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Abstract

We use the Japanese Management and Organizational Practices Survey (JP MOPS) across six industries to understand the unique and general features of Japanese management practices and their impact on productivity. This study uses management scores, constructed from survey questions about management practices, that intend to measure the quality of operational efficiency embedded in a set of management practices. Our analyses reveal several interesting and shared features of Japanese management practices. First, there is substantial variation in management scores across establishments in each industry. Second, management scores are positively associated with labor productivity in most industries. Third, the patterns of management practices and their association with potential drivers are quite similar across the six industries. Fourth, management scores are high when establishments recognize that they face many competitors. Finally, labor shares decline with management scores. This study shows important roles played by management practices in establishment and firm activities.

Keywords: Management Practices, Productivity
JEL Code: L2, M11, M2

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1. Introduction

The spirit of the Toyota Production System dates back to the days of Sakichi Toyoda, who invented Non-Stop Shuttle Change Toyoda Automatic Loom, Type G, in 1924. If cotton yarn broke during the weaving process, this device would automatically stop the loom to prevent it from producing defective fabric. The founder of Toyota Motor Corporation, Kiichiro Toyoda, developed new worker practices integrating the device to enable production to quickly resume, establishing what would become known as the Toyota Production System. Along with the just-in-time system, Toyota Production System is still highly praised for being one of the most efficient production management systems practiced today, while also demonstrating both broad applicability outside of the manufacturing industry where it originated (such as in retail and wholesale) and significant plant-level productivity improvements.[1]

The Toyota Production System intuitively illustrated the importance of management practices for establishment-level and firm-level performance. Despite its importance, it is only since the pioneering work by Bloom and Van Reenen (2007, 2010), using the data from a series of World Management Survey projects (hereafter, WMS), that economists have started to quantify the impacts of management practices on various aspects of firm performance, such as productivity, growth, and survival. A unique feature of their approach is to extract general characteristics of management practices and organizational roles from interviews of hundreds of firms and to gain useful insights that are impossible to obtain from individual case studies. The WMS has evolved into the Management and Organizational Practices Survey, systematizing survey questions about management and organization and enabling the implementation of a large-scale management survey. With the cooperation of the U.S. Census Bureau, the Management and Organizational Practices Survey (hereafter, the US MOPS) was launched in 2010 and revealed the general landscape of the relationship between management practices and productivity in the U.S. for the first time (Bloom et al., 2019).

In this paper, we take a similar approach and examine several issues related to the management practices of Japanese establishments and firms. We use data from the Japanese version of the Management Organizational Practices Surveys (*soshiki-manegimento-ni-kansuru-chosa*, hereafter the JP MOPS) across six industries (manufacturing, food and drink retail, wholesale, information technology service, road

[1] One famous example in retail industry was its application to the chain operation of supermarket by Daiei. Given the success of Japanese supermarket store chain Daiei, the just-in-time system was widespread into supermarkets during 1980s and convenience stores during 1990s.

freight transport, and medical industries). This paper is partly motivated by the fact that there are many case studies (e.g., Ohno, 1978) and structured interviews (e.g., Lee et al., 2016) about the management systems of selected Japanese firms. These studies showcase many fascinating stories but do not tell us whether these innovative management systems represent typical management practices adopted at Japanese firms or whether these cases are exceptional. In short, we know very little about how much the management practices in Japan vary across establishments/firms, where any variance originates, and how variation in management practice may be related to the variation in establishment- and firm-level outcomes.

The primary goals of this study are three-fold. One goal is to uncover general features of management practices adopted at Japanese establishments and to examine their impacts on establishment- and firm-level productivity. The series of JP MOPS data sets we use in this study contain over 20,000 observations with a sufficient number of observations in each industry to ensure a reasonable level of representativeness regarding Japanese management practices. To the best of our knowledge, there is no empirical study about Japanese establishments and firms that has utilized this level of representativeness. To conduct quantitative analysis, we construct management scores for each establishment or firm in the six industries and perform industry-by-industry analyses to gain insights into the fundamental roles of management practices at Japanese establishments or firms. Management scores are intended to measure the quality of an establishment's operational efficiency embodied in the set of management practices adopted. The second goal is to investigate influential factors that lead to variation in management practices across establishments in a given industry. In this investigation, we focus on examining how the adoption of management practices is related to different internal and external factors. We examine organizational type and culture as the primary internal factors and market competition as the primary external factor. Finally, we try to shed light on two fundamental issues in economics; labor shares (total wage payment divided by value-added) and establishment size, from a productivity-management link perspective. More specifically, we investigate how labor shares change with management scores to gain insights into whether productivity gains from structured management practices are returned to employees. We also try to empirically answer the question of whether establishments with structured management practices grow large or large establishments tend to adopt structured management practices.

Our main data come from a series of the JP MOPS administered by the Economic and Social Research Institute (hereafter, ESRI), Cabinet Office, Japan. The first wave was conducted in the sectors of manufacturing, food and drink retail, and information services between January and February of 2017, and the second wave targeted the wholesale, road freight transport, and medical sectors between October of 2018 and April of 2019. Both waves of the JP MOPS closely followed the protocol of the 2015 US MOPS. In particular, the JP MOPS contains 16 questions regarding management practices across the six Japanese industries, which are used to construct the "management scores" used in this study. These questions are identical to those asked in the 2015 US MOPS. In principle, these management scores are comparable across industries and countries, but, in practice, care is required to take industry and country-specific conditions into account. To conduct the productivity analysis, we link the JP MOPS with both establishment-level from government statistics and firm-level data from a Japanese corporate credit research company, Teikoku Databank. This link allows us to conduct comparison studies across the six industries in a comprehensive way and to deepen our understanding of the roles played by management practices in establishment and firm activities.

While most of our empirical analyses are descriptive in nature, they reveal several interesting and general features about Japanese management practices. First, there is substantial variation in management scores across establishments within each industry. For example, the JP MOPS data show that the top 25 percent of establishments in the manufacturing sector have a management score of at least 0.62, whereas the bottom 25 percent receive a score of less than 0.37. Since management scores are standardized from 0 to 1, a score of 0.62 can be interpreted as indicating that the management practices of those establishments reach the 60 percent level of the best management practices. Second, management scores are positively associated with labor productivity in most industries. Our estimate implies that a ten-point increase in the management score (i.e., a change in the adoption of the management practices towards the best ones by 10 percent) is associated with firm-level labor productivity in a range of 7.6 to 12.0 percent increase. These point estimates are also similar in magnitude to the 13.6 percent increase in labor productivity estimated from the 2010 US MOPS (Bloom et al., 2019). This relationship thus indicates that structured management is a potential driver for the productivity dispersion we observe. Third, management scores rise with our subjective measure of competition, but we do not observe that management scores are systematically associated with organizational culture. This result can be interpreted as indicating that establishments adopt structured management practices when they recognize an external factor such as a competitive environment and they are less responsive to internal factors such as organizational culture. Finally, labor shares decline with management scores. This observation implies that productivity gains from adopting structured management practices accrue disproportionally to the average pay increase (i.e., less to wage payment and more to markups). We also find suggestive evidence that both mechanisms mentioned above are at play in the relationship between structured management practices and establishment size.

This study contributes to several strands of the extant literature. First, this study uses representative data from JP MOPS to provide a comprehensive view of Japanese management practices and their impact on productivity. This study thus reinforces our knowledge about Japanese management practices from past case studies and structured interviews such as Lee et al. (2016), who followed the protocol of WMS and collected information on management practices from 573 Japanese firms and 350 Korean firms. It also allows us to grasp both the generality and idiosyncrasies of Japanese management practices by comparing them to those adopted in other countries such as the United States and the United Kingdom. Second, we extend existing research about management practices by exploiting the richness of our data—this study is not merely a Japan-focused replication of the seminal studies by Bloom and Van Reenen (2007) and Bloom et al. (2019). Specifically, we use two market competition measures in an attempt to separate competition effects on management practices from agglomeration effects. We also examine the relationship between management scores and organizational culture. Because these aspects have not been investigated thoroughly in past studies, such empirical examinations enrich our understanding of the determinants of adopting management practices.[2] Finally, we provide suggestive evidence about how management practices are related to fundamental variables of markets that have recently received attention in policy discussions: labor share and establishment size. Given that our methods are different from conventional approaches, it provides fresh insights about declining labor shares and the positive productivity-size correlation.

The paper is organized as follows. Section 2 describes the design and implementation of the JP MOPS and introduces the other data sources that are merged with the JP MOPS for our empirical analyses. We also explain how management scores are calculated from the JP MOPS data. In Section 3, we first present descriptive statistics from the JP MOPS to obtain an overall picture of similarities and differences in

[2] Bloom and Van Reenen (2007) use the number of potential competitors each firm recognizes in the manufacturing sector as a measure of competition, whereas Bloom et al. (2015) use the number of potential competitors in a geographical area in the health care industry. This study utilizes both measures and extend a sample coverage in terms of the number of industries and the number of observations in each industry to conduct empirical analysis.

management practices across the six industries. We then show our results examining the relationship between management practices and establishment-level and firm-level labor productivity in the six industries. We also explore sources of variation in management practices across establishments by focusing on the internal and external factors mentioned above. Finally, we investigate how management scores are related to labor shares and establishment size. Section 4 concludes.

2. Data

2.1 Japan MOPS

We use data from two waves of the JP MOPS, conducted by ESRI. The first wave was conducted between January and February of 2017, and survey respondents were instructed to answer most survey questions as of 2015.[3] The target industries for this initial wave were manufacturing, food and drink retail, and information technology services, and survey questionnaires were mailed to establishments with at least 30 workers.[4] The ESRI performed the second wave survey between October of 2018 and April of 2019, adopting a similar survey protocol. In this second wave, the wholesale, road freight transport, and medical industries were target industries, and its reference year was 2018.

Both waves of the JP MOPS closely followed the protocol of the 2015 US MOPS, which had been developed jointly by the U.S. Census Bureau and the research team of Bloom, Brynjolfsson, and Van Reenen (Bloom et al., 2013, and Buffington et al., 2016). The protocol for that survey was developed based on the WMS (Bloom and Van Reenen, 2007)[5] and has been adopted internationally by the MOPS of other countries and institutions such as the United Kingdom, Mexico, Pakistan, and the World Bank. While the U.S. MOPS targets only the manufacturing sector, the two waves of the JP MOPS

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[3] There are also recall questions about management practices in 2010.

[4] The establishments in the JP MOPS survey were sampled from the Business Register database. The number of employees include all types of workers including regular workers, part-time workers, and temporary workers dispatched to other firms. We use the number of regular workers from the Economic Census data when we measure labor productivity. One reason for the 30-emplyee cutoff is that detailed establishment data are only available in the Census of Manufacturers when an establishment employs 30 employees or more.

[5] The goal of the WMS project is to systematically collect data on the types of practices used at thousands of organisations, across industries, under different settings and over time, while maintaining comparability. (Scur et al., 2021, p.2)

include not only the manufacturing sector but also the non-manufacturing sectors, which is important for policy in Japan where the productivity in the on-manufacturing sectors are relatively low compared to the manufacturing sector[6]. Thus, the JP MOPS has information on management and organizational practices from six different industries.

The questions in the JP MOPS are based on those in the US MOPS. To ensure comparability with the US MOPS, both waves of the JP MOPS contain a total of 16 management practice questions and seven organization questions. There are mainly two different views towards "good" management practices. In the technology view of management practices, the core of "good" management practices remains unchanged no matter what business environment and technology a firm faces and these good management practices have positive impacts on firm performances. In the design view of management practices, a set of "good" management practices depends heavily on business environments and technologies so that there is no such thing as universally good management practices. Although the design view captures some important aspects of management practices, we take the position of the technology view in this study by following the existing research using WMS and US MOPS. Management practice questions ask how activity is monitored, how targets for production and other monitored performance indicators are set, and how achievement of those targets is incentivized[7], and these questions are interpreted appropriately in light of the technology view. Furthermore, the past studies show that such structured management practices are associated with higher productivity, profitability, innovation and survival rates, which renders support to the technology view. Organization questions examine the level of decision making, one of the establishments' characteristics that can affect the difference of "good" management practice.[8]

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[6] The targeted industries were selected from the industries emphasized for enhancing productivity in the non-manufacturing sector in the Japanese government measures such as "Growth Strategy."

[7] The five monitoring questions ask the correction and use of information to monitor production or service such as the number of key performance indicators monitored at the establishment. The three targets questions ask the nature of targets and their integration such as awareness of production/sales targets at the establishment. The eight incentive questions ask whether personnel practices, such as bonuses, promotion and dismissal practices, provide incentives to workers and managers.

[8] The questions ask the degree of autonomy in branches from their headquarters. The questions ask whether an establishment is a branch or not at first, and then the branch establishments answer the subsequent questions; whether decisions on employment, pay increases, new product introductions, product pricing, advertisements, and investments are made at the establishment, headquarters, or both. (The headquarter

In the survey of the non-manufacturing industries, the terminology of questionnaires was modified to account for each industry's actual environment.[9] In addition, the JP MOPS includes survey questions about competitors and organizational culture in the non-manufacturing sectors, which are relevant factors that can affect the variation of "good management practices" and were not asked in the MOPS of other countries. The JP MOPS, therefore, covers a broader range of information on management and organizational practices than the US MOPS. However, there is one caveat. Although the JP MOPS is an official government statistical survey, a survey response is not mandatory. Despite being voluntary, however, the response rate exceeds 30 percent in all the industries except information technology services, ranging from 26.7 to 35.6 percent. The maximum number of observations we can use for our empirical analyses is 11,405 in manufacturing, 1,273 in food and drink retail, 3,813 in wholesale, 936 in information technology service, 1,286 in road freight transport, and 1,650 in medical. To show how voluntary survey responses affect this self-selected sample, we provide statistics on key establishment-level variables for the JP MOPS sample and the Economic Census data separately in the Online Appendix (see Table A.1 in the online appendix for the comparisons of the JP MOPS samples and Economic Censuses).

We follow the methodology introduced by Bloom et al. (2019) to calculate management scores for each establishment. Survey respondents were instructed to select at least one answer for each multiple-choice management practice question, and this answer is evaluated on a scale of 0 to 1.[10] In principle, a more structured management practice gets a higher score and can be regarded as a "better management practice." (see Table B.1 for the details). For example, the management practice that promotes employees solely based on performance and ability gets 1, the highest score, whereas the management practice that does not normally promote employees at all gets 0. Intermediate scores are given to those that promote partly based on performance and ability or promote based on other factors such as seniority and family connection (the former scoring higher than the latter). The average management score is a simple average of scores from the 16 management practice questions. For some analysis in this paper, 16

establishments skip them.)

[9] For example, the questionnaire for manufacturing uses *Seisan* (Production); while in service sectors this is modified into *Uriage* (Sales).

[10] When multiple answers are possible, we averaged scores of these answers.

management practice questions are grouped into five management practices; monitoring, targeting, bonuses, promotion, and dismissal.[11]

We also construct a decentralization score from six organization questions. These survey questions apply to only branch establishments. Each question is evaluated from 0 to 1 and the score is a simple average from six questions. A higher decentralization score indicates that more decisions are made at a branch establishment than at the headquarters.

2.2 Other Data Sources

We link the JP MOPS data to both establishment-level and firm-level data to quantify the relationship between management scores and productivity as well as other potentially influential factors that could impact the adoption of management practices.

We use data from the Japanese Census of Manufacturers (*kogyo-tokei-chosa*) for the manufacturing sector and the Japanese Economic Census for Business Activities (*keizai-census*) for non-manufacturing sectors to construct establishment-level productivity measures. The Ministry of Economy, Industry and Trade administers the Japanese Census of Manufacturers and gathers information about establishments in the manufacturing sector on an annual basis. All establishments with four or more employees located in Japan are subject to the manufacturing census, but only establishments with at least 30 employees must provide more detailed information about their characteristics and assets. The Ministry of Internal Affairs and Communications and the Ministry of Economy, Industry and Trade were responsible for conducting the 2016 Economic Census for Business Activities to gather information on basic business activities in all industries in Japan. These two data sources provide us with information on establishment characteristics and allow us to examine critical factors for variation in productivity and management practice adoption. We also use these data to identify each establishment's geographical location and construct a competition measure that counts the number of potential competitors within a certain distance.

Limitations of these data include missing values and time-lag when we construct establishment-level labor productivity measures from the Economic Census, especially in the non-manufacturing sectors. To deal with these data limitations, we use the accounting and financial information at the firm-level from Teikoku Databank. Teikoku

[11] For example, in the JP MOPS questionnaire written for firms in the manufacturing industry, questions 1 to 5 correspond to monitoring, questions 6 to 8 to targeting, questions 9 to 12 to bonuses, questions 13 and 14 to promotion, and questions 15 and 16 to dismissal.

Databank is a public company that gathers a wide range of firm-level information and constructs databases for corporate credit reporting and business solution services. We conduct data matching through names, telephone numbers, and addresses of establishments and firms and aggregate the establishment-level JP MOPS data to firm-level data (weighting by relative employment size when a firm has multiple establishments in the JP MOPS). We were able to match the JP MOPS data for the manufacturing industry with the Teikoku Databank data for 88 percent of establishments surveyed.[12]

2.3 Limitations of Datasets Utilized

As described above, survey questions about management practices in the JP MOPS were crafted by translating the US MOPS into Japanese carefully, and the questions are almost identical across the six industries. Thus, in principle, management scores are comparable across industries and countries. However, we are cautious about conducting such comparisons because a structure of management practices is not free from industry-specific conditions, and because words and phrases used in the JP MOPS survey may be interpreted differently in different industrial contexts. Our basic stance in this paper is that within-industry comparisons are more appropriate and credible than industry-by-industry or country-by-country comparisons. We still see some benefits of making industry-by-industry comparisons to see similarities and differences in qualitative patterns and occasionally make such comparisons for this purpose, but we do not judge whether management practices are better in one industry than in another industry. For this reason, we mainly conduct separate regression analyses and present estimation results for each industry separately.

One advantage of the JP MOPS is the ease with which it is possible to link these survey results to other data sources, but this convenience comes with notable limitations. First, there is no time lag between the first wave of JP MOPS and the Economic Census,[13] but there is a three-year lag between the second wave of JP MOPS and the Economic Census. Although this study and other studies show that adopted management practices do not change significantly on these time scales, this lag can pose a potential problem for

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[12] The Teikoku Databank data cover about 1,470,000 firms, accounting for approximately 90 percent of sales in Japan. As a result, most establishments in the JP MOPS are linked with the Teikoku Databank but some establishments are excluded from the merged data set because they are not in the database of Teikoku Databank.

[13] The reference year is 2015 for flow variables such as sales.

our empirical analysis; e.g., larger measurement errors in explanatory variables. Our firm-level analysis on the productivity link is intended to alleviate this problem. Second, attrition and missing values in the merged data sets differ from industry to industry. Labor productivity, for example, can be measured for the majority of the observations in all the industries (77 percent to 96 percent) except the road freight transport industry (19.1 percent). Finally, the data from the Manufacturing Census are richer in scope and time than other Economic Censuses for the purposes of our empirical analyses. In particular, the number of employees, total factor productivity, and labor shares can be measured at several points in time from the Manufacturing Census only. For this reason, we can perform in-depth analyses about pertinent topics using the manufacturing sector as an exemplar.

3. Empirical Results

3.1 Summary Statistics

3.1.1 Management Score Distribution

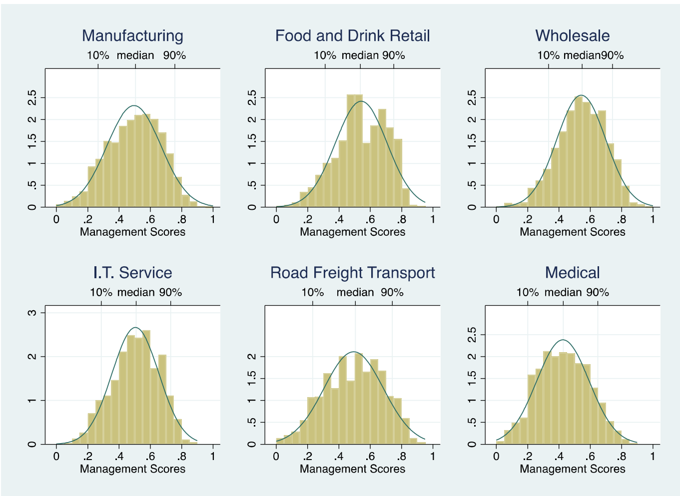
We begin our analysis by exploring similarities and differences in management practices across the six industries through their summary statistics. Table 1 reports summary statistics on the total management score (average score across 16 management practice questions) and scores of each of five management practice categories (Monitoring, Targeting, Bonuses, Promotion, and Dismissal). Mean management scores range from 0.425 (medical) to 0.542 (retail, wholesale), while median management scores vary from 0.423 (medical) to 0.548 (retail, wholesale). These numbers can be interpreted as indicating that a typical Japanese establishment adopts about 50 percent of structured management practices or "best" management practices. For the remainder of this paper, this terminology refers to those practices that are designed to enhance establishment performances through structured management practices (See also Section 3.3 for the link to establishment and firm productivity). The maximum cross-industry difference is about 0.12, which implies a twelve percent difference in the adoption rate of structured management practices between typical establishments in the highest scoring and the lowest-scoring industries.

Table 1 also shows that the 90^{th} to 10^{th} percentile difference in within-industry management scores varies from 0.408 (wholesale) to 0.508 (road freight transport). Table 1 clearly shows that within-industry variation in management scores is substantial for all industries studied; this variation is also visible in the distributions of management scores displayed in Figure 1. For example, the 0.508 difference could mean that, while an establishment at the 90^{th} percentile adopts 75 percent of structured management practices, an establishment at the 10th percentile adopts only 25 percent of structured management practices.

Table 1: Summary Statistics on Management Scores

Industry	Overall (Q1-Q16) Mean	Overall (Q1-Q16) Median	Overall (Q1-Q16) 90th-10th difference	Monitoring (Q1-Q5) Mean	Targeting (Q6-Q8) Mean	Bonuses (Q9 -Q12) Mean	Promotion (Q13-Q14) Mean	Dismissal (Q15-Q16) Mean	No. of observations
Manufacturing	0.495	0.505	0.446	0.442	0.563	0.466	0.776	0.232	11,040
Food & Drink Retail	0.542	0.536	0.439	0.451	0.617	0.500	0.827	0.385	1,211
Whole Sale	0.542	0.548	0.408	0.371	0.660	0.606	0.824	0.373	3,741
IT Service	0.505	0.509	0.407	0.398	0.634	0.514	0.815	0.186	898
Transportation	0.494	0.505	0.508	0.402	0.495	0.506	0.773	0.404	1,270
Medical	0.425	0.423	0.448	0.311	0.463	0.372	0.746	0.338	1,626

Figure 1: Distributions of Management Scores by Industry



The numbers above suggest that variation in management scores is much larger within industries than between industries. Such a large dispersion of management scores in a given industry is consistent with the findings in other studies (Bloom et al., 2019), but here we able to provide a more comprehensive view of this phenomena because JP-MOPS offers a rare opportunity for cross-industry comparisons.[14] Similar to the dispersion of management scores we documented above, it is also well known that

[14] The UK MOPS also covers several industries across production and service industries.

productivity dispersion is substantial even in a narrowly defined industry (Syverson, 2011). Given that management score dispersion closely follows productivity dispersion, this evidence suggests that management practices could play an important role in determining the level of productivity. We will investigate this issue in Section 3.2.

Table 1 is also useful for understanding the main objective features of Japanese management practices. Our data show that the scores of promotion practice are highest among the management practice categories across all industries studied, meaning that managers and non-managers are promoted based on performance and ability at the vast majority of establishments in our data. On the other hand, the monitoring and dismissal scores are relatively low among the management practices. Regarding monitoring, around half of the establishments in our data adopt the best practice of "kaizen" activities in which they not only detect problems but also improve production or service processes to prevent them from occurring again. However, key performance indicators are not used or monitored at many establishments (from 36 percent in the wholesale industry to 61 percent in the medical industry), contributing to the low score. The low scores for dismissal practices mean that under-performing employees are not easily reassigned or dismissed. For example, 72 percent of the manufacturing establishments in our data stated that they do not dismiss or reassign under-performing employees at all. This low score partly reflects explicit or implicit employment norms and contracts in Japan (Ono, 2010), is much lower than observed in U.S. data (0.23 in the Japanese manufacturing versus 0.62 in the U.S. manufacturing), and is consistent with the findings from other data sources (Kambayashi and Kato, 2017).

3.1.2 Management Score and Establishment Size

Table 2 reports the relationship between management scores and establishment size as measured by the number of employees.[15] We observe that the average management score increases with establishment size; this is consistent with studies from other countries such as the United States and United Kingdom (Bloom et al., 2019; Office for National Statistics, 2018). Note that the MOPS surveys are not designed, a priori, in such a way that management scores are computed in favor of large establishments. We additionally find that the 90th to 10th percentile difference decreases with size. For example, in the road freight transport industry, the 90th to 10th percentile difference is 0.493 in the 30 to 49 employees category and 0.208 in the 1000 employees or more category. That is, between these percentiles, while the adoption of structured management practices differs by about

[15] For this analysis, we use the number of employees recorded in the Japanese Business Register.

50 percent in the former size category, this difference narrows down to about 20 percent in the latter size category.

Table 2: Management Scores and Establishment Size

Panel A: Mean

Employees	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
30-49	0.434	0.453	0.517	0.452	0.436	0.368
50-99	0.488	0.539	0.545	0.496	0.501	0.372
100-249	0.543	0.600	0.576	0.537	0.528	0.441
250-499	0.600	0.551	0.620	0.563	0.573	0.502
500-999	0.640	0.571	0.635	0.626	0.710	0.531
1000 or more	0.665	0.663	0.704	0.645	0.731	0.572

Panel B: 90th to 10th Difference

Employees	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
30-49	0.454	0.502	0.411	0.428	0.493	0.425
50-99	0.431	0.407	0.395	0.394	0.512	0.418
100-249	0.396	0.336	0.382	0.334	0.455	0.420
250-499	0.367	0.396	0.319	0.326	0.479	0.399
500-999	0.344	0.297	0.273	0.302	0.327	0.359
1000 or more	0.314	NA	0.235	0.252	0.208	0.358

Table 2 suggests that establishment size significantly impacts the adoption of structured management practices, while the dispersion of management scores diminishes with size. However, the direction of causation is ambiguous - does a large establishment adopts structured management practices, or does an establishment that adopts many structured management practices grow in size? We introduce temporal information into our analysis to explore this ambiguity in more detail in Section 3.4.2 below.

3.2 Management Score and Labor Productivity

This section examines the relationship between management scores and productivity. Here, productivity is measured by labor productivity; value-added or sales divided by the number of employees.[16] This choice is mainly because our analysis involves non-

[16] We use value-added for establishment-level analysis in the manufacturing sector, and sales for establishment-level analysis in the other five sectors and firm-level analysis. This is mainly because of data

manufacturing sectors in which data and conceptual limitations do not allow us to measure total factor productivity accurately. As a robustness check, we present estimation results for the relationship between management scores and total factor productivity using only the data for the manufacturing industry. We examine this relationship at the establishment level as well as at the firm level due to the limitations on establishment-level productivity analysis described in Section 2.2. To aggregate establishment-level data on management scores into the firm-level data, we use the relative sizes of establishments within a given firm as weights and compute the weighted average to obtain firm-level management scores. The majority of establishments in our data are either a single business unit or the only establishment of a firm included in our data. Our preferred interpretation of the firm-level management scores is that they represent the typical management practices adopted by a firm.

We report estimation results for the relationship between management scores and labor productivity in Table 3. The dependent variable is the logarithm of labor productivity for both the establishment- and firm-level analyses. Due to data constraints, this measure of labor productivity does not account for employees' individual characteristics such as hours worked, tenure, or educational attainments. Independent variables include the number of employees, fixed capital, and prefectural-level location dummies at the firm-level analysis. Establishment age, sub-industry, and establishment type dummies are added as independent variables to the establishment-level analysis.

We first look at the firm-level analysis. According to our estimation results in Table 3, the coefficient on management score is positive and statistically significant at the one percent significance level in all the industries except the medical industry. In the manufacturing sector, our estimates indicate that an increase in management score by 0.1 points is associated with an increase in labor productivity of about 8 percent. Recall that the 90^{th} to 10^{th} percentile difference is 0.446 in the manufacturing sector (See Table 1); this difference in management scores can be translated into a 36 percent difference in labor productivity when the number of employees, capital, and location are controlled for. A similar calculation can be made using the management score difference of 0.231 between the 30 to 49 employees category and the 1000 employees or more category. This

availability. The economic census collects information on items such as costs of sales, wage payments and so forth, but these items are missing values for many establishments in the data. Half of our observations are lost when we calculate a value-added for all the industries except the manufacturing industry. Empirical results remain qualitatively the same; for example, when we use sales for the manufacturing sector.

difference is associated with an increase in labor productivity by about 18 percent, based on the estimates in Table 3.

Table 3: The Relationship Between Labor Productivity and Management Scores

Panel A: Firm-Level Labor Productivity Regressions

	DV: Labor productivity (ln(sales/# employees)) at the firm level					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Management score	0.769 ***	0.616 ***	0.554 ***	1.125 ***	0.661 ***	0.088
	(0.046)	(0.212)	(0.114)	(0.172)	(0.127)	(0.103)
No. of observations	8,836	403	2,795	716	787	1,066
R_squared	0.304	0.321	0.158	0.161	0.153	0.214
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Share of 90-10 spread explained	18.0%	14.0%	10.0%	28.4%	23.2%	N.A.

Notes: (i) JP MOPS and TDB database are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%. (v) Controls include the number of employees, capital fund, location and subindustry dummies. (vi) The share of 90-10 spread explained is a 90-10 spread of management scores times the coefficient on management scores divided by a 90-10 spread of labor productivity.

Panel B: Establishment-Level Labor Productivity Regressions

	DV: Labor productivity (ln(sales/# employees)) at the establishment level					
	Manufacturing(‡)	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Management score	0.625 ***	-0.081	0.924 ***	0.790 ***	0.241	0.155
	(0.049)	(0.167)	(0.161)	(0.251)	(0.221)	(0.098)
No. of observations	9,376	937	3,354	784	242	1,563
R_squared	0.200	0.225	0.186	0.195	0.281	0.135
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Share of 90-10 spread explained	13.7%	NA	13.0%	17.8%	NA	NA

Notes: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%. (v) Controls include the number of employees, fixed capital, age, establishment types, location and subindustry dummies. (vi) The share of 90-10 spread explained is a 90-10 spread of management scores times the coefficient on management scores divided by a 90-10 spread of labor productivity. (vii) Value-added are used for the manufacturing industry(‡).

We can also see the magnitude of the effect of management scores on labor productivity by looking at the share of the observed 90^{th}-10^{th} decile spread in labor productivity can be explained by the 90th-10th spread in management scores (Bloom et al., 2019). The shares range from 10 percent (wholesale) to 28 percent (I.T. Services), and they are likely to understate true shares because of the possibility of measurement errors. Thus, the impact of structured management practices on labor productivity is substantial economically.

Turning to the establishment-level analysis, we observe that management scores are positively associated with establishment-level labor productivity in the manufacturing, wholesale, I.T. service, and medical industries. Again, the economic impact of structured management on labor productivity at the establishment level is similar to the impact observed at the firm level and is substantial in these industries.[17] We do not observe this positive association between labor productivity and management scores for the food and drink retail and road freight transport industries. Regarding the road freight transport industry, the high standard error and many missing observations lead us to suspect that this result is largely due to the missing data. Given that the insufficiency of observations does not seem critical, the results for the food and drink retail and medical industries may indicate that industry-specific factors weaken the productivity-management link. However, we are not able to provide evidence for this assertion using our data.

To probe the management and productivity link further, Table 4 reports the empirical results from panel estimations using the manufacturing part of the JP MOPS alongside the Census of Manufactures. To construct the panel data, we utilize recall questions about management practices that an establishment adopted in 2010 (as recorded in the JP MOPS data) and combine them with the information about establishment characteristics in the 2010 and 2015 Censuses of Manufactures.[18] Our estimation using labor productivity as the dependent variable shows that the coefficient on management scores from the fixed-effect model is 0.467 and statistically significant at the one percent level. The magnitude of this coefficient is about 28 percent lower than that estimated from the random effect model, but it remains economically significant with respect to

[17] In the transport industry, the coefficient on management scores is positive but not statistically significant at the conventional significance levels due to a large standard error. We suspect that one of the reasons is a substantial loss of observations in this estimation, due to missing values of sales information in the economic census.

[18] Such panel estimations at the establishment level are not feasible for other industries because the timing of economic censuses do not allow us to construct panel data for estimations. In addition, about one-third of establishments in the 2012 Economic Census did not report revenues in the retail and wholesale sectors whereas only 9.2 percent of them did not so in the 2016 Economic Census.

productivity. For example, the panel estimation indicates an increase in management score by 0.1 points is associated with an increase in labor productivity of about 6 percent.

Table 4: The Relationship between Labor Productivity and Management Scores (Panel Estimation)

	DV: Labor productivity (ln(value-added/# employees)) at establishment level					
	Pooled OLS		Random Effect		Fixed Effect	
Management score	0.661	***	0.639	***	0.467	***
	(0.036)		(0.040)		(0.084)	
No. of observations	16,312		16,312		16,312	
R_squared	0.267		0.267		0.186	
Other controls are included	Yes		Yes		Yes	

Notes: (i) JP MOPS and Manufacturing Census data are used. (ii) Coefficients are estimated by Pooled OLS, Random-Effect and Fixed-Effect Models. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%. (v) Controls include the number of employees, fixed capital, age for the fixed-effect model estimation. Establishment types, location and subindustry dummies are added to the pooled and random-effect model estimations.

We also utilize the manufacturing data to conduct robustness checks using total factor productivity and noise-control variables.[19] Labor productivity is a widely used measure of productivity, but it does not account for productivity contributions from physical capital. This fact may distort the productivity and management link we observed above, depending on how structured management practices affect the substitution between labor and capital. One may also be concerned that management scores do not reflect the reality of management practices at establishments because survey respondents answered survey questions inaccurately. To address this issue, a noise control variable is included in our productivity estimation equation. To gauge the extent of possible reporting errors, we utilize the same survey question in two separate surveys. More specifically, the noise control variable is constructed by the percentage difference in a report on the actual value of 2016 shipments of goods between the MOPS survey and the Census of Manufactures.

Our estimation results from the TFP regression without the noise control are reported in Column (I) of Table 5. The coefficient on management score is positive and statistically significant at the one percent level. It is also economically important and

[19] We follow the procedure of Fukao et al. (2006) to compute capital stock. Labor hours are adjusted based on cells of industry and worker type. TFP is calculated as the residual from an ordinary least squares regression with controls for labor and capital, as well as industry dummies.

consistent with the US MOPS results (Bloom et al., 2019). Thus, we still see the link between productivity and management scores when productivity is measured by total factor productivity.

Table 5: The Relationship between Total Factor Productivity and Management Scores

	DV: TFP				DV: Labor productivity	
	(I)		(II)		(III)	
Management score	0.176	***	0.184	***	0.599	***
	(0.035)		(0.038)		(0.053)	
Noise control			-0.105	***	-0.176	***
			(0.018)		(0.028)	
No. of observations	8,212		6,967		7,775	
R_squared	0.08		0.0917		0.254	
Other controls	Yes		Yes		Yes	

Notes: (i) JP MOPS and Manufacturing Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%. (v) Controls include the number of employees, fixed capital, age, establishment types, location and subindustry dummies.

The noise control is added to our baseline estimation equations in Columns (II) and (III) of Table 5. We find that management scores are positively associated with TFP and labor productivity in each specification, respectively. The magnitudes remain similar, regardless of whether or not we include the noise control. It is also interesting to note that the sign of the noise control is negative. This result implies that the level of productivity tends to be lower for establishments that reported values of shipments inaccurately. In sum, our results are robust to possible reporting errors.

Notably, management scores are positively associated with labor productivity in most industries of our data. Furthermore, the panel estimation using within-variation of manufacturing establishments also points to this management-productivity link. Although we should be cautious about interpreting our results above as a causal effect, these findings suggest that management practices substantially impact labor productivity. The evidence for a causal relationship between management scores and productivity observed in other studies (Bloom et al., 2013, Bloom et al., 2018; Giorcelli, 2019) gives partial credibility to this inference, but this aspect demands further investigation.

3.3 Management Scores, Internal Factors, and External Factors

The previous subsection presents evidence that management scores are positively associated with labor productivity. In this section, we investigate influential factors for variation in management scores to provide insight into productivity improvement from the lens of structured management.

3.3.1 Internal Factors

The adoption of management practices can be influenced by internal factors rooted in establishment characteristics. To examine this, we utilize establishment-level data regarding establishment type, its degree of decentralization, and its organizational culture with regard to specialization and creativity. In the regression analysis below, the units of analysis are establishments, the dependent variable is the total management score, and the set of control variables includes establishment size, location, and sub-industry categories.

Panel A of Table 6 reports estimation results for the relationship between management scores and establishment types. Establishments can be classified as a single business unit, a branch of a company with multiple establishments, or the headquarters of a company with multiple establishments. The base category in the regression analysis is a single business unit, and coefficients on the branch and headquarter types are estimated relative to the base category.

There are two noteworthy patterns in the regression results from the six industries. First, a single business unit's management scores are generally lower than those for multi-establishment firms after controlling for establishment size. For example, in the food and drink retail industry, the coefficients on the 'branch' and 'headquarters' establishment types are 0.19 and 0.11, respectively. These estimates indicate that these establishments adopt more structured management practices by, on average, 19 percent and 11 percent relative to a single business unit establishment type. Second, it is not generally the case that the coefficient on the headquarters type exceeds the coefficient on the branch type. For example, this is not true for the manufacturing, food and drink retail, or I.T. service industries. We suggest that, in these industries, while a branch-type establishment can focus on operational efficiency and devote its attention and resources to it, a headquarter-type establishment possesses headquarters functions. This organizational division may divert headquarters' attention and resources away from operational efficiency, resulting in lower management scores.

Panel B of Table 6 presents the relationship between management scores and decentralization scores. As mentioned in Section 2.1, decentralization scores capture a degree of decentralization, where a higher decentralization score indicates that more decisions are made at an establishment rather than at its headquarters. Note that we examine a subsample of our data in this analysis wherein establishments are only included if they are a branch of a company with multiple establishments.

Our results show that decentralization scores are negatively associated with management scores (although this relationship is weak relative to that for establishment

Table 6: The Relationship Between Management Scores and Internal Factors

Panel A: Organizational Types

	DV: Management Scores											
	Manufacturing		Food & Drink Retail		Wholesale		I.T. Service		Transportation		Medical	
Multiple establishments & branch	0.080	***	0.190	***	0.046	***	0.118	***	0.061	***	0.049	***
	(0.004)		(0.019)		(0.008)		(0.012)		(0.016)		(0.010)	
Multiple establishments & headquarters	0.033	***	0.107	***	0.103	***	0.060	***	0.164	***	0.069	***
	(0.004)		(0.022)		(0.008)		(0.012)		(0.014)		(0.010)	
No. of observations	11,036		1,208		3,731		898		1262		1620	
R_squared	0.1456		0.2493		0.1796		0.2148		0.2408		0.1714	

Panel B: Decentralization Scores

	Manufacturing		Food & Drink Retail		Wholesale		I.T. Service		Transportation		Medical	
Decentralization score	-0.038	***	-0.139	***	-0.047	***	-0.030		-0.142	***	-0.056	***
	(0.011)		(0.032)		(0.011)		(0.049)		(0.022)		(0.018)	
No. of observations	4,382		774		2,263		267		933		860	
R_squared	0.15231		0.1902		0.1453		0.13182		0.1675		0.1664	

Panel C: Organizational Culture

	Manufacturing	Food & Drink Retail		Wholesale		I.T. Service		Transportation		Medical	
Specialization score: low	NA	0.029	**	-0.001		-0.010		0.004		0.006	
		(0.012)		(0.007)		(0.019)		(0.015)		(0.013)	
Specialization score: high	NA	0.073	***	0.001		-0.024	*	0.028		-0.004	
		(0.020)		(0.008)		(0.013)		(0.019)		(0.013)	
Creativity score : low	N.A.	-0.028	**	-0.033	***	-0.003		-0.039	***	-0.021	**
		(0.011)		(0.007)		(0.016)		(0.013)		(0.001)	
Creativity score: high	NA	-0.062	**	0.008		0.015		0.012		0.001	
		(0.020)		(0.008)		(0.015)		(0.021)		(0.017)	
No. of observations	NA	1,127		3,517		867		1,156		1,457	
R_squared	NA	0.1853		0.1435		0.1245		0.1375		0.1503	

Notes: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10%, **<5%, ***<1%. (v) Controls include the number of employees, location and subindustry dummies.

types). That is, establishments tend to adopt more structured management practices when various business decisions are centralized at their headquarters rather than made at their establishments.

We further investigate the relationship between each of the five management practices and decentralization scores, because a degree of decentralization may affect the adoption of different management practices differently. Our estimates show that while this relationship is ambiguous in some cases, most practices exhibit a negative relationship with decentralization in most industries (See Table C1 in the Online Appendix). This generally negative relationship between management scores and decentralization scores stands in sharp contrast to the results found for other countries such as the United States and Pakistan (Bloom et al., 2019 and Lemos et al., 2016), and is perhaps a unique feature of the management practices adopted in Japan.

Panel C of Table 6 provides the results for the relationship between management scores and organizational culture. We measure organizational culture in two dimensions by using JP MOPS survey questions. One variable concerns specialization in individual tasks by measuring the importance of specialized knowledge and skills, relative to the importance of coordination across individual tasks. In other words, this variable captures the relative importance of specialized and general knowledge or skills within each establishment. The other variable concerns creativity and measures the importance of individual initiative and imagination in tasks, relative to the importance of standardized approaches. Although such dichotomies may be inappropriate for some purposes, our intention here is to capture individuals' flexibility in performing tasks. Since these survey questions are not available for the manufacturing sector, they are excluded from this analysis. Based on 9-point ordinal scale survey answers, we split this information into low (lowest 3-point), middle (middle 3-point), and high (highest 3-point) categories, where the middle category is used as the base category in the regression.

Our estimation results appear to suggest that these factors are generally not crucial for variation in management scores. Regarding specialization, the coefficients on specialization categories are not statistically significant at the conventional significance levels in four industries, but are positive and statistically significant at the one percent significance level in the food and drink retail industry. Even in the food and drink retail industry, the coefficients on the low and high categories are not statistically different, implying that specialization does not affect management scores monotonically. The coefficients for the low creativity category are negative in four industries, and the high-creativity category is statistically different from zero only in the food and drink retail industry. Two takeaways from this analysis are that establishments do not obtain high management scores by pursuing standardization of tasks. They may, in fact, benefit from an organizational culture that leaves room for exercising individual initiative and creativity (although this relationship is a weak one). However, further deviation from a balanced culture toward a creativity-oriented culture does not appear to impact management scores, on average (See Table C2 in the Online Appendix for results for each management practice). This inference is made based on the assumption that firm culture affects the adoption of structured management practices. Still, the influence may run in the opposite direction, from management practices to organizational culture.

3.3.2 External Factors

Market competition is an external factor to establishments and firms, and may have non-negligible impacts on the adoption of structured management practices. Given that productivity is positively associated with management scores, competitive pressure may lead establishments to adopt more structured management practices for their survival and profitability. Here, we focus on the effects of competition to analyze this potential source of variation in the adoption of management practices.

For this purpose, we measure the degree of market competition with two different pieces of information. The first competition measure comes from a survey question about market competition in the JP MOPS that directly asks establishments how many firms they are aware of as direct competitors. The survey respondents chose one of the multiple choices that best described the degree of competition it faces.[20] This measure thus captures establishments' recognition of competitive pressure. We do not calculate this measure for the manufacturing sector because of a lack of information, and so the manufacturing sector is excluded from this analysis. We then attempt to construct an objective measure of competition because the first measure is based on establishments' subjective judgment. This second measure counts the number of establishments in the same industry (four-digit, 3.5 *syo-bunrui*) within 10 kilometers of the establishment in question.[21] The rationale behind this measure is that the simultaneity of service provision

[20] The multiple choices are (i) No competitors, (ii) one to two competitors, (iii) three to five competitors, (iv) six to ten competitors, and (v) more than ten competitors.

[21] The estimation results remain qualitatively the same when we use other cutoff numbers such as 2, 5, and

and consumption in the service sector leads to competition taking place in a geographically restricted area. As such, this measure intends to capture potential competitors in a specific geographical area. Given the nature of this competition measure, we expect that this measure reflects the competition effects (if any) that are relevant to the non-manufacturing industries; however, it is mostly irrelevant to competition in the manufacturing sector. That is, if an estimated coefficient on this variable is positive for the manufacturing sector, it is an indication that this measure is serving as a proxy variable for agglomeration effects induced by, for example, learning and spillover effects from neighbors (rather than from the geography of service provision and consumption).

Estimation results for the effects of competition on management scores are reported in Table 7. To account for demand-side conditions, we include population, population growth, and population density at the municipality level in our regression analyses, along with establishment characteristics. The estimation results in Panel A of Table 7 show that the coefficient on the 'more than ten direct competitors' category is positive and statistically significant at the conventional significance levels across five industries, with magnitudes varying from 0.02 (wholesale) to 0.09 (medical). That is, management scores are 0.02–0.09 higher in cases where establishments recognize more than ten competitors, relative to the absence of direct competitors. Based on our estimates and data, this effect can be translated into about a 1.3 to 2.2 percent increase in labor productivity. Our results indicate that competition effects are strongly pronounced in wholesale, road freight transport, and medical industries, whereas they are weak in food and drink retail and information technology services.

Panels B of Table 7 report estimation results from regressions using the geographical-distance measure of competition. When counting the number of potential competitors within the radius of 10 kilometers, we also distinguish them by size. While all potential competitors are counted to construct this competition measure in the upper part of Panel B, only large competitors whose size is larger than the upper quartile in a given subindustry are counted, and competitive fringe is ignored in the lower part of Panel B. First, our results show that the coefficient on this measure is not statistically significant at the conventional significance levels for the manufacturing sector. Second, in contrast to our first measure of competition, the effect of geographically-defined competition on management scores is mixed in the service industries. This measure is positively associated with management scores for the information technology service and medical industries but negatively associated for the food and drink retail industry. Finally, the

20 kilometers.

estimated magnitude of this effect on management scores is almost negligible practically, even though this relationship is statistically significant. As an illustration, our estimation for the information technology service industry indicates that 100,000 potential competitors within 10 kilometers are needed to raise management scores by 0.5, while its median number is 621 in our data.

Table 7: The Relationship Between Management Scores and External Factors

Panel A: Recognition of Competitors

	DV: Management Score					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
one to two competitors	NA	-0.020 (0.022)	<0.0001 (0.012)	0.015 (0.015)	0.014 (0.017)	0.045 *** (0.016)
three to five competitors	NA	0.003 (0.019)	0.011 (0.008)	0.017 (0.014)	0.072 *** (0.014)	0.072 *** (0.014)
six to ten competitors	NA	-0.028 (0.0239)	0.023 *** (0.009)	0.021 (0.019)	0.106 *** (0.016)	0.077 *** (0.015)
more than ten competitors	NA	0.043 * (0.022)	0.020 *** (0.007)	0.026 ** (0.012)	0.060 *** (0.014)	0.088 *** (0.014)
No. of observations	NA	1,173	3,640	875	1,240	1,566
R_squared	NA	0.1838	0.1492	0.1438	0.1856	0.1683

Notes: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10%, **<5%, ***<1%. (v) Controls include the number of employees, location, subindustry dummies, population, population growth, and population density at the municipal level.

Panel B: Potential Competitors in a Geographical Area

	DV: Management Scores					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
No. of competitors within 10km	-0.00002 (0.00002)	-0.00001 * (0.00001)	-0.000002 (0.000004)	0.000006 ** (0.000003)	-0.00003 (0.00002)	0.00001 (0.00001)
No. of observations	8,935	1,130	3,728	826	1,264	1,624
R_squared	0.1363	0.1655	0.1455	0.1658	0.1575	0.1385
No. of *large* competitors within 10km	-0.0001 (0.0002)	-0.00008 (0.00005)	-0.00002 (0.00002)	0.000034 ** (0.000017)	-0.00025 (0.00018)	0.0001 * (0.0001)
No. of observations	8,935	1,130	3,728	826	1,264	1,624

R_squared	0.1362	0.1648	0.1458	0.1658	0.1574	0.1388

Notes: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10%, **<5%, ***<1%. (v) Controls include the number of employees, location and subindustry dummies. (vi) Large competitors are competitors whose size is larger than the upper quartile in a given sub industry.

The estimation results from the second competition measure do not provide clear-cut evidence about the relationship between the adoption of management practices and competition. However, a couple of useful inferences can be made by taking advantage of the nature of our competition measures under certain assumptions. First, our estimation results point to the importance of the awareness of competitors in the relationship with the adoption of management practices, rather than the actual presence of potential competitors (under the assumption that the geographical-distance measure of competition reflects the real competitive environment). Second, our results indicate that learning or spillover from neighboring establishments and selection are unlikely to play a prominent role in the adoption of structured management practices, under the assumption that the geographical-distance measure of competition captures learning/spillover opportunities from agglomeration, especially for the manufacturing industry. Finally, this second inference provides good support for the assertion that our first measure of competition mainly captures competitive pressure, rather than agglomeration effects. In sum, the competition effect on the adoption of management practices may only be present when establishments recognize that they are in competition with many others.

3.4 Insights from Productivity-Management Link

In this section, we take advantage of the richness of our data for the manufacturing industry to offer fresh insights to two hotly debated issues, declining labor shares and the positive relationship between productivity and size, from the perspective of the productivity-management link. Autor et al. (2020) provide firm- and establishment-level evidence about the recent decline in the labor share. Based on their empirical analysis, they infer that superstar firms are the leading cause of the recent decline in the labor share. Since the labor share is inversely related to markups (De Loecker et al., 2020), this also concerns a broad range of issues regarding market concentration and its economic welfare implications.

Several studies have documented a positive correlation between productivity and firm or establishment size. For example, Berlingieri et al. (2018) use the OECD MultiProd dataset that contains firm-level data in both the manufacturing and non-manufacturing sectors from 22 countries to investigate this relationship. Their study shows a strong positive correlation between productivity and size in the manufacturing sector and a weak positive correlation in the non-financial market sector.[22] Despite sustained interest from academia and policymakers, a consensus has not yet been reached regarding the direction of causality of this positive correlation. Interestingly, Autor et al. (2020) document that the labor share declines with firm size, suggesting a close connection between these two issues. Here, we provide evidence that considers these issues from a somewhat different perspective to prior work, which makes direct comparison difficult but may bring this line of research closer to a definitive conclusion.

3.4.1 Management Scores and Labor Share

The empirical results in Section 3.2 provide suggestive evidence that structured management raises labor productivity. However, it is not clear, a priori, whether an increase in labor productivity through this channel contributes proportionally to wage payments. A simple decomposition of our measure of labor productivity shows that

$$ln\left(\frac{value-added}{Number\ of\ employees}\right) = ln\left(\frac{value-added}{wage\ payments}\cdot\frac{wage\ payments}{Number\ of\ employees}\right)$$
$$= ln\left(\frac{average\ wage}{labor\ share}\right).$$

Therefore, we can infer that an increase in labor productivity would likely accompany a proportional rise in the average wage when the labor share remains constant with management scores. However, an increase in labor productivity is translated into a less than proportional rise, or perhaps even a drop, in the average wage when the labor share declines with management scores.

To gain insight on this issue, we investigate the relationship between management scores and a labor share. Table 8 reports estimation results from level and difference regressions using the logarithm of a labor share as the dependent variable and management scores as the main independent variable. Figure 2 displays binned scatter plots of these two variables (Cattaneo et al., 2019).

Three noteworthy patterns emerge about the relationship between management scores and labor shares. First, labor shares are negatively correlated with total

[22] Their empirical analysis is restricted to the manufacturing sector and non-financial service sector from 17 countries including Japan. Oku et al. (2019) conduct similar research using the Japanese data *hojin-kigyo-tokei*.

management scores. This result holds true in both level and difference regressions. Second, this relationship is weaker in the difference regression than in the level regression. While the coefficient on total management scores is estimated to be -0.462 in the level estimation, it is -0.132 in the difference regression. This discrepancy indicates that

Table 8: The Relationship between Labor Shares and Management Scores

	DV: Logarithm of labor share in 2015			
	Total	Monitoring & Targeting	Bonus & Promotion	Dismissal
Management score in 2015	-0.462 ***	-0.155 ***	-0.124 ***	-0.005
	(0.041)	(0.016)	(0.018)	(0.020)
No. of observations	7,503	7,501	6,577	7,471

	DV: Difference in logarithm of labor shares between 2010 and 2015			
	Total	Monitoring & Targeting	Bonus & Promotion	Dismissal
Management score difference between 2010 and 2015	-0.132 *	-0.023	-0.094 ***	0.006
	(0.072)	(0.027)	(0.031)	(0.039)
No. of observations	6,705	6,698	5,746	6,675

Notes: (i) JP MOPS and manufacturing Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10%, **<5%, ***<1%. (v) Controls include the number of employees, location and subindustry dummies.

Figure 2: Labor Shares and Management Scores

between-establishment variation explains a larger part of the relationship between management scores and labor shares than within-establishment variation. However, this result can be attributed partially to only small variations in management scores between 2010 and 2015. Finally, when turning our attention to each component of the management scores individually, we find that dismissal scores are not correlated with labor shares. In other words, a management practice of dismissing or relocating underperforming managers/employees is not linked to establishment behaviors that set the ratio of total wage payments to value-added at a low level.

A back-of-the-envelope calculation implies that most of the productivity gains from structured management are not returned to employees. The coefficient on management scores from the cross-sectional productivity regression is 0.63, and the coefficient on management scores from the cross-sectional labor share regression is -0.46. These numbers indicate that about one-third of the productivity gains go to employees in the form of an average wage increase. The same exercise for the panel estimations demonstrates that two-thirds of the productivity gains go to an increase in the average wage.

In sum, our finding suggests that labor share declines with management scores and that productivity gains from structured management do not contribute proportionally to wage rises. The model by Autor et al. (2020) offers a possible explanation for this finding. More structured management allows firms to produce on a large scale more efficiently and lower their share of "fixed" labor costs in value-added, resulting in a concomitant lowering of total labor share. This logic would indicate that management plays a role similar to that of Information and Communication Technology. This explanation is also consistent with the findings that management scores increase with establishment size and that between-establishment variation in management scores can explain a large portion of labor share decline.

3.4.2 Management Score and Establishment Size

We observed a positive relationship between management scores and establishment size in Section 3.1.2 as well as a positive relationship between productivity and management scores in Section 3.2. Given that structured management practices improve productivity, it is worthwhile investigating the direction of causality in the positive relationship between management scores and size. Do establishments with more structured management practices grow large? Or, do large establishments adopt more structured management practices? This question is difficult to answer empirically based on the data available for us, but we attempt to provide suggestive evidence about it by taking advantage of the longitudinal aspect of our data.

To examine the first question above, we select establishments with a size of fewer than 50 employees in 2010 and divide them into three groups based on the upper and lower quartiles of management scores in 2010. We then compute an establishment-size growth rate between 2010 and 2015 for each establishment and compare the growth rates of the lower quartile group with those of the upper quartile group. We would expect to see that the growth rates of the upper quartile group are higher than those of the lower quartile group if more structured management facilitates growth.

Table 9: Growth Rates of Establishment Size – Upper vs. Lower Quartiles of Management Scores

	DV: Growth rate of establishment size		
	I	II	III
Above upper quartile	0.042	0.058	0.100 **
	(0.043)	(0.044)	(0.040)
No. of observations	1,581	1,581	1,581
R_squared	0.001	0.073	0.20
Size in 2010 included	No	No	Yes
Location and Industry dummies included	No	Yes	Yes

Notes: (i) JP MOPS and manufacturing Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients;**<5%.

Table 9 reports estimation results from this regression. The coefficient on the upper quartile group is positive in all the specifications, and it is statistically significant at the 5 percent significance level when establishment size is included in the estimation (Specification III). Although we do not have strong evidence, the estimation results in Table 9 appear to suggest that more structured management plays a role in spurring establishment growth.

We next investigate whether larger establishments tend to adopt more structured management since the two mechanisms are not mutually exclusive. To this end, we exploit size category changes of establishments between 2014 and 2015. It is reasonable to assume that management structure does not adjust instantaneously such that management scores in 2015 contain information about management structure in 2014. We utilize this assumption to answer the second question. More specifically, those establishments that move down (up) a size category from 2014 to 2015 would have higher (lower) management scores than those establishments that stay in the same size category if larger establishments tend to adopt more structured management practices. This is because management scores for the former group partially reflect a larger size category they belonged to a year ago.

Table 10 lends partial support to this hypothesis. In this regression analysis, we use management scores as the dependent variable and a dummy variable that indicates whether an establishment belonged to a size category in 2014 larger (smaller) than its 2015 size category as the main independent variable. The coefficient on the larger size category in 2014 is positive and statistically significant at the 1 percent or the 5 percent in all specifications. This result indicates that establishments belonging to a given category in 2015 but to the larger categories in 2014 have higher management scores. The coefficient on the smaller size category in 2014 is negative in all the specifications, but it is statistically significant at the conventional significance levels only in (II). Note that the sign of these coefficients would be opposite if the size change is solely driven by more structured management, as the first question implies. Thus, our estimation results indicate that the size difference in 2014 still carries certain impacts over to management scores, especially when they were in the larger size categories.

Table 10: Management Scores and Changes in Size Category

	DV: Management scores			
	I. less than 50	II. 50 to 99	III. 100 to 199	IV. 200 to 299
Laeger size category in 2014	0.027 ***	0.044 ***	0.055 ***	0.044 **
	(0.010)	(0.011)	(0.012)	(0.020)
Smaller size category in 2014		-0.022 **	-0.019	-0.004
		(0.010)	(0.012)	(0.016)
No. of observations	2,958	2,701	1,918	621
R_squared	0.06	0.07	0.07	0.16

Notes: (i) JP MOPS and manufacturing Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients;**<5% and ***<1%. (v) Controls include location and subindustry dummies.

Overall, the results in Tables 9 and 10 indicate that both mechanisms linking size and management scores are at play. While large establishments tend to employ structured management practices, those establishments that employ structured management practices are also more likely to grow large.

4. Conclusion

We combined the JP MOPS data with Japanese Economic Census data to investigate the management-productivity link as well as the determinants of adopting management practices in Japan. Contrary to typical case studies and structured interviews about

Japanese management systems, this study attempted to quantify the quality of management practices that Japanese establishments adopt by collecting information on a large number of establishments from six industries: manufacturing, food and drink retail, wholesale, information technology services, road freight transport, and medical. This approach allows us to rely on direct evidence to gain insights into general features of Japanese management practices. Furthermore, this approach also permits us to shed light on the uniqueness of Japanese management practices by comparing empirical results from the MOPS of other countries, especially the US MOPS, because it closely followed their survey design and research approach. Yet, this study is not merely a replication of the seminal studies by Bloom and Van Reenen (2007) and Bloom et al. (2019) but using Japanese data. Our data contained additional information that allows us to examine structured management practices' relationship to labor share, organizational culture, and size. Our broader industry coverage also allowed us to generalize the roles played by structured management practices. Although it has been about 15 years since Hoshi and Jorgenson (2005) stated that "For economies like Japan that have been experiencing rapid aging, enhancing productivity is the only way to maintain economic growth," enhancing productivity remains an important social and economic issue in Japan. This study views the relationship between productivity and management practices as an important but under-examined productivity-enhancement channel for Japanese firms and establishments and contributes to advancing our understanding of their productivity determinants.

This study is descriptive in nature about both the effects of structured management on productivity and the mechanisms of management practices adopted at Japanese establishments. However, it still offers several useful insights about them under certain conditions. First, our empirical analysis showed that management scores vary substantially across establishments and that management scores are positively associated with labor productivity. It is worthwhile for low-productivity establishments under less structured management to consider devoting resources to reviewing current management practices and improving them, provided that the management-productivity link is causal in nature. Second, our analyses regarding labor shares implied that productivity improvement does not necessarily lead to a proportional increase in employees' average wage payment. Therefore, employees may not be rewarded in the form of pay increases in proportion to the productivity gains made due to the adoption of structured management practices. In addition, that labor shares decline with management scores suggests that implied markups *rise* with management scores (Autor et al., 2020; Fukao and Perugini, 2000). Similar to the role of information and communication technology, structured management also seems to play a role in the creation of large firms. This idea is in line with our analysis of the relationship between management scores and establishment size. Finally, we find that establishments' management scores are higher in the service industries when they recognize competitors. Competition in this sense encourages establishments to improve their management practices. The effect of competition on the adoption of structured management practices is quite similar to its role in determining the level of productivity. This observation lends additional support to the existence of a strong link between management practice and productivity.

In essence, this study illuminates both the vital role of structured management in determining productivity and potential sources of variation in the adoption of management practices. Further analyses and data collection are needed to draw causal inferences more generally—this study is confined to the description of Japanese management practices and their related issues. We nonetheless believe that this study provides valuable insights into firms' business decisions, has ramifications for economic policy regarding productivity improvement and serves as a stepping stone for future research.

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Appendix of "Management Practices in Japan: Survey Evidence from Six Industries in JP MOPS" by R. Kambayashi, A. Ohyama, and N. Hori

A. Characteristics of MOPS Samples

Table A.1 reports the means and standard deviations of establishment-level characteristic variables separately for the MOPS sample and Non-MOPS sample by using the Economic Census. To construct the comparison table, establishments are included only if they employ at least 30 regular workers. In general, establishments in the MOPS sample are larger in size, generate more value-added/sales, make more total payments and are more productivity than establishments in the Non-MOPS sample.

Table A.1: Comparison of MOPS sample and Non-MOPS sample

A. Manufacturing

	MOPS (Max N =10,083)		Non-MOPS (Max N =36,055)		H0: equal means
	Mean	S.D.	Mean	S.D.	p-value
Number of employees	140	394	118	288	<0.0001
Paid-up capital	512,178	2,885,477	302,968	2,384,611	<0.0001
Value-added	237,998	2,111,650	166,043	934,770	<0.0001
Total wage payment	71,219	286,498	57,197	201,625	<0.0001
Labor productivity	1,294	2,746	1,072	2,545	<0.0001

B. Food and Drink Retail

	MOPS (Max N =1,187)		Non-MOPS (Max N =17,916)		H0: equal means
	Mean	S.D.	Mean	S.D.	p-value
Number of employees	93	88	65	44	<0.0001
Paid-up capital	300,302	939,663	281,760	864,947	<0.0001
Sales	165,828	145,710	114,715	188,950	<0.0001
Total wage payment	NA	NA	NA	NA	NA
Labor productivity	1,830	1,103	1,722	1,556	0.02

C. Wholesale

	MOPS (Max N =3,811)		Non-MOPS (Max N =18,960)		H0: equal means
	Mean	S.D.	Mean	S.D.	p-value
Number of employees	89	135	82	186	0.02
Paid-up capital	575,493	3,007,964	518,508	2,771,622	0.26
Sales	1,306,797	10,400,000	1,137,437	9,152,768	0.31
Total wage payment	NA	NA	NA	NA	NA

Labor productivity	11,276	26,332	11,059	27,481	0.65

D. Information Technology Service

	MOPS (Max N =1,187)		Non-MOPS (Max N =17,916)		H0: equal means
	Mean	S.D.	Mean	S.D.	p-value
Number of employees	155	303	128	256	0.01
Paid-up capital	471,177	3,197,192	281,641	2,154,183	0.03
Sales	562,825	4,651,853	279,601	1,191,392	0.0001
Total wage payment	32,885	44,167	26,476	32,160	0.006
Labor productivity	1,926	3,406	1,638	2,240	0.001

E. Road Freight Transport

	MOPS (Max N =1,286)		Non-MOPS (Max N =14,722)		H0: equal means
	Mean	S.D.	Mean	S.D.	p-value
Number of employees	63	67	107	143	<0.0001
Paid-up capital	817,535	1,892,136	746,464	1,788,911	0.178
Sales	14,192	41,542	16,287	40,893	0.079
Total wage payment	21,946	25,835	16,579	12,716	<0.0001
Labor productivity	231	599	329	726	<0.0001

G. Medical

	MOPS (Max N =1,658)		Non-MOPS (Max N =14,818)		H0: equal means
	Mean	S.D.	Mean	S.D.	p-value
Number of employees	197	261	137	202	<0.0001
Paid-up capital	14,100,000	64,400,000	95,945	277,038	<0.0001
Sales	194,339	378,437	125,382	267,973	<0.0001
Total wage payment	49,144	65,088	42,659	83,773	0.05
Labor productivity	872	498	820	594	0.0007

B. Management Score Calculation

Table B.1 lists JP MOPS questions and answers about management practices. The number attached to each answer in a given question is a management score for that question. A survey respondent was instructed to skip Questions 3 to 5 when choosing "no key performance indicators" in Question 2. In that case, we set management scores of Questions 3 to 5 equal to 0. The total management score is a simple average of management scores from the 16 management practice questions.

Table B.1 Management Scores for Each Question

Management Score	Question and Answers
	Q1. What best describes what happened at this establishment when a problem in the production process arose?
0.33	We fixed it but did not take further action.
0.67	We fixed it and took action to make sure that it did not happen again
1.00	We fixed it and took action to make sure that it did not happen again, and had a continuous improvement process to anticipate problems like these in advance
0.00	No action was taken
	Q2. How many key performance indicators were monitored at this establishment?
0.33	1-2 key performance indicators
0.67	3-9 key performance indicators
1.00	10 or more key performance indicators
0.00	No key performance indicators
	Q3. How frequently were the key performance indicators reviewed by managers at this establishment?
0.17	Yearly
0.33	Quarterly
0.50	Monthly
0.67	Weekly
0.83	Daily
1.00	Hourly or more frequently
0.00	Never
	Q4. How frequently were the key performance indicators reviewed by non-managers at this establishment?
0.17	Yearly
0.33	Quarterly

0.50	Monthly
0.67	Weekly
0.83	Daily
1.00	Hourly or more frequently
0.00	Never
	Q5. Where were the production display boards showing output and other key performance indicators located at this establishment?
0.50	All display boards were located in one place
1.00	Display boards were located in multiple places
0.00	We did not have any display boards
	Q6. What best describes the time frame of production targets at this establishment?
0.33	Main focus was on short-term (less than one year) production targets
0.67	Main focus was on long-term (more than one year) production targets
1.00	Combination of short-term and long-term production targets
0.00	No production targets
	Q7. How easy or difficult was it for this establishment to achieve its production targets?
0.00	Possible to achieve without much effort
0.50	Possible to achieve with some effort
0.75	Possible to achieve with normal amount of effort
1.00	Possible to achieve with more than normal effort
0.25	Only possible to achieve with extraordinary effort
	Q8. Who was aware of the production targets at this establishment?
0.00	Only senior managers
0.33	Most managers and some production workers
0.67	Most managers and most production workers
1.00	All managers and most production workers
	Q9. What were non-managers' performance bonuses usually based on at this establishment?
1.00	Their own performance as measured by production targets
0.75	Their team or shift performance as measured by production targets
0.50	Their establishment's performance as measured by production targets
0.25	Their company's performance as measured by production targets
0.00	No performance bonuses
	Q10. When production targets were met, what percent of non-managers at this establishment received performance bonuses?

0.20	0%
0.40	1-33％
0.60	34-66％
0.80	67-99％
1.00	100%
0.00	Production targets not met
	Q11.What were managers' performance bonuses usually based on at this establishment?
1.00	Their own performance as measured by production targets
0.75	Their team or shift performance as measured by production targets
0.50	Their establishment's performance as measured by production targets
0.25	Their company's performance as measured by production targets
0.00	No performance bonuses
	Q12. When production targets were met, what percentage of managers at this establishment received performance bonuses?
0.20	0%
0.40	1-33％
0.60	34-66％
0.80	67-99％
1.00	100%
0.00	Production targets not met
	Q13. What was the primary way non-managers were promoted at this establishment?
1.00	Promotions were based solely on performance and ability
0.67	Promotions were based partly on performance and ability, and partly on other factors
0.33	Promotions were based mainly on factors other than performance and ability
0.00	Non-managers are normally not promoted
	Q14. What was the primary way managers were promoted at this establishment?
1.00	Promotions were based solely on performance and ability
0.67	Promotions were based partly on performance and ability, and partly on other factors
0.33	Promotions were based mainly on factors other than performance and ability
0.00	Non-managers are normally not promoted
	Q15. When was an under-performing non-manager reassigned or dismissed at this establishment?
1.00	Within 6 months of identifying non-manager under-performance
0.50	After 6 months of identifying non-manager under-performance
0.00	Rarely or never

	Q16. When was an under-performing manager reassigned or dismissed at this establishment?
1.00	Within 6 months of identifying non-manager under-performance
0.50	After 6 months of identifying non-manager under-performance
0.00	Rarely or never

C. Estimation Results for Each Management Practice

Estimation results are presented below about the effects of decentralization and organizational culture on each management practice.

Table C.1 The Relationship between Management Score and Decentralized Score by Practice

	Monitoring					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Decentralization scores	-0.043 **	-0.125 ***	-0.067 ***	-0.114 *	-0.152 ***	-0.033
	(0.018)	(0.048)	(0.017)	(0.068)	(0.031)	(0.024)
No. of observations	4,380	774	2,261	267	933	860
R_squared	0.124	0.183	0.110	0.208	0.126	0.160
	Targeting					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Decentralization scores	-0.058 ***	-0.090 **	-0.019	-0.037	-0.147 ***	-0.065 **
	(0.018)	(0.046)	(0.018)	(0.081)	(0.034)	(0.031)
No. of observations	4,382	774	2,263	267	933	860
R_squared	0.092	0.214	0.079	0.143	0.086	0.124
	Bonus					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Decentralization scores	-0.011	-0.221 ***	-0.050 **	0.098	-0.187 ***	-0.119 ***
	(0.024)	(0.065)	(0.021)	(0.100)	(0.042)	(0.040)
No. of observations	4,040	762	2,153	256	842	727
R_squared	0.314	0.166	0.100	0.190	0.137	0.087
	Promotion					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Decentralization scores	-0.048 ***	-0.152 ***	-0.033 **	-0.081	-0.115 ***	-0.031
	(0.015)	(0.056)	(0.016)	(0.081)	(0.035)	(0.029)

No. of observations	4,365	770	2,223	267	903	852
R_squared	0.205	0.190	0.084	0.212	0.096	0.082
	Dismissal					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Decentralization scores	-0.006	-0.121	-0.056 *	0.002	-0.071	-0.065
	(0.023)	(0.076)	(0.030)	(0.097)	(0.053)	(0.045)
No. of observations	4,359	767	2,219	266	925	842
R_squared	0.332	0.100	0.048	0.216	0.089	0.109

Note: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10% and ***<1%. (v) Controls include the number of employees, fixed capital, establishment age, establishment types, location and subindustry dummies.

Table C.2 The Relationship between Management Score and Organizational Culture by Practice

	Monitoring					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Specialization score 1	NA	0.069 ***	0.011	0.005	0.023	0.022
		(0.020)	(0.012)	(0.028)	(0.021)	(0.017)
Specialization score 3	NA	0.091 ***	0.015	-0.025	0.027	-0.006
		(0.032)	(0.013)	(0.019)	(0.028)	(0.017)
Creativity score 1	NA	-0.089 ***	-0.026 **	0.002	-0.059 ***	-0.017
		(0.019)	(0.011)	(0.025)	(0.018)	(0.014)
Creativity score 3	NA	-0.123 ***	0.027 **	-0.005	-0.012	0.010
		(0.029)	(0.013)	(0.022)	(0.031)	(0.023)
No of observations		1,127	3,516	867	1,155	1,457
R_squared		0.200	0.100	0.117	0.111	0.150
	Targeting					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Specialization score 1	NA	0.011	-0.020 *	0.013	-0.023	-0.007
		(0.018)	(0.012)	(0.033)	(0.021)	(0.021)

Specialization score 3	NA	0.086 ***	-0.014	-0.066 ***	-0.016	-0.018
		(0.028)	(0.014)	(0.025)	(0.027)	(0.023)
Creativity score 1	NA	-0.032 **	-0.057 ***	-0.028	-0.046 **	-0.006
		(0.016)	(0.012)	(0.027)	(0.018)	(0.018)
Creativity score 3	NA	-0.051 *	-0.023 *	0.003	0.007	-0.009
		(0.029)	(0.014)	(0.028)	(0.031)	(0.029)
No of observations		1,127	3,517	867	1,156	1,457
R_squared		0.151	0.086	0.098	0.069	0.134
	Bonus					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Specialization score 1	NA	-0.051 **	-0.009	-0.063	-0.001	-0.032
		(0.024)	(0.013)	(0.044)	(0.027)	(0.029)
Specialization score 3	NA	-0.019	-0.016	-0.005	0.036	-0.013
		(0.033)	(0.016)	(0.029)	(0.034)	(0.029)
Creativity score 1	NA	0.120 ***	-0.028 **	0.033	-0.052 **	-0.013
		(0.021)	(0.014)	(0.036)	(0.023)	(0.024)
Creativity score 3	NA	0.013	0.023	0.065 **	0.043	0.016
		(0.038)	(0.014)	(0.033)	(0.035)	(0.034)
No of observations		1,100	3,309	810	1,006	1,152
R_squared		0.129	0.082	0.081	0.098	0.054
	Promotion					
	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
Specialization score 1	NA	0.045 **	0.011	-0.045	0.003	-0.004
		(0.018)	(0.010)	(0.031)	(0.022)	(0.022)
Specialization score 3	NA	0.034	0.013	-0.021	-0.009	0.004
		(0.027)	(0.012)	(0.023)	(0.025)	(0.018)
Creativity score 1	NA	-0.033 *	-0.060 ***	-0.029	-0.007	-0.058 ***
		(0.018)	(0.011)	(0.025)	(0.018)	(0.017)
Creativity score 3	NA	-0.102 ***	-0.0004	0.016	-0.028	-0.039
		(0.032)	(0.011)	(0.024)	(0.030)	(0.027)
No of observations		1,121	3,455	864	1,128	1,444
R_squared		0.140	0.066	0.064	0.059	0.087
	Dismissal					

	Manufacturing	Food & Drink Retail		Wholesale	I.T. Service	Transportation		Medical
Specialization score 1	NA	0.073	**	-0.005	0.004	0.008		0.022
		(0.034)		(0.020)	(0.037)	(0.035)		(0.031)
Specialization score 3	NA	0.192	***	-0.004	0.005	0.097	**	0.024
		(0.048)		(0.023)	(0.029)	(0.048)		(0.032)
Creativity score 1	NA	-0.087	***	0.007	-0.008	-0.0001		-0.024
		(0.030)		(0.019)	(0.032)	(0.031)		(0.026)
Creativity score 3	NA	0.001		0.001	0.010	0.073		0.056
		(0.051)		(0.023)	(0.032)	(0.053)		(0.044)
No of observations		1,122		3,475	864	1,147		1,441
R_squared		0.092		0.030	0.078	0.080		0.047

Note: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10% and ***<1%. (v) Controls include the number of employees, fixed capital, age, establishment types, location and subindustry dummies.

D. Full Estimation Results of Tables 3, 4, 5, and 7

Full estimation results of Tables 3 to 7 are presented below.

Table D.1: Table 3

Panel A: Firm-level regression analysis

	DV: Labor productivity (ln(sales/# employees)) at firm level											
	Manufacturing		Food & Drink Retail		Wholesale		I.T. Service		Transportation		Medical	
Management score	0.769	***	0.616	***	0.554	***	1.125	***	0.661	***	0.088	
	0.046		0.212		0.114		0.172		0.127		0.103	
No. of employees	0.000004		-0.000054		-0.000009		0.000132	**	-0.000015	***	0.000001	
	0.000015		0.000029		0.000		0.000053		0.000006		0.000006	
Paid in capital	<0.000001	***	<0.000001	***	<0.000001		<0.000001		<0.000001		<0.000001	***
	<0.0000001		<0.0000001		<0.000001		<0.000001		<0.000001		<0.0000001	
No. of observations	8,836		403		2,795		716		787		1,066	
R_squared	0.304		0.321		0.158		0.161		0.153		0.214	
Location& subindustry	Yes		Yes		Yes		Yes		Yes		Yes	
Share of 90-10 spread explained	18.0%		14.0%		10.0%		28.4%		23.2%		NA	

Note: (i) JP MOPS and TDB database are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%. (v) The share of 90-10 spread explained is a 90-10 spread of management scores times the coefficient on management scores divided by a 90-10 spread of labor productivity.

Panel B: Establishment-level regression analysis

	DV: Labor productivity (ln(sales/# employees)) at establishment level											
	Manufacturing		Food & Drink Retail		Wholesale		I.T. Service		Transportation		Medical	
Management score	0.625	***	-0.081		0.924	***	0.790	***	0.241		0.155	
	(0.049)		(0.167)		(0.161)		(0.251)		(0.221)		(0.098)	
No. of employees	0.00002		0.00009		-0.00001		-0.00027		-0.00281	***	0.00029	***
	(0.00003)		(0.00045)		(0.00015)		(0.00039)		(0.00082)		(0.00005)	
Paid in capital	<0.000001	***	<0.00001		<0.000001	***	<0.000001	***	0.00009	***	NA	
	(<0.0000001)		(<0.0000001)		(<0.0000001)		(<0.0000001)		(0.00003)		NA	
Branch of Multiple Establishment	0.34177	***	-0.24946		-0.01898		0.14411	**	0.00745		0.03033	
	(0.01934)		(0.15726)		(0.05984)		(0.07165)		(0.09788)		(0.03029)	

Headquarters	0.06230 ***	0.20346 **	0.43971 ***	0.26436 ***	-0.62623 ***	0.07897 **
	(0.02025)	(0.08972)	(0.06756)	(0.09828)	(0.20059)	(0.03369)
Age category 2	-0.04268 **	0.09341	-0.12696 *	0.00314	0.04261	0.00049
(1985-1994)	(0.02251)	(0.10008)	(0.06670)	(0.11538)	(0.10077)	(0.03634)
Age category 3	-0.06462 **	-0.07170	-0.13894 **	0.05128	0.15804 *	-0.00271
(1995-2004)	(0.02598)	(0.06305)	(0.06292)	(0.10659)	(0.09473	(0.03765)
Age category 4	-0.04402	-0.07292	0.00141	0.11232	0.11632	0.06502
(2005-2014)	(0.02811)	(0.06863)	(0.05381)	(0.11296)	(0.11102)	(0.04069)
No of observations	9,376	937	3,354	784	242	1,563
R_squared	0.200	0.225	0.186	0.195	0.281	0.135
Location&subindustry	Yes	Yes	Yes	Yes	Yes	Yes

Note: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10% and ***<1%. (v) Value-added are used in the manufacturing(‡).

Table D.2: Table 4

	DV: Labor productivity (ln(value-added/# employees)) at establishment level		
	Pooled OLS	Random Effects	Fixed Effects
Management score	0.661 ***	0.639 ***	0.467 ***
	(0.036)	(0.040)	(0.084)
No. of employees	0.00003	0.00003	-0.00032
	(0.00003)	(0.00003)	(0.00021)
Paid in capital	<0.000001 ***	<0.000001 ***	<0.000001
	(<0.0000001)	(<0.0000001)	(<0.000001)
Branch of Multiple Establishment	0.34089 ***	0.34592 ***	
	(0.01447)	(0.01734)	
Headquarters	0.07777 ***	0.07900 ***	
	(0.01420)	(0.01661)	
Age category 2 (1985-1994)	-0.03203 **	-0.03284 *	
	(0.01610)	(0.01902)	
Age category 3 (1995-2004)	-0.03945 **	-0.04207 *	
	(0.01922)	(0.02304)	
Age category 4 (2005-2014)	-0.05645 **	-0.05482 *	
	(0.02466)	(0.02927)	
No of observations	16,312	16,312	16,312

R_squared	0.267	0.267	0.186

Note: (i) JP MOPS and Manufacturing Census data are used. (ii) Coefficients are estimated by Pooled OLS, Random-Effect and Fixed-Effect Models. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%.

Table D.3: Table 5

	DV: TFP				DV: Labor productivity	
	(I)		(II)		(III)	
Management score	0.176	***	0.184	***	0.599	***
	(0.035)		(0.0389		(0.053)	
Noise control			-0.105	***	-0.176	***
			(0.018)		(0.028)	
No. of employees	-0.00006	***	-0.00011	***	0.00014	**
	(0.00001)		(0.00003)		(0.00006)	
Paid in capital	<0.000001	**	<0.000001	**	<0.000001	***
	(<0.0000001)		(<0.0000001)		(<0.0000001)	
Branch of Multiple Establishment	0.06905	***	0.07978	***	0.34051	***
	(0.01385)		(0.01505)		(0.02106)	
Headquarters	-0.07780	***	-0.05015	***	0.07366	***
	(0.01431)		(0.01506)		(0.02182)	
Age category 2 (1985-1994)	0.02370		0.01836		-0.03449	
	(0.01486)		(0.01570)		(0.02362)	
Age category 3 (1995-2004)	0.02345		0.03076	*	-0.03565	
	(0.01767)		(0.01847)		(0.02731)	
Age category 4 (2005-2014)	0.01311		0.02702		-0.02646	
	(0.02098)		(0.02277)		(0.03152)	
No of observations	8,212		6,967		7,775	
R_squared	0.08		0.0917		0.254	
Location and subindustry	Yes		Yes		Yes	

Note: (i) JP MOPS and Manufacturing Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; ***<1%.

Table D.4: Table 7

Panel A: Recognition of Competitors

	Manufacturing	Food & Drink Retail		Wholesale		I.T. Service		Transportation		Medical	
one to two	NA	-0.020		-0.0004		0.015		0.014		0.045	***
		(0.022)		(0.0116)		(0.015)		(0.017)		(0.016)	
three to five	NA	0.003		0.011		0.017		0.072	***	0.072	***
		(0.019)		(0.008)		(0.014)		(0.014)		(0.014)	
six to ten	NA	-0.028		0.023	***	0.021		0.106	***	0.077	***
		(0.023)		(0.009)		(0.019)		(0.016)		(0.015)	
more than ten	NA	0.043	*	0.020	***	0.026	**	0.060	***	0.088	***
		(0.022)		(0.007)		(0.012)		(0.014)		(0.014)	
No. of employees (100 employees)	NA	0.0063	**	0.0133	***	0.0087	***	0.0247	***	0.0128	***
		(0.0031)		(0.0022)		(0.0021)		(0.0028)		(0.0020)	
Multiple establishments	NA	0.1707	***	0.0714	***	0.0898	***	0.1312	***	0.0567	***
		(0.0200)		(0.0078)		(0.0108)		(0.0134)		(0.0086)	
Total population (1000 people)	NA	0.0001		0.0001		-0.0001		0.0003		-0.0004	
		(0.0003)		(0.0002)		(0.0004)		(0.0003)		(0.0003)	
Population change	NA	0.0011		0.0009	**	-0.0003		0.0007		0.0008	
		(0.0012)		(0.0004)		(0.0007)		(0.0015)		(0.0012)	
Population density (1000 people)	NA	0.0061		0.0145	***	0.0031		0.0172		0.0248	**
		(0.0105)		(0.0048)		(0.0087)		(0.0147)		(0.0101)	
No of observations	NA	1,173		3,640		875		1,240		1,566	
R_squared	NA	0.1838		0.1492		0.1438		0.1856		0.1683	
subindustry	NA	Yes		Yes		Yes		Yes		Yes	

Note: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10%, **<5%, ***<1%. (v) Population, population growth, and population density are at the municipal level.

Panel B: Potential Competitors in a Geographical Area

	Manufacturing	Food & Drink Retail	Wholesale	I.T. Service	Transportation	Medical
No of competitors within 10km	-0.00002	-0.00001 *	-0.000002	0.000006 **	-0.00003	0.00001
	(0.00002)	(0.00001)	(0.000004)	(0.000003)	(0.00002)	(0.00001)
No. of employees (100 employees)	0.01308 ***	0.00676 *	0.012758 ***	0.008121 ***	0.02518 ***	0.01314 ***
	(0.00115)	(0.00363)	(0.001914)	(0.001675)	(0.00304)	(0.00187)
Multiple establishments	0.06047 ***	0.14536 ***	0.069131 ***	0.103611 ***	0.13819 ***	0.05797 ***
	(0.00403)	(0.02009)	(0.007694)	(0.010798)	(0.01321)	(0.00856)
Total population (1000 people)	-0.00034 **	-0.00002	0.000170	0.000057	0.00040	-0.00031
	(0.00014)	(0.00027)	(0.000160)	(0.000380)	(0.00032)	(0.00026)
Population change	0.00103 *	0.00171	0.001104 **	-0.001172	0.00043	0.00066
	(0.00056)	(0.00123)	(0.000472)	(0.000907)	(0.00150)	(0.00114)
Population density (1000 people)	-0.02624 ***	0.00692	0.014215 **	-0.012704	0.04097 *	0.01907
	(0.00680)	(0.01188)	(0.005783)	(0.009925)	(0.02150)	(0.01167)
No of observations	8,935	1,130	3,728	826	1,264	1,624
R_squared	0.1363	0.1655	0.1455	0.1658	(0.1575	(0.1385)
No of *large* competitors within 10km	-0.0001	-0.00008	-0.00002	0.000034 **	-0.00025	0.0001 *
	(0.0002)	(0.00005)	(0.00002)	(0.000017)	(0.00018)	(0.0001)
No. of employees (100 employees)	0.0131 ***	0.00681 *	0.01285 ***	0.008072 ***	0.02515 ***	0.0132 ***
	(0.0012)	(80.00366)	(0.00192)	(0.001669)	(0.00304)	(0.0019)
Multiple establishments	0.0605 ***	0.14527 ***	0.06898 ***	0.103604 ***	0.13868 ***	0.0578 ***
	(0.0040)	(0.02011)	(0.00770)	(0.010801)	(0.01326)	(0.0086)
Total population (1000 people)	-0.0003 **	-0.00001	0.00017	0.000036	0.00040	-0.0003
	(0.0001)	(0.00027)	(0.00016)	(0.000384)	(0.00032)	(0.0003)
Population change	0.0010 *	0.00160	0.00125 ***	-0.001157	0.00054	0.0006
	(0.0006)	(0.00123)	(0.00047)	(0.000902)	(0.00151)	(0.0011)
Population density (1000 people)	-0.0274 ***	0.00533	0.01585 ***	-0.011380	0.03834 *	0.0174
	(0.0066)	(0.01214)	(0.00554)	(0.009536)	(0.02035)	(0.0118)
No of observations	8,935	1,130	3,728	826	1,264	1,624
R_squared	0.1362	0.1648	0.1458	0.1658	0.1574	0.1388

Note: (i) JP MOPS and Economic Census data are used. (ii) Coefficients are estimated by OLS. (iii) Numbers in the parentheses are robust standard errors. (iv) The number of asterisks indicates the significance level in t-test for coefficients; *<10%, **<5%, ***<1%. (v) Population, population growth, and population density are at the municipal level. (vi) Large competitors are competitors whose size is larger than the upper quartile in a given sub industry.