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Natália P. Monteiro

Odd Rune Straume

"Management, performance and pay"

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Universidade do Minho
Escola de Economia e Gestão

Management, performance and pay*

Natália P. Monteiro† Odd Rune Straume‡

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Abstract

We use rich Portuguese data to analyse the relationship between the use of structured management practices and worker pay in a large representative sample of firms. We find that management practices are significantly associated with both higher average wages and higher within-firm wage dispersion. The positive relationship between management practices and average pay is present throughout the wage distribution and for all occupational skill groups, but is stronger for workers higher up in the wage distribution and in higher-skilled occupations. These results are driven by management practices related to incentives, and are also mainly driven by small and medium-sized firms.

Keywords: Management practices, wages, labour productivity.

JEL Classification: D22; J31; M11; M54

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†Department of Economics/NIPE, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal. E-mail: n.monteiro@eeg.uminho.pt

‡Corresponding author. Department of Economics/NIPE, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal; and Department of Economics, University of Bergen. E-mail: o.r.straume@eeg.uminho.pt

1 Introduction

Management matters. This is the key message from an already sizable literature showing that advanced management practices play a crucial role in accounting for the large variation in firm performance across industries and countries. Firms that use more structured management practices have been shown to perform better along a number of different dimensions, such as productivity, profitability, growth, survival rates and innovation (see, e.g., Bloom and Van Reenen, 2007, 2010, and Bloom et al., 2019). The abundance of literature on the importance of management practices in the last couple of decades has been greatly assisted by the development of the World Management Survey (WMS), first described by Bloom and Van Reenen (2007), which provides a significant amount of information on measures of management practices across a large number countries.

There is however still relatively little empirical evidence on the relationship between management practices and labour outcomes, most importantly wages. This is perhaps somewhat surprising, since management practices are likely to have both direct and indirect effects on worker outcomes. If better management practices improve firm performance, workers might benefit in the form of higher wages. But the extent to which such performance gains are distributed to workers, and how they are distributed across the workforce, is still not extensively documented. Furthermore, since management practices include policies on the use of bonuses, promotions, reassignments and dismissals, they are also likely to have a direct impact on firms' remuneration schemes and skill compositions.

In the present paper we contribute to the scant literature on management practices and wages by using information on management practices in 2016 from a large representative sample of Portuguese firms. This data is linked with two other sources of data, including a matched employer-employee dataset, which allows us to relate the use of structured management practices with a very rich set of firm and worker characteristics. In particular, we have data on several different wage measures, including disaggregated pay components such as base wages, bonus-related payments and overtime pay. We also have information on occupational categories, which allows us to look at the relationship between managerial practices and occupational skill composition, as well as wage effects within each skill category. Furthermore, our data covers a large set of both manufacturing and services firms, and with a much larger range of firm size distribution that what is common in the literature. The Portuguese survey of management

practices is also unusually rich, and our constructed management score is based on 29 different questions in this survey.

Our analysis is conducted in three parts. In the first part we investigate which firm and industry characteristics are conducive to the use of structured management practices, and in the second part how the use of such practices is related to firm performance in general and labour productivity in particular. In these first two parts of our analysis, we mainly confirm that the established results in the literature also apply to Portuguese firms. All else equal, the use of structured management practices is significantly higher in larger firms, in multinational firms, in firms with a higher-skilled workforce, and also in firms with works councils. On the other hand, the use of structured management practices is significantly lower in public firms and in family-managed firms. Furthermore, we find that the use of more structured management practices is positively associated with labour productivity, and that this relationship is primarily driven by the use of management practices related to incentives. Perhaps more surprisingly, we also find that the magnitude of this relationship decreases with firm size.

The main contribution of the paper lies in the third part of our analysis, where we study the relationship between management practices and different measures of wages and wage inequality. Our two main findings are that the use of more structured management practices is positively related to (i) average pay and (ii) within-firm pay inequality. A more detailed analysis also shows that these relationships are almost entirely driven by management practices related to incentives (rather than monitoring and targeting, which are our two other categories of management practices). Furthermore, we show that the positive relationship between structured management practices and average wages applies throughout the wage distribution, even for workers in the bottom decile, but is much stronger towards the top of the distribution. The relationship also applies for all occupational skill groups, but is much stronger for workers in high-skilled occupations. Moreover, when we decompose the overall pay into different pay components, we find that, for managers, the relationship between management practices and average pay stems from differences in base wages, while for non-managers it stems from differences in both base wages and overtime pay.

We also investigate several potential mechanisms and mediating factors related to our main results, which we show could be partly explained by increased labour productivity and partly by changes in the occupational skill composition within the firm. In line with previous literature (e.g., Lee, 2018) we find that the use of structured management practices is positively associated

with a higher (absolute and relative) demand for workers in high-skilled occupations. However, our main results cannot be fully explained by differences in occupational skill composition, since the positive relationship between management practices and average wages also applies within each occupational category. We also find some evidence of complementarity between labour productivity and management practices, in the sense that the positive relationship between management practices and average wages is stronger in firms with more productive workers, and *vice versa*, that the relationship between labour productivity and wages is stronger in better managed firms. Finally, we explore the role of workers' collective bargaining power as a mediating factor. Using the presence of *works councils* as a proxy for workers' bargaining power, we find that such presence amplifies the first and dampens the second of our two main results. This suggests that, in firms with worker representation through works councils, the productivity gains from more structured management practices are to a larger extent transmitted to workers in the form of higher average wages, but in a less unequal way across the workforce.

Although the main contribution of our paper lies in the richness of our data, as explained above, it must be stressed that the main weakness of our analysis lies in the cross-sectional nature of the same data, since the information on management practices is collected only for a single year. This makes it difficult to claim causality for our above described findings. Nevertheless, in an extension to our main analysis we make some tentative steps towards establishing causality by estimating the effect of management practices on the level and dispersion of wages, using two alternative approaches based on instrumental variables and propensity score matching, respectively. These alternative approaches qualitatively confirm our main results.

As previously mentioned, our analysis contributes to the relatively limited evidence on the relationship between structured management practices and wages. The two most closely related papers are Bender et al. (2018) and Bloom et al. (2021). In the former paper, the authors use a sample of less than 600 German firms and find that the use of more structured management practices is positively correlated with firm average wages, but negatively correlated with two different measures of within-firm wage inequality (the coefficient of variation in wages and the difference between the 90th and 10th percentile in the within-firm wage distribution). Whereas the former result is in line with ours, the latter is not. It should be noted, though, that the relationship between management practices and wage inequality is relatively briefly treated by Bender et al. (2018) in an extension to their main analysis. In contrast, we perform a much more comprehensive analysis of this relationship using both aggregate measures of wage inequality

and average wages within several intervals of the wage distribution.

The other closely related paper is Bloom et al. (2021), who provide evidence that in US large firms the use of structured management practices is positively associated with both higher average wages and higher within-firm wage dispersion. In a general sense, our results are thus in line with those reported by Bloom et al. (2021). However, it is worth noticing that, while those results are based on a sample of relatively large firms (with more than 100 workers), our results are mainly driven by small and medium-sized firms. When we decompose our main results according to firm size categories, it turns out that the magnitudes of the positive relationships between management practices and the level and dispersion of wages are decreasing with firm size and to a large extent vanish for large firms (with more than 250 workers). On the other hand, these relationships are fairly similar across manufacturing and services and across foreign and domestic firms.[1]

Our paper is also somewhat related to an earlier literature on various types of human resource management practices, often referred to as *high-performance work systems* or *high-involvement management*, which include practices such as decentralisation, teamwork, job rotation, quality programs, etc. Relevant papers in this literature include Osterman (2006), who finds that high-performance work systems are associated with higher wages but has no effect on wage inequality, and Forth and Millward (2004), who find that high-involvement management is positively associated with higher pay, and more so when trade union are involved in bargaining.[2]

The rest of the paper is organised as follows. In the next section we present our data and the construction of our main variables, along with some descriptive statistics on how the adoption of management practices in Portugal varies across a number of different firm and industry characteristics. The empirical analysis is found in Section 3 and is presented in three parts as explained above. Throughout this section we explain and discuss how each of our results relate to the existing literature. A summary and some final remarks are given in Section 4.

[1] Another related paper is Lee (2018). Although the main focus in that paper is on the effect of management practices on the demand for different occupational skills, the author also estimates the effect on average earnings for each occupational skill group and finds a positive effect for technical workers in particular. However, it should be noted that this part of the analysis relies on imputed data and is therefore arguably less reliable.

[2] See also Sgobbi and Cainarca (2015) for evidence on the wage effects of high-performance work practices in Italian manufacturing firms and for a comprehensive review of the earlier literature.

2 Data and descriptive statistics

In this section we first present our data and explain how we construct the relevant variables for our analysis. We then proceed to present a series of figures that describe how the adoption of management practices in Portugal varies across a number of different firm and industry characteristics.

2.1 Data and variables

Our main source of data is *Inquérito às Práticas de Gestão* (IPG), collected by the National Statistics Institute (INE). This is a non-periodical compulsory survey collected only once (during the period between June and August 2017) at firm level, asking which management practices were in place in 2016. The survey aims to capture the perceptions of managers and top executives about the importance of their management practices for firm productivity.

IPG gathers data on all firms operating in Portugal in the non-financial private sector, excluding firms with less than five employees. It consists of a representative stratified sample of 4469 Portuguese firms based on the following criteria: economic activity, firm age, size, and whether or not the firm belongs to a conglomerate. The final number of valid responses is 3875, which corresponds to a very high response rate of approximately 87 percent.

The IPG survey includes questions organised in three different areas of management: (1) strategy, monitoring and information; (2) human resources and (3) management and social responsibility. It also includes detailed information on managerial delegation of decisions and leadership.[3] The questions closely follow those from the Management and Organizational Practices Survey (MOPS) supplements of 2010 and 2015 in the US. For our purposes we select 29 (out of 55) questions from the survey, which are described in detail in Table A1 in the Appendix. The questions refer to operational aspects (2 questions), performance monitoring (10 questions), target setting (4 questions), and incentives to workers (13 questions).

Following previous work (e.g., Bloom et al., 2019), we scale the possible responses to each question between 0 and 1, where 0 and 1 correspond, respectively, to the least and most structured management practice. We then compute an overall measure of management practices—a management score—which corresponds to the simple unweighted mean of the non-missing an-

[3] Despite the comprehensiveness of the survey, information on the time of introduction of each management practice in the firm is unfortunately absent.

swers.[4] We also decompose the overall management score by grouping the 29 questions into three broad categories of management practices, following Bloom and Van Reenen (2010). The first category consists of practices related to *monitoring*, i.e., how much of what happens inside the firm is monitored and used for improving procedures. The management score in this category is calculated as the average score across questions 1, 2 and 7-16 in Table A1. The second category consists of management practices related to *targeting*, i.e., the extent to which the firm defines and tracks goals over time and takes action if needed. The management score in this category is calculated as the average score across questions 3-6 in Table A1. The final category consists of practices related to *incentives*, i.e., the extent to which the firm rewards and promotes its workforce, and how it attracts their best workers. The management score in this category is given by the average score across questions 17-29 in Table A1.

In order to link management practices to the firm characteristics and labour outcomes that are relevant for the present study, we link the IPG survey to information from two different censuses of Portuguese firms provided by INE, namely *Sistema de Contas Integrado das Empresas* (SCIE) and *Quadros de Pessoal* (QP). SCIE consists of data gathered from two compulsory financial statements (balance sheet and income statement) and gives access to a rich set of information about each firm. Key variables include gross output, value added, capital stock, exports, wage bill (for managerial and non-managerial occupations separately), industry affiliation and a firm exit indicator. In addition, the dataset includes workforce characteristics such as gender distribution and share of part-time workers. QP, on the other hand, is a matched employer-employee dataset that contains detailed information about each unit observed (worker and firm). For instance, QP provides information on each component of worker pay, number of hours worked (normal and overtime), gender, age, tenure, education and occupation. For the firms, QP also provides information on ownership, location, sales and age.

Our final sample used for the empirical analysis is constructed by imposing a condition that firms have non-missing observations on all variables from the three datasets (IPG, SCIE and QP). This condition implies that 259 firms are dropped from the initial 3875 firms in the IPG survey (234 of these firms do not appear in QP, whereas another 25 firms have missing information on some variables), leaving us with a final sample of 3616 firms. This is the sample that will be used when exploring the factors facilitating the use of structured management practices (Section 3.1) and the relationship between management practices and labour productivity

[4] All the firms in the final sample answered at least 20 out 29 questions.

(Section 3.2). When analysing the relationship between management practices and worker pay (Section 3.3), we impose a further restriction on the sample by excluding micro firms (with less than 11 workers). This part of the analysis is based on various within-firm inequality measures that are more meaningful when the number of workers is sufficiently large.

2.2 Descriptive statistics

Figure 1 shows the distribution of the overall management practices score of the 3875 Portuguese firms in the IPG survey, where the bars represent the actual data and the dark line shows a smooth kernel fit. The average management practices score in Portugal is 0.43 (0.41 in manufacturing versus 0.44 in services), which means that, on average, firms adopt 43 percent of the pre-defined management practices. These figures are significantly below to the ones found in the US (0.615 in 2015), Finland (0.59 in 2016) or Germany (0.57 in 2013) and which refer solely to the manufacturing sector.[5] One possible reason for this finding relates to the firm size coverage of the IPG survey. More than half (53 percent) of firms included are small and micro firms, and firm size correlates positively with management practices, as we discuss below. Nevertheless, an earlier comprehensive international study by Bloom and Van Reenen (2010) for medium-sized firms places management in Portugal below the international average, only above Brazil, India, China and Greece.[6] Overall, the distribution of management practices shown in Figure 1 confirms the low level of adoption of management practices in Portugal. Despite the large variation and heterogeneity observed in management practices across firms, almost two-thirds of firms score less than 0.5 and less than 2 percent score above 0.75.

[Figure 1 here]

In Figure 2 we show the distribution of management scores for each of the three aforementioned subcategories of management practices: monitoring, targeting and incentives. Interestingly, Figure 2 reveals that the distribution of the overall management score (in Figure 1) largely reflects the shape of the distribution of monitoring practices. In contrast, the score distribution for targeting and incentives are much more left- and right-skewed, respectively. In particular, the remarkably low use of management practices related to incentives is a striking feature of the management style in Portugal. Bloom and Van Reenen (2010) and Ohlsbom and

[5] See Ohlsbom and Maliranta (2021) for Finland, Broszeit et al. (2019) for Germany and Bloom et al. (2019) for the US.

[6] This study uses 140 manufacturing firms from Portugal employing between 100 and 5000 employees.

Maliranta (2021) point to strict job market regulations and high union membership rates as possible explanations for the low use of incentives. In an international context, the relatively larger emphasis on targeting and monitoring practices places Portugal closer to the profile of countries like Japan, Germany or Sweden, as opposed to the US management style that to a much larger extent is based on incentives.[7]

[Figure 2 here]

Figure 3 shows the distributions of the overall management score for four different categories of firm size (number of employees): micro, small, medium and large. The figure reveals two clear patterns. First, the mode of the distribution of management scores is monotonically increasing with firm size. Thus, on average, the use of structured management practices is higher in larger firms, which is consistent with findings from several other countries (e.g., Bloom and Van Reenen, 2010; Broszeit et al., 2019; Forth and Bryson, 2019). Second, there appears to be a clear distinction between micro and small firms on the one hand, and medium and large firms on the other. The distributions for micro and small firms are both right-skewed with average management scores of 0.32 and 0.39, respectively. On the other hand, the distributions for medium and large firms are left-skewed with average scores of 0.48 and 0.54, respectively. The position and shape of these distributions thus suggest that the majority of badly (well) run firms are micro and small (medium and large).

[Figure 3 here]

In contrast to most of the existing literature, our data also allows us to compare the distribution of management scores across two categories of industries, namely manufacturing and services. Figure 4 shows that the distribution of management scores in the services sector lies slightly to the right of the equivalent distribution in the manufacturing sector, suggesting that services firms are, on average, better managed than manufacturing firms. Although prior evidence on the shape of the distribution of management scores across sectors is scarce, the pattern displayed here seems to be the opposite of what is found by Bloom et al. (2022) in a recent study on management practices in Mexican firms. The spatial distribution of firms in terms of management practices also varies across services and manufacturing firms, as can be seen from Figure A1 in the appendix, although firms in the metropolitan area of Lisbon are characterised by the highest adoption of structured management practices in both sectors.

[7] See Bloom and Van Reenen (2010) for an overview of management practices in a number of different countries.

[Figure 4 here]

In Figure 5 we show how the average score in each of the three main categories of management practices—monitoring, targeting and incentives—varies according to the skill level of managers and workers, when skill is measured by the share of employees with at least a degree. These figures suggest that the use of structured management practices (of any kind) is lower in firms with very low skill-levels, which is consistent with previous findings of complementarity between structured management practices and employee skills (Bender et al., 2018; Lee, 2018). However, the figures also suggest that the relationship between skill-level and management practices is not necessarily monotonic in firms where the share of high-skilled employees (managers or workers) is sufficiently high.

[Figure 5 here]

3 Empirical analysis

We now turn to the empirical analysis where we use the above described data to estimate different models in order to understand which factors are conducive to the use of structured management practice and how the use of such practices affect labour productivity and worker pay.

3.1 Factors facilitating the use of structured management practices

We start out by investigating the importance of a set of factors that can potentially explain the adoption of more structured management practices in firms. The existing literature identifies several firm and industry characteristics that tend to systematically correlate with the use of management practices, and our aim in this part of the analysis is to examine if a similar pattern applies to firms located in Portugal. We do this by estimating the following empirical model:

$$M_i = \alpha + \beta\Phi_i + \gamma H_j + \tau_k + \rho_r + \varepsilon_i, \tag{1}$$

where M_i is the management practices score of Firm i and Φ_i is a vector of firm-specific characteristics which include size (log of employment), age (years), ownership and governance (indicators for publicly owned and family-owned or family-managed firms, and an indicator for the presence of works councils), two variables measuring the global engagement of the firm (whether

the firm is a multinational or an exporter), and two continuous measures of the level of education and skill of the firm's workforce (share of workers with at least one degree and share of high-skilled workers defined by occupation). Industry-specific characteristics are controlled for by the variable H_j, which measures market concentration (by the Herfindahl-Hirschman Index) in industry j, and an industry indicator variable τ_k, where k and $j \subset k$ are defined at the 2- and 5-digit industry levels, respectively. The model also includes an indicator variable ρ_r for region r, defined at the NUTS-2 level, in addition to the residual term ε_i. The standard errors are robust to arbitrary heteroscedasticity.

[Table 1 here]

The estimation results are presented in Table 1. Among the baseline firm characteristics, size is significantly positively correlated with the management practices score, and the magnitude of this effect drops only slightly after inclusion of all the remaining firm and industry characteristics. Thus, larger firms tend to adopt more structured management practices, all else equal. This finding is in line with the positive associations between firm size and management practices previously reported by Bloom and Van Reenen (2010), Broszeit et al. (2019) and Forth and Bryson (2019), among others.

We also find that firm ownership and governance matter. In line with the existing literature, public ownership is associated with less structured management practices. In particular, the weak use of incentives (e.g., promotions being based on tenure rather than performance) is a typical feature of publicly owned firms (Bloom et al., 2012). For another ownership category that has received attention in the literature on management practices, namely family-owned firms, our results suggest that what really matters is whether such firms are managed by family members or not. The use of structured management practices is significantly different, and lower, only for the subset of firms in which both ownership and management is kept within the family, which again is in line with previous findings in the literature and likely explained by the limited pool of potential managers in such firms (Bloom and Van Reenen, 2007, 2010; Lemos and Scur, 2019).

We also explore the potential importance of different governance structures by identifying firms in which worker representation is formalised in the form of works councils. Interestingly, and perhaps surprisingly, we find that the presence of works councils is significantly associated with the use of more structured management practices. This runs contrary to the finding of

Broszeit et al. (2019) who do not find any such relationship for German firms. It also runs contrary to the more general effect of labour market regulations, which are found to be detrimental to the use of management practices (e.g., Bloom and Van Reenen, 2012). However, as suggested by Osterman (2006), managerial systems and practices might, in themselves, increase employee power, if such practices require more contributions and participation from workers. Thus, the formalisation of such participation in the form of works councils might be a result of the use of more structured management practices, rather than the other way around.

The existing literature also suggests that the adoption of management practices is related to various dimensions of firms' global engagement. In particular, the use of structured management practices have been found to be higher among exporters and multinationals (Bloom and Van Reenen, 2010; Görg and Hanley, 2017). Our results partly corroborate these findings. Whereas we find, on average, significantly higher management scores for multinationals, the equivalent relationship for exporters ceases to be statistically significant when including the full set of control variables. Once more, reverse causality is likely to be at play here, since multinational and export status might result from a selection effect related to better management practices in the first place.

Another regularity reported in the literature is that the use of more structured management practices is positively correlated with the education and skill-level of the workforce (Bloom and Van Reenen, 2010; Bloom et al., 2012). Our results show a similar picture. In particular, our measure of education (share of workers with at least one degree) is strongly correlated with the management score.

Finally, we also explore the potential importance of competitive pressure. Several studies report a positive association between the degree of product market competition and the use of structured management practices (Bloom and Van Reenen, 2007; Bloom et al., 2012; Kambayashi et al., 2021; Bakhadirov and Farooq, 2022). However, using the Herfindahl-Hirschman Index at 5-digit level as a measure of competition, we do not find a significant relationship between this measure and the overall management score. In this respect our results are similar to Broszeit et al. (2019), although they use a self-reported measure of competitive pressure rather than the Herfindahl-Hirschman Index.

Overall, though, the estimation results shown in Table 1 are very much in line with previous findings from other countries reported in the literature.

3.2 Management practices and firm performance

Is the management score positively associated with better performance in Portugal, as in other countries? In order to answer this question, we start out by showing the raw correlation between the management score and six different firm performance measures—output, output growth (measured two years after the survey), labour productivity (output per worker), employment, profitability (measured by operational profits) and exports—across manufacturing and services. In Figure 6, the vertical bars show the median value of each performance measure for each decile of the overall management score. Although the relationships are not strictly monotonic in all cases, it is clearly evident from this figure that higher management scores are generally associated with better performance for each of the performance measures, and this applies to both manufacturing and services firms.

[Figure 6 here]

We proceed by using regression analysis to establish the relationship between management scores and one of the firm performance measures displayed in Figure 6, namely labour productivity, measured as output per worker. More specifically, we estimate the following augmented Cobb-Douglas function:

$$\ln\left(\frac{Y_i}{L_i}\right) = \alpha_0 + \alpha_1 M_i + \alpha_2 \ln\left(\frac{K_i}{L_i}\right) + \beta\Phi_i + \gamma H_j + \tau_k + \rho_r + \varepsilon_i, \tag{2}$$

where Y_i, L_i and K_i are, respectively, the output, employment and capital of Firm i. The remaining variables are as defined in equation (1). Notice that we allow for non-constant returns to scale by including L_i in the vector of controls (Φ_i). Our main coefficient of interest is α_1, which measures the relationship between the management score and the (logarithm of) output per worker. The regression estimates of this coefficient are displayed in Table 2, where we also report the corresponding estimates of regressions where M_i is defined as the management score of Firm i in each of the three subcategories of management practices: monitoring, targeting and incentives.

[Table 2 here]

The first four columns in Table 2 show the estimate for each of the four measures of the management score (overall and for each of the three subcategories) when included separately in

equation (2). The results are very clear. There is strong evidence of a positive and significant relationship between the management score (overall and for each subcategory of management practices) and labour productivity. However, an interesting picture emerges when we estimate an extended version of equation (2), where the management scores in each of the three subcategories of practices are included jointly. The resulting estimates are reported in the final column of Table 2, and show that only management practices related to incentives appear to be relevant for labour productivity, as the statistical significance of the management scores for practices related to monitoring and targeting vanishes.

Table 3 replicates the specification of the first column in Table 2 for different sub-samples of the data. Columns (1)-(4) present estimates for different subsamples related to firm size, columns (5) and (6) show estimates for manufacturing and services, respectively, whereas columns (7) and (8) present estimates for low- and high-skilled firms, respectively, where a firm is defined as low-skilled (high-skilled) if the share of its workers with a degree is below (above) the median of the sample of firms.

[Table 3 here]

The results reported in the first four columns of Table 3 show a consistent and somewhat surprising pattern, where the magnitude of the estimated coefficient decreases monotonically with firm size and ceases to be significant for medium-sized and large firms. In other words, the use of structured management practices seems to be more important for labour productivity in small firms than in large firms. This contrasts markedly with previous findings in the literature. For example, Brozeit et al. (2019), when estimating a similar specification, find an opposite pattern in terms of magnitude and significance for German firms.

The remaining results in Table 3 are more as expected. The relationship between the overall management score and labour productivity is positive and statistically significant for both manufacturing and services firms, with a relatively similar magnitude across the two sectors. We also find that the use of structured management practices is more strongly correlated with labour productivity in high-skilled firms, which corroborates previous findings in the literature suggesting that managerial practices are complementary with worker skills (e.g., Bender et al., 2018; Lee, 2018).

3.3 Management practices and wages

Whereas our results reported in the previous two subsections to a large extent confirm the established results in the literature, we now turn to the part of the empirical analysis for which the existing literature is relatively scant, and which represents the main contribution of the present paper, namely the relationship between management practices and wages. A first indication of this relationship is depicted in Figure 7, which shows the raw association between management scores and six different measures of the level and within-firm distribution of wages. For each of these measures, the figure depicts the median level of the measure in each decile of the distribution of firms when ranked according to the management score. These correlations are shown separately for services and manufacturing firms, and we also distinguish between managerial and non-managerial pay.

[Figure 7 here]

In the top row of Figure 7 we display three measures of pay for the whole sample of workers, namely (i) average annual pay (computed as the total wage bill divided by the total employment), (ii) average monthly pay (for full-time workers aged between 17 and 68) and (iii) hourly wage for the same workers. Whereas (ii) and (iii) consist only of wage payments to workers, (i) is a conceptually different pay measure in the sense that it encompasses all the firm's labour costs, including insurance, payroll taxes, perks, etc.[8] However, all three pay measures show a clear positive (though not always strictly monotonic) association with management scores, both for services and manufacturing firms, and this association does not seem to be driven by variation in working hours.

In the bottom row of Figure 7 we include one measure of within-firm wage inequality, namely the standard deviation of (the logarithm of) monthly wages, and we also split the average annual pay between managers and the rest of the workforce. Once more, we observe a positive correlation between management scores and each of these three variables. Thus, higher management scores appear not only to be associated with higher average pay, but also with higher pay inequality within the firm. It is also worth noticing that the positive correlation between management scores and average annual pay seems to be more pronounced for managers than for non-managers.

[8] These measures also come from different data sources. Whereas average annual pay is extracted from the SCIE data, average monthly and hourly wages are extracted from the QP dataset.

We proceed to explore whether the above described links between management practices and wages persist in regression analyses. More specifically, we estimate the following model:

$$\ln W_i = \alpha_0 + \alpha_1 M_i + \beta \widetilde{\Phi}_i + \gamma H_j + \tau_k + \rho_r + \varepsilon_i, \tag{3}$$

where W_i is a pay (or pay dispersion) measure defined at firm level. We consider a variety of measures of average firm pay and within-firm pay dispersion. Specifically, we look at annual, monthly and hourly compensation measures. We construct the annual measure as payroll expenses per worker obtained from annual accounts in the SCIE dataset. In contrast, we calculate monthly and hourly wages of full-time workers in each firm using information from our matched employer-employee dataset (QP). For these workers, we compute the standard deviation and the coefficient of variation of (the logarithm of) monthly wages. We also compute monthly wages for narrower groups of workers, defined either according to their position in the wage distribution or by their occupational status. The independent variables in equation (3) are similar to the ones previously defined, with the exception that the vector $\widetilde{\Phi}_i$ expands the previously defined vector Φ_i with the following firm-specific workforce attributes: average age and tenure of the workforce, share of females and new hires in the firm, and share of workers covered by firm, multi-firm, sectorial or other type of wage agreement.

3.3.1 Main findings

Table 4 reports the estimated relationship between the overall management score and our key measures of pay and pay dispersion. In Panel A, this relationship is shown for average wage and dispersion measures that are based on the firms' entire workforce. In contrast, Panel B shows the estimated relationship between the management score and average wages within different intervals of the within-firm wage distribution, whereas Panel C displays the corresponding estimates for managers versus non-managers.

The evidence presented in Table 4 largely confirms the overall picture previously shown in Figure 7. The results shown in the first three columns of Panel A indicate that a higher management score is significantly associated with higher average wages, regardless of which wage measure we use, and the magnitude of this relationship is also sizeable. This finding of a positive relationship between structured management practices and worker pay is in line with the (few) previous findings in the literature (Bender et al., 2018; Bloom et al., 2021).

[Table 4 here]

However, the results in the last two columns of Panel A also reveal that higher management scores are significantly associated with higher within-firm wage inequality. Taken together, the results in Panel A suggest that the positive relationship between structured management practices and wages is stronger for workers higher up in the wage distribution, and this is precisely what the results in Panel B reveal. Although the estimated association is on average positive even for workers in the bottom decile of the distribution, it is much stronger for workers closer to the top of the distribution. These results are in line with the ones reported by Bloom et al. (2021), but contrast with the ones reported by Bender et al. (2018), who find that management scores are negatively correlated with within-firm wage inequality.

In a similar vein, the results in Panel C indicate that the positive relationship between management scores and wages is much stronger for managers than for non-managers. When using the monthly wage measure, these estimates are very similar regardless of whether managers are defined by occupation (which implies a sizeable loss of observations) or by their placement in the wage distribution (top 1 percent). Since management practices are implemented by managers, the stronger correlation between management scores and average pay for managers might be a result of reverse causality, where the propensity to implement structured management practices reflects managerial quality, which in turn is associated with higher managerial compensation. In other words, some firms might have higher management scores because they attract better managers by paying them more.

In Table 5 we re-estimate the relationships in Table 4, but instead of using the overall management score as the dependent variable, we use management scores based on each of the three aforementioned subcategories of management practices, related to *monitoring*, *targeting* and *incentives*. The results are quite striking, showing that only management practices related to *incentives* are consistently associated with higher wages and increased wage inequality. For the other categories of management practices, the relationships with average wages and wage inequality are for the most part not significant. These results mirror our previously derived results regarding the relationship between management practices and labour productivity, as shown in Table 2.

[Table 5 here]

We also perform a more disaggregated analysis where we estimate the relationship between

the overall management score on each of the three components of workers' monthly wage, namely (i) base wage, (ii) bonus-related payments, and (iii) overtime pay. As before, we perform this analysis both for the entire workforce and for managers and non-managers separately. The results are displayed in Table 6, where the estimates in the first column refer to the overall monthly wage and are therefore replicated from Table 4. We see that higher management scores are significantly associated with higher base wages for both managers and non-managers. However, while the relationship between management practices and average monthly wages for *managers* is predominantly determined by differences in base wages across firms with different management scores, the equivalent relationship for the rest of the workforce is also to a significant extent determined by differences in overtime payments. Of course, the absence of a significant effect on overtime pay for managers is not surprising, given that managers often are paid according to contracts where overtime is not a relevant concept. For the remaining wage component, namely bonus-related payments, we do not find any significant association with overall management scores, although the point estimates are positive and quite sizeable both for managers and non-managers. The lack of statistical significance for this variable is perhaps a bit surprising, given our results in Table 5 showing that the positive relationship between management scores and average wages is mainly driven by management practices related to incentives. This might suggest that the positive relationship between incentives-based management practices and average worker pay is not primarily related to the use of performance-based pay contracts.

[Table 6 here]

3.3.2 Firm heterogeneous effects

We proceed by exploring whether the main results reported in Table 4 systematically vary across different categories of firms. In Table 7 we report results for different firm size categories (Panel A) and for services versus manufacturing firms (Panel B). The results reported in Panel A suggest that the relationship between structured management practices and wages is not uniform across different sized firms. More specifically, the relationship between management scores and average wages seems to decrease with firm size, and for large firms there is no significant association between management scores and average monthly wages. These results mirror our previously shown results regarding the relationship between structured management practices and labour productivity (cf. Table 3). Firm size also seems to play a similar role

for the relationship between management scores and wage dispersion, where our results suggest that the positive relationship between these two variables is driven by small and medium-sized firms. On the other hand, the results displayed in Panel B indicate that our main results are fairly homogeneous across services and manufacturing firms.

[Table 7 here]

In Table 8 we perform a similar decomposition by looking at firms with different ownership (Panel A) and governance (Panel B). In Panel A we distinguish between firms with foreign and domestic ownership. Although the association between management scores and wage inequality seems to be somewhat stronger in foreign-owned firms, the overall picture is quite similar for the two ownership categories. The same applies to Panel B, where we explore whether these associations are different for family-managed firms and conclude that this is generally not the case, although we know that management scores tend to be significantly lower in such firms (cf. Table 1).

[Table 8 here]

The most eye-catching difference between the two categories of firms in Panel B is that the relationship between management scores and managerial pay is much stronger (almost twice as large in magnitude) for firms that are not family-managed. This is an interesting observation, since a distinction between firms that are family-managed or not could plausibly serve as a test of how much of the relationship between management scores and management pay that can be explained by reverse causality. As previously explained, firms might have higher management scores because they pay more for hiring better managers. However, this explanation can hardly apply to family-managed firms, where the pool of managerial candidates is highly restricted by family ties. Thus, we would argue that the difference between the two estimated coefficients in Column (8) of Panel B could potentially be seen as an estimate of how much of the overall correlation between management scores and managerial pay that could be attributed to reverse causality.

3.3.3 Potential mechanisms and mediating factors

In this subsection we explore some potential mechanisms and mediating factors that could explain the relationships between management scores on the one hand and pay and pay inequality

on the other. We start out by exploring the role of labour productivity. We have already shown that management scores are positively associated with both labour productivity (Table 2) and worker pay (Table 4). A straightforward hypothesis is therefore that higher management scores are correlated with higher wages because more structured management practices make workers more productive.

In Table 9 we re-estimate the key results from Table 4 using labour productivity as an additional independent variable. The results in Panel A show that, in every single regression, the inclusion of this variable reduces the estimated magnitude of the management score coefficient, but the coefficient still remains statistically significant. These results indicate that some, but not all, of the positive correlation between management scores and wages can be explained by changes in labour productivity.

[Table 9 here]

We have also estimated regressions where we include an interaction between management scores and labour productivity. The results of these regressions are displayed in Panel B in Table 9, where the significantly positive coefficient on the interaction term in Column (2) indicates that there might be some complementarities between labour productivity and management scores with respect to average monthly wages. An illustration of this complementarity is given by Figure 8, which shows the predicted monthly wage for different combinations of management score and labour productivity.[9] This figure reveals two interesting insights. First, a positive relationship between between management scores and average pay requires that labour productivity is sufficiently high. For sufficiently low-productive firms, such a relationship does not exist. Second, although higher labour productivity is associated with higher average wages for practically all types of firms, this association is much stronger for firms with higher management scores.

[Figure 8 here]

Whereas the implementation of more structured management practices in a firm might make existing workers more productive, for example through a better use of incentives, they might

[9] The interaction between management score and labour productivity in our empirical model causes the curvature of the contour lines in Figure 8. Without the interaction, the contour lines would be straight. Thus, the curvature reveals how the relationship between management scores and monthly wages varies across different levels of productivity, and *vice versa*.

also induce the firm to hire more skilled workers. In other words, the relationship between management practices and worker pay might also be explained by changes in the skill composition of the workforce. In order to explore this potential channel of influence, we classify workers into four different skill groups using the International Standard Classification of Occupations (ISCO-08). We then estimate different versions of a regression equation similar to (3) for each of the skill groups, using monthly wage, employment and employment share as dependent variables. These regressions are estimated on the full sample of firms and on a sub-sample consisting only of firms in which all four skill groups are present. The results are presented in Table 10 and reveal a relatively clear picture. Higher management scores are significantly associated with higher demand, both in absolute and relative terms (Panel B and C), for high-skilled occupations. In other words, firms with more structured management practices tend to have a different occupational skill composition with a higher share of workers in high-skilled occupations. This result resembles the result reported by Lee (2018), who finds that modern management practices increase the relative demand for skilled (in particular technical) workers. Given that workers in higher-skilled occupations are on average paid more, our main results in Table 4 could therefore to some extent be explained by differences in occupational skill composition.

[Table 10 here]

However, the results in Panel A also reveal a significantly positive relationship between management practices and average wages *within each occupational skill group*. Furthermore, this relationship is considerably stronger for high-skilled than for low-skilled occupations. Thus, neither the relationship between management scores and firm average wages, nor the relationship between management scores and within-firm wage inequality, can be fully explained by differences in occupational skill composition. A complementary explanation might be that firms with more structured management practices are better at hiring and retaining better (more productive) workers within each occupational category, as documented by Cornwell et al. (2021), and that this applies particularly to high-skilled occupations.

Finally, we explore the potential role of labour market institutions as a mediating factor in the relationship between management scores and wages. If more structured management practices improve firm performance, the extent to which these gains are transmitted to workers in the form of higher wages, and exactly how these wage increases are distributed across the workforce, are likely to depend on the collective bargaining power of workers. In the absence of a

direct measure, we use the presence (or not) of *works councils* as a proxy for workers' collective bargaining strength. All else equal, worker representation in the form of works councils are likely to increase workers' influence over the distribution of productivity gains stemming from better management practices.

[Table 11 here]

In Panel A of Table 11 we reproduce the main results from Table 4 showing the separate effect of the presence of works councils. We see that, all else equal, firms with works councils have both higher annual labour costs and lower wage inequality than firms with no such worker representation, which is consistent with our underlying assumption that the presence of works councils is a proxy for workers' collective bargaining power. The more interesting results emerge in Panel B, where we interact the management score variable with the works council indicator variable. The estimated coefficients associated with this interaction term indicate that the relationship between management practices and worker pay is indeed mediated by the presence of works councils. More specifically, the presence of works councils seems to strengthen the relationship between management scores and average pay while simultaneously weaken the relationship between management scores and wage inequality. This might suggests that, in firms with works councils, a larger share of the productivity gains from better management practices is shared with workers, and the gains are more evenly distributed across the workforce.

3.3.4 Robustness

An undeniable limitation of our study is the cross-sectional nature of our data, since we only have information about management practices in a single year (2016). This obviously makes it hard to claim causality for our findings. Our aim in this subsection is therefore to make some tentative steps towards establishing causal relationships by re-estimating our key results from Table 4 using two alternative approaches based on (i) instrumental variables and (ii) propensity score matching.

IV estimations In order to test for reverse causality, that firms with higher wages and wage dispersion choose to adopt more structured management practices, we need to find instruments that can plausibly explain management scores but not wages. Such instruments are hard to find. We use two different instruments inspired by the literature on management systems (e.g.,

Osterman, 2006, and Sgobbi and Cainarca, 2015). In particular, we use two variables indicating whether the firm has multiple plants and whether it has more than four hierarchical levels. These two variables are collected directly by the IPG survey and are related to firm size, which is the variable with highest explanatory power in the estimation of equation (1). Once employment is controlled for, there is not an obvious relationship between these two instruments and wages.

Our eight selected outcome variables are shown in Table 12. As a first step, we perform a Durbin-Wu-Hausman test for whether or not our management score variable is endogenous to these outcome variables. The results reported in Table 12 show that in six out of eight variables the Durbin-Wu-Hausman test leads to strong rejection of the null hypothesis that the mean management score is exogenous. We then check the relevance of the instruments in the first step. Both the F-statistic (that tests the joint significance of both instruments) and the minimum eigenvalue statistic firmly reject the null hypothesis of weak instruments. This means that the two instruments account for a significant variation in management practices given by Shea's partial R-squared. Since our model is overidentified, we also test the validity of our instruments. In all eight specifications the Hansen statistic does not reject the null hypothesis and we conclude that the instruments are valid.

[Table 12 here]

The results we obtain when re-estimating the effect of structured management practices on the key wage measures, using the above described IV approach, give a strong qualitative confirmation of the results previously reported in Table 4. A comparison of the estimated coefficients in Table 12 and Table 4 reveal that they are qualitatively very similar. The main difference is that the magnitudes of the coefficients are generally much larger using the IV approach.

Propensity score matching In our second robustness check, we use observed values of the management score to create two different categories of firms, with 'high' and 'low' adoption of structured management practices, respectively, based on whether the management score is above or below a certain threshold. We then consider firms with high and low adoption of management practices as 'treated' and 'untreated' firms, respectively, and use propensity score matching to eliminate systematic differences (along other relevant dimensions) between treated and untreated firms.

In order to create a relevant benchmark, we first re-estimate (3) when the continuous variable M_i is replaced by a binary variable $\widetilde{M}_i \in \{0,1\}$, where $\widetilde{M}_i = 1$ ($\widetilde{M}_i = 0$) if Firm i has a high (low) adoption of management practices. We choose two alternative thresholds, defined by the 50th and 75th percentile of the distribution of management scores, respectively, to split the sample into 'treated' and 'untreated'. Panel A of Table 13 shows the estimated coefficients on eight different measures of pay and pay inequality, for each of the two alternative definitions of $\widetilde{M}_i$. In both cases, the general picture (in terms of sign and statistical significance of the estimated coefficients) is very similar to the results presented in Table 4.

[Table 13 here]

Panel B shows the corresponding estimated coefficients obtained when we apply propensity matching methods. The propensity score is estimated using the variable specification of Table 1 in a logit model to ensure that our predicted management score lies between 0 and 1. For each treated firm, we find the closest nearest neighbour in the control group without imposing any maximum distance between the two potential matches. Figure A2 in the Appendix shows how matching succeeds in reducing the variability between the two groups of firms for the two alternative definitions of $\widetilde{M}_i$. The results based on propensity score matching, shown in Panel B, are generally in line with our benchmark results in Panel A, particularly in terms of sign and magnitude of the coefficients, although the statistical significance is markedly stronger when using the 75th percentile threshold.

4 Concluding remarks

In this paper we have used rich Portuguese data to study the relationship between structured management practices and pay, focusing both on average earnings and within-firm pay dispersion. Our two main results are that the use of structured management practices is significantly associated with both (i) higher average pay and (ii) higher pay dispersion within the firm. Although the positive relationship between management practices and average wages applies throughout the wage distribution, even for workers in the bottom decile, the magnitude of this relationship is monotonically larger for workers higher up in the distribution, thus contributing to higher within-firm wage inequality.

Whereas our two main results partly confirm existing literature, our detailed analysis produces a further set of new insights regarding the relationship between management practices

and pay. First, our two main results seem to be exclusively driven by only a relatively narrow subset of management practices, namely practices related to incentives. Second, both results are also mainly driven by small and medium-sized firms, while, perhaps surprisingly, similar relationships are generally not present for large firms. Third, the positive relationship between management practices and average wages applies to all occupational skill groups, but the magnitude of the relationship is much stronger for workers in high-skilled occupations. Fourth, a decomposition of the average wage variable shows that the positive relationship with structured management practices is driven by differences in both base wages and overtime pay.

The main limitation of our study is the absence of more than one observation per firm for the management practices variable, which makes it hard to claim causality for the above described relationship between management practices and wages. Although our main results are robust to alternative approaches based on instrumental variables and propensity score matching, a more solid confirmation of causality could potentially be established in a panel data analysis, which would require new waves of the management practices survey. This will hopefully be available in the future.

Appendix

Table A1 shows a description and categorisation of the 29 questions from the IPG survey that are used to construct the management scores that we use in our analysis.

[Table A1 here]

Figure A1 illustrates (for services and manufacturing firms separately) the spatial distribution of firms in terms of management practices.

[Figure A1 here]

Figure A2 illustrates the propensity score matching quality in the form of covariate balance plots that show how propensity score matching reduces the variability between firms with 'high' and 'low' adoption of structured management practices ('treated' and 'untreated' firms, respectively), for each of the two management score thresholds.

[Figure A2 here]

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Figure 1 - Distribution of management scores

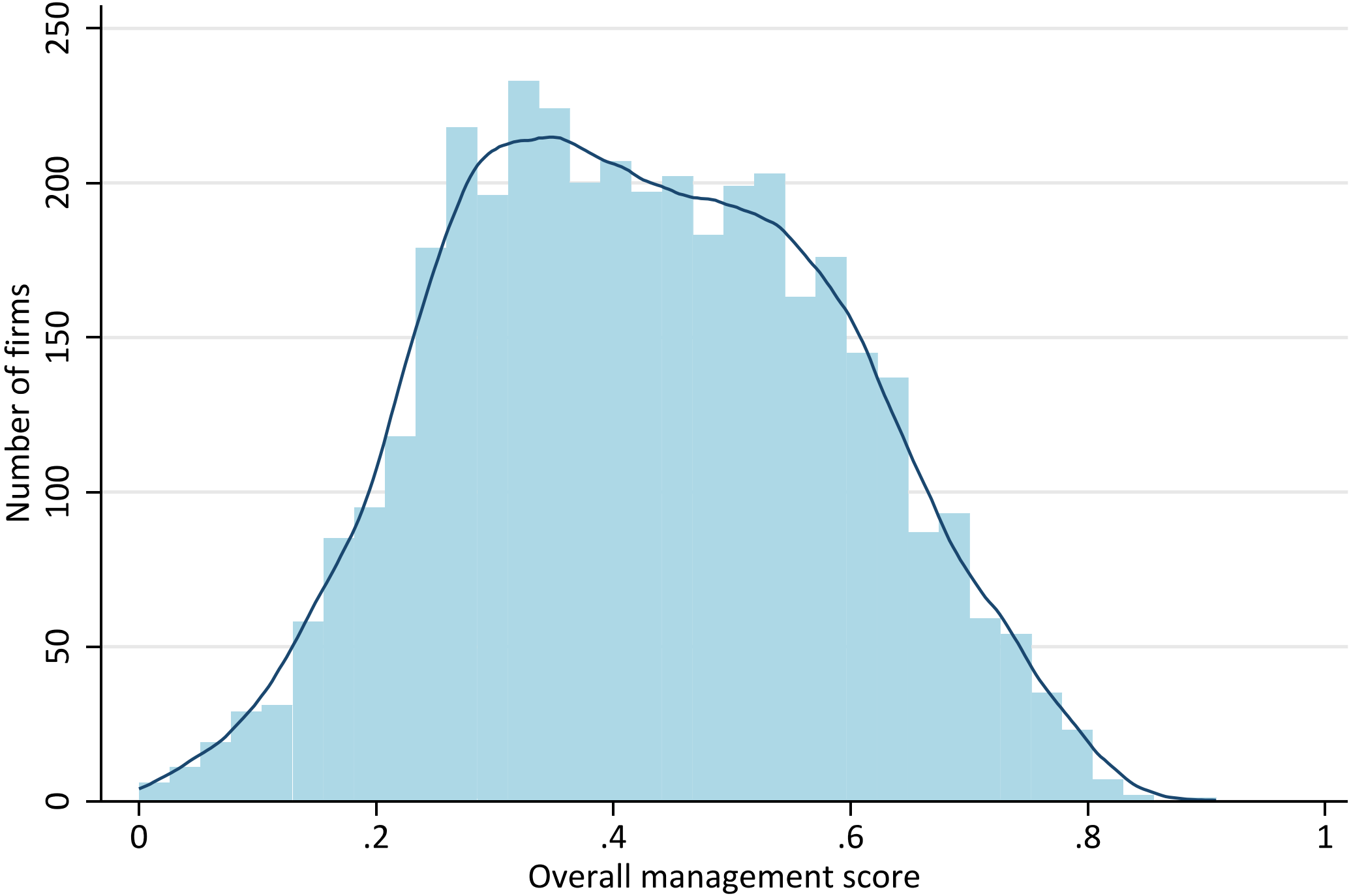
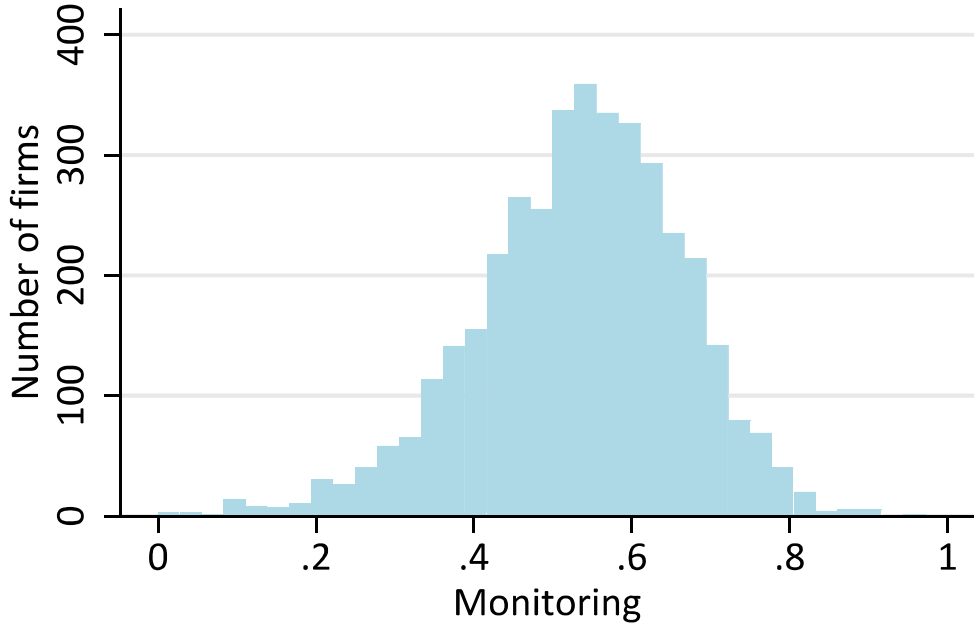
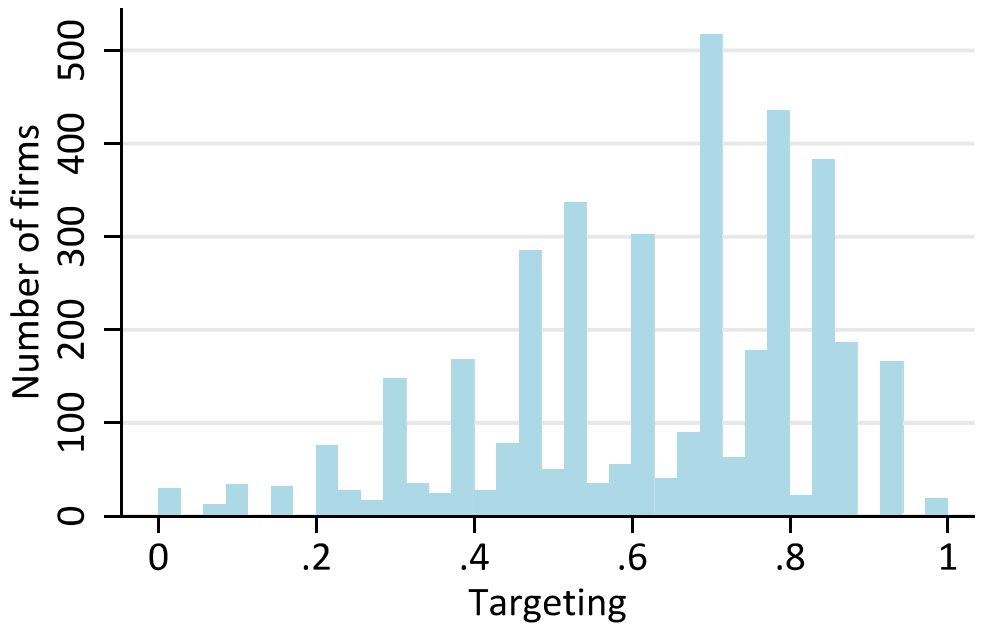


Figure 2 - Management practices by category





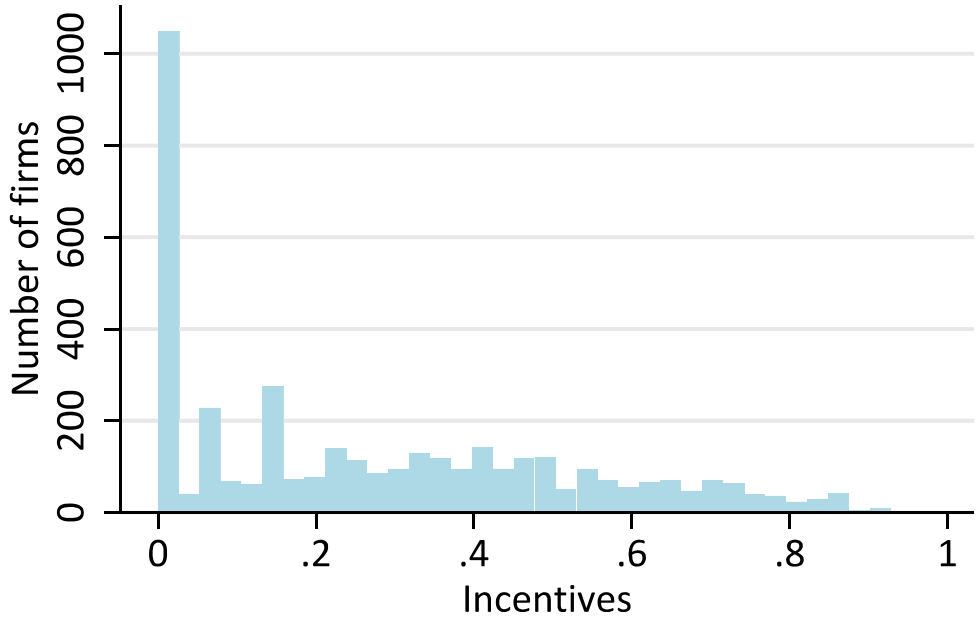


Figure 3 - Management practices and firm size

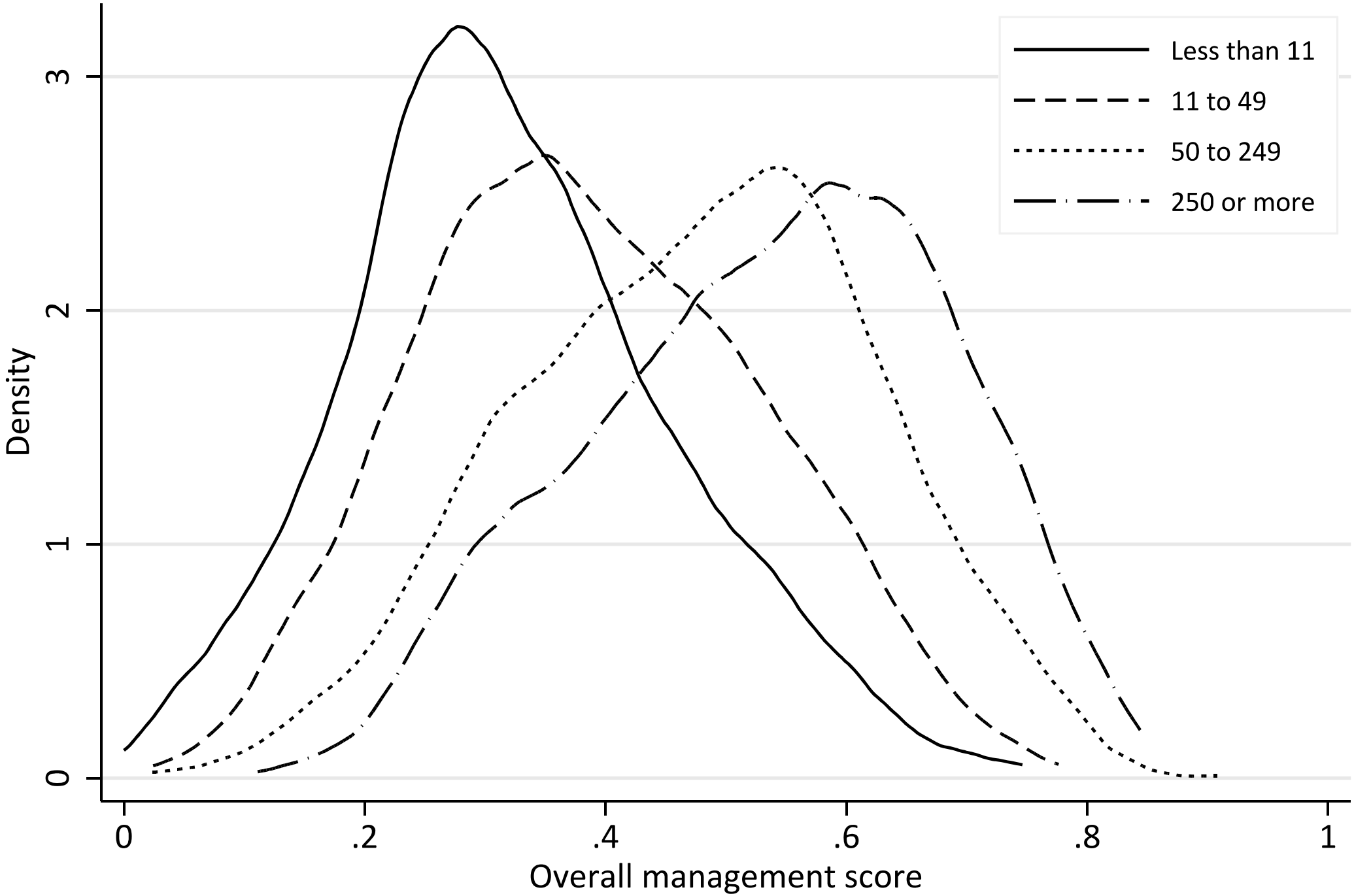


Figure 4 - Management practices by economic sector

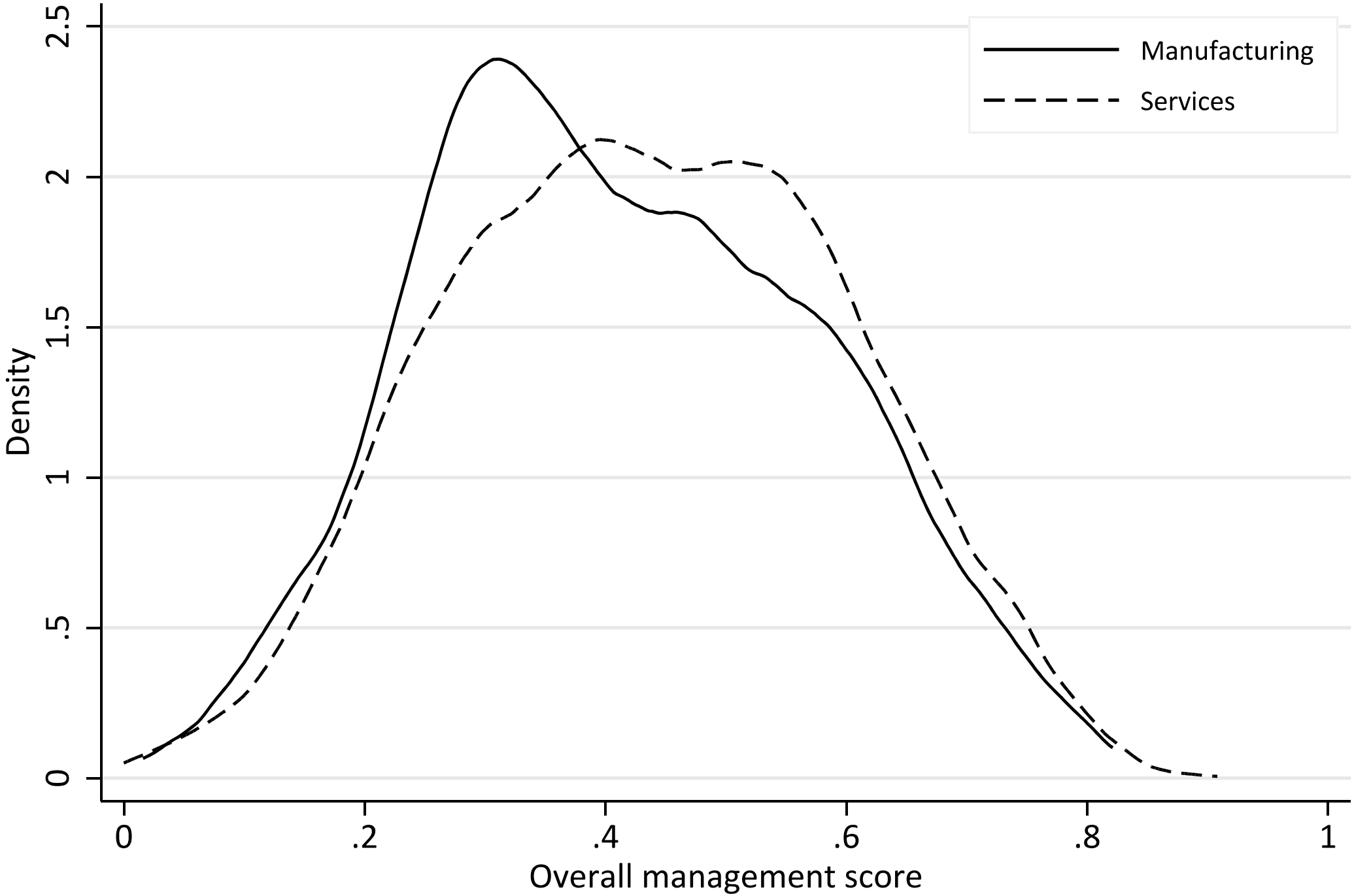


Figure 5 - Management score by skill level of (non)managers

(Skill measured by share of workers with at least a degree)

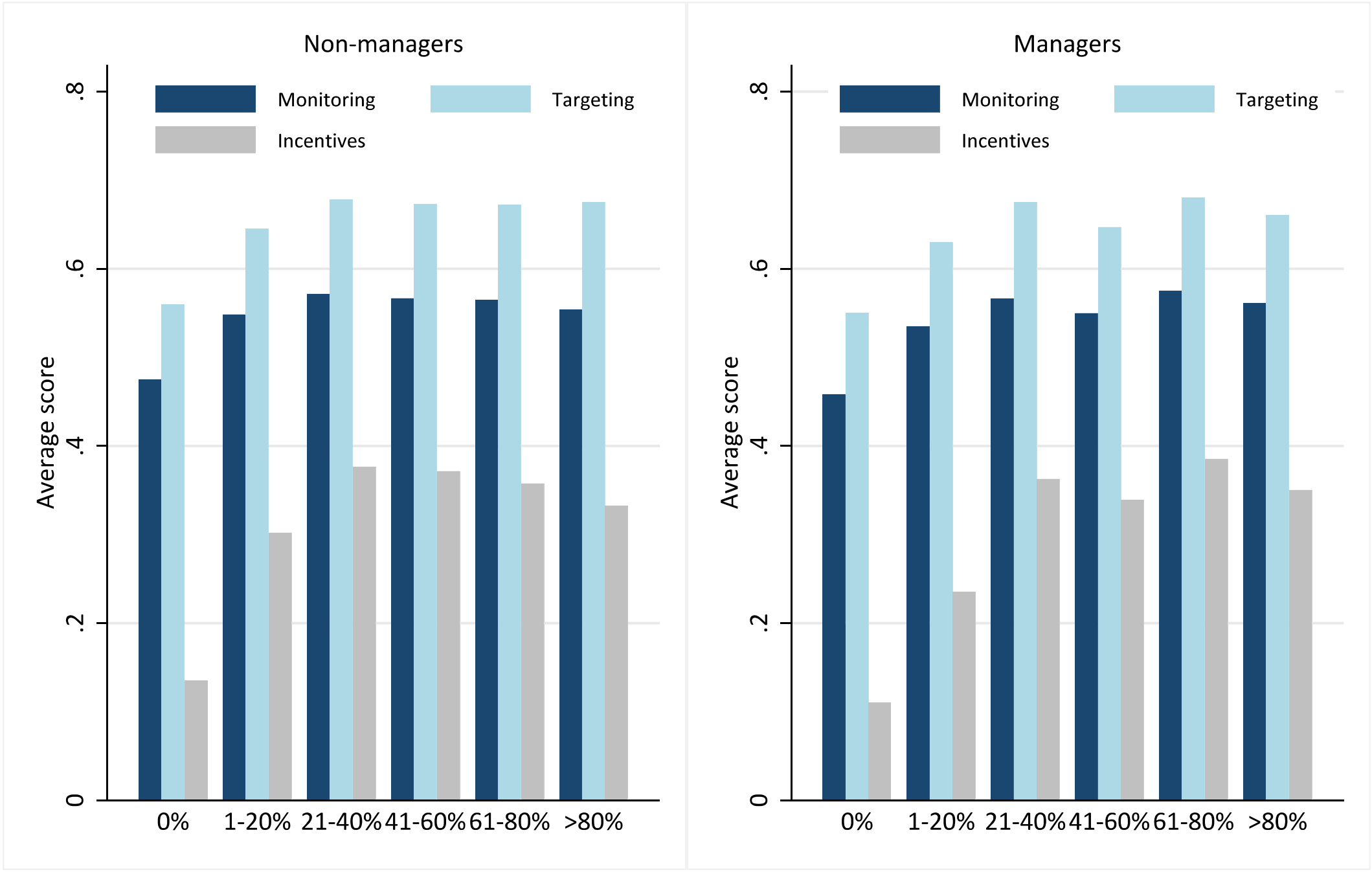


Figure 6 - Firm performance and management practices

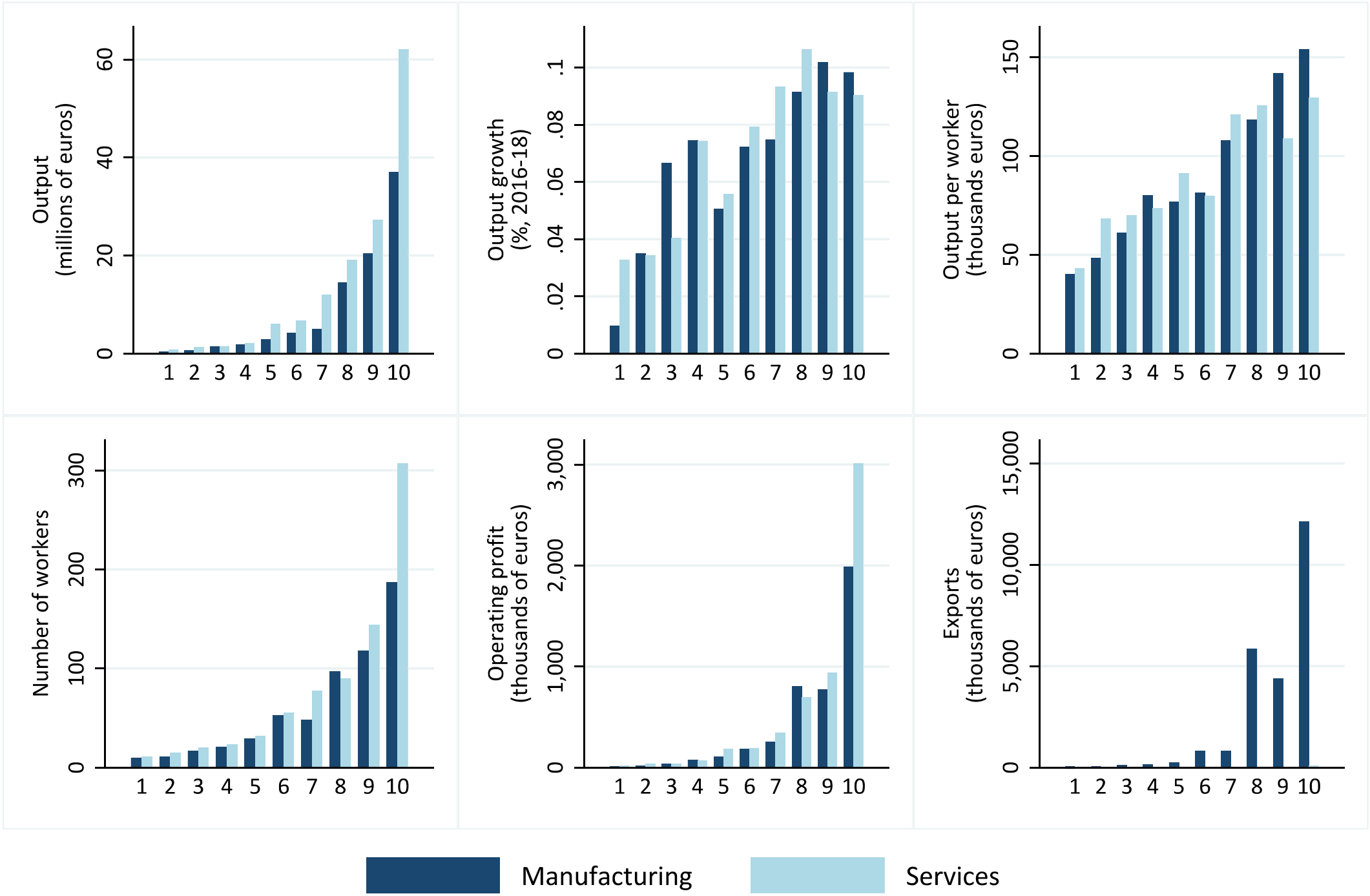


Figure 7 - Firm pay and management practices

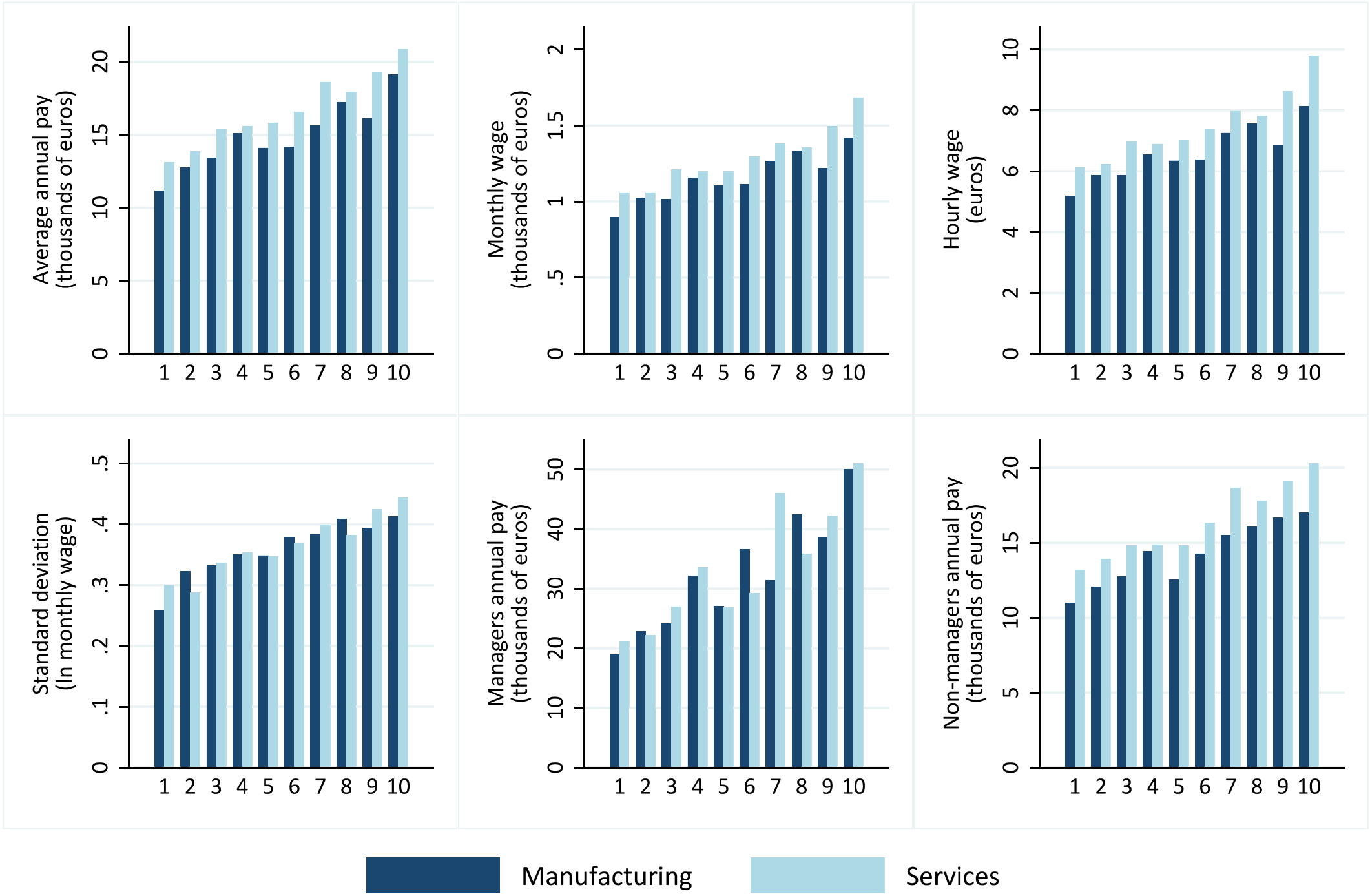


Figure 8 - Predicted monthly wage

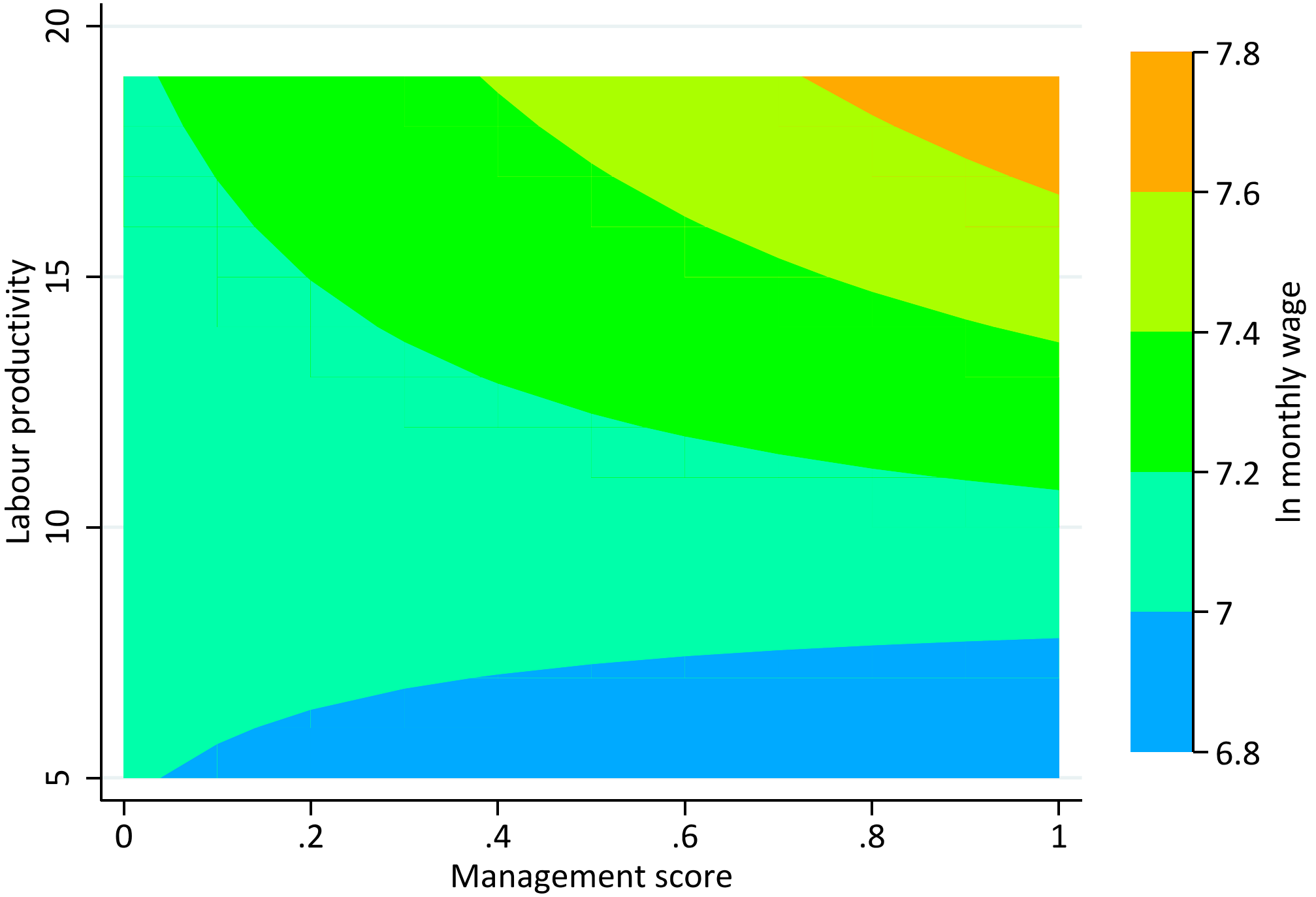


Figure A1 - Management practices across regions

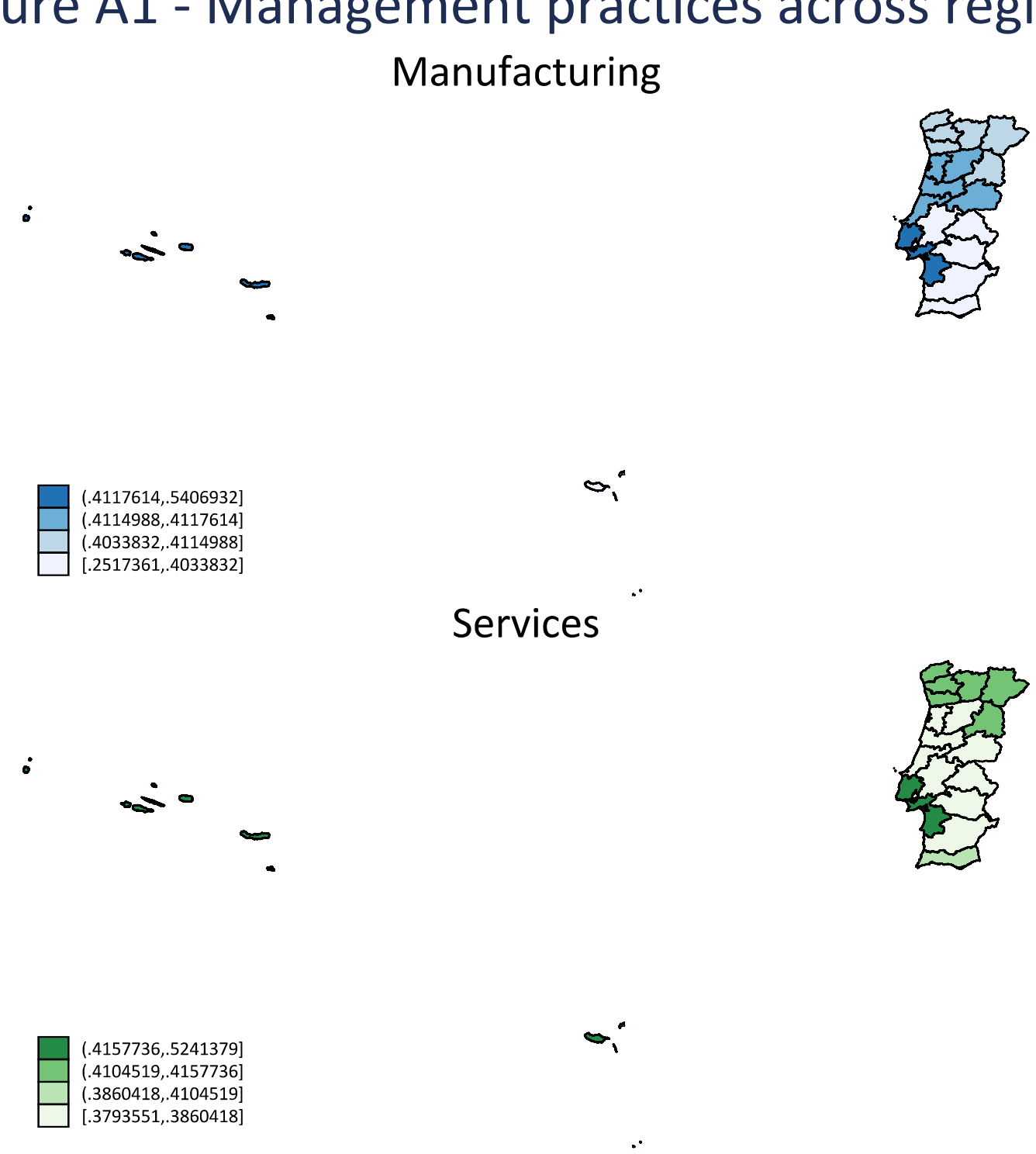


Figure A2 - Quality of matching on propensity score

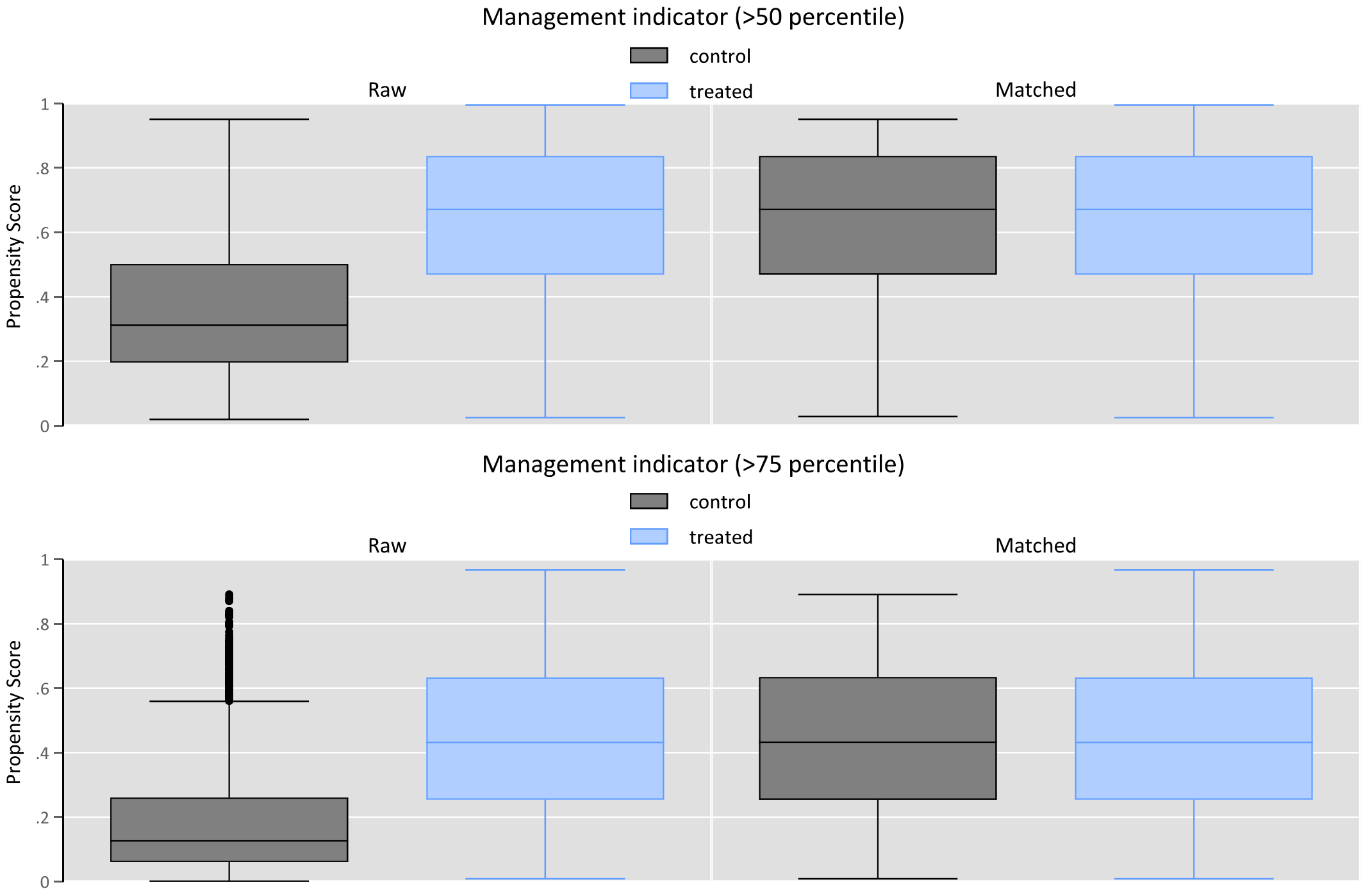


Table 1 - Factors facilitating the use of structured management practices, 2016 Portugal

Variables	(1)	(2)	(3)	(4)	(5)
Baseline characteristics					
ln number of workers	0.050***	0.047***	0.045***	0.046***	0.046***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Firm age (years)	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ownership and governance					
Public ownership (>50%)		-0.150***	-0.133***	-0.139***	-0.139***
		(0.018)	(0.018)	(0.018)	(0.018)
Family-owned (>50%)		-0.004	-0.004	-0.001	-0.001
		(0.007)	(0.007)	(0.007)	(0.007)
Family-managed		-0.035***	-0.027***	-0.020***	-0.020***
		(0.007)	(0.007)	(0.007)	(0.007)
Works council status		0.032***	0.029***	0.024***	0.023***
		(0.009)	(0.009)	(0.009)	(0.009)
Global engagement			0.043***	0.035***	0.035***
Multinational			(0.007)	(0.006)	(0.006)
			0.010**	0.003	0.003
Exporter			(0.005)	(0.005)	(0.005)
Human capital					
Share of workers with at least a degree				0.140***	0.139***
				(0.014)	(0.014)
Share of high-skilled workers (based on occupations)				0.040***	0.040***
				(0.011)	(0.011)
Product market competition					
HHI defined at 5 digits					0.033
					(0.023)
Region and industry FE	Yes	Yes	Yes	Yes	Yes
Number of firms	3616	3616	3616	3616	3616
Adjusted R^2	0.321	0.345	0.353	0.387	0.388

Notes: In all columns, the dependent variable is the management practices score. The OLS regressions include indicators for regions defined at Nuts 2 level and indicators for industry sectors defined at 2-digits. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 2 - Management practices and labour productivity

Dependent variable: ln sales per worker	(1)	(2)	(3)	(4)	(5)
Management score	1.218***				
	(0.213)				
Monitoring		0.636***			0.280
		(0.215)			(0.211)
Targeting			0.319**		0.134
			(0.134)		(0.139)
Incentives				0.754***	0.689***
				(0.127)	(0.128)
ln number of workers	-0.084***	-0.042*	-0.038	-0.081***	-0.087***
	(0.024)	(0.023)	(0.023)	(0.023)	(0.024)
ln capital per worker	0.089***	0.092***	0.092***	0.091***	0.090***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Share of workers with at least a degree	0.276	0.392	0.405	0.304	0.276
	(0.274)	(0.269)	(0.266)	(0.275)	(0.273)
Share of high-skilled workers	1.193***	1.229***	1.241***	1.184***	1.187***
	(0.161)	(0.162)	(0.161)	(0.160)	(0.161)
Region and industry FE	Yes	Yes	Yes	Yes	Yes
Number of firms	3616	3616	3616	3616	3616
Adjusted R^2	0.348	0.342	0.342	0.347	0.348

Notes: In all columns, the dependent variable is ln sales per worker. The OLS regressions include ownership and governance indicators, multinational and export indicators, HHI, regional indicators (Nuts 2) and industry indicators defined at 2-digits. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 3 - Management practices and labour productivity across firm size, economic sector and skill level

Dependent variable: ln sales per worker	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Firm size				Economic sector		Workforce skill	
Sample:	Micro	Small	Medium	Large	Manufacturing	Services	Low	High
Management score	1.650***	1.424***	0.692	0.377	0.950***	0.987***	0.719***	1.563***
	(0.466)	(0.357)	(0.473)	(0.261)	(0.272)	(0.261)	(0.238)	(0.369)
ln number of workers	-0.949***	0.030	0.138*	-0.094*	-0.027	-0.111***	-0.068*	-0.105***
	(0.228)	(0.110)	(0.075)	(0.054)	(0.035)	(0.032)	(0.037)	(0.034)
ln capital per worker	0.066***	0.131***	0.102**	0.043***	0.147***	0.062***	0.149***	0.045***
	(0.025)	(0.047)	(0.049)	(0.015)	(0.044)	(0.018)	(0.037)	(0.012)
Share of workers with at least a degree	0.203	0.430	0.916**	-0.249	-0.333	0.595**	1.420	-0.344
	(0.425)	(0.587)	(0.358)	(0.859)	(0.643)	(0.244)	(1.417)	(0.401)
Share of high-skilled workers	1.131***	0.886***	1.200***	1.397*	1.146***	1.178***	0.725***	1.470***
	(0.302)	(0.207)	(0.253)	(0.767)	(0.233)	(0.211)	(0.169)	(0.269)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	824	1079	983	730	1729	1887	1808	1808
Adjusted R^2	0.384	0.409	0.438	0.543	0.291	0.449	0.338	0.325

Notes: In all columns, the dependent variable is ln sales per worker. The OLS regressions include ownership and governance indicators, multinational and export indicators, HHI, regional indicators (Nuts 2) and industry indicators defined at 2-digits. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 4 - Management practices and pay

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	ln annual pay	ln monthly wage	ln hourly wage		Standard deviation	Coefficient of variation
Panel A:						
Management score	0.328***	0.203***	0.188***		0.076***	0.954***
	(0.057)	(0.043)	(0.043)		(0.021)	(0.262)
Region and industry FE	Yes	Yes	Yes		Yes	Yes
Number of firms	2791	2792	2792		2792	2792
Adjusted R^2	0.610	0.644	0.651		0.333	0.290
Dependent variable:	ln monthly wage					
Sample:	100-50	50-0	100-90	90-50	50-10	10-0
Panel B:						
Management score	0.266***	0.110***	0.406***	0.197***	0.122***	0.075***
	(0.051)	(0.033)	(0.067)	(0.046)	(0.035)	(0.028)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.633	0.606	0.586	0.633	0.608	0.554
Dependent variables:	ln annual pay		ln monthly wage			
Sample:	Managers	Non-managers	Managers (top 1%)	Non-managers (bottom 99%)	Managers (occupation)	Non-managers (occupation)
Panel C:						
Management score	0.521***	0.088	0.545***	0.195***	0.584***	0.167***
	(0.198)	(0.087)	(0.085)	(0.042)	(0.100)	(0.041)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1741	1740	2792	2792	1908	2790
Adjusted R^2	0.136	0.512	0.594	0.638	0.438	0.629

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 5 - Categories of management practices and pay

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	ln annual pay	ln monthly wage	ln hourly wage		Standard deviation (ln monthly wage)	Coefficient of variation (ln monthly wage)
Panel A:						
Monitoring	-0.017	0.023	0.016		0.010	0.158
	(0.068)	(0.052)	(0.052)		(0.025)	(0.309)
Targeting	0.047	0.002	-0.003		0.006	0.102
	(0.036)	(0.027)	(0.028)		(0.013)	(0.171)
Incentives	0.210***	0.130***	0.124***		0.045***	0.536***
	(0.034)	(0.026)	(0.026)		(0.012)	(0.154)
Region and industry FE	Yes	Yes	Yes		Yes	Yes
Number of firms	2791	2792	2792		2792	2792
Adjusted R^2	0.610	0.644	0.651		0.332	0.289
				ln monthly wage		
Dependent variables:	100-50	50-0	100-90	90-50	50-10	10-0
Panel C:						
Monitoring	0.028	0.022	0.070	0.007	0.030	0.012
	(0.061)	(0.040)	(0.080)	(0.055)	(0.042)	(0.033)
Targeting	0.007	0.002	0.028	0.005	0.000	-0.001
	(0.032)	(0.023)	(0.044)	(0.030)	(0.024)	(0.020)
Incentives	0.168***	0.066***	0.235***	0.131***	0.074***	0.047**
	(0.030)	(0.022)	(0.040)	(0.028)	(0.022)	(0.019)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.633	0.606	0.586	0.633	0.608	0.554
Dependent variables:	ln annual pay		ln monthly wage			
Sample:	Managers	Non-managers	Managers (top 1%)	Non-managers (bottom 99%)	Managers (occupation)	Non-managers (occupation)
Panel B:						
Monitoring	0.124	-0.231**	0.153	0.015	0.327***	-0.010
	(0.243)	(0.095)	(0.099)	(0.051)	(0.122)	(0.050)
Targeting	0.160	0.044	0.035	0.003	0.006	0.004
	(0.150)	(0.052)	(0.058)	(0.027)	(0.067)	(0.027)
Incentives	0.240*	0.129**	0.295***	0.126***	0.268***	0.117***
	(0.136)	(0.055)	(0.053)	(0.026)	(0.061)	(0.025)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1741	1740	2792	2792	1908	2790
Adjusted R^2	0.135	0.514	0.594	0.638	0.437	0.630

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 6 - Management practices and pay components

	(1)	(2)	(3)	(4)
		Monthly wage components		
Dependent variables:	ln monthly wage	ln base wage	ln (1+bonus)	ln (1+ overtime pay)
Sample:	All			
Panel A:				
Management score	0.203***	0.152***	0.245	3.586***
	(0.043)	(0.036)	(0.256)	(0.671)
Region and industry FE	Yes	Yes	Yes	Yes
Number of firms	2792	2792	2792	2792
Adjusted R^2	0.644	0.727	0.103	0.245
Sample:	Managers (top 1%)			
Panel B:				
Management score	0.545***	0.504***	0.504	-0.057
	(0.085)	(0.090)	(0.546)	(0.436)
Region and industry FE	Yes	Yes	Yes	Yes
Number of firms	2792	2792	2792	2792
Adjusted R^2	0.594	0.546	0.0734	0.0521
Sample:	Non-managers (bottom 99%)			
Panel C:				
Management score	0.195***	0.142***	0.302	3.594***
	(0.042)	(0.036)	(0.273)	(0.671)
Region and industry FE	Yes	Yes	Yes	Yes
Number of firms	2792	2792	2792	2792
Adjusted R^2	0.638	0.725	0.0947	0.245

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 7 - Management practices and pay, by firm size and industry

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	ln annual pay	ln monthly wage	Standard deviation	100-90	90-50	50-10	10-0	Managers (top 1%)
Panel A - Firm size								
Small firms								
Management score	0.360***	0.191***	0.106***	0.386***	0.212**	0.073	0.030	0.461***
	(0.096)	(0.072)	(0.040)	(0.113)	(0.083)	(0.059)	(0.048)	(0.129)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1079	1079	1079	1079	1079	1079	1079	1079
Adjusted R^2	0.543	0.593	0.287	0.540	0.561	0.541	0.496	0.536
Medium firms								
Management score	0.252***	0.188***	0.067**	0.388***	0.156**	0.119**	0.033	0.510***
	(0.092)	(0.072)	(0.033)	(0.122)	(0.071)	(0.053)	(0.045)	(0.161)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	983	983	983	983	983	983	983	983
Adjusted R^2	0.657	0.676	0.332	0.574	0.691	0.651	0.582	0.470
Large firms								
Management score	0.219**	0.093	-0.002	0.139	0.104	0.121	0.115*	0.232
	(0.107)	(0.079)	(0.033)	(0.104)	(0.092)	(0.078)	(0.059)	(0.152)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	729	730	730	730	730	730	730	730
Adjusted R^2	0.702	0.744	0.487	0.693	0.725	0.684	0.664	0.551
Panel B - Industry sector								
Manufacturing								
Management score	0.296***	0.196***	0.068**	0.359***	0.185***	0.126***	0.073**	0.423***
	(0.074)	(0.052)	(0.029)	(0.088)	(0.060)	(0.044)	(0.037)	(0.111)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1323	1324	1324	1324	1324	1324	1324	1324
Adjusted R^2	0.536	0.616	0.313	0.568	0.589	0.562	0.487	0.612
Services								
Management score	0.337***	0.179***	0.064**	0.367***	0.181**	0.107**	0.070	0.542***
	(0.088)	(0.069)	(0.031)	(0.104)	(0.072)	(0.054)	(0.043)	(0.130)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1468	1468	1468	1468	1468	1468	1468	1468
Adjusted R^2	0.645	0.649	0.361	0.599	0.643	0.624	0.588	0.588

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 8 - Management practices and pay, by ownership and governance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	ln annual pay	ln monthly wage	Standard deviation	100-90	90-50	50-10	10-0	Managers (top 1%)
Panel A - Ownership								
Foreign firms								
Management score	0.297***	0.180*	0.092**	0.340**	0.194**	0.113	-0.009	0.475**
	(0.106)	(0.093)	(0.040)	(0.142)	(0.099)	(0.097)	(0.086)	(0.218)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	571	571	571	571	571	571	571	571
Adjusted R^2	0.758	0.765	0.251	0.626	0.768	0.714	0.633	0.466
Domestic firms								
Management score	0.326***	0.190***	0.068***	0.379***	0.182***	0.112***	0.076***	0.495***
	(0.063)	(0.047)	(0.024)	(0.075)	(0.052)	(0.037)	(0.028)	(0.091)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	2220	2221	2221	2221	2221	2221	2221	2221
Adjusted R^2	0.544	0.570	0.333	0.534	0.560	0.539	0.485	0.571
Panel B - Governance								
Non-family managed								
Management score	0.344***	0.233***	0.083***	0.457***	0.206***	0.156***	0.108***	0.700***
	(0.076)	(0.059)	(0.029)	(0.093)	(0.062)	(0.045)	(0.039)	(0.124)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1647	1648	1648	1648	1648	1648	1648	1648
Adjusted R^2	0.654	0.681	0.296	0.589	0.678	0.674	0.616	0.559
Family managed								
Management score	0.305***	0.170***	0.075***	0.352***	0.187***	0.076	0.024	0.364***
	(0.081)	(0.061)	(0.029)	(0.095)	(0.071)	(0.054)	(0.038)	(0.111)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	1144	1144	1144	1144	1144	1144	1144	1144
Adjusted R^2	0.478	0.490	0.353	0.487	0.480	0.411	0.330	0.548

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 9 - Management practices, productivity and wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	ln annual pay	ln monthly wage	Standard deviation	100-90	90-50	50-10	10-0	Managers (top 1%)
Panel A:								
Management score (MS)	0.245***	0.163***	0.064***	0.340***	0.156***	0.095***	0.060**	0.469***
	(0.057)	(0.043)	(0.021)	(0.067)	(0.046)	(0.035)	(0.028)	(0.086)
ln sales per worker	0.074***	0.036***	0.011***	0.058***	0.036***	0.024***	0.013***	0.067***
	(0.014)	(0.008)	(0.003)	(0.013)	(0.008)	(0.005)	(0.004)	(0.016)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.641	0.655	0.341	0.599	0.642	0.615	0.558	0.605
Panel B:								
Management score (MS)	-0.251	-0.475	0.162	-0.087	-0.420	-0.661**	-0.539**	-0.034
	(0.712)	(0.343)	(0.107)	(0.499)	(0.334)	(0.303)	(0.242)	(0.678)
ln sales per worker	0.055**	0.012	0.014**	0.042*	0.014	-0.004	-0.010	0.048*
	(0.027)	(0.013)	(0.006)	(0.022)	(0.014)	(0.009)	(0.007)	(0.027)
MS x ln sales per worker	0.043	0.056*	-0.009	0.037	0.050*	0.066**	0.052**	0.044
	(0.061)	(0.030)	(0.009)	(0.043)	(0.029)	(0.026)	(0.021)	(0.058)
Region and industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.641	0.656	0.341	0.600	0.643	0.618	0.561	0.605

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 10 - Management practices and occupational skill levels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	All firms				Firms with all four skill levels			
Skill level (ISCO 2008):	1 (lowest)	2	3	4	1 (lowest)	2	3	4
Panel A:								
Dependent variable: ln monthly wage								
Management score	0.124**	0.154***	0.151**	0.428***	0.098	0.142***	0.167**	0.453***
	(0.053)	(0.039)	(0.063)	(0.076)	(0.063)	(0.055)	(0.082)	(0.097)
Number of firms	1638	2704	2245	2271	1243	1243	1243	1243
Adjusted R^2	0.274	0.475	0.353	0.366	0.300	0.445	0.326	0.345
Panel B:								
Dependent variable: Employment								
Management score	-0.491**	0.446***	0.770***	0.566***	-0.444	0.501***	0.695***	0.713***
	(0.236)	(0.109)	(0.155)	(0.134)	(0.287)	(0.140)	(0.201)	(0.157)
Number of firms	1638	2704	2245	2271	1243	1243	1243	1243
Adjusted R^2	0.447	0.815	0.649	0.767	0.443	0.853	0.676	0.774
Panel C:								
Dependent variable: Employment share								
Management score	-0.785***	0.199**	0.451***	0.181	-0.760***	0.185*	0.380**	0.397***
	(0.236)	(0.089)	(0.146)	(0.121)	(0.285)	(0.112)	(0.188)	(0.142)
Number of firms	1638	2704	2245	2271	1243	1243	1243	1243
Adjusted R^2	0.421	0.524	0.352	0.644	0.380	0.456	0.425	0.640

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 11 - Management practices, works councils and pay

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	ln annual pay	ln monthly wage	Standard deviation	100-90	90-50	50-10	10-0	Managers (top 1%)
Panel A:								
Management score (MS)	0.328***	0.203***	0.076***	0.318***	0.115***	0.058**	0.037*	0.545***
	(0.057)	(0.043)	(0.021)	(0.071)	(0.042)	(0.027)	(0.021)	(0.085)
Works council	0.055**	0.014	-0.020***	0.014	-0.038**	-0.026**	0.032***	-0.019
	(0.024)	(0.017)	(0.008)	(0.040)	(0.017)	(0.011)	(0.012)	(0.037)
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.610	0.644	0.333	0.574	0.221	0.317	0.395	0.594
Panel B:								
Management score (MS)	0.302***	0.199***	0.087***	0.287***	0.132***	0.063**	0.023	0.556***
	(0.059)	(0.044)	(0.021)	(0.071)	(0.044)	(0.027)	(0.021)	(0.087)
Works council	-0.136	-0.021	0.058**	-0.216	0.088	0.008	-0.072	0.062
	(0.094)	(0.068)	(0.029)	(0.143)	(0.064)	(0.043)	(0.048)	(0.138)
MS x Works council	0.355**	0.065	-0.146***	0.428	-0.235**	-0.064	0.192**	-0.150
	(0.180)	(0.122)	(0.050)	(0.273)	(0.110)	(0.073)	(0.093)	(0.253)
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.610	0.644	0.334	0.575	0.222	0.317	0.397	0.594

Notes: In all columns, the OLS regression includes controls for firm size, firm age, ownership and governance indicators, multinational and export indicators, worker attributes (age, tenure, share of females, share with degree, share of new hires and share of workers covered by either firm, multi-firm, sectoral or other type of wage agreement), regional and industry dummies. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 12 - Management practices and pay - IV estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	ln annual pay	ln monthly wage	Standard deviation	100-90	90-50	50-10	10-0	Managers (top 1%)
Management score	1.561***	0.835***	0.386***	1.771***	0.788***	0.392**	0.199	2.460***
	(0.292)	(0.208)	(0.097)	(0.342)	(0.221)	(0.170)	(0.135)	(0.449)
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Test of endogeneity F(1, 2709)	21.662	9.960	11.196	18.387	7.556	2.557	0.842	21.801
p-value	0.000	0.002	0.001	0.000	0.006	0.110	0.359	0.000
First stage F-statistic F(2, 2710)	65							
p-value	0.000							
Shea´s partial R^2	0.046							
Minimum eigenvalue statistic	66							
Hansen's test statistic	0.537	0.231	1.038	0.933	0.229	0.0811	0.287	0.143
p-value	0.464	0.631	0.308	0.334	0.632	0.776	0.592	0.705

Notes: In all columns, the regression includes controls for firm size, firm age, ownership and governance indicators, worker attributes (age, tenure, share of females, share with degree, share of newcomers), regional and industry dummies. Mean practices is instrumented with two binary indicators: a multiple establisment indicator and an indicator if the firm has more than 4 hierarchy levels. Standard errors are robust to arbitrary heteroscedasticity. *10% level of significance, **5% level of significance, ***1% level of significance.

Table 13 - Management practices and pay - OLS and propensity score matching estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	ln annual pay	ln monthly wage	Standard deviation	100-90	90-50	50-10	10-0	Managers (top 1%)
Panel A:								
Ordinary least squares								
Management indicator (> 50 percentile)	0.066***	0.039***	0.023***	0.098***	0.036***	0.013	0.008	0.129***
	(0.016)	(0.012)	(0.006)	(0.019)	(0.013)	(0.010)	(0.008)	(0.024)
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.606	0.642	0.333	0.583	0.631	0.607	0.553	0.592
Management indicator (> 75 percentile)	0.065***	0.040***	0.005	0.053***	0.041***	0.035***	0.022**	0.080***
	(0.016)	(0.013)	(0.006)	(0.020)	(0.014)	(0.011)	(0.009)	(0.027)
Number of firms	2791	2792	2792	2792	2792	2792	2792	2792
Adjusted R^2	0.606	0.642	0.329	0.580	0.631	0.608	0.554	0.589
Panel B:								
Propensity score matching								
Management indicator (> 50 percentile)	0.073	0.047	0.019	0.113	0.039	0.026	0.007	0.154**
	(0.050)	(0.052)	(0.016)	(0.072)	(0.057)	(0.037)	(0.025)	(0.072)
Management indicator (> 75 percentile)	0.074***	0.047**	0.007	0.077***	0.039*	0.037*	0.030*	0.116***
	(0.028)	(0.022)	(0.007)	(0.028)	(0.021)	(0.021)	(0.017)	(0.036)

Note: The propensity score is estimated with a logit model using the full specification from Table 1. The number of industries is reduced whenever industry becomes a perfect predictor of treatment. The standard errors are robust to arbitrary heteroscedasticity in Panel A. Robust Abadie-Imbens standard errors are shown in Panel B. *10% level of significance, **5% level of significance, ***1% level of significance.

Table A1 - Information used from IPG to compute the management score

Question topic	*Question*	*Answer text*	*Value*
Operational	1. Existence and type of management practices.	- None	0
		- Old practices	`1/2
		- New practices	1
Operational	2. When a service or production problem arose, what best describes the action undertaken by the firm?	- No action was taken	0
		- We fixed it but did not take further action	1/3
		- We fixed it and took action to avoid its repetition	2/3
		- We fixed it and took action to avoid its repetition and had a continuous improvement processes to anticipate similar problems	1
Target breath	3. What is the strategic target of the firm?	- Survival	0
		- Stability	1/3
		- Growth	2/3
		- Development	1
Target breath	4. Which type of good or services is the firm producing?	- Same goods/services	0
		- New goods/services	`1/2
		- Both	1
Target time horizon	5. What best describes the time horizon of service or production targets of the firm?	- None	0
		- < 1 year	1/3
		- > 1 year	2/3
		- both	1
Target stretching	6. Degree of ambitiousness of targets: How easy/difficult would it have been to achieve service or production targets at this firm?	- Not difficult	0
		- Somewhat difficult	1/4
		- Moderately difficult	1/2
		- Very difficult	3/4
		- Totally difficult	1
Monitoring - performance clarity and comparability	7. Workforce awareness of firms' goals.	- Not aware	0
		- Somewhat aware	1/4
		- Moderately aware	1/2
		- Very aware	3/4
		- Totally aware	1
Monitoring - performance tracking	8.How many key performance indicators does your firm monitor?	0	0
		1-5	1/5
		6-10	2/5
		11-15	3/5
		16-20	4/5
		>20	1

Monitoring - performance tracking	9. How frequently are these key performance indicators measured?	- Never	0
		- Yearly	1/6
		- Twice a year	1/3
		- Quarterly	1/2
		- Monthly	2/3
		- Weekly	5/6
		- Daily	1
Monitoring - performance tracking	10. How frequently are these key performance indicators measured – for top managers?	See previous question	
Monitoring - performance tracking	11. How frequently are these key performance indicators measured – for middle managers?	See previous question	
Monitoring - performance tracking	12. How frequently are these key performance indicators measured – for operational managers?	See previous question	
Monitoring - performance tracking	13. How frequently are these key performance indicators measured – for non-managers?	See previous question	
Monitoring - performance communication	14. Does the firm display key performance outcomes? How many dissemination tools - private platform, e-mail, newsletter, meetings, posters, multiple tables- does the firm use to display performance indicators?	- No communication	0
		- Use of 1 tool	1/6
		- Use of 2 tools	1/3
		- Use of 3 tools	1/2
		- Use of 4 tools	2/3
		- Use of 5 tools	5/6
		- Use of 6 tools	1
Monitoring - performance dialogue	15. Involvement of non-managers employees in the decision process of the firm.	- Not involved	0
		- Somewhat involved	1/4
		- Moderate involved	1/2
		- Very involved	3/4
		- Totally involved	1
Monitoring - performance dialogue	16. Extent of information shared in the decision process of the firm.	- No information shared	0
		- Somewhat informed	1/4
		- Moderate informed	1/2
		- Very informed	3/4
		- Totally informed	1
People and incentives – fixing poor performers	17. When the firm is under-performing, are there consequences to workers?	- No	0
		- Yes	1

People and incentives – fixing poor performers	18. If part of the business is under-performing, workers join "Intensive training program duration".	- Not applied - Rarely - > 6 months - 3-6 months - < 3 months	0 1/4 1/2 3/4 1
People and incentives – fixing poor performers	19. If part of the business is under-performing, workers undergo “job rotation duration”.	See previous question	
People and incentives – fixing poor performers	20. If part of the business is under-performing, workers are dismissed.	See previous question	
People and incentives – rewarding high performance	21. Is performance related to rewards (bonuses)?	- No - Yes	0 1
People and incentives – rewarding high performance	22. What percentage of managers received performance bonuses?	- 0% - 1-20% - 21-40% - 41-60% - 60-80% - 81-100%	0 1/5 2/5 3/5 4/5 1
People and incentives – rewarding high performance	23. What percentage of non-managers received performance bonuses?	See previous question	
People and incentives – rewarding high performance	24. What are managers’ performance bonuses usually based on in your firm?	- No bonuses - Entire company´s performance - Company or team performance - Team performance - Individual, team or company performance - Individual or company performance - Individual or team performance - Individual performance	0 1/7 2/7 3/7 4/7 5/7 6/7 1
People and incentives – rewarding high performance	25. What are non-managers’ performance bonuses usually based on in your firm?	See previous question	

People and incentives - promoting high performers	26. Criteria for managers promotion	- Usually managers are not promoted - Mainly on factors such as tenure or family connections - Partly performance and partly other factors - Solely performance and ability	0 1/3 2/3 1
People and incentives – promoting high performers	27. Criteria for non-managers promotion	See previous question	
People and incentives – retaining human capital	28. Does the firm have programs to retain youth talent?	- No - Yes	0 1
People and incentives – retaining human capital	29. Does the firm hire highly educated young workers to train and retain in the firm?	- No - Yes	0 1

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