistent with Schmidt (1997): an increase in competition raises the probability of exit for a firm. The threat of liquidation imposes discipline on managers, reducing managerial slack.⁴⁸ Therefore, our finding suggests that the increase in competition following the firm entry deregulation program provides a direct incentive for the manager to exert more effort. It also becomes less costly for the owner to induce managerial effort.

9. Conclusion

Economists have long argued that competition provides strong incentives for managers to reduce slack and avoid bankruptcy. Accordingly, the need to provide managers with monetary incentives should be smaller with increased competition. A number of theoretical papers have studied the effect of increased product market competition on managerial incentives (Hart, 1983; Scharfstein, 1988; Schmidt 1997; Raith, 2003; Vives, 2008). The majority of this literature delivers ambiguous results about the effect of competition on performance-related pay as an incentive scheme. However, by allowing for endogenous firm entry and exit, Raith (2003) predicts unambiguously that increased competition through a larger market or product substitutability leads to stronger managerial incentive provision,

⁴⁷ We do not report logit results for the IV specifications because the appropriate bivariate distribution for the error terms in the two stages is not yet derived. However, even if the underlying second-stage is non-linear, linear IV estimates provide good estimates of the parameters of interest (see e.g. Angrist and Krueger, 2001).

⁴⁸ There is also a second effect in Schmidt (1997), arising if and only if the manager is above his reservation utility. Increased competition may reduce the value of a cost reduction and thus the benefits of inducing higher effort. Thus, the overall effect of increased competition is ambiguous in the model.

while a reduction in firm entry costs induces firms to provide weaker incentives to their managers.

Given the channels identified theoretically, determining which of the competing effects dominates is an important empirical question. This paper investigates the effect of competition on managerial incentives, for the case of an episode of comprehensive firm entry deregulation across industries. We use the “On the Spot Firm” business registration reform introduced in Portugal in 2005 as a quasi-natural experiment. By exploiting the exogenous change in entry costs that increased firm entry across industries and municipalities, we are able to identify the causal link between competition and the sensitivity of managers’ pay to firm performance, avoiding the caveats of common measures of competition.

Our estimates show that the increase in competition following the “On the Spot Firm” reform increased CEOs’ and department managers’ overall pay, but reduced their dependence on firm performance. That is, after the entry deregulation, firms changed the structure of managerial compensation substituting fixed for performance-related pay. These results provide empirical support for the theoretical prediction in Raith (2003) that lower firm entry costs lead to weaker managerial incentives.

Controlling for firm-worker fixed effects, we are able to identify the effect from individuals that stay in the same firm after the deregulation, and not from those that move to other firms, with potentially different structures of compensation. We also account for industry-year and region-year fixed effects, and for municipality-time trends, to parse out any industry or region characteristics or aggregate trends. Our results provide novel evidence on the causal link between increased product market competition through lower entry costs and the pay-performance sensitivity of executives.

We also find that following the “On the Spot Firm” program, the link between firm performance and CEOs’ job-turnover risk is strengthened, suggesting that firms also use

management changes as incentive mechanisms to induce managerial effort. The reform is also found to increase the probability of firm exit. Since the threat of liquidation imposes discipline on managers, increased competition provides a direct incentive for the manager to exert more effort (Schmidt, 1997). Finally, we find that following the reform firms seek to employ CEOs with greater talent. This is consistent with the overall increase in salary, required to attract more talented managers to the more competitive environment.

Our findings have important policy implications given recent efforts to improve competition through deregulation. In an era of low growth and austerity, governments will be attracted to policies such as deregulation which induce productivity growth and innovation (Djankov et al., 2006; Aghion et al., 2009) at no extra public expense. Our results show that reducing barriers to entry also lowers the sensitivity of executives' pay to firm performance, as there is less need to rely on incentive-based pay schemes to mitigate managerial slack. By enforcing discipline on managers, increased competition may also reduce inefficiencies associated with weak corporate governance prevalent in less competitive industries (Giroud and Mueller, 2010, 2011).

References

- Abowd J., Kramarz F., Margolis D. 1999. "High wage workers and high wage firms." *Econometrica* 67(2):251-333.
- Aggarwal R., Samwick A. 1999. "Executive compensation, strategic competition, and relative performance evaluation: Theory and evidence." *Journal of Finance* 54(6):1999-2043.
- Aghion P., Blundell R., Griffith R., Howitt P., Prantl S. 2009. "The effects of entry on incumbent innovation and productivity." *Review of Economics and Statistics* 91(1):20-32.
- Angrist J., Krueger A. 2001. "Instrumental variables and the search for identification: From supply and demand to natural experiments." *Journal of Economic Perspectives* 15(4):69-8.
- Baker G., Hall B. 2004. "CEO incentives and firm size." *Journal of Labor Economics* 22(4):767-798.
- Bell B., Van Reenen J. 2011. "Firm performance and wages: Evidence from across the corporate hierarchy." CEP Discussion Paper No 1088, LSE.
- Bertrand M. 2009. "CEOs." *Annual Review of Economics* 1:121-150.
- Bertrand M., Mullainathan S. 2001. "Are CEOs rewarded for luck? The ones without principals are." *Quarterly Journal of Economics* 116(3):901-932.
- Bertrand M., Schoar A. 2003. "Managing with style: The effect of managers on firm policies." *Quarterly Journal of Economics* 118(4):1169-208.
- Black S., Strahan P. 2001. "The division of spoils: Rent sharing and discrimination in a regulated industry." *American Economic Review* 91(4):814-831.
- Blanchflower D., Oswald A. 1988. "Profit-related pay: prose discovered?" *Economic Journal* 98(392):720-730.
- Blundell R., Griffith R., Van Reenen J. 1999. "Market share, market value and innovation in a panel of British manufacturing firms." *Review of Economic Studies* 66(3):529-554.
- Branstetter L., Lima F., Taylor L., Venancio A. 2014. "Do entry regulations deter entrepreneurship and job creation? Evidence from recent reforms in Portugal." *Economic Journal* 124:805-832.

- Bruhn M. 2011. "Licence to sell: The effects of business registration reform on entrepreneurial activity in Mexico." *Review of Economics and Statistics* 93(1):382-386.
- Burgess S., Metcalfe P. 2000. "Incentive pay and product market competition." CMPO Working Paper No. 00/28, University of Bristol.
- Bushman R., Smith A. 2001. "Financial accounting information and corporate governance." *Journal of Accounting and Economics* 32:237-333.
- Coughlan A. T., Schmidt R. M. 1985. "Executive compensation, management turnover, and firm performance: An empirical investigation." *Journal of Accounting and Economics* 7(1-3):43-66.
- Cuñat V., Guadalupe M. 2005. "How does product market competition shape incentive contracts?" *Journal of the European Economic Association* 3(5):1058-1082.
- Cuñat V., Guadalupe M. 2009. "Globalization and the provision of incentives inside the firm: the effect of foreign competition." *Journal of Labor Economics* 27(2):179-212.
- Cuñat V., Guadalupe M. 2009b. "Executive compensation and competition in the banking and financial sectors." *Journal of Banking and Finance* 33(3):495-504.
- De Fond M., Park C. 1999. "The effect of competition on CEO turnover." *Journal of Accounting and Economics* 27(1):35-36.
- Djankov S., McLiesh C., Ramalho R. 2006. "Regulation and growth." *Economics Letters* 92(3):395-401.
- Falato A., Li D., Milbourn T. 2010. "To each according to his ability? The value of CEO talent." *Mimeo*, Washington University in St Louis.
- Fernandes A. P., Ferreira P., Winters L. A. 2014. "Firm entry deregulation, competition and returns to education and skill." *European Economic Review* 70:210-230.
- Gabaix X., Landier A. 2008. "Why has CEO pay increased so much?" *Quarterly Journal of Economics* 123(1):49-100.
- Giroud X., Mueller H. 2010. "Does corporate governance matter in competitive industries?" *Journal of Financial Economics* 95(3):312-331.

- Giroud X., Mueller H. 2011. "Corporate governance, product market competition, and equity prices." *Journal of Finance* 66(2):563-600.
- Guadalupe M. 2007. "Product market competition, returns to skill and wage inequality." *Journal of Labor Economics* 25(3):439-474.
- Guadalupe M., Pérez-González F. 2011. "Competition and private benefits of control." *Mimeo*, Stanford University.
- Graham J., Li S., Qiu J. 2012. "Managerial attributes and executive compensation." *Review of Financial Studies* 25(1):144-186.
- Hall B., Liebman J. 1998. "Are CEOs really paid like bureaucrats?" *Quarterly Journal of Economics* 113(3):653-691.
- Hart O. 1983. "The market mechanism as an incentive scheme." *Bell Journal of Economics* 14(2):366-382.
- Hermalin B. 1992. "The effects of competition on executive behaviour." *RAND Journal of Economics* 23(3):350-365.
- Hirsch B., Macpherson D. 2000. "Earnings, rents, and competition in the airline labor market." *Journal of Labor Economics* 18(1):125-55.
- Hubbard R. G., Palia D. 1995. "Executive Pay and Performance: Evidence from the US Banking Industry." *Journal of Financial Economics* 39(1):105-130.
- Huson M. R., Parrino R., Starks L. T. 2001. "Internal monitoring mechanisms and CEO turnover: A long term perspective." *Journal of Finance* 56(6):2265-2297.
- Jensen M. C., Murphy K. J. 1990. "Performance pay and top management incentives." *Journal of Political Economy* 98(2):225-264.
- Jenter D., Lewellen K. 2014. "Performance-induced CEO turnover." Stanford GSB Working Paper No. 3054, Stanford University.
- Jenter D., Kanaan F. 2015. "CEO turnover and relative performance evaluation." *Journal of Finance* 70(5):2155-2183.

- Kaplan S., Minton B. 2012. "How has CEO turnover changed?" *International Review of Finance* 12(1):57-87.
- Kostiuk P. 1990. "Firm size and executive compensation." *Journal of Human Resources* 25(1):90-105.
- Murphy K. 1999. "Executive compensation." in *Handbook of Labor Economics*, Vol. 3B, edited by Orley Ashenfetter and David E. Carlo. Elsevier Science, North-Holland.
- Murphy K. 1986. "Incentives, learning, and compensation: A Theoretical and empirical investigation of managerial labor contracts." *RAND Journal of Economics* 17(1):59-76.
- Peters F., Wagner A. 2014. "The executive turnover risk premium." *Journal of Finance* 69(4) 1529-1563.
- Raith M. 2003. "Competition, risk and managerial incentives." *American Economic Review* 93(4):1425-1436.
- Rosen S. 1982. "Authority, control, and the distribution of earnings." *Bell Journal of Economics* 13:311-323.
- Rosen S. 1990. "Contracts and the market for executives." NBER working paper no. 3542.
- Scharfstein D. 1988. "Product-market competition and managerial slack." *RAND Journal of Economics* 19(1):147-155.
- Schmidt K. M. 1997. "Managerial incentives and product market competition." *Review of Economic Studies* 64(2):191-213.
- Sutton J. 1991. *Sunk costs and market structure: Price competition, advertising and the evolution of concentration*. MIT Press, Cambridge Mass.
- Taylor L. A. 2010. "Why are CEOs rarely fired? Evidence from structural estimation." *Journal of Finance* 65(6):2051-2087.
- Vives X. 2008. "Innovation and competitive pressure." *Journal of Industrial Economics* 56(3):419-469.
- World Bank. 2006. *Doing business 2006*.

Tables

Table 1 Sample size; employer-employee data full sample

Year	All firms	Entrants	% Entrants "On-the-spot"	CEOs	Department managers	Other workers
	(1)	(2)	(3)	(4)	(5)	(6)
2002	211,113	13,389	-	3,862	59,046	1,733,353
2003	215,354	15,603	-	5,067	52,695	1,698,841
2004	218,817	14,593	-	5,520	52,752	1,732,098
2005	233,514	16,509	20.00	6,373	56,379	1,862,363
2006	235,094	17,147	42.32	2,930	59,912	1,870,955
2007	255,757	20,182	51.24	3,678	65,789	1,981,376
2008	258,943	20,413	66.42	3,891	66,150	2,015,322
2009	253,148	17,382	76.26	3,978	62,017	1,936,227

Notes: Own calculations based on Portugal's linked employer-employee data, MTSS (2002-2009).

Table 2 Summary statistics of logged monthly real pay by occupation; estimation sample

ln(monthly real pay)	Nb. Obs.	Mean	Median	Std. Dev.	P10	P90
	(1)	(2)	(3)	(4)	(5)	(6)
CEOs	20,000	8.198	8.268	0.851	7.037	9.208
Department managers	181,913	7.703	7.734	0.774	6.670	8.649
Other workers	8,287,113	6.639	6.570	0.607	6.079	7.408
All employees	8,489,026	6.666	6.583	0.635	6.085	7.469

Notes: Own calculations based on Portugal's linked employer-employee data, MTSS (2002-2009).
Statistics computed using the estimation sample.

Table 3 Pre-reform trends of outcome variables; municipality-level

	Late adopters (1)	Early adopters (2)	Difference (3)	P-value (4)	Nb. Obs. (5)
Total monthly pay					
Overall	0.042 (0.004)	0.044 (0.003)	-0.002 (0.006)	0.762	981
CEOs	0.103 (0.018)	0.088 (0.032)	0.016 (0.035)	0.654	416
Department managers	0.068 (0.009)	0.078 (0.007)	-0.011 (0.014)	0.451	801
Other workers	0.041 (0.004)	0.044 (0.003)	-0.002 (0.006)	0.715	981
Regular pay					
Overall	0.035 (0.003)	0.036 (0.002)	-0.001 (0.006)	0.917	981
CEOs	0.077 (0.015)	0.054 (0.028)	0.024 (0.030)	0.429	416
Department managers	0.064 (0.007)	0.071 (0.006)	-0.007 (0.011)	0.492	801
Other workers	0.035 (0.003)	0.035 (0.002)	-0.001 (0.006)	0.890	981
Bonuses					
Overall	0.053 (0.028)	0.062 (0.022)	-0.008 (0.048)	0.861	981
CEOs	0.282 (0.123)	0.272 (0.119)	0.010 (0.177)	0.956	416
Department managers	0.068 (0.061)	0.038 (0.044)	0.030 (0.094)	0.749	801
Other workers	0.052 (0.028)	0.062 (0.022)	-0.010 (0.048)	0.832	981
New firm creation	0.067 (0.001)	0.069 (0.002)	-0.001 (0.002)	0.594	1,138
Profits	0.195 (0.161)	0.095 (0.101)	0.100 (0.277)	0.718	981
CEO pay-performance elasticity	0.003 (0.002)	0.001 (0.0004)	0.002 (0.002)	0.255	4,349,651

Notes: The table reports average pre-reform growth trends (between 1996 and 2004) of total monthly pay, regular pay and bonuses, profits and average industry ratio of new firms to incumbents, at the municipality level. Early adopters are municipalities that adopted the reform between 2005 and 2006 and late adopters are municipalities that adopted between 2007 and 2009. Those that do not adopt the reform over our sample period are not considered in this table. The results are robust to changing the cut-off definition of early adopters to municipalities that adopted the reform between 2005 and 2007 (see online appendix Table 4). Observations are by municipality-year, except for the performance-pay elasticity. Standard errors are reported in parentheses. The p-value is for the test of the null hypothesis of equality between the means (proportions) for early and late adopters of the reform. For profits, we drop outlier observations of firm-level annual growth rates. CEO pay-performance elasticities are the estimated coefficients from compensation regressions for early and late adopters, for the pre-reform period, with controls for worker-firm and other sets of fixed effects. The p-value is for the test that the coefficients are not different.

Table 4 Effect of the "On the Spot Firm" program on firm creation

Dependent variable	Number of new firms created			
	(1)	(2)	(3)	(4)
Spot	0.984*** (0.112)	1.208*** (0.164)	0.227*** (0.017)	0.079*** (0.020)
ME	3.135***	4.242***	0.585***	0.196***
Constant	-0.283*** (0.062)	-0.238*** (0.074)	0.417*** (0.043)	0.287*** (0.047)
Industry FE	Yes	Yes	Yes	Yes
Year FE		Yes		Yes
Municipality FE			Yes	Yes
Nb. Obs.	56,782	56,782	56,782	56,782
R ²	0.133	0.136	0.289	0.291

Notes: The table reports negative binomial results. Observations are by municipality-industry-year, corresponding to 56,782 records. ME stands for the marginal effect of the "On the Spot Firm". Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 5 Effect of the "On the Spot Firm" program on the level of executives' pay

Dependent variable	ln Compensation		
	(1)	(2)	(3)
CEO × Spot	0.024*** (0.007)	0.026*** (0.007)	0.026*** (0.007)
Dpt.Mng. × Spot	0.017*** (0.005)	0.027*** (0.004)	0.027*** (0.004)
Spot	-0.011*** (0.002)	-0.010*** (0.002)	-0.008*** (0.002)
CEO	0.110*** (0.008)	0.062*** (0.009)	0.062*** (0.009)
Dpt.Mng.	0.088*** (0.003)	0.055*** (0.004)	0.055*** (0.004)
ISCED2 × Spot	0.006*** (0.002)	0.008*** (0.002)	0.007*** (0.002)
ISCED3 × Spot	0.021*** (0.002)	0.019*** (0.002)	0.019*** (0.002)
ISCED5/6 × Spot	0.061*** (0.004)	0.045*** (0.003)	0.045*** (0.003)
ln(firm size)	0.013** (0.006)	0.051*** (0.003)	0.051*** (0.003)
Industry × Year FE	Yes	Yes	Yes
Municipality FE	Yes		
Munic × time trend	Yes	Yes	Yes
Region × Year FE			Yes
Worker FE	Yes		
Match (worker-firm) FE		Yes	Yes
Nb. Obs.	8,489,026	8,489,026	8,489,026
R ²	0.047	0.040	0.041

Notes: The dependent variable is the ln monthly pay of the worker. Further covariates include age and tenure (and their squares), type of contract (whether fixed term or permanent), whether the firm is an exporter, whether it is multi-establishment and ownership of the firm. ISCED are the education categories: ISCED2 - lower secondary education; ISCED3 - high school (upper secondary) education; ISCED5/6 - university education; ISCED1 - basic education - is the omitted category. Firm size is firm employment. Robust standard errors, clustered by municipality, are reported in parentheses. *p<0.10, ** p<0.05, *** p<0.01.

Table 6 Effect of the "On the Spot Firm" program on executives' pay-performance sensitivity

Dependent variable	ln Compensation			
	(1)	(2)	(3)	(4)
CEO × Profit	0.003** (0.002)	0.003** (0.001)	0.004** (0.002)	0.003** (0.001)
Dpt. Mng. × Profit	0.000 (0.000)	0.001** (0.000)	0.000 (0.000)	0.001** (0.000)
Profit	-0.001** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)	-0.000** (0.000)
CEO × Spot × Profit	-0.003* (0.002)	-0.003** (0.001)	-0.003** (0.002)	-0.003** (0.001)
Dpt. Mng. × Spot × Profit	-0.001* (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Spot × Profit	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
CEO × Spot	0.029*** (0.007)	0.032*** (0.006)	0.029*** (0.007)	0.033*** (0.007)
Dpt. Mng. × Spot	0.019*** (0.005)	0.030*** (0.004)	0.018*** (0.005)	0.030*** (0.004)
Spot	-0.012*** (0.003)	-0.009*** (0.002)	-0.011*** (0.002)	-0.008*** (0.002)
CEO	0.104*** (0.008)	0.056*** (0.008)	0.102*** (0.008)	0.053*** (0.009)
Dpt. Mng.	0.088*** (0.003)	0.052*** (0.004)	0.087*** (0.003)	0.051*** (0.004)
ISCED2 × Spot	0.005*** (0.002)	0.007*** (0.002)	0.006*** (0.002)	0.007*** (0.002)
ISCED3 × Spot	0.021*** (0.002)	0.018*** (0.002)	0.020*** (0.002)	0.018*** (0.002)
ISCED5/6 × Spot	0.061*** (0.004)	0.044*** (0.003)	0.061*** (0.004)	0.044*** (0.004)
ln(firm size)	0.014** (0.006)	0.052*** (0.003)	0.014** (0.006)	0.052*** (0.003)
Rivals' profits and interactions			Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes		Yes	
Munic × time trend	Yes	Yes	Yes	Yes
Region × Year FE		Yes		Yes
Worker FE	Yes		Yes	
Match (worker-firm) FE		Yes		Yes
Nb. Obs.	8,489,026	8,489,026	8,345,151	8,345,151
R ²	0.048	0.041	0.047	0.040

Notes: The dependent variable is the ln monthly pay of the worker. Further covariates include age and tenure (and their squares), type of contract (whether fixed term or permanent), whether the firm is an exporter, whether it is multi-establishment and ownership of the firm. ISCED are educational categories, as explained in Table 5. Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 7 Performance-induced CEO turnover and the "On the Spot Firm" program

Dependent var.	CEO turnover		CEO turnover_a		CEO turnover_b		CEO turnover_c	
	LPM	Logit	LPM	Logit	LPM	Logit	LPM	Logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spot × Profit	-0.002*** (0.000)	-0.010*** (0.004)	-0.002*** (0.000)	-0.010*** (0.004)	-0.002*** (0.000)	-0.010*** (0.004)	-0.001*** (0.000)	-0.010*** (0.004)
Profit	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)
Spot	0.011 (0.015)	0.042 (0.060)	0.010 (0.015)	0.029 (0.059)	0.007 (0.015)	0.024 (0.059)	0.012 (0.015)	0.067 (0.056)
Age	0.007 (0.246)	-0.049*** (0.015)	0.006 (0.246)	-0.051*** (0.015)	0.006 (0.245)	-0.053*** (0.015)	0.118 (0.240)	-0.025* (0.014)
Age ²	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.000** (0.000)
Seniority	-0.010 (0.010)	-0.040*** (0.006)	-0.010 (0.010)	-0.037*** (0.006)	-0.011 (0.010)	-0.035*** (0.006)	-0.010 (0.010)	-0.017*** (0.006)
Seniority ²	-0.000** (0.000)	0.001*** (0.000)	-0.000** (0.000)	0.001*** (0.000)	-0.000** (0.000)	0.001*** (0.000)	-0.000 (0.000)	0.000 (0.000)
ISCED 2		0.034 (0.096)		0.029 (0.095)		0.030 (0.095)		0.033 (0.085)
ISCED 3		-0.187** (0.089)		-0.204** (0.087)		-0.193** (0.087)		-0.159** (0.078)
ISCED 5/6		-1.782*** (0.088)		-1.795*** (0.087)		-1.809*** (0.087)		-1.663*** (0.076)
Industry × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Munic × time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Match Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nb. Obs.	17,799	17,721	17,799	17,721	17,799	17,721	17,799	17,693
R ²	0.379		0.378		0.378		0.359	
Log-likelihood		-9,721		-9,710		-9,652		-9,467

Notes: The dependent variable in columns (1)-(2) takes the value of 1 if the CEO is last observed in the job in year t, and zero otherwise; this is not defined for 2009, the last year in our sample. To account for voluntary turnover due to promotion in a different firm, in columns (3)-(4) the turnover variable takes the value of zero when the departing CEO is observed as the CEO of a larger firm in the following survey year. In columns (5)-(6) the turnover variable additionally excludes events in which the CEO moves to a smaller firm as the CEO but with a higher wage. In columns (7)-(8), we additionally exclude moves to a larger firm in a non-CEO position and moves to a smaller firm in a non-CEO position but with higher wage. Further covariates include gender (in RE models), type of contract (whether or not fixed term), natural log of firm size, firm age (in years), whether the firm is an exporter, whether it is multi-establishment and ownership of the firm. Odd (even) columns report results for a linear probability model with worker-firm fixed effects (random effects logit model). Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 8 Performance-induced CEO turnover and the "On the Spot Firm" program; age<60

Dependent var.	CEO turnover		CEO turnover_a		CEO turnover_b		CEO turnover_c	
	LPM	Logit	LPM	Logit	LPM	Logit	LPM	Logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spot × Profit	-0.001** (0.000)	-0.008** (0.004)	-0.001** (0.000)	-0.008** (0.004)	-0.001** (0.000)	-0.008** (0.004)	-0.001** (0.000)	-0.008** (0.004)
Profit	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.000 (0.001)	0.000 (0.000)	-0.000 (0.001)
Spot	0.007 (0.015)	0.018 (0.063)	0.006 (0.015)	0.005 (0.062)	0.003 (0.015)	-0.001 (0.062)	0.006 (0.014)	0.029 (0.059)
Age	0.189 (0.233)	0.403*** (0.021)	0.186 (0.232)	0.394*** (0.021)	0.185 (0.231)	0.390*** (0.021)	0.284 (0.226)	0.352*** (0.018)
Age ²	-0.001*** (0.000)	-0.005*** (0.000)	-0.001*** (0.000)	-0.005*** (0.000)	-0.001*** (0.000)	-0.005*** (0.000)	-0.001*** (0.000)	-0.004*** (0.000)
Seniority	-0.006 (0.010)	-0.042*** (0.007)	-0.007 (0.010)	-0.038*** (0.007)	-0.007 (0.009)	-0.036*** (0.007)	-0.004 (0.009)	-0.018*** (0.007)
Seniority ²	-0.001*** (0.000)	0.001*** (0.000)	-0.000*** (0.000)	0.001*** (0.000)	-0.000*** (0.000)	0.001*** (0.000)	-0.000*** (0.000)	0.000 (0.000)
ISCED 2		0.115 (0.100)		0.108 (0.099)		0.111 (0.099)		0.064 (0.089)
ISCED 3		-0.042 (0.093)		-0.057 (0.092)		-0.045 (0.091)		-0.068 (0.082)
ISCED 5/6		-1.639*** (0.093)		-1.656*** (0.092)		-1.668*** (0.092)		-1.579*** (0.081)
Industry × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Munic × time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Match Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nb. Obs.	17,799	17,696	17,799	17,696	17,799	17,696	17,799	17,659
R ²	0.332		0.331		0.331		0.314	
Log-likelihood		-9,047		-9,032		-8,982		-8,712

Notes: To account for turnover due to potential retirement, this table considers CEO departures when younger than 60 years old. The dependent variable in columns (1)-(2) takes the value of 1 if the CEO is last observed in the job in year t and is younger than 60 years old, and zero otherwise; this is not defined for 2009, the last year in our sample. To account for voluntary turnover due to promotion in a different firm, in columns (3)-(4) the turnover variable takes the value of zero when the departing CEO is observed as the CEO of a larger firm in the following survey year. In columns (5)-(6) the turnover variable additionally excludes events in which the CEO moves to a smaller firm as the CEO but with a higher wage. In columns (7)-(8), we additionally exclude moves to a larger firm in a non-CEO position and moves to a smaller firm in a non-CEO position but with higher wage. Further covariates include gender (in RE models), type of contract (whether or not fixed term), natural log of firm size, firm age (in years), whether the firm is an exporter, whether it is multi-establishment and ownership of the firm. Odd (even) columns report results for a linear probability model with worker-firm fixed effects (random effects logit model). Robust standard errors, clustered by municipality, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9 CEO talent and the "On the Spot Firm" program

Dependent Variable	Talent	
	All (1)	CEOs (2)
Spot	0.048*** (0.000)	0.090*** (0.013)
Constant	0.040*** (0.000)	1.014*** (0.008)
Nb. Obs.	8,357,924	19,663
R ²	0.001	0.002

Notes: Talent is the worker's estimated fixed effect from a compensation regression. See Eq. (5). Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 10 Probability of employing a talented CEO and the "On the Spot Firm" program

Dependent variable	Pr(Talented CEO)			
	LPM (1)	Logit (2)	LPM (3)	Logit (4)
Spot	0.059*** (0.008)	0.317*** (0.044)	0.021*** (0.005)	0.674*** (0.158)
Constant	0.044 (0.050)	-2.639*** (0.265)	0.102** (0.049)	-13.863*** (1.306)
Industry	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Munic × time trend	Yes	Yes	Yes	Yes
Firm RE			Yes	Yes
Nb. Obs.	13,648	13,645	13,648	13,645
R ²	0.197		0.003	
Log-likelihood		-7,419		-4,639

Notes: The dependent variable takes the value of 1 if the firm employs a CEO with talent above the median of the CEOs talent distribution (where talent is the CEO's estimated fixed effect) and zero if it employs a CEO with talent below the median. Further covariates include the natural log of firm size, firm age (in years), whether the firm is an exporter, whether it is multi-establishment and ownership of the firm. Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 11 Firm size and the "On the Spot Firm" program

Panel A	OLS specification		
	Size	Output	Sales
Dependent variable	(1)	(2)	(3)
Spot	-0.013*** (0.004)	-0.019*** (0.006)	-0.014** (0.006)
Industry × Year FE	Yes	Yes	Yes
Munic × time trend	Yes	Yes	Yes
Region × Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Nb. Obs.	292,799	291,841	276,835
R ²	0.025	0.027	0.066
Panel B	IV specification		
	Size	Output	Sales
Dependent variable	(1)	(2)	(3)
Entry	-0.004*** (0.001)	-0.006*** (0.001)	-0.004*** (0.001)
Industry × Year FE	Yes	Yes	Yes
Munic × time trend	Yes	Yes	Yes
Region × Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Nb. Obs.	292,799	291,841	276,835
R ²	0.013	0.014	0.060

Notes: The dependent variable is the ln of firm employment in column (1), the ln of real firm output in column (2) and the ln of real firm sales in column (3), at the firm-year level. In each OLS specification, the main independent variable is the "On the Spot Firm" program variable. In each IV specification, firm entry (number of new firm entrants) is instrumented with the "On the Spot Firm" program introduction. Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 12 Firms' probability of exit and the "On the Spot Firm" program

Dependent Variable	Pr(Firm exit)					
	LPM (1)	Logit (2)	LPM (3)	Logit (4)	IV specification (5) (6)	
Spot	0.003*** (0.001)	0.085** (0.035)	-0.004** (0.002)	0.088 (0.057)		
Spot $\times I^{dr}$			0.016*** (0.002)	0.143** (0.069)		
Entry					0.0002*** (0.0001)	-0.000 (0.0000)
Entry $\times I^{dr}$						0.001*** (0.0001)
I^{dr}			0.021*** (0.001)	0.980*** (0.056)		0.009*** (0.003)
Industry \times Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Munic \times time trend	Yes	Yes	Yes	Yes	Yes	Yes
Region \times Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm RE	Yes	Yes	Yes	Yes	Yes	Yes
Nb. Obs.	313,882	312,985	226,206	223,564	313,882	226,206
R ²	0.108		0.103		0.100	0.097
Log-likelihood		-59,917		-38,772		

Notes: The dependent variable takes the value of 1 if the firm is last observed in year t and 0 otherwise; firm exit is not identified for 2009, the last year in our sample. I^{dr} is a dummy variable that takes the value of 1 if the firm is above the median across all firms in terms of pre-reform debt/sales ratio and 0 otherwise. Firm debt ratios are obtained as the firm average over the three years prior to the introduction of the reform. Further covariates include the natural log of firm size, firm age (in years), whether the firm is an exporter, whether it is multi-establishment and ownership of the firm. Columns (1) and (3) report results from a linear probability model, and columns (2) and (4) from a random effects logit model. Columns (5) and (6) report IV specifications where the "On the Spot Firm" program introduction is used as an instrument for firm entry (number of new firm entrants). Robust standard errors, clustered by municipality, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Figures

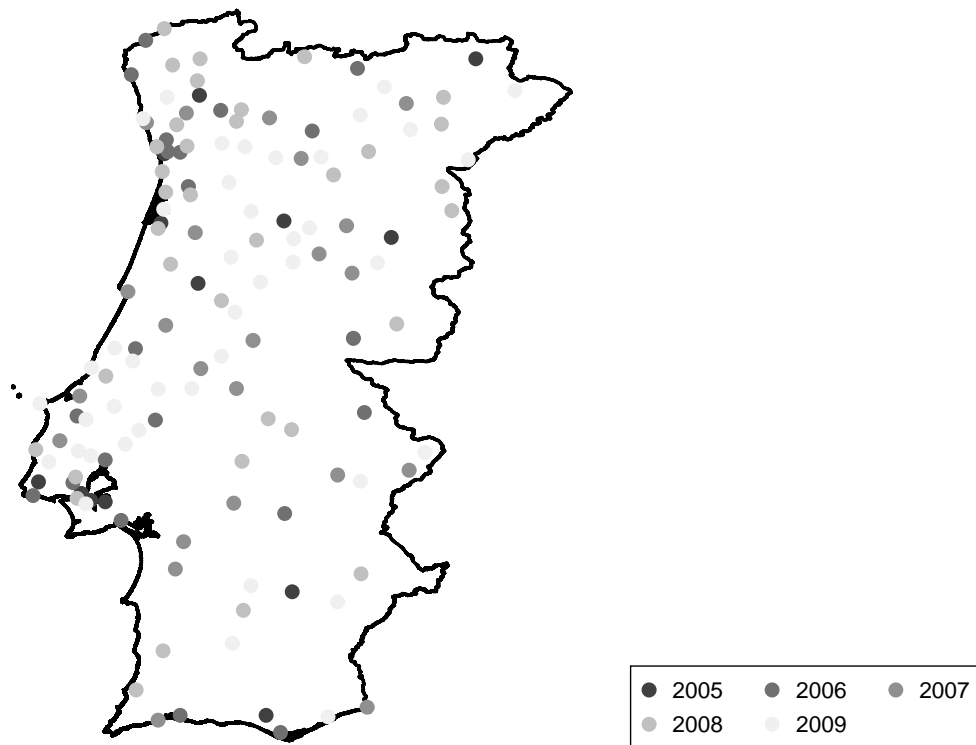


Figure 1 Introduction of "On the Spot Firm" offices by year and municipality

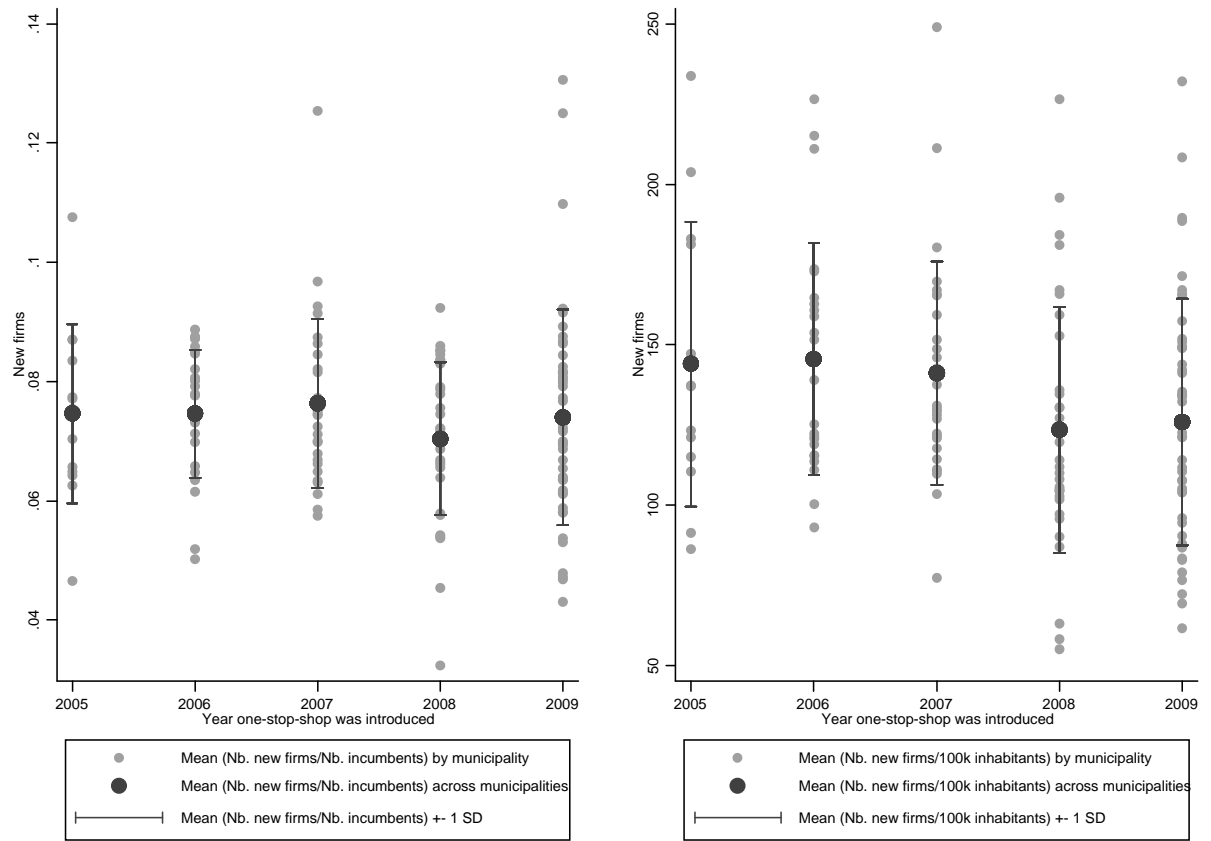


Figure 2 Pre-reform firm entry by municipality and year of "On the Spot Firm" introduction

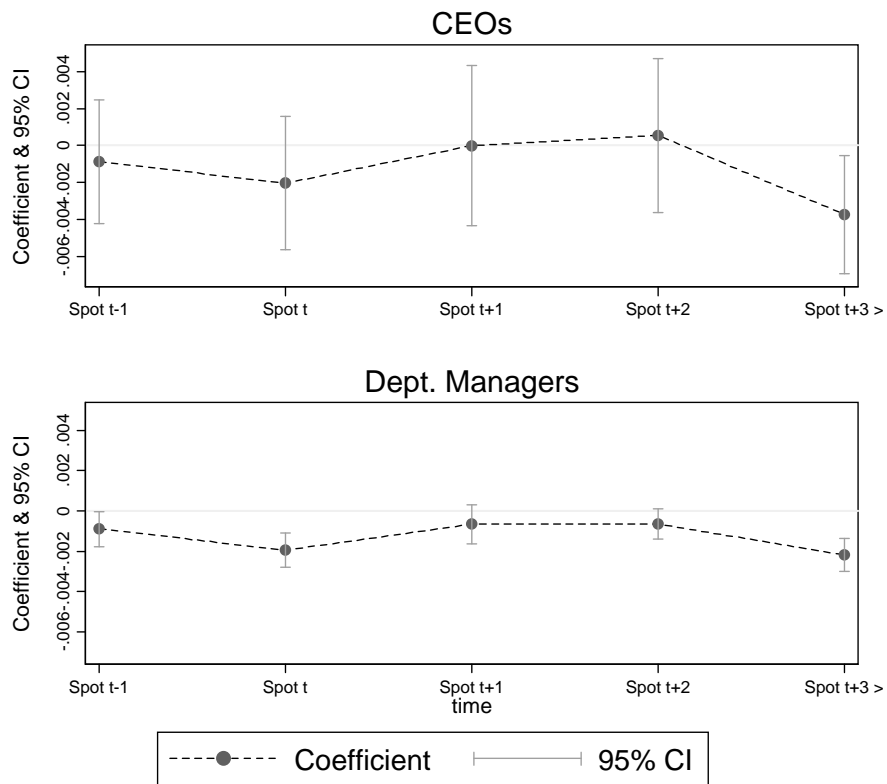


Figure 3 Effect of the "On the Spot Firm" program on the pay-performance sensitivity over time