

# Compensation Practices, Worker Mobility, and Wage Dispersion: Evidence from Brazilian Employer-Employee Matched Data

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# Our Starting Point

- Management practices can be a tool for
  - improved efficiency
  - improved rent capture
- Human resource management, pay, and productivity
  - selection and sorting
  - incentives
  - turnover

[ Lazear 1979; Dostie 2005; Daniel and Heywood 2007; Zwick 2011 ]

- We know there is **between-firm variation** in pay and earnings **inequality**  
[ Card et al. (2013); Barth et al. (2014); Song et al. (2015); Card et al. (2016), Alvarez, Benguria, Engbom, Moser (2018) ]
- We explore **heterogeneous application** of management practices as a **channel**  
[ Abowd et al. (1999; 2006) ]

# Overview

## Research questions:

- 1 Are observed differences in **worker outcomes** across firms driven by **management quality**?
  - We document relationships between good management pay, worker selection (production and managers) and productivity.
- 2 How does management quality contribute to **wage dispersion**?
  - **Firms choose:** level and sequencing of pay and contract terms (length, termination policy, etc)
  - These drive **firm-level differences in:** wage-seniority relationship, sorting and retention of high/low ability workers and turnover

We **link new data** from Brazil to explore these questions:

- **Linked EE data:** *Relação Anual de Informações Sociais* (RAIS) 2003-2013
- **Firm management practices:** World Management Survey: 2008, 2013
- **Firm productivity:** *Pesquisa Industrial Anual* (PIA) 2003-2013

## Some related efforts

- Bender, Bloom, Card, Reenen and Wolter (2016) use German EE data linked to WMS
  - They find better management is associated with higher productivity, higher pay (establishment effect), sorting of high-paid workers to “better” firms

We replicate their analysis in Brazil using **more detailed occupation codes** to cleanly distinguish between production workers and managers and find strikingly similar results.

- Engbom and Moser (2017); Alvarez, Benguria, Engbom, Moser (2018) use Brazilian EE data
  - They find that a decrease in inequality in Brazil is strongly driven by minimum wage, with spillovers and large declines in firm-specific pay.

We explore the **role of firm management** in pay practices.

## Dataset I: RAIS: 2003-2013

- Administrative records collected *from employers* to administer a legislated end-of-year bonus (“thirteenth salary”)
- Covers the population of formal-sector jobs ( $\approx 50$  million per year)
- Includes information on
  - worker characteristics: education, experience, race, gender ...
  - job characteristics: wage, hours, tenure, *occupation* ...
  - employer characteristics: industry, “legal structure”, size, location ...
  - *reason for separation*

We use RAIS under an agreement with the Brazilian Ministry of Labor and Employment (MTE).

# RAIS: Sample for Wage Decomposition

- Full time workers (> 30 hours per week), plants with > 4 workers
- **Final RAIS Sample**
  - 269,007,340 worker-year observations
  - 80,463,643 workers
  - 4,195,934 establishments

## Earnings decomposition

$$y_{it} = \alpha + x_{it}\beta + \theta_i + \psi_{J(i,t)} + \varepsilon_{it}.$$

- $y_{it}$  – log monthly wage of worker  $i$  at time  $t$
- $x_{it}$  – vector of observed time-varying worker characteristics
- $\theta_i$  – worker effect
- $\psi_{J(i,t)}$  – firm-specific contribution to pay

# Correlations in Components of Log Earnings, 2003-2013

Component	Label	Mean	Std. Dev.	Component Correlations				
				$Y$	$X\hat{\beta}$	$\hat{\theta}$	$\hat{\psi}$	$\hat{\varepsilon}$
$Y$	Log wage	1.336	0.747	1.000				
$X\hat{\beta}$	Observables	-.110	0.388	0.105	1.000			
$\hat{\theta}$	Worker effect	0.000	0.510	0.828	-.052	1.000		
$\hat{\psi}$	Firm effect	0.000	0.311	0.658	0.034	0.332	1.000	
$\hat{\varepsilon}$	Sample residual	0.000	0.200	0.279	0.000	0.000	0.000	1.000

	RAIS	WMS		
		2003-2005	2006-2009	2010-2013
$\theta$	0.512	0.581	0.560	0.604
$\psi$	0.184	0.105	0.116	0.124
$x\beta$	0.072	0.013	0.016	0.025
$2 \times (\theta, \psi)$	0.205	0.213	0.208	0.148
$2 \times (\theta, x\beta)$	-0.045	0.001	0.006	0.000
$2 \times (\psi, x\beta)$	-0.008	0.000	0.001	-.003
residual	0.078	0.097	0.081	0.074

## Dataset II: World Management Survey: 2008, 2013

- Survey of management practices
  - operations, performance, target-setting practices
  - personnel practices
- 18 indicators with ordinal scores
  - Score of 1: (“little/no formal management practices”)
  - Score of 2 (“some informal management practices”)
  - Score of 3: (“formal practices with some weaknesses”)
  - Score of 4: (“established formal practices”)
  - Score of 5: (“best practices, part of the culture of org”)

We construct an **overall management** and a **personnel management** index by:

- standardizing each indicator
- taking the average of all 18 topics and 6 personnel topics
- standardizing the average.

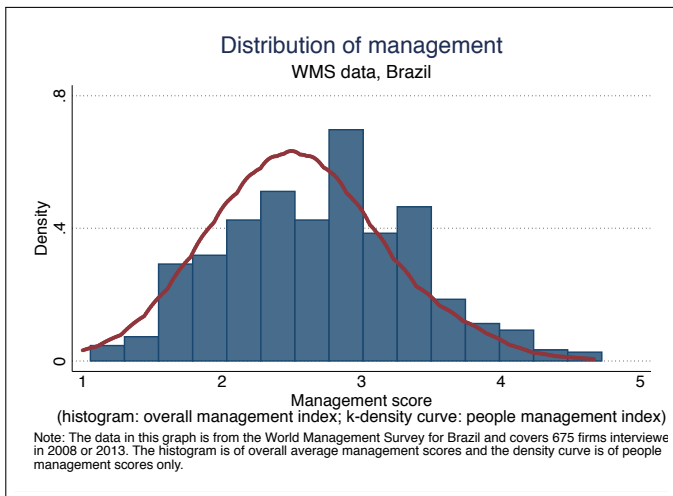
Thus, we interpret coefficients in standard deviations of management. The SD for the Brazilian management sample is 0.65 points.



# WMS Sample

- Frame: Bureau van Dijk ORBIS Database for Brazil
- Universe:
  - Manufacturing
  - Between 50–5,000 employees
  - Active in 2008 (2013)
- 2008: simple random sample, 2013: stratified 20% 50-100 and 80% 100-5,000
- 763 unique firms
  - 227 surveyed in 2008 only
  - 228 surveyed in 2013 only
  - 308 surveyed in 2008 and 2013
- 745 with valid matching variables (CNPJ)
- 689 matched to 2008 RAIS population

# Distribution of management quality in Brazilian firms



# Summary Statistics of WMS-RAIS Merged Firms

	Mean	SD
<b>Firm characteristics</b>		
Number of employees (WMS)	582.85	(786.97)
<b>Management scores</b>		
Overall management score, raw (WMS)	2.67	(0.68)
Operations management score, raw (WMS)	2.36	(1.06)
Monitoring management score, raw (WMS)	3.03	(0.84)
Target management score, raw (WMS)	2.63	(0.82)
People management score, raw (WMS)	2.51	(0.60)
<b>Worker characteristics</b>		
Share of female workers, total (WMS)	0.30	(0.14)
Share of female workers, total (RAIS)	0.28	(0.22)
Weekly hours worked (RAIS)	43.56	(1.32)
Weekly hours worked (WMS)	43.88	(2.47)
Employee tenure, weeks (RAIS)	59.30	(30.25)
Hourly wage, BRL Reais (RAIS)	7.78	(6.71)
Monthly earnings, BRL Reais (RAIS)	1438.59	(1213.45)
<b>Worker education</b>		
Share of employees with university degree (WMS)	0.12	(0.13)
Share of employees with university degree (RAIS)	0.12	(0.16)
<b>N=689</b>		

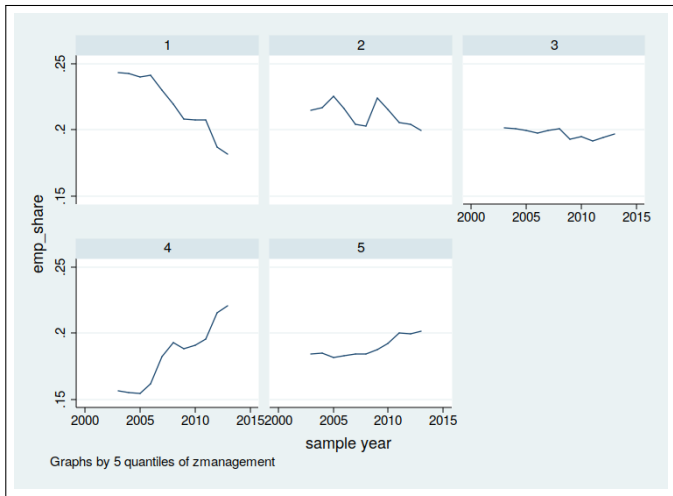
## Dataset III: PIA - *Pesquisa Industrial Anual*

- Industrial Survey of Manufacturing Establishments
- Design
  - More than 30 Employees: Census
  - 5-30 Employees: Random sample
- Information
  - Longitudinal tracking
  - Balance sheet
  - Other economic variables

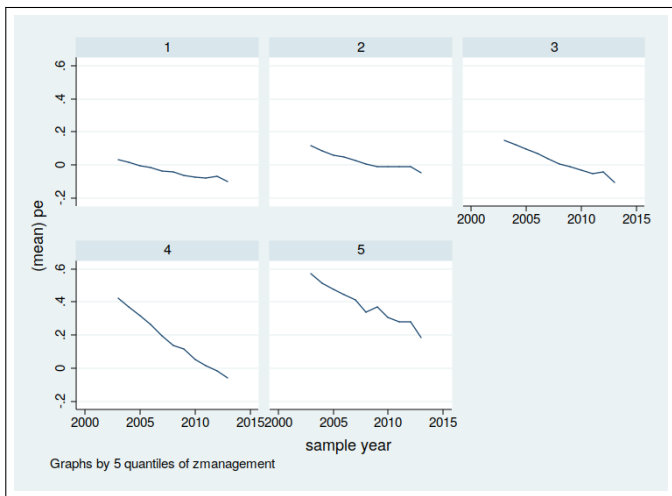
# Descriptive Statistics

	Mean	25th p	Median	75th p	SD	N
Share workers with college degree	0.07	0	0.02	0.07	0.13	19788
Avg share of high school educated workers	0.41	0.2	0.39	0.58	0.26	19788
Avg share of white workers	0.71	0.56	0.82	0.95	0.3	19788
Log of wage mean (RAIS)	1.74	1.39	1.69	2.01	0.5	19788
Separation mean (RAIS)	0.28	0.18	0.26	0.36	0.16	19788
# employees	260.49	60	91	180	1065.05	20056
Log employees	4.76	4.14	4.54	5.23	1.05	19263
Log capital	13.4	12.6	15.02	16.61	5.47	19537
Log materials	15.49	14.04	15.73	16.99	2.32	19272

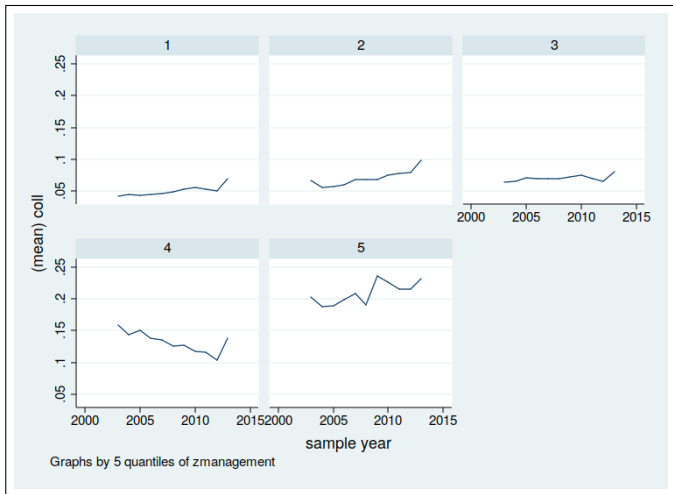
# Employment Shares by Management Quality, 2003-2013



# Worker Effect by Management Quality, 2003-2013

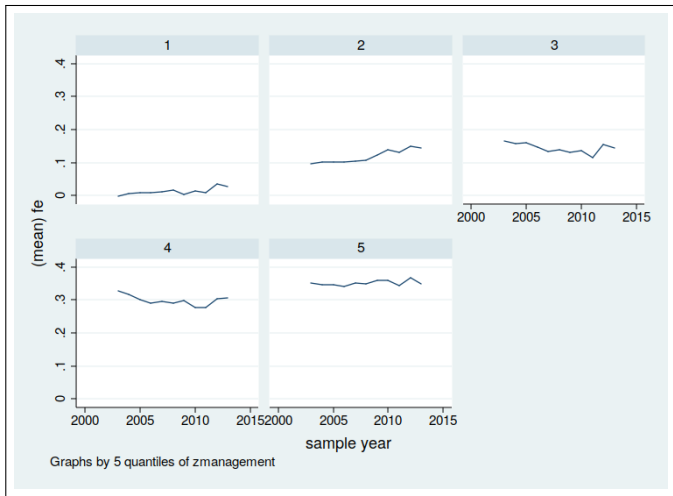


# Share College by Management Quality, 2003-2013





# Estab. Effect by Management Quality, 2003-2013



# Worker FE and Management Indices: With Controls



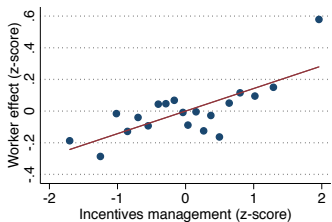
Includes controls for firm size and industry.



Includes controls for firm size and industry.

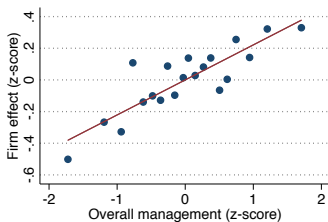


Includes controls for firm size and industry.



Includes controls for firm size and industry.

# Firm FE and Management Indices: With Controls



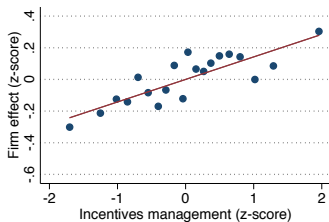
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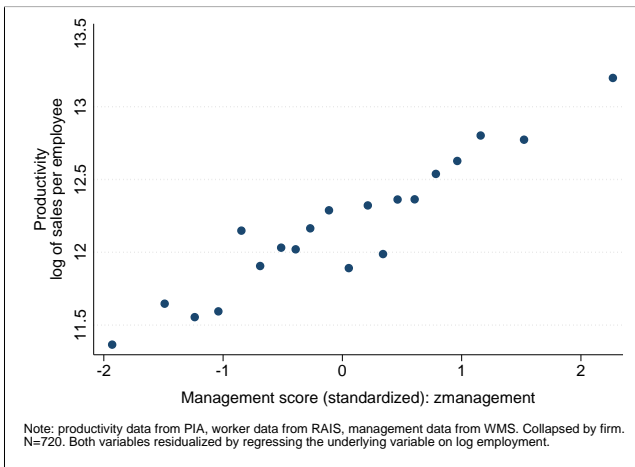


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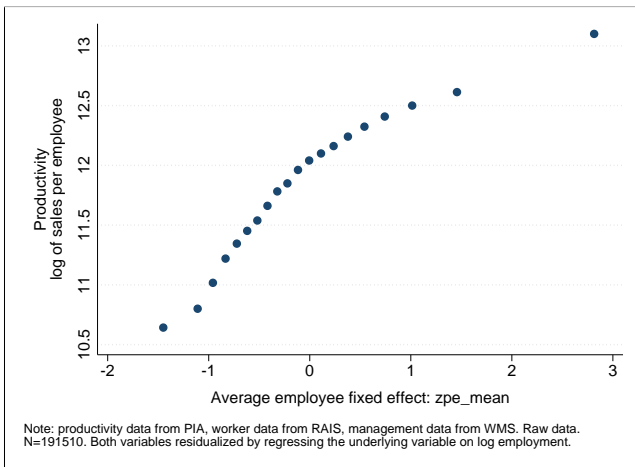
# Compensation Practices, Management Quality, and Employment Outcomes

Variables	Mean	Std. Dev.	Component Correlations		
			Management	$\hat{\psi}$	$\hat{\theta}$
Management (z-score)	0	1	1.000		
Firm effect: $\hat{\psi}$	0	1	0.439	1.000	
Worker effect: $\hat{\theta}$	0	1	0.392	0.603	1.000
Firm size (employment)	583	787	0.325	0.219	0.267
Share of employees with college degree	0.12	0.16	0.325	0.500	0.873
Hire rate	0.19	0.14	-0.054	-0.193	-0.154
Separation rate	0.22	0.13	-0.177	-0.251	-0.258
Average tenure (months)	59.30	30.25	0.113	0.338	0.293
Average hours worked (week)	43.56	1.32	-0.070	-0.273	-0.287
Share of white workers	0.69	0.28	0.026	0.124	0.277
Share of male workers	0.72	0.22	0.101	0.243	-0.013
Share of unionized workers (non-managers)	0.56	0.40	-0.108	-0.123	-0.099

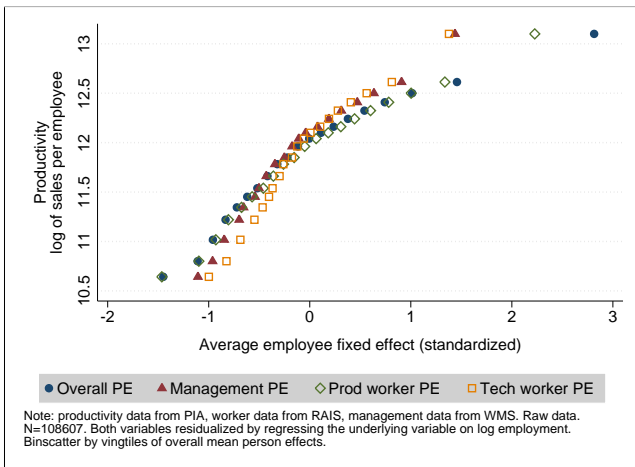
# Management X Sales per Worker



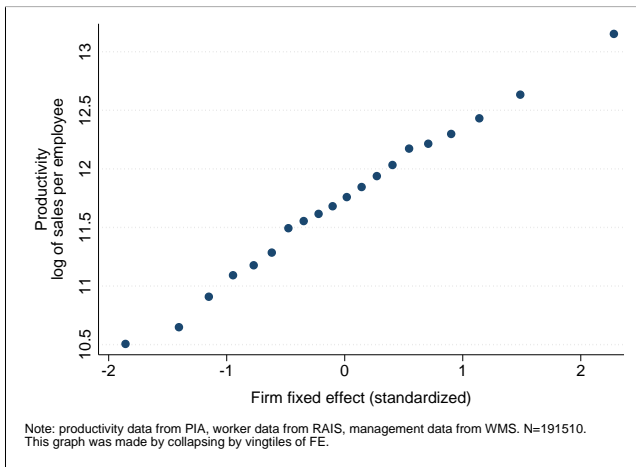
# Employee FE X Sales per Worker



# Employee FE X Sales per Worker



# Firm FE X Sales per Worker





# Management Quality and Manager/Production Worker FE

	(1)	(2)	(3)	(4)	(5)
	z-mgmt	z-mgmt	z-mgmt	z-mgmt	z-mgmt
Mean person effect		0.274** (0.112)			
Mean person effect (production)			0.107 (0.199)	-0.083 (0.242)	-0.291 (0.288)
Mean person effect (managers)			0.330*** (0.069)	0.283*** (0.081)	0.294*** (0.081)
Mean person effect (supervisors)				0.023 (0.134)	0.019 (0.133)
Mean person effect (technical)				0.324** (0.160)	0.259 (0.165)
share college					0.777** (0.369)
Ln(employment)	0.325*** (0.042)	0.314*** (0.042)	0.246*** (0.045)	0.203*** (0.047)	0.195*** (0.047)
Worker chars	Y	Y	Y	Y	Y
Industry controls	Y	Y	Y	Y	Y
# Observations	840	840	696	632	632
# Firms	611	611	522	474	474
R <sup>2</sup>	0.442	0.447	0.470	0.466	0.471
F-stat	7.085	6.968	7.864	6.414	6.154

# Worker FE and Management Quality

Dependent Variable: Firm Avg. Worker Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
z-management	0.224*** (0.034)	0.178*** (0.035)	0.080** (0.033)									
z-operations				0.214*** (0.035)	0.165*** (0.035)	0.067** (0.034)				0.137*** (0.044)	0.092** (0.043)	0.017 (0.043)
z-people							0.195*** (0.032)	0.154*** (0.032)	0.079*** (0.029)	0.105*** (0.040)	0.100** (0.040)	0.069* (0.038)
Ln(employment)		0.110** (0.044)	0.079* (0.041)		0.116*** (0.044)	0.084** (0.041)		0.132*** (0.043)	0.084** (0.041)		0.113** (0.044)	0.081** (0.041)
MNE = 1			0.331** (0.128)			0.335*** (0.129)			0.340*** (0.126)			0.336*** (0.128)
% unionized workers			-0.027 (0.075)			-0.025 (0.076)			-0.035 (0.075)			-0.033 (0.076)
Worker chrs	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	961	961	840	961	961	840	961	961	840	961	961	840
# Firms	694	694	611	694	694	611	694	694	611	694	694	611
R <sup>2</sup>	0.366	0.374	0.472	0.362	0.371	0.471	0.360	0.372	0.473	0.367	0.375	0.473
F-stat	43.043	22.911	14.168	38.366	20.827	14.168	37.223	21.295	14.010	21.825	15.529	13.316

# Production Worker FE and Management Quality

Dependent Variable: Firm Avg. Production Worker Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
z-management	0.156*** (0.044)	0.142*** (0.042)	0.048 (0.037)									
z-operations				0.148*** (0.044)	0.132*** (0.043)	0.041 (0.039)				0.090* (0.054)	0.076 (0.053)	0.011 (0.050)
z-people							0.137*** (0.039)	0.121*** (0.037)	0.047 (0.033)	0.077* (0.046)	0.076* (0.046)	0.041 (0.043)
Ln(employment)		0.033 (0.044)	0.018 (0.036)		0.037 (0.044)	0.020 (0.036)		0.052 (0.044)	0.021 (0.036)		0.035 (0.044)	0.019 (0.036)
MNE = 1			0.289** (0.128)			0.291** (0.129)			0.296** (0.126)			0.293** (0.128)
% unionized workers			-0.064 (0.080)			-0.062 (0.080)			-0.069 (0.080)			-0.067 (0.081)
Worker chars	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	950	950	829	950	950	829	950	950	829	950	950	829
# Firms	690	690	606	690	690	606	690	690	606	690	690	606
R <sup>2</sup>	0.316	0.316	0.480	0.313	0.314	0.479	0.313	0.315	0.480	0.316	0.317	0.480
F-stat	12.678	6.433	11.400	11.035	5.583	11.363	12.479	6.326	11.541	6.664	4.491	10.779

# Managerial Worker FE and Management Quality

Dependent Variable: Firm Avg. Managerial Worker Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
z-management	0.350*** (0.037)	0.286*** (0.040)	0.227*** (0.043)									
z-operations				0.366*** (0.038)	0.303*** (0.040)	0.247*** (0.043)				0.362*** (0.054)	0.307*** (0.052)	0.266*** (0.056)
z-people							0.240*** (0.036)	0.178*** (0.038)	0.130*** (0.041)	0.005 (0.049)	-0.005 (0.049)	-0.026 (0.053)
Ln(employment)		0.159*** (0.039)	0.125*** (0.041)		0.155*** (0.038)	0.122*** (0.040)		0.211*** (0.040)	0.157*** (0.042)		0.155*** (0.039)	0.123*** (0.041)
MNE = 1			0.273** (0.129)			0.263** (0.129)			0.314** (0.133)			0.262** (0.129)
% unionized workers			-0.037 (0.090)			-0.025 (0.090)			-0.053 (0.092)			-0.021 (0.091)
Worker chrs	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	814	814	703	814	814	703	814	814	703	814	814	703
# Firms	601	601	525	601	601	525	601	601	525	601	601	525
R <sup>2</sup>	0.372	0.389	0.440	0.377	0.393	0.444	0.330	0.361	0.422	0.377	0.393	0.445
F-stat	87.156	53.965	8.527	91.338	54.450	8.816	43.652	40.969	7.078	45.668	36.405	8.223

# Managerial Worker FE and People-Management Quality

Dependent Variable: Firm Avg. Managerial Worker Effect

	(1)	(2)	(3)	(4)	(5)	(6)
z-people	0.240*** (0.036)	0.130*** (0.041)				
z-incentives			0.218*** (0.035)	0.118*** (0.038)		
z-talent mindset					0.063 (0.042)	0.045 (0.045)
z-appraisals					0.062 (0.043)	0.019 (0.045)
z-fixing/firing					0.040 (0.036)	0.041 (0.038)
z-promotions					0.090** (0.043)	0.081* (0.048)
z-EVP					0.138*** (0.041)	0.041 (0.043)
z-retention					-0.044 (0.036)	-0.024 (0.038)
Ln(employment)		0.157*** (0.042)		0.160*** (0.042)		0.147*** (0.043)
MNE = 1		0.314** (0.133)		0.303** (0.135)		0.307** (0.133)
% unionized workers		-0.053 (0.092)		-0.056 (0.092)		-0.054 (0.093)
Worker chrs		Y		Y		Y
Industry controls	Y	Y	Y	Y	Y	Y
# Observations	814	703	814	703	809	699
# Firms	601	525	601	525	598	523
R <sup>2</sup>	0.330	0.422	0.323	0.421	0.340	0.425
F-stat	43.652	7.078	40.002	7.046	9.280	5.373

# Firm FE and Management Quality

Dependent Variable: Establishment Effect

	(1)	(2)	(3)	(4)	(5)	(6)
z-management	0.260*** (0.030)	0.200*** (0.033)	0.083** (0.033)			
z-operations				0.236*** (0.041)	0.180*** (0.041)	0.072* (0.039)
z-people				0.038 (0.038)	0.031 (0.038)	0.016 (0.034)
Ln(employment)		0.143*** (0.035)	0.107*** (0.038)		0.141*** (0.035)	0.107*** (0.038)
Firm controls	No	No	Yes	No	No	Yes
Worker chars controls	No	No	Yes	No	No	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
# Firms	961	961	840	961	961	840
$R^2$	0.517	0.531	0.652	0.518	0.531	0.652

# Firm FE vs People-Management Quality

Dependent Variable: Establishment Effect

	(1)	(2)	(3)	(4)
z-people	0.193*** (0.029)	0.058** (0.029)		
z-talent mindset			0.029 (0.035)	0.003 (0.033)
z-appraisals			0.089*** (0.032)	0.011 (0.027)
z-fixing/firing			0.041 (0.029)	0.024 (0.026)
z-promotions			0.036 (0.032)	0.032 (0.030)
z-EVP			0.114*** (0.033)	0.006 (0.034)
z-retention			-0.031 (0.031)	0.007 (0.027)
Ln(employment)		0.119*** (0.037)		0.120*** (0.038)
Firm controls	No	Yes	No	Yes
Worker chars controls	No	Yes	No	Yes
Industry controls	Yes	Yes	Yes	Yes
# Firms	961	840	955	836
R <sup>2</sup>	0.497	0.651	0.503	0.650

## Conclusions and Future Direction

- Jointly model within-firm seniority and pay
- Consider roles of labor-market institutions
  - unionization
  - regulation
  - minimum wage
- Sorting and mobility of managers / non-managers workers



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