Mental models of competition and technology upgrading

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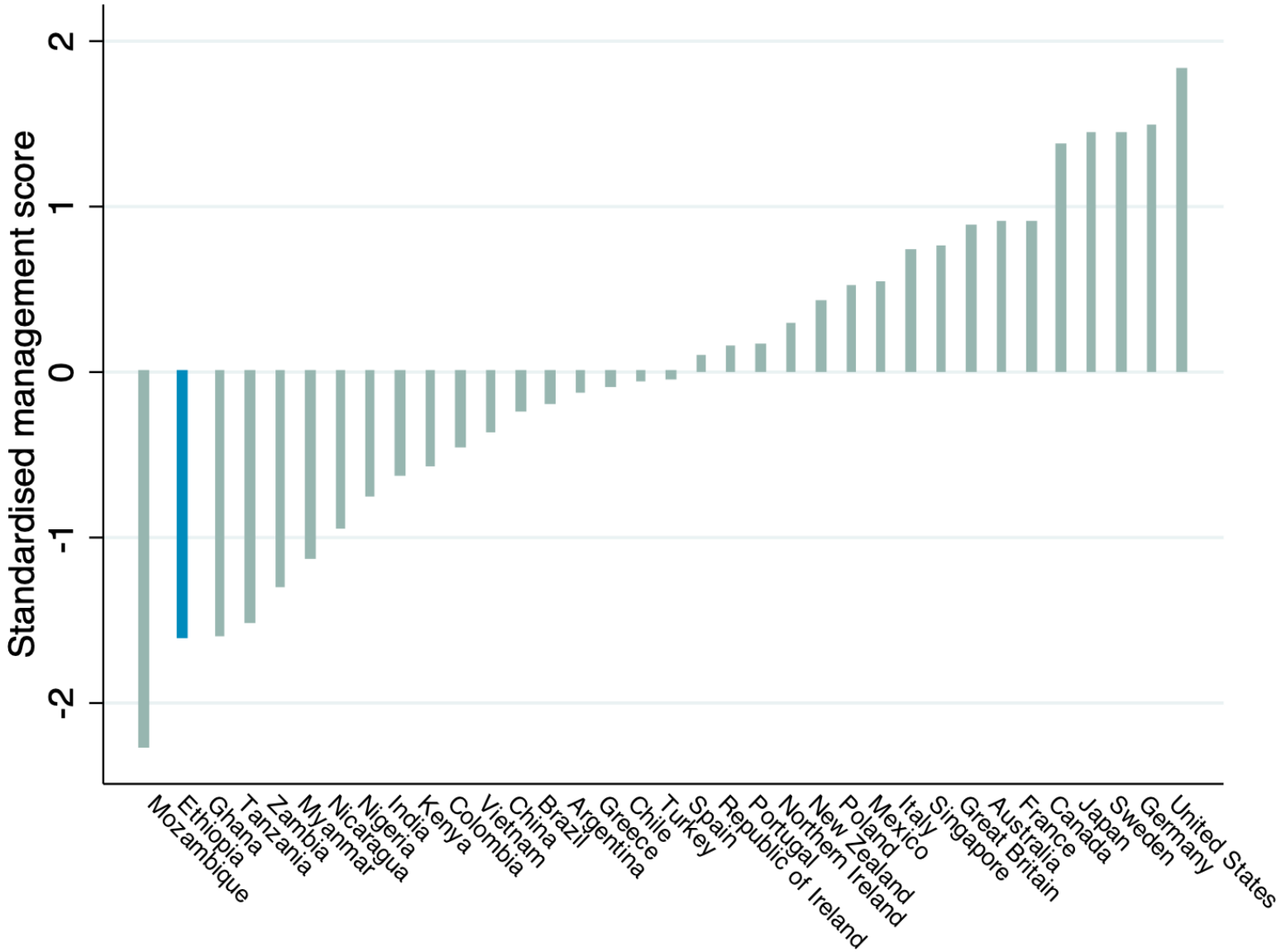
Why is management quality lower in LICs?



The role of product and labor markets

Two leading hypotheses are:

1. Product market competition is too low (Bloom Van Reenen 2007, Bloom et al. 2013, Bloom et al. 2015, Macchiavello Morjaria 2020).
2. Labor market competition is too high (Becker 1964, Acemoglu and Pischke 1999).

$\rightarrow$ We test these hypotheses experimentally, focusing on how competition shapes choices (not how it affects selection).

$\rightarrow$ Assumption: managers use *mental models* of competition that do not feature spillovers. We will test this directly.

The role of product and labor markets

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$\rightarrow$ Assumption: managers use *mental models* of competition that do not feature spillovers. We will test this directly.

Experiment 1: decrease labor market competition

- We invite middle managers to join an *in-person management training* course.
- We offer to pay a bonus to trained managers, randomizing whether the bonus is conditional on retention or not.

$\rightarrow$ The retention bonus should decrease the risk of poaching.

Does reducing expected turnover increase demand for management training?

- The retention bonus reduces expected manager turnover.
- But it does not increase demand for training.

Experiment 2: raise product market competition

- We create groups of similar firms, and offer *marketing training* to some firms in each group, for free.
- We randomize information designed to change the perception of how many competitors are trained.
  - Passive control at baseline
  - Active control at endline
- We elicit willingness to pay for the training.

Does training competitor firms increase demand for management training?

- First stage: the (active control) intervention raises expected management quality among competitors.
- But it does not increase demand for training.

The positive spillover mental model

- We show most firms believe in several positive spillover mechanisms (especially diversification).
  - DAGs show firms expect responses on quality margin.

- About half of firms do not believe their profits will be reduced if competitors' management improves.

$\rightarrow$ Under this mental model, neither product nor labor market competition spur management upgrading.

Contribution

- We test two seminal hypotheses on the drivers of management quality (Becker 1964, Bloom and Van Reenen 2007).

- We provide new evidence on firms' mental models and how these shape competition (Pearl 2000, Sloman 2005, Eliaz Spiegler 2020, Andre et al. 2022).

Roadmap

Context and sample

Experiment 1
- Design
- Results

Experiment 2
- Design
- Results

The positive spillover mental model

We sample 1200 firms in Ethiopia

- A sample of 1,230 firms in 8 sectors: manufacturing, construction, transport, tourism, services, trade, mining, agriculture.
- Firms initially interviewed in 2017.
- In 2019 (experiment 1), we:
  - tracked 97% percent of the original firms (and of those reached, 4% refused to answer and 13% had closed)
  - surveyed 344 additional firms through snowball sampling.
- In 2022 (experiment 2) we reached about 900 of the firms sampled in 2019.

Comparison with representative sample

Sample:	SEDRI	SEDRI eligible	World Bank representative
	(1)	(2)	(3)
Firm size	16	37	40
Firm age	8	9	5
Sector = manufacturing	0.44	0.43	0.40
Sales per worker	3830	6954	10137
Obs.	1127	569	425

We report medians for continuous variables.
Sales and cost values are in 2016 USD.

Management quality predicts sales

Competition and management quality

	Dep. var: Management quality index		
	(1)	(2)	(3)
Domestic competition	0.200*		
	(0.089)		
Foreign competition		0.814***	
		(0.086)	
Learner index			2.348**
			(0.898)
Mean	0.737	0.102	0.828
N	1159	1159	870

A low training, low turnover equilibrium?

Training	
Ever organized or participated in formal training for employees (%)	0.32
	(0.47)
At least one manager trained with formal training in FY 2010 (%)	0.22
	(0.41)
Skills via formal training important during recruitment (%)	0.90
	(0.30)
Turnover	
Non manager turnover rate in FY2010 (question asked directly)	15.48
	(21.78)
Manager turnover rate in FY2010 (question asked directly)	2.78
	(10.39)
At least one manager quit over the last fiscal year (%)	0.17
	(0.37)
Agree that difficult to retain managers at this establishment (%)	0.20
	(0.40)
Turnover (top manager survey)	
If lose managers: because take better paying job (%)	0.89
	(0.32)
Agree that managers turnover negatively affects this establishment (%)	0.73
	(0.45)
Agree that managers more likely to leave after training (%)	0.26
	(0.44)
N	619

Roadmap

Context and sample

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The positive spillover mental model

We study the demand for management training

We invite firms to send their *middle managers* to attend a management training program at AA School of Commerce.

We offer two types of incentives:

- A bonus for the middle manager: 1 month of pay after 12 months and 2 months of pay after 24 months;
- A subsidy of the cost of the training.

Firms (top managers) are then invited to apply for the program by nominating up to two middle managers.

We vary bonus conditionality to reduce expected turnover

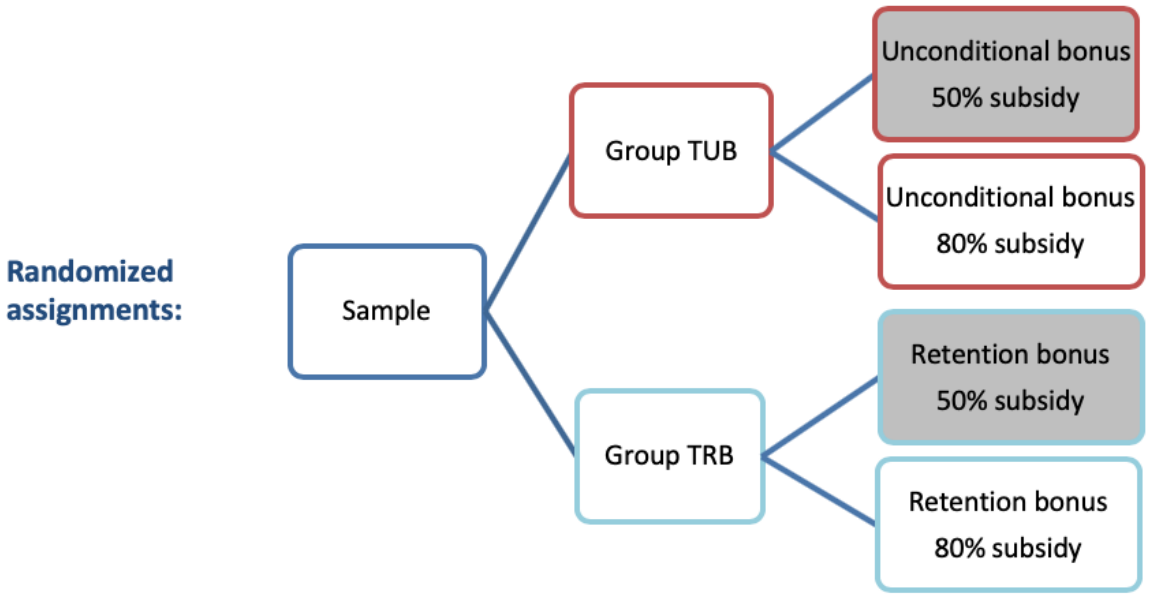
We vary the conditionality of the bonus:

- The *retention bonus* is conditional on staying at the firm;
- The *unconditional bonus* is not conditional on retention.

$\rightarrow$ Retention bonus designed to reduce expected turnover.

We also vary the amount of the subsidy: 50% or 80%.

We cross-cut the two interventions



▸ Balance

Examples of courses (cost is between 20 and 40 percent of monthly wage)

Logistics and Supply Chain Management Program Unit

ST-LSCM-01	Advanced Procurement Management	60 Hours
ST-LSCM-02	Inventory Management	40 Hours
ST-LSCM-03	Negotiation and Contract Management	40 Hours
ST-LSCM-04	Public Procurement	40 Hours
ST-LSCM-05	Operations Systems Change (Kaizen, BPR, TQM)	40 Hours
ST-LSCM-06	Import and Export Procedures	40 Hours
ST-LSCM-07	Office Kaizen	40 Hours
ST-LSCM-08	Value Chain Management	40 Hours
ST-LSCM-09	Global Supply Chain Management	40 Hours
ST-LSCM-10	Foreign Procurement	32 Hours
ST-LSCM-11	Disaster Relief Operations Management	32 Hours
ST-LSCM-12	Warehouse/Stores Management	40 Hours
ST-LSCM-13	Transport/Fleet Management	40 Hours
ST-LSCM-14	Customs Procedure	40 Hours
ST-LSCM-15	Property Management	40 Hours

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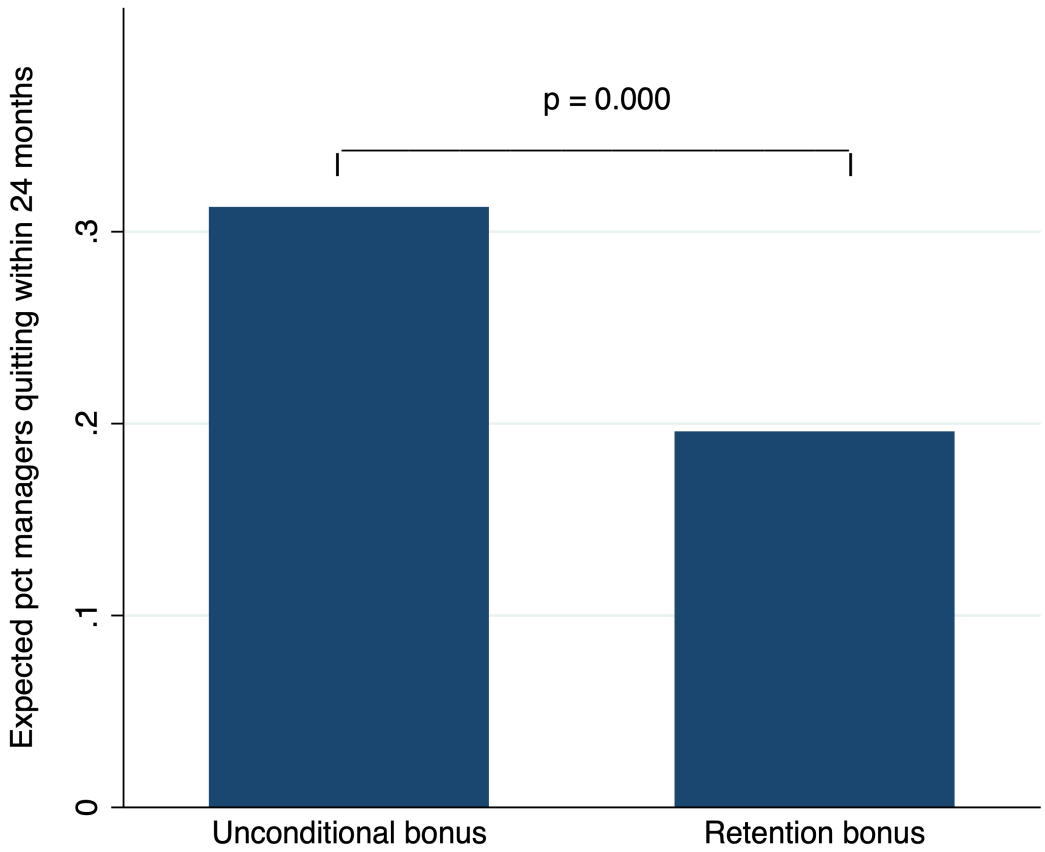
The positive spillover mental model

The retention bonus reduces expected turnover

Figure: Expected turnover decreases by 1/3



But it does not affect demand for training

	Dep var: Application	
	(1)	(2)
Retention bonus	-.025	-.019
	(0.028)	(0.040)
High subsidy	-.034	-.028
	(0.029)	(0.041)
Retention bonus * high subsidy		-.011
		(0.056)
Mean uncond. bonus, low subsidy	0.211	0.211
Obs.	598	598

Are firms and/or workers simply uninterested?

- 88% of firms agree that ‘This training will significantly increase this establishment’s performance’.
- Firms estimate that the training program will increase market wages by 20 pct.
- Nominated managers do not take up the training, citing non-monetary costs as the main reason.

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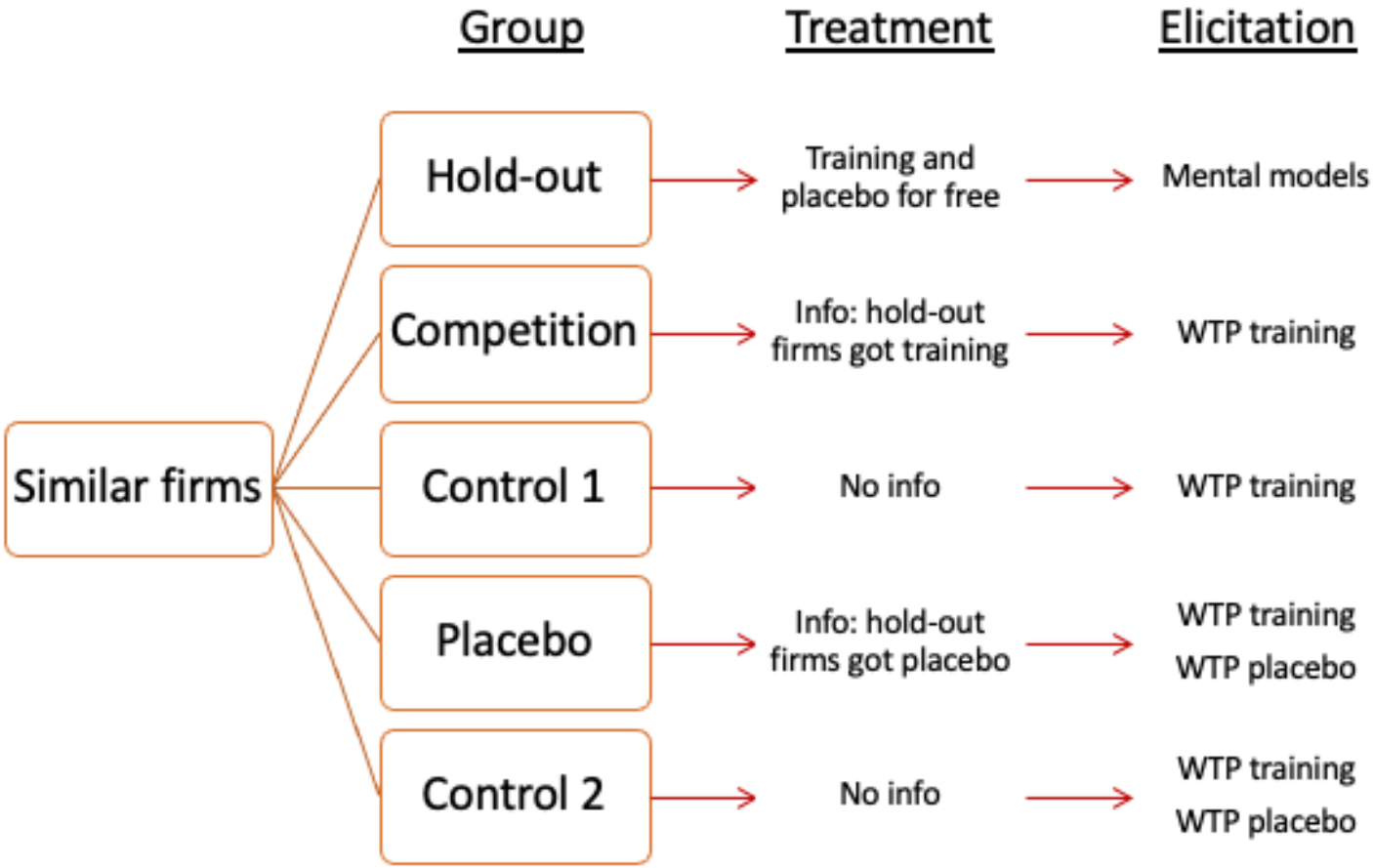
The positive spillover mental model

A new video training on marketing

- We design a new training product focused on marketing management.
- This is a video training, to reduce training costs.
- Designed to train top managers in the aspects of management that they flagged as most important for them.
- Covers the following topics: pricing, advertisement, quality decisions, reputation management, competition.

The passive-control experiment



▸ Balance

The active-control experiment

- At endline, cross-cut with initial experiment.
- Half of the firms are (truthfully) told: ‘we have already offered this video training to all of the firms with more than 10 employees based in your Kebele which we were able to reach.’
- Half of the firms are (truthfully) told: ‘so far we have only offered this video to a very small proportion of Ethiopian firms.’

▸ Balance ▸ Attrition

Willingness to pay elicitation

- Standard Becker-De Groot mechanism:
  - Firms report WTP.
  - We extract price p.
  - If $WTP > p$, firms can purchase at price p.
- High compliance with payment of p (Maffioli et al. 2022).
- Use practice round as recommended by Jayachandran and Dizon-Ross 2022.

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The positive spillover mental model

Does the competition treatment raise training WTP?

Table: Active control

	WTP>0 (1)	WTP (2)	WTP winsorized (3)	WTP (4)
High competition	-0.04	-213.95	-7.97	-0.00
	(0.03)	(367.34)	(113.46)	(34.32)
Low competition mean	0.66	1007.03	666.34	1007.03
N	987	987	987	987

Does the competition treatment raise training WTP?

Table: Passive control

	WTP>0 (1)	WTP (2)	WTP winsorized (3)	WTP (4)
Competition	0.02	-8.43	-1.71	0.00
	(0.03)	(48.66)	(22.20)	(15.18)
Control mean	0.56	258.97	211.82	258.97
N	767	767	767	767

What explains this null result?

- Is there a first stage? ▸ Link
- Is this due to lack of familiarity with the training? ▸ Link
- Is there a social consumption effect? ▸ Link

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The positive spillover mental model

The positive spillover mental model

- We provide evidence that firms expect positive spillovers from competitors' adoption of new management practices.
- Under this mental model, both product and labor market interventions fail to provide incentives for training.
- Positive spillovers may arise from:
  - Market expansion effects
  - Innovation risk (e.g. adoption of inferior practices)
  - Diversification
  - Poaching
  - Direct observation
  - Motivation contagion

Evidence for the spillover mental model

- Direct mental model elicitation ▸ Link
- Firm usual practices ▸ Link
- Additional WTP elicitation ▸ Link

Conclusion

- Improving competitor management or reducing expected poaching does not increase management upgrading WTP.

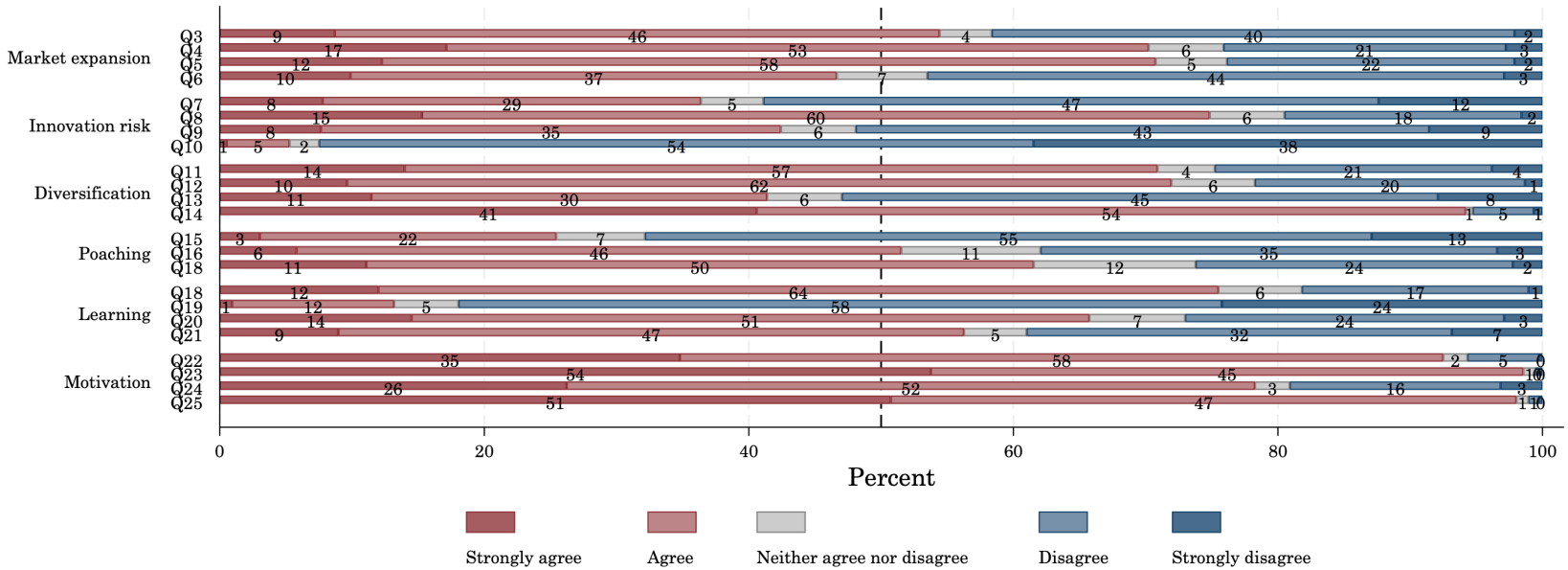
- 'Positive spillover' mental models may (partly) explain this.

$\rightarrow$ These mental models generate counterintuitive competition responses...

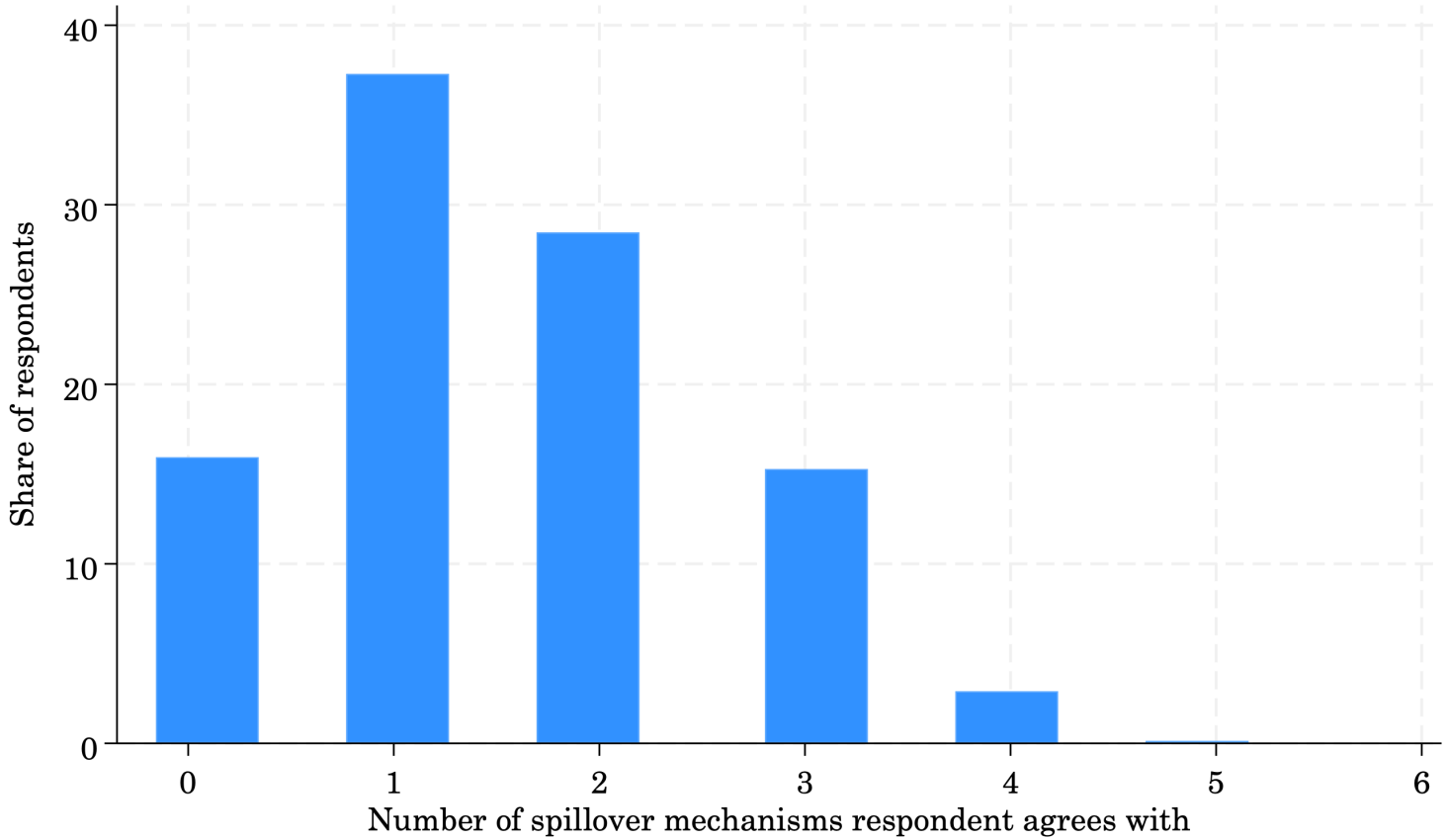
$\rightarrow$ ... and could (partly) explain persistent heterogeneity in management quality and productivity.

Thank you!

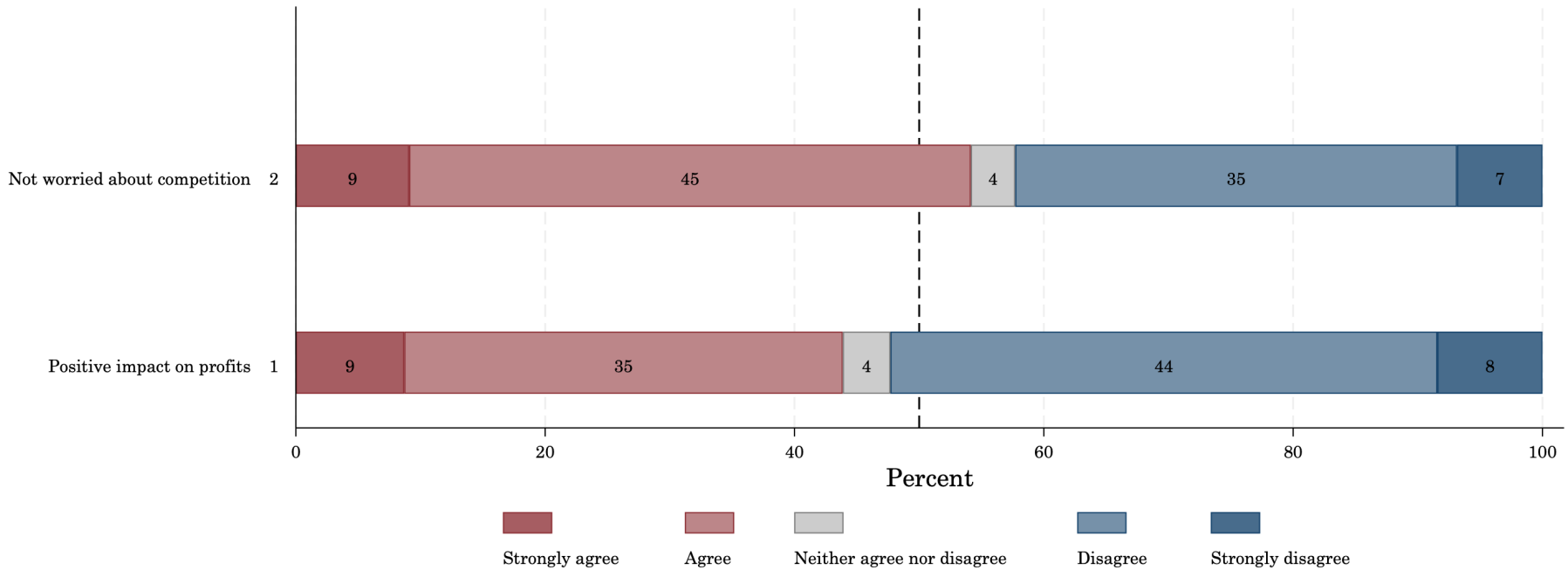
Direct evidence on the 6 mechanisms



85% of managers believe in at at least 1 mechanism



Almost 50% of managers believe competitors' upgrading will not affect their profits



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Diversification is a key predictor of mental model

	Dep. var: Mental model question	
	(1)	(2)
Expansion	0.077	0.039
	(0.081)	(0.060)
Innovation risk	0.030	-0.236***
	(0.088)	(0.059)
diversification	0.331***	0.184**
	(0.083)	(0.059)
Poaching	0.152*	0.088
	(0.067)	(0.049)
Learning	-0.022	-0.067
	(0.073)	(0.056)
Motivation	-0.085	-0.110
	(0.096)	(0.073)
Constant	1.740***	3.311***
	(0.473)	(0.349)
Mean	3.082	2.970
N	759	759

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Mental models elicitation with DAGs ▸ Back

Mental models can be captured by *Directed Acyclical Graphs*.

- Nodes represent random variables.
- Directed links represent causal relations.

Many applications in philosophy, psychology, economics: Pearl 2000, Sloman 2005, Eliaz Spiegler 2020, Andre et al. 2022.

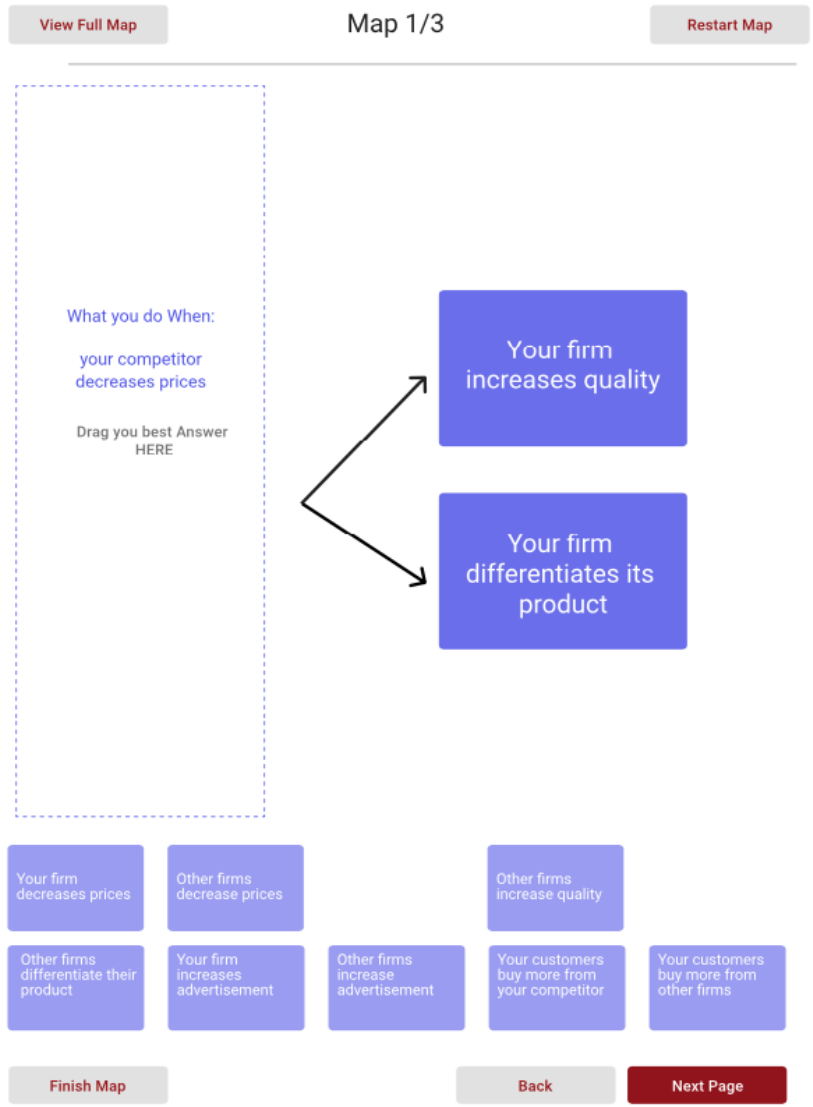
$\rightarrow$ We develop a simple app to have respondents sketch their own DAGs.

Example: two competing mental models

The DAG app


View Full Map
Map 1/3
Restart Map
What you do When:
your competitor decreases prices
Drag you best Answer HERE
Your firm decreases prices
Other firms decrease prices
Your firm increases quality
Other firms increase quality
Your firm differentiates its product
Other firms differentiate their product
Your firm increases advertisement
Other firms increase advertisement
Your customers buy more from your competitor
Your customers buy more from other firms
Finish Map
Continue

The DAG app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Other firms decrease prices
Other firms increase quality
Other firms differentiate their product
Your firm increases advertisement
Other firms increase advertisement
Your customers buy more from your competitor
Your customers buy more from other firms
Finish Map
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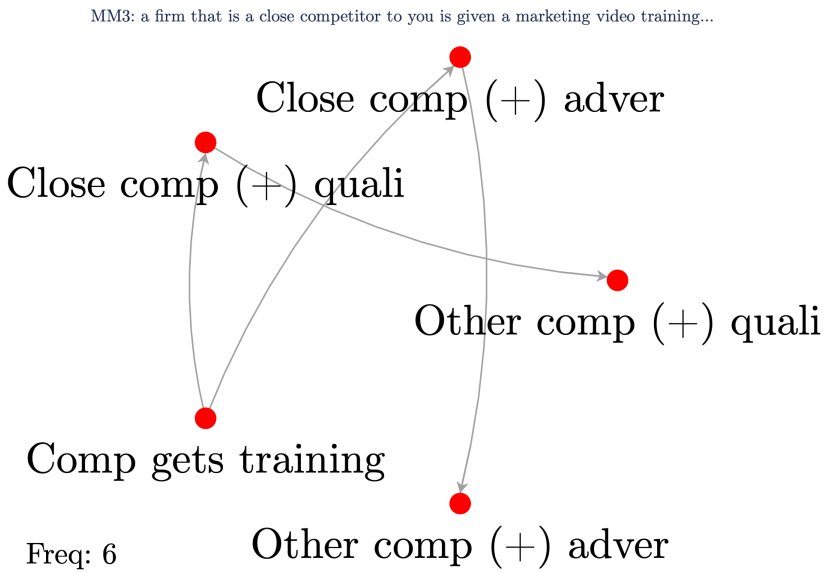
The most common DAGs: firms expect the training to affect quality and advertisement



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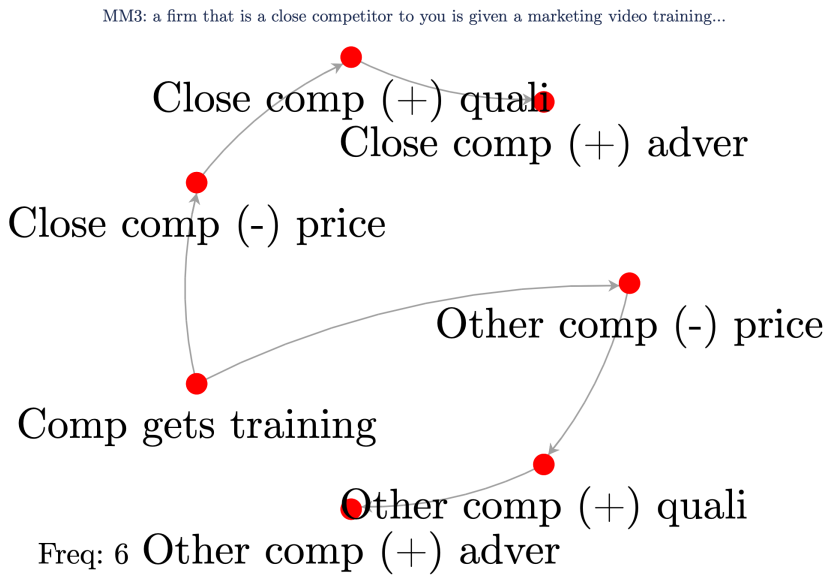
The most common DAGs: firms expect the training to affect quality and advertisement



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How does competition work?

	Response
Rarely or never cuts prices when competitors cut prices	0.58
Rarely or never boosts ads when competitors boost ads	0.74
Agrees it is better to differentiate	0.89

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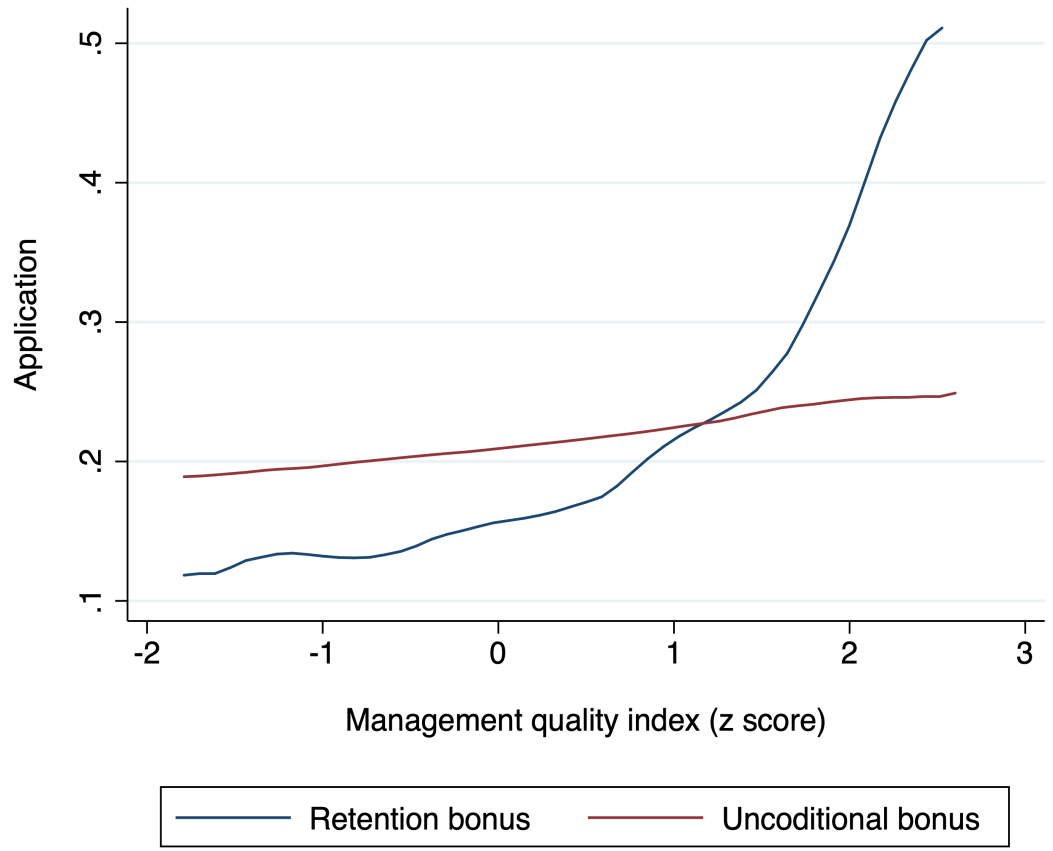
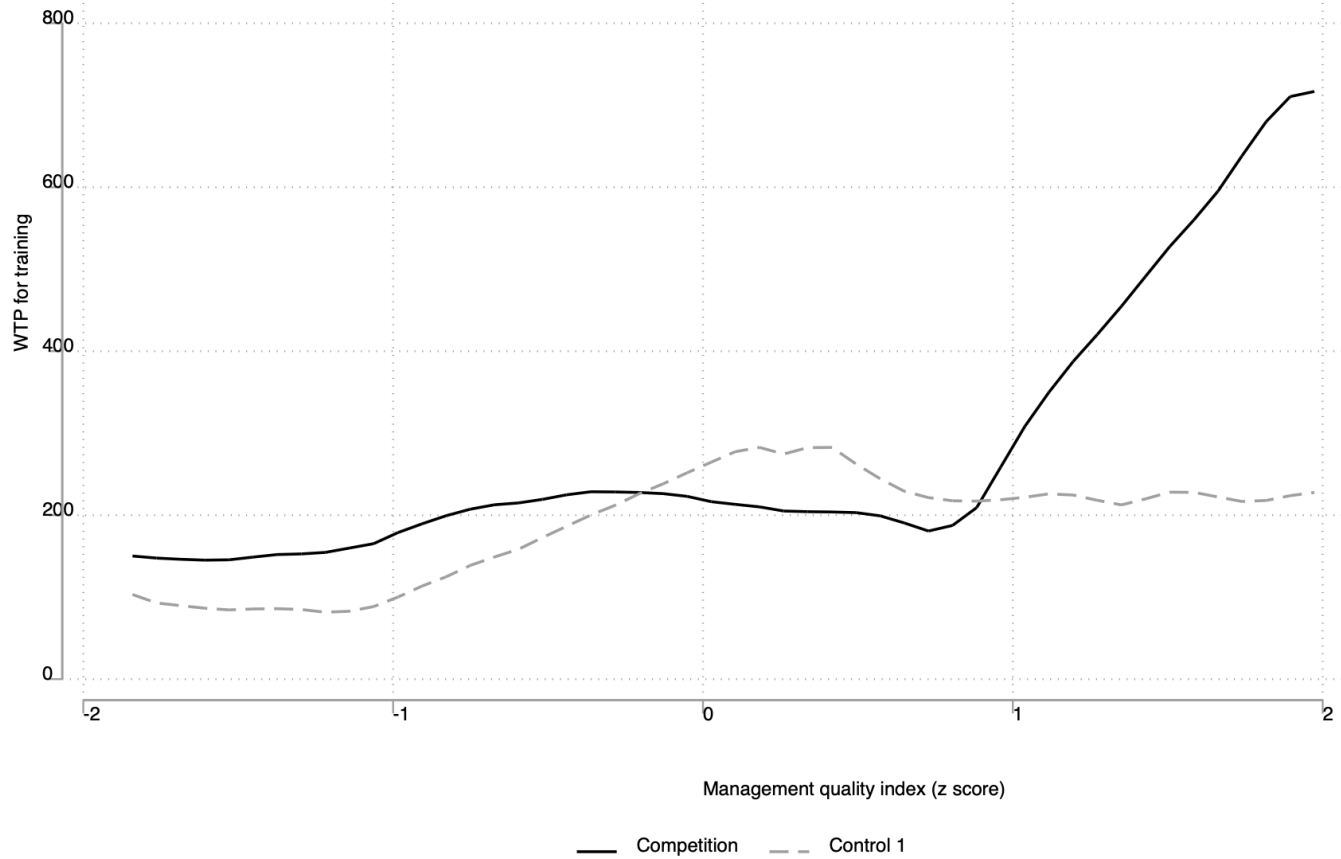
Management quality and demand for training

Back



Management quality and demand for training

Back



What is a middle manager? Back

A middle manager is a manager who is not a top manager, and for whom at least one of these two statements is true:

- manages at least one junior manager OR
- works non-routine management tasks (e.g., exclude the line supervisors in a factory)

Balance W2 firms

Back

	Mean and Standard Deviation		N	Imbalance (p)
	Unconditional bonus	Retention bonus		
	(1)	(2)	(3)	(4)
Variables used for randomization				
Firm size	52.80	57.53	1192	0.36
	(85.69)	(91.18)		
Firm age	8.57	8.26	1165	0.38
	(6.22)	(5.86)		
Manufacturing sector (dummy)	0.08	0.08	1343	0.63
	(0.26)	(0.28)		
Distance from School of Commerce (min)	69.07	70.27	1335	0.53
	(34.82)	(35.56)		
Applicability (0, 1 or 2)	1.37	1.37	1343	0.91
	(0.76)	(0.78)		
Average wage middle managers	4808.82	4813.62	692	0.98
	(2901.86)	(2725.62)		
Trained managers (%)	10.96	11.31	1190	0.84
	(28.82)	(29.81)		
Turnover rate managers in FY2008 (%)	2.18	1.56	1192	0.08
	(6.45)	(5.61)		

Balance Experiment 1

Back

	Mean and Standard Deviation		N	Imbalance (p)
	Unconditional bonus	Retention bonus		
	(1)	(2)	(3)	(4)
Variables used for randomization				
Firm size	87.89	103.88	619	0.12
	(120.85)	(132.13)		
Firm age	9.20	8.89	604	0.56
	(6.73)	(6.26)		
Manufacturing sector (dummy)	0.13	0.10	620	0.18
	(0.34)	(0.30)		
Distance from School of Commerce (min)	75.98	78.09	619	0.45
	(34.78)	(35.03)		
Applicability (0, 1 or 2)	1.89	1.90	620	0.75
	(0.34)	(0.31)		
Average wage middle managers	5513.03	5603.20	508	0.75
	(3261.30)	(3052.61)		
Trained managers (%)	14.97	16.48	617	0.58
	(32.84)	(34.76)		
Turnover rate managers in FY2008 (%)	3.83	2.30	619	0.03
	(9.43)	(7.48)		

Balance Experiment 2 Passive Control

Back

	Mean and Standard Deviation					N	Imbalance (p)
	Holdout	Treatment	Control 1	Control 2	Placebo		
				Targeted			
Food and Beverages	0.14	0.12	0.11	0.11	0.12	902	0.86
	(0.35)	(0.32)	(0.31)	(0.31)	(0.33)		
Wood products	0.04	0.06	0.08	0.12	0.09	902	0.17
	(0.21)	(0.24)	(0.27)	(0.32)	(0.28)		
Construction	0.03	0.08	0.09	0.05	0.05	902	0.08
	(0.18)	(0.28)	(0.29)	(0.23)	(0.21)		
Tourism and hotel	0.18	0.08	0.12	0.16	0.10	902	0.02
	(0.39)	(0.28)	(0.33)	(0.37)	(0.30)		
Restaurant	0.22	0.17	0.18	0.16	0.17	902	0.69
	(0.42)	(0.38)	(0.38)	(0.37)	(0.38)		
Payroll employees	41.19	52.24	46.14	51.55	43.65	902	0.82
	(94.72)	(126.75)	(95.70)	(116.16)	(102.67)		
Age of the firm	1.73	1.92	1.95	1.90	1.78	898	0.06
	(0.87)	(0.80)	(0.79)	(0.78)	(0.80)		
Latitude	8.94	8.94	8.96	8.96	8.95	902	0.71
	(0.19)	(0.18)	(0.17)	(0.17)	(0.19)		
Longitud	38.84	38.82	38.81	38.82	38.82	902	0.56
	(0.19)	(0.19)	(0.18)	(0.17)	(0.21)		
Gender owner	0.78	0.88	0.74	0.76	0.84	884	0.00
	(0.41)	(0.33)	(0.44)	(0.43)	(0.37)		
N	159	303	142	146	152		

Balance Experiment 2 Active Control

Back

	Mean and Standard Deviation		N	Imbalance (p)
	Low competition	High competition		
	Targeted variables			
Firm size	2.99	2.98	990	0.96
	(1.23)	(1.31)		
Firm age	11.49	12.08	982	0.28
	(8.00)	(9.21)		
Food and Beverages	0.10	0.10	990	0.93
	(0.31)	(0.30)		
Wood products	0.07	0.09	990	0.17
	(0.25)	(0.28)		
Construction	0.04	0.05	990	0.24
	(0.19)	(0.22)		
Tourism	0.12	0.12	990	1.00
	(0.33)	(0.33)		
Restaurant	0.21	0.21	990	0.86
	(0.40)	(0.41)		
Latitude	8.95	8.94	990	0.56
	(0.17)	(0.18)		
Longitud	38.82	38.83	990	0.62
	(0.18)	(0.18)		
N	491	499		

Attrition experiment 2 ▸ Back

	Attrition (1)
Competition	-0.02
	(0.04)
Control 2	0.01
	(0.04)
Placebo	-0.03
	(0.04)
Holdout	0.04
	(0.04)
Mean	0.15
N	948

Does competition increase demand for the placebo?

	(1) Interest	(2) WTP	(3) Log (WTP +1)
Placebo	0.129**	18.78	0.649*
	(0.0497)	(24.37)	(0.266)
Mean	0.164	47.60	0.866
N	281	281	281

Standard errors in parentheses
$^{*}\ p < 0.05,\ ^{**}\ p < 0.01,\ ^{***}\ p < 0.001$

▸ Back

Social consumption effect

total effect = pure competition effect + social consumption effect

Table: Placebo

	WTP>0 (1)	WTP (2)	WTP winsorized (3)	WTP (4)
Competition	0.12**	27.65	26.01	0.00
	(0.05)	(22.23)	(18.42)	(129.17)
Control mean	0.18	47.73	44.48	47.73
N	312	312	312	312

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Is this due to the novelty of the training?

Table: WTP for training

	All firms (1)	Did not receive training (2)	Received training (3)
High competition	-7.97	21.09	-69.59
	(113.46)	(77.24)	(289.21)
Low competition mean	666.34	286.69	1431.57
N	987	662	325

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The active control treatment affects perceptions

	Treated firms (1)	Treated competitors (2)	Better managed (3)	More competition (4)
High competition	6.64***	4.75**	0.15*	0.10
	(1.71)	(1.55)	(0.07)	(0.07)
Mean	24.43	16.34	3.64	3.90
N	866	866	858	862

Back

The passive control treatment

	Better managed (1)	More competition (2)
Competition	0.01	-0.04
	(0.09)	(0.09)
Mean	3.55	3.90
N	444	445

Back

Additional WTP

	Full sample (1)	Did not receive training (2)	Received training (3)
Most competitors	118.30	196.24***	-37.44
	(85.91)	(67.12)	(210.22)
No competitors	446.32***	370.09***	598.45**
	(112.73)	(88.38)	(273.53)
Control means	683.53	287.73	1489.76
No competitor = Most competitors	0.01	0.08	0.03
N	2940	1965	975

Back