For Online Publication

Appendix A: Data

The Management and Organizational Practice Survey (MOPS)

Sample Selection: The sample for the 2010 MOPS consisted of the approximately 50,000 establishments in the 2010 Annual Survey of Manufacturers (ASM) mailout sample. The mailout sample for the ASM is redesigned at 5-year intervals beginning the second survey year subsequent to the Economic Census. (The Economic Census is conducted every five years in years ending in '2' or '7.') For the 2009 survey year, a new probability sample was selected from a frame of approximately 117,000 manufacturing establishments of multi-location companies and large single-establishment companies in the 2007 Economic Census, which surveys establishments with paid employees located in the United States. Using the Census Bureau's Business Register, the mailout sample was supplemented annually by new establishments, which have paid employees, are located in the United States, and entered business in 2008 - 2010.[1]

Overall, 49,782 MOPS surveys were sent for 2010, of which 2,248 were undeliverable as addressed. For the 47,534 surveys which were successfully delivered, 37,177 responses were received, implying a high response rate of 78%. For most of our analysis, we further restrict the sample to establishments with at least 10 non-missing responses to management questions (including those that missed questions by correctly following the skip pattern) and a successful match to ASM, which were also included in ASM tabulations, have a valid identifier in the LBD (LBDNUM), have positive value added, positive employment and positive imputed capital in the ASM (see below for details on capital imputation). For the 2010 sample, Table A3 shows how the numbers of firms and average employment changes as we condition on different sub-samples.

The sample for the 2015 MOPS was constructed following the same methodology, and were matched to the ASM and LBD on the same criteria.

In Table A5, we report the results for linear probability models for the different steps in the sampling process. In column (1) the sample is 2010 ASM observations with positive employment and sales and the dependent variable is an indicator that equals 1 if MOPS was sent to the establishment and zero otherwise. The right hand side of the regression includes the log of employment and a set of region and industry dummies. The establishments that were mailed the MOPS survey are somewhat larger. This difference between the ASM respondents and the MOPS mail sample is in part due to the continued sampling of new births in the ASM throughout the survey year, which focuses particularly on gathering data for large establishments. However, because the MOPS was mailed after the ASM, some ASM cases did not receive the MOPS due to status updates. In column (2), we compare MOPS respondents to the MOPS mail-out sample, finding that MOPS respondents tend to be slightly larger. Finally, in columns (3) to (5), we compare our "clean" sample to the sample of respondents and to the ASM sample, finding again that the "clean" sample has slightly larger establishments, which are also slightly more productive (column (5)).

Management Scores: The management score for each establishment is generated in two steps.[2] First, the responses to each of the 16 management questions are normalized on a 0-1 scale. The response which is associated with the most structured management practice is normalized to 1, and the one associated with the least structured is normalized to zero. Table A2 contains the details on this. We define more structured management practices as those that are more specific, formal, frequent or explicit. For example, when asking "*...when was an under-performing non-manager*

[1] This paragraph is from the official methodological documentation for the 2010 MOPS, which can be found at https://www.census.gov/mcd/mops/how_the_data_are_collected/index.html. The certainty category slightly differs over industries. For more details on the ASM sample design see: http://www.census.gov/programs-surveys/asm/technical-documentation/methodology.html

[2] The full survey instrument is available on https://www.census.gov/programs-surveys/mops/technical-documentation/questionnaires.html

reassigned or dismissed?", the response "*Within 6 months of identifying non-manager under-performance*" is ranked 1 and the response "*Rarely or never*" is ranked 0. If a question has three categories, the "in between" category is assigned the value 0.5. Similarly for four categories the "in between" categories are assigned 1/3 and 2/3 and so on.[3] Second, the management score is calculated as the unweighted average of the normalized responses for the 16 management questions. In robustness tests, we also evaluated another way to average across the 16 individual scores. We used a management z-score, which normalizes each question to have a mean of 0 and a standard deviation of 1 and averaging across these. We found that our results were extremely similar because the average z-score is extremely correlated with our main management measure.

Recall questions: In each wave, managers were asked to report the answer to each question for both the survey year and for five years earlier (in 2015 we asked about 2010 and in 2010 about 2005). This allows us to construct recall measures for the management score in 2005, and for missing observations in 2010. For all establishments that we observe both in 2010 and in 2015, we have both real and recall data. This provides us with a unique opportunity to benchmark the quality of the recall responses. The key variable that determines the quality of recall management score is the tenure at the establishment of the manager responding to the survey. Appendix Figure A3 shows how the correlation between the 2010 management score and the 2010 recall score (collected in 2015) correlate as a function of the respondent start year at the establishment. As is clear from the figure, for managers who started 2008 or before, the correlation is stable and high (at 0.48). Following this analysis, we only use 2005 and 2010 recall values for the management score when the survey respondent has at least 7 years of tenure at the establishment.

Share of employees with a degree: To generate our firm level measure of employees with a degree we used the mid-point values in the bin responses in questions 34 and 35 (2010 numbering) scaled up by the share of managers and non-managers in the firm calculated from the response to questions 32 and 33.

Decentralization: We calculate decentralization measures in two steps. First, we score MOPS questions 18 through 23 (2010 numbering) on a 0-1 scale, where 0 is least decentralized, and 1 is most decentralized. We then average the scores over those six questions.

Data-driven decision making: We create data driven decision making measures in two steps. First, we score MOPS questions 27 and 28 (2010 numbering) on a 0-1 scale, where 0 is lowest availability/use of data, and 1 for highest. We then average the scores over those two questions.

Additional Databases

Establishment level: Our primary source of establishment-level data in addition to the MOPS is the ASM from 2003 to 2015. We use the Census of Manufactures (CM) from 2002, 2007 and 2012 to obtain data on capital stocks, which is then combined with the ASM data on investment flows to impute capital stock for 2005, 2010 and 2015 (see details below). The CM is conducted every 5 years (for years ending 2 and 7) as part of the Economic Census. It covers all establishments with one or more paid employees in the manufacturing sector (SIC 20-39 or NAICS 31-33) which amounts to 300,000 to 400,000 establishments per survey. Both the CM and the ASM provide detailed data on sales/shipments, value added, labor inputs, labor cost, cost of materials, capital expenditures (including in ICT), inventories and much more. We match the MOPS to the ASM using the SURVU_ID variable, and match the ASM to the CM, as well as ASM and CM over time using the LBDNUM variable. Finally, we use the Longitudinal Business Database (LBD) to describe the universe of establishments in Table A3 as well as for the calculation of firm level characteristics such as age, spread of age and employment, and number of industries and locations the firm operates in.

Firm level: We use the 2009 Business R&D and Innovation Survey (BRDIS) data to obtain information on R&D spending and patent applications by the parent firm associated with each establishment. BRDIS provides a nationally representative sample of all companies with 5 or more employees. It is conducted jointly by the Census Bureau and

[3] For multiple choice questions which allow for the selection of more than one answer per year, we use the average of the normalized answers as the score for the particular question. If the question does not allow for the selection of more than one answer, but more than one box is selected, we treat the observation as missing.

the NSF and collects data on a variety of R&D activities. It replaced the Survey of Industrial Research and Development (SIRD) in 2008. The BRDIS is matched to the ASM (and then to MOPS) using the LBD. We are able to match a total of 13,888 MOPS observations in our "clean" sample to BRDIS observations with non-missing data on R&D spending and patent applications.[4]

Industry level: We use the NBER-CES data for industry-level price indices for total value of shipments (PISHIP), and capital expenditures (PIINV), as well as for total cost of inputs for labor (PAY), used in the construction of cost share. We match the NBER data to the establishment data using 6-digit NAICS codes.[5] We use the BLS multifactor productivity database for constructing industry-level cost of capital and capital depreciation, and the BEA fixed assets tables to transform establishment-level capital book value to market value.[6]

Million-Dollar-Plants (MDPs): We follow the approach in Greenstone, Hornbeck and Moretti (2010) in tracking events where large (mostly multinationals) firms pick a site for a new large establishment. Greenstone, Hornbeck and Moretti (2010) used articles from the feature on "Million Dollar Plants" from Site Selection, a business magazine. Unfortunately this segment has been discontinued, hence to expand our data of MDPs we had to combine data from multiple other sources. First, Site Selection magazine does report 'Top Deals' and 'Honorable Mentions', which we have used. Second, we have used the Southern Business and Development top deals. Third, we use deals from Hyunseob Kim's dataset built for his work titled "How Does Labor Market Size Affect Firm Capital Structure? Evidence from Large Plant Openings".[7] Finally, we included any other site selection deals which we came across while searching for control counties for any of the other deals, as well as web-searching for additional deals using the key terms "blockbuster deal archive," "runner up," "winning bid," "top deals" and "location report."

Once we have the top MDP deals, we have searched for the control locations – counties which were mentioned as runner ups for the chose location. For our final MDP list, we require to have at least one county control.[8]

Industry distance measures: For our analysis of MDPs we construct distance measures between industries. Our main distance measure is based on managers' flow between industries. These flows were constructed using CPS data from the monthly basic files of 2003 to 2015 (downloaded from IPUMS). Using these data, we constructed the CPS panels, and then within each person, we identified job-to-job transitions.[9] For our baseline measure we then only keep transitions of workers in occupations classified as "Executive, Administrative, and Managerial Occupations", corresponding to occupation codes 003 to 037 in the IPUMS harmonized occ1990 variable. We then match the CPS industry codes to NAICS codes (3 digit for manufacturing and mostly 2 digit outside manufacturing – overall 43 categories), and create a transition matrix. When matching the matrix to our sample, we treat the MDP as the source of the flow.
As a robustness test we use a similar measure which is constructed using all workers transition, rather than only workers in managerial occupations.
The other distance measure we use is based on trade flows between industries. To construct this distance measure we simply use the real input-output matrices calculated by the BLS.[10] We take the average of in and out flows as our distance measures between the industries.

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4 For more details see http://www.census.gov/manufacturing/brdis/index.html and http://www.nsf.gov/statistics/srvyindustry/about/brdis/interpret.cfm.

5 See: http://www.nber.org/nberces/ for the public version. We thank CES for providing us with an updated version of the data.

6 For more details about the relevant variables from the BLS and BEA tables, see the appendix to Bloom, Floetotto, Jaimovich, Terry and Saporta (2018).

7 We are grateful to Hyunseob Kim for sharing an updated list of million dollar plants and discussing search strategies from his work Kim (2013)

8 While we do not use them in the analysis, our compiled list of MDPs includes also pairs where the control is at the state level.

9 These can be identified using the CPS interviewer's question whether the person works for the same employer (see for example Fallick and Fleischman, 2004).

10 This can be downloaded from: https://www.bls.gov/emp/ep_data_input_output_matrix.htm

Additional Variable Construction

Capital Imputation: As mentioned above, the capital measures are based on the CM 2002, 2007 and 2012 reported book value of assets. We first transform book values to market using the industry-level BEA fixed assets tables, and then deflate both the initial stock and the investment flows using the NBER deflators. We then apply the perpetual inventory method (PIM) to impute capital stocks for 2005, 2010 and 2015. This procedure only provides us with capital stock values in 2010 for establishments which were in the CM in 2007 and in the ASM in both 2008, 2009 (and analogously 2013, 2014 for 2015 MOPS). To impute capital stock for establishments observed in 2010 or 2015 but do not meet the criteria above, we follow the following procedure:[11]

(a) If investment in 2009 is missing, impute it using the average investment for the plant in 2008 and 2010 (or 2007 and 2010 if 2008 missing).

(b) Similarly, if investment in 2008 is missing, impute it using 2007 and 2009 (or 2007 and 2010 if 2009 is missing).

(c) For 2008 and 2009 births, use the establishment's 2008 or 2009 investment to initialize the capital stock. To do that use the 2007 median ratio of book value to investment for new establishments by 6 digit NAICS (winsorized at the 95%, since some industries have very small number of observations). Run the PIM again using these initial capital stocks, only for observations with missing capital stock in 2010.

(d) For observations that are still missing capital stock, impute it by using the industry median ratio of book value of capital stock to investment (these are establishments which appear in 2008 or 2009 but not in 2007, but are not marked as births). Run the PIM again only on the establishments with missing capital stock in 2010.

(e) Finally, if PIM implied zero capital stock for 2010, but investment in 2010 is positive, impute the 2010 stock using industry median as in (d).

Performance measures: Below is a summary of the measures used in the analysis:

Value added per worker: Calculated as establishment value added over total employment. In Figure 2 raw (nominal) value added is used, while in Table 4 it is deflated using industry level deflators.

Total Factor Productivity (TFP): TFP is calculated using cost shares following for example Foster, Haltiwanger, and Krizan (2001).[12] Our log TFP measure is defined as

$$logTFP_i = logY_i \ - \alpha \log K_i - \beta logL_i \ - \gamma logI_i \ ,$$

where Y_i is real value added, K_i is capital input recovered as described in the capital imputation paragraph above. L_i is labor input calculated as:

$$L_i = \frac{total\ salaries}{production\ worker\ salaries} * production\ hours$$

I_i is intermediate good input, calculated as material and energy cost deflated using NBER-CES industry deflators for those factors. To recover α, β and γ, we use cost shares at the industry 6-digit NAICS industry level. The total cost of labor inputs for industry j (c_j^L) and for materials (c_j^I) are taken from the NBER-CES Manufacturing Industry Database. The cost of capital (c_j^K) is set to be capital income at the industry level. The BLS productivity dataset includes data on capital income at the 3-digit NAICS level. To obtain capital income at 6-digit level we apply the ratio of capital income to capital input calculated using BLS data to the 6-digit NBER-CES real capital stock measure. Once the two input costs are recovered at the industry level, the cost share is simply recovered as

$$s_j^L = \frac{c_j^L}{c_j^L + c_j^K + c_j^I}, s_j^K = \frac{c_j^K}{c_j^L + c_j^K + c_j^I}, s_j^I = \frac{c_j^I}{c_j^L + c_j^K + c_j^I}$$

and measured log(TFP) at the establishment level is measured as:

$$\log\left(\widehat{TFP}_{i,j}\right) = logY_i \ - s_j^K \log K_i - s_j^L logL_i \ - s_j^I logI_i$$

Note that TFP is always measured within a 6-digit NAICS industry. For further detail about local input prices, see Appendix B.

Employment Growth: We define growth of employment from 2005 to 2010 as (emp_{2010}-emp_{2005})/ (0.5*emp_{2010}+0.5*emp_{2005}).

[11] To ease notation, the procedure is described for imputing capital in 2010. The same procedure is applied for 2015.

[12] The main difference is that we use a single capital stock, rather than separating equipment and structures, because separate stocks are no longer reported in the CM in recent years.

Profitability: We measure profitability from ASM data as value added-total salaries. In Figure 2 we use this value for profitability, while in the regressions in Table 1 we use (value added- total salaries)/(total value of shipments).
R&D intensity: R&D intensity is defined as (domestic R&D expenditures)/(domestic employees). In the regressions in Table 4, the dependent variable is log(1+R&D intensity).
Patent intensity: Patent intensity is defined as (patent applications)/(domestic employment). In Figure 2 we report this measure multiplied by a 1,000.
Log wage: Log wage is defined as the log of total salaries for production workers over total hour of production workers at the establishment level.
ICT per worker: the total spending on information and communication technology hardware and software per employee.

Appendix B: A Simple Model of Measured Productivity and the Drivers of Management Practices

Consider a simplified version of the production function in equation (1):

$$Y_i = A_i K_i^{\alpha} L_i^{\beta} I_i^{\gamma} \widetilde{M}_i^{\delta} \tag{B1}$$

Where $\widetilde{M}$ is the unobservable managerial capital stock and M the index we measure in the data, so $log\widetilde{M} = M$. We assume that the factor cost of managerial capital, $\log W_i^M$, has an economy wide component (e.g. management consultancy fees or CEO remuneration), but may be lower due to "drivers" Z (which in our context are Right To Work laws, RTW, and Million Dollar Plants, MDPs). As these drivers are local, we index them at the county level (Z_c). Denote this as:

$$\log W_i^M = -\theta_1 Z_c + v_i \tag{B2}$$

Where v_i are other shocks affecting the factor cost of management capital. For a maximizing profit firm, the first order condition for the firm's level of management capital is (normalizing output price to be 1):

$$log\widetilde{M}_{it} = log\delta - logW_i^M + logY_i$$

Substituting in equation (B2) for the effect of drivers on the management factor cost gives a management equation in observables:

$$M_i = log\delta + \theta_1 Z_c + logY_i - v_i \tag{B3}$$

Congestion effects of Drivers

We illustrate the problem of determining the impact of our drivers in the face of congestion costs which may increase the price of local inputs in limited supply (like commercial rents). We do this in terms of capital, but the argument holds true for any input that has a local component (materials, wages, etc.). Labor, materials and capital are supplied at factor cost W_c , W_c^I and W_c^K respectively in county c. For simplicity assume for the moment that the factor cost of labor and materials are determined in national markets ($W_c = W; W_c^I = W^I$), but there is a county-specific aspect of capital (we extend the idea to other factors below). As with management factor costs, one way to think about this is that there is some national cost of capital (e.g. based on national interest rates captured empirically by time dummies) and a local component (e.g. commercial rents which depend on the constrained local supply of land). As is typical, in our data, we do not observe the plant's quantity of capital directly. Imagine that we only have data on the capital costs (e.g. total rental charges), $W_c^K K_i$ and a national (or sometimes industry) price deflator (W^K). We therefore measure capital inputs as $\overline{K}_i = \frac{W_c^K K_i}{W^K}$.[13] The relationship between measured and real capital in logs is:

$$Log\overline{K}_i = logK_i + log\left(\frac{W_c^K}{W^K}\right) \tag{B4}$$

The measurement error will depend on the deviation of factor prices between local and nation-wide costs $\left(\frac{W_c^K}{W^K}\right)$.

[13] As detailed in the Data Appendix A, the construction of the capital stock is more complex than this as it uses past as well as current investment flows. The current price still enters the formula, however, so the biases will still be present. The argument that local factor price inflation induced by MDPs will cause an over-estimate of factor quantities (and therefore an underestimate of measured TFP) is quite general.

We now allow for a congestion effect of our two drivers. MDPs entering the area could drive up land prices through competition for scarce land; RTW encourages entry into the area which also increases demand. We parameterize this "congestion" effect as:

$$log\left(\frac{W_c^K}{W^K}\right) = \varphi Z_c \tag{B5}$$

Where we expect $\varphi \geq 0$. Substituting equation (B4) and (B5) into the production function (B1) gives us an expression for output (using measured capital) as:

$$logY_i = -\alpha\varphi Z_c + logA_i + \alpha \log \bar{K}_\iota + \beta \log L_i + \gamma \log I_i + \delta M_i$$

Substituting in the management equation (B3) gives:

$$logY_i = \frac{1}{1-\delta}\left(\delta log\delta + (\delta\theta_1 - \alpha\varphi)Z_c + logA_i + \alpha \log \bar{K}_\iota + \beta \log L_i + \gamma \log I_i - \delta v_i\right)$$

As is conventional measured TFP ("MTFP") is calculated as

$$logMTFP_i = logY_i - s_L logL_i - s_K \log \bar{K}_\iota - s_I logI_i$$

where (s_K, s_L, s_I) are the shares of each factor cost in total costs[14]. This generates the relationship[15]:

$$logMTFP_i = \pi_0 + \pi_1 Z_c + e_i \tag{B6}$$

where

$$\pi_1 = \frac{\delta\theta_1 - \alpha\varphi}{1-\delta}$$

and

$$\pi_0 = \frac{1}{1-\delta}\left(\delta log\delta + logA_i\right)$$

$$e_i = -\frac{\delta}{1-\delta} v_i$$

It is clear that the sign of the coefficient on our drivers in the measured TFP equation (π_1) will consist of two offsetting effects. MDP and RTW are likely to have positive effects on management as $\theta_1 > 0$ and as consequence also positive effects on measured TFP. But the congestion effect (φ) will have a negative effect. Consequently, although the theoretical impact of our drivers on management is clearly positive from the management equation (B3), the impact on measured TFP in (B6) is ambiguous.

Effect of Drivers on TFPQ?

So far we have considered the effect of the drivers on management and on measured TFP (which does not correct for

[14] As noted by Hall (1988) cost shares will be accurate measures of the technology parameters even if the firm has market power as in the case of monopolistic completion (when factor shares of revenues will be less than the output elasticities due to positive price cost margins).

[15] This assumes that the measured factor cost shares are equal to the output elasticities of each factor inflated by (1 - δ), so $\frac{\beta}{1-\delta} = s_L$, etc. The cost share of managerial capital is not directly observed, but will instead be recorded as be a payment to other factors (e.g. senior managerial remuneration will be reflected in the observed labor share). We are assuming that the (unobserved) share of management capital costs in total costs are proportional to the observed shares of the three factors.

management). We could also allow the drivers to have a *direct* effect on TFPQ (*A*) over and above any effect on management. For example, consider specifying:

$$logA_i = logA_0 + \rho Z_c \tag{B7}$$

In this case the coefficient on the drivers, Z_c, in the measured TFP equation (B6) becomes $\pi'_1 = \frac{\delta\theta_1 + \rho - \alpha\varphi}{1-\delta}$ which is more likely to be positive if $\rho > 0$.

If RTW and MDP also affect TFP through non-managerial channels then we will under-estimate the impact of these drivers on *M* by conditioning on size in equation (B3).[16] Hence when estimating the management equation our preferred estimates do not condition on output or other measures of size (the unconditional management equation – see below), so that the coefficients on RTW and MDP can contain both direct and indirect effects. But we also examine the estimates of RTW and MDP on size (e.g. as measured by employment) and measured TFP. Additionally, to parse out the direct effects of the drivers on management we also consider regressions controlling for size as in equation (B3), with the caveat that size is potentially endogenous.

Differential MDP Spillover effects

Consider allowing larger spillover effects on management and real productivity (*A*) for MDPs which have a "managerial connection" as revealed by the managerial labor market vs. others which have smaller effects (using superscript "M" and "NM" to denote managerial vs. non-managerial respectively). Recall we measure this by whether the general flow of managerial labor to the incumbent MDP plant is higher. The generalized model is:

$$\log(W_i^M) = -\theta_1^M Z_c^M - \theta_1^{NM} Z_c^{NM} - v_i$$

with $\theta_1^M > \theta_1^{NM}$. Symmetrically, we could also allow for differential congestion effects and real productivity (*A*) effects of the drivers:

$$log\left(\frac{W_c^K}{W^K}\right) = logW^K + \varphi^M Z_c^M \quad + \varphi^{NM} Z_c^{NM}$$

$$logA_i = logA_0 + \rho^M Z_c^M \quad + \rho^{NM} Z_c^{NM}$$

Therefore:

$$LogMTFP_i \quad = \pi_0 + \pi^M Z_c^M + \pi^{NM} Z_c^{NM} + e_{it}$$

where

$$\pi^M = \frac{\delta\theta_1^M \quad + \rho^M - \alpha\varphi^M}{1-\delta} \text{ and } \pi^{NM} = \frac{\delta\theta_1^{NM} \quad + \rho^{NM} - \alpha\varphi^{NM}}{1-\delta}.$$

This equation gives us some further insight into the effect of the drivers. Consider a simplified example where all MDPs create equal congestion effects ($\varphi^M = \varphi^{NM} = \varphi$), but only managerial MDPs create positive productivity spillovers ($\theta_1^{NM} = \rho^{NM} = 0$). This gives the measured TFP equation:

$$LogMTFP_i \quad = \pi_0 + \pi^M Z_c^M - \alpha\varphi^{NM} Z_c^{NM} \tag{B8}$$

The pattern of regression coefficients in the TFP equation of Table 8 Panel B columns (3) and (4) is broadly consistent

[16] An increase in TFPQ would increase the marginal product of management, hence the demand for management. Controlling for size helps in shutting down the impact of drivers on management through this channel.

with this simple model with a positive and significant effect of Z_c^M ($\pi^M > 0$), a negative (and insignificant) effect of Z_c^{NM} ($\varphi^{NM} > 0$).

Solving for output as a function of exogenous variables (using the FOC like equation (B3) for all factor inputs) gives:

$$logY_i = (1-\varepsilon)^{-1}\begin{pmatrix} logA_i - \alpha \log W_c^K - \beta \log W - \gamma \log W^I - \delta\, logW_c^M \\ +\alpha log\alpha + \beta log\beta + \gamma log\gamma + \delta log\delta \end{pmatrix}.$$

where $\varepsilon = \alpha + \beta + \gamma + \delta$ is a returns to scale parameter. Substituting this into equation (B3) generates the "unconditional management equation":

$$M_i = \mathrm{c} + \theta^M Z_c^M - \theta^{NM} Z_c^{NM} + \left(\frac{\delta - 1 + \varepsilon}{1-\varepsilon}\right) \widetilde{v_i} \tag{B9}$$

where $\theta^M = \theta_1^M + (1-\varepsilon)^{-1}(\rho + \theta_1^M \delta - \alpha\varphi)$ and $\theta^{NM} = \alpha\varphi(1-\varepsilon)^{-1}$. Note that $\widetilde{v_i} = \left(\frac{\delta-1+\varepsilon}{1-\varepsilon}\right) v_i$ and $c = (1-\varepsilon)^{-1}\left(logA_0 - \alpha \log W^K - \beta \log \mathrm{W} - \gamma \log W^I + \alpha log\alpha + \beta log\beta + \gamma log\gamma + \delta log\delta\right) + log\delta$ is common across firms.

We expect the coefficient on Z_c^M in the unconditional management equation (B9) to be positive ($i.e. \theta^M > 0$) because the driver causes (i) a direct substitution effect towards management away from other factors (θ_1^M); (ii) raises TFPQ ($\rho > 0$) generating an *indirect* output scale effect raising management; (iii) raises management which will also generate an *indirect* output scale effect. However, to the extent that the driver increases congestion ($-\alpha\varphi$) this will tend to decrease output and therefore offset the positive effects on management.

In summary, the discussion implies a positive effect of drivers on management and an ambiguous coefficient in the measured TFP equation. When diving the MDP driver into Z_c^M and Z_c^{NM} we expect (a) a positive effect of Z_c^M in the management and measured TFP equations; (b) a negative effect of Z_c^{NM} in the management and measured TFP equation.

Mismeasurement of output prices and Product Market Competition

In the production function literature, there has been a greater focus on mismeasurement of *output* prices (e.g. de Loecker, 2011) than the input price effect we discuss here. As is well known, in the absence of plant-specific output prices, MTFP will not be a quantity-based measure but rather a revenue-based measure (TFPR).[17] It will contain a price-cost margin. For example, if the entrance of an MDP creates more local output market competition this will tend to reduce price-cost margins. This will be a further effect that pushes down MTFP (Aitken and Harrison, 1999). In this case, the coefficient on MDP will then be a function of three unobserved structural parameters, causing us to underestimate the positive effects of productivity spillovers.

We can assess the importance of this competition mechanism by again disaggregating MDPs into manufacturing and non-manufacturing entrants. Since we are only looking at the impact of MDPs on manufacturing plants, we would only expect to see these negative effects at play for manufacturing MDPs as they are in similar product markets and not expect to see any negative effects from non-manufacturing MDPs competing in different markets to our plants.

In fact, we see very similar associations between the productivity of our ASM plants to manufacturing and non-manufacturing MDPs. As discussed above this is consistent with input congestion effects, but not product market competition.

[17] Exceptionally, Foster, Haltiwanger, and Syverson (2008) derive plant-specific output prices for a selection of homogenous goods for which value and physical quantity measures of output are available from the CM.

Congestion effects in other factor inputs

The congestion effects argument we make here could also be true for other inputs such as labor and materials. For intermediate inputs, local supply costs will likely rise with exactly the same mechanisms we have described. For labor, we observe employment and hours separately from the wage bill, so it is less of an issue. However, since our labor service measure for TFP uses some information on plant wages to compute the contribution non-production workers, it is also potentially suffers from this bias.

Appendix C: Comparison of Management and Organizational Practices and the World Management Surveys

The two methods for gathering management data are: (i) Open Ended questions (those with a wide variety of possible answers) used by the World Management Survey (WMS); and (ii) Closed Ended questions (those with a list of potential answers like "Yes or No") used in the Management and Organizational Practices Surveys (MOPS). We compare the instruments in this Appendix (more details are in Bloom, Sadun and Van Reenen, 2010 and Bloom, Lemos, Sadun, Scur and Van Reenen, 2014).

Open Ended Questions: World Management Survey (WMS): The WMS approach is modelled on what leading management consulting firms do when interviewing client firms in consulting engagements. Bloom and Van Reenen first implemented this in 2004 in a survey developed jointly with the consulting firm McKinsey & Co. (Bloom and Van Reenen, 2007). They used open questions to collect information. For example, on monitoring, they begin with asking the open question "*can you tell me how you monitor your production process?*". They continued with open questions focusing on actual practices and examples until the interviewer can make an accurate assessment of the firm's practices. For example, the second question on that monitoring dimension is "*what kinds of measures would you use to track performance?*" and the third is "*if I walked round your factory could I tell how each person was performing?*". These open questions are designed to mimize the chance we steer respondents to a particular answer

They target production plant managers using a 'double-blind' technique. One part of this technique is that managers were not told in advance they were being scored or shown the scoring grid. They were only told they were being "*interviewed about management practices for a piece of work.*" (we avoid the words "survey" or "research" because of connotations with market research). The other side of the technique is that interviewers were not told in advance about the firm's performance. They were only provided with the company name, telephone number and industry. Since the survey requires some degree of business acumen and knowledge, they hired skilled interviewers – usually graduate students with business qualifications to run interviews. This double-blind approach tries to prevent firms from biasing their responses towards higher-scores, and interviewers from biasing their scores based on knowledge of the firm's performance.

To score these interview responses they had a grid for each question running on a scale from 1 to 5, where for example on the monitoring question discussed above a score of 1 was defined as "*Measures tracked do not indicate directly if overall business objectives are being met. Tracking is an ad-hoc process (certain processes aren't tracked at all)*" while a score of 5 was defined as "*Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools*". From this example it is clear that designing these surveys take some expertise in terms of selecting questions and response grids, and our experience was that this is an iterative process involving repeated rounds of testing and refinement. The full questionnaire is available on www.worldmanagementsurvey.com.

Finally, these surveys have to be run as an interactive conversation, which they did over the telephone to reduce travel time and ensure consistency. They obtained response rates of about 40%, interviewing managers for around 45 minutes. Intervierwers received one week of intense training combined with daily coaching and monitoring for their interview team.

Response rates to surveys in general have been falling in the US and other countries over time. For these type of surveys, private sector companies often only have response rates of 5-10% and although attempts are made to balance these on observables such as size, industry and geography there is an obvious concern over selection on unobservables. The much higher response rates achieved by the WMS are partly due to interviewer persistence, as senior managers are hard to reach and convince to take part on our interviews, but also because the survey itself is very interactive and thus more enjoyable for managers than simply being "pumped for information."

They also use endorsement letters from senior officials from respected institutions such as the Central Bank, Finance Ministry and Employers Federation. Given the high overhead costs to administer these surveys, each interview is

budgeted at between US$400 and US$500.

Close Ended Questions: Management and Organizational Practices Survey (MOPS): Closed ended surveys allow respondents to choose from a menu of answers, so the survey does not need an interviewer to run it over the telephone or face-to-face. As outlined above, the MOPS, which was designed in collaboration with the US Census Bureau to be comparable to the WMS questions, is a closed ended survey. For example, in the monitoring section we asked how frequently were performance indicators tracked at the establishment, with options ranging from "*hourly", "daily", "weekly", "monthly, "quarterly", "yearly"* to *"never"*. The targets section asked about the design, integration and realism of production targets and the incentives section asked about non-managerial and managerial bonus, promotion and reassignment/dismissal practices. The full questionnaire is available on http://bhs.econ.census.gov/bhs/mops/form.html.

Comparison of Open vs Closed Ended Surveys: No one method clearly dominates the other, with the WMS vs MOPS a quality-cost and flexibility-scale tradeoff. In summary, the WMS approach likely elicits more accurate responses as respondents can be probed more deeply and asked for examples. It also can be run without any government support and still achieve reasonable response rates. However, the WMS has the disadvantage that it requires trained highly quality interviewers, which is expensive and harder to organize.

For the closed approach, collaborating with national statistical agencies like the US Census Bureau is a major advantage. First, it is possible to leverage off the sampling frames of existing surveys like the ASM. Second, it makes it easier to link to data on productivity from these surveys. Third and most importantly, if it goes out as a mandatory survey alongside the standard official surveys, response rates can be much higher (around 75% in the case of MOPS) and the survey can be administered at a larger scale. Overall, the WMS method has the advantage of accuracy, but the MOPS has the advantage of lower per-survey cost.

The WMS randomly samples medium-sized manufacturing firms (employing between 50 and 5,000 workers). Bloom and Van Reenen's initial view was that in smaller firms formal management practices may be less valuable. In very large firms they worried that one plant-interview would be too limited to evaluate the whole firm. By contrast, in MOPS, we covered the entire firm size distribution using plant-level interviews. Although it was true that large firms were more likely to have higher management scores, we found that the link with performance extended throughout the size distribution, similar to McKenzie and Woodruff (2015) who find an important role for management in micro-firms in developing countries.

Comparison of WMS and MOPS Management Scores for Matched Sample

We conducted a quantitative comparison of WMS and MOPS management scores by matching observations from the two surveys. To do that, we first constructed a name-address based bridge between census firm identifiers and Compustat CUSIP identifiers.[18] WMS data already include CUSIP identifiers, hence we were able to use these to match MOPS with the CUSIPs to WMS. To maximize the matched sample we used two WMS waves with US manufacturing data (2004 and 2006), and matched to any MOPS observation in our sample (2005 to 2015). We were able to match a few hundred WMS firms to a few thousands of MOPS surveys. Each CUSIP maps to multiple census firm identifiers, and each census firm identifier maps to multiple MOPS establishments, hence we ended up with an average of 17.65 MOPS management scores per WMS score. We take the average management score over all MOPS observations that match to a WMS identifier, and compare those averages to the WMS management score.

Appendix Figure A4 shows a bin-scatter of MOPS scores (y-axis) over WMS scores (x-axis). The two scores are highly correlated, with a correlation coefficient of 0.26 (t-stat of 5.79), and the shape of the relation is close to linear. To benchmark this correlation, recall that the upper bound that can be expected for such correlation is 0.55 – the correlation between two duplicate MOPS observations calculated using the same survey instrument in about the same time for the same establishment (see section 3.3 in the paper). There are at least three reasons why we would expect a

[18] We thank Veronika Penciakova from the Center for Economic Studies in Census for providing the code used for the matching.

lower correlation between MOPS and WMS. First, the two instruments use different scoring tools. Second, it is likely that the matching is not perfect, in which case wrong matches would drive down the correlation. Finally, The MOPS data are reported for 2005, 2010 and 2015 (mostly 2010 and 2015), while the WMS data refers to 2004 and 2006. Given that the management score is not fixed over time, but include some stochatic component, we would expect further reduction in the correlation.

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Table A1: The Most Common Titles and Categories of MOPS Contacts

Panel A: Categories	**Share**
Manager (except CEO)	53%
Finance (except CFO)	23%
CEO	8%
CFO	5%
HR/admin (non-manager)	4%
Missing	6%
Panel B: Titles	**Share**
Plant manager	13%
Financial controller	10%
CEO	8%
CFO	4%
General manager	3%
Other (e.g. vice-president of engineering, COO or production manager)	64%

Note: Data from the MOPS 2015 survey meta data on the titles of MOPS contact in the certification section (question 47). This requests a range of details on the survey response, including "*Name of person to contact regarding this report*" and "*Title*".

Table A2: Scoring MOPS Survey Questions

Question	Question Text	Response	Score
1	What best describes what happens at your firm when a problem in the production process arises? Examples: Finding a quality defect in a service, product, or a piece of equipment breaks down.	We fixed it but did not take further action	1/3
		We fixed it and took action to make sure that it did not happen again	2/3
		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	1
		No action was taken	0
2	How many key performance indicators are monitored in your firm? Examples: Metrics on service quality, customer satisfaction, production, cost, waste, quality, inventory, and absenteeism.	1-2 key performance indicators	1/3
		3-9 key performance indicators	2/3
		10 or more key performance indicators	1
		No key performance indicators (If no key performance indicators in both years, SKIP to (6))	0
3	How frequently are key performance indicators typically **reviewed** by **managers** at your firm?	Yearly	1/6
		Quarterly	1/3
		Monthly	1/2
		Weekly	2/3
		Daily	5/6
		Hourly or more frequently	1
		Never	0
4	How frequently are key performance indicators typically **reviewed** by **non-managers** at your firm?	See question 3	See question 3
5	Where are display boards showing service quality, output and other key performance indicators located in your firm?	All display boards were located in one place (e.g. in the store back office or at the end of the production line)	1/2
		Display boards were located in multiple places (e.g. at multiple places in the store or establishment)	1

Question	Question Text	Response	Score
		We did not have any display boards	0
6	What best describes the time frame of operational targets at your firm? Examples of operational targets are: customer satisfaction, wait-times, production, quality, efficiency, on-time delivery.	Main focus was on short-term (less than one year) targets	1/3
		Main focus was on long-term (more than one year) targets	2/3
		Combination of short-term and long-term targets	1
		No targets (If no targets in both years, SKIP to (13))	0
7	How easy or difficult is it in your firm for people to typically achieve their operational targets?	Possible to achieve without much effort	0
		Possible to achieve with some effort	½
		Possible to achieve with normal amount of effort	¾
		Possible to achieve with more than normal effort	1
		Only possible to achieve with extraordinary effort	¼
8	Who was aware of the operational targets at your firm?	Only senior managers	0
		Most managers and some workers	1/3
		Most managers and most workers	2/3
		All managers and most workers	1
9	What are **non-managers'** performance bonuses usually based on in your firm?	Their own performance	1
		Their team or shift performance	3/4
		Their local establishment or branch's performance	1/2
		Their entire company's performance	1/4
		No performance bonuses (If no performance bonuses in both years, SKIP to (11))	0
10	When targets are met, what percent of **non-managers** received performance bonuses?	0%	1/5
		1-33%	2/5
		34-66%	3/5
		67-99%	4/5
		100%	1
		Targets not met	0

Question	Question Text	Response	Score
11	What were **managers'** performance bonuses usually based on in your firm?	See question 9 (If no performance bonuses in both years, SKIP pattern directs respondent to SKIP to (13))	See question 9
12	When production targets are met, what percent of **managers** at your firm received performance bonuses?	See question 10	See question 10
13	What is the primary way **non-managers** are promoted in your firm?	Promotions are based solely on performance and ability	1
		Promotions are based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	2/3
		Promotions are based mainly on factors other than performance and ability (for example, tenure or family connections)	1/3
		Non-managers are normally not promoted	0
14	What is the primary way **managers** are promoted in your firm?	See question 13 (Replace "non-managers" with "managers")	See question 13
15	When is an under-performing **non-manager** usually reassigned or dismissed?	Within 6 months of identifying non-manager under-performance	1
		After 6 months of identifying non-manager under-performance	1/2
		Rarely or never	0
16	When an under-performing manager is usually reassigned or dismissed?	See question 15 (Replace "non-manager" with "manager")	See question 15

Note: Questions 3, 4 and 5 are scored at 0 if missing, which typically arises from firms reporting "no performance indicators" to question 2 and skipping to question 6. The rationale for this is that firms with no performance indicators have no managerial or non-managerial review of performance indicators, and have no performance display boards. For questions with multiple possible responses (those with "*mark all that apply*") the average value was used. Only establishments with at least 10 scored responses were included.

A3: MOPS Sample of Approximately 32,000 Manufacturing Establishments

Sample	Source	Sample Criteria	Number of establishments (in thousands)	Total employment (in thousands)	Average employment
(1) Universe of establishments	LBD	None	7,041	134 ,637	19.1
(2) Manufacturing	LBD	NAICS 31-33	298	12,027	40.4
(3) Annual Survey of Manufactures	ASM	NAICS 31-33, and either over 500 employees, or in ASM stratified random sample. Positive employment and sales, and tabbed	51	7,387	143.5
(4) MOPS respondents	MOPS	As in (3), also responded to MOPS	36	5,629	155.8
(5) MOPS clean (baseline sample)	MOPS	As in (4) with 11+ non-missing responses, match to ASM, tabbed in ASM and have positive value added, employment and imputed capital in ASM 2010	32	5,308	167

Note: The LBD numbers are from 2009. ASM and MOPS numbers are for 2010.

Table A4: Descriptive Statistics

A. Management Descriptives	Mean	S.D.	p(10)	p(25)	p(50)	p(75)	p(90)
Management score	0.615	0.172	0.379	0.521	0.648	0.742	0.806
Non-incentive management	0.643	0.199	0.365	0.521	0.677	0.792	0.865
Incentives	0.583	0.215	0.3	0.474	0.623	0.739	0.819
B. Establishment Characteristics							
Size (Establishment employment)	177.2	398.5	16.8	36.0	86.0	186.0	382.0
Parent firm size	3359.0	9034.0	25.0	63.4	255.5	1862.0	8424.0
Establishment Age	21.0	10.1	4.0	12.0	25.0	30.0	30.0
Parent firm age	25.4	8.3	10.0	24.0	30.0	30.0	30.0
% of managers with degree	44.0%	30.9%	10.0%	10.0%	44.0%	70.0%	90.0%
% of non-managers with degree	9.8%	12.2%	0%	5.0%	5.0%	15.0%	40.0%
% of union members	12.2%	27.0%	0%	0%	0%	0%	70.0%
Multi-unit Parent	67.9%	46.7%	0	0	1	1	1

Note: The management score is the unweighted average of the score for each of the 16 questions, where each question is first normalized to be on a 0-1 scale. The sample in all columns is all MOPS observations with at least 10 non-missing responses to management questions and a successful match to ASM, which were also included in ASM tabulations, have positive value added, positive employment and positive imputed capital in the ASM. Recalls are used for respondents with at least 7 years of tenure at the establishment. For the few cases where establishment characteristics had missing values (for the degree and union questions), we replaced these with the means in the sample, so to keep a constant sample size. P(n) is the value at the n-th percentile, e.g. p(50) is the median value (fuzzed).

Table A5: Linear regressions for sample selection

	Mailed MOPS vs ASM	MOPS Respondents vs. Mailed MOPS	Clean sample vs. MOPS respondents	Clean sample vs. ASM	Clean sample vs. ASM
Log(employment)	0.059	0.031	0.057	0.096	0.094
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log(Output/employment)					0.038
					(0.004)
F-stat (region)	5.591	45.381	1.1	34.665	33.443
(p-value)	(0.001)	(0)	(0.348)	(0)	(0)
F-stat (industry)	10.213	7.871	8.399	15.267	11.948
(p-value)	(0)	(0)	(0)	(0)	(0)
Observations	51,461	47,503	36,140	51,461	51,461
Number of firms	28,905	26,345	20,694	28,905	28,905

Note: The table reports the results from linear probability regressions. In column 1 the sample is 2010 ASM observations with positive employment and sales, which were tabbed, and the dependent variable is an indicator that equals 1 if MOPS was sent to the establishment. In column 2 the sample is the subsample of the one in column 1, also conditioning on MOPS mailed, and the dependent variable is an indicator that equals 1 if MOPS survey was filled. In column 3 the sample is the subsample of the one in column 2, also conditioning on MOPS respondent, and the dependent variable is an indicator that equals 1 if the observation is in our baseline "clean" sample. In columns 4 and 5 the sample is as in column 1, and the dependent variable is an indicator that equals 1 if the observation is in our baseline "clean" sample. Standard errors are clustered at the firm level.

Table A6: Question by Question Management-Performance Relation

#	Question (short version)	Mean	log(output)	log(output/emp.)	Exit 10-15	Emp growth 10-15
		(1)	(2)	(3)	(4)	(5)
1	What happens when a problem arise?	0.846	1.753	0.569	-0.092	0.2
		(0.213)	(0.041)	(0.024)	(0.011)	(0.027)
2	# of key performance indicators (KPI)	0.753	2.318	0.762	-0.099	0.199
		(0.267)	(0.039)	(0.025)	(0.009)	(0.021)
3	Frequently KPI reviewed by managers	0.524	1.798	0.528	-0.051	0.104
		(0.222)	(0.041)	(0.022)	(0.01)	(0.023)
4	Frequently KPI reviewed by non-managers	0.426	1.596	0.547	-0.046	0.086
		(0.281)	(0.035)	(0.02)	(0.007)	(0.017)
5	Display boards location	0.513	1.482	0.368	-0.036	0.066
		(0.442)	(0.022)	(0.014)	(0.005)	(0.011)
6	Time frame of operational targets	0.684	1.116	0.381	-0.05	0.114
		(0.363)	(0.024)	(0.016)	(0.006)	(0.015)
7	Difficulty to achieve operational targets	0.746	0.816	0.233	-0.035	0.074
		(0.252)	(0.027)	(0.016)	(0.007)	(0.017)
8	Awareness of operational targets	0.713	0.969	0.41	-0.027	0.052
		(0.329)	(0.027)	(0.018)	(0.006)	(0.015)
9	What are non-managers' bonuses based on?	0.266	0.5	0.26	-0.042	0.107
		(0.299)	(0.036)	(0.024)	(0.006)	(0.016)
10	Percent of non-managers receiving bonuses	0.69	0.688	0.427	-0.066	0.162
		(0.265)	(0.034)	(0.022)	(0.007)	(0.016)
11	What are managers' bonuses based on?	0.332	0.968	0.46	-0.069	0.147
		(0.278)	(0.038)	(0.023)	(0.007)	(0.017)
12	Percent of managers receiving bonuses	0.73	0.675	0.426	-0.073	0.182
		(0.282)	(0.034)	(0.022)	(0.006)	(0.016)
13	Criteria for non-managers' promotion	0.834	1.16	0.315	-0.048	0.124
		(0.32)	(0.025)	(0.014)	(0.007)	(0.016)
14	Criteria for non-managers' promotion	0.81	1.4	0.44	-0.034	0.068
		(0.356)	(0.025)	(0.015)	(0.006)	(0.014)
15	When is an under-performing non-manager reassigned or dismissed?	0.619	0.449	0.013	-0.005	0.044
		(0.412)	(0.019)	(0.011)	(0.005)	(0.012)
16	When is an under-performing manager reassigned or dismissed?	0.521	0.657	0.087	0.002	0.004
		(0.415)	(0.02)	(0.012)	(0.005)	(0.011)
	Management Score	0.615	4.264	1.351	-0.18	0.412
		(0.172)	(0.057)	(0.039)	(0.014)	(0.033)
	Observations	~82,500	~82,500	~82,500	~32,000	~32,000

Notes: Each row (1-16) corresponds to one MOPS question, where each question is first normalized to be on a 0-1 scale. The "Management Score" row reports results for the total management score as used in the rest of the paper (the unweighted average of the score for each of the 16 questions). Questions with missing values were replaced with the mean in the sample. Column (1) shows the mean and standard deviation of each question. Columns 2 to 5 show OLS coefficients with standard errors in parentheses (clustered at the firm level). The sample in columns (1) to (3), is all MOPS observations with at least 10 non-missing responses to management questions and a successful match to ASM, which were also included in ASM tabulations, have positive value added, positive employment and positive imputed capital in the ASM. Recalls are used for respondents with at least 7 years of tenure at the establishment. Sample in columns (4) and (5) is restricted to 2010 MOPS observations. The dependent variable is log(real output) in columns (2), log(real output over total employment) in column (3), exit dummy between 2010 and 2015 in column (4), and employment growth between 2010 and 2015 in column (5). All regressions include year fixed effect and recall dummy.

Table A7: Measurement Error is Uncorrelated with Observables

Dependent Variable	**Absolute Value of Diff in Management Score Between Double Surveyed Establishments**							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(number plants in the firm - CM)	0.0003							
	(0.0029)							
Log(number plants in the firm - LBD)		0.0006						
		(0.0023)						
Log(employees in the plant)			-0.0059					
			(0.0045)					
Log(employees in the firm - CM)				-0.0004				
				(0.0024)				
Log(employees in the firm - LBD)					-0.00004			
					(0.0022)			
Log(firm age)						-0.0044		
						(0.0055)		
Log(Value added/Emp)							0.00073	
							(0.0053)	
Log(Total Factor Productivity)								-0.00366
								(0.0084)
Observations	~500	~500	~500	~500	~500	~500	~500	~500

Note: The management score is the unweighted average of the score for each of the 16 questions, where each question is first normalized to be on a 0-1 scale. The sample is approximate 500 plants from the baseline sample that filled-out two surveys by different responders for MOPS 2010. The exact number of plants is suppressed to prevent disclosure of confidential information. The regression controls for the total management score.

Table A8: Management and Performance by Establishment Age

Dependent Variable	Employment growth 2010-2015			Exit 2010-2015			Log(Output/Emp)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Management	0.343	0.302	0.612	-0.144	-0.124	-0.248	0.283	0.280	0.311
	(0.033)	(0.039)	(0.080)	(0.014)	(0.016)	(0.034)	(0.021)	(0.024)	(0.039)
Management X (age≤5 years)	0.285	0.326		-0.114	-0.134		0.047	0.048	
	(0.108)	(0.110)		(0.046)	(0.047)		(0.049)	(0.051)	
Management X (5<age≤20 years)		0.114			-0.046			0.003	
		(0.069)			(0.028)			(0.035)	
Management X age			-0.011			0.004			-0.001
			(0.003)			(0.001)			(0.002)
Observations	~32,000	~32,000	~32,000	~32,000	~32,000	~32,000	~32,000	~32,000	~32,000

Notes: OLS coefficients with standard errors in parentheses (clustered at the firm level). The management score is the unweighted average of the score for each of the 16 questions, where each question is first normalized to be on a 0-1 scale. The sample in all columns is all MOPS observations with valid management score in 2010 and a successful match to ASM, which were also included in ASM tabulations, have positive value added, positive employment and positive imputed capital in the ASM. In columns (1) to (3), the dependent variable is employment growth between 2010 and 2015. Growth between years s and t is calculated as $0.5*(e_t - e_s)/(e_t + e_s)$. In columns (4) to (6), the dependent variable is a dummy that takes the value of 1 for exit between 2010 and 2015. In columns (7) to (9) the dependent variable is log(output over total employees). In those 3 columns we control for log(Capital/Employment), log(Materials/Employment), log(Employment), and share of employee with college degree. Establishment age is from the Longitudinal Business Database (LBD), and truncated at age 30. In columns (1), (2), (4), (5), (7), and (8) we also control for the two age categories, and in columns (3), (6) and (9) we control for age.

Table A9: Management and Performance Controlling for other Organizational Variables

Dependent variable:	**Log(Output/Employment)**											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Management	0.200	0.193	0.180	0.173	0.075	0.075	0.079	0.078	0.074	0.080	0.061	0.067
	(0.022)	(0.021)	(0.023)	(0.022)	(0.045)	(0.045)	(0.046)	(0.046)	(0.025)	(0.025)	(0.026)	(0.025)
Decentralization		-0.106		-0.106		0.003		0.003		-0.091		-0.092
		(0.017)		(0.017)		(0.035)		(0.035)		(0.021)		(0.021)
Data driven decision making			0.050	0.049			-0.009	-0.009			0.035	0.036
			(0.017)	(0.016)			(0.031)	(0.031)			(0.017)	(0.017)
Observations	43,000	43,000	43,000	43,000	19,500	19,500	19,500	19,500	43,000	43,000	43,000	43,000
Fixed effects	Industry	Industry	Industry	Industry	Establish.	Establish.	Establish.	Establish.	FirmXYear	FirmXYear	FirmXYear	FirmXYear

Notes: OLS coefficients with standard errors in parentheses (clustered at the firm level). The management score is the unweighted average of the score for each of the 16 questions, where each question is first normalized to be on a 0-1 scale. The sample in columns (1)-(4), (9)-(12) is all MOPS observations with at least 10 non-missing responses to management questions and a successful match to ASM, which were also included in ASM tabulations, have positive value added, positive employment and positive imputed capital in the ASM. Recalls are used for respondents with at least 7 years of tenure at the establishment. It further conditions on the establishment having at least one sibling (i.e. from the same parent firm) in MOPS within the year. The sample in columns (5)-(8) uses the same sample with the extra restriction that the establishment has 2 non-recall observations (in 2010 and 2015), and excludes 2005. In all columns the dependent variable is log(real output over total employment). Decentralization measure is defined as the unweighted response to questions 18 to 24 in MOPS. Data Driven Decision Making score is calculated as the average of questions 27 and 28 in MOPS (2010 numbering). All columns include controls for log(capital/Employment), log(material/ Employment), log(Employment), share of employee with college degree, year fixed effect and a recall dummy.

Table A10: Drivers of Productivity Variation using Production Function Approach at *firm* level

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	**Firm Level Log(Labor Productivity)**				
Management score	0.307				0.242
	(0.022)				(0.023)
R&D		0.048			0.037
		(0.005)			(0.005)
ICT/worker			0.018		0.013
			(0.003)		(0.003)
Skills (% employees with college degree)				0.295	0.117
				(0.03)	(0.031)
Log(Capital/Emp)	0.131	0.127	0.132	0.131	0.124
	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Log(Material/Emp)	0.493	0.496	0.496	0.497	0.488
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Log(Emp)	0.017	0.02	0.035	0.03	0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	~18,000	~18,000	~18,000	~18,000	~18,000
Share of 90-10 explained	0.082	0.083	0.037	0.062	0.181
Share of S.D explained	0.069	0.082	0.043	0.057	0.108

Notes: OLS coefficients with standard errors in parentheses (clustered at the firm level). Dependent variable is firm level Log(Output over Employment) built from industry de-meaned plant-level Log(Output over Employment) weighted up by plant's shipments. Right-hand side variables are management score, R&D from BRDIS measured as log(1+R&D intensity) where R&D intensity is the total domestic R&D expenditure divided by total domestic employment, ICT investment per worker (1000* spending on information and communication technology hardware and software per employee), skill measured by the share of employees (managers and non-managers) with a college degree. All these variables are also weighted up to the firm level using plant's total value of shipments. Missing values have been replaced by zero for R&D and by means for the other variables. Industry demeaning is at NAICS 6 level. All regressions are weighted by the number of establishments in the firm. "Share of 90-10 explained" is calculated by multiplying the coefficient on the key driver variable (e.g., management in column 1) by its 90-10 spread and dividing this by the 90-10 spread of TFP. Share of S.D. explained corresponds to the marginal square root of the R^2 of the relevant factors in the regression.

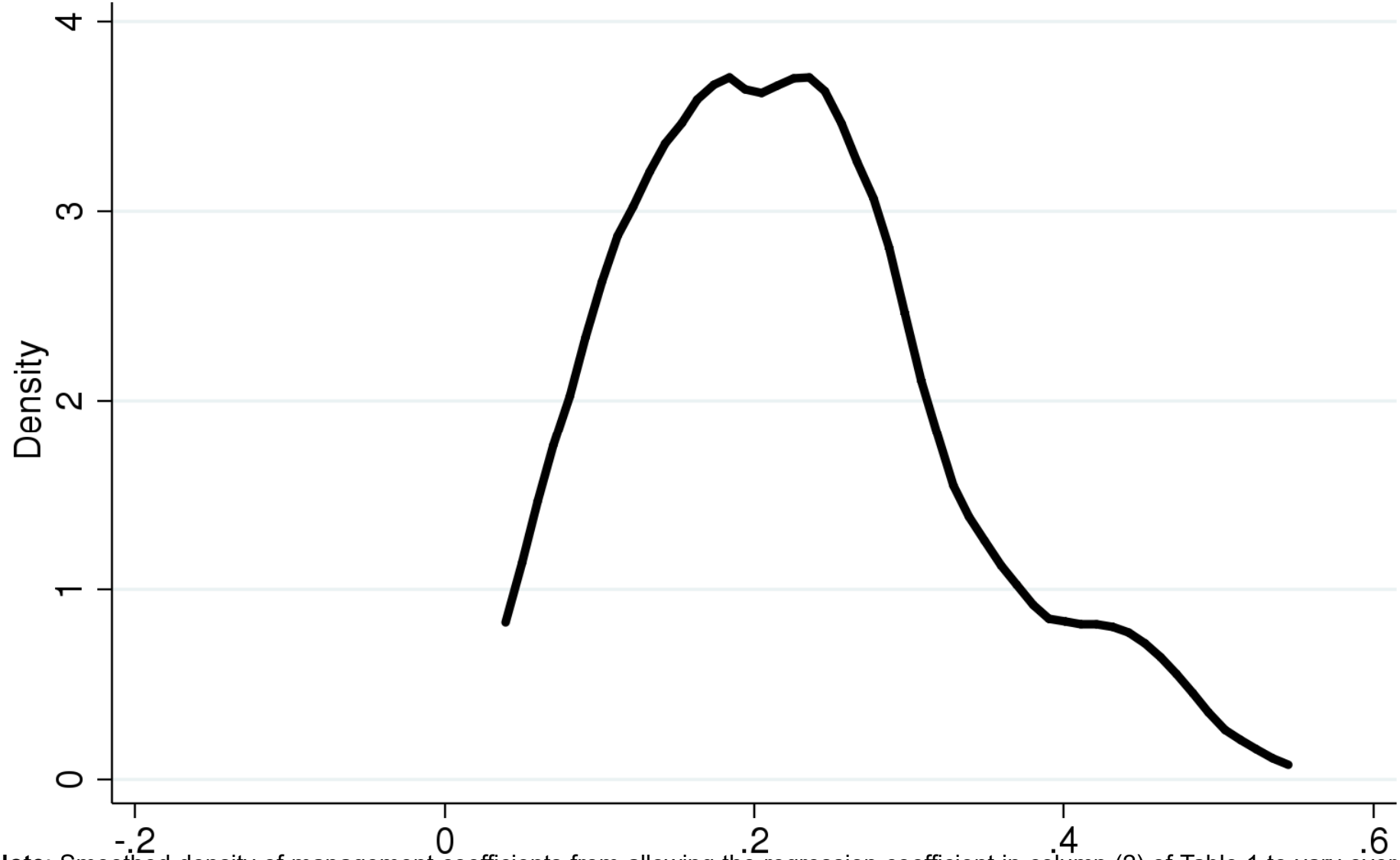
Table A11: MDP Balancing Tests

	All	Million Dollar Plant Opens ×(High manager flow)	Million Dollar Plant Opens ×(Low manager flow)	Observations
	(1)	(2)	(3)	
Panel A: $t-5$ Levels of:				
Management score	-0.011	-0.024	0.011	~2,500
	(0.007)	(0.010)	(0.015)	
log(TFP)	-0.005	-0.016	0.012	~2,500
	(0.064)	(0.074)	(0.080)	
Log(employment)	-0.143	-0.216	-0.030	~2,500
	(0.029)	(0.050)	(0.074)	
Establishment age	0.853	0.503	1.399	~2,500
	(0.578)	(0.837)	(0.949)	
Share of employees with a degree	0.002	0.005	-0.002	~2,500
	(0.018)	(0.020)	(0.016)	
High Unionization (>80%)	0.013	0.016	0.008	~2,500
	(0.008)	(0.009)	(0.021)	
Panel B: $t-10$ to $t-5$ Change in (establishment level):				
log(TFP)	-0.023			~4,100
	(0.018)			
Employment^	0.001			~4,100
	(0.008)			
Log(value added)	0.0003			~4,100
	(0.055)			
Panel C: $t-10$ to $t-5$ Change in (county level):				
Change in Log(#establishments)	-0.001			~100
	(0.013)			
Change in Log(#manufacturing plants)	-0.053			~100
	(0.074)			
Exit rate	-0.0001			~100
	(0.004)			
Exit rate in manufacturing	-0.007			~100
	(0.007)			
Birth rate	0.005			~100
	(0.004)			
Birth rate in manufacturing	~0			~100
	(0.008)			

Notes: The sample in panel A is identical to the MDP sample in Table 8, and the variables are the same ones used in the regressions in Table 8. In panel B the sample includes all ASM establishments with valid TFP for $t-10$ and $t-5$ in counties which were included in the MDP analysis in Table 8. In panel C we report aggregate statistics from the Longitudinal Business Database (LBD) for the sample of counties which were part of the MDP analysis. Column 1 reports results from a regression of each variable on the MDP dummy, while columns (2) and (3) report the results from a regression where MDP dummies are interacted with dummies for high and low manager flow between the establishment and the MDP industry codes.

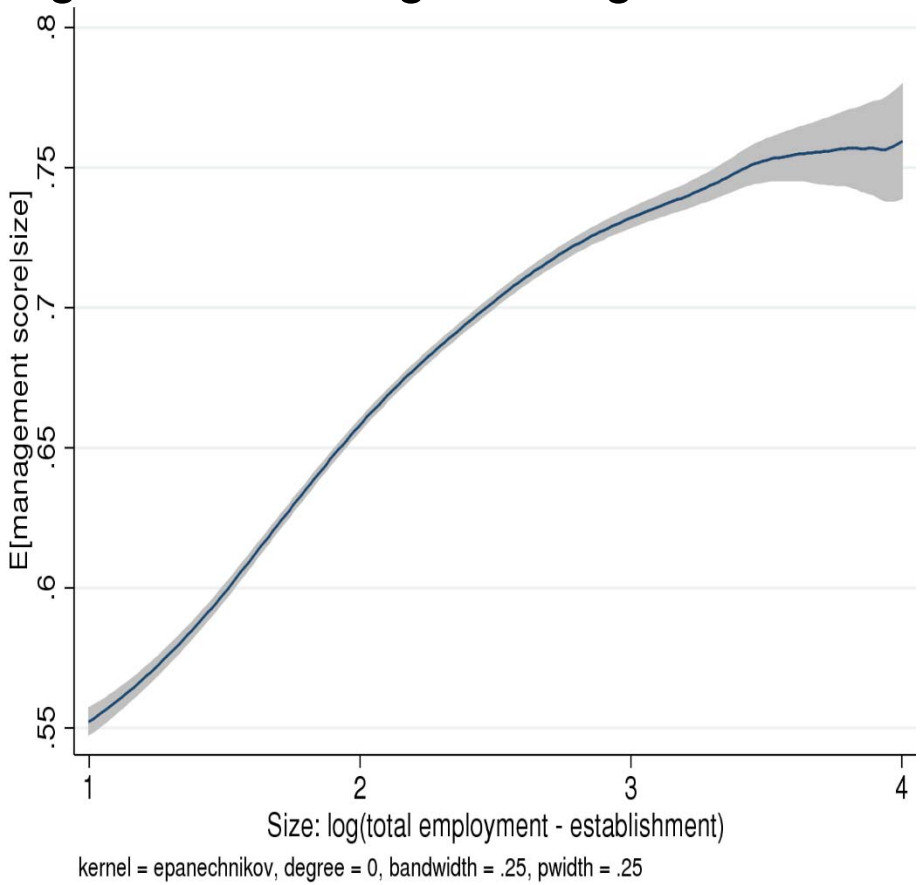
^ For consistency with Table 8, for employment change we report here the employment growth defined as $0.5*(emp_t - emp_{t-5})/(emp_t + emp_{t-5})$

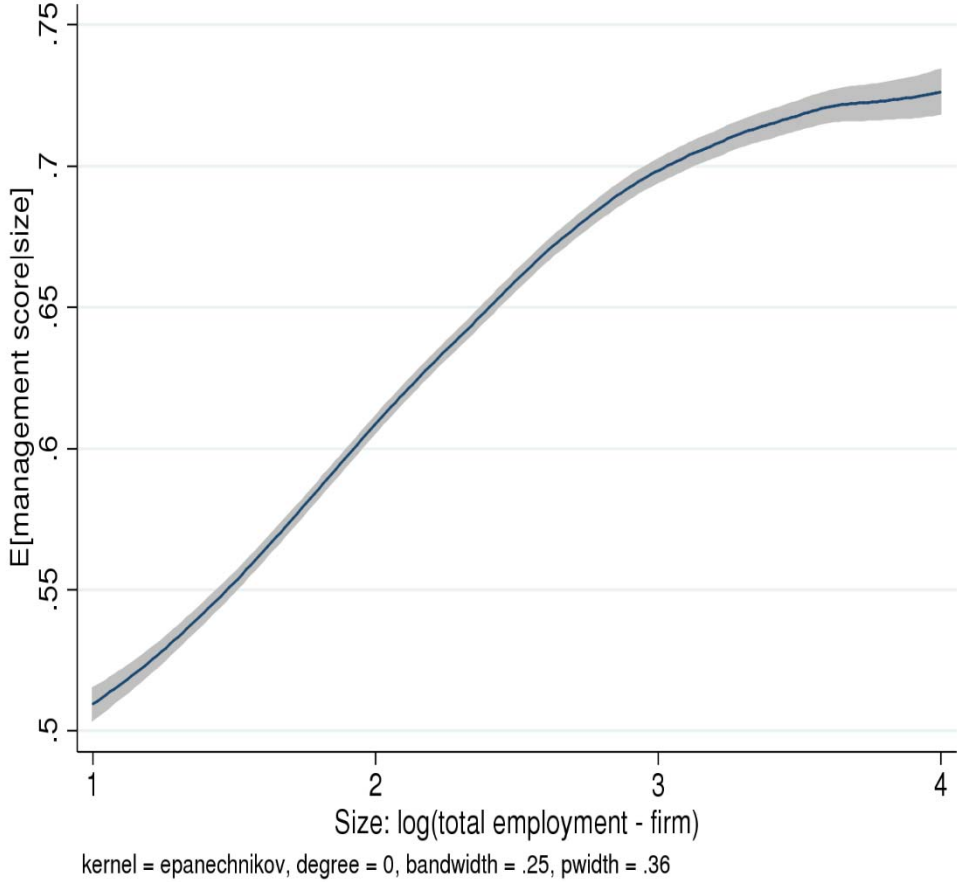
Figure A1: The distribution of the management regression coefficient over 86 NAICS four-digit industries



Note: Smoothed density of management coefficients from allowing the regression coefficient in column (2) of Table 1 to vary over the 86 four-digit manufacturing NAICS codes. The raw regression coefficients are then compressed using an Empirical Bayes Shrinkage procedure. The sample of ~82,500 is all MOPS observations with at least 10 non-missing responses to management questions and a successful match to ASM, which were also included in ASM tabulations, have positive value added, positive employment and positive imputed capital in the ASM. Recalls are used for respondents with at least 7 years of tenure at the establishment.

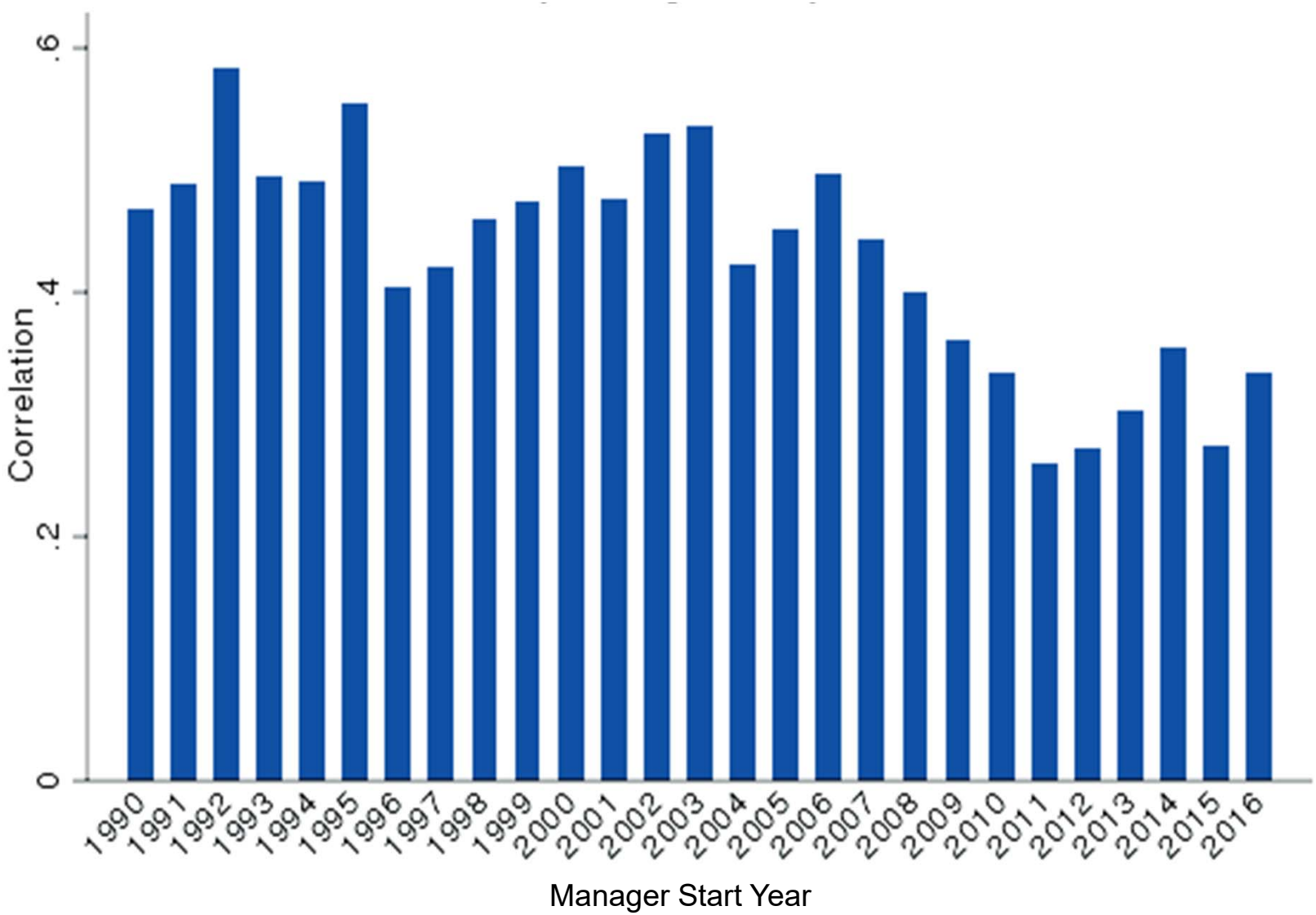
Figure A2: Average Management Score Rises with Establishment and Firm Size





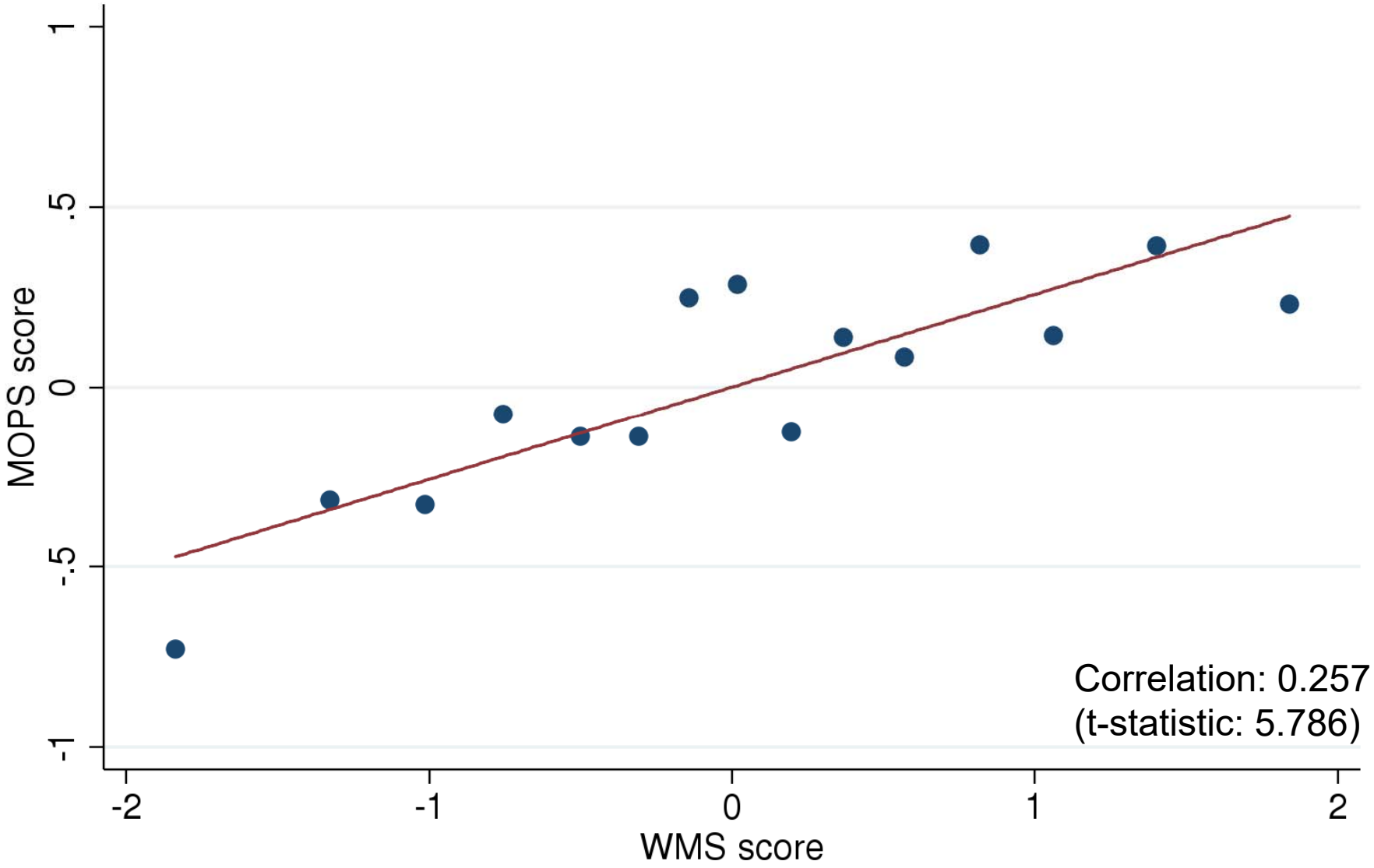
Note: The management score is the unweighted average of the score for each of the 16 questions, where each question is first normalized to be on a 0-1 scale. The sample is all 2010 MOPS observations with at least 10 non-missing responses to management questions and a successful match to ASM, which were also included in ASM tabulations, and have positive value added, positive employment and positive imputed capital in the ASM. The figure further restricts to establishments with 10 employees or more, and winsorizes establishment size at 10,000 employees. The figure was generated using a local mean smoother with Epanechnikov kernel and 0.25 bandwidth. The x-axis is base 10 logarithm.

Figure A3: The Correlation between 2010 Reported Management Score and 2010 Recall Score (Reported in 2015), by Manager Start Year



Note: On the x-axis the manager start year at the establishment. On the y-axis the correlation between the management score as calculated using the responses to the 2010 MOPS and the score calculated using the recall responses collected in 2015 asking about 2010. The sample includes ~16,500 MOPS establishments which were surveyed in both 2010 and 2015.

Figure A4: Correlation of MOPS and WMS Management Scores



Note: On the x-axis the management score from the World Management Survey (WMS). On the y-axis the management score from MOPS. Sample includes all WMS firms observed between 2004 and 2006 which were matched to MOPS establishments (in any wave, see Appendix C for details on the matching). MOPS management scores were calculated as the average over MOPS establishments management scores at the firm level. WMS scores were collected at the firm level. There are 17.65 establishments on average in each MOPS point.