

# Mapping the Dynamics of Management Styles - Evidence from German Survey Data\*

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## Abstract

We study how firms adjust the bundles of management practices they adopt over time, using repeated survey data collected in Germany from 2012 to 2018. By employing unsupervised machine learning, we leverage high-dimensional data on human resource policies to describe clusters of management practices (management styles). Our results suggest that two management styles exist, one of which employs many and highly structured practices, while the other lacks these practices but retains training measures. We document sizeable differences in styles across German firms, which can (only) partially be explained by firm characteristics. Further, we show that management is highly persistent over time, in part because newly adopted practices are discontinued after a short time. We suggest miscalculations of costs-benefit trade-offs and non-fitting corporate culture as potential hindrances of adopting structured management. In light of previous findings that structured management increases firm performance, our findings have important policy implications since they show that firms which are managed in an unstructured way fail to catch up and will continue to underperform.

**JEL codes:** M12, D22, C38

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# 1 Introduction

Good management matters for firm performance. This is a well established result in the economics literature (Bloom, Lemos, et al. 2014; Bloom and Van Reenen 2011). However, determining what constitutes good management remains a challenging task. The *design perspective* of management argues that, synergy effects between individual practices (Ichniowski and Shaw 2003) as well as contingency on the environment (Englmaier, Galdon-Sanchez, et al. 2020; Gibbons and Roberts 2013) make studying management a highly complex problem. Others highlight the *management as technology* aspect and argue that some practices are superior for all firms (Bloom, Sadun, and Van Reenen 2016). Regardless the perspective, reducing the dimensionality of management data is inevitable to go beyond assessing individual practices and analyze management as a whole. For this reason, recent literature has started to use machine learning (ML) in order to detect bundles of individual practices that firms employ, which can be interpreted as *management styles* (Bandiera et al. 2020; Englmaier, Galdon-Sanchez, et al. 2020). However, to the best of my knowledge, this approach has not yet been applied to panel data of management practices and thus little is known about the dynamics of such management styles.

This study analyzes dynamic developments of management. Using machine learning I describe which styles (bundles of management practices) are employed and how the adoption of these styles has developed over recent years.

I address my research questions by utilizing data from the *Linked-Personnel-Panel* of the German Institute for Employment Research (IAB). It is administered to German establishments and asks detailed questions about human-resource (HR) management instruments. The survey has been conducted four times from 2012 to 2018, a time without major economic crises but of increasing workplace digitalization.

In a first step I identify two management styles using Latent Dirichlet Allocation (LDA)<sup>1</sup>,

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<sup>1</sup>This machine learning algorithm was initially developed to identify topics in text data, but can also be

which allows me to detect potentially complex correlation patterns and identify those practices that distinguish management styles the most. My results reveal that firms are mainly distinguished by the adoption of highly structured practices, such as development plans, employee surveys and target agreements. While one management style is characterized by the adoption of these practices, the other style lacks structured practices but retains employee training measures.

Second, I show that the adoption of these styles varies largely across German firms and describe how styles are distributed, based on firms' characteristics. I find that larger, non-manager-owned and multiplant firms yield the most structured management styles, which is in line with previous findings made with international data (Bloom and Van Reenen 2011; Englmaier, Galdon-Sanchez, et al. 2020).<sup>2</sup> In a second paper, I and coauthors, further show that management positively correlates with technology adoption and promotion of diversity, suggesting that the structured style is one part of modern corporate governance (Englmaier, Hofmann, et al. 2022).

Third, exploiting the panel structure of my data, I analyze how firms adjust management styles over time. Overall, I report a striking absence of trends toward either of the two styles and the average number of practices stays remarkably constant, as well. Analyzing differentiated trends across firms I find suggestive evidence that the smallest firms slowly move toward more structured management styles. However, small firms are not able to fully catch up, leaving the gap to bigger firms sizeable. I further show that single-plant and owner-managed firms, both starting with very unstructured management styles, are unable to catch up to other firms. Even changes of ownership structure or managers do not systematically affect management styles. With an absence of trends across self-reported market competition categories, I find no evidence that competition increases the adoption of applied to survey data.

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<sup>2</sup>My results differ in one regard. While the literature has identified market competition as one of the key drivers for the adoption of structured management (Bloom, Propper, et al. 2015; Bloom, Sadun, and Van Reenen 2016; Bloom and Van Reenen 2007), I cannot confirm this in my data.

structured management practices. If anything, firms facing no competition have moved the farthest toward a more structured management style. I further show that although many firms adopt structured practices, they drop them again shortly after their introduction.

The observed rigidity in management styles has clear policy implications. Since structured management has been shown to positively affect firm performance (see literature review below), it is striking that firms which lag behind in this respect fail to catch up. Backed by additional results, I discuss potential obstacles of adopting structured management styles. I suggest that miscalculations of cost-benefit trade-offs and a mismatch of corporate culture could play a key role and propose directions for future research.

This study contributes to a comprehensive and still growing literature on management. I limit my review to a recent strand of this literature which empirically analyzes management at large scale and is most closely related to my analysis.<sup>3</sup>

While earlier studies on management were focussed on few firms and often single practices, researchers have started to collect more comprehensive data in the mid 2000s. The most influential studies are based on the World Management Survey (WMS), which systematically collects management data around the world (Bloom and Van Reenen 2007). This line of work has shaped the technology perspective of management, introducing a uni-dimensional measure called *management score*, that measures the degree to which structured management practices are in place. Cross-sectional evidence highlights that management scores vary considerably across but also within countries. Market competition, separation of ownership and control as well as multinational presence are associated with high levels of management scores (Bloom, Lemos, et al. 2014; Bloom and Van Reenen 2007). While cross-sectional differences are well documented the time-series dimension of management is only scarcely investigated. One exception is Bloom, Sadun, and Van Reenen (2016) who show that product market competition accelerates the adoption of structured management practices, widening

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<sup>3</sup>See Gibbons and Roberts (2013) or Bloom and Van Reenen (2011) for more comprehensive surveys of the literature.

the already existing gap in management scores. Bloom, Brynjolfsson, et al. (2019) find that changes in the business environment (introduction of right-to-work laws) can affect management scores. They also show that the presence of large multinationals can lead to positive spillovers in management quality.

Further, the literature shows that differences across management have implications on productivity and firm performance. Bloom and Van Reenen (2007) show that management scores are positively associated with profitability and firm survival. Bloom, Sadun, and Van Reenen (2016) find that differences in management scores account for 30% of cross-country total factor productivity differences. Causal evidence from an RCT in India can be found in Bloom, Eifert, et al. (2012), who show that adopting management practices leads to increased productivity, decentralization and better use of information technologies. Also, conducting an RCT with Mexican enterprises, Bruhn et al. (2018) document a positive causal effect of management consulting on total factor productivity and return on assets. These results highlight the importance of management for firm performance and thus the need to better understand differences in management across firms and how these differences evolve over time.

Most of the above-mentioned studies rely on ex-ante assumptions on whether practices are “good” or “bad”. Recent contributions to the literature, as well as mine, loosen this assumption and employ machine learning to add back elements of the design perspective. Bandiera et al. (2020) are the first to apply LDA to management data, more specifically diaries of CEO activities. They show that CEO behavior differs considerably and that CEOs can be characterized either as “leaders” or as “managers”. Regarding firm performance, neither CEO type is clearly superior but rather the matching of CEOs to firms matters, which aligns with the contingency perspective of management. Englmaier, Galdon-Sanchez, et al. (2020), which is most closely related to my work, apply LDA to Spanish survey data, explicitly allowing for complementarities between management instruments. In their analysis — similar

to mine — two distinct management styles emerge, a highly structured and a less structured style. Analyzing the impact of the financial crisis in 2008, their results suggest that “good” management is contingent to the environment. The structured style performs well in times of an economic boom, but it makes firms less flexible to adjust to economic crises. Both studies demonstrate the value of using machine learning to measure and analyze management using cross-sectional data. I contribute to this by applying ML to panel data in order to study how management styles evolve over time.

The remainder of this paper is structured as follows. Section 2 describes the data source and preprocessing. Section 3 introduces my management measures and the machine learning algorithm I use to estimate management styles. In the second part of this section I describe the results and characterize management styles. In Section 4 I first correlate my management measures with firm characteristics and then analyze how management evolves over time. I discuss my findings in Section 5 and conclude in Section 6.

## **2 Data**

In order to study management styles I use the Linked Personnel Panel (LPP) provided by the Institute of Employment Research (IAB). The LPP consists of matched employer and employee surveys which were conducted in four waves from 2012 to 2018. It covers between 765 and 1,219 German establishments per wave and is representative of German private sector firms with more than 50 employees. Establishment managers are asked to provide information on human resource (HR) practices covering four broad categories: (i) “HR planning and recruitment”, (ii) “HR development”, (iii) “Remuneration structure” and (iv) “Commitment, values and corporate culture”. In the second part of the LPP, which I shortly cover in Appendix 8<sup>4</sup>, a random sample of employees working at the establishments

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<sup>4</sup>In an accompanying paper I, together with coauthors, use the employee survey to investigate the relationship between management and employee satisfaction (Englmaier, Hofmann, et al. 2022).

is interviewed. Between 6,500 and 7,500 employees per wave provide information about experienced quality of work, work attitude and behavior and personal characteristics. Further, the data is complemented by rich socio-economic indicators.<sup>5</sup>

I estimate latent management styles using data from the employer survey. I employ an unsupervised machine-learning algorithm that requires categorical data at a single common scale. Since the vast majority of the data is in binary form I transform the remaining data into binary indicators as well. All non-binary categorical variables are of a five-point agreement scale type, which I convert into two binary indicators: (i) an indicator for being to the “left” of the neutral position (disagreement) (ii) and an indicator for being to the right of the neutral position (agreement).<sup>6</sup> I split numerical indicators at the median-value and add two binary indicators for being above and below the median, respectively.

For estimating latent management styles I strictly stick to questions regarding actual management practices and disregard firm-level or employee-level outcome variables. This ensures that I do not force the algorithm to explain any of these outcomes, but solely detect latent management styles (bundles of practices). I restrict the data to practices that are featured (and unchanged) in all four survey waves. This way I analyze a constant set of management practices across time and my findings are not driven by changes in the survey design. Further, I calculate TF-IDF-like scores, which penalize frequent and infrequent practices, and exclude five practices with the lowest scores. These practices are not informative for detecting differences in management bundles across firms and should thus be excluded.<sup>7</sup> The algorithm requires an input matrix of complete cases. To deal with missing values, I first remove all firms with more than 10% missing values in any given wave and then remove all practices which are missing for more than 10% of firms. Remaining missing values are set to

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<sup>5</sup>For a more detailed discussion of the survey and data refer to Kampkötter et al. (2016).

<sup>6</sup>I exclude indicators for the neutral position, because this position is of little informative value. Firms choosing the neutral position are covered by setting both of the remaining indicators to zero.

<sup>7</sup>For robustness, I re-estimate the LDA model using the full set 46 practices without removing frequent and infrequent occurrences. The results are not shown but are very similar.

zero.<sup>8</sup> The final input data to estimate latent management styles contains 41 binary variables.<sup>9</sup>

### 3 Management styles

This section briefly introduces my approach to construct management styles using machine learning. I then present and analyze the results in order to characterize management styles.

#### 3.1 Estimating management styles

To reduce the dimensionality of the survey data I employ an unsupervised machine learning algorithm: Latent Dirichlet Allocation (LDA) (David M. Blei et al. 2003). LDA is a hierarchical Bayesian factor model that was originally developed to discover topics in text data. However, the algorithm is also applicable to survey data and was initially introduced to the economics literature by Bandiera et al. (2020).

In the context of this study, I argue that a firm's management is a mixture of a small number of *latent management styles* which determine the adoption of *individual practices*. More specifically, the core idea of LDA is based on two distributions: First, a latent management style is a mixture distribution over individual practices, the *style-over-practices distribution*. Thereby practices carry *loadings* that determine which practices are the most prevalent and therefore most characteristic of each latent style. Second, the *firm-over-styles distribution* describes a firm's actual configuration of management practices as a weighted combination of latent management styles. I call these style weights *style intensities*. Intuitively, LDA estimates both distributions by detecting bundles of practices (management styles) which tend to appear together and at the same time discriminate across firms. Being unsupervised ML, an important advantage of LDA is that it detects patterns of co-occurrence without forcing practices or

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<sup>8</sup>Only 0.3% of the answers are missing and set to zero.

<sup>9</sup>An overview of these practices and related questions is provided in Table A4 in the Appendix.



latent styles to explain any firm outcomes. Further, as Bandiera et al. (2020) argue, LDA was developed to naturally handle high-dimensional data which enables me to detect potentially complex correlation patterns.

LDA requires the researcher to specify the number of latent factors (styles) to be estimated, and I set this number to two. I choose two styles for the following reasons: First, these latent styles are complex data objects which are not straightforward to understand. A low number of two latent management styles therefore facilitates the interpretability of my results, which according to David M. Blei et al. (2003) should be taken into account. Second, LDA is a probabilistic classifier, which *does not* deterministically label firms but assigns each firm a linear combination of the two “pure” management styles. Therefore, the model retains a high degree of flexibility despite limiting the number of latent factors. Third, cross-validation shows no significant improvement of the model’s fit when increasing the number of management styles.

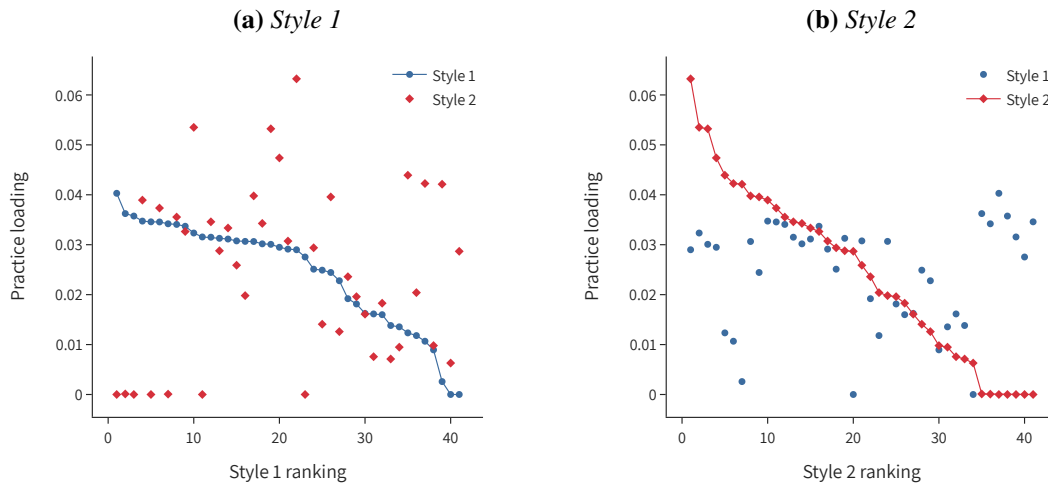
Further, LDA requires priors on both of the Dirichlet distributions. I follow Bandiera et al. (2020) and Englmaier, Galdon-Sanchez, et al. (2020) in setting these. Similar to Englmaier, Galdon-Sanchez, et al. (2020) I assume that only few rather than many practices are characteristic of latent styles. To incorporate this concept in the model I choose a low prior of 0.1 for the style-over-practices distribution, which promotes sparsity. I am agnostic about the firm-over-styles distribution and thus choose a symmetric uniform distribution by setting the prior to 1.0. This initially distributes firms uniformly across the linear combination between the two latent styles. I estimate posteriors using the Gibbs sampling method based on 41 individual management practices and the pooled sample of 3,453 firm-year observations.

The analysis of management dynamics in Section 4 will be based primarily on the above described style estimates. However, I additionally construct a much simpler measure, which calculates the share of adopted practices (hereafter: PAS). While this measure provides a simple way to study *how many practices* firms adopt, the advantage of my main approach is

that it additionally determines *which practices* distinguish firms from each other.

### 3.2 Describing management styles

**Figure 1** Practice loadings



**Notes:** This figure shows differences in practice loadings across both styles. Each style is a distribution across 41 individual practices, all of them having a strictly positive weight, and with the sum of weights equal to one. In panel (a) practices are shown in a decreasing order of Style 1 loadings. In panel (b) practices are shown in a decreasing order of Style 2 loadings. The vertical axis shows the respective practice loadings.

Figure 1 describes the style-over-practices distribution. It plots practice loadings of both styles and panel (a) orders practices from highest to lowest according to their Style 1 loading. The relatively flat line reveals that many practices carry a similarly high loading. This means that a high Style 1 intensity can only result from the adoption of *many* of these high-loading practices. In contrast, Style 2 loads high on just a few practices as reflected by the comparatively steep practice-loadings curve in panel (b) of Figure 1. Therefore, the adoption of these *few* high-loading practices will lead to high Style 2 intensity. Table A5 in the Appendix shows correlations of different management measures, and confirms this observation. A correlation of 0.6 between Style 1 intensity and the PAS indicates that firms with high Style 1 intensity tend to adopt more practices than those with high Style 2 intensity.<sup>10</sup>

<sup>10</sup>By construction style intensities sum to one. Therefore, the correlation between Style 2 intensity and PAS

Table 1 takes a closer look at which practices are the most characteristic of both styles. The top panel shows the five individual practices which carry the highest loadings in each style.<sup>11</sup> In the bottom panel practices are ordered by practice scores as suggested in David M Blei and Lafferty (2009), highlighting those practices with the largest difference in loadings across styles.<sup>12</sup> Style 1 practices include development plans, employee surveys and appraisal interviews, which all reflect a highly structured approach to management. Practices related to development plans and employee surveys are also those that carry the highest Style 1 scores compared to Style 2 scores. Figure 1 reveals that loadings of these practices are relatively high in Style 1 and at the same time almost zero in Style 2, meaning that these practices are highly differentiating between management styles. The top five list of Style 2 lacks structured practices but contains practices related to employee training. Practices with the highest Style 2 scores are mainly related to dealing with inefficient employees, but point toward a lack of structured ways to deal with these employees.<sup>13</sup>

Taken together Figure 1 and Table 1 suggest that Style 1 is characterized by the adoption of *many* management practices that lead to a *highly structured* approach to people management. Style 2, on the other hand, leads to the adoption of *fewer* and *less structured* management practices, but retains employee training measures.<sup>14</sup> Therefore, Style 1 seems to be more closely related not only to the PAS but also to the management score of the WMS than Style 2. However, at this stage I am agnostic about quality differences across these styles since my results simply reflect patterns in the data and are not forced to explain any differences in firm outcomes.

Now I turn to the firms-over-styles distribution. By construction of the LDA algorithm

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equals -0.6.

<sup>11</sup>Table A3 in the Appendix reports the full list of practices and their loadings in both styles.

<sup>12</sup>The disadvantage of this approach is that practices with high scores might still have relatively low loadings in both styles.

<sup>13</sup>For example, these firms dismiss inefficient people rather than reallocating them to better fitting jobs within the firm or taking other HR development measures.

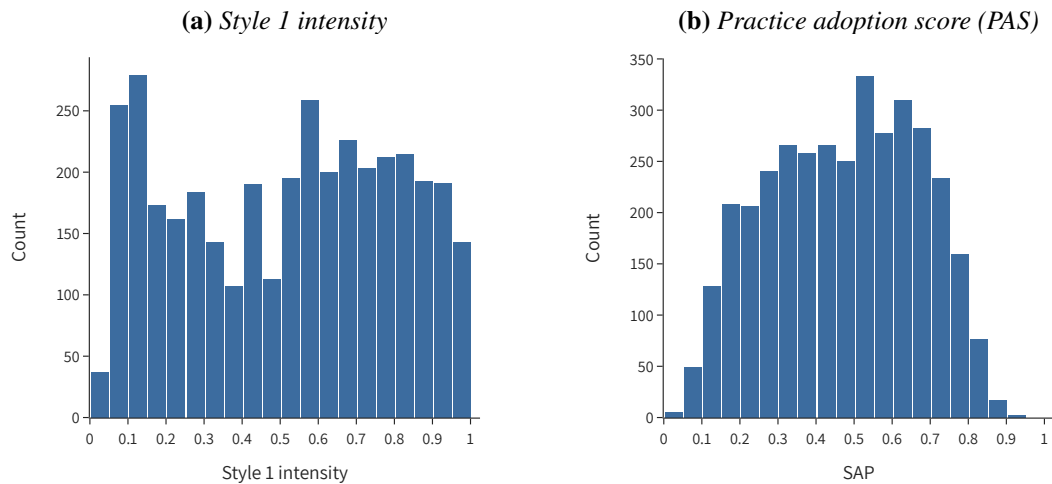
<sup>14</sup>Since latent management styles are not ordinal, these interpretations are necessarily subjective.

**Table 1** *Most characteristic practices of both styles*

Rank	Style 1	Style 2
<b>Ranked by practice loadings</b>		
1	Development plans	Inefficiency: Discussions (high)
2	Employee surveys	Internal training
3	Development plans: Implementation	On-the-job training
4	Appraisal interviews	Attending lectures
5	Development plans: Management	Inefficiency: Dismissal (high)
<b>Ranked by practice-loading scores</b>		
1	Development plans	Inefficiency: HR development measures (low)
2	Development plans: Implementation	Inefficiency: Another position (low)
3	Development plans: Management	HR at highest management level
4	Employee surveys: Communicated to employees	Inefficiency: Dismissal (high)
5	Employee surveys: Develop solutions	Inefficiency: Discussions (low)

**Notes:** This table shows the most characteristic practices for both styles. The top panel ranks practices from highest to lowest according to loadings in Style 1 and Style 2. The bottom panel ranks practices according to TF-IDF inspired practice scores as suggested in David M Blei and Lafferty (2009).

**Figure 2** *Distributions of management measures*



**Notes:** This figure shows histograms of both management measures using bins of size 0.05. Panel (a) shows the distribution of Style 1 intensity and panel (b) the distribution of the practice adoption score. Both measures range from zero to one. The counts are based on the pooled sample of  $N = 3,508$  firm-year observations.

style intensities are always positive and sum to one, which allows me to fully describe the distribution by focusing on Style 1 intensities. Figure 2 panel (a) plots the distribution of Style 1 intensities across firms. The distribution spreads across the whole range, indicating a good amount of variation of management styles across firms. Most firms employ a combination of both styles, but one can observe a slight tilt toward Style 1 with more mass to the right of 0.5. However, there is also a bunching region at very low Style 1 intensity levels, around 0.1. The average Style 1 intensity is 0.51 with a standard deviation of 0.29.<sup>15</sup> Panel (b) of Figure 2 shows the distribution of the PAS, which is more centered, i.e. few firms adopt a very small or a very large number of practices. The average firm has adopted 47% (about 19 out of 41) of practices and the standard deviation of the PAS is 0.19. Figure A1 and Table A2 repeat the exercise for the subset of panel firms and show similar patterns. However, the means of Style 1 intensity and the PAS are both slightly lower.

## 4 Results

This section describes the main results of the paper. First I document how management styles and the PAS correlate with firm characteristics. Then I show how firms adjust management over time.

### 4.1 Correlates of management styles

I explore correlates of firm characteristics with management styles to get an overview of the management landscape in Germany. For this, I estimate regressions of the form:

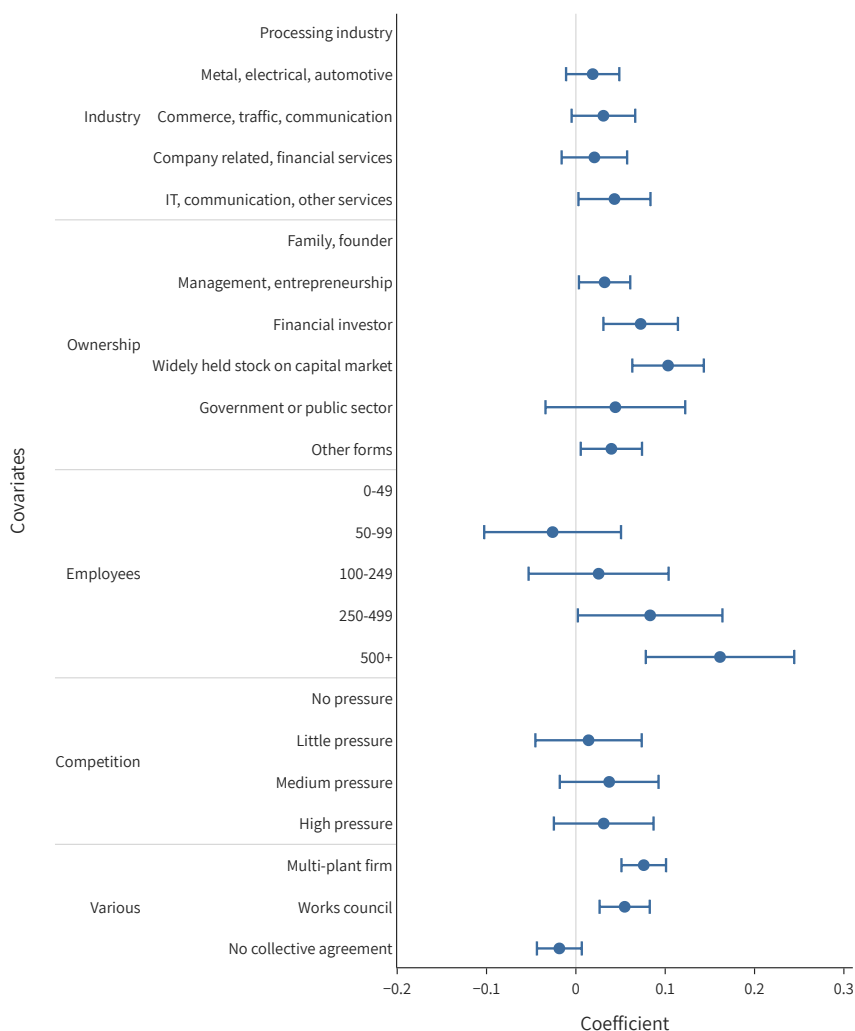
$$\theta_{it} = \alpha + X_{it}\beta + \varepsilon_{it}, \quad (1)$$

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<sup>15</sup>Table A1 in the Appendix shows summary statistics of management measures.

where  $\theta_{it}$  refers to Style 1 intensity of firm  $i$  at time  $t$ , and  $X_{it}$  is a vector of firm characteristics.<sup>16</sup> Figure 3 shows coefficients and 95% confidence intervals of a multivariate pooled OLS regression. Table A6 in the Appendix summarizes the corresponding univariate and multivariate regression results.

**Figure 3** Management Style 1 correlates



**Notes:** This figure shows coefficients and 95% confidence intervals from an OLS regression of Style 1 intensity on firm characteristics. All regressors are either dummies or categorical variables. Reference categories are those without coefficient indicators. The regression is estimated on the pooled sample including all firm-year observations. The number of observations is  $N = 3,508$  and standard errors are clustered at the firm-level.

<sup>16</sup>Summary statistics of firm characteristics are reported in Tables A1 and A2 in the Appendix.

I find relatively little variation in Style 1 intensity across industries, although the processing industry (the left-out category) seems to have the least structured management approach, indicated by positive and significant (at the 10% level) coefficients for all other industries. Table A6 confirms this observation for the univariate case. Therefore, styles do not just reflect potential industry-specific management requirements. Instead, I observe considerable variation of management within industries.

Style 1 intensities differ across principal ownership and I can confirm earlier findings that family-owned firms tend to be managed in comparably unstructured ways (Bloom and Van Reenen 2007). The data offers additional ownership categories and results show that firms owned by financial investors or listed on the stock market have the highest Style 1 intensities. Bloom and Van Reenen (2007) argue that in theory the effect of a separation of management and control is ambiguous, since it allows selecting (potentially) more skilled managers but also introduces principal-agent problems. My results suggest that the positive selection effects predominate and a separation of ownership and control leads to more structured management styles.

Figure 3 shows that self-reported competition intensity does not affect style intensities, which is contrary to previous findings from international data (Bloom and Van Reenen 2007). This could indicate that selection effects or variations in incentives to provide (managerial) effort through competition play a less significant role in Germany than in other countries. However, in contrast to the measure in Bloom and Van Reenen (2007), competition in my data is self-reported and could thus be subject to heterogeneous reporting. If structured management leads to better performing firms, then their managers might systematically underestimate the pressure from competition. This could lead to the observed differences in results between self-reported and non-self-reported competition.

Larger firms — as measured by workforce size — lean toward Style 1, which reflects that these firms naturally require structured management to cope with the challenges of size. The

same observation can be made for multi-plant firms which also show higher levels of Style 1 intensity. Again, given the increased organizational effort that multi-plant firms require, it is natural that these firms employ a more structured approach to management (Bloom, Sadun, and Van Reenen 2012a,b).<sup>17</sup>

Not surprisingly, firms with works councils or collective agreements have higher Style 1 intensities, since both reflect a structured approach to corporate governance in general. Note that the effect size in the univariate case in Table A6 is much larger since both indicators correlate strongly with firm size.

In Figure A2 and Table A8 in the Appendix I re-estimate Equation (1) using the PAS as the dependent variable. Given the high correlation between Style 1 intensity and the PAS, the patterns are very similar: Non owner-managed, larger and multiplant firms have adopted the most practices leading to high PAS levels. There are two noteworthy differences. First, the gap between “IT, communications, other services” and the remaining industries is more pronounced than with management styles. One potential explanation is that this industry is very knowledge intensive and regular employee training measures, which load high in management Style 2, are required. This would lead to a larger number of adopted practices but at the same time keep Style 1 intensity comparably low. Second, medium and high market competition (self-reported) leads to statistically significantly higher PAS, which contrary to my results for Style 1 intensity is in line with previous findings. Taking these results at face value, they suggest that although firms which operate in competitive markets tend to employ a greater number of management practices, these are not necessarily structured practices.

Tables A7 and A9 repeat the regressions for the subset of panel firms, which I observe in every survey wave and use to estimate dynamics below. The observed patterns are qualitatively identical, however less significant due to the reduction in sample size. Overall, I find significant and systematic differences in management styles (and the PAS) across firms which are largely

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<sup>17</sup>An alternative interpretation of these observations is that firms which employ more structured management styles grow faster and thus are larger and more likely to have multiple establishments.



in line with previous findings. These correlations corroborate my interpretation of Style 1 as being highly structured, since I observe that firms whose management I can describe as “naturally” structured are those with high Style 1 intensities. However, firm characteristics cannot fully explain the variation in management styles and thus the LDA model is able to capture systematic differences beyond those that I can readily explain with observables. Further, in the light of the positive effect of structured management on firm performance, theoretically all firms should benefit from a structured management style. Thus, I next analyze how firms change their management styles over time and whether a secular trend toward more structured management exists.

## 4.2 Dynamics of management styles

This section analyzes dynamics of management practices. First I describe overall trends and then investigate how subgroups of firms adjust management styles over time.

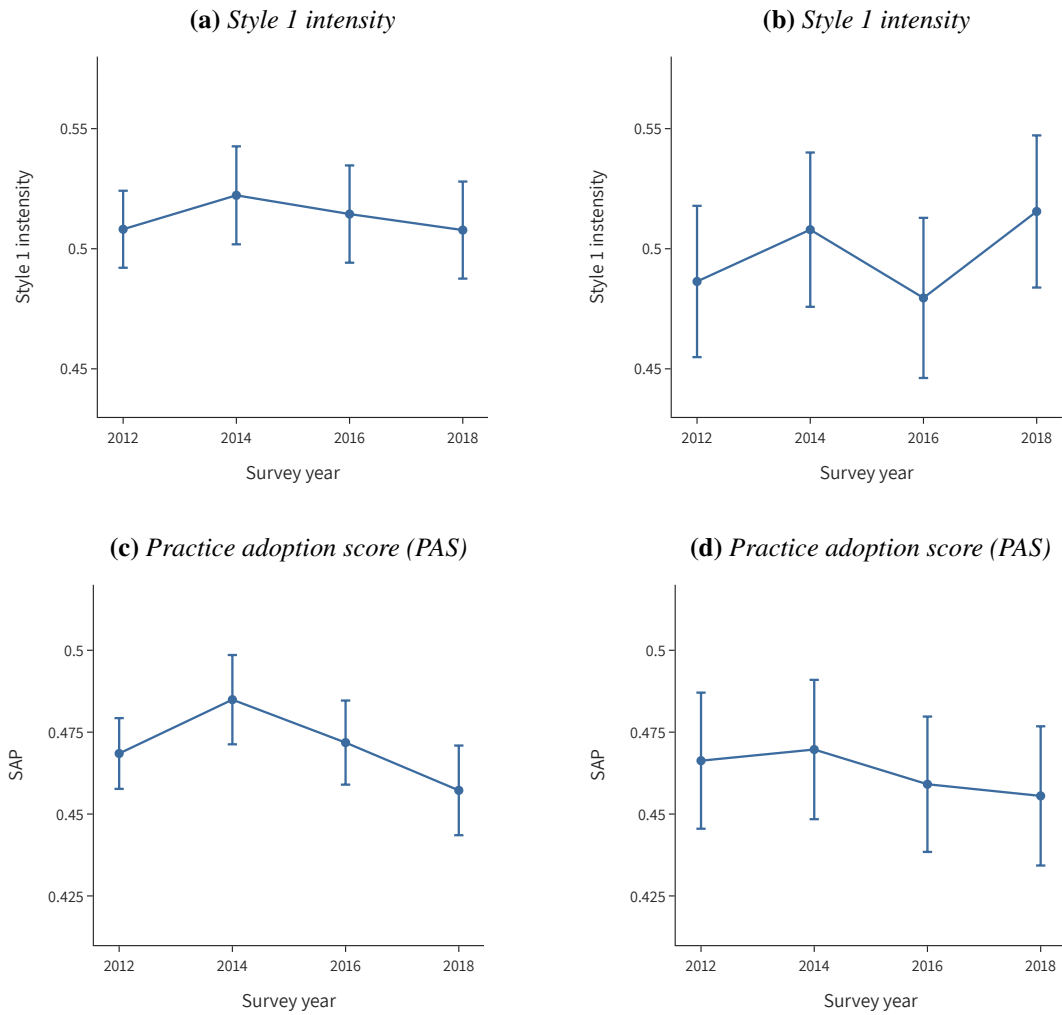
I begin by observing overall trends in management. Figure 4 shows mean Style 1 and PAS levels in each survey wave. Panels (a) and (c) employ the full sample and show trends in management across German firms. The average Style 1 intensity is 0.51 in the first survey wave and remains virtually unchanged across all other waves. A similar picture emerges with the PAS, however, after a small (statistically insignificant) increase in 2014 to 0.48 PAS levels seem to decline slightly until 2018 to 0.46.<sup>18</sup>

Analyzing the full dataset has the advantage that I observe a representative sample of German firms in each survey wave, allowing me to detect potential country wide trends. However, the sample composition changes in each survey year, which could dilute within-company developments. To address this, panel (b) and (d) restrict the sample to firms I observe in every wave, thus holding the sample constant across all years. Again Style 1 intensities remain virtually unchanged over the whole period, although the point estimates increase from

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<sup>18</sup>This amounts to a reduction of on average 0.82 individual practices.

**Figure 4** *Change of management*



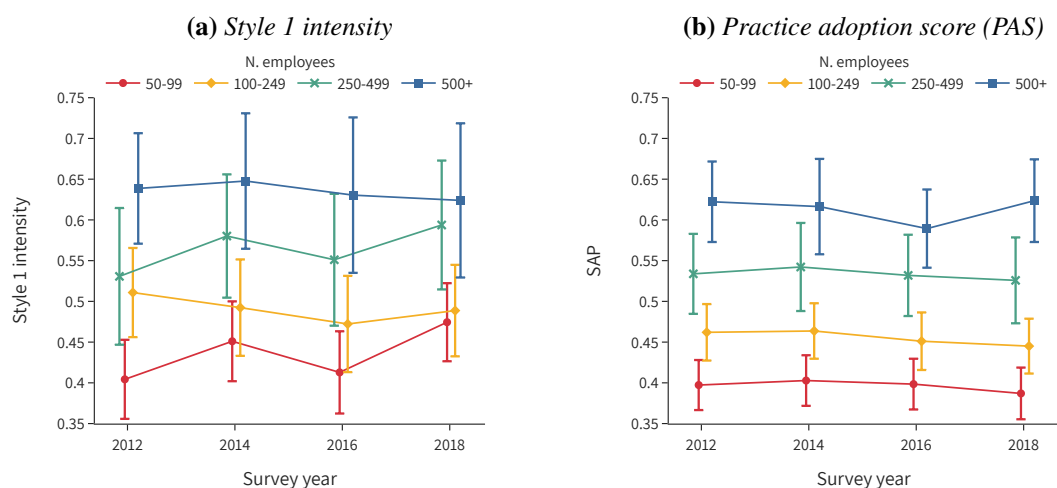
**Notes:** This figure shows Style 1 intensities (PASs) across survey-years. Panel (a) and (b) show mean values and 95% confidence intervals of Style 1 intensity. Panel (c) and (d) show mean values and 95% confidence intervals of PAS. Panel (a) and (c) are based on the full sample, panel (b) and (d) contain only firms which I observe in every survey wave.

0.49 to 0.52. The PAS remains constant throughout, indicating no adoption of additional practices.

Although I find a striking absence of country-wide trends in management styles, there might be differentiated developments in management styles across subgroups of firms, especially those for which I document large differences in levels. In this section I mainly analyze

univariate relationships but provide multivariate regression estimations in Table A12 in the Appendix. I estimate two versions of Equation (1): First, I set first-differences of Style 1 intensity and the PAS as dependent variable and include all firms which I observe for at least two consecutive survey waves.<sup>19</sup> Second, in order to capture long-term developments, I restrict the sample to panel firms and regress total differences (from first to last observation) in management measures on firm characteristics.<sup>20</sup>

**Figure 5** *Change of management by number of employees*



**Notes:** This figure shows Style 1 intensities (PASs) across survey-years split by initial number of employees category. The markers are slightly shifted to enhance the readability of the figure. Panel (a) shows mean values and 95% confidence intervals of Style 1 intensity. Panel (b) shows mean values and 95% confidence intervals of PAS. The figure is based on the panel sample of  $N = 1,288$  firm-year observations of firms which I observe in every survey wave.

In Section 4.1 I have established that firms with a larger workforce employ a more structured management style than smaller firms. Figure 5 investigates whether this gap narrows over time. Similar to Figure 4 it shows average Style 1 intensities and PASs across years, but separately for each workforce-size category. First, management of the largest firms (squares) remains very stable at a high level of Style 1 intensity. Second, the smallest firms (circles) shift their management toward Style 1 indicated by a statistically significant increase

<sup>19</sup>This maximizes the number of observations but can only capture short-term developments.

<sup>20</sup>I use firm characteristics from the first observation of each firm.

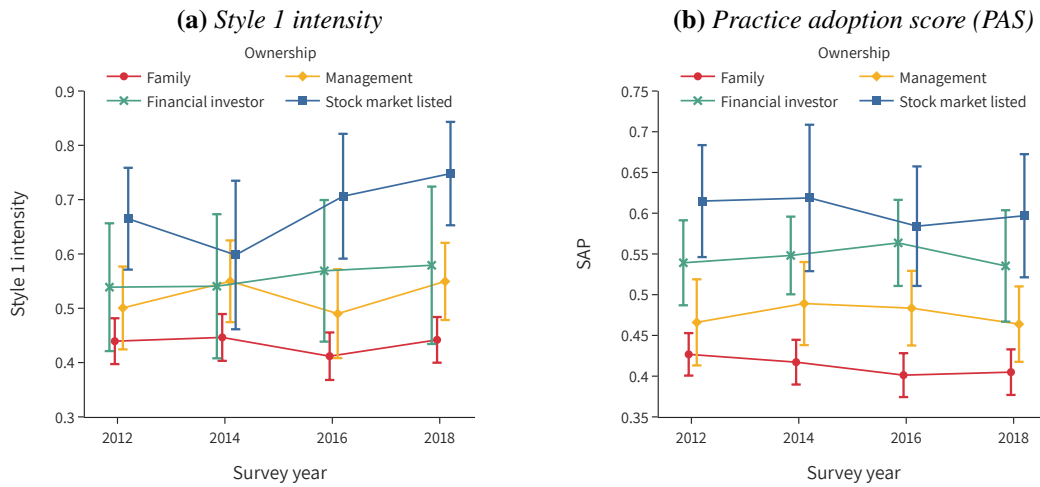
in Style 1 intensity from 0.40 in 2012 to 0.47 in 2018. Third, the two medium size-groups remain fairly stable over time, however, one can observe a diverging pattern. While in the first survey wave Style 1 intensities of both size-categories are almost identical, the gap in point estimates widens from 0.02 to 0.10 (statistically significant) in 2018. This is mostly driven by medium-large firms (crosses) which slowly narrow the gap in Style 1 intensity to the largest firms in the sample. Medium-small firms do not change their management style and are caught up by the smallest firms in the last survey wave.

Panel (b) of Figure 5 depicts yearly PASs. All four size categories show virtually no change in PASs across years, i.e. the total number of adopted practices stays constant throughout. This means that the observed dynamics of Style 1 intensities are not driven by adopting additional practices or dropping practices which are already in place. Instead, firms seem to discard Style 2 practices in favor of more structured Style 1 practices.

One reason for firms to adopt structured practices could be that their workforce grows and thus requires a more structured management style. I investigate this in Figure A3 in the Appendix. Panel (a) splits the sample into firms with an increasing workforce, i.e. those that move into a higher size category, and firms that either shrink or stay constant. Although the point estimates for growing firms lie slightly above others, there is no clear difference in trends. Panel (b) repeats the exercise for firms that start out in the smallest size category and again shows that trends are similar between growing and non-growing firms. Although I cannot entirely rule out that firms grow within categories, these patterns suggest that smaller firms adopt a structured management style deliberately rather than out of necessity as they grow.

Figure 6 investigates how firms have changed their management based on their ownership model. However, there are no notable dynamics since both management indicators remain fairly constant in all groups. If anything, stock-market-listed firms, which already start at a high Style 1 intensity, slightly increase the gap to all other ownership categories (not

**Figure 6** *Change of management by ownership*



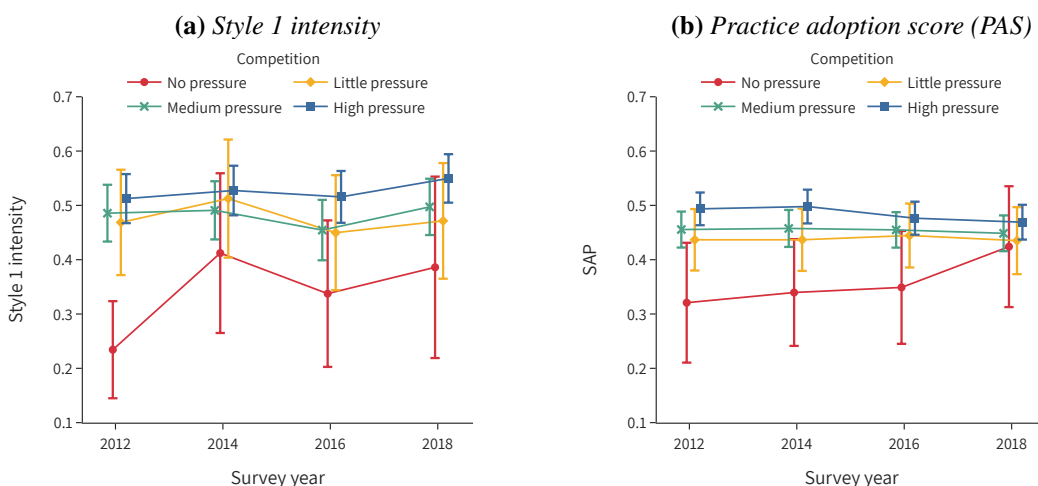
**Notes:** This figure shows Style 1 intensities (PASs) across survey-years split by initial number of employees category. The markers are slightly shifted to enhance the readability of the figure. Panel (a) shows mean values and 95% confidence intervals of Style 1 intensity. Panel (b) shows mean values and 95% confidence intervals of PAS. The figure is based on the panel sample of  $N = 1,288$  firm-year observations of firms which I observe in every survey wave.

statistically significant).

A potential trigger of larger adjustments of management styles could be a change in ownership or managers. In each wave the LPP survey asks whether management or ownership has changed over the previous two years. Of the 322 firms which I observe in every year, ownership has changed in 75 (23%) firms and managers have changed in 171 (53%) firms. To investigate whether these changes affect management styles I estimate a regression of the total change in Style 1 intensity (PAS) on an indicator whether ownership or management has changed at least once during the observational period. Tables A10 and A11 summarize the results. Contrary to my expectations I find no significant effect on Style 1 intensity and changes of ownership seem to slightly reduce the number of adopted practices. I use the absolute change of the respective management measure in column (5) of both tables to estimate whether either event triggers adjustments but in varying directions. Again the coefficients are close to zero and statistically insignificant. One potential explanation for my results could be

that out of the 75 firms in which ownership changes 43 remain within the same ownership category and only very few firms switch from any category to “Financial investor” or “Stock market listed”. For the latter cases I would expect the largest changes in management style, since these categories show the highest Style 1 intensities in my cross-sectional analysis. However, it still remains puzzling why adopted management styles appear so rigid, even if new managers take over.

**Figure 7** *Change of management by competition*



**Notes:** This figure shows Style 1 intensities (PASs) across survey-years split by competition category. The markers are slightly shifted to enhance the readability of the figure. Panel (a) shows mean values and 95% confidence intervals of Style 1 intensity. Panel (b) shows mean values and 95% confidence intervals of PAS. The figure is based on the panel sample of  $N = 1,288$  firm-year observations of firms which I observe in every survey wave.

Although, my cross-sectional results do not indicate management-style differences across self-reported competition levels, previous literature has identified competition as a key driver for improvements in management quality (Bloom, Sadun, and Van Reenen 2016; Bloom and Van Reenen 2007). Bloom, Sadun, and Van Reenen (2016) show that average management quality at the industry-country level increases over time in markets with high product competition and attribute this to a reallocation of market share from badly-managed to well-managed firms. Different to their setting, my data allows for analyzing within-firm dynamics.

Therefore, I am able to investigate whether self-reported market competition induces firms to invest in “improving” their management isolated from distributive effects. Figure 7 shows the results.<sup>21</sup> Panel (a) reveals not only an absence of level differences, but also shows that facing stronger competition does not lead to the adoption of more structured practices. Firms facing no pressure from competition, appear to be an outlier as they start from lower levels but subsequently adopt structured practices. However, these results are based on very few firms and therefore should be taken with caution. Panel (b) of Figure 7 shows a very similar picture for the PAS. In sum, my results do not indicate that stronger competition causes firms to introduce a greater number of practices or more structured practices, but if anything indicate the opposite. Note again, that the competition measure in my data is self reported and could thus be biased if some managers systematically underestimate or overestimate the pressure from competition. Nevertheless, taking my results at face value, they suggest that previously found differences in average management quality could be mostly driven by redistributive effects rather than actual changes of firms’ management styles.

Table A12 in the Appendix includes differences in dynamics with respect to the remaining firm characteristics. Similar to above, I find no significant differences across groups and again management appears very stable over time. One exception is the processing industry which seems to slightly catch up to the “IT, communication, other services” industry.

In a final analysis I aim to better understand the origin of the observed management rigidity and turn my focus to dynamics of individual structured management practices. Are firms adopting structured practices but discontinuing them again quickly or are they not implementing these practices in the first place? Figure A4 in the Appendix summarizes how firms adopt or drop the most characteristic practices of management Style 1. Panel (a) is based on firms which had not adopted a given practice in the first survey wave (2012). For each of the practices listed along the y-axis, it shows the number of firms which never adopt the

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<sup>21</sup>I divide the sample by competition in 2012.

practice (gray), the number of firms which introduce the practice but drop it again (yellow) and the number of firms which introduce and keep the practice until the last survey wave (blue). Each of the practices is introduced at some point by more than 35% of the firms. However, between 40% and 50% of the adopting firms do not keep those practices until the end of the observational period. Panel (b) is based on firms which had adopted a given practice in the first survey wave and for each practice shows the number of firms which kept it throughout the whole period (gray), dropped but reintroduced it (yellow) or permanently (until the last survey wave) dropped the practice. Each of the practices is permanently dropped by about 30% of the firms, while a smaller share drops but reintroduces the practices. These patterns suggest that many managers try out introducing structured practices, but for some reason (see the discussion below) a lot of those managers decide not to stick with the practices. Revisiting Indian weaving firms nine years after their field-experiment Bloom, Mahajan, et al. (2020) report similar patterns. Most firms had dropped a considerable amount of management practices that were introduced in the initial experiment. My results show that this also happens in non-experimental settings when management practices are not imposed by an outside party.

## **5 Discussion**

The previous section documents sizeable differences in management styles, which can only to a minor part be explained by firm characteristics. Moreover, due to a striking absence of management dynamics, these differences are persistent. Part of the absence of trends can be explained by firms dropping recently adopted structured practices after only a short time. In light of previous research which consistently documents the positive impact of structured management on performance, across all types of firms, it is puzzling why no trend toward more structured management styles can be observed. It is particularly unclear why industries and firms that lag behind in terms of practice adoption fail to catch up. In this section I start to



disentangle this puzzle by discussing potential mechanisms and offering direction for future research. To support my discussion I refer to additional results from Appendix 8.<sup>22</sup>

A first factor which may play a role is that I observe management dynamics in times of high economic stability, 2012–2018, a period after Europe had largely recovered from the Great Financial Crisis and before the onset of the COVID-19 pandemic. If firms are successful, managers could be reluctant to initiate costly changes toward more structured management styles. However, considering recent findings by Englmaier, Galdon-Sanchez, et al. (2020), who show that structured management practices are especially valuable in economically thriving times, this constitutes a particularly harmful lost opportunity. Table A15 in the Appendix further supports this notion by documenting that structured management styles are correlated with a higher likelihood of making profits. Extending my analysis to the most recent and future waves of the LPP will cover management data before, during and after the COVID-19 crisis. This offers an opportunity to analyze whether the challenge of a global pandemic, with its push toward more flexible and mobile work models, triggered larger adjustments of management styles.

Another potential hindrance to adopting structured management styles is that managers miscalculate the cost-benefit trade-off of introducing structured practices. While the costs of these practices — e.g. effort and time — are immediately noticeable, the benefits are likely not immediate, potentially indirect,<sup>23</sup> and hard to measure. This is consistent with both firms abstaining from adopting practices in the first place and firms abandoning management practices shortly after they have introduced them. As a first step to better understand the role of this mechanism, future surveys should include questions, which specifically ask why managers choose not to adopt structured practices and whether the associated cost-benefit trade-off plays a role. A second step is to further investigate why some firms adopt structured

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<sup>22</sup>A description of the data and methods used to obtain these results is provided in the Appendix.

<sup>23</sup>For example, Table A17 in the Appendix shows that more structured management is associated with higher levels of employee satisfaction and lower turnover intention, which is likely beneficial for firm performance in the long run (**Halkos2010; Bockerman2012a**).

practices and others fail to do so, with a particular focus on who bears the costs of adopting these practices. Consider a situation in which these costs are not directly borne by those who decide whether to introduce structured practices. Although this carries the danger of adopting counterproductive practices<sup>24</sup>, it could also help overcome the reluctance of adopting management practices which carry high up-front costs but are beneficial in the long run. Such a situation would create an advantage for bigger firms if they had multiple hierarchy levels and management decisions were made at the top management level but implemented mostly by lower management. My finding that larger and non-owner-managed firms employ relatively structured management styles, is consistent with the discussion above.

Lastly, I return to the design perspective on management. If management is contingent on firm characteristics and the environment, I may (in an extreme case) observe a steady state in which all firms have already chosen their optimal configuration of management practices, subject to an unobserved factor to which the observable configuration is maximally complementary. While this would explain the observed persistent level-differences in management styles, the combined findings in the literature raise doubts that this is the case. First, studies consistently document a positive relationship between structured management and firm performance, including both descriptive (Bloom, Sadun, and Van Reenen 2012a, 2016; Bloom and Van Reenen 2011; Englmaier, Galdon-Sanchez, et al. 2020; Englmaier, Hofmann, et al. 2022) and causally identified findings (Bloom, Eifert, et al. 2012; Bloom, Mahajan, et al. 2020). Table A15 in the Appendix confirms that in my setting structured management positively correlates with a self-reported profit measure, as well. Second, my study and others show that firm characteristics and the environment can explain differences in management styles only to some degree. This suggests the existence of other, less researched, factors which are complementary to structured practices and thus make their introduction profitable for some firms but not for others.

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<sup>24</sup>A negative example are the excessive documentation requirements in public institutions.

One limiting factor for structured management can be a lack of digital tools and data skills to design and implement management practices as well as analyze their value. This especially concerns practices which aim to analyze a firm's workforce in a structured way, such as employee surveys or performance tracking. Table A16 documents a strong positive correlation between structured management practices and the usage of digital tools, suggesting potential synergy effects.<sup>25</sup>

Another, and likely even more significant, potential precondition for the success of structured management is a suitable corporate culture. Good working relationships between employees and their (direct) supervisors could be especially important. The employee survey of the LPP, which I shortly introduce in the Appendix 8, features several questions related to corporate culture and specifically asks about supervisor-employee relationships. Table A18 shows conditional correlations of these corporate culture variables and my management measures. Structured management is positively associated with supervisors being perceived as fair, understanding, confident in their employees and offering good guidance. All of these factors are likely beneficial for the success of structured management practices. For instance, they could help employees to speak up and raise relevant issues in appraisal interviews or employee surveys. To this end, Castro et al. (2022) show that regular meetings (structured practice) with a particular focus on employees' individual needs and aspirations (corporate culture) lead to an increase in psychological safety and ultimately to higher team performance. Further, managers who are fair and offer good guidance should succeed in forming encouraging yet attainable target agreements and development plans. To the best of my knowledge, research specifically investigating synergies between corporate culture and structured management practices is very scarce. One exception is Blader et al. (2019) who show that corporate culture can play an important role for the success of introducing performance tracking. However, their study only considers the introduction of this particular management practice in a single

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<sup>25</sup>Although the related questions do not specifically ask whether these tools are used for HR management, they suggest a general digital and data-analytics competence of an organization.

company. Therefore, analyzing synergies of corporate culture and other factors with structured management styles more broadly and at a larger scale constitutes a promising endeavor for future research.

## **6 Conclusion**

In this paper I paint a picture of the dynamics of management styles in Germany. I analyze survey data on management practices provided by the German Institute of Employment Research, which offers a rare opportunity to repeatedly observe firms' management over a longer period of time. To reduce the dimensionality of the data I employ machine learning (LDA) and a simpler method of counting management practices. The advantage of LDA is that it is able to detect (potentially complex) underlying patterns and helps me identify practices which distinguish firms the most. My results show that firms differ the most in practices related to structured management such as development plans, employee surveys and appraisal interviews.

Using the low-dimensional representation of adopted management practices, I first analyze the cross-sectional dimension of the data to describe the German management landscape. My empirical findings show that investor-owned, large and multiplant firms tend to have the most structured management styles, confirming previous results in the literature of management (Bloom, Brynjolfsson, et al. 2019; Bloom, Lemos, et al. 2014; Englmaier, Galdon-Sanchez, et al. 2020). Second, I exploit the panel structure of my data to investigate how firms adjust their management over time. Overall, I find that management is fairly rigid without any major trends in management styles. In particular, there is no secular trend toward more structured management. Analyzing these dynamics in more detail, I find suggestive evidence that small firms are able to slightly catch up, however the gap to larger firms remains big. My results further document some degree of experimentation with adopting practices, where in many

firms recently introduced practices are not kept permanently.

My results have practical implications for other empirical studies of management, particularly for those that are based on cross-sectional data (e.g. Bandiera et al. 2020; Englmaier, Galdon-Sanchez, et al. 2020; Englmaier, Hofmann, et al. 2022). Englmaier, Galdon-Sanchez, et al. (2020) rely on cross-sectional management data from 2006 to estimate effects on productivity over a time frame from 2001 to 2016. This temporal mismatch of management and outcome data will be less of a concern if management styles remain unchanged over time. Possible explanations as to why management styles remain rigid are offered in the discussion section of this paper. Future research should give a special focus to cost-benefit trade-offs of practices and to synergy effects of corporate culture. This study carries important implications for managers. Laying the groundwork for a successful and permanent implementation of structured management styles, managers can lead firms on the path of realizing their full potential.

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## **Appendix**

### **7 Main Appendix**



**Table A1** *Summary statistics: full sample*

Variable	Observations (1)	Mean (2)	St. Dev. (3)	Min (4)	Max (5)
<b>Management measures</b>					
Style 1 intensity	3571	0.513	0.288	0.038	0.973
Style 1 intensity (first-difference)	1762	0.005	0.303	-0.891	0.884
Practice adoption score (PAS)	3571	0.470	0.192	0.024	0.902
Practice adoption score (PAS) (first-difference)	1762	-0.003	0.127	-0.512	0.488
<b>Industry</b>					
Processing industry	3595	0.315	0.465	0	1
Metal, electrical, automotive	3595	0.275	0.447	0	1
Commerce, traffic, communication	3595	0.161	0.368	0	1
Company related, financial services	3595	0.153	0.360	0	1
It, communication, other services	3595	0.096	0.294	0	1
<b>Ownership</b>					
Family, founder	3551	0.496	0.500	0	1
Management, entrepreneurship	3551	0.197	0.397	0	1
Financial investor	3551	0.068	0.252	0	1
Widely held on stock market	3551	0.067	0.250	0	1
Government or public sector	3551	0.019	0.136	0	1
Other forms	3551	0.154	0.361	0	1
<b>Employees</b>					
0-49	3595	0.022	0.147	0	1
50-99	3595	0.354	0.478	0	1
100-249	3595	0.336	0.473	0	1
250-499	3595	0.168	0.374	0	1
500+	3595	0.119	0.324	0	1
<b>Competition</b>					
No pressure	3587	0.035	0.183	0	1
Little pressure	3587	0.088	0.283	0	1
Medium pressure	3587	0.372	0.483	0	1
High pressure	3587	0.506	0.500	0	1
<b>Various</b>					
Multi-plant firm	3584	0.255	0.436	0	1
Works council	3590	0.637	0.481	0	1
No collective agreement	3593	0.397	0.489	0	1
Change of ownership	3584	0.075	0.264	0	1
Change of management	3582	0.241	0.428	0	1
<b>Annual result</b>					
Profit	3595	0.792	0.406	0	1
Loss	3595	0.081	0.273	0	1
<b>Digital technologies</b>					
Distribution channels	760	0.850	0.357	0	1
Big Data	749	0.198	0.398	0	1
Internet of Things	750	0.187	0.390	0	1

**Notes:** This table shows summary statistics of management measures and firm characteristics. The statistics are taken from the full sample of all firm-year observations.

**Table A2** *Summary statistics: panel firms*

Variable	Observations (1)	Mean (2)	St. Dev. (3)	Min (4)	Max (5)
<b>Management measures</b>					
Style 1 intensity	1288	0.497	0.294	0.040	0.973
Style 1 intensity (first-difference)	966	0.010	0.314	-0.891	0.884
Practice adoption score (PAS)	1288	0.463	0.192	0.049	0.902
Practice adoption score (PAS) (first-difference)	966	-0.004	0.121	-0.463	0.488
<b>Industry</b>					
Processing industry	1288	0.318	0.466	0	1
Metal, electrical, automotive	1288	0.307	0.462	0	1
Commerce, traffic, communication	1288	0.171	0.376	0	1
Company related, financial services	1288	0.146	0.353	0	1
It, communication, other services	1288	0.057	0.233	0	1
<b>Ownership</b>					
Family, founder	1274	0.521	0.500	0	1
Management, entrepreneurship	1274	0.192	0.394	0	1
Financial investor	1274	0.058	0.234	0	1
Widely held on stock market	1274	0.071	0.258	0	1
Government or public sector	1274	0.024	0.152	0	1
Other forms	1274	0.134	0.341	0	1
<b>Employees</b>					
0-49	1288	0.036	0.186	0	1
50-99	1288	0.340	0.474	0	1
100-249	1288	0.329	0.470	0	1
250-499	1288	0.181	0.385	0	1
500+	1288	0.114	0.318	0	1
<b>Competition</b>					
No pressure	1286	0.037	0.190	0	1
Little pressure	1286	0.093	0.291	0	1
Medium pressure	1286	0.373	0.484	0	1
High pressure	1286	0.496	0.500	0	1
<b>Various</b>					
Multi-plant firm	1286	0.227	0.419	0	1
Works council	1287	0.670	0.470	0	1
No collective agreement	1287	0.386	0.487	0	1
Change of ownership	1286	0.070	0.255	0	1
Change of management	1285	0.211	0.408	0	1

**Notes:** This table shows summary statistics of management measures and firm characteristics. The statistics are taken from the panel sample including all firm-year observations of the 322 firms that I observe in every survey wave.

**Table A3 Summary of individual practices**

Practice	Style 1		Style 2		Share adopted		
	Rank	Loading	Rank	Loading	Full Sample	Style 1	Style 2
<b>Development plans</b>	1	0.040	37	0.000	0.459	0.749	0.114
<b>Employee surveys</b>	2	0.036	35	0.000	0.413	0.640	0.147
<b>Development plans: Implementation</b>	3	0.036	38	0.000	0.408	0.675	0.090
<b>Appraisal interviews</b>	4	0.035	10	0.039	0.703	0.836	0.543
<b>Development plans: Management</b>	5	0.035	41	0.000	0.396	0.660	0.082
<b>Staffing plan</b>	6	0.035	11	0.037	0.688	0.812	0.538
<b>Development plans: Non-management</b>	7	0.034	36	0.000	0.390	0.649	0.081
<b>Appraisal interviews: Management</b>	8	0.034	12	0.036	0.670	0.807	0.505
<b>Target agreements</b>	9	0.034	16	0.033	0.642	0.785	0.471
<b>Internal training</b>	10	0.032	2	0.054	0.791	0.872	0.694
Employee surveys: Communicated to employees	11	0.032	39	0.000	0.359	0.572	0.107
Performance appraisal	12	0.032	13	0.035	0.633	0.763	0.476
Target agreements: Management	13	0.031	19	0.029	0.599	0.751	0.416
Appraisal interviews: Non-management	14	0.031	15	0.033	0.621	0.753	0.462
Performance appraisal: Management	15	0.031	21	0.026	0.556	0.700	0.388
Inefficiency: HR development measures (high)	16	0.031	24	0.020	0.506	0.652	0.331
<b>Analysis of age structure</b>	17	0.031	8	0.040	0.666	0.761	0.547
Promotion of higher educational qualification	18	0.030	14	0.034	0.613	0.709	0.500
<b>On-the-job training</b>	19	0.030	3	0.053	0.763	0.827	0.682
<b>Attending lectures</b>	20	0.030	4	0.047	0.709	0.787	0.615
Performance appraisal: Non-management	21	0.029	17	0.031	0.575	0.698	0.429
<b>Inefficiency: Discussions (high)</b>	22	0.029	1	0.063	0.830	0.847	0.810
Employee surveys: Develop solutions	23	0.028	40	0.000	0.313	0.510	0.083
Conduction of performance appraisal	24	0.025	18	0.029	0.522	0.621	0.404
Target agreements: Non-management	25	0.025	28	0.014	0.405	0.529	0.256
<b>Variable remuneration</b>	26	0.024	9	0.040	0.590	0.667	0.499
Self-directed study (by media)	27	0.023	29	0.013	0.358	0.472	0.224
Increase of women in management set as goal	28	0.019	22	0.024	0.405	0.476	0.318
Recruitment: Social networks	29	0.018	25	0.020	0.366	0.439	0.273
Recruitment: Private agency	30	0.016	27	0.016	0.311	0.381	0.224
Quality/workshop meeting	31	0.016	32	0.008	0.243	0.329	0.140
Inefficiency: Another position (high)	32	0.016	26	0.018	0.326	0.375	0.268
Job rotation	33	0.014	33	0.007	0.213	0.288	0.126
Recruitment agency: Management	34	0.014	31	0.010	0.229	0.296	0.147
<b>Inefficiency: Dismissal (high)</b>	35	0.012	5	0.044	0.488	0.452	0.529
Inefficiency: Dismissal (low)	36	0.012	23	0.020	0.296	0.316	0.272
<b>HR at highest management level</b>	37	0.011	6	0.042	0.460	0.424	0.498
Recruitment agency: Non-management	38	0.009	30	0.010	0.179	0.214	0.135
<b>Inefficiency: Another position (low)</b>	39	0.003	7	0.042	0.363	0.274	0.465
Inefficiency: Discussions (low)	40	0.000	34	0.006	0.050	0.030	0.071
Inefficiency: HR development measures (low)	41	0.000	20	0.029	0.227	0.088	0.385
Advanced training measures					0.921	0.956	0.877
External training					0.874	0.922	0.816
Distribution recommendation for performance appraisal					0.081	0.119	0.037
Distribution recommendation: Non-management					0.071	0.103	0.033
Distribution recommendation: Management					0.067	0.103	0.026

**Notes:** This table shows a full list of management practices including practice loadings and ranks within each style. By construction the loadings of all practices are strictly positive and sum up to one. The top 10 practices of both styles, ordered from highest to lowest loadings, are shown in bold. It further shows adoption rates of management practices for the full sample as well as Style 1 firms and Style 2 firms. Style 1 firms are firms with Style 1 intensity  $\geq 0.5$  and Style 2 firms are firms with Style 1 intensity  $< 0.5$ . The five practices at the bottom are excluded from the LDA estimation, due to their low TF-IDF scores.

**Table A4** *Overview of management practices*

Practice	Question text
Development plans	Are there any development plans for employees in your establishment/office?
Employee surveys	Does your establishment/office regularly conduct employee surveys?
Development plans: Implementation	Do you systematically review the implementation of the development plans?
Appraisal interviews	Do you conduct structured appraisal interviews in your establishment/office at least once a year?
Development plans: Management	For whom are development plans available? (management staff)
Staffing plan	Does your establishment/office have a staffing plan?
Development plans: Non-management	For whom are development plans available? (employees without management responsibility)
Appraisal interviews: Management	With whom do you conduct the structured appraisal interviews? (management staff)
Target agreements	Does your establishment have target agreements?
Internal training (IAB BP)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? Internal training courses, seminars or workshops
Employee surveys: Communicated to employees	Are the results of the survey communicated to all employees?
Performance appraisal	Is a review of the performance of the employees carried out by the respective supervisor in your establishment/office at least once a year?
Target agreements: Management	For whom are the target agreements available? (management staff)
Appraisal interviews: Non-management	With whom do you conduct the structured appraisal interviews? (employees without management responsibility)
Performance appraisal: Management	For whom are the annual performance appraisals issued? (management staff)
Inefficiency: HR development measures (high)	How do you and your management staff deal with employees, whose performance is not satisfactory? HR development measures are purposefully offered to correct performance problems.
Analysis of age structure	Do you systematically analyze the age structure of employees in your establishment/office?
Promotion of higher educational qualification	Have you actively promoted employees' qualification activities leading to a higher educational qualification, e.g. by releasing from work or partially bearing costs? This includes e.g. further training to master craftsmen, technician, postgraduate program, MBA, doctorate.
On-the-job training (IAB BP)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? Further training on the job (instruction, familiarization training)
Attending lectures (IAB BP)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? Participation in lectures, symposia, fairs, etc.

**Notes:** This table lists survey questions to the related management practices. A detailed data report of the last LPP survey wave (2018) can be found in Mackeben, Ruf, Stefanie Wolter, et al. (2020). (IAB BP) indicates that these practices are taken from the IAB Establishment Panel (Bellmann et al. 2019). The remaining practices are all taken from the LPP (Mackeben, Ruf, Sefanie Wolter, et al. 2020). This table is continued on the next page.

**Table A4** *Overview of management practices (cont'd)*

Practice	Question text
Performance appraisal: Non-management	For whom are the annual performance appraisals issued? (employees without management responsibility)
Inefficiency: Discussions (high)	How do you and your management staff deal with employees, whose performance is not satisfactory? The management staff openly discusses the problems with the employee in question.
Employee surveys: Develop solutions	Is there a systematic process to develop solutions for flaws, which were identified in the employee surveys?
Conduction of performance appraisal	Is the performance appraisal generally conducted by just one superior or collectively by a group of superiors (evaluation round), meaning not only by one superior?
Target agreements: Non-management	For whom are the target agreements available? (employees without management responsibility)
Variable remuneration	Does your establishment/office have a salary system with variable proportions?
Self-directed study (by media)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? Self-directed study (e.g. by means of computer-aided self-learning programs or reference books)
Increase of women in management set as goal	Do you pursue the goal to increase the proportion of women in management positions?
Recruitment: Social networks	Have you directly addressed applicants employed by another company via social networks such as Xing, LinkedIn etc. in the past two years?
Recruitment: Private agency	Have you recruited applicants in the past two years, who were employed by another company, with the help of a private recruitment agency or HR consulting?
Quality/workshop meeting (IAB BP)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? Quality circles, workshop circles, learning workshop, continuous improvement teams
Inefficiency: Another position (high)	How do you and your management staff deal with employees, whose performance is not satisfactory? We try to find another position in the establishment/office if there are permanent performance problems.
Job rotation (IAB BP)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? Job rotation

**Notes:** This table lists survey questions to the related management practices. A detailed data report of the last LPP survey wave (2018) can be found in Mackeben, Ruf, Stefanie Wolter, et al. (2020). (IAB BP) indicates that these practices are taken from the IAB Establishment Panel (Bellmann et al. 2019). The remaining practices are all taken from the LPP (Mackeben, Ruf, Sefanie Wolter, et al. 2020). This table is continued on the next page.

**Table A4** *Overview of management practices (cont'd)*

Practice	Question text
Recruitment agency: Management	Have you recruited applicants in the past two years, who were employed by another company, with the help of a private recruitment agency or HR consulting? (management staff)
Inefficiency: Dismissal (high)	How do you and your management staff deal with employees, whose performance is not satisfactory? Employees who permanently show poor working performance will be dismissed or urged to leave the establishment/office.
Inefficiency: Dismissal (low)	How do you and your management staff deal with employees, whose performance is not satisfactory? Employees who permanently show poor working performance will be dismissed or urged to leave the establishment/office.
HR at highest management level	On which level is the management of the human resources (HR) located in your company? On the first management level, that means executive board or management?
Recruitment agency: Non-management	Have you recruited applicants in the past two years, who were employed by another company, with the help of a private recruitment agency or HR consulting? (employees without management responsibility)
Inefficiency: Another position (low)	How do you and your management staff deal with employees, whose performance is not satisfactory? We try to find another position in the establishment/office if there are permanent performance problems.
Inefficiency: Discussions (low)	How do you and your management staff deal with employees, whose performance is not satisfactory? The management staff openly discusses the problems with the employee in question.
Inefficiency: HR development measures (low)	How do you and your management staff deal with employees, whose performance is not satisfactory? HR development measures are purposefully offered to correct performance problems.
Advanced training measures (IAB BP)	Did your establishment/office support training courses in the first half of this year?
External training (IAB BP)	For which of the following internal or external training courses did your establishment release staff and cover the expenses in full or in part? External training courses, seminars or workshops
Distribution recommendation for performance appraisal	Do you have recommendations regarding distribution of performance appraisal? Recommendations regarding performance appraisal include information on what percentage of employees should, for instance, receive the best performance appraisal, the second-best performance appraisal etc.
Distribution recommendation: Non-management	Do you have recommendations regarding distribution of performance appraisal? Recommendations regarding performance appraisal include information on what percentage of employees should, for instance, receive the best performance appraisal, the second-best performance appraisal etc. (employees without management responsibility)
Distribution recommendation: Management	Do you have recommendations regarding distribution of performance appraisal? Recommendations regarding performance appraisal include information on what percentage of employees should, for instance, receive the best performance appraisal, the second-best performance appraisal etc. (management staff)

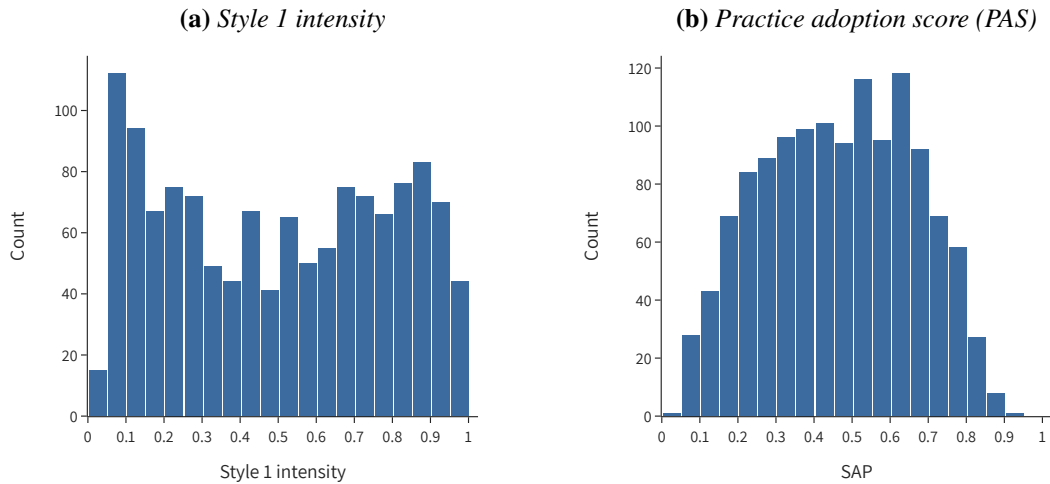
**Notes:** This table lists survey questions to the related management practices. A detailed data report of the last LPP survey wave (2018) can be found in Mackeben, Ruf, Stefanie Wolter, et al. (2020). (IAB BP) indicates that these practices are taken from the IAB Establishment Panel (Bellmann et al. 2019). The remaining practices are all taken from the LPP (Mackeben, Ruf, Sefanie Wolter, et al. 2020).

**Table A5** Management styles and PAS: correlations

	Style 1	Style 1 (alt.)	PAS
Style 1	1.000		
Style 1 (alt.)	0.709	1.000	
PAS	0.636	0.663	1.000

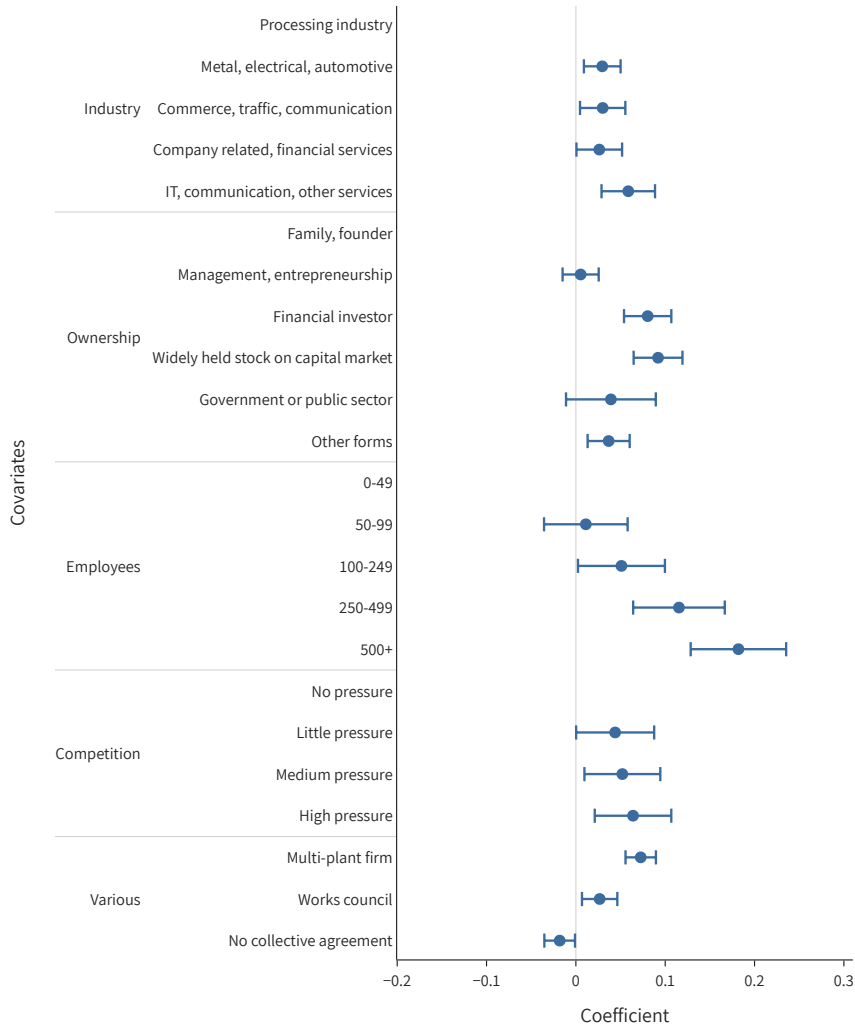
**Notes:** This table shows correlations of management measures. Style 1 indicates the intensity of the structured management style, resulting from LDA. Style 1 (alt.) is an alternative measure without TF-IDF elimination. PAS is simply the share of adopted practices.

**Figure A1** Distributions of management measures – panel firms



**Notes:** This figure shows histograms of both management measures. Panel (a) shows the distribution of Style 1 intensity and panel (b) the distribution of the PAS. The statistics are taken from the panel sample including all firm-year observations of the 322 firms that I observe in every survey wave.

**Figure A2** Practice adoption score (PAS) correlates



**Notes:** This figure shows coefficients and 95% confidence intervals from an OLS regression of the PAS on firm characteristics. All regressors are either dummies or categorical variables. Reference categories are those without coefficient indicators. The regression is estimated on a pooled sample including all firm-year observations. The number of observations is  $N = 3,508$  and standard errors are clustered at the firm-level.



**Table A6** Management levels: Style 1 intensity – full sample

	Dependent: Style 1 intensity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Industry (Ref: Processing industry)</b>								
Metal, electrical, automotive	0.046** (0.017)							0.019 (0.015)
Commerce, traffic, communication	0.030 (0.020)							0.031 (0.018)
Company, financial services	0.022 (0.020)							0.021 (0.019)
IT, communication, other services	0.043* (0.021)							0.043* (0.021)
<b>Principal owner (Ref: Family, founder)</b>								
Management, entrepreneurship		0.053*** (0.015)						0.032* (0.015)
Financial investor		0.121*** (0.022)						0.073*** (0.021)
Listed on stock market		0.217*** (0.020)						0.103*** (0.020)
Government or public sector		0.108** (0.042)						0.044 (0.040)
Other forms		0.095*** (0.017)						0.040* (0.017)
<b>Competition (Ref: No pressure)</b>								
Little pressure			0.011 (0.032)					0.014 (0.030)
Medium pressure			0.051 (0.030)					0.037 (0.028)
High pressure			0.056 (0.030)					0.031 (0.028)
<b>Firm size (Ref: Employees: 0-49)</b>								
Employees: 50-99				-0.028 (0.040)				-0.026 (0.039)
Employees: 100-249				0.049 (0.040)				0.026 (0.040)
Employees: 250-499				0.127** (0.042)				0.083* (0.041)
Employees: 500+				0.224*** (0.042)				0.161*** (0.042)
<b>Dummy indicators</b>								
Multiplant firm					0.132*** (0.012)			0.076*** (0.013)
Works council						0.138*** (0.012)		0.055*** (0.014)
No Collective agreement							-0.097*** (0.012)	-0.019 (0.013)
Intercept	0.488*** (0.012)	0.462*** (0.009)	0.465*** (0.029)	0.458*** (0.039)	0.478*** (0.007)	0.425*** (0.010)	0.551*** (0.008)	0.353*** (0.049)
Adj. R <sup>2</sup>	0.003	0.044	0.002	0.081	0.039	0.053	0.027	0.129
Observations	3,571	3,530	3,563	3,571	3,561	3,567	3,569	3,508
Cluster	1,773	1,761	1,771	1,773	1,769	1,772	1,773	1,754

**Notes:** The dependent variable is the intensity of Style 1. The regressions are based on the full sample of firm-year observations. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Table A7** Management levels: Style 1 intensity – panel firms

	Dependent: Style 1 intensity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Industry (Ref: Processing industry)</b>								
Metal, electrical, automotive	0.049 (0.032)							0.034 (0.029)
Commerce, traffic, communication	0.036 (0.038)							0.045 (0.033)
Company, financial services	0.060 (0.040)							0.057 (0.035)
IT, communication, other services	0.010 (0.049)							0.022 (0.047)
<b>Principal owner (Ref: Family, founder)</b>								
Management, entrepreneurship		0.052 (0.028)						0.034 (0.027)
Financial investor		0.070 (0.045)						0.039 (0.043)
Listed on stock market		0.237*** (0.035)						0.115** (0.036)
Government or public sector		0.167* (0.070)						0.120 (0.065)
Other forms		0.125*** (0.036)						0.062 (0.035)
<b>Competition (Ref: No pressure)</b>								
Little pressure			-0.015 (0.051)					-0.012 (0.047)
Medium pressure			0.045 (0.050)					0.025 (0.046)
High pressure			0.052 (0.051)					0.019 (0.047)
<b>Firm size (Ref: Employees: 0-49)</b>								
Employees: 50-99				-0.036 (0.055)				-0.031 (0.053)
Employees: 100-249				0.045 (0.058)				0.018 (0.057)
Employees: 250-499				0.099 (0.061)				0.050 (0.059)
Employees: 500+				0.202** (0.061)				0.135* (0.063)
<b>Dummy indicators</b>								
Multiplant firm					0.167*** (0.023)			0.103*** (0.025)
Works council						0.147*** (0.024)		0.067* (0.027)
No Collective agreement							-0.103*** (0.023)	-0.017 (0.025)
Intercept	0.467*** (0.023)	0.445*** (0.016)	0.456*** (0.049)	0.454*** (0.054)	0.459*** (0.013)	0.399*** (0.019)	0.537*** (0.016)	0.337*** (0.072)
Adj. R <sup>2</sup>	0.003	0.053	0.003	0.062	0.056	0.055	0.028	0.133
Observations	1,288	1,274	1,286	1,288	1,286	1,287	1,287	1,268
Cluster	322	322	322	322	322	322	322	322

**Notes:** The dependent variable is the intensity of Style 1. The regressions are based on the panel sample firm-year observations of firms which I observe in every survey wave. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Table A8 Management levels: Practice adoption score (PAS) – full sample**

	Dependent: PAS							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Industry (Ref: Processing industry)</b>								
Metal, electrical, automotive	0.052*** (0.013)							0.030** (0.010)
Commerce, traffic, communication	0.029 (0.015)							0.030* (0.013)
Company, financial services	0.029 (0.015)							0.026* (0.013)
IT, communication, other services	0.051** (0.016)							0.059*** (0.015)
<b>Principal owner (Ref: Family, founder)</b>								
Management, entrepreneurship		0.021 (0.011)						0.005 (0.010)
Financial investor		0.122*** (0.014)						0.080*** (0.014)
Listed on stock market		0.192*** (0.014)						0.092*** (0.014)
Government or public sector		0.081** (0.031)						0.039 (0.026)
Other forms		0.083*** (0.012)						0.037** (0.012)
<b>Competition (Ref: No pressure)</b>								
Little pressure			0.039 (0.024)					0.044* (0.022)
Medium pressure			0.061* (0.024)					0.052* (0.022)
High pressure			0.083*** (0.024)					0.064** (0.022)
<b>Firm size (Ref: Employees: 0-49)</b>								
Employees: 50-99				0.010 (0.026)				0.011 (0.024)
Employees: 100-249				0.071** (0.027)				0.051* (0.025)
Employees: 250-499				0.150*** (0.028)				0.115*** (0.026)
Employees: 500+				0.235*** (0.028)				0.182*** (0.027)
<b>Dummy indicators</b>								
Multiplant firm					0.119*** (0.009)			0.073*** (0.009)
Works council						0.106*** (0.009)		0.027** (0.010)
No Collective agreement							-0.084*** (0.009)	-0.018* (0.009)
Intercept	0.442*** (0.009)	0.430*** (0.007)	0.403*** (0.023)	0.390*** (0.026)	0.440*** (0.005)	0.403*** (0.007)	0.504*** (0.006)	0.279*** (0.034)
Adj. R <sup>2</sup>	0.011	0.085	0.009	0.152	0.073	0.070	0.046	0.245
Observations	3,571	3,530	3,563	3,571	3,561	3,567	3,569	3,508
Cluster	1,773	1,761	1,771	1,773	1,769	1,772	1,773	1,754

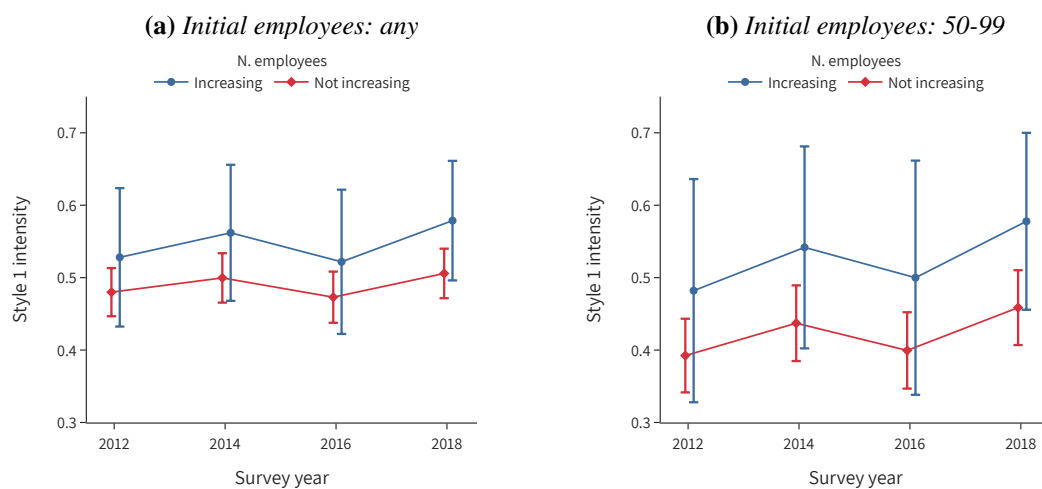
**Notes:** The dependent variable is the PAS. The regressions are based on the full sample of firm-year observations. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Table A9** Management levels: Practice adoption score (PAS) – panel firms

	Dependent: PAS							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Industry (Ref: Processing industry)</b>								
Metal, electrical, automotive	0.050*							0.037
	(0.025)							(0.020)
Commerce, traffic, communication	0.024							0.029
	(0.029)							(0.025)
Company, financial services	0.059							0.052*
	(0.032)							(0.025)
IT, communication, other services	0.027							0.038
	(0.037)							(0.034)
<b>Principal owner (Ref: Family, founder)</b>								
Management, entrepreneurship		0.028						0.015
		(0.022)						(0.020)
Financial investor		0.107***						0.082***
		(0.024)						(0.023)
Listed on stock market		0.214***						0.099***
		(0.026)						(0.025)
Government or public sector		0.099						0.065
		(0.055)						(0.045)
Other forms		0.100***						0.047
		(0.026)						(0.025)
<b>Competition (Ref: No pressure)</b>								
Little pressure			0.043					0.042
			(0.041)					(0.031)
Medium pressure			0.068					0.048
			(0.043)					(0.032)
High pressure			0.084					0.051
			(0.044)					(0.033)
<b>Firm size (Ref: Employees: 0-49)</b>								
Employees: 50-99				0.006				0.006
				(0.039)				(0.037)
Employees: 100-249				0.065				0.042
				(0.039)				(0.038)
Employees: 250-499				0.147***				0.107**
				(0.041)				(0.041)
Employees: 500+				0.234***				0.184***
				(0.043)				(0.044)
<b>Dummy indicators</b>								
Multiplant firm					0.155***			0.106***
					(0.018)			(0.017)
Works council						0.107***		0.024
						(0.019)		(0.020)
No Collective agreement							-0.092***	-0.019
							(0.018)	(0.017)
Intercept	0.433***	0.420***	0.392***	0.386***	0.427***	0.391***	0.498***	0.287***
	(0.018)	(0.012)	(0.042)	(0.037)	(0.010)	(0.015)	(0.012)	(0.053)
Adj. R <sup>2</sup>	0.011	0.101	0.007	0.153	0.114	0.068	0.054	0.282
Observations	1,288	1,274	1,286	1,288	1,286	1,287	1,287	1,268
Cluster	322	322	322	322	322	322	322	322

**Notes:** The dependent variable is the PAS. The regressions are based on the panel sample firm-year observations of firms which I observe in every survey wave. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Figure A3** *Change of management by employee growth*



**Notes:** This figure shows Style 1 intensities across survey-years split by firms that move to a higher workforce category and firms that don't. The markers are slightly shifted to enhance the readability of the figure. Panel (a) shows mean values and 95% confidence intervals of Style 1 intensity for all initial workforce sizes. Panel (b) shows mean values and 95% confidence intervals of Style 1 intensity only for firms with initially 50-99 employees.

**Table A10** *Management dynamics: Style 1 – change of ownership or managers*

	Dependent: Total change of Style 1 intensity <sup>a</sup>				
	(1)	(2)	(3)	(4)	(5) <sup>a</sup>
Change of ownership	-0.004 (-0.100)		0.004 (0.090)	-0.002 (-0.030)	-0.016 (-0.550)
Change of management		-0.017 (-0.500)	-0.019 (-0.510)	-0.015 (-0.380)	0.016 (-0.600)
Intercept	0.030 (1.520)	0.038 (1.540)	0.038 (1.510)	0.176 (1.820)	0.164* (2.330)
Controls				<b>X</b>	<b>X</b>
Adj. R <sup>2</sup>	-0.003	-0.002	-0.005	0.014	-0.016
Observations	322	322	322	318	318

**Notes:** The dependent variable is the total change of Style 1 intensity from 2012 to 2018. Change of ownership indicates that the ownership structure of a firm has changed at least once between 2012 and 2018. Change of management indicates that the management staff of a firm has changed at least once between 2012 and 2018. Robust standard errors are reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

<sup>a</sup> The dependent variable in column (5) is total change of Style 1 intensity in absolute terms. Thus, the coefficients in column (5) indicate changes of Style 1 intensity in any direction.

**Table A11** *Management dynamics: SAP – change of ownership or managers*

	Dependent: Total change of PAS <sup>a</sup>				
	(1)	(2)	(3)	(4)	(5) <sup>a</sup>
Change of ownership	-0.033 (-1.630)		-0.045* (-2.000)	-0.046* (-1.980)	0.008 (0.490)
Change of management		0.014 (0.810)	0.027 (1.450)	0.021 (0.930)	-0.016 (-1.110)
Intercept	-0.003 (-0.320)	-0.018 (-1.400)	-0.015 (-1.160)	0.094 (1.880)	0.134*** (3.720)
Controls				<b>X</b>	<b>X</b>
Adj. R <sup>2</sup>	0.005	-0.001	0.009	0.014	0.002
Observations	322	322	322	318	318

**Notes:** This table summarizes regressions results of management measures on indicators for changes of principal owners or managers. Robust standard errors are reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

<sup>a</sup> The dependent variable in column (5) is the absolute total change of the PAS.

**Table A12 Management dynamics**

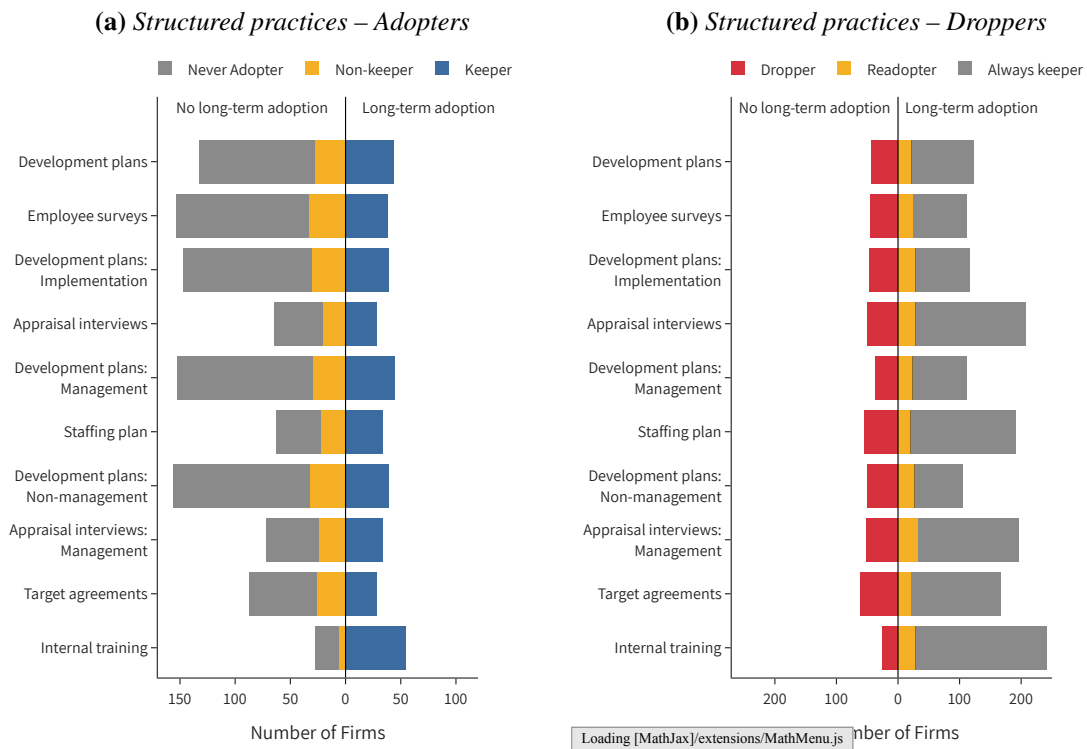
	Dependent: Change Style 1 intensity			Dependent: Change PAS		
	FD (1)	FD (2)	Total (3)	FD (4)	FD (5)	Total (6)
<b>Industry (Ref: Processing industry)</b>						
Metal, electrical, automotive	0.017 (1.190)	0.000 (-0.020)	0.009 (0.200)	0.005 (0.820)	0.001 (0.100)	-0.001 (-0.050)
Commerce, traffic, communication	0.007 (0.430)	0.001 (0.050)	-0.004 (-0.080)	0.001 (0.080)	0.012 (1.290)	0.029 (1.070)
Company, financial services	-0.005 (-0.290)	-0.004 (-0.230)	-0.081 (-1.420)	-0.005 (-0.670)	0.003 (0.350)	-0.007 (-0.270)
IT, communication, other services	-0.023 (-0.970)	-0.041 (-1.510)	-0.211** (-2.660)	-0.013 (-1.090)	-0.024 (-1.850)	-0.084* (-2.180)
<b>Principal owner (Ref: Family, founder)</b>						
Management, entrepreneurship	0.012 (0.700)	0.031 (1.290)	0.075 (1.540)	0.006 (0.860)	0.007 (0.100)	0.029 (1.270)
Financial investor	0.013 (0.480)	-0.001 (-0.030)	0.068 (0.770)	0.014 (1.150)	0.000 (0.010)	0.034 (0.810)
Listed on stock market	0.030 (1.260)	0.024 (0.760)	0.136 (1.740)	0.019 (1.740)	0.012 (0.820)	-0.005 (-0.140)
Government or public sector	0.019 (0.590)	0.055 (1.720)	0.155* (2.020)	0.021* (1.970)	0.014 (1.130)	0.046 (1.620)
Other forms	-0.003 (-0.160)	-0.015 (-0.600)	0.113* (2.110)	0.010 (1.140)	-0.004 (-0.360)	0.041 (1.420)
<b>Competition (Ref: No pressure)</b>						
Little pressure	-0.059 (-1.520)	-0.039 (-0.800)	-0.167 (-1.700)	-0.010 (-0.570)	0.007 (0.320)	-0.109* (-2.030)
Medium pressure	-0.031 (-0.900)	0.006 (0.130)	-0.163 (-1.780)	-0.018 (-1.160)	-0.009 (-0.480)	-0.123** (-2.810)
High pressure	-0.039 (-1.180)	-0.001 (-0.030)	-0.135 (-1.480)	-0.025 (-1.600)	-0.018 (-1.030)	-0.146*** (-3.360)
<b>Firm size (Ref: Employees: 0-49)<sup>a</sup></b>						
Employees: 50-99	-0.029 (-0.890)	-0.051 (-1.390)		0.028 (1.680)	0.022 (1.070)	
Employees: 100-249	-0.024 (-0.740)	-0.062 (-1.690)	-0.086 (-1.970)	0.029 (1.790)	0.020 (1.000)	0.001 (0.030)
Employees: 250-499	-0.030 (-0.880)	-0.069 (-1.750)	-0.012 (-0.210)	0.023 (1.370)	0.016 (0.760)	0.001 (0.030)
Employees: 500+	-0.033 (-0.920)	-0.046 (-1.100)	-0.094 (-1.310)	0.027 (1.550)	0.031 (1.470)	0.022 (0.710)
<b>Dummy indicators</b>						
Multiplant firm	0.001 (0.050)	-0.001 (-0.040)	-0.033 (-0.730)	-0.002 (-0.260)	-0.004 (-0.460)	0.013 (0.580)
Works council	0.012 (0.790)	0.027 (1.600)	0.015 (0.330)	-0.006 (-0.930)	0.005 (0.560)	-0.006 (-0.270)
No Collective agreement	0.003 (0.170)	0.016 (0.930)	0.048 (1.200)	-0.007 (-0.650)	-0.007 (-0.880)	0.020 (0.970)
Change of owner	-0.029 (-1.110)	-0.006 (-0.170)	-0.002 (-0.030)	0.007 (0.650)	0.018 (1.120)	-0.046* (-1.980)
Change of management	0.004 (0.200)	-0.004 (-0.160)	-0.015 (-0.380)	0.000 (-0.030)	-0.009 (-0.980)	0.021 (0.930)
Intercept	0.024 (0.480)	0.029 (0.450)	0.159 (1.570)	0.000 (0.020)	-0.005 (-0.160)	0.069 (1.330)
Panel firms		X	X		X	X
Adj. R <sup>2</sup>	-0.007	-0.014	0.014	-0.004	-0.009	0.014
Observations	1,730	949	318	1,730	949	318
Cluster	922	320		922	320	

**Notes:** The dependent variables in columns (1)–(2) and (4)–(5) are the first-difference of Style 1 intensity and PAS, respectively. The dependent variables in columns (3) and (6) are the total difference of Style 1 intensity and PAS. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

<sup>a</sup>The reference category “Employees: 0-49” was only introduced in the second wave. In the regressions of columns (3) and (6) firm characteristics are evaluated at the first wave and therefore in these regressions the reference category is “Employees: 50-99”.



**Figure A4 Practice adopters and droppers**



**Notes:** This figure shows patterns of adopting and dropping the ten most characteristic practices of management Style 1. Panel (a) considers all firms which had a practice adopted at the beginning of the sample and shows how many of those adopted and permanently kept (blue), adopted but dropped again (yellow) or never adopted (gray) this practice. Panel (b) considers all firms which had a practice not adopted at the beginning of the sample and shows how many of those firms dropped (red), dropped but readopted (yellow) or always kept (gray) this practice.

## 8 Additional management correlates

This section introduces additional correlates with management styles. The aspects analyzed here are neither firm nor environment characteristics, but could be important complements or outcomes of structured management.<sup>26</sup> Although, some of these results are covered in the accompanying paper (Englmaier, Hofmann, et al. 2022), they strongly support my discussion in Section 5 of this paper. To ensure Chapter ?? can be read independently, I briefly describe the methodology and results of these additional analyses.

I estimate conditional correlations of additional firm-level variables and management measures using the following specification:

$$y_{it} = \alpha + \beta * \theta_{it} + \mathbf{X}_{it} \boldsymbol{\delta} + \eta_t + \varepsilon_{it}, \quad (2)$$

where  $y_{it}$  is the variable of interest for firm  $i$  in year  $t$ ,  $\theta_{it}$  is one of the management measures,  $\mathbf{X}_{it}$  are firm-level controls<sup>27</sup> and  $\eta_t$  denote year-fixed effects. The regressions are estimated using the pooled sample of all firm-year observations and dependent variables as well as management measures are z-score standardized.

First, I consider firm success. Balance sheet data or productivity measures are not available in my setting, but the employer survey asks whether the annual result of the past year was positive, neutral or negative. I define two indicators: *Profit* and *Loss*, which are one if the annual result was positive or negative, respectively, and zero otherwise. The results are summarized in Table A15 and show that structured management is associated with a higher likelihood for positive and lower likelihood for negative annual results. These correlations are consistent with previous (causal) findings (Bloom, Eifert, et al. 2012) that structured management leads to higher productivity. Second, I analyze the correlation of structured management and the use of digital tools and data, which as discussed in Section 5 could be complementing each other. Table A16 documents consistent positive correlations of both management measures with the usage of three digital tools: Digital distributions channels, big data and the Internet of Things.<sup>28</sup>

I further describe correlations with variables from the employee survey, which surveys multiple employees of the firms covered in my previous analysis. It thus complements the firm-

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<sup>26</sup>I do not claim to identify causal channels from structured management to the respective variables and in some parts explicitly suggest effects in both directions.

<sup>27</sup>Controls include indicators of firm characteristics: Industry, size, region, multiplant firm, ownership, collective agreement, works council, competition and changes of ownership and management.

<sup>28</sup>All three variables are dummies indicating whether the respective technology is used.

level data with linked employee-level information on, among other topics, corporate culture, job satisfaction and commitment, work-life balance as well as health, personal characteristics and socio-demographic variables. A more detailed description of the survey can be found in Kampkötter et al. (2016). Table A13 and Table A14 show summary statistics of the available information. Here, I focus on two topics, employee satisfaction and corporate culture, and estimate the following specifications:

$$y_{jit} = \alpha + \beta * \theta_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \mathbf{Z}_{jt}\boldsymbol{\delta} + \eta_t + \varepsilon_{it}. \quad (3)$$

$y_{jit}$  denotes the variable of interest for employee  $j$  of firm  $i$  at time  $t$ ,  $\theta_{it}$  is one of the management measures,  $\mathbf{X}_{it}$  and  $\mathbf{Z}_{jt}$  are firm-level<sup>29</sup> and employee-level<sup>30</sup> controls and  $\eta_t$  denote year-fixed effects. The regressions are estimated using the pooled sample of slightly less than 15,000 employee-firm-year observations and dependent variables as well as management measures are z-score standardized. First, Table A17 focuses on indicators of employee satisfaction. Structured management is associated with lower levels of turnover intention and higher levels of job as well as income satisfaction.<sup>31</sup> These correlations provide suggestive evidence that employees prefer structured management styles. Second, I analyze correlations of management styles and corporate culture, more specifically how employees assess qualities of their supervisors. Table A18 summarizes the results. I document strong positive correlations between Style 1 intensity (PAS) and supervisors being perceived as fair and understanding, confident in their employees and offering good guidance.<sup>32</sup> As discussed in Section 5, I expect synergy effects between corporate culture and management practices, which would make having the right corporate culture an important requirement for the success of structured management styles.

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<sup>29</sup>Firm-level controls include indicators for industry, size, region, mutliplant firm, ownership, collective agreement.

<sup>30</sup>Employee-level controls include indicators for management position, functional area, employment situation, full-time employment, education, training qualification, net income, year of birth, gender, household size and relationship status.

<sup>31</sup>Job and income satisfaction are measured on a scale from 0 (“totally unhappy”) to 10 (“totally happy”). Turnover intention measures how often employees think about changing their job and ranges from 1 (“daily”) to 5 (“never”). In the regressions all three variables are z-score standardized.

<sup>32</sup>All indicators are measured on an agreement scale from 1 (“does not apply at all”) to 5 (“fully applies”).

**Table A13** *Summary statistics: employee survey – controls*

Variable	Observations (1)	Mean (2)	St. Dev. (3)	Min (4)	Max (5)
<b>Demographics</b>					
Year of birth	19,469	1967.649	10.386	1942	1998
Female	19,469	0.274	0.446	0	1
Household size	19,441	2.774	1.221	1	14
In relationship	19,437	1.156	0.363	1	2
<b>Education</b>					
No qualification	19,424	0.005	0.069	0	1
Lower secondary school	19,424	0.218	0.413	0	1
Intermediate secondary school	19,424	0.417	0.493	0	1
Vocational diploma	19,424	0.113	0.317	0	1
A-level	19,424	0.239	0.427	0	1
Other	19,424	0.008	0.087	0	1
<b>Training qualification</b>					
Apprenticeship	19,454	0.456	0.498	0	1
Vocational training	19,454	0.092	0.289	0	1
College of advanced vocational studies	19,454	0.206	0.404	0	1
University of applied science	19,454	0.099	0.299	0	1
University degree	19,454	0.113	0.317	0	1
Other	19,454	0.005	0.069	0	1
None	19,454	0.021	0.143	0	1
Bachelor	19,454	0.008	0.091	0	1
<b>Employment situation</b>					
Worker	19,464	0.370	0.483	0	1
Employee	19,464	0.630	0.483	0	1
Full-time employment	19,448	0.873	0.333	0	1
Part-time employment	19,448	0.127	0.333	0	1
Management position	19,446	0.292	0.455	0	1
<b>Functional area</b>					
Production	12,982	0.410	0.492	0	1
Sales, marketing	12,982	0.113	0.317	0	1
Administration	12,982	0.167	0.373	0	1
Services	12,982	0.310	0.462	0	1

**Notes:** This table shows summary statistics of employee characteristics. The statistics are from the full sample including all firm-employee-year observations.

**Table A14** *Summary statistics: employee survey – outcomes*

Variable	Observations (1)	Mean (2)	St. Dev. (3)	Min (4)	Max (5)
<b>Satisfaction</b>					
Job satisfaction	19,457	7.458	1.775	0	10
Income satisfaction	19,453	6.872	2.096	0	10
Turnover intention	19,441	1.594	0.920	1	5
Perceived job security	19,444	2.571	0.615	1	3
<b>Commitment</b>					
Stay rest of my life at firm	19,417	4.087	1.142	1	5
Emotionally attached to firm	19,390	3.786	1.214	1	5
Consider problems at work my own	19,435	2.856	1.301	1	5
Personal meaning	19,439	3.762	1.175	1	5
Part of the company family	19,370	3.782	1.204	1	5
Feel a sense of belonging to firm	19,405	3.880	1.181	1	5
<b>Fairness</b>					
Income	19,424	3.540	1.149	1	5
Decision procedures	19,268	3.406	0.995	1	5
Supervisor	19,408	3.924	0.952	1	5
<b>Work-life balance</b>					
Time pressure at work	19,451	3.579	1.214	1	5
Work interferes with private life	19,445	2.211	1.165	1	5
Work interferes with private responsibilities	19,450	2.270	1.201	1	5
Work strain interferes with private life	19,451	2.425	1.205	1	5
Put off doing things at work	19,445	1.621	0.833	1	5
Things at work don't get done	19,440	1.460	0.724	1	5
Private life interferes with work	19,453	1.600	0.927	1	5
<b>Corporate culture</b>					
Create meaning through work	7756	3.790	1.065	1	5
Supervisors show understanding	19,429	3.722	0.982	1	5
Supervisors offer good guidance	19,409	3.529	1.034	1	5
Supervisors show confidence	19,418	3.773	1.010	1	5
Good understanding of corporate culture	19,366	3.793	1.002	1	5
Long-term plans are clear	19,383	3.563	1.182	1	5

**Notes:** This table shows summary statistics of employee-level outcomes. The statistics are from the full sample including all firm-employee-year observations.

**Table A15** *Management effects: annual result*

	Dependent variable			
	Profit		Loss	
	(1)	(2)	(3)	(4)
Style 1 intensity	0.022** (2.710)		-0.016** (-3.080)	
PAS		0.054*** (5.780)		-0.029*** (-5.160)
Adj. R <sup>2</sup>	0.044	0.055	0.036	0.043
Observations	3,453	3,492	3,453	3,492

**Notes:** All specifications include employer controls and year-fixed effects. Style 1 intensity and PAS are both z-score standardized. The dependent variable in columns (1) and (2) is and indicator if a firm's annual results was positive, rather than neutral or negative. The dependent variable in columns (3) and (4) is and indicator if a firm's annual results was negative. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Table A16** *Management effects: digital technologies*

	Dependent variable					
	Distribution channels		Big Data		Internet of Things	
	(1)	(2)	(3)	(4)	(5)	(6)
Style 1 intensity	0.029* (2.000)		0.054*** (3.640)		0.054*** (3.610)	
PAS		0.087*** (5.910)		0.095*** (6.040)		0.065*** (4.260)
Adj. R <sup>2</sup>	0.039	0.082	0.074	0.104	0.076	0.083
Observations	730	730	719	719	720	720

**Notes:** All specifications include employer controls and year-fixed effects. Style 1 intensity and PAS are both z-score standardized. In columns (1) and (2) the dependent variable indicates usage of digital distribution channels. In columns (3) and (4) the dependent variable indicates usage of Big Data. In columns (5) and (7) the dependent variable indicates usage of the Internet of Things. All dependent variables are self-reported. Standard errors are clustered at the firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Table A17** Management effects: employee satisfaction

	Dependent variable					
	Turnover intention		Job satisfaction		Income satisfaction	
	(1)	(2)	(3)	(4)	(5)	(6)
Style 1 intensity	-0.040*		0.056***		0.056***	
	(-2.550)		(3.890)		(3.600)	
PAS		-0.080***		0.070***		0.118***
		(-4.950)		(4.660)		(6.480)
Adj. R <sup>2</sup>	0.098	0.101	0.037	0.037	0.134	0.141
Observations	11,472	11,472	11,475	11,475	11,475	11,475

**Notes:** All specifications include employer controls, employee controls and year-fixed effects. Style 1 intensity, PAS and dependent variables are all z-score standardized. Standard errors are clustered at the employee-firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%.

**Table A18** Management synergies: corporate culture

	Dependent variable: Supervisor qualities							
	Fairness		Understanding		Guidance		Confidence	
	(1)	(2)	(3)	(4)	(5)	(6)	(5)	(6)
Style 1 intensity	0.062***		0.066***		0.061***		0.044**	
	(4.790)		(5.160)		(4.200)		(3.270)	
PAS		0.080***		0.091***		0.088***		0.079***
		(5.800)		(6.680)		(5.850)		(5.410)
Adj. R <sup>2</sup>	0.019	0.020	0.027	0.029	0.039	0.041	0.027	0.029
Observations	11,451	11,451	11,463	11,463	11,457	11,457	11,461	11,461

**Notes:** All specifications include employer controls, employee controls and year-fixed effects. Style 1 intensity, PAS and dependent variables are all z-score standardized. Standard errors are clustered at the employee-firm level and reported in parentheses. \*\*\*, \*\*, \* indicate significance at 1%, 5% and 10%. The original statements are as follows and original agreement scales range from one (fully agree) to five (fully disagree): *Fairness*: My direct supervisor treats me fairly in all aspects of work. *Understanding*: Supervisors show understanding for employees. *Guidance*: Supervisors offer good guidance to employees. *Confidence*: Supervisors show confidence in employees.