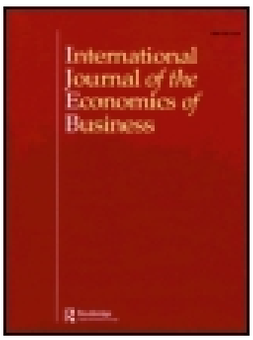

International Journal of the Economics of Business

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cijb20

Management Practices and Allocation of Employment: Evidence from Finnish Manufacturing

Roope Ohlsbom & Mika Maliranta

To cite this article: Roope Ohlsbom & Mika Maliranta (2020): Management Practices and Allocation of Employment: Evidence from Finnish Manufacturing, International Journal of the Economics of Business, DOI: 10.1080/13571516.2020.1800343

To link to this article: https://doi.org/10.1080/13571516.2020.1800343

Published online: 14 Sep 2020.

INTERNATIONAL JOURNAL OF THE ECONOMICS OF BUSINESS
https://doi.org/10.1080/13571516.2020.1800343

Management Practices and Allocation of Employment: Evidence from Finnish Manufacturing

Roope Ohlsbom[a] and Mika Maliranta[b]

[a]Jyväskylä University School of Business and Economics, Jyväskylä, Finland; [b]Jyväskylä University School of Business and Economics, Jyväskylä, Finland and Finnish Competition and Consumer Authority, Advocacy and research, Helsinki, Finland

ABSTRACT

We analyse variation in the management practices across countries and across regions within a country. For cross-country comparisons we use the Finnish Management and Organizational Practices Survey (FMOP) to calculate a management score for Finnish manufacturing that is compared to corresponding measures obtained from similar data in the US and Germany. Scores measured by unweighted averages of the establishments in these countries show that Finland is only slightly behind the US and on par with those of Germany. With the FMOP data, we then perform an Olley-Pakes decomposition of the management score using a moment-based estimation procedure. Our decomposition shows no statistically significant differences in the unweighted average scores between Finnish regions, but reveal some significant differences in the employment weighted averages (i.e. aggregate scores) that can be attributed to the differences in the allocation of the labour force between establishments within regions.

KEYWORDS

Management practices; management survey; MOPS; Olley-Pakes de-composition; competitiveness; allocation effect

JEL CLASSIFICATION

D22; L25; L60; M11; M50

1. Introduction

In the past decade, since the development of the quantitative survey tool known as the Management and Organizational Practices Survey (MOPS), management practices have gained a footing as a key driver of productivity differences. This paper contributes to the management practices literature by using the novel Finnish Management and Organizational Practices Survey (FMOP) to examine cross-regional and cross-country variations in management practices. Furthermore, we perform an Olley-Pakes micro-level decomposition that allows splitting the aggregate (i.e. employment weighted) management practice score into the contributions of the establishment-level component (unweighted average) and the allocation of employment between establishments (a covariance-like allocation term). We perform this decomposition by applying a moment-based estimation method, proposed by Hyytinen, Ilmakunnas, and

CONTACT Roope Ohlsbom roope.a.ohlsbom@student.jyu.fi Economics, Jyväskylä University School of Business and Economics, Kerttulinkuja 3 F 94, 00810 Helsinki, Finland

Maliranta (2016), that allows us to highlight the statistical, in addition to that of the economic, significance of the differences in the micro-level components of management practices found across regions.

Our results show that even when no statistically or economically significant differences are found using simple unweighted averages, employment weighted averages reveal some economically and statistically significant differences in the adoption of productivity-affecting management practices at the aggregate regional level. Furthermore, these disparities can be attributed to the allocation component, which exhibits economically and statistically significant variation across regions. Our analysis demonstrates that it is important to measure the contribution of the allocation of employment between establishments in explaining variations in management quality across regions, or countries, and that these estimates involve statistical uncertainty that has so far been largely ignored in the literature.

An indicative cross-country comparison using post-stratification weighted averages is presented, in addition to the descriptive statistics and a cross-regional analysis of Finnish management practices. Based on a rudimentary examination of averages, the Finnish management scores appear to be only slightly behind those of the US and approximately on par with those of Germany. This suggests that the management practices in Finnish manufacturing are on an internationally competitive, high quality level.

The domestic cross-regional analysis focuses specifically on the differences in the quality of the management practices between the large areas of Finland. An Olley-Pakes (OP) decomposition is used to decompose the aggregate (employment weighted) average management score into contributions of the unweighted average score, which gauges the management score at the plant-level, and a covariance-like allocation term that measures the role of the allocation of employment between management-heterogenous establishments.

The allocation term itself has gained notice in the productivity literature (Bartelsman, Haltiwanger, and Scarpetta 2013) and more recently in the management literature (Bloom, Sadun, and Van Reenen 2016). In productivity studies, the reallocation of resources has been shown to account for a large part of cross-country productivity differences[1]. However, these studies have not addressed the issue of estimating standard errors for the allocation component of the decomposition.

The covariance term also seems to be a useful measure of resource allocation, as argued for example by Bartelsman, Haltiwanger, and Scarpetta (2013). They empirically show that differences in the Olley-Pakes covariance term of productivity account for a significant part of the observed cross-country productivity dispersion. Furthermore, by showing that the covariance between employment and productivity is an informative and robust measure for the impact of misallocation, Bartelsman, Haltiwanger, and Scarpetta (2013) argue that employment is a natural choice for measuring the policy relevant allocation term. Therefore, following for example Bartelsman, Haltiwanger, and Scarpetta (2013), Maliranta and Määttänen (2015) and Hyytinen, Ilmakunnas, and Maliranta (2016), this paper uses the covariance between employment and management practices to measure resource allocation.

The evidence for management practices, as measured by survey tools derivative of the MOPS, as a key driver of productivity is convincing: previous studies have found

repeated evidence on the significance of management practices in explaining productivity differences. Bloom et al. (2019) find that management practices are highly correlated with productivity and can account for as much as 22% of the cross-firm differences in labour productivity. As a comparison, the labour productivity differences that are explained by research and development, information and communications technology investment per worker and human capital are 21.6%, 12% and 15.9%, respectively. These factors have traditionally been considered to significantly explain the observed variation of productivity.

Jointly, with management practices included, all of the above can explain approximately 44% of the observed labour productivity differences, according to Bloom et al. (2019). Similar results are found with other measures of productivity. This implies that management practices, as measured by the MOPS management score, have a significant part in explaining firm productivity. The quantitative analysis of the differences in management practices can therefore reveal valuable information concerning the differences in productivity and economic competitiveness. Encouraging establishments to adopt better management practices on a large scale could potentially have tangible effects on the economy.

Yet, it is also important to consider the role of allocation of employment between establishments in explaining the competitive performance of the economy, or its regions. Because competition between establishments is one of the key drivers of the allocation of employment and output (Bloom and Van Reenen 2007; Syverson 2011), this insight emphasises the potentially important role of *national competition* policy in determining the *international competitiveness* of the economy.

The structure of the paper is organized as follows. Section 2 provides an overview of the FMOP survey instrument and data, the indicative international comparisons and the descriptive statistics of the FMOP data. A short description of the decomposition methods and the results from the moment-based estimation and hypothesis testing are presented in section 3. Section 4 concludes. All the analysis in this paper is descriptive, and without additional assumptions, no causal inferences can be made based on the calculations that are presented.

2. Data and international comparison

2.1. Data

In his survey of empirical research on productivity differences, Syverson (2011, 336) states that 'perhaps no potential driver of productivity differences has seen a higher ratio of speculation to actual empirical study' when discussing the aptitudes of managers and the quality of management practices. At the forefront of amending this shortcoming is the Management and Organizational Practices Survey (MOPS), which is a quantitative survey tool that was developed by Nick Bloom, John Van Reenen and Erik Brynjolfsson together with the United States Census Bureau and the National Science Foundation. With funding from the Strategic Research Council and as a part of the Skills, Education and the Future of Work research project, this tool has been translated and adapted to collect data on the quality of management practices in Finnish

manufacturing establishments. The Finnish Management and Organizational Practices Survey (FMOP) was conducted by Statistics Finland.

The sample for the 2016 FMOP data collection consisted of 2509 Finnish manufacturing establishments with at least 4 employees. Firms employing less than 50 employees are excluded from the sample (see appendix), but the small establishments that belong to firms of at least 50 employees are included. The final number of valid responses was 731, with a response rate of approximately 31% after accounting for overcoverage.

This is relatively high for a non-compulsory survey. In Germany, for example, where responding was not compulsory, the response rate was approximately 6% (Broszeit et al. 2019). The Management and Expectations Survey, conducted in the United Kingdom by the Office for National Statistics, had a response rate of 38.7% (Awano et al. 2018). In the United States, where responding was mandatory by law, the response rates for the first and second waves of the survey were approximately 78% and 74%, respectively (Bloom et al. 2019). As an example of a high response rate for a non-compulsory survey, the first wave pilot Management Practices Survey (MPS) of 2015 in the UK achieved a response rate of 68% (Awano, Heffernan, and Robinson 2017).

The analysis of total non-response that was conducted by Statistics Finland showed that the distribution of the respondents is skewed towards larger establishments, as measured by the number of personnel. Statistics Finland also conducted a post-stratification test to provide sample weights that correct for some of the non-response bias in the data. Additional restrictions[2] drop the final number of establishments that was used in the analysis down to 609.

The FMOP questionnaire has a total of 35 questions, of which 16 concern management practices. In addition to the 16 management questions, the questionnaire has 13 questions on organizational practices and 6 background questions. The questions concern the year 2016, but most of the questions also have a recall component, where respondents are asked to give an answer regarding the circumstances five years earlier.

The responses for each question are normalized on a scale of $0-1$ and the establishment-level management score is calculated as the unweighted average of the normalized responses. The answer options corresponding with the management practices that are considered to be the most structured are assigned a value of 1 and the least structured practices are assigned a value of 0. Bloom et al. (2019) define more structured management practices as 'those that are more specific, formal, frequent or explicit' (Bloom et al. 2019, 28).

The management questions can be divided into three sections: monitoring, targets and incentives. The monitoring section consists of questions $1-5$ and they ask about the utilization and gathering of information and data in the monitoring of production. Questions $6-8$ are about the setting of production targets and questions $9-16$ ask about practices concerning bonuses and incentives, policies on recruitment and promotion and policies concerning the dismissal and reassignment of managers and non-managers. All the questions measure practical (often plant floor level) operating models and in-place practices, not personnel related factors such as managerial skills.

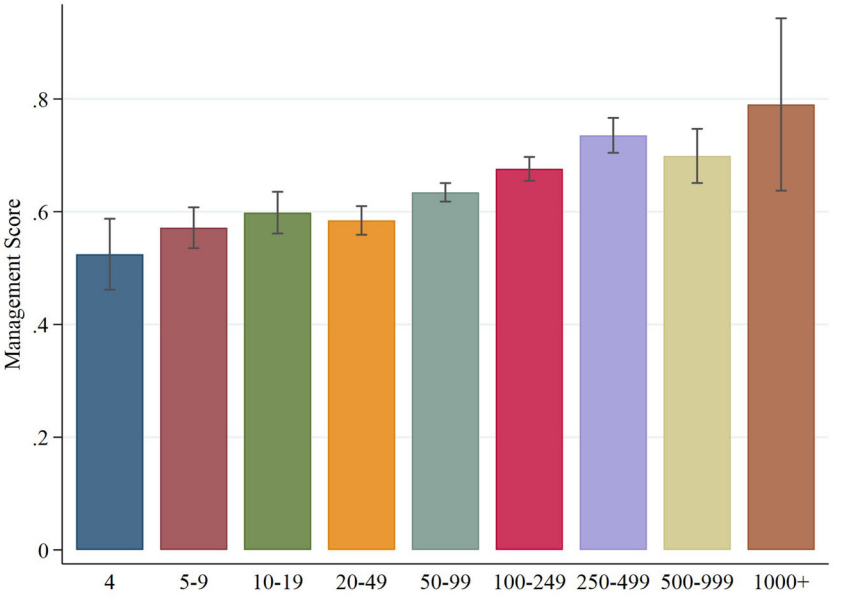

Figure 1. Unweighted average management scores by establishment size (number of employees) with confidence intervals.

For parts of the empirical analysis, the control variables and regional subdivisions for the establishments in the FMOP data are acquired from the Establishments 2015 and 2016 data sets of the Finnish Business Register by Statistics Finland. Only data for the establishments that responded to the questionnaire were used. Consent to linkage with Statistics Finland establishment-level micro data was ensured for all respondents as a part of the FMOP survey. All handling of data has been conducted following disclosure avoidance procedures to ensure the confidentiality of the individual surveyed units.

2.2. International comparisons

The FMOP design meticulously follows the US Management and Organizational Practices Survey. The United States is a useful benchmark for international comparisons because its management practices have been recognized as the best in the world in studies that utilize the World Management Survey (WMS). Comparing the management scores between countries is challenging since the samples are constructed differently in each country.

Studies have found a clear positive correlation between the size of establishments and the management score (Bloom, Sadun, et al. 2016; Awano, Heffernan, and Robinson 2017; Bender et al. 2018; Bloom et al. 2019; Broszeit et al. 2019), which means that different size limits for the establishments that are included in each country's data will also affect the comparability of the management scores. In the case of Finnish manufacturing establishments, this relationship between establishment size and management practices can be seen in Figures 1 and 2. Figure 2 also shows the additional role of firm size.

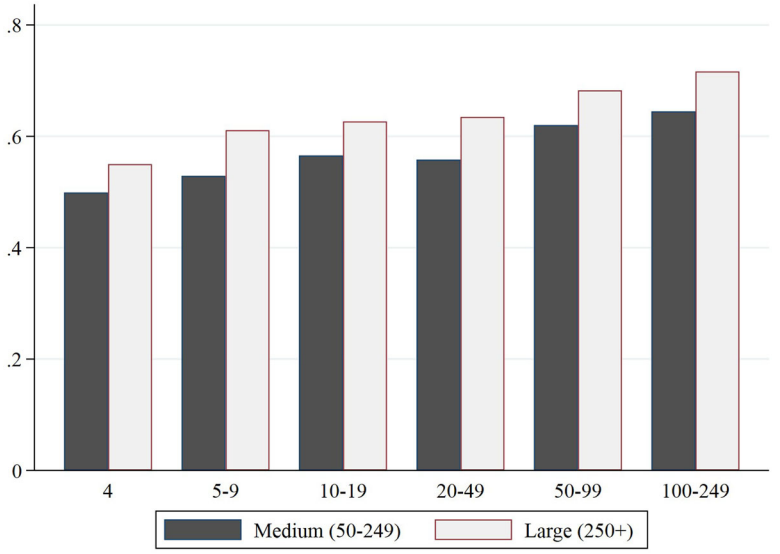

Figure 2. Unweighted average management scores by establishment size (number of employees) for medium and large enterprises.

Figure 3 is a simple comparison of the post-stratification weighted averages without using any imputed values. Because the establishments of small firms are missing from the FMOP data, the Finnish scores in the figure are slightly overestimated.

Another factor that might contribute to the overestimation of the Finnish scores compared to the US is the clearly the lower response rate. The FMOP had a response rate of 31%, whereas 78% of establishments responded in the US. The different reference years in each country also hinder their comparability, especially if the management scores vary over time. Comparisons utilizing the FMOP and the most recent US data have yet to be conducted.

Finland also seems to have higher scores in performance monitoring than in incentives and targets when compared to Germany and the US. When incentives and targets are further divided into two categories, it is the incentives part that results in the lowest scores in the Finnish data. It is plausible that the low incentive scores are related to the relatively strict job market regulations and very high union membership rates in Finland.

The potential for effective monitoring is arguably related to digitalization, with the increasing use of digital systems in manufacturing establishments. To further examine this connection, we look at data from the annual Digibarometer published by Business Finland, the Ministry of Transport and Communications, the Technology Industries and Ecommerce Finland. Interestingly, Finland has indeed been ranked among the best three countries in the level of digitalization every year since 2014 (Ali-Yrkkö et al. 2019). This could partly explain the high monitoring score of Finland compared to Germany and the US. In 2016, when the FMOP was conducted, Finland was number one in the Digibarometer, the US was ranked sixth and Germany placed fourteenth. Among other things, the Digital Barometer reflects the level and adoption of

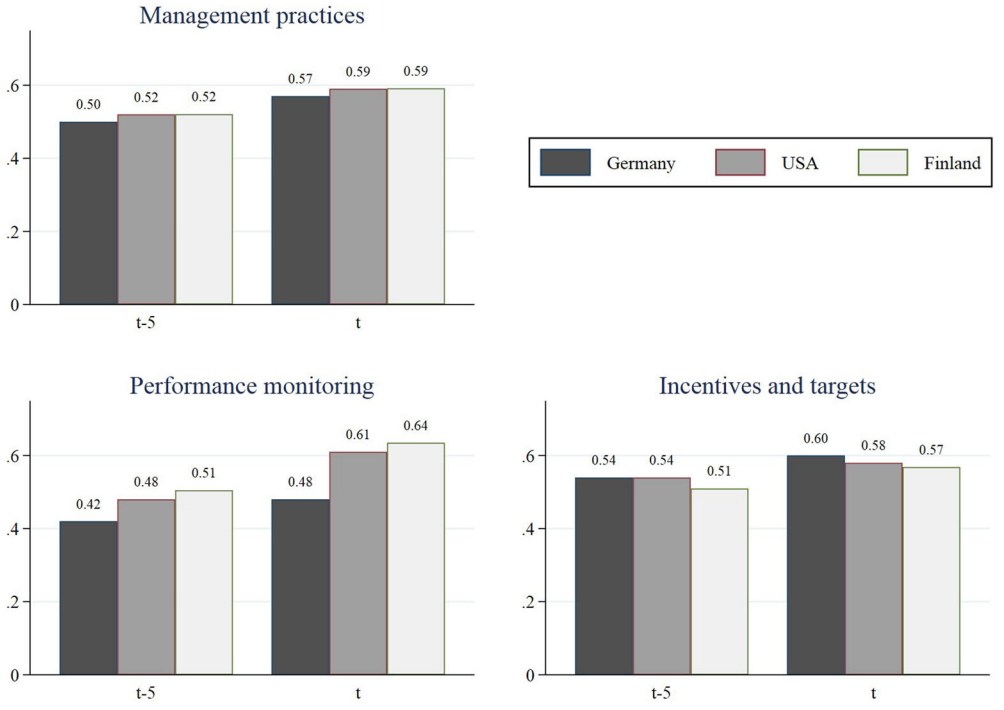

Figure 3. Comparison between Germany, the USA and Finland. Year t denotes 2010 for the US, 2013 for Germany and 2016 for Finland. The Finnish scores are weighted using industry-level post-stratification weights. Germany (Broszeit et al. 2019) and the USA (Bloom et al. 2013).

digitalised monitoring solutions, factors which are implicitly measured by the monitoring section of the FMOP questionnaire.

Evaluation of the different dimensions of the management score in Sweden, based on the World Management Survey (WMS), provides some further support for the conjecture that high monitoring scores may be related to the level of digitalization: Much like Finland in this paper, Sweden has a very high monitoring score in the WMS (Bloom et al. 2012). Sweden also ranks 4th in the Digibarometer for the years 2015 – 2017, higher than both Germany and the US (Ali-Yrkkö et al. 2019).[3]

To mitigate the effect of different establishment size limits, comparing employment weighted (aggregate) averages instead of simple average scores would be useful. However, we do not have estimates of the strength of the allocation of workforce from other countries based on a survey following the MOPS methodology. The World Management Survey (WMS) based international comparisons in Bloom, Sadun, et al. (2016), and our own calculations in Maliranta and Ohlsbom (2017), suggest that the reallocation of workforce is stronger in the USA compared to Finland. Furthermore, Bloom, Sadun, et al. (2016) note that the reallocation is stronger in the United States than in the other 33 countries in their comparison, including countries like Japan, Sweden, Germany, Singapore and others. However, the WMS scores and the MOPS scores are not directly comparable, so we can not estimate how much stronger reallocation is in the US compared to Finland.

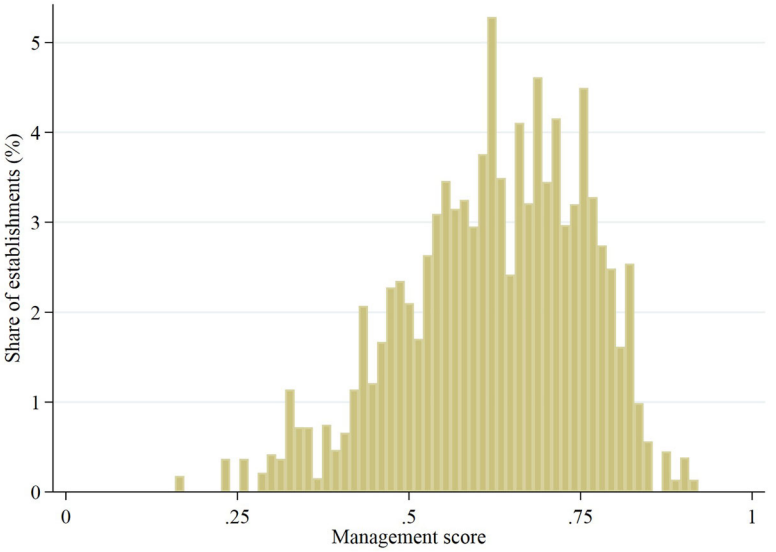

Figure 4. Distribution of the unweighted management scores.

2.3. Descriptive statistics

With a standard deviation of 0.13, the dispersion of the management practices of Finnish manufacturing establishments is evident. As described by Maliranta and Ohlsbom (2017), approximately 7% of establishments have a management score higher than 0.8, whereas establishments with a score of less than 0.4 make up a little over 5% of the data. Furthermore, Figure 4 shows that the distribution is skewed slightly to the left, which means that the mass of the establishments is concentrated on the right side of the distribution. A rudimentary examination of the data shows that a considerable part of this dispersion is related to differences in establishment size. This aspect of the dispersion is analysed more carefully in Maliranta and Ohlsbom (2017), where we find a positive correlation between establishment size, firm size and management scores.

The empirical analysis in the following section is focused on the possible role of cross-regional differences in the dispersion of management practices. The subdivision of large areas[4] was chosen to ensure that the individual areas have enough establishments in the data. Helsinki-Uusimaa is used as a baseline since it has the highest employment weighted (aggregate) and unweighted average management scores (0.71 and 0.64, respectively). Figure 5 shows a map of the large areas of Finland.

The economic and demographic differences between the large areas are visible in Table 1.

Population density and economic activity, measured by figures such as value added, GDP per capita and number of establishments, are the highest in Helsinki-Uusimaa by a relatively large margin. The higher density of production and housing might contribute to greater resource (re)allocation between establishments within Helsinki-Uusimaa. Furthermore, Helsinki-Uusimaa is by far the least rural of the large areas, with an 8.1% share of people living in rural areas, whereas the share is 24.5% in Southern Finland and more than 40% in both Western Finland and Northern & Eastern Finland.

Figure 5. The large areas (NUTS 2) of Finland. Source: Statistics Finland municipality-based statistical units. Contains data from the National Land Survey of Finland Background map series Database.

The last three rows in Table 1 describe job reallocation and worker flows in each of the large areas, providing us with complementary dynamic measures of allocation. Measuring these job and worker flows is based on the measures of the job creation rate (JC) and the job destruction rate (JD), which are calculated as $JC_t = \sum_i \Delta E_{it}^{+} / ((\sum_i E_{it} + \sum_i E_{i,t-1})/2)$ and $JD_t = \left|\sum_i \Delta E_{it}^{-}\right| / \left((\sum_i E_{it} + \sum_i E_{i,t-1})/2\right)$, respectively. Here, employment of firm i in year t is denoted by E_{it} and the plus and minus superscripts denote positive and negative changes in employment. The difference of the job creation and job destruction measures is called the net rate of change of employment (NET): $NET_t = JC_t - JD_t$ and the sum of these measures provides the (gross) job reallocation rate (JR): $JR_t = JC_t + JD_t$. (Davis and Haltiwanger 1998.)

Subtracting the absolute value of the net rate of employment from the gross job reallocation rate results in the excess job reallocation rate (EJR): $EJR_t = JR_t - |NET_t|$,

Table 1. Descriptive statistics for the large areas of Finland.

Statistic	Helsinki-Uusimaa	Southern Finland	Western Finland	Northern & Eastern Finland
Population density (per km^2)	180.1	36.8	23.7	6.4
Gross value added at basic prices (million EUR)	73,186	34,760	41,582	36,605
Share of manufacturing in gross value added	15.7%	24.9%	24.2%	21.0%
GDP per capita (EUR)	52,141	34,788	34,980	32,754
Employment (1000 persons)	876	496	606	539
Standard deviation of employment	30.2	16.7	16.4	17.5
Job vacancies	12,300	5,500	7,800	7,800
Economic dependency ratio	116.5	152.2	150.2	162.9
Share of population with higher education	12.8%	6.5%	7.0%	6.0%
Share of persons living in rural areas	8.1%	24.5%	40.4%	46.2%
Number of establishments	111,302	82,456	101,502	76,117
Turnover of establishments per employee (1000 EUR)	346	1,168	1,167	1,214
Excess job reallocation rate	15.2%	14.1%	14.0%	14.7%
Worker inflow rate	17.6%	15.3%	15.3%	16.3%
Worker outflow rate	21.8%	19.4%	18.8%	19.5%

Sources: Official Statistics of Finland (OSF) (2020): National Accounts and Enterprises. Source of excess job reallocation and worker flow rates: own calculations from linked employer-employee data of Statistics Finland. The job reallocation and worker flow rates are measured as averages of the rates in the years 2010 – 2014. The economic dependency ratio is calculated by dividing the sum of the number of unemployed and the number of inactive persons, or the non-employed population, by the number of employed and multiplying by one hundred. Higher education is defined as having a master's degree or equivalent level or a doctoral degree or equivalent level.

which is included in Table 1. It is a simultaneous measure of the economy's job creation and job destruction (Ilmakunnas and Maliranta 2003).

To calculate worker inflow, the number of employees who have started working at an establishment i during year t, and have not left by the end of year t, denoted by H_{it}, is summed over all establishments. Dividing the value of worker inflow by the average of employment in periods t and $t-1$ results in the worker inflow rate (WIF), also known as the hiring rate: $WIF_t = 100\sum_i \Delta H_{it} / \left((E_{it} + E_{i,t-1})/2\right)$. Similarly, worker outflow is $\sum_i S_{it}$, where S_{it} is the number of employees who started working in establishment i during year t, but have left by the end of year t. Again, the worker outflow rate (WOF) or separation rate is calculated by dividing the worker outflow by the average employment in periods t and $t-1$. (Ilmakunnas and Maliranta 2003.)

Differences in these worker flow measures highlight the importance of the allocation term, which is analysed in section 3, when performing cross-regional comparisons. Each of these statistics measures the highest in Helsinki-Uusimaa and the lowest in Western Finland and Southern Finland, the two of which have very similar labour market flow rates. All the flow rates of Northern & Eastern Finland are lower than those of Helsinki-Uusimaa but higher than those of the other large areas. These differences in worker flow rates suggest that, especially when comparing Helsinki-Uusimaa to Southern and Western Finland, the allocation of employment should be considered when estimating regional differences in management practices.

Studies from other countries have found significant differences in the unweighted management scores between different geographical areas (i.e. Bloom et al. (2012); Bloom et al. (2013)). Based on Table 2, which provides descriptive statistics of the FMOP data, these differences are not as apparent between the Finnish large areas.

Table 2. Descriptive statistics for the establishments in the FMOP data.

	Number of establishments	Total number of employees	Aggregate management score	Unweighted management score
Helsinki-Uusimaa	97	12,175	0.71	0.64
Southern Finland	146	14,090	0.67	0.63
Western Finland	209	24,646	0.68	0.62
Northern & Eastern Finland	149	15,461	0.70	0.63
Total	601	66,371	0.69	0.63

Figure 6 demonstrates that the differences in the unweighted average management scores of the Finnish large areas are quite small, especially in relation to the confidence intervals. The differences in the unweighted averages, which do not take the allocation of the workforce into consideration, are also not statistically significant. Figure 6 also includes the employment weighted, or aggregate, management scores, to which the related statistical inference is presented in section 3.

3. Methods and results

3.1. Premise

The descriptive statistics that are presented in the previous section would suggest that there are no significant differences in the management practices of the large areas of Finland when measured using unweighted management scores. However, a simple inspection of the means gives no insight into the possible differences in the covariance-like allocation term. A decomposition of the aggregate management score could potentially reveal statistically significant cross-regional differences in the allocation term, despite there being none when considering only the unweighted averages. Since the allocation term describes the amount of workforce that is allocated to establishments with good management practices, it is an important measure in terms of economic and policy significance.

As pointed out by Hyytinen, Ilmakunnas, and Maliranta (2016), a simple Olley-Pakes decomposition does not produce standard errors for the OP components or allow for any statistical inference regarding the policy relevant allocation term. They show, however, that this can be done by means of a procedure that is based on a generalized method of moments (GMM) estimation.

3.2. Methods

The empirical decomposition of the micro-level components of the levels of aggregate management practices in Finnish regions is performed using the method proposed by Olley and Pakes (1996). In the economics literature, these kinds of decompositions have often been used to analyse productivity levels. In the decomposition, aggregate productivity is divided into two terms: the unweighted average productivity and a covariance term of the productivity and firm size. The latter, which is also known as the allocation term, is essential because it describes how much of the input activity is allocated to more productive establishments or enterprises (Hyytinen, Ilmakunnas, and Maliranta 2016).

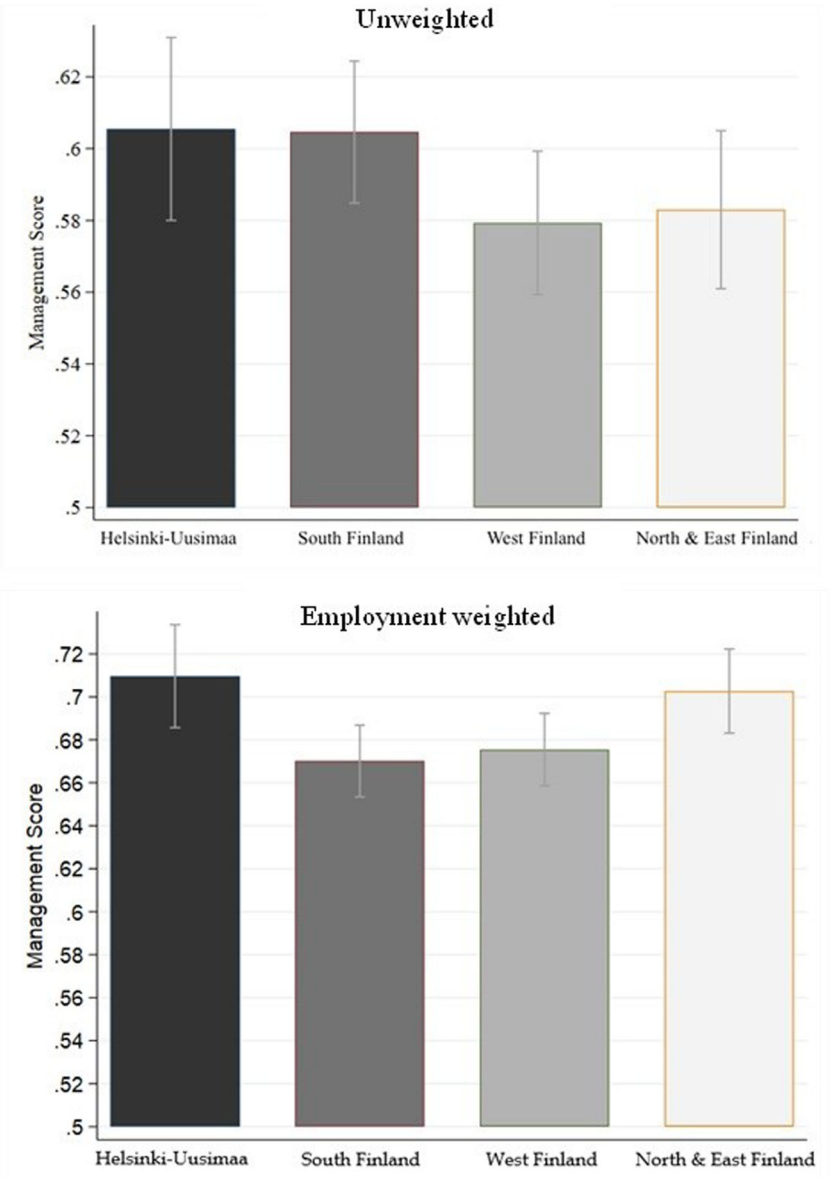

Figure 6. Unweighted and employment weighted average management scores for large areas with confidence intervals. Åland is omitted since it has only two establishments in the FMOP data.

A significant part of the growth and cross-country dispersion of productivity may be caused by the reallocation of resources from enterprises with low productivity to those with high productivity (Maliranta and Määttänen 2015). The covariance-like allocation term of the Olley-Pakes decomposition is a much-used measure for this reallocation since it is straightforward and has been theoretically and empirically shown to provide meaningful information. Bartelsman, Haltiwanger, and Scarpetta (2013), for example, show that the allocation term, measured as the covariance between

employment and productivity, is a robust indicator for the misallocation of resources and that it interacts strongly with frictions and policy-induced market distortions. Therefore, the allocation of resources with respect to management practices is measured as the covariance-like term between employment and the management score.

As with productivity, the qualities mentioned above make the Olley-Pakes covariance term essential in the analysis of cross-regional differences in management practices, especially in terms of how they relate to competitiveness. The aggregate (employment weighted) management score can be decomposed into the unweighted average score and the allocation effect, which is a covariance-like term for the management score and the size of the workforce in an establishment.

Here, the allocation term is economically significant because it measures how workforce is allocated between establishments with varying management scores. The larger the term, the larger share of the workforce is working under better managed establishments. This means that, in terms of competitiveness, the allocation term may play a crucial role when studying cross-regional differences.

Furthermore, comparing employment weighted (aggregate) averages instead of simple average scores would provide valuable insight into cross-country differences in management practices. Using employment weights decreases the impact of the smallest establishments on the results. This would help mitigate the comparability issues caused by each country's samples having different lower limits for establishment size.

To obtain the standard errors of the OP decomposition, a moment-based procedure, which was introduced by Hyytinen, Ilmakunnas, and Maliranta (2016), is used. This method allows for statistical inference and hypothesis testing of the magnitude of the OP components, which in turn allows for more statistically meaningful cross-regional comparisons of the allocation term.

The procedure is based on a method of moments estimation, which is a way of motivating an ordinary least squares (OLS) estimator (Davidson 2001). Hyytinen, Ilmakunnas, and Maliranta (2016) show how the components of the OP decomposition of aggregate labour productivity can be captured using a generalized method of moments (GMM) approach. This paper utilizes the same procedure for the aggregate management score in a cross-sectional setting. Following Olley and Pakes (1996), the decomposition is described by the expression

$$M_i = \overline{m} + \sum_{i=1}^{N} (s_i - \overline{s})(m_i - \overline{m}\Big), \tag{1}$$

where m_i is the management score of establishment i.

s_i is the activity share of establishment i, as measured using labour input shares. $\overline{m}_i$ denotes the unweighted mean of the management scores, whereas the weighted or aggregate management score is $M_i = \sum_{i=1}^{N} s_i m_i$. The remaining term, $\sum_{i=1}^{N} (s_i - \overline{s})(m_i - \overline{m})$, is the policy relevant allocation term. It then follows from the population moments expression of the regression,

$$E[m_i s_i] = E[m_i] + cov(m_i, s_i) var(s_i)^{-1} (s_i - E[s_i]), \tag{2}$$

that by scaling the labour input share measure s_i, a GMM estimation can capture the two components of the OP decomposition (Hyytinen, Ilmakunnas, and Maliranta 2016).

Table 3. Weighted and unweighted average management scores and allocation terms for the large areas with confidence intervals.

		95% confidence interval	
	Point estimate	Lower bound	Upper bound
Unweighted average management score			
Helsinki-Uusimaa	0.64	0.61	0.66
Southern Finland	0.63	0.61	0.65
Western Finland	0.62	0.61	0.64
Northern & Eastern Finland	0.63	0.61	0.65
Allocation term			
Helsinki-Uusimaa	0.07	0.04	0.11
Southern Finland	0.04	0.01	0.06
Western Finland	0.05	0.03	0.08
Northern & Eastern Finland	0.07	0.02	0.12
Aggregate average management score			
Helsinki-Uusimaa	0.71	0.67	0.75
Southern Finland	0.67	0.65	0.69
Western Finland	0.68	0.65	0.70
Northern & Eastern Finland	0.70	0.66	0.75

3.3. Results from the moment-based approach

As mentioned in section 1, the following analysis is descriptive, and no causal results can be inferred without strong additional assumptions. Table 3 shows the results of the moment-based estimation. The left column shows the point estimates for all areas, whereas the right column shows the associated 95% confidence intervals. The first four rows of each column are for the unweighted average management score of each area. The second four rows show the results for the allocation term of each area, and at the bottom is the aggregate (employment weighted) average, which is the sum of the first two components.

The results in Table 3 show that the confidence intervals in the lower bound and upper bound columns for Northern & Eastern Finland, especially for the allocation term, are clearly wider than those for the other large areas. Furthermore, the allocation terms in the point estimate column for Helsinki-Uusimaa and Northern & Eastern Finland account for approximately 10% of the respective aggregate management scores ($9.9\% \approx 100 * \frac{0.07}{0.71}$ and $10\% = 100 * \frac{0.07}{0.70}$), whereas for Southern Finland and Western Finland, these ratios are 6% and 7%, respectively. The differences in the unweighted average scores, as mentioned in subsection 2.3, are not statistically significant between any two large areas.

The statistical tests that were performed using the moment-based procedure show that the differences in allocation terms are also not statistically significant at conventional significance levels, except for the difference in the allocation terms between Helsinki-Uusimaa and Southern Finland in the point estimate column of Table 3 ($0.03 = 0.07 - 0.04$). The Wald test statistic, testing the null hypothesis that there is no difference between the allocation terms of Helsinki-Uusimaa and Southern Finland, is 2.76 ($p = 0.096$). The difference is therefore statistically significant at the 10% significance level. The difference in the allocation terms accounts for approximately $3/4$ or 75% of the difference in the aggregate management scores between these two areas.

Based on results from other countries, more cross-regional variations in the management practices of Finnish manufacturing establishments were expected. The lack

of large cross-regional variations suggests that intervening on the management practices of Finnish establishments is unlikely to be among the most important tools in compressing regional disparities in Finland. The allocation component of the management score almost entirely accounts for the little variations that were found.

This suggests that policies focusing on issues related to competition between establishments and the mobility of labour within regions would likely be more effective than trying to directly improve management practices. Labour mobility is necessary for the reallocation of employment, but also works as a channel of knowledge spillovers between firms (Maliranta, Mohnen, and Rouvinen 2009). Competition may drive workforce towards best-managed establishments and affect the adoption of management practices by increasing firms' incentives to invest in them (Bloom and Van Reenen 2007; Bloom et al. 2015).

Examining the relationship between some measures of competition, such as the Herfindahl–Hirschman Index (HHI) or concentration ratios, and the reallocation of employment could be an interesting supplement to the analysis. However, the choice of unit of observation (establishment or firm), level of industry classification and geographic regions to define the relevant market renders the commonly used measures of competition highly ambiguous in this context. We have therefore not included calculations involving these types of measures.

The results from the moment-based approach show that statistical inference concerning the allocation component of the decomposition is essential for credible analysis of cross-regional differences in management practices. Cross-country comparisons of the Olley-Pakes components of the management score would therefore provide new insights into the differences in the allocation of resources, management practices and the aggregate productivity of countries. This would complement existing and upcoming analyses of global competitiveness.

Furthermore, the aggregate (i.e. employment weighted) management score is more robust to different establishment size lower limits in the compared samples. Therefore, it allows for not only more relevant, but also more reliable comparisons in the presence of such differences in size cut-offs. However, uniform establishment size cut-off limits for samples, in addition to the statistical method used in this paper, are needed to reliably compare the covariance-like allocation terms between countries or regions.

Standard errors for the allocation component can be estimated using the moment-based estimation method presented in part 3.2. However, a downside to the moment-based estimation procedure is the inability to include control variables in the estimation. An OLS estimation of a linear regression model is therefore presented to support the robustness of the results.

3.4. OLS estimation results

The GMM estimation procedure, proposed by Hyytinen, Ilmakunnas, and Maliranta (2016), unfortunately does not allow for measuring the allocation component when the regression models include control variables, such as industry fixed effects. However, the allocation term can also be computed by performing a standard OLS estimation with and without employment weights and taking the differences of the

parameter estimates of these two estimations. Unlike the GMM estimation procedure, this does not provide us with the standard errors for the allocation component.

Estimating the regression models with and without employment weights, while including control variables, can nevertheless provide evidence on the regional differences in the aggregate management practice quality levels, and at least an impression of the role of the allocation of employment between establishments. The results of the OLS regression can be found in Table 4, where the other large areas are compared to Helsinki-Uusimaa.

Adding employee education (average years of schooling) as a control variable in columns $5-8$ shows that the education level of employees might have a positive relationship with the management quality in Helsinki-Uusimaa, but the inclusion of this factor does not dramatically change the results for regional differences. Productivity (log(revenue)/number of employees) is, as expected, also positively correlated with the management score, as seen in columns $9-16$.

Qualitatively similar conclusions concerning regional differences are obtained from the regressions that include both education and productivity effects, presented in columns $13-16$ of Table 4. Helsinki-Uusimaa has an aggregate score that is between 0.05 and 0.06 higher than Southern Finland ($p < 0.05$), with and without industry fixed effects. This difference could be considered somewhat economically significant in magnitude since the management scores are normalized on a scale of $0-1$. Without industry fixed effects, Helsinki-Uusimaa's aggregate score is approximately 0.04 higher than Western Finland ($p < 0.10$). However, the statistical significance of the latter difference disappears when industry fixed effects are included.

With industry fixed effects included, the regional differences become larger by a small margin in every regression, with and without the control variables, but the conclusions remain unchanged. Furthermore, columns 4, 10, 12, 14 and 16 of Table 4 provide evidence that the aggregate (employment weighted) management quality is greater in Helsinki-Uusimaa than in Southern Finland.

The moment-based estimation in part 3.3 shows that the allocation terms are statistically significantly different between Helsinki-Uusimaa and Southern Finland, but the unweighted scores are not. The latter conclusion is supported by the OLS estimation, which unfortunately cannot be used to estimate the former. Since the moment-based estimation procedure does not allow control variables, the OLS estimation results are more credible when examining differences in the aggregate scores. However, since OLS does not allow for statistical inference or hypothesis testing concerning the allocation component, we must rely on the moment-based estimation for the allocation terms.

The OLS results suggest that if we were able to include control variables in the GMM estimation, we would find a statistically significant difference in the aggregate scores of Helsinki-Uusimaa and Southern Finland, like we did for the allocation term. Combining the GMM and OLS results indicates that the difference in the aggregate scores can be attributed to differences in the allocative efficiency of the regions, not differences in the quality of management practices at the establishment level.

Table 4. OLS regression results.

Management score	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Employment weighted		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Southern Finland	−0.005	−0.040	−0.010	−0.046*	−0.014	−0.036	−0.019	−0.043	−0.006	−0.052**	−0.009	−0.057**	−0.014	−0.055**	−0.018	−0.058**
	(0.016)	(0.024)	(0.017)	(0.025)	(0.018)	(0.026)	(0.018)	(0.027)	(0.017)	(0.021)	(0.017)	(0.024)	(0.018)	(0.023)	(0.018)	(0.025)
Western Finland	−0.013	−0.034	−0.013	−0.036	−0.020	−0.032	−0.020	−0.032	−0.010	−0.039	−0.010	−0.041*	−0.017	−0.040*	−0.017	−0.041
	(0.016)	(0.025)	(0.016)	(0.026)	(0.018)	(0.026)	(0.017)	(0.028)	(0.016)	(0.022)	(0.016)	(0.025)	(0.018)	(0.024)	(0.017)	(0.026)
Northern & Eastern Finland	−0.007	−0.007	−0.014	−0.019	−0.005	−0.001	−0.013	−0.014	−0.004	−0.008	−0.010	−0.018	−0.001	−0.010	−0.009	−0.020
	(0.017)	(0.032)	(0.017)	(0.028)	(0.019)	(0.033)	(0.019)	(0.030)	(0.017)	(0.030)	(0.017)	(0.027)	(0.019)	(0.031)	(0.019)	(0.029)
Employee education					0.017***	0.005	0.017***	0.005					0.014***	−0.004	0.012**	−0.006
					(0.005)	(0.008)	(0.006)	(0.008)					(0.005)	(0.008)	(0.006)	(0.008)
Productivity (log)									0.030***	0.046***	0.027***	0.043***	0.033***	0.047***	0.029***	0.044***
									(0.007)	(0.009)	(0.007)	(0.009)	(0.007)	(0.009)	(0.007)	(0.010)
Observations	601	601	601	601	517	517	517	517	601	601	601	601	517	517	517	517
Industry Fixed Effects			Yes	Yes			Yes	Yes			Yes	Yes			Yes	Yes
R^2	0.001	0.019	0.039	0.056	0.022	0.020	0.061	0.061	0.044	0.103	0.070	0.123	0.073	0.101	0.0982	0.1243
Prob > F	0.872	0.287	0.003	0.050	0.011	0.395	0.000	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: The coefficient for each large region shows the difference in the mean of the management score compared to Helsinki-Uusimaa. Productivity (log) is measured as log(revenue/number of employees). Employee education is measured as the employees' average years of schooling for each establishment. The industry fixed effects were calculated at the 2-digit level of the Standard Industrial Classification; manufacturing (10-33) was divided into seven subindustries: 10-15, 16-18, 19-23, 24-25, 26-27, 28-30 and 31-33. Prob > F is the p-value of the F-test and standard errors are in parentheses.

*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.5. Validity of the results

As mentioned in section 2, the data are skewed towards larger establishments and establishment size seems to be positively correlated with the management score. This means that the sample means that are calculated from the data are likely to be too high compared to the population means, unless post-stratification weights are used to correct for this non-response bias. The post-stratification weights used in the international comparisons are calculated from the entire population of manufacturing establishments, so they should be relatively effective in correcting for the non-response bias.

It is unlikely that there are systematic differences in the amount of bias between the large areas. Therefore, non-response bias should not significantly affect the main conclusions presented in this paper. If the bias were bigger in one large area than in another, the unweighted management score of the large area with greater non-response bias would be overestimated. However, employment weighted measures are much less affected by this type of bias, since the biggest measurement issues stem from missing small, rather than big, establishments. This implies that the allocation terms would be underestimated in the large areas with worse non-response bias.

Furthermore, the number of establishments in the data is relatively small, which might partly explain the apparent lack of statistically significant results. The partitioning into large areas was chosen partly because of the small sample size, yet the number of data points for each area remains relatively low. The measured cross-regional differences are also somewhat small in magnitude, which is a result that most likely would not be affected by a larger sample size.

However, more robust results could be achieved by repeating the survey for a larger sample, which should also contain the establishments that were included in the 2016 FMOP data. Combining more comprehensive data on management practices with the exceptionally rich microdata of Statistics Finland would allow for more potent robustness tests and further analysis. Creating a time series of Finnish management practices using the FMOP methodology would also enable researchers to study how the adoption of structured management practices evolves over time.

The FMOP, like any large-scale survey, almost certainly suffers from survey noise, but there should be no systematic differences in the amount or type of survey noise between the large areas. Therefore, it is unlikely to interfere with the comparisons. Some rudimentary descriptive analysis was also conducted using Finnish regions (NUTS 3) instead of large areas. The results suggest that the apparent statistical non-significance of the cross-regional differences in the unweighted management scores is likely preserved for this geographical division. However, for some of the regions, the number of establishments in the data is extremely small. Figure 7 shows the unweighted average management scores for each region.

We have also conducted the OLS and the moment-based estimations in log-units, which returned similar results. Furthermore, the analysis was conducted with and without mining and utilities, industries that are included in manufacturing[5] in the Finnish sample but were not included in the United States MOPS. The exclusion of these industries did not change the conclusions presented in the paper, but it does restrict the data by an additional 98 observations. All the analyses in sections 2 and 3 are

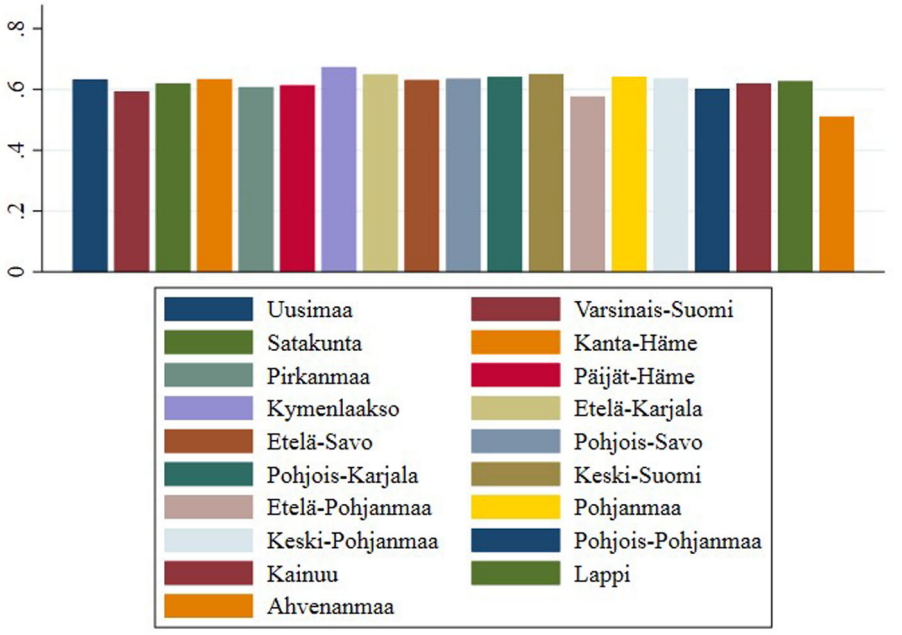

Figure 7. Unweighted average management scores by region.

descriptive, and without additional assumptions, no causal inferences can be made based on the calculations that are presented.

4. Conclusions

An examination of Finnish manufacturing establishments, using data from the Finnish Management and Organizational Practices Survey, showed no statistically significant cross-regional differences in the unweighted management scores when comparing the large areas of Finland. An Olley-Pakes decomposition is utilized to split the aggregate (employment weighted) management score into an unweighted average component and a covariance-like allocation term. Examining the regional differences in the OP components using a moment-based estimation procedure, presented in Hyytinen, Ilmakunnas, and Maliranta (2016), provides us with standard errors for the estimates of the allocation term, which is novel in the literature.

Our analyses advice policy-makers to direct their attention to the competition and the mobility of the labour force between firms. We find suggestive indications of small to moderate regional variations in the allocation component of the management scores of Finnish manufacturing establishments. This points to the allocation of employment between establishments within regions as an explanation for the regional differences in management practices. What drives this variation in Finland is a subject for future research. However, Bloom et al. (2019) conclude that two key drivers for the differences in the management practices in the United States are the business environment and learning spillovers.

An OLS estimation is performed to support the conclusions drawn from the moment-based estimation procedure. The results for the aggregate (employment weighted) differences between regions are robust to the inclusion of the educational level of employees and the productivity level of the establishments as control variables. However, with currently known methods, we are unable to test whether the difference in the allocation term is robust to the inclusion of control variables.

The results suggest that the regional variations in the aggregate score are related to differences in the allocative efficiency within the regions, not to differences in the quality of management practices at the level of establishments. This shows that statistical inference concerning the allocation component of the decomposition is an integral part of any cross-regional, or cross-country, comparisons of management practices. The literature has so far largely ignored this aspect of the uncertainty concerning the measurement of management practices.

Many countries have found large differences in the quality of management practices between establishments, firms, industries and geographical areas (Bender et al. 2018; Bloom, Sadun, et al. 2016; Bloom et al. 2019). Since management practices are also closely related to firm productivity (Bloom et al. 2019), and therefore economic competitiveness, understanding the variations in management practices should clearly be of major policy interest. In particular, the share of the workforce that is allocated to establishments with different levels of management practices is a policy relevant piece of the productivity puzzle. The results presented in this paper highlight the importance of workforce allocation, and the uncertainty regarding its estimates, when measuring management practices.

Despite the varied economic and demographic features of the Finnish large areas, and in contrast with the international results, we find surprisingly little cross-regional variations in the quality of management practices in Finland. This, and the already internationally competitive level of Finnish management, implies that investing in the improvement of management practices is unlikely to be the most effective tool in compressing regional disparities, for example.

Instead, our analysis suggests that more attention should be paid to factors that are reducing the mobility of the workforce and hampering competition between firms, both important elements of (re)allocation of employment. Besides being a mechanism of reallocation, the mobility of the labour force works as a channel of knowledge spillovers between firms (Maliranta, Mohnen, and Rouvinen 2009). Competition may increase firms' incentives to invest in their management practices (Bloom and Van Reenen 2007; Bloom et al. 2015) and drive workforce towards best-managed firms through a process involving creative destruction, with the result of improved competitiveness at the level of the economy or its regions.

We suggest that if the methods presented in this paper were used to analyse the management differences of cities and industries, in other countries or between countries, researchers might find results that are of major policy relevance for the purpose of improving productivity and economic competitiveness. Our cross-regional analysis highlights the uncertainty in international comparisons when they are performed without the use of micro-level decomposition methods and standard errors for the covariance-like allocation term.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes

1. See for example Foster, Haltiwanger, and Krizan (2001) for an overview.
2. A more detailed description is provided in the appendix.
3. We thank an anonymous referee for suggesting a consideration of the potential role of digitalization in the monitoring dimension of management.
4. Level 2 of the subdivisions in the Nomenclature of Territorial Units for Statistics (NUTS) codes of Finland.
5. Establishments were classified as manufacturing if they belong to industries 05-39 in the Standard Industrial Classification TOL 2008 (Statistics Finland 2017)
6. Available at https://www.census.gov/programs-surveys/mops/technical-documentation/questionnaires.html.

Acknowledgements

This research has been conducted as a part of the Skills, Education and the Future of Work research project, funded by the Strategic Research Council at the Academy of Finland. Mika Maliranta thanks the Institute of Social Research in Norway (295914) for financial support. This work was also supported by the OP Group Research Foundation under Grant 20190053.

Notes on contributors

Roope Ohlsbom M.Sc. (Economics and Business Administration) is a research assistant at ETLA Economic Research (Etla) and a doctoral candidate at the Jyväskylä University School of Business and Economics.

Mika Maliranta Ph.D. (Economics) is a professor of economics at the Jyväskylä University School of Business and Economics and a research professor at the Finnish Competition and Consumer Authority.

ORCID

Roope Ohlsbom http://orcid.org/0000-0001-9414-7684

Data availability

All the data is controlled by Statistics Finland and can be accessed by contacting Statistics Finland's research services and completing an application for licence to use the statistical data. See https://www.tilastokeskus.fi/tup/mikroaineistot/index_en.html.

References

Ali-Yrkkö, J. Mattila, J., Pajarinen, M.. and Seppälä, T. Digibarometri. 2019: Digi tulee, mutta riittävätköresurssit? Helsinki: Taloustieto Oy.

Awano, G., N. Bloom, T. Dolby, P. Mizen, R. Riley, T. Senga, J. Vyas, and P. Wales. 2018. Management Practices and Productivity in British Production and Services Industries - Initial Results from the Management and Expectations Survey: 2016. Office for National Statistics.

Awano, G., A. Heffernan, and H. Robinson. 2017. Management Practices and Productivity among Manufacturing Businesses in Great Britain: Experimental Estimates for 2015. Office for National Statistics.

Bartelsman, E., J. Haltiwanger, and S. Scarpetta. 2013. Cross-Country Differences in Productivity: The Role of Allocation and Selection. *American Economic Review* 103 (1): 305–334. doi:10.1257/aer.103.1.305.

Bender, S., N. Bloom, D. Card, J. Van Reenen, and S. Wolter. 2018. Management Practices, Workforce Selection, and Productivity. *Journal of Labor Economics* 36 (S1): S371–S409. doi:10.1086/694107.

Bloom, N., E. Brynjolfsson, L. Foster, R. Jarmin, I. Saporta-Eksten, and J. Van Reenen. 2013. Management in America. US Census Bureau Center for Economic Studies, Paper No. CES-WP-13-01.

Bloom, N., R. Sadun, and J. Van Reenen. 2016. Management as a Technology? NBER Working Paper 22327.

Bloom, N., E. Brynjolfsson, L. Foster, R. Jarmin, M. Patnaik, I. Saporta-Eksten, and J. Van Reenen. 2019. What Drives Differences in Management Practices?. *American Economic Review* 109 (5): 1648–1683. doi:10.1257/aer.20170491.

Bloom, N., C. Genakos, R. Sadun, and J. Van Reenen. 2012. Management Practices across Firms and Countries. *Academy of Management Perspectives* 26 (1): 12–33. doi:10.5465/amp.2011.0077.

Bloom, N., R. Lemos, R. Sadun, D. Scur, and J. Van Reenen. 2016. International Data on Measuring Management Practices. *American Economic Review* 106 (5): 152–156. doi:10.1257/aer.p20161058.

Bloom, N., C. Propper, S. Seiler, and J. Van Reenen. 2015. The Impact of Competition on Management Quality: Evidence from Public Hospitals. *The Review of Economic Studies* 82 (2): 457–489. doi:10.1093/restud/rdu045.

Bloom, N., and J. Van Reenen. 2007. Measuring and Explaining Management Practices across Firms and Countries. *The Quarterly Journal of Economics* 122 (4): 1351–1408. doi:10.1162/qjec.2007.122.4.1351.

Broszeit, S., M.-S. Laible, U. Fritsch, and H. Görg. 2019. Management Practices and Productivity in Germany. *German Economic Review* 20 (4): e657–e705. doi:10.1111/geer.12187.

Davidson, J. 2001. *Econometric Theory*. Oxford: Blackwell Publishers.

Davis, S. J., and J. Haltiwanger. 1998. Measuring Gross Worker and Job Flows. In *Labor Statistics Measurement Issues*, 77–122. Chicago: University of Chicago Press.

Foster, L., J. Haltiwanger, and C. J. Krizan. 2001. Aggregate Productivity Growth: Lessons from Microeconomic Evidence. In *New Developments in Productivity Analysis*, edited by C. R. Hulten & E. R. Dean, 303–363. Chicago and London: University of Chicago Press.

Hyytinen, A., P. Ilmakunnas, and M. Maliranta. 2016. Olley–Pakes Productivity Decomposition: computation and Inference. *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 179 (3): 749–761. doi:10.1111/rssa.12135.

Ilmakunnas, P., and M. Maliranta. 2003. The Turnover of Jobs and Workers in a Deep Recession: evidence from the Finnish Business Sector. *International Journal of Manpower* 24 (3): 216–246. doi:10.1108/01437720310479714.

Maliranta, M., and N. Määttänen. 2015. An Augmented Static Olley–Pakes Productivity Decomposition with Entry and Exit: Measurement and Interpretation. *Economica* 82 (s1): 1372–1416. doi:10.1111/ecca.12159.

Maliranta, M., and R. Ohlsbom. 2017. Suomen tehdasteollisuuden johtamiskäytäntöjen laatu. ETLA Reports No 73. [Referred 12.11.2017]. Available at: https://www.etla.fi/wp-content/uploads/ETLA-Raportit-Reports-73.pdf.

Maliranta, M., P. Mohnen, and P. Rouvinen. 2009. Is Inter-Firm Labor Mobility a Channel of Knowledge Spillovers? Evidence Form a Linked Employer-Employee Panel. *Industrial and Corporate Change* 18 (6): 1161–1191. doi:10.1093/icc/dtp031.

Official Statistics of Finland (OSF) 2020a. Regional Account [e-publication]. Helsinki: Statistics Finland [referred 26.3.2020]. Available at: http://www.stat.fi/til/altp/index_en.html.

Olley, G. S., and A. Pakes. 1996. The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica* 64 (6): 1263–1297. doi:10.2307/2171831.
Statistics Finland 2017. Document: MOPS-Keruun Toteutus. Description of data collection.
Statistics Finland 2017. Financial statements inquiry for enterprises (TILKES). Statistics Finland Data Collections. [Referred 12.5.2017]. Available at: http://stat.fi/keruu/yrti/index.html.
Statistics Finland 2017. Standard Industrial Classification TOL 2008. Statistics Finland Data Collections. [Referred 15.5.2017]. Available at: http://stat.fi/meta/luokitukset/toimiala/001-2008/index.html.
Statistics Finland 2020. Municipality-based statistical units. [Referred 9.4.2020]. Available at: https://www.stat.fi/org/avoindata/paikkatietoaineistot/kuntapohjaiset_tilastointialueet_en.html.
Syverson, C. 2011. What Determines Productivity?. *Journal of Economic Literature* 49 (2): 326–365. doi:10.1257/jel.49.2.326.

Appendix: data description

Survey Design

Sampling frame

The enterprise-level sampling frame for the 2016 FMOP is based on the total sample of Statistics Finland's Financial statements inquiry for enterprises (TILKES). The TILKES concerns all enterprises that employ over 50 people, or who alternatively have a turnover of more than EUR 40 million or whose balance sheet exceeds EUR 300 million (Statistics Finland 2017). The inquiry also includes 10-50 employee enterprises, which have been selected using random sampling, some enterprises with less than 10 employees and all enterprises that are owned by municipalities. The inquiry includes approximately 6000 enterprises in total. The FMOP sampling frame consists mainly of the over 3-employee manufacturing establishments of the over 50-employee enterprises that are included in the TILKES inquiry.

Sample

The sample for the 2016 FMOP data collection consisted of 2509 manufacturing establishments with at least 4 employees that were extracted from the manufacturing and non-manufacturing enterprises that were included in the TILKES based sampling frame. Establishments were classified as manufacturing if they belong to industries 05-39 in the Standard Industrial Classification TOL 2008 (Statistics Finland 2017). A manufacturing establishment with at least 4 employees was picked from the sampling frame if it was a part of an enterprise that meets at least one of the following criteria: (1) More than 50 employees, (2) greater than a EUR 40 million turnover, or (3) a balance sheet of more than EUR 300 million. The main rule for the sample selection was the number of personnel, but the sample includes 38 enterprises with less than 50 employees, which is due to the other conditions. Because the establishments in the sample were chosen using nonprobability sampling, most of the results can only be generalized to the subset of manufacturing establishments that have at least 4 employees and are a part of an enterprise with at least one of the qualities that were listed above. (Statistics Finland 2017.)

Data collection

The first step of data collection was to find a respondent for each establishment in the sample. Telephone interviews were conducted to find the plant managers to whom to send the questionnaire. 10% of the original sample was lost at this phase due to over-coverage and recipients' unwillingness to answer. The survey was conducted as an internet questionnaire, and the description, instructions and link for it were sent out as an email to the target respondents. Responding was voluntary, and three follow-ups were sent to establishments that could not be reached or did not respond. Over-coverage and establishments that were explicitly unwilling to answer were dropped after each follow-up.

Questionnaire content

To ensure comparability between results, the FMOP questionnaire followed the United States 2010 MOPS[6] as closely as possible. The questionnaire has a total of 35 questions, 16 of which concern management practices. In addition to the 16 management questions, the questionnaire has 13 questions on organizational practices and 6 background questions. The questionnaire concerns the past year (2016), but most of the questions also have a recall component where respondents are asked to give an answer regarding the circumstances five years earlier (2011). The questions are in Finnish and have been translated to correspond with the questions of the US MOPS. The complete FMOP questionnaire can be found at the end of this document.

Data

The final number of valid responses was 731 with a response rate of approximately 31% after accounting for over-coverage. According to the feedback from the establishments, the voluntary nature of the survey was a major negative factor in their willingness to respond. This can also be seen when comparing the 31% response rate of the FMOP to the 78% response rate of the original 2010 MOPS in the United States where the survey was mandatory. Technical issues also affected the response rate since the survey was conducted solely through the internet. The analysis of the total non-responses that was conducted by Statistics Finland showed that the distribution of the respondents was skewed towards larger establishments, as measured by the number of personnel. Statistics Finland conducted post-stratification to provide sample weights that correct for non-response bias. The over-coverage of 146 establishments was also taken into account when constructing the sample weights.