# Competition and Management Upgrading: Experimental Evidence from Ethiopia*

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**Abstract**

We experimentally test two seminal hypotheses on the impact of competition on firms' management upgrading. In a first experiment, we protect firms from labor market competition by reducing the risk that a freshly trained manager would be poached by a rival firm. We find that this protection does not increase firms' investment in management training. In a second suite of experiments, we boost perceived product market competition by informing firms either that rival firms have received management training or that foreign firms are gaining easier access to the domestic market. Again, we find no evidence that this increases firms' average willingness to invest in management training. To explain why firms do not feel threatened by competition, we present evidence suggesting that, in contrast to commonly held assumptions, firm managers in our setting hold a mental model of competition that posits *positive*—instead of negative—spillovers, arising primarily from differentiation.

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# 1 Introduction

Whether competition among firms boosts or hampers innovation is a central question in economics. In low-income countries, understanding the relationship between competition and innovation is particularly important since firm upgrading in management, technology and products is essential to achieve economic growth and poverty reduction (Verhoogen, 2021). Firms' responses to competition are likely shaped by perceptions of consumer preferences and market fundamentals (Anderson et al., 2018; Caria and Falco, 2024; Abebe et al., 2023), trust in institutions (Colonnelli et al., 2024), expectations about other firms (Cullen et al., 2025), and experiences of growth and volatility (Donovan et al., 2023, 2024). Competition in lower-income countries may thus play out differently from what has been typically modeled with a higher-income context in mind.

It is generally expected that competition is essential to foster innovation and management upgrading among firms. This paper provides field-experimental evidence on two canonical hypotheses regarding the impact of competition on innovation in a particularly important dimension of technology: firm management. The first hypothesis that we test examines the role played by competition in *labor markets* (Becker, 1964; Acemoglu and Pischke, 1999). If competition in these markets is high, firms have little incentive to train their managers because these newly trained managers will attract offers from competing firms that fully reflect the value of their newly acquired skills. This, in turn, will make it difficult or impossible for the incumbent firm to recoup the cost of training. The second hypothesis we test, often put forward in the economics of management literature (Bloom and Van Reenen, 2007; Bloom and Van Reenen, 2010; Sadun et al., 2025), focuses on competition in *product markets*. If competition in these markets is weak, the argument goes, firms have limited incentives to adopt new business practices. With weak competition, profits could remain positive even in the absence of innovation, decreasing managers' incentives to bear the risk of upgrading.

These two hypotheses—i.e., that *tight competition in labor markets* and *weak competition in product markets* discourage firm upgrading—have shaped economists' thinking for decades. Surprisingly, they have largely not yet been tested experimentally in the field.[1] Our paper fills

[1]To our knowledge, the only exception is Cefala et al. (2024) showing that, in Burundi's casual agricultural labor markets, employers are more likely to train workers who have been incentivized to work for them in the future. This casual-labor market setting differs markedly from ours, since employment relationships are highly

that void. In a suite of real-stakes experiments with around 1,000 Ethiopian firms, we find the exact opposite. Survey evidence, as well as a data from a novel elicitation task, suggest that a mental model of competition that features positive spillovers arising from differentiation is the key reason why firms do not respond in the anticipated way.

We focus on innovation in management, which has received much attention from researchers and policy makers in recent years. It is now widely recognized that in low and middle-income countries (LMICs), measured management quality is substantially lower than in richer economies. Firms in LMICs do not systematically keep well-organized inventories, maintain a consistent product quality, set up incentive systems to raise worker effort, or analyze sales data to improve their marketing strategies. Adopting these managerial best practices has been shown to considerably raise firm productivity and profitability (Bloom et al., 2013, 2020). The persistence of low levels of management quality thus represents a puzzle for economists (Verhoogen, 2021): what prevents firms in LICs from upgrading their management?

We run two field experiments in and around Addis Ababa, Ethiopia, leveraging the AUDRI dataset, a panel of around 1,400 medium to large firms located in the outskirts of the city. In a first experiment, we decrease firms' perception of the risk that a trained manager will be poached by a competitor. To do this, we invite firms to apply for a package of two interventions designed to support them to train their middle managers: (i) a management training course subsidy, and (ii) a generous bonus paid to the manager one and two years after the completion of the training. Crucially, we randomly vary whether the bonus is conditional on the manager remaining in the firm who sponsored the training or not. This is cross-cut with variation in the amount of the subsidy. Firms assigned to the conditional bonus should anticipate a lower likelihood that a trained manager is poached by a competitor compared to firms assigned to the unconditional bonus—a premise which we confirm empirically. If labor market competition is an obstacle to management upgrading, offering a retention bonus to trained managers should increase the likelihood that firms apply to the program and train their middle managers.

In a second experiment, we raise firms' perception of the competitiveness of their rival firms. To do this, we identify groups of firms that operate in a similar sector and area of the city, and

unstable, with, in the status quo, no expectation that a worker will work for the same employer for more than a few days. In addition, product market competition among employers is likely to play out very differently in our urban setting compared to that in the rural areas studied by Cefala et al. (2024).

who have similar size and age. In each group, we randomly select three firms and give them free access to a training course focused on marketing management (5.5 hours of video lectures that can be watched at one's own pace and time). We then elicit willingness to pay for the same training course among the remaining firms in the group. We introduce three sources of random variation that we can use to test our hypothesis, independently randomizing firms into treatment and control each time.

First, in a passive-control design implemented in 2022, we inform treated firms that three of their close competitors have been given the training course for free. Control firms are not given this information. Second, in an active-control design implemented in 2023, we randomly inform treated firms that the training has already been offered to several of their competitors, while control firms are told that the training has only been offered to very few firms in Ethiopia.[2] Compared to the controls, treated firms in these two designs should expect more management upgrading among their competitors. Third, in a final design implemented in 2024, we inform treated firms of a newspaper article reporting on a recent government proposal to facilitate the entry of foreign firms in domestic markets. Control firms are not given this information. In this final design, treated firms should expect more competition from well-managed, innovative foreign firms, compared to control firms.

We find that neither sheltering firms from labor market competition nor changing the perception of product market competition significantly affects firms' willingness to invest in management upgrading. In the first experiment, 21 percent of firms assigned to the unconditional bonus and to a 50 percent training subsidy apply for the program. This proportion does not increase when managers are offered a bonus conditional on retention, or when the subsidy is raised to 80 percent of the training fee. In the second experiment, we find that, at baseline, the average willingness to pay (WTP) for the management training course in the control group is only about USD5. WTP remains unchanged when firms are told that their competitors have received the marketing management training course. We find similar results for the 2023 and 2024 product competition treatments, even as we show that these treatments significantly in-

[2]Both statements are truthful. The exact wording of the first statement is as follows: '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. Several of these firms are likely to produce products similar to yours and hence to be your competitors. They may already have used the materials in these videos to improve their marketing strategy.' The exact wording of the second statement reads as follows: 'So far we have only offered this video to a very small proportion of Ethiopian firms'.

crease perceived competition. Taken together, the findings imply that fear of competition does not affect willingness to pay for management training.

We offer evidence of one plausible explanation why we fail to observe the anticipated effect of competition on upgrading, namely that most firms hold a mental model of competition that features positive spillovers from rival firms' upgrading. These spillovers reduce the firm's perceived threat of the loss of a trained manager (in the first experiment) or of the management upgrading of a competitor. These spillovers also reduce the private returns to investing in management training, since the firm expects to benefit from the investment of other firms. As a result, firms do not respond to labor or product market competition in the way predicted by the majority of the literature.

This evidence comes from two new tools that we use to measure firm managers' mental models of product market competition. Camuffo et al. (2025) have indeed shown that causal reasoning is a critical determinant of economic performance among entrepreneurs. First, we leverage Pearl (2000)'s insight that complex causal mental models can be summarized by *directed acyclical graphs* (DAGs), and develop an app that allows top managers to directly sketch a DAG during the interview. We use this tool to collect a set of DAGs representing how firms think that their competitors will react after receiving the training course materials. Second, we measure the relative salience of relevant causal models among our respondents by administering a survey module post-hoc that elicits firms' perceptions regarding six mechanisms that potentially generate positive spillovers: imitation through direct observation, market expansion by competitors, product diversification between firms, poaching of workers, reduction in innovation risk, and a boost to personal motivation after observing another firm innovate.[3]

We present a series of findings in support of the hypothesis of positive spillover mental models. First, managers themselves expect substantial spillovers from the management upgrading of their competitors. In particular, a large majority (85%) of managers believe in one or more of the mechanisms that generate positive spillovers, beliefs that limit the perceived negative direct impacts of competition. In addition, 55% of managers report that they are not worried about competition and 45% of managers report that they expect that their firm's profit will *increase* when a competitor gets trained—i.e. they expect large positive spillovers that more

[3]In section 5.1, we present a simple conceptual framework that clarifies how these mechanisms can generate positive spillovers.

than offset any direct negative impact of competition. We further find that firms' belief in the diversification mechanism is the strongest predictor of expecting positive spillovers. Consistent with this emphasis on diversification, the DAGs show that firms expect their trained competitors to change the quality of their products, an evolution perceived to spur quality upgrading among untreated competitors as well.

Second, when we ask firms about their usual market conduct, we also find evidence consistent with the belief in diversificaton-driven spillovers. For example, 89 percent of managers agree that it is better to diversify away from the business practices of their competitors; 58 percent say that they seldom or never imitate the practices of their competitors; 57 percent say that they seldom or never cut prices when their competitors cut prices, and 74 percent that they seldom or never increase advertisement when their competitors increase advertisement. These results are largely consistent with a mental model where firms believe to enjoy some degree of market power that comes from diversification.

We make three key contributions to the literature. First, we show that firms in urban Ethiopia do not respond to perceived competition in the way two seminal economic hypotheses posit they should. They do, however, resonate with Argente et al. (2025)'s finding that, through marketing and advertising, new entrants build market share by adding new customers rather than displacing incumbents and reducing their markup. In environments where the background level of competition is weak, marginal changes in competition seem unlikely to foster the management upgrading required to significantly boost productivity.

Second, we uncover the mental models of firm managers using not only survey evidence but also DAGs. DAGs have been popularised as a tool to describe causal relationships in the work of Pearl (2000). Recently, Eliaz and Spiegler (2020) have proposed to use DAGs to represent mental models, defined as the way people think about causal relationships; and Andre et al. (2021) have used DAGs to rationalize free text data. A recent literature has explored people's mental models of the economy (Stantcheva, 2020; Andre et al., 2021; Camuffo et al., 2025). We elicit DAGs from firm managers in an innovative way: using a digital tool that enables respondents to sketch their own DAGs. This allows us to shed some rare light on how firms perceive the market structure around them. We are able to show that mental models are widely heterogeneous across managers, but dominated by a belief in beneficial spillovers from competitor upgrading.

Third, we document that demand for management training is low, among both top and middle managers. This is true even when we offer considerable financial incentives for training. This contributes to a recent literature that estimates that training costs are surprisingly high (Caicedo et al., 2022).

# 2 Study Sample, Experimental Design and Data

## 2.1 Study Context and Sample

The suite of experiments was conducted with a sample of firms from the AUDRI panel. The AUDRI firms panel is a dataset of about 1,400 firms located in Addis Ababa and its surrounding area (part of the Oromia region).[4] The first experiment took place during the second wave of the AUDRI panel, between March and September 2019. The second experiment took place in three rounds (2A, 2B and 2C), spread between April 2022 and March 2024. Table 1 describes the characteristics of the AUDRI sample and those of the firms eligible for our experiments, and compares them to the characteristics of Addis Ababa firms in the 2015 *World Bank Enterprise Survey*, a survey that aims to be representative of "firms in the non-agricultural, formal, private economy" with at least five employees. Figure B.1 and Figure B.2 show the location of firms. Table B.5 shows the overall study timeline.

[4]See Appendix B for details. Additional information about the AUDRI sample is available at the following link: https://kingcenter.stanford.edu/our-work/research-initiatives/african-urbanization-and-development-research-initiative-audri. To the best of our knowledge, the AUDRI survey is unique in depth and breadth, with detailed questions not only management practices and standard metrics such as profits, wage bills and employment, but also detailed questions on labor market competition, product market competition, and other practices.

Table 1: AUDRI sample vs representative sample (World Bank survey)

| | AUDRI sample | | | AUDRI eligible Experiment 1 | | | AUDRI Experiment 2 | | | Representative Sample (WB) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean (SD) | Median | N | Mean (SD) | Median | N | Mean (SD) | Median | N | Mean (SD) | Median | N |
| # of middle managers | 1.06 (2.50) | 0.00 | 1134 | 1.86 (3.21) | 1.00 | 578 | 1.29 (2.91) | 0.00 | 926 | | | |
| Firm size (employees) | 71 (168) | 16 | 1159 | 116 (214) | 40 | 598 | 44 (89) | 13 | 935 | 129 (279) | 40 | 422 |
| Firm age (years) | 9 (9) | 7 | 1132 | 10 (9) | 7 | 583 | 10 (8) | 8 | 931 | 17 (15) | 12 | 451 |
| Sales per worker (annual, USD) | 15354 (34720) | 4146 | 852 | 23615 (43459) | 7768 | 440 | 11614 (115326) | 2367 | 701 | 32463 (65779) | 10780 | 396 |
| Sales per worker - Manufacturing (annual, USD) | 17035 (35194) | 4325 | 422 | 25129 (40920) | 9734 | 223 | 18705 (173673) | 2713 | 304 | 18016 (28292) | 8565 | 172 |
| Management quality score | 41.41 (12.77) | 39.00 | 1159 | 45.63 (13.21) | 45.00 | 598 | 42.35 (13.92) | 41.00 | 940 | | | |
| Sector = manufacturing | 0.44 | | 1397 | 0.43 | | 598 | 0.42 | | 940 | 0.40 | | 451 |
| Foreign-owned | 0.11 | | 1160 | 0.18 | | 598 | 0.05 | | 940 | 0.14 | | 451 |

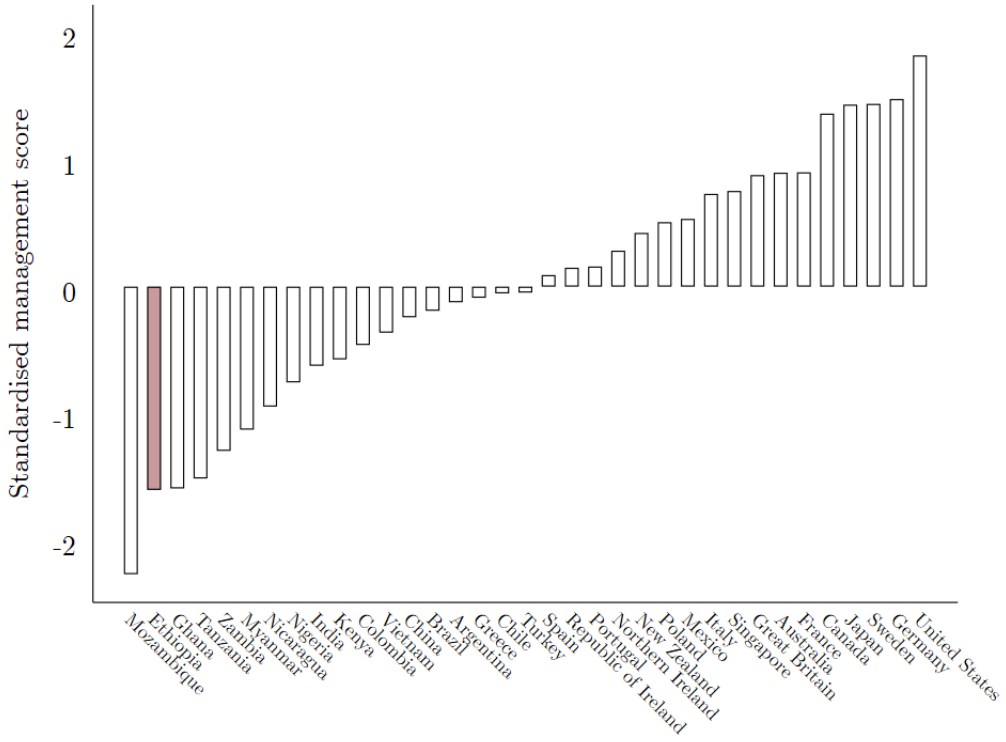
Data sources: Columns 1-3: AUDRI Wave 1 (2017) and Wave 2 (2019); Columns 4-6: AUDRI Wave 2 (2019); Columns 7-9: Experiment 2A survey (2022); Columns 10-12: 2015 World Bank Enterprise Survey. Sample size varies within a column due to non-answers and trimming of outlying values. Appendix E details the methodology used to compute the Management Quality Score. The minimum possible score is 18, and the maximum possible score is 90.

Firms in the AUDRI sample have 71 employees on average (median: 16), and have been in business for 9 years (median: 7). The median number of middle managers is zero. Close to half (44%) of firms are in manufacturing.[5] They tend to be smaller than the firms in the World Bank survey, and somewhat less likely to be foreign-owned (11% vs. 14%)—due to the fact that the AUDRI study purposefully excluded large firms in the business district from its analysis.

A few points are worthy of note about our study context. First, firms in Ethiopia have the second lowest average level of management quality in a sample of about 35 countries (Figure 1).

[5]The other sectors are services (around 25%), construction (12%), agriculture/floriculture (10%) and trade (6%).

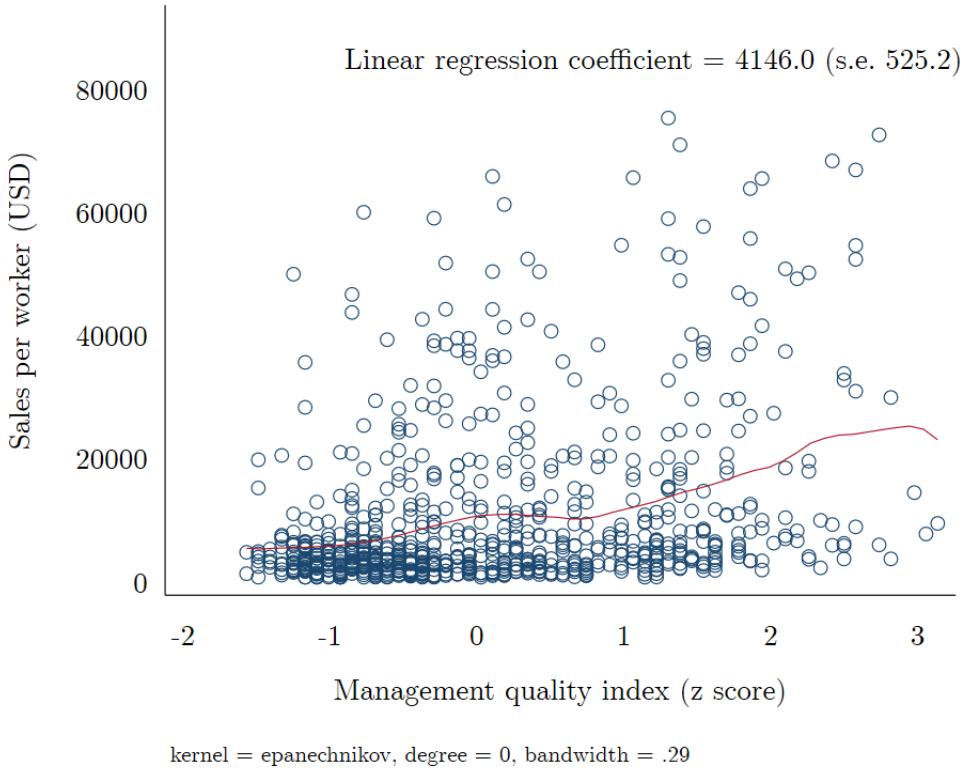
Figure 1: Management quality across the world




Data source: 2004-2015 World Management Survey Manufacturing

Second, among firms in our study sample, management quality is positively correlated with sales per worker—a standard proxy of firm productivity. We show this in Figure 2. Third, consistent with low levels of product market competition, the firms in our sample generally post positive profits.

Figure 2: Management quality and productivity within the AUDRI sample




Additionally, consistent with a disincentive effect coming from anticipated poaching, 73 percent of firms report that manager turnover negatively affect their establishment, and 26 percent of firms agree that managers would be more likely to leave after training (Table A.1). Fourth, two qualitative indicators of product market competition are positively related to management quality (with mixed statistical significance, Table A.2). Thus, overall, this sample seems suitable to study the relationship between management upgrading and competition in product and labor markets.

## 2.2 Experiment 1: Labor market competition

In the first experiment, we study how labor market competition affects firm willingness to invest in management upgrading. Specifically, we focus on firms' decision to train their middle managers—a key strategy through which firms can boost the quality of their management. We define middle managers as workers who are not the top manager and for whom one of the following statements is true: (i) the worker manages at least one junior manager, or (ii) the

worker is engaged on non-routine managerial tasks. This definition captures workers in the middle of the organizational hierarchy, who have some authority to make managerial decisions. This includes workers such as an operations manager in a factory, a project leader in an office job, or a team manager in a hotel. It excludes junior managers with limited scope to influence the firm's management, such as the line supervisors in a factory. To be eligible for this experiment, a firm must have at least one middle manager.

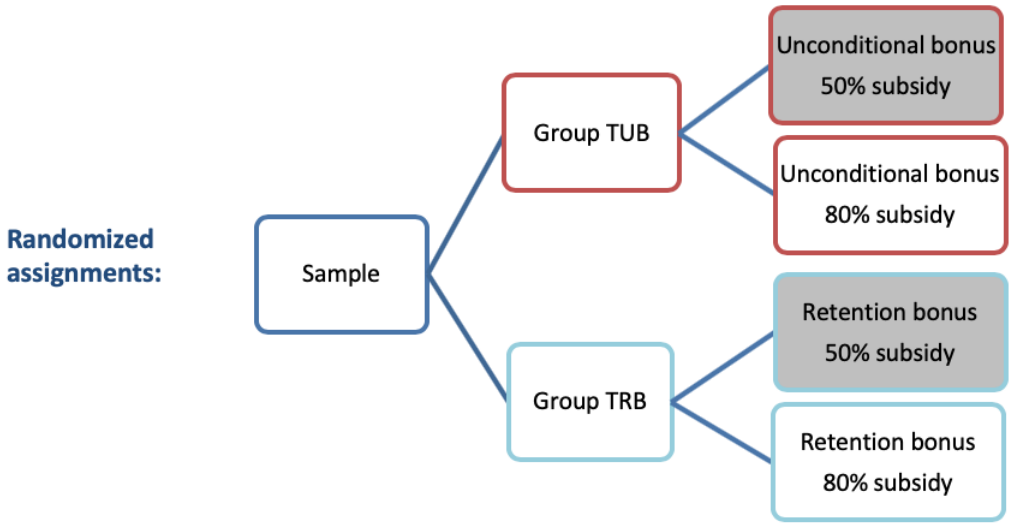
We invite eligible firms in our sample to send up to two of their middle managers to attend a training course in management and leadership. To sign a middle manager up for training, the top manager has to fill in a simple paper form with the name of the selected employee (they can also send the required information by text message, or call a pre-specified number). We offer firms a package consisting of two elements: (i) a subsidy of the cost of training up to two middle managers, and (ii) a bonus paid to each trained manager. The firm is expected to pay for the remaining training fees and for any additional costs. The fee for a module is usually between 1,000 - 2,000 ETB, while the median monthly salary for middle managers was 5,000 ETB.[6] Managers could choose up to three modules from a large list (we show a subset of the courses available in Figure A.1). Some examples of available modules include: supply chain management, inventory management, and public procurement. Each module consists of about 40 hours of in-person classes, offered during weekends or in the evenings to avoid clashes with the managers' professional commitments. The training is offered by the Addis Ababa University School of Commerce, a reputable local institute specializing in professional training and certification. Usually, these modules are attended by middle managers based in firms across the city who pay for the training out of pocket.

In order to be able to measure the impact of the training, we randomly offer the package to 50 percent of the applicants. Firms are clearly informed of the likelihood that they will be offered the package in case they apply to the program.

We randomly vary the conditionality of the bonus to test whether labor market competition discourages investment in management training by increasing the perceived risk that trained managers will be poached by other firms. In both treatment arms, trained managers receive a lump-sum payment one and two years after the end of the training, worth one and two months of the baseline average salary of a middle manager, respectively. In one treatment arm

[6]The exchange rate at the time was USD1=28 ETB.

Figure 3: Design of Experiment 1




(Retention Bonus, Group TRB), this payment is conditional on remaining employed at the firm that originally sponsored their training. In the other arm (Unconditional Bonus, Group TUB), there is no such condition: trained managers receive the lump-sum payment unconditionally. Variation in bonus conditionality aims to vary the training benefit that can be expected by the firm: when the bonus is conditional, the firm should perceive the risk of poaching to be lower and should hence have a higher willingness to pay for training its workers. Take-up of the School of Commerce training program by firms should thus be higher in the retention bonus group compared to the unconditional bonus group.

Additionally, we vary the level of the training subsidy in order to assess willingness to pay for such training and identify financial constraints to take-up. Firms in the low-subsidy group receive a subsidy worth 50 percent of the training fee, while firms in the high-subsidy group receive a subsidy worth 80 percent of the fee. This intervention is cross-cut with the variation in the bonus conditionality described above. Thus, we have four separate experimental groups, as shown in Figure 3.

## 2.3 Experiment 2: Product market competition

In a second series of experiments, we study how product market competition affects firm willingness to improve their management. Here, we focus on a different training, designed to meet the needs of the management team. This training is a course in marketing management, covering

sales, branding, advertisement, approaches to handle competition , and to build a reputation. The material is structured around five video lectures, translated to Amharic and delivered in a USB stick, with five and a half hours worth of lectures in total. Both the topic of the training and the delivery modality follow the recommendation that emerged from focus group discussions with top managers. In particular, top managers showed high interest for this type of training and also highlighted the need for a flexible delivery modality.

The sampling frame for this new suite of experiments consists of 948 firms. In addition to all firms eligible for Experiment 1, we include 337 firms that were identified as competitors through a "snowball" sampling technique. Firms are interviewed up to three times. We refer to these as the 2022, 2023 and 2024 interviews.

### 2.3.1 Outcome of interest

The outcome of interest for the suite of designs in Experiment 2 is firms' willingness to pay (WTP) for the training. To measure WTP, we use a standard Becker-DeGroot-Marshack (BDM) mechanism (if firms have not yet received the training). In the BDM, firms report the maximum price $p_1$ that they are willing to pay. We then draw a price $p_2$ (from a distribution unknown to firms ranging from 100 ETB to 2000 ETB). If $p_1 \geq p_2$, firms are offered the training at price $p_2$. If $p_2 > p_1$, the firm is not offered the training. These rules make reporting true willingness to pay incentive-compatible. In order to ensure firms understand the rules of the BDM mechanism, we first elicit willingness to pay for a pen, and play out the whole procedure with the top manager. Finally, in some treatment conditions, we also elicit willingness to pay using BDM for a placebo product—a video describing a tour of a river in Southern Ethiopia, delivered in USB stick just as the main training.

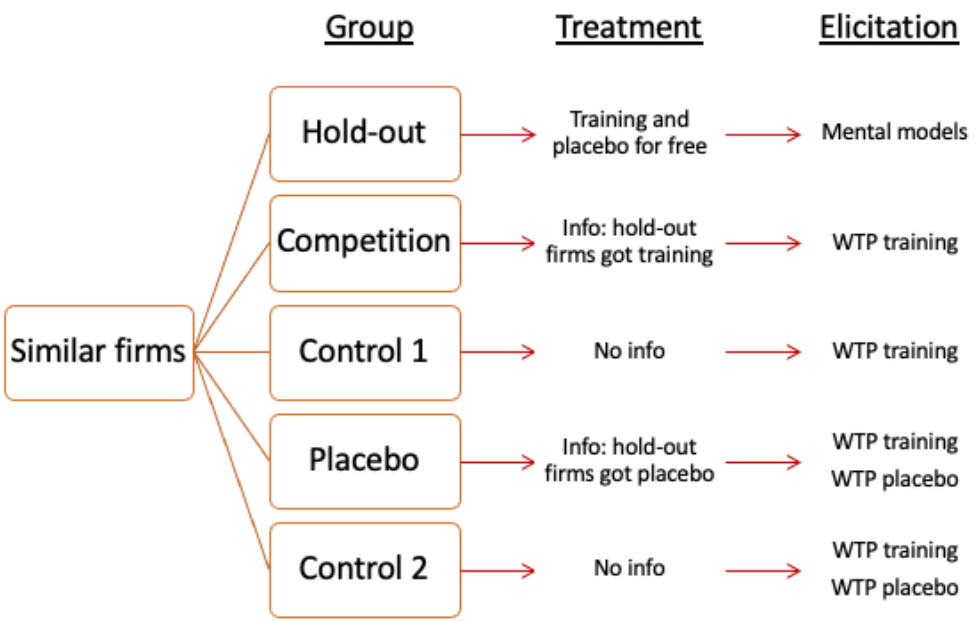
### 2.3.2 Experiment 2A (2022): The passive-control design

The central feature of this experimental design is that we randomize whether, prior to WTP elicitation, firms are told that up to three of their close competitors have received the training course material for free. To implement this feature of the design, we assign firms to strata chosen to minimize differences in sector, size, age and location. Three firms in each stratum—the *hold-out sample*—are given the marketing training course material for free. We hypothesize

that treated firms, who are informed about the three firms receiving training, perceive that their close competitors have become more competitive since the price of an input in production (the training) has gone to zero and they now have access to more knowledge. Our main objective is to study how this perception of stronger competition affects the firm's WTP for training.

A second feature of this design is that we also randomize whether firms are told that up to three of their close competitors have received the placebo product for free. To implement this feature, firms in the hold-out sample are also given a placebo product for free. Comparing WTP for a placebo with and without information about whether the product was given to one's peers allows us to measure the *social consumption effect*: a change in WTP for a product that is motivated by the fact that one's peer possesses it, irrespective of its possibly minimal material benefits. On the other hand, comparing WTP for the training course material with and without information about whether it was given to one's competitors identifies a combination of a *pure competition effect* and social consumption effect. Under the assumption that these two effects are additive, we can recover the pure competition effect by subtracting the placebo product treatment effect from the training course effect.

Figure 4: Design of Experiment 2A




Overall, we have six experimental groups as shown in Figure 4:

1. *Hold-out group*: Firms in this group are given the training course material and placebo product for free.

2. *Competition group*: Firms in this group are asked to pay for the training course material. Before eliciting demand for the training material, these firms are told that we have given the training material to up to three close competitors. These firms are not offered the placebo product.

3. *Competition control group*: Firms in this group are asked to pay for the training course material. They are not given information on whether we offered the training material to other firms. They are also not offered the placebo product.

4. *Placebo competition group*: Firms in this group are asked to pay for both the training course material and the placebo product. Before demand for the placebo is elicited, they are told that a close competitor has been given the placebo product.

5. *Placebo control group*: Firms in this group are asked to pay for both the training course material and placebo product. They are not told whether we offered these products to other firms.

6. *Pure control group*: Firms in this group are not contacted at baseline. They are only contacted at follow-up to measure the impacts of the training.

#### 2.3.3 Experiment 2B (2023): The active-control design

We ran the second and third designs motivated by the finding of the first design.[7] In the second design, we manipulate treated managers' perceptions of product market competition by assigning them to one of two (truthful) statements (e.g., Cullen et al., 2025). The first ("treatment") statement reads as follows:

> *We have already offered this video training to all of the firms in your kebele with more than 10 employees that we could reach. Several of these firms likely produce products similar to yours and hence are your competitors. They may already have used the materials in these videos to improve their marketing strategy.*

[7] These two additional experiments were not pre-registered.

The second ("control") statement reads as follows:

> *So far we have only offered this video to a very small proportion of Ethiopian firms.*

This is a thus an active-control design (Haaland et al., 2023).

We then asked all firms for their WTP for the training course videos (this was the standard WTP question for those firms that did not receive the product at baseline and an hypothetical question for those who did). We also asked them a number of questions to measure their competition perceptions.

#### 2.3.4 Experiment 2C (2024): The foreign-competition design

In this third design, we randomized half of the firms to receive the following information treatment:

> *I would like to share some important information that may be relevant for your firm. In October 2023, the Ethiopian Reporter discussed a potential major change in policy regarding imports. The article stated that the government may soon choose to reverse the current 'longtime ban on foreign businesses importing goods into the country.' In other words, if this happens, foreign investors would be allowed to engage in import businesses and sell any kind of imported good in Ethiopia.*

Control firms did not receive any information. The aim of this treatment was to induce firms to expect the entry of well-managed, highly competitive firms in the market.

We then asked all firms, whether or not they had received this information, their hypothetical WTP for the training course videos. We also asked them how much they agreed (Likert scale) with the following statement: *"Competition from foreign competitors will limit the growth of my profits or even reduce my profits in the coming years."*

### 2.4 Randomization and balance

In both Experiment 1 and Experiment 2A, we assigned firms to one of the experimental groups using a matched randomization procedure. We first construct groups of firms that minimize the Mahalanobis distance over a set of targeted variables. For Experiment 1, these variables include: firm size, age, sector, distance from the training institution, eligibility score, wages, access to manager training, and turnover rate. For experiment 2A, they include a number of sector fixed effects, firm size, age, and location (measured by introducing separate variables capturing

longitude and latitude). We then randomly allocate the firms in these groups to the different experimental conditions.[8] We report balance tests for variables used in the randomization and untargeted variables in Tables A.3 and A.4. In Experiments 2B and 2C, we assigned treatment status with a simple random draw, stratifying by 2A status. We report balance tests for these designs in Tables A.5 and A.6.

## 2.5 Estimation strategy

We estimate models of this form:

$$y_i = \alpha + \sum_k \beta_k T_k + X_i + u_i, \tag{1}$$

where $y_i$ is an outcome for firm $i$ (e.g., an indicator variable for "applied" for Experiment 1, or reported willingness to pay for experiment 2), $T_k$ are treatment indicators, and $X_i$ is a vector of covariates used in the matched randomization procedure. We use robust standard errors throughout the analysis.

## 2.6 Mental Models Data

An innovation of this research project is that, beyond the standard modules generally asked in a firm survey and the management module of Bloom and Van Reenen (2007), we developed two instruments to understand mental models of firm competition among top managers in our study context (Camuffo et al., 2025). This subsection describes these two instruments.

**DAGs** Mental models can be captured by *Directed Acyclical Graphs*, in which nodes represent random variables and directed links represent causal relations. Such an approach, named and proposed by Pearl (2000), has many applications in philosophy, psychology, and very recently economics (Sloman, 2005; Eliaz and Spiegler, 2020; Andre et al., 2021). To elicit firm managers' DAGs, we developed an app that allowed respondents to sketch their own DAGs on the enumerator's tablet during the baseline survey of experiment 2A.[9] Due to limited available

[8] In Experiment 1, we have four experimental groups. So, we create groups of 4 firms and assign each firm to a condition. In experiment 2A, we have six experimental conditions. We create groups of 21 firms and assign six of these firms to the competition treatment, and three firms to each of the other treatments).

[9] A few screenshots of the DAG app are shown in Figure A.2.

survey time, we only elicited DAGs from firms assigned to the hold-out group.

**Post-hoc Survey** After analysis of the DAGs suggested a large share of managers appear to hold a *positive spillover* mental model of competition (in which they believe upgrading of their competitors would benefit their own profit), we fielded a survey in Winter 2024 to understand which pathways for positive spillovers are at play. The survey included modules designed to elicit managers' views about potential spillovers.

# 3 Results: Labor Market Competition Experiment

Our central finding is that temporarily shielding firms from labor market competition does not increase demand for training. Table 2 shows that neither changing the conditionality of the bonus nor increasing the level of the subsidy affects demand for middle manager training. To measure demand for training, we construct an indicator variable that captures whether the firm signed up at least one middle manager for training. In the unconditional bonus group, 21 percent of firms nominate a middle manager for the training. This proportion does not change when middle managers are offered a retention bonus instead of an unconditional bonus.

Table 2: Labor market competition and demand for training

| | Nominated middle manager for training | |
|---|---|---|
| | (1) | (2) |
| Retention Bonus | -0.025 | -0.019 |
| | (0.028) | (0.040) |
| High Subsidy | -0.034 | -0.028 |
| | (0.029) | (0.041) |
| Retention Bonus x High Subsidy | | -0.011 |
| | | (0.056) |
| Mean UB, low subsidy | 0.21 | 0.21 |
| N | 598 | 598 |

This table presents the main results of Experiment 1. Each column reports the coefficient of a separate OLS regression. Means for the unconditional bonus (UB) group are shown in the bottom. 'Nominated middle manager for training' is an indicator variable equal to 1 if the firm applied for middle manager training. In column (1) and (2), we use robust standard errors.

Similarly, raising the subsidy from 50 to 80 percent does not affect demand. We are also unable to detect any meaningful interaction between these two treatments.

### Experimental manipulation failure or true zero?

In this section, we provide two pieces of evidence that the zero effect of the retention bonus on average demand for training is not simply due to a failure of our experimental design.

First, we show that the retention bonus succeeded in generating a meaningful change in the perceived risk that a trained manager will be poached. Figure 5 shows that firms expect 31 percent of trained managers to quit within 24 months of the training if offered the unconditional bonus. This expected probability goes down by about a third (11 percentage points) to 20 percent when a trained manager is offered the retention bonus. The treatment thus generated a significant and sizable drop in the perceived risk of poaching.

Figure 5: Expected turnover


'Expected turnover' captures the probability that a trained manager leaves the firm in the following 24 months. This question was asked twice to each firm. First, the firm was asked to report this probability for the case where the middle manager is offered the retention bonus (we obtain 508 responses from 598 firms; the remaining firms decline to report a figure). Second, the firm was asked to report this probability for the case where the middle manager is offered the unconditional bonus (we obtain 503 responses from 598 firms; the remaining firms decline to report a figure). We thus create a dataset that has two observations per firm, and a binary indicator to identify whether the expected turnover response applies to the case when a retention bonus is offered. We cluster standard errors (in parentheses) at the level of the firm.

Second, we present evidence that firms valued the training provided by the School of Commerce to middle managers. In our surveys, 88 % of managers agreed or strongly agreed with the statement, 'This training will significantly increase this establishment's performance' (see Table A.7). Also, top managers, on average, thought that a trained middle manager's market wage would increase by 17 percent as a result of training—a clear indication that they expect trained managers to be more productive.

Overall, firms nominated 121 middle managers for the training lottery. 16 of these managers were drawn by the lottery and invited to take the training with the appropriate subsidy and bonus. Training take-up among managers was distorted by the fact that, three months after the bonus offers were made, the COVID-19 pandemic reached Ethiopia. However, in the three months prior to the start of the pandemic, no manager actually started the training, a surprising low level of interest which could be indicative of high training costs (Caicedo et al., 2022), lack of interest in training among workers or firms reluctance to release their middle managers for training (Diaz et al., 2025). We provide additional details on the training and barriers to take-up in Appendix C.

# 4 Results: Product Market Competition Experiment

We elicited willingness to pay (WTP) from firms up to three times. The first elicitation (2022) uses the BDM mechanism described in section 2.3.1 for all firms. The second elicitation happened in 2023. At that time, all firms that had received the product in 2022 (hold-out sample + BDM winners in the treatment group) were asked a hypothetical WTP question, asking firms how much they would pay for the training if they did not have it. Other firms did the BDM exercise. In the 2024 survey, the WTP question is hypothetical for all firms. In what follows, we systematically control for the elicitation method.

Table 3 shows no significant impact of the product market competition treatment on WTP for training in any of the three designs in experiment 2. In the baseline passive-control design (2A), average WTP in the control group was about 257 ETB, or around USD 5 (at the exchange rate that prevailed at the time). This did not increase among firms told that their competitors had been given access to the training course for free (column 1 of Table 3; we show the full demand curves in Figure A.3.) The effect is noisily estimated, but even if we were to consider

the upper bound of the confidence interval (+88 birrs, or a 34% increase), it would represent a smaller proportional increase in WTP than the point estimate for the placebo treatment (column 5 of Table A.8). For designs 2B and 2C, the point estimates suggest a *reduction* in WTP of between 8 and 14 percent, though both are noisily estimated and we cannot reject the null.[10] The results are robust to using other specifications (Tables A.8-A.10.)

Table 3: Product market competition and demand for training

| | WTP winsorized | | | Perceived competition | | |
|---|---|---|---|---|---|---|
| | 2A | 2B | 2C | 2A | 2B | 2C |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treatment | -9.8 | -86.2 | -342.8 | 0.017 | 0.109* | 0.197** |
| | (48.1) | (298.8) | (442.1) | (0.091) | (0.058) | (0.087) |
| Mean(Control) | 256.7 | 1007.0 | 2260.5 | 3.5 | 3.6 | 2.7 |
| StDev(Control) | 786.0 | 5431.0 | 6667.1 | 1.0 | 0.9 | 1.2 |
| N | 772 | 990 | 759 | 444 | 978 | 759 |

This table presents the main results of experiments 2A, 2B and 2C. Each column reports the coefficient of a separate OLS regression. The dependent variable is indicated in the first row of the table. 'WTP' stands for willingness to pay. Across all three experiments, WTP refers to the respondent's willingness to pay for the training, winsorized at the 99th percentile and expressed in Ethiopian birrs. WTP was elicited through a BDM mechanism in 2A and as an hypothetical question in 2C. In 2B, it was a mix: firms that had received the product in 2022 (hold-out sample + BDM winners in the treatment group for 2A) were asked a hypothetical WTP question, asking firms how much they would pay for the training if they did not have it. Other firms did the BDM exercise. In Experiment 2C (column 3), some firms answered "Do not know" to the WTP question. We consider "Don't know" responses as zero WTP but the results are unchanged if we instead code "Don't know" as missing, see column (4) of Appendix Table A.10. 'Perceived competition' in experiments 2A and 2B is measured using the respondent's agreement on a 5-point Likert scale to the statement: 'My close competitors will improve the quality of their marketing in the coming months.' In experiment 2A, this question was only asked to firms in the competition, control 1, and control 2 treatment cells. In experiment 2B, some firms did not respond to this question. For experiment 2C, 'Perceived competition' is an indicator variable equal to 1 if the respondent agrees that competition from foreign competitors will limit or reduce their profits in the coming years, and 0 otherwise. Higher values of perceived competition indicate stronger competitive pressure. The regressions in columns (1) and (4) include control for randomization stratum and for the willingness to pay to purchase a pen. The control group in columns (1) and (4) includes both the Control 1 and Control 2 groups.

[10] Average WTP is higher in 2C since it was elicited through an hypothetical BDM question, rather than through an actual BDM. In 2B, WTP was elicited through a mix of actual and hypothetical BDM questions, depending on whether the firm had already received the training course material or not. This is why average WTP is in between the value measured in 2A and 2C.

**Experimental manipulation failure or true zero?**

The lack of impact of experiment 2 (in its variant forms) could come from a true zero (firms do not fear product competition), or from a manipulation failure. In the latter case, it could be that treated firms did *not* expect their competitors to engage in substantial managerial upgrading as a result of receiving the free training course videos (experiments 2A and 2B); or they did not expect foreign firms to enter (experiment 2C). We test for this in columns 4-6 of Table 3. We find clear changes in perceptions of competitive pressure in two of the three variants.

The competition treatment in the passive-control experiment (2A) did not increase the perception that competitor firms would upgrade their management (though we note that we only have data on beliefs for a subsample of firms). However, treatment 2B raised the perception that competitor firms will upgrade their management by a significant 0.11 of a standard deviation (column 5 of Table 3). It also increased the perception of the number of competitors who received training videos by about 30 percent (Table A.11). These findings are similar to those reported by Cullen et al. (2025) in Italy.

We also find that the foreign-competition treatment 2C raised the perception that foreign competitors would limit the growth of a firm's profit by about 0.16 of a standard deviation (column 6 of Table 3). What's more, 89% of treated firms agreed with the statement that "this [reform] would increase competition for local traders and producers" (Table A.12). However, it is important to note that, in absolute terms, treated firms still feel quite protected from foreign competition. On a 5 point Likert scale capturing whether firms expect to lose profits from foreign competition, the average treated firm has a score of 3.5, just above the level 'neither agree nor disagree'.

In sum, these results confirm that at least two of the treatments substantially changed perceptions, validating Experiment 2 as a test of the product market competition hypothesis.[11]

[11]In Appendix C, we document reactions to the training among firms who received it (in particular, the hold-out sample). We find that firms believed the training was useful, and a subset of firms applied some of the training suggestions, but we are not powered to detect treatment effects on firm outcomes.

# 5 The Positive Spillover Mental Model

Why are firms not threatened by the management upgrading of their competitors or potential entry of well-managed foreign firms? In this section, we provide evidence that firms expect *positive spillovers* from competitors' use of good management practices, which partly or fully offset the negative or direct impacts of competition, as in Argente et al. (2025). This can explain both null results above, since, under such a mental model of positive spillovers, neither product competition nor labor market competition provides incentives to upgrade management quality. Before we discuss the empirical evidence, we present a simple framework that clarifies the mechanisms that can generate positive spillovers.

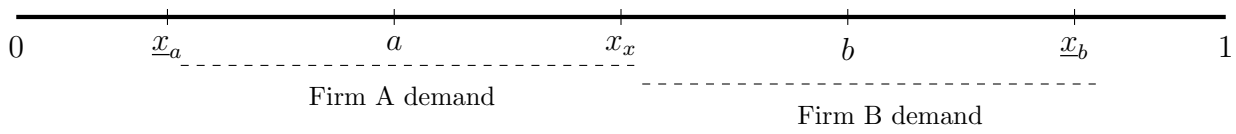
## 5.1 A simple framework

We present a stylized framework of competition over product types. Consider two firms, A and B, that each produce a single product. Both firms charge a fixed price $p$ per unit of the product, and have a fixed marginal production cost $c$. The firms compete on what *type* of product to offer. There is a continuum of types and a corresponding continuum of customers that have different preferences over these types. Customers are located uniformly along an interval of length $s = 1$. Prior to the intervention, firm $A$ produces a type that is located at point $a$ on the interval, while firm $B$ produces a type that is located at point $b$. When customers buy a product that is not their favorite type, they incur a cost that is proportional to the linear distance between the customer's location and the product type. Thus, a customer who is at distance $d$ from point $a$ has to pay cost $t_a * d * p$ to buy from firm $A$. And a customer who is at distance $d$ from firm $B$ has to pay cost $t_b * d * p$ to buy from firm $B$. Prior to any intervention $t_a = t_b = t$, the cost of distance is the same for both firms. So, each customer buys from the firm that is closest (in a type sense) to herself.

We can easily characterize the demand for the products of the two firms. We define $\underline{x}_a$ ($\underline{x}_b$) to be the location of the customer to the left of $a$ (to the right of $b$) who is indifferent between buying from firm $A$ (firm $B$) or not buying at all. Similarly, $\overline{x}_a$ ($\overline{x}_b$) is the location of the customer to the right of $a$ (to the left of $b$) who is indifferent between buying from firm $A$ ($B$) or not buying at all. Finally, $x_x$ is the location of the customer who is indifferent between buying from firm $A$ or firm $B$. We assume that firm $B$'s market size is curtailed by the presence

of $A$, and vice versa. In our notation, this means that $\overline{x}_a$ is strictly to the right of $x_x$ and $\overline{x}_b$ is strictly to the left of $x_x$. Demand for the product of firm $A$ is thus given by $|x_x - \underline{x}_a|$, and demand for B is $|x_x - \underline{x}_b|$. We show this graphically in Figure 6. Profits for firm $A$ (firm $B$) will simply be $(p-c)(|x_x - \underline{x}_a|)$ $((p-c)(|x_x - \underline{x}_b|))$.

Figure 6: Illustration of Theoretical framework




Suppose firm $B$ improves its marketing. What does this do the profits of firm $A$? In our framework, marketing can operate in three ways: (i) it can help attract customers beyond the interval 0-1 (the market expansion channel); (ii) it can help firms relocate on the line (the diversification channel); (iii) it can help reduce the cost of distance $t_B$ that customers have to pay to buy from firm $B$ (related to the channels of direct observation, poaching, motivation, and innovation risk). We consider each mechanism in turn.

**Market expansion:** Firm $B$ improves its marketing and attracts more customers located outside of the 0-1 interval to this market. So now there are $s'$ customers in the market. If these new customers are located entirely to the right of point 1, then the profits of firm A are unaffected. However, due to search and advertisement frictions, some of these new customers may also be located the left of 0. In this case, as long as $\underline{x}_a < 0$, the profits of firm $A$ will actually increase, since it will be able to sell to new customers.

**Diversification:** Firm $B$ improves its marketing and this enables the firm to choose a new location on the interval $s$. Assume $\underline{x}_b < 1$. Since the presence of $A$ curtails firm $B$'s market to the left, firm $B$ will find it convenient to choose a new product type location $b'$, to the right of its current location $b$. If after this change, $\overline{x}_b$ remains to the left of $x_x$, firm $A$ is not affected. But if $\overline{x}_b$ moves to the right of $x_x$ this will also increase the demand for the product of firm $A$.

**Direct observation, poaching, motivation:** Firm $B$ changes its marketing to reduce the cost of distance $t_b$ faced by customers. Suppose firm $B$ succeeds. If firm $A$ will be able to also reduce its cost of distance by directly observing the innovations of $B$, it can poach

$b$'s managers; or it can generate more motivation to improve its management[12], keeping the location of the indifferent customer $x_x$ unchanged. If so, the profits of firm $A$ will be unaffected, or will increase if $\underline{x}_a > 0$, and the firm is able to attract some customers from the left end of the interval.

**Innovation risk:** Firm $B$ changes its marketing to reduce the cost of distance $t_b$ faced by customers. Suppose firm $B$ fails in doing so and ends up with a cost of distance that is unchanged or even higher than the original cost. Firm $A$ will be unaffected if the cost of distance $t_b$ does not change, or will see higher profits if $t_b$ increases.

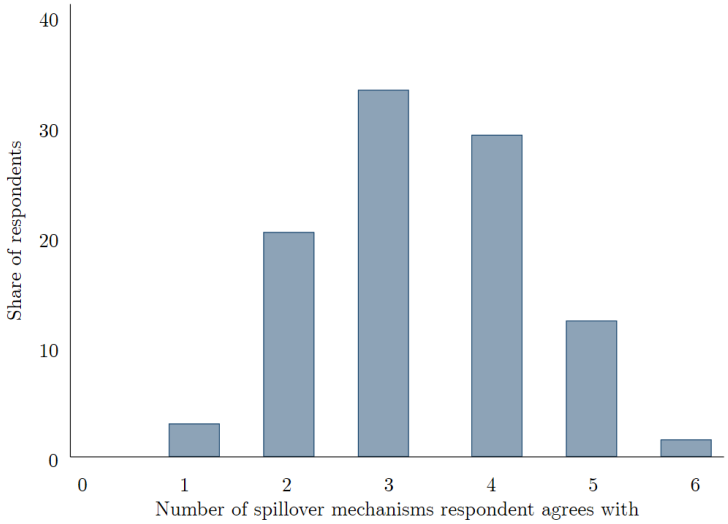
## 5.2 The evidence

We present three sets of findings in support of the hypothesis of a positive spillover mental model (SMM). First, we present managers' responses to the survey questions designed to capture their SMM. Second, we study the heterogeneity of treatment responses with respect to a measure of the strength of the SMM. Finally, we report data on firms' usual market conduct that is consistent with the SMM.

**Top Managers' self-reports:** Managers themselves report expecting substantial spillovers from the management upgrading of their competitors. In our survey, we asked four to five questions on each of the four mechanisms. Each question asked respondents to express, using a 5-point Likert-scale, their level of agreement with a given statement. We report summary statistics on all questions in Figure A.4 and Figure A.5. To aggregate this information, we stipulate that a respondent agrees with the existence of a given mechanism, if her average response to the questions related to that mechanism is above 3.5, indicating average agreement with the statements. In Figure 7, we show the share of managers that agree with a different number of mechanisms. We find that the large majority (85%) of managers report to believe in at least one mechanism, and that the modal manager beliefs in two mechanisms.

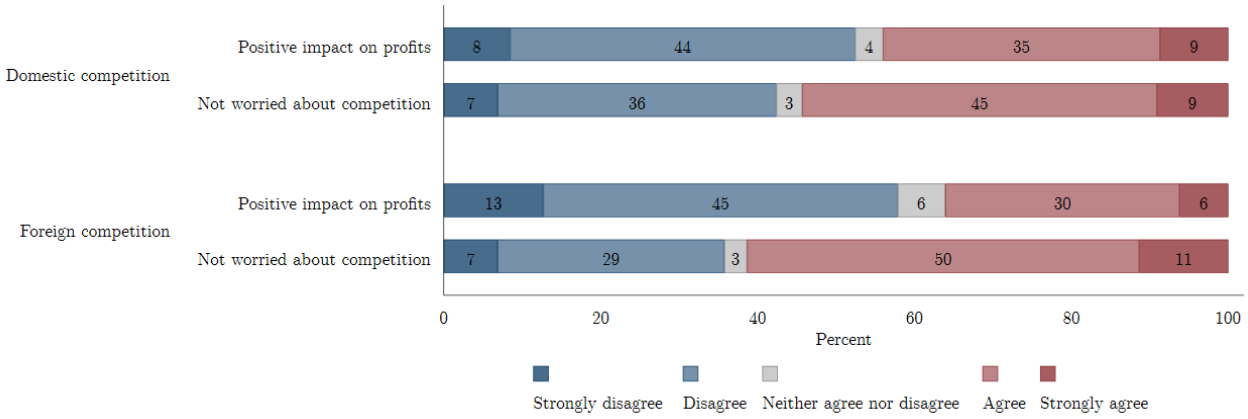
[12]This is a behavioral explanation that was suggested by firm managers in focus group discussions. The basic idea is that seeing a competitor improve its management would inspire enthusiasm for innovation in one's firm.

Figure 7: Firm managers' beliefs in positive spillover mechanisms




Further, in Figure 8, we show the responses to two general questions about the impacts of competition we asked at the start of the survey. We find that 54% of top managers report that they are not worried about domestic competition and 44% of top managers report that they expect that their firm's profit will *increase* when a domestic competitor gets trained—i.e., they expect large positive spillovers that more than offset the direct negative impacts of competition.

Figure 8: Spillover mental model: summary questions




The figure presents top managers' views on four summary statements describing spillovers from domestic and foreign competition. Top managers report their agreement to each statement using a 5 point Likert scale. 'Positive impacts on profits' refers to the statement 'If a domestic/foreign competitor improves his marketing or his products, the profits of my firm increase'. 'Not worried about competition' refers to the statement 'I worry that foreign competitors will encroach on my market and steal my customers', which we reverse code, so that agreement implies a view consistent with the existence of positive spillovers.

We further find that belief in the diversification mechanism is a predictor of agreement with the first statement and of willingness to pay for training (Table A.13). Consistent with this emphasis on diversification, the DAGs show that the firms expect their trained competitors to change the quality of their products, and that this will, in turn, spur further quality changes among untreated competitors as well. Consistent with the findings of Argente et al. (2025), respondents expect advertisement to play a role in this process. We show this in Table 4, and provide a more detailed description of the DAGs and their analysis in Appendix D.

Table 4: Quality effects are predominant in DAGs

| | Response occurs (% DAGs) | | Follow-up responses (no.) |
|---|---|---|---|
| Response | Direct | Direct + indirect | Direct |
| Treated competitor changes: | | | |
| Quality | 0.63 | 0.86 | 0.62 |
| Advertisement | 0.42 | 0.76 | 0.44 |
| Price | 0.34 | 0.57 | 0.55 |
| Other competitors change: | | | |
| Quality | 0.35 | 0.74 | 0.43 |
| Advertisement | 0.18 | 0.61 | 0.23 |
| Price | 0.33 | 0.61 | 0.44 |

The table presents summary statistics from the DAGs drawn by firm managers. The first event in every DAG is that a firm's competitor receives training in marketing management. The firm manager then sketches a DAG that includes, as possible responses to this initial event, a set of actions taken by the treated competitors (a change in quality, advertisement or price) and a set of actions taken by other competitors in the market (a change in quality, advertisement or price). The table shows key statistics on the responses chosen by firm managers. The first column reports the share of firm managers that mention a given action as a *direct* response to the initial event. E.g., the first row of the first column shows that 63% of firm managers mention that, as a result of receiving the management training, the treated competitor will change the quality of their products. The second column reports the share of firm managers that mention a given action as a *direct or indirect* response to the initial event. E.g., 86% of firm managers mention that the treated competitor will improve the quality of their products, either as a direct response to the training or as a consequence of another response to the training. The last column reports the average number of responses that follow a given event. E.g., when the treated competitor changes the quality of their product, respondents believe this is followed on average by 0.62 responses—the highest number of responses for any of the actions included in the DAG.

**Market conduct:** Further evidence that firms perceive some degree of market power that comes from diversification is shown in Table A.14: 90 percent of managers agree that it is better to diversify away from the business practices of their competitors; 57 percent say that they seldom or never cut prices when their competitors cut prices, and 74 percent that they seldom or never increase advertisement when their competitors increase advertisement.

# 6 Conclusion

What are the barriers to managerial skills-accumulation in low-income contexts? We focused on two well-theorized but empirically untested factors that may reduce firms' adoption of good management practices: turnover of well-trained managers and lack of product competition. We conduct a suite of field experiments with a set of firms around Addis Ababa, Ethiopia. We find that firms' demand for managerial training is low, in line with available evidence on demand for training in general (Meier and Sprenger, 2008; Bhattacharya et al., 2012; Meier and Sprenger, 2013; Bruhn et al., 2014) and for training in firms (Caicedo et al., 2022; Diaz et al., 2025). We add an important element to this body of evidence, namely that demand for training does not meaningfully respond to a credible reduction in manager turnover risk, or to a credible increase in product market competition. These zero results are quite powerful in that they suggest that competition alone is not sufficient to overcome barriers to management upgrading.

One reason for these results is that firms believe they have some degree of market power that comes from diversification. As such, they do not fear management upgrading among competitors. In contrast, we document evidence of a pervasive "positive spillovers" mental model among firms' top managers.

This opens up at least two areas for future research. First, it will be important to verify the accuracy of firms' perceptions about the returns to investing in management training and how these change when competitors improve their management. If firms base their strategies on erroneous models, information interventions may improve market conduct and promote management innovation. Second, if firms are correct about the existence of spillovers, it would be important to understand how to best promote innovation in such an environment. In the standard model where spillovers are generated by the ability to directly observe the innovations of others, free-riding slows down innovation—why pay the cost of training if there is, borrowing the terminology of of Gerschenkron (2015), some "backwardness advantage"? However, in such a model, a policy maker only needs to induce innovation among a handful of visible firms to ensure the whole market observes and then quickly adopts the new technology. Instead, when spillovers come from differentiation, promoting innovation in a few firms will not guarantee diffusion, and different, less-targeted policies may be needed.

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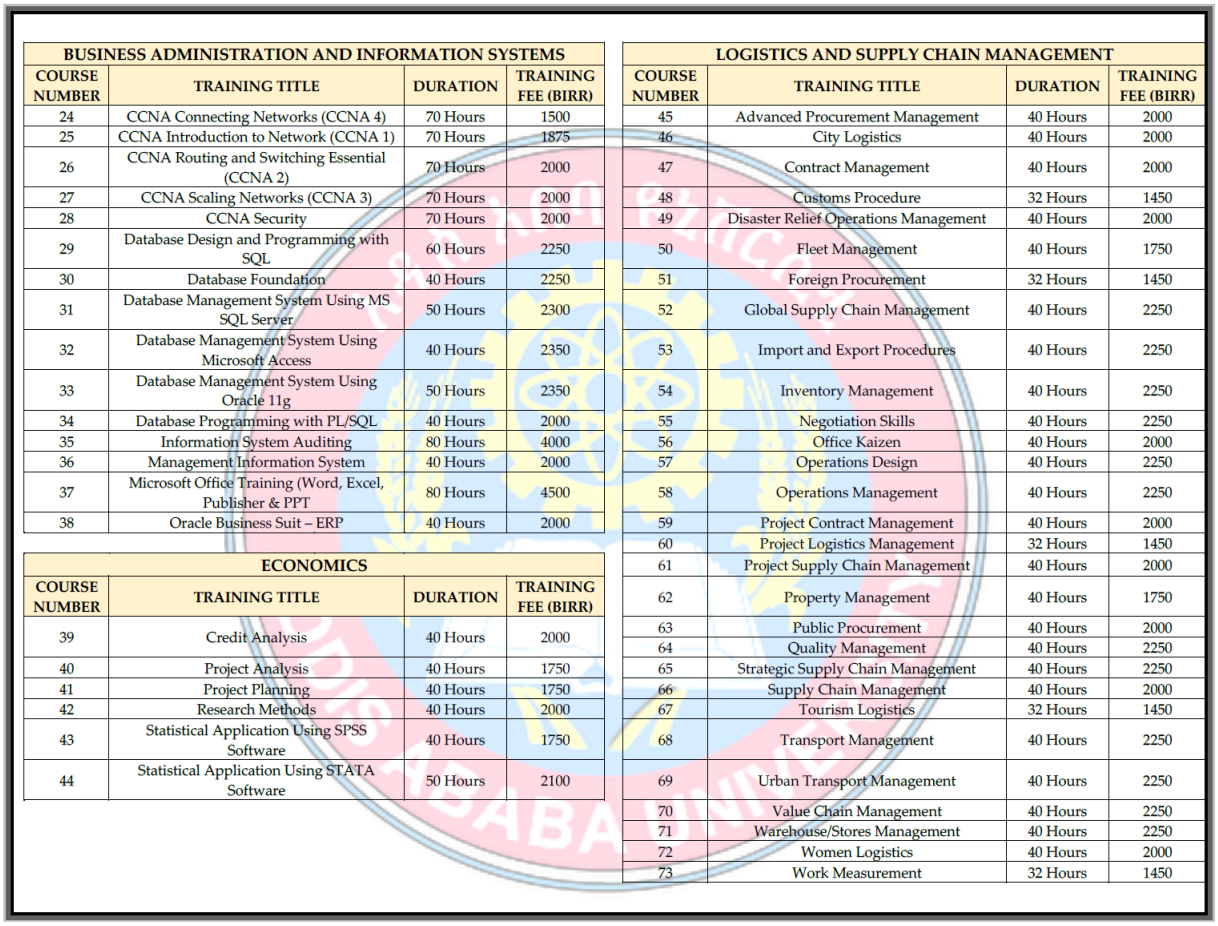
Figure A.1: Examples of School of Commerce Courses



**BUSINESS ADMINISTRATION AND INFORMATION SYSTEMS**

| COURSE NUMBER | TRAINING TITLE | DURATION | TRAINING FEE (BIRR) |
|---|---|---|---|
| 24 | CCNA Connecting Networks (CCNA 4) | 70 Hours | 1500 |
| 25 | CCNA Introduction to Network (CCNA 1) | 70 Hours | 1875 |
| 26 | CCNA Routing and Switching Essential (CCNA 2) | 70 Hours | 2000 |
| 27 | CCNA Scaling Networks (CCNA 3) | 70 Hours | 2000 |
| 28 | CCNA Security | 70 Hours | 2000 |
| 29 | Database Design and Programming with SQL | 60 Hours | 2250 |
| 30 | Database Foundation | 40 Hours | 2250 |
| 31 | Database Management System Using MS SQL Server | 50 Hours | 2300 |
| 32 | Database Management System Using Microsoft Access | 40 Hours | 2350 |
| 33 | Database Management System Using Oracle 11g | 50 Hours | 2350 |
| 34 | Database Programming with PL/SQL | 40 Hours | 2000 |
| 35 | Information System Auditing | 80 Hours | 4000 |
| 36 | Management Information System | 40 Hours | 2000 |
| 37 | Microsoft Office Training (Word, Excel, Publisher & PPT | 80 Hours | 4500 |
| 38 | Oracle Business Suit – ERP | 40 Hours | 2000 |

**ECONOMICS**

| COURSE NUMBER | TRAINING TITLE | DURATION | TRAINING FEE (BIRR) |
|---|---|---|---|
| 39 | Credit Analysis | 40 Hours | 2000 |
| 40 | Project Analysis | 40 Hours | 1750 |
| 41 | Project Planning | 40 Hours | 1750 |
| 42 | Research Methods | 40 Hours | 2000 |
| 43 | Statistical Application Using SPSS Software | 40 Hours | 1750 |
| 44 | Statistical Application Using STATA Software | 50 Hours | 2100 |

**LOGISTICS AND SUPPLY CHAIN MANAGEMENT**

| COURSE NUMBER | TRAINING TITLE | DURATION | TRAINING FEE (BIRR) |
|---|---|---|---|
| 45 | Advanced Procurement Management | 40 Hours | 2000 |
| 46 | City Logistics | 40 Hours | 2000 |
| 47 | Contract Management | 40 Hours | 2000 |
| 48 | Customs Procedure | 32 Hours | 1450 |
| 49 | Disaster Relief Operations Management | 40 Hours | 2000 |
| 50 | Fleet Management | 40 Hours | 1750 |
| 51 | Foreign Procurement | 32 Hours | 1450 |
| 52 | Global Supply Chain Management | 40 Hours | 2250 |
| 53 | Import and Export Procedures | 40 Hours | 2250 |
| 54 | Inventory Management | 40 Hours | 2250 |
| 55 | Negotiation Skills | 40 Hours | 2250 |
| 56 | Office Kaizen | 40 Hours | 2000 |
| 57 | Operations Design | 40 Hours | 2250 |
| 58 | Operations Management | 40 Hours | 2250 |
| 59 | Project Contract Management | 40 Hours | 2000 |
| 60 | Project Logistics Management | 32 Hours | 1450 |
| 61 | Project Supply Chain Management | 40 Hours | 2000 |
| 62 | Property Management | 40 Hours | 1750 |
| 63 | Public Procurement | 40 Hours | 2000 |
| 64 | Quality Management | 40 Hours | 2250 |
| 65 | Strategic Supply Chain Management | 40 Hours | 2250 |
| 66 | Supply Chain Management | 40 Hours | 2000 |
| 67 | Tourism Logistics | 32 Hours | 1450 |
| 68 | Transport Management | 40 Hours | 2250 |
| 69 | Urban Transport Management | 40 Hours | 2250 |
| 70 | Value Chain Management | 40 Hours | 2250 |
| 71 | Warehouse/Stores Management | 40 Hours | 2250 |
| 72 | Women Logistics | 40 Hours | 2000 |
| 73 | Work Measurement | 32 Hours | 1450 |

Figure A.2: Screenshots of the DAG app

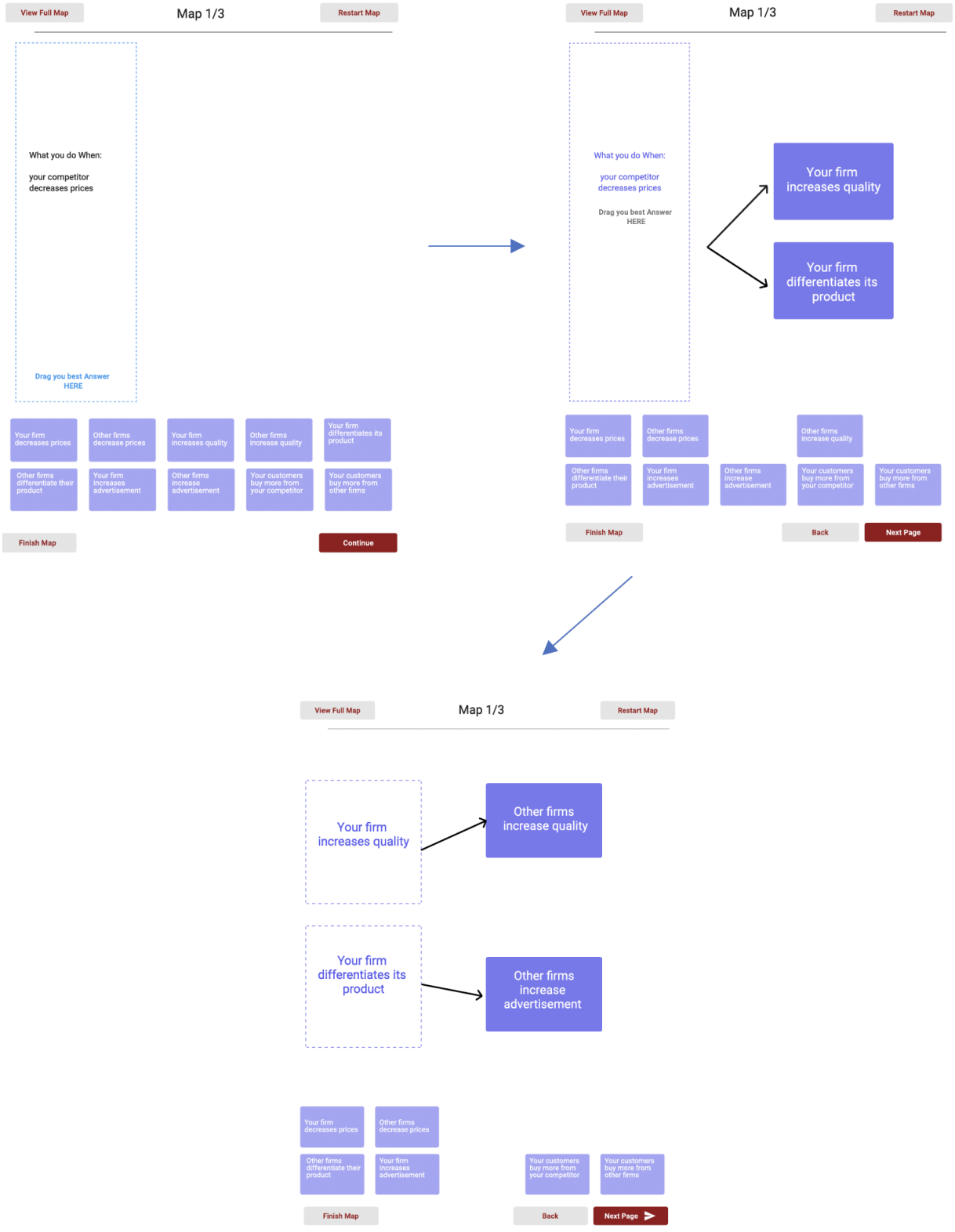
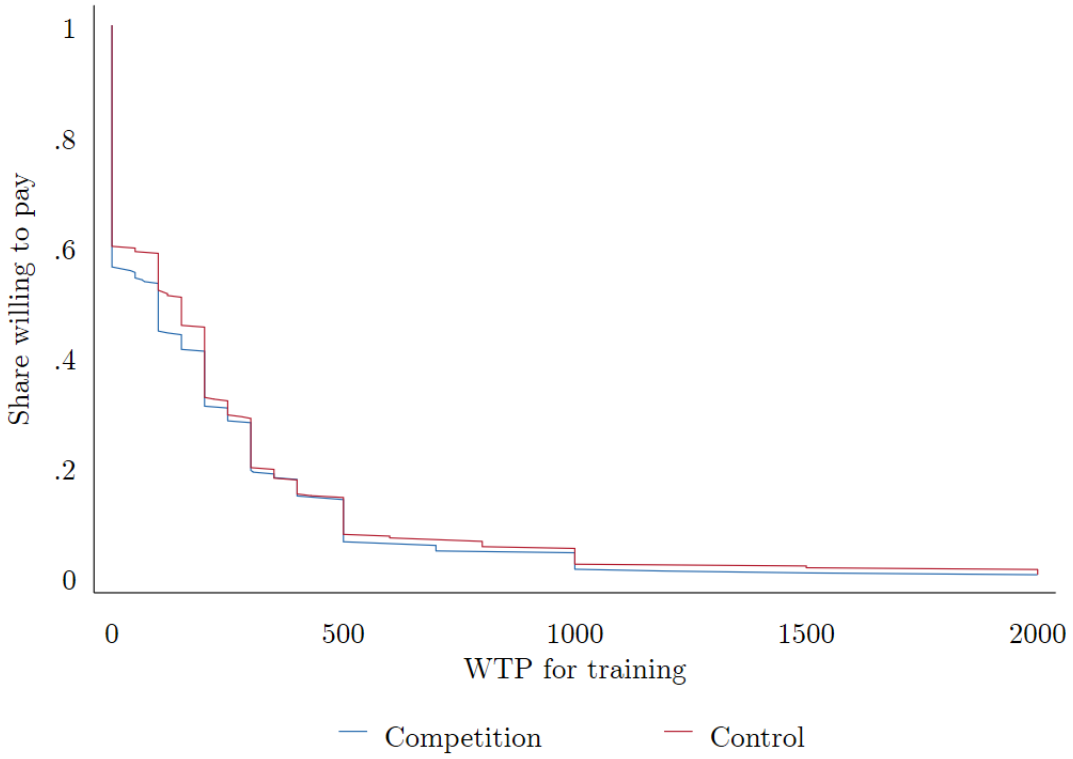
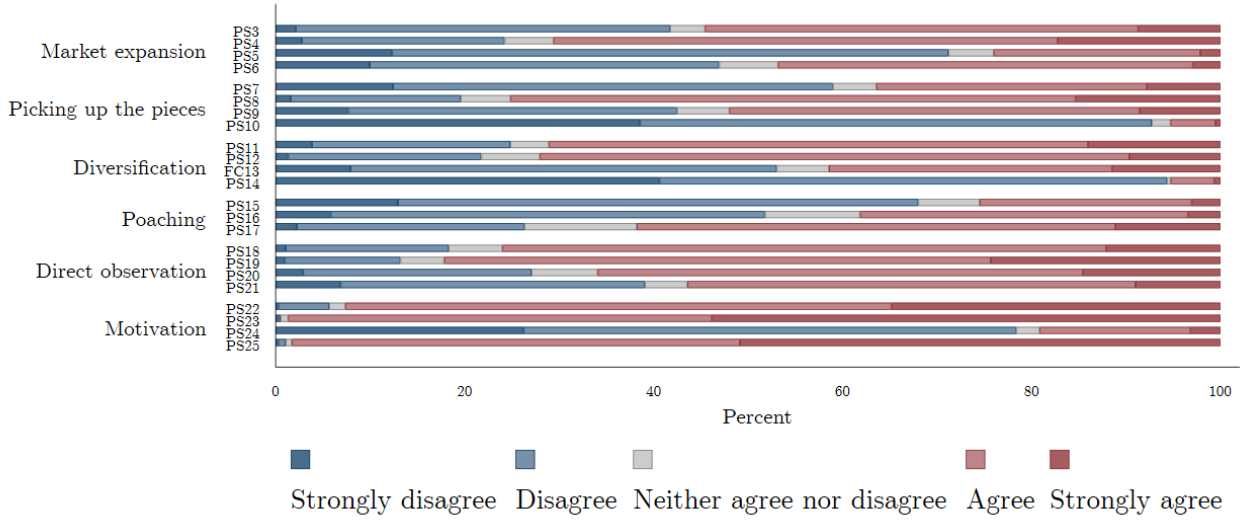


Figure A.3: Experiment 2A: Willingness to Pay for training, by Treatment Status



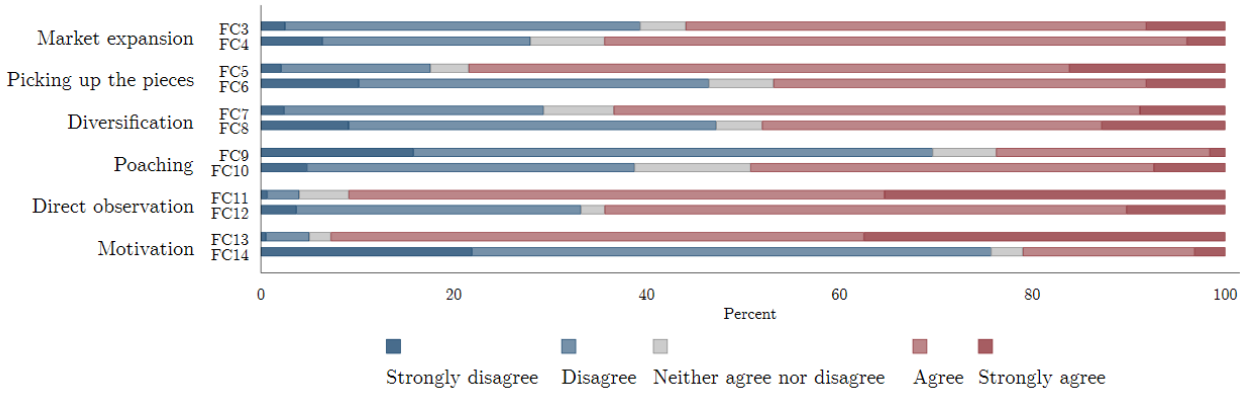

Note: This figure illustrates the distribution of WTP for the training across treatment status in the passive-control design. The control group comprises Control 1, Control 2 and Placebo groups (see Figure 4).

Figure A.4: Spillover mental model: answers to all questions (domestic)




PS3 = "If a competitor improves the quality of its product and manages to attract new customers because of that, I can steal some of these new customers from them."
PS4 = "If a competitor launches a new product, I can copy their new product."
PS5 = "It is difficult to start selling a new product if my competitor has already started selling it before me."
PS6 = "In this country, customers rarely switch from one provider of a product to another provider."
PS7 = "It is best to continue producing with tried and tested methods than following new technological fads and fashions."
PS8 = "While other firms try new ideas and fail, I take advantage of their difficulties to attract new customers."
PS9 = "It is not possible to benefit from other firms' failures."
PS10 = "In my country, innovating is not necessary because consumers are conservative."
PS11 = "When a competitor launches a new product, it is best for my firm to develop a different product, diversifying away from what they do."
PS12 = "When a competitor specializes in a new product, my firm benefits as our customers will have fewer options to buy our product from other firms."
PS13 = "It is futile to follow others' example because we are all different and we each must find our own way."
PS14 = "There is no need to diversify since most consumers want the same thing."
PS15 = "If I find out that a competitor is earning high profits, I can easily hire their managers."
PS16 = "In this country, it is difficult to convince managers to change employer."
PS17 = "Managers are ready to change employer for a small increase in salary."
PS18 = "It is easy for my firm to observe what products are produced by my competitors."
PS19 = "My competitors keep their business practices secret."
PS20 = "It is easy for my firm to find out how my competitor firms manage their workers."
PS21 = "Among businessmen, we often talk to one another about our experience with new technologies."
PS22 = "Seeing others innovate motivates me to do the same."
PS23 = "It is inspiring to see Ethiopian entrepreneurs develop new products that appeal to our consumers."
PS24 = "I follow my own path and do not care about what new products other firms create."
PS25 = "When I notice other firms succeed, it raises my own desire to do better."

Figure A.5: Spillover mental model: answers to all questions (foreign)




FC3 = "If a foreign competitor improves the quality of its product and manages to attract new customers because of that, I can steal some of these new customers from them."
FC4 = "In this country, customers rarely switch from one domestic provider of a product to a foreign provider."
FC5 = "While foreign competitors try new ideas and fail, I take advantage of their difficulties to attract new customers."
FC6 = "It is not possible to benefit from the failures of foreign competitors."
FC7 = "When a foreign competitor specializes in a new product, my firm benefits as our customers will have fewer options to buy our product from other firms."
FC8 = "It is futile to follow the example of foreign competitors because we are all different and we each must find our own way."
FC9 = "If I find out that a foreign competitor is earning high profits, I can easily hire their managers."
FC10 = "Managers in foreign firms are ready to change employer for a small increase in salary."
FC11 = "Foreign competitors keep their business practices secret."
FC12 = "I often talk to foreign competitors about our respective experiences with new technologies."
FC13 = "Seeing foreign competitors innovate motivates me to do the same."
FC14 = "I follow my own path and do not care about what new products other foreign firms create."

Table A.1: Experiment 1: Summary Statistics on Training and Turnover

| Training | | N |
|---|---|---|
| Ever organized or participated in formal training for employees (%) | 0.33 | 598 |
| | (0.47) | |
| At least one manager trained with formal training in FY 2010 (%) | 0.22 | 598 |
| | (0.41) | |
| Skills via formal training important during recruitment (%) | 0.90 | 598 |
| | (0.30) | |
| Turnover | | |
| Non manager turnover rate in FY2010 (question asked directly) | 15.53 | 554 |
| | (21.96) | |
| Manager turnover rate in FY2010 (question asked directly) | 2.81 | 577 |
| | (10.49) | |
| At least one manager quit over the last fiscal year (%) | 0.16 | 588 |
| | (0.37) | |
| Agree that difficult to retain managers at this establishment (%) | 0.20 | 598 |
| | (0.40) | |
| Turnover (top manager survey) | | |
| If lose managers: because take better paying job (%) | 0.38 | 582 |
| | (0.49) | |
| Agree that managers turnover negatively affects this establishment (%) | 0.72 | 598 |
| | (0.45) | |
| Agree that managers more likely to leave after training (%) | 0.24 | 598 |
| | (0.43) | |

Table A.2: Experiment 1: Competition and Management quality

| | Management quality score | |
|---|---|---|
| | (1) | (2) |
| High competition from domestic firms | 0.196 | |
| | (0.127) | |
| High competition from foreign firms | | 0.686*** |
| | | (0.097) |
| Mean | 0.4 | 0.4 |
| StDev | 1.1 | 1.1 |
| N | 598 | 598 |

The sample is made of the firms that participated to Experiment 1. "High competition from domestic/foreign firms" is an indicator equal to 1 if the answer to the question "For the market where this establishment sells its main products/services, rank the competition from other formal domestic/foreign firms?" is "Very competitive" or "Somewhat competitive", and 0 if the answer is "Not very competitive" or "No competition".

Table A.3: Experiment 1: Balance Table

| | Mean and Standard Deviation | | $N$ | Imbalance ($p$) |
|---|---|---|---|---|
| | Unconditional bonus | Retention bonus | | |
| | Targeted variables | | | |
| Firm size | 89.32 | 106.45 | 598 | 0.11 |
| | (124.33) | (137.30) | | |
| Firm age | 10.56 | 10.14 | 598 | 0.58 |
| | (9.73) | (9.07) | | |
| Sector = manufacturing | 0.41 | 0.46 | 598 | 0.28 |
| | (0.49) | (0.50) | | |
| Distance from School of Commerce (min) | 75.74 | 78.49 | 597 | 0.34 |
| | (34.87) | (35.30) | | |
| Applicability (0, 1 or 2) | 1.89 | 1.91 | 598 | 0.59 |
| | (0.34) | (0.29) | | |
| Average wage middle managers | 5928.14 | 6003.65 | 545 | 0.86 |
| | (5378.38) | (4706.44) | | |
| Trained managers (%) | 15.42 | 16.19 | 597 | 0.78 |
| | (33.23) | (34.57) | | |
| Turnover rate managers in FY2008 (%) | 3.72 | 2.27 | 598 | 0.04 |
| | (9.25) | (7.53) | | |
| | Other variables | | | |
| N senior managers | 2.55 | 2.68 | 598 | 0.43 |
| | (1.97) | (2.08) | | |
| N middle managers | 5.29 | 5.83 | 598 | 0.38 |
| | (7.78) | (7.37) | | |
| N production workers | 56.63 | 70.50 | 598 | 0.08 |
| | (89.76) | (103.81) | | |
| N staff | 13.63 | 16.98 | 598 | 0.02 |
| | (15.95) | (19.50) | | |
| % women | 0.42 | 0.39 | 598 | 0.19 |
| | (0.25) | (0.24) | | |
| Management quality score | 44.98 | 45.91 | 598 | 0.38 |
| | (13.04) | (12.63) | | |
| N | 298 | 300 | | |

Missing values for Distance from School of Commerce (1), and Trained managers (%) (1) are "Don't know". Missing values for Average wage of middle managers correspond to firms that report having at least one middle manager but report no wage for professionals employed in the firm (i.e., middle management, lawyers, teachers, administrators, bankers).

Table A.4: Experiment 2A: Balance Table

| | Mean and Standard Deviation | | | | | $N$ | Imbalance ($p$) |
|---|---|---|---|---|---|---|---|
| | Holdout | Treatment | Control 1 | Control 2 | Placebo | | |
| | | | Targeted variables | | | | |
| Firm size | 44.67 | 56.18 | 70.73 | 44.92 | 46.57 | 940 | 0.69 |
| | (101.01) | (137.19) | (285.55) | (133.05) | (100.53) | | |
| Firm age | 9.89 | 10.32 | 11.90 | 9.98 | 9.81 | 933 | 0.29 |
| | (7.43) | (8.50) | (10.45) | (5.51) | (6.68) | | |
| Sector = food and beverages | 0.10 | 0.10 | 0.10 | 0.08 | 0.11 | 940 | 0.94 |
| | (0.30) | (0.29) | (0.29) | (0.28) | (0.32) | | |
| Sector = wood products | 0.07 | 0.06 | 0.07 | 0.10 | 0.08 | 940 | 0.71 |
| | (0.25) | (0.24) | (0.26) | (0.30) | (0.27) | | |
| Sector = construction | 0.04 | 0.08 | 0.07 | 0.04 | 0.04 | 940 | 0.27 |
| | (0.20) | (0.27) | (0.25) | (0.19) | (0.19) | | |
| Sector = tourism | 0.13 | 0.08 | 0.10 | 0.08 | 0.09 | 940 | 0.54 |
| | (0.33) | (0.27) | (0.29) | (0.27) | (0.28) | | |
| Sector = restaurant | 0.29 | 0.22 | 0.22 | 0.27 | 0.24 | 940 | 0.45 |
| | (0.45) | (0.41) | (0.42) | (0.44) | (0.43) | | |
| | (0.19) | (0.19) | (0.17) | (0.17) | (0.21) | | |
| | | | Other variables | | | | |
| N senior managers | 1.87 | 2.11 | 2.39 | 2.11 | 1.91 | 940 | 0.56 |
| | (2.42) | (2.55) | (3.78) | (2.72) | (2.11) | | |
| N middle managers | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 452 | . |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | | |
| N production workers | 26.66 | 37.20 | 47.06 | 21.00 | 32.56 | 926 | 0.15 |
| | (76.74) | (111.38) | (195.63) | (51.49) | (86.38) | | |
| N staff | 7.15 | 9.72 | 12.21 | 10.36 | 6.51 | 926 | 0.29 |
| | (15.20) | (23.11) | (65.44) | (47.24) | (13.21) | | |
| % women | 0.48 | 0.43 | 0.46 | 0.43 | 0.43 | 926 | 0.17 |
| | (0.25) | (0.26) | (0.27) | (0.25) | (0.27) | | |
| Management quality score | 40.21 | 41.50 | 40.61 | 42.14 | 38.59 | 699 | 0.15 |
| | (12.64) | (12.43) | (11.63) | (13.36) | (11.09) | | |
| N | 166 | 314 | 147 | 154 | 159 | | |

For firm age, missing values (7) correspond to "Don't know" (6) and refuse to answer (1).

Table A.5: Experiment 2B: Balance Table

| | Mean and Standard Deviation | | $N$ | Imbalance ($p$) |
|---|---|---|---|---|
| | Low competition | High competition | | |
| Firm size | 51.27 | 54.26 | 990 | 0.71 |
| | (98.99) | (142.79) | | |
| Firm age | 11.53 | 11.09 | 982 | 0.43 |
| | (8.56) | (8.76) | | |
| Sector = food and beverages | 0.09 | 0.12 | 990 | 0.24 |
| | (0.29) | (0.32) | | |
| Sector = wood products | 0.06 | 0.10 | 990 | 0.02 |
| | (0.24) | (0.30) | | |
| Sector = construction | 0.04 | 0.04 | 990 | 0.97 |
| | (0.21) | (0.21) | | |
| Sector = tourism | 0.14 | 0.10 | 990 | 0.03 |
| | (0.35) | (0.30) | | |
| Sector = restaurant | 0.19 | 0.23 | 990 | 0.10 |
| | (0.39) | (0.42) | | |
| N | 560 | 430 | | |

Table A.6: Experiment 2C: Balance Table

| | Mean and Standard Deviation | | $N$ | Imbalance ($p$) |
|---|---|---|---|---|
| | Policy information | No policy information | | |
| Firm size | 57.69 | 48.37 | 728 | 0.27 |
| | (120.28) | (108.40) | | |
| Firm age | 14.02 | 14.11 | 727 | 0.89 |
| | (8.89) | (9.45) | | |
| Sector = food and beverages | 0.11 | 0.12 | 728 | 0.64 |
| | (0.31) | (0.33) | | |
| Sector = food products | 0.05 | 0.07 | 728 | 0.38 |
| | (0.22) | (0.25) | | |
| Sector = construction | 0.06 | 0.04 | 728 | 0.15 |
| | (0.24) | (0.20) | | |
| Sector = tourism | 0.02 | 0.02 | 728 | 0.68 |
| | (0.13) | (0.14) | | |
| Sector = restaurant | 0.18 | 0.17 | 728 | 0.67 |
| | (0.39) | (0.38) | | |
| N | 391 | 368 | | |

Table A.7: Experiment 1: Top managers' characteristics and expected impact of middle managers short-term training sessions of 100 hours in general management

| | Frequency (%) or Mean (Standard deviation) |
|---|---|
| Male | 535 (86.29%) |
| Age | 42.60 (12.06) |
| Years with company | 6.75 (5.63) |
| Years at position | 6.01 (5.15) |
| *Highest level of education completed* | |
| No education | 109 (0.20%) |
| Education through the Literacy campaign | 111 (0.59%) |
| Some primary school | 117 (1.76%) |
| Primary school | 140 (6.25%) |
| High school | 241 (25.98%) |
| Preparatory school | 115 (1.37%) |
| Vocational school | 130 (4.30%) |
| Diploma (non-vocational) | 166 (11.33%) |
| BA (BSc) degree | 264 (30.47%) |
| MA/MSc | 163 (10.74%) |
| PhD | 123 (2.93%) |
| *"Providing this short-term training to managers will significantly increase this establishment's performance"* | |
| Strongly agree | 314 (50.65%) |
| Agree | 236 (38.06%) |
| Neither agree nor disagree | 55 (8.87%) |
| Disagree | 13 (2.10%) |
| Strongly disagree | 2 (0.32%) |
| *"After completing such short-term training, managers's market wage would increase by"* | 16.80% (10.09%) |

Table A.8: Experiment 2A: Willingness to Pay for Training

| | WTP for training video | | | WTP for placebo video | | |
|---|---|---|---|---|---|---|
| | WTP>0 | WTP | log (WTP+1) | WTP>0 | WTP | log (WTP+1) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treatment | 0.022 | -9.796 | 0.118 | | | |
| | (0.031) | (48.065) | (0.177) | | | |
| Placebo | | | | 0.110** | 28.555 | 0.584** |
| | | | | (0.047) | (21.617) | (0.252) |
| Mean(Control) | 0.56 | 256.72 | 3.14 | 0.18 | 47.73 | 0.92 |
| StDev(Control) | 0.50 | 786.02 | 2.86 | 0.38 | 166.31 | 2.02 |
| N | 772 | 772 | 772 | 312 | 312 | 312 |

'WTP' stands for willingness to pay. The dependent variable in columns (1) and (4) is an indicator equal to 1 if the respondent is willing to pay for the training course/ placebo videos. The dependent variable in columns (2) and (5) represent the respondent's willingness to pay for the training course/placebo videos, expressed in Ethiopian birrs. In columns (3) and (6), it is the log of the amount (plus 1).

Table A.9: Experiment 2B: Willingness to Pay for Training

| | WTP>0 | WTP | WTP winsorized | log (WTP+1) |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treatment | -0.042 | -86.167 | 30.482 | -0.220 |
| | (0.030) | (298.831) | (106.439) | (0.197) |
| Mean(Control) | 0.66 | 1007.03 | 666.34 | 4.03 |
| StDev(Control) | 0.47 | 5431.03 | 1567.44 | 3.05 |
| N | 990 | 990 | 990 | 990 |

'WTP' stands for willingness to pay. The dependent variable in column (1) is an indicator equal to 1 if the respondent is willing to pay for the training, and 0 otherwise. The dependent variable in columns (2), (3), and (4) represents the respondent's willingness to pay for the training, expressed in Ethiopian birrs. In column (2), it is the raw amount, in column (3) it is winsorized at the 99th percentile, and in column (4) it is the log of the amount (plus 1).

Table A.10: Experiment 2C: Willingness to Pay for Training

| | WTP>0 | WTP winsorized | log (WTP+1) | WTP |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treatment | -0.009 | -240.521 | -0.129 | -398.889 |
| | (0.033) | (271.036) | (0.242) | (528.360) |
| Mean(Control) | 0.72 | 1940.79 | 4.98 | 2727.93 |
| StDev(Control) | 0.45 | 3877.53 | 3.35 | 7238.20 |
| N | 759 | 759 | 759 | 627 |

'WTP' stands for willingness to pay. The dependent variable in column (1) is an indicator equal to 1 if the respondent is willing to pay for the training, and 0 otherwise. The dependent variable in columns (2), (3), and (4) represents the respondent's willingness to pay for the training, expressed in Ethiopian birrs. In column (2), it is the raw amount winsorized at the 99th percentile, in column (3) it is the log of the amount (plus 1), and in column (4) it is the raw amount where "Don't know" responses are coded as missing instead of 0.

Table A.11: Experiment 2B: Perceived competition

| | Perceived share of treated firms | Perceived share of treated competitors | Increased competition |
|---|---|---|---|
| | (1) | (2) | (3) |
| Treatment | 4.386*** | 6.419*** | 0.066 |
| | (1.492) | (1.614) | (0.059) |
| Mean(Control) | 16.30 | 24.49 | 3.90 |
| StDev(Control) | 20.42 | 22.53 | 0.96 |
| N | 870 | 871 | 986 |

The dependent variable in column (1) is the share of firms in the respondent's Kebele that the respondent believes have received the training video from us, regardless of whether they are close competitors. The dependent variable in column (1) is the share of firms in the respondent's Kebele, which the respondent considers to be close competitors, that he or she believes have received the training video from us. The dependent variable in column (3) is measured using the respondent's agreement on a 5-point Likert scale to the statement: 'My close competitors will improve the quality of their marketing in the coming months.'

Table A.12: Experiment 2C: Expected impact of the reform

| | Frequency (%) |
|---|---|
| *"Do you agree that this would increase competition for local traders and producers?"* | |
| Yes | 717 (88.59%) |
| No | 432 (11.14%) |
| Don't know | 392 (0.27%) |

Table A.13: Diversification predicts the spillover mental model

| | PS1 | PS2 | WTP | WTP winsorized |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Market expansion effect | 0.028 | 0.258*** | 150.345 | 56.351 |
| | (0.089) | (0.080) | (291.322) | (252.145) |
| Picking up the pieces | 0.041 | -0.471*** | 93.527 | 121.480 |
| | (0.088) | (0.077) | (266.190) | (217.641) |
| Diversification | 0.328*** | 0.034 | -376.868 | -409.636* |
| | (0.083) | (0.078) | (476.944) | (215.567) |
| Poaching | 0.155** | 0.022 | -271.213 | -63.623 |
| | (0.067) | (0.066) | (264.173) | (201.275) |
| Direct observation | -0.015 | -0.113 | 80.051 | 77.815 |
| | (0.073) | (0.070) | (391.227) | (219.620) |
| Motivation | -0.056 | -0.179** | 465.156 | 256.528 |
| | (0.092) | (0.090) | (463.159) | (249.720) |
| Mean | 2.9 | 3.0 | 2094.3 | 1824.2 |
| StDev | 1.2 | 0.9 | 6120.6 | 3740.0 |
| N | 757 | 757 | 757 | 757 |

The dependent variable in column (1) is the answer on a likert scale to "PS1: If a domestic competitor improves his marketing or his products, the profits of my firm increase." The dependent variable in column (2) is the answer on a 5-point Likert scale to "PS2: I worry that domestic competitors will encroach on my market and steal my customers." 'WTP' stands for willingness to pay. The dependent variable in columns (3) and (4) represents the respondent's willingness to pay for the training, expressed in Ethiopian birrs. In column (4), it is winsorized at the 99th percentile. The controls are calculated as the averages of responses to questions on a 5-point Likert scale, grouped as shown in Figure A.4. For consistency, the scoring for questions PS3, PS7, PS8, PS10, PS11, PS12, PS13, PS15, PS17, PS18, PS20, PS21, PS22, PS23, and PS25 was inverted (e.g., a score of 5 became 1, 4 became 2, etc.) so that higher scores uniformly indicate stronger alignment with the driver of the spillover mental model. Treatment of missing values: two participants did not answer questions PS1 and PS2 because they didn't have local competitors; one participant did not answer questions FC1 and FC2 because of having no foreign competitor; one competitor did not answer question FC1. We set these few missing values to 'neither agree nor disagree' to avoid losing observations in the analysis.

Table A.14: Survey Data: How does competition work in practice?

| | Average response | Observations |
|---|---|---|
| Rarely or never cuts prices when competitors cut prices | 0.57 | 932 |
| Rarely or never boosts ads when competitors boost ads | 0.74 | 926 |
| Agrees it is better to differentiate | 0.90 | 708 |

Data source: 2022 survey with firms sampled for Experiment 2.

# Online Appendix

## Table of Contents

# B Sampling and Timeline

## B.1 Sampling frame

The sample used for this study originates in a two-wave panel survey of firms conducted in Ethiopia. In order to be included in the survey, firms had to have five or more permanent employees at the time of sampling. The initial wave of the panel—which we refer to as Panel w1 here—took place between January and July 2017 and covers 1240 firms. The next wave—which we refer to as Panel w2—took place between March and September 2019 and covers 1320 firms, 986 of which were also surveyed in the first wave, while the rest were identified via snowball sampling around the firms in the initial Panel w1 sample.[13] In practice, this was achieved by having enumerators walk in the immediate geographical vicinity of w1 firms to identify new suitable firms, i.e., those with five or more permanent employees. The sample from this second wave is used as the starting point for our study.

Table B.1: Geographical distribution of the sample

| | Panel W1<br>freq/colpct | Panel W2<br>freq/colpct |
|---|---|---|
| Oromia | 605<br>48.8% | 653<br>49.5% |
| Addis Ababa | 635<br>51.2% | 667<br>50.5% |
| N. Observations | 1240 | 1320 |

In terms of geographical location, we concentrate our attention on the economic heartland of the country, which includes the federal capital Addis Ababa and the part of the Oromia region that surrounds it. By design, the firm sample is divided equally between the Oromia and Addis Ababa regions—see Table B.1.

Map B.1 shows the location of all sample firms on a map of Central Ethiopia. The approximate border of the Addis Ababa region is shown in bold; the rest of the sample is located in the Oromia region, which is much larger. The areas denoted in gray mark those administrative units (woredas in Addis Ababa and kebeles in Oromia) from which the sample was drawn. The map confirms that, for the Oromia region, most surveyed firms are located along main roads, except for some concentration in the towns of Bishoftu and Adama. Map B.2 provides a close-up view of Map B.1 centering on the Addis Ababa region. It shows that very few firms were sampled from the center of Addis Ababa, in keeping with the objective of the panel to document the evolution of businesses at the outskirt of large cities.

Given the absence of a firm census in Ethiopia, the sampling frame for the first wave was drawn from a list of firms constructed by combining information from many different sources. Specifically, outside of Addis Ababa, we obtained lists from Woreda (district) investment, trade, industry, and revenue bureaus. There was no standard data format and not all bureaus in each Woreda were willing or able to share data, so data from the Oromia Regional Investment Bureau

[13] Eleven firms that were identified by the snowball exercise are omitted from this number because they had fewer than five permanent employees.

Figure B.1: Spatial Distribution of the Firm Sample

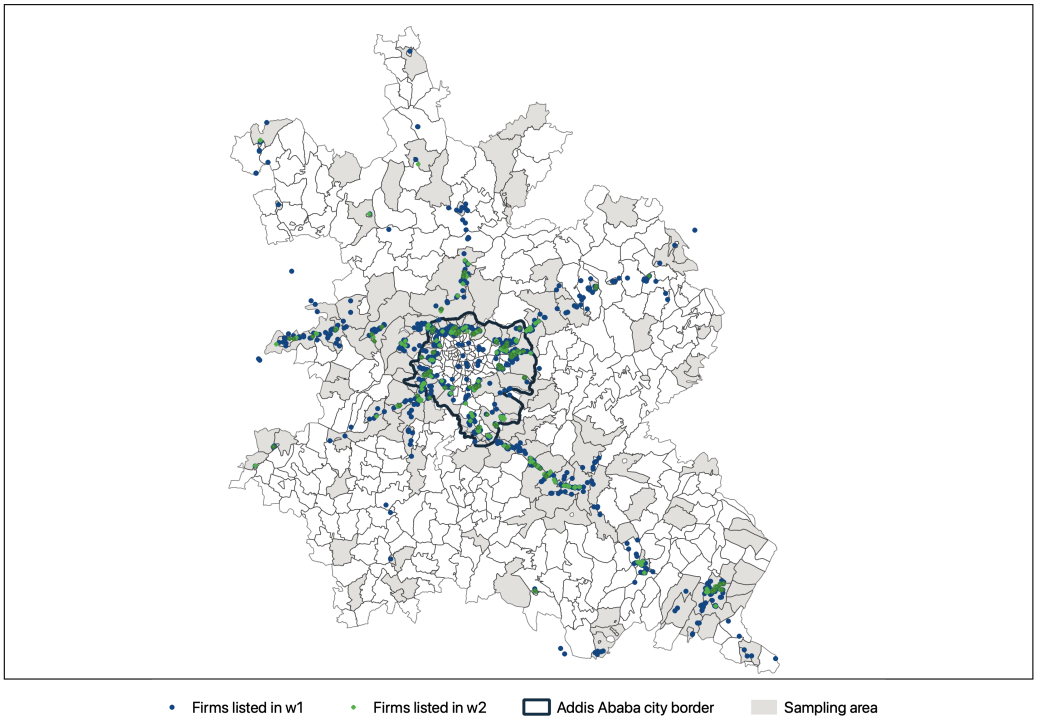
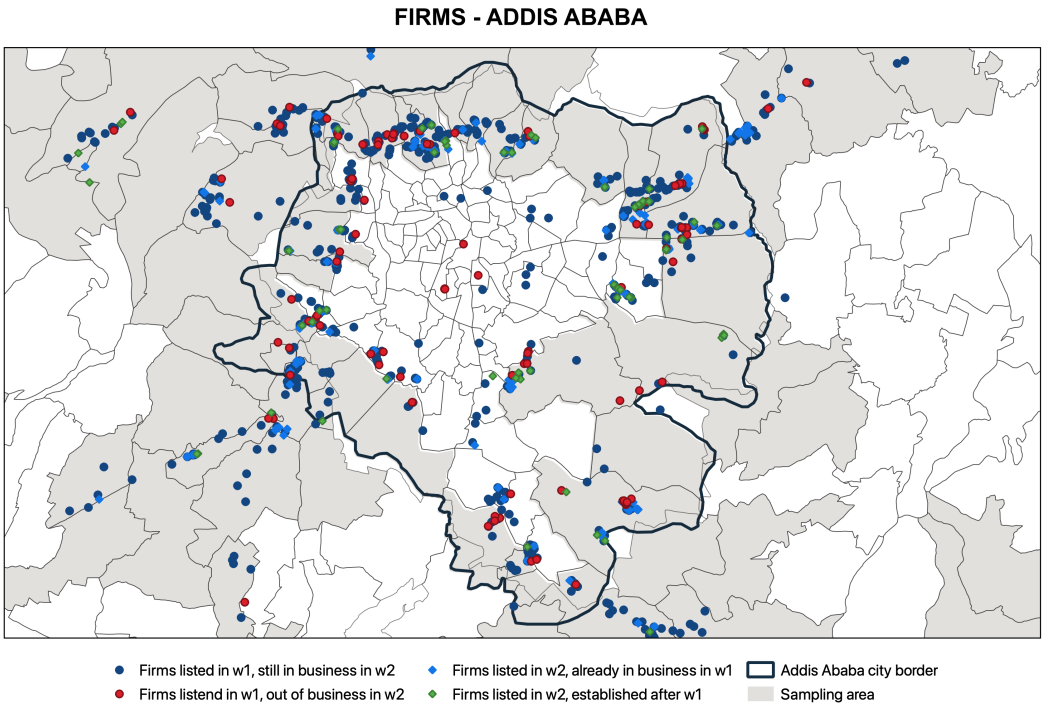



Figure B.2: Close-up of the Spatial Distribution of Sampled Firms near Addis Ababa



was added for the relatively large towns of Adama, Burayu, Holeta, Sululta, and Sendafa. We constructed a sampling frame separately for Addis Ababa. The sampling frame there relied primarily on a partial census of firms interviewed by the Addis Ababa Labor and Social Affairs Bureau. Since this list under-represents manufacturing firms, lists from the Addis Ababa Industry Office, the Addis Ababa Investment Office, the Ethiopian De- velopment Research Institute, and Federal Micro and Small Enterprise Development Agency were added to build a more representative frame. After all firms lists in a Woreda were collected and appended, the team systematically attempted to remove firms that appear multiple times in a given list based on name and phone number matching. We then attempted to remove firms from ineligible sectors  schools (public and private), health centers/clinics, public administrative offices, NGOs/non-profits, and bank branches. Although many of the firms on this list were no longer in existence at the time the survey began, it nonetheless provided an excellent starting point. As a result, we are confident that the sample is as representative of the firms located in the study area as could reasonably be achieved.

Due to the short time interval (two years) between the two surveys, a different method was used in order to refresh the sample to compensate for dropouts. In order to identify potential additions to the sample, enumerators were instructed to scout the vicinity of wave 1 firms for eligible firms. This process enabled us to find enough replacements to refresh the sample for the wave 1 firms that dropped out of the sample and to expand it to keep up with the economic expansion of the study area itself. The panel structure of the resulting sample is summarized in Table B.2.

Table B.2: Panel structure of the sample

| | Panel w1 | Panel w2 |
|---|---|---|
| Only panel w1 | 254 | 0 |
| Only panel w2 | 0 | 334 |
| Both waves | 986 | 986 |
| N. observations | 1240 | 1320 |

## B.2 Experiment 1

The sampling frame for Experiment 1 was constructed by combining: 1226 firms that were tracked down from the Panel w2 sample, 38 of which were used for the pilot; and 206 firms identified using a new snowball exercise similar to the one used to refresh the sample for Panel survey w2. This resulted in a sampling population of 1394 firms. These firms were then divided into strata of four firms each and, within each strata, the four firms where randomly assigned to one the four treatment cells: unconditional bonus + 50% subsidy; unconditional bonus + 80% subsidy; retention bonus + 50% subsidy; and retention bonus + 80% subsidy. To recall, the bonus is paid directly to the newly trained middle manager while the subsidy is pay to the firm to cover the cost of training. Sets of similar firms were identified using a Mahalanobis distance index to measure the average distance between the characteristics of the four firms

in the set.[14] The identification of these sets was accomplished by randomly partitioning firms into sets of four firms and calculating the average within-set Mahalanobis distance across all the sets. We replicated this process hundreds of time until we could no longer improve on our objective function. The partition with the lowest average within-set Mahalanobis distance was used to stratify the sample.[15]

A sample of strata covering 841 firms was then drawn randomly from sampling frame and interviewed in person using a shortened version of the Panel questionnaire that included questions relative to the training offered to middle managers. 32 of the invited firms refused to participate to the survey. Of the 809 firms that answered the questionnaire, 211 were found not to have any middle manager, making them ineligible for Experiment 1. Table B.3 shows the actual number of observations in each of the four treatment cells of Experiment 1. Since the nature of the treatment was only revealed to respondents at the very end of the questionnaire, there is no reason to expect attrition to be correlated with treatment.

Table B.3: Structure of the sample for Experiment 1

| | All | Unconditional bonus+ 50% subsidy | Unconditional bonus+ 80% subsidy | Retention bonus+ 50% subsidy | Retention bonus+ 80% subsidy |
|---|---|---|---|---|---|
| N. firms | 598 | 152 | 146 | 140 | 160 |

## B.3 Experiment 2

The sampling frame was expanded to accommodate the six treatment cells included in Experiment 2: hold-out; competition; control 1; placebo; control 2; and pure control. In addition, the size of the hold-out sample was set to double the number of firms in the other cells, so as to be able to estimate the effect of receiving the training materials on firm outcomes of interest. Given the absence of secondary census data on firms in Ethiopia, the expansion of the sampling frame was achieved using the same snowball approach that was used to refresh the Panel w1 sample for Panel survey w2: enumerators were instructed to scout the vicinity of w2 sample firms for additional firms with at least 5 permanent employees. This resulted in an expanded sampling frame of 2096 firms: 1102 firms that could be tracked from the sampling population identified in Experiment 1 (N = 1394)[16] and 994 firms from the snowball exercise.[17]

As for Experiment 1, the sampling frame was divided into strata using a Mahalanobis algorithm and selection into the six treatment cells was conducted using randomized stratified

[14]The characteristics used to construct the Mahalanobis distance index were: firm size; firm age; manufacturing indicator; distance from the School of Commerce; an applicability score; the 10th and 90th percentage of paid wages; indicator if the firm has even given general training to managers; and the worker turnover rate in percent.

[15]The algorithm was applied separately to the Panel and the snowball firms to account for possible differences between the two subsamples.

[16]Some 21% of firms could not be located due to firm closure or, in a few cases, a switch to an unknown location.

[17]Of the 1379 firms identified during the snowball exercise, 47 were dropped because of missing data on the Mahalanobis variables—see below—and 338 turned out to already be in the Panel sample.

samplinge. More weight was given to the Panel sample because snowball firms tend to be smaller on average and thus less representative of our target population.[18] To this effect, we assembled sets of firms that were as similar to each other as possible. These firms where then randomly assigned to the hold-out treatment cell, the other five treatment cells, and the pure control sample. As for Experiment 1, sets of similar firms were identified using a Mahalanobis distance index to measure the average distance between the characteristics of the seven firms in the set.[19] The identification of these sets was accomplished by randomly partitioning firms in the sampling frames into sets of firms and calculating the average within-set Mahalanobis distance across all the sets. We replicated this process hundreds of time until we could no longer improve on our objective function. The partition with the lowest average within-set Mahalanobis distance was used to stratify the sample. This resulted in an intended sample of 1,474 firms—1206 for the baseline survey (2A) and 268 as pure controls to be interviewed only during the follow-up surveys (2B and 2C).

Table B.4 shows the actual number of observations in each of the six treatment cells. Given the time lag between the Panel w2 survey and the three experiment 2 surveys, these numbers are lower than the originally intended sample due either to firm closure or firm refusal.[20] Since, in each case, the nature of the treatment was only revealed to respondents at the very end of the questionnaire, there is no reason to expect attrition to be correlated with each of the three treatments.

Table B.4: Structure of the sample for experiment 2

| | All | Hold-out | Competition | Control 1 | Placebo | Control 2 | Pure control |
|---|---|---|---|---|---|---|---|
| Intended sample: | 1,474 | 201 | 402 | 201 | 201 | 201 | 268 |
| N. of respondents in: | | | | | | | |
| Baseline (2A) | 948 | 168 | 316 | 149 | 159 | 154 | n.a. |
| First follow-up (2B) | 990 | 135 | 272 | 126 | 130 | 140 | 187 |
| Second follow-up (2C) | 758 | 115 | 204 | 104 | 98 | 107 | 130 |

## B.4 Timeline

The sequencing of the experiments and of their corresponding surveys is shown in Table B.5. Experiment 1 involves a single survey of eligible firms, the four treatments being incorporated directly into the survey script. Additional data on take-up of the training offer comes from subsequent communication by firms regarding the identity of the selected middle managers and from invoicing data from the School of Commerce, for those who initiated the training.

[18] In practice, we constructed 67 sets of 22 firms by selecting randomly 16x67=1072 firms from the Panel w2 sampling frame and 6x67=402 firms from the snowball sampling frame. With each strata of 22 firms, random assignment to treatment was as follows: 3 to Hold-out, 6 to Competition, 3 to Control 1, 3 to Placebo, 3, to Control 2, and 4 to Pure control.

[19] The characteristics used to construct the Mahalanobis distance index were: sectoral fixed effects for food and beverages, wood products, construction, tourism, hotels, and restaurants; number of employees on the payroll, firm age; and GPS data for longitude and latitude.

[20] Of the 1206 firms earmarked for the baseline survey, 258 were not interviewed due primarily to firm closure and firm refusal. This translates into a loss of 21.3% of the intended sample, a figure comparable to the loss rate of 20.4% between Panel w1 and w2 that is implied by Table B.1.

Table B.5: Timeline of the study

| | Starting date | End date |
|---|---|---|
| Panel survey w1 | January 2017 | July 2017 |
| Panel survey w2 | March 2019 | September 2019 |
| | | |
| Experiment 1 survey | March 2019 | September 2019 |
| | | |
| Experiment 2: | | |
| Baseline survey (2A) | March 2022 | July 2022 |
| First follow-up survey (2B) | December 2022 | March 2023 |
| Second follow-up survey (2C) | January 2024 | March 2024 |

Experiment 2 includes three surveys: an in-person baseline survey of all selected firms *except* the pure control firms, which were not interviewed at baseline to avoid triggering any expectation regarding the training; a first follow-up survey of all firms—including pure controls—that was conducted in person as well; and a second, shorter follow-up survey of all firms that was conducted over the phone. Willingness to pay information for the training offered in experiment 2A is incorporated into the baseline survey, willingness to pay data for experiment 2B is collected in the first follow-up survey, and willingness-to-pay for experiment 2C is collected in the second follow-up survey. Information on the use of the training materials by recipients and on the effect of that training on firm outcomes was collected in the first follow-up survey.

# C Information on the two trainings offered

In this Appendix, we examine how recipients of our two interventions—the subsidized middle manager training at the School of Commerce and the manager training videos on a USB memory stick—engaged with these interventions and whether receiving them had an effect on their firm. These questions are not central to our experimental design, which focuses on variation in take-up of these interventions when competition threats are made salient. But they nonetheless cast additional light on our findings.

## C.1 Engagement with the middle manager intervention

For our first experiment, the middle manager intervention, we decided to offer training that was already available on the local market—namely a set of training programs developed for working managers in Ethiopia. As provider of such training, we selected the Addis Ababa School of Commerce because of its high level of professionalism and its demonstrated appeal among managers of large domestic and foreign corporations operating in Ethiopia.

Given the high cost of this training, we were unable to offer to subsidize it for all participating firms. We instead offered them to enter a lottery with a 10% chance of receiving a training subsidy, and we elicited their interest in participating to the lottery—in which case they were invited to propose the name of one or two recipients among their middle managers. This means that, in practice, few firms actually received the subsidy.

Keeping this in mind, we found that 431 respondents expressed an interest to participate but only 121 (28.1%) of them submitted the names of one or two recipients of the award. Furthermore, of the 10 firms that submitted names and won the lottery, none of their 16 nominees actually took advantage of the subsidized training—irrespective of the retention bonus or not.[21] In other words, engagement with the intervention was minimal, suggesting that demand for middle manager training is low in spite of the well-known weakness in managerial practices among our study population.

## C.2 Engagement with the training treatment

Focus group interviews with participants to Experiment 1 revealed that the low engagement with the Experiment 1 intervention was primarily due to the travel and time costs associated with attending lecture courses in the central part of Addis Ababa, a metropolis of more than four million inhabitants. Given that middle managers were often married with children, subsidizing the training itself did not compensate them for these costs. For these reasons, we chose for the second experiment an intervention that required no travel and was flexible enough for managers to take the training on their own time. After verifying that manager in Ethiopian firms had access to a TV set or computer accepting USB input, we therefore opted for a series of modular videos delivered to participants on a USB memory stick. We also held focus groups and short surveys with firm respondents and other experts to identify the training needs most relevant for our study population.

On this basis, we developed training materials organized in five one-hour-long video lectures produced by the authors. The content of the course was designed to address the most relevant

[21] The outbreak of the COVID 19 pandemic a few months later put an end to the granting of further awards.

training needs of population of interest while remaining sufficient general to apply to the wide range of business sectors participating to our study. These five lectures were: (1) 'Know your product' (product definition); (2) 'Break it down to build it up' (quality control); (3) 'Know your customers and keep them' (customer acquisition and retention); (4) 'Make new customers' (marketing); and (5) 'Know your competitors' (how to compete). The teaching material was designed specifically with Ethiopian firms in mind and it was provided to respondents in either English or Amharic.

According to our records, 383 firms received the videos at the end of the baseline survey (experiment 2A). 328 of these were interviewed during the first follow-up survey. Of these, 257 state having received the memory stick with the training materials but 71 were unaware of the training materials or did not have access to it because it was given to someone else. Only 9 endline respondents report getting access to the training materials received by someone else and a few declared receiving the memory stick although it was not provided to their firm by our team. In total, 271 respondents (82.6% of recipient firms) report receiving the memory stick with the training.

Of those who report, 163 (60.1% of recipients) state having watched any of the content. Among those, 73 (45%) state watching all 5 videos. Of those who declare watching some of the content, 70% found it very useful and another 27% a bit useful. Only 5 of those who watched some of the content did state not finding the training useful. Although those who watched are a self-selected sample of respondents, this data nonetheless suggests that low WTP for the training is not because it was not found useful, conditional on watching. 161 respondents answered the question on what they changed in their firm as a result of watching the training videos. Of those 72 (45%) state they changed nothing. The rest mention a large variety of changes that affected customers, products, quality control, or worker training. Hence, based on respondents' accounts, 89 firms introduced small incremental changes in a wide variety of managerial practices, but with little overlap in the type of improvement across firms. When asked whether competitors would find the training useful, most say yes. Yet only 73 respondents (45%) anticipate changes in competitors' businesses after they receive the training. And only 5 anticipate that, if competitors got the training, the respondent's market share would decrease a bit—compared to 30 who anticipate competitors' access to the training would *increase* the respondent's market share. These findings are consistent with what we find for the willingness to pay for the training materials, namely, very little concern for competition.

## C.3 Effect of the training videos on firm outcomes

Both ITT and LATE estimates of the experiment 2 training treatment on management practices show minimal impacts. These results align well with the qualitative finding that few recipients of the training material engaged with it in a deep and sustained way.

Regression tables are available upon request. We summarize the key approaches and findings here. The ITT regressions have two regressors: a binary indicator being in the hold-out sample, and a binary indicator for having participated in any of the BDM treatments. The omitted category are the pure controls, that is, those firms that were not given an opportunity to obtain the training materials.[22] If receiving the training matters, then the coefficient of the

[22]We could of course include separate indicators for each of the BDM sub-treatments. However, since very few of the estimated coefficients show a statistically significant effect, we focus here on a simpler setup that

hold-out sample indicator should be larger than the coefficient of the BDM indicator since, by construction, BDM participants were much less likely to obtain the training materials.

To estimate the LATE coefficients, we use three types of instruments: (1) indicator variables for the six different treatments; (2) the randomized price in the BDM; and (3) the interaction between the randomized BDM price and indicator variables for the four BDM treatments. This ensures that the price offers made by respondents do not affect the predicted values of take-up. The first stage is estimated using data from the baseline survey. In the second step, we look at outcomes measured at the first follow-up and we use the predicted value of take-up at baseline as instrument. This yields the same result as using a standard IV approach (see Wooldridge (2010), pp. 908-936).

Given the focus of our study, we collected a considerable amount of information on the marketing and management practices of participating firms. These variables form the core of our analysis, which is summarized here.

The first set of variables captures marketing practices. They can be divided into five categories: branding (6 variables); customer engagement (4 variables); product design (5 variables); quality control (3 variables); and the monitoring of competitors (4 variables). Of these 22 variables, 4 are weakly significant: recipients of the training materials are more likely to be registered, to brand their products, to have now products competing with foreign producers, and to monitor their competitors' prices. None of them survives correction for multiple hypothesis testing.

The second set of variables focuses on firms' knowledge of marketing principles, divided into 18 questions on the same five categories as above, 14 of which are directly related to the content of the course itself. Regression results from the LATE regression indicate that recipients of the training are less likely to agree that: 'know your consumer' means understanding their interest in the product; the price of a product only reflects the value of the inputs entering its production; and that it is profitable in the long run to lower the price below marginal cost. None of these effects would survive correction for multiple hypothesis testing.

reduces the likelihood of false positives.

# D Causal chains as seen by participating firms

We conducted a directed acyclic graph (DAG) exercise with a subset of the sample—the pure controls. The purpose of this exercise was to complement the information produced by the experiments and help the interpretation of our findings using a sample of firms unaffected by either the training materials or any of the competition treatments.

Participating respondents were asked to reconstruct their view of likely causal chains by iteratively choosing a sequence of likely causal links between different outcomes. Each graph starts with a single initial event or cause. The respondent is asked to select the most likely direct consequences of this initial event from a set of pre-populated options. For each direct consequence, the exercise is repeated, so that respondents can specify a complex set of indirect consequences.

This survey module started with four training modules that ensure participants understand key concepts - direct consequences, indirect consequences, multiple consequences. After these practice runs, respondents face three DAG exercises relative to firms and competition. In the first two DAGs, the firm considers a hypothetical scenario where two steel mills compete with each other. The initial event is that one of the two mills lowers its output price (what varies between the first and second DAG is whether the firm reducing its price has a large or small relative market share). The respondent is asked to predict what is most likely to happen in response to this action. In the last DAG, the initial event corresponds closely to our competition intervention. The respondent is asked to consider a scenario where one of its close competitors receives training in management and marketing. The respondent then predicts how this close competitors and other market players will react to this.

Because each DAG exercise generates a very large number of possible graphs, we need a way of summarizing the information collected from respondents. To this effect, we start by turning each respondent's graph into a network adjacency matrix. We then normalize these adjacency matrices and average them to identify dominant patterns among respondents.

We start in Table D.1 by showing the number of consequences that follow from the initial event, listed first for each DAG. The larger the reported number is, the more frequently its associated action causes further changes. Unsurprisingly, the initial event is the most consequential: by construction, none of the other events can occur without it. On average, the initial node of each of the three DAGs causes around 4 consequences. In DAG 1, price reduction by the second steel mill is predicted to be consequential as well (1.89 consequences on average). In contrast, in DAG 3, the exercise that most closely resembles experiment 2A, none of the possible consequences is noticeably more consequential than others. This indicates the absence of a commonly shared causal chain associated with a competitors receiving management training.

Table D.1: Number of outcomes caused by each node

| | Mean |
|---|---|
| DAG 1: Mill A is the dominant firm | |
| Mill A reduces its steel price | 4.29 |
| Mill A goes bankrupt | 0.23 |
| Mill A raises the steel price above p | 0.23 |
| Mill A reduces its steel price even further | 0.95 |
| Mill A returns to the original steel price p. | 0.73 |
| Mill B goes bankrupt | 0.13 |
| Mill B increases its steel price | 0.34 |
| Mill B reduces its steel price | 1.89 |
| Mill B reduces its steel price even further | 0.81 |
| DAG 2: Mill A is the fringe firm | |
| Mill A reduces its steel price | 3.72 |
| Mill A goes bankrupt | 0.21 |
| Mill A raises the steel price above p | 0.20 |
| Mill A reduces its steel price even further | 0.76 |
| Mill A returns to the original steel price p. | 0.67 |
| Mill B goes bankrupt | 0.27 |
| Mill B increases its steel price | 0.39 |
| Mill B reduces its steel price | 1.23 |
| Mill B reduces its steel price even further | 0.55 |
| DAG 3: Your competitor receives training in marketing management | |
| Your close competitor receives training in marketing management | 4.12 |
| Your close competitor decreases the price of their product (Pc) | 0.48 |
| Your close competitor increases advertising for their product (Ac) | 0.51 |
| Your close competitor increases the quality of their product (Qc) | 0.87 |
| Your other competitors decreases the price of their product (Po) | 0.40 |
| Your other competitors increases advertising for their product (Ao) | 0.21 |
| Your other competitors increases the quality of their product (Qo) | 0.48 |

More interestingly, Table D.2 shows the frequency with which a particular consequence is caused by the initial event in each DAG. We see that, when a dominant firm reduces its price, 84% of respondents predict that the fringe firm will also reduce its price. This proportion falls to 58% when mill A is the fringe firm. Respondents also expect a reduction in price by one firm (especially the dominant firm) to result in further lowering of the price by that firm (54% if it is dominant and 46% if it is not). These findings are consistent with standard economic theory. We also note that respondents associate a price war with a high probability of bankruptcy for *both* firms. Furthermore, while the anticipated probability of bankruptcy is slightly lower for the dominant firm, it is still above 50% in both DAG 1 and 2. This indicates that, in their majority, respondents do not see price competition between firms as potentially beneficial

for either of them. This is consistent with our experimental findings: if all firms see price competition as detrimental to them, they are less likely to engage in it—and to expect other firms to initiate a price war. Consistent with this view, we see that in DAG3, respondents are much more likely to predict that a competitor who received training in marketing management will increase product quality or perhaps advertizing, but less likely to decrease their price—and similarly for competitors who did not receive the training.

Table D.2: Frequency with which a consequence is caused

| | Mean frequency |
|---|---|
| DAG 1: Dominant mill A lowers its price | |
| Mill A goes bankrupt | 0.47 |
| Mill A raises the steel price above p | 0.37 |
| Mill A reduces its steel price even further | 0.54 |
| Mill A returns to the original steel price | 0.58 |
| Mill B goes bankrupt | 0.52 |
| Mill B increases its steel price | 0.44 |
| Mill B reduces its steel price | 0.84 |
| Mill B reduces its steel price even further | 0.54 |
| | |
| DAG 2: Fringe mill A lowers its price | |
| Mill A goes bankrupt | 0.59 |
| Mill A raises the steel price above p | 0.34 |
| Mill A reduces its steel price even further | 0.46 |
| Mill A returns to the original steel price | 0.47 |
| Mill B goes bankrupt | 0.50 |
| Mill B increases its steel price | 0.41 |
| Mill B reduces its steel price | 0.58 |
| Mill B reduces its steel price even further | 0.38 |
| | |
| DAG 3: Your close competitor receives training in marketing management | |
| Your close competitor decreases his/her price | 0.57 |
| Your close competitor increases his/her advertizing | 0.76 |
| Your close competitor increases his/her quality | 0.85 |
| Your other competitors decrease their price | 0.60 |
| Your other competitors increase their advertizing | 0.61 |
| Your other competitors increase their quality | 0.73 |

# E Construction of the Management Quality Score

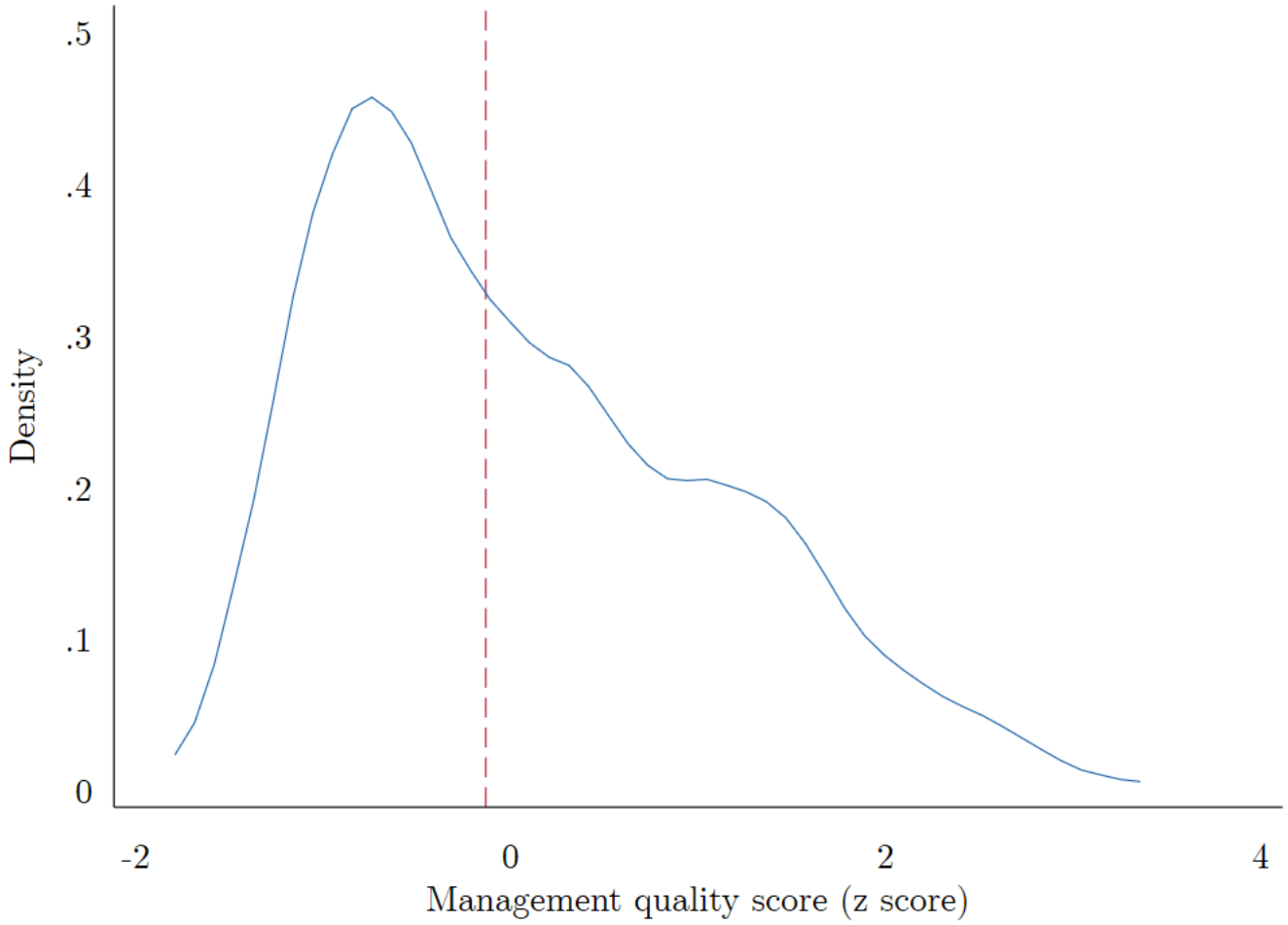
The Management Quality Score computation is an adaptation from Bloom and Van Reenen (2007), 'Measuring and Explaining Management Practices Across Firms and Countries'.

We compute 18 indicators or dimensions (displayed in the first column of Table E.1) from AUDRI variables (specified in column 3). Column 2 shows the original questions from Bloom and Van Reenen (2007).

These indicators are "scores". Any score from 1 to 5 can be given, but the scoring guide and examples are only provided for scores of 1, 3 and 5. Multiple questions are used for most dimensions to improve scoring accuracy. The guide to compute each indicator is detailed in column 3.

The Management Quality Score is the sum of all indicators, therefore ranging from 18 to 90. Figure E.1 shows the density distribution of the management quality score in the AUDRI sample.

Figure E.1: Kernel density of Management Quality Score




Dash line shows median.

Table E.1: Management Quality Scoring

| **Indicator** | **Bloom and Van Reenen's questions** | **AUDRI questions** |
|---|---|---|
| (1) Modern manufacturing, introduction | a) Can you describe the production process for me?<br>b) What kinds of lean (modern) manufacturing processes have you introduced? Can you give me specific examples?<br>c) How do you manage inventory levels? What is done to balance the line?<br>**Scoring grid:**<br>Score 1 - Other than Just-In-Time (JIT) delivery from suppliers few modern manufacturing techniques have been introduced, (or have been introduced in an ad-hoc manner).<br>Score 3 - Some aspects of modern manufacturing techniques have been introduced, through informal/isolated change programs.<br>Score 5 - All major aspects of modern manufacturing have been introduced (Just-In-Time, autonomation, flexible manpower, support systems, attitudes and behavior) in a formal way. | C13. Has this establishment introduced new production/operational processes or new technology in the past two years?<br>1. Yes<br>2. No → C18<br>C15. Where did this establishment procure the new processes/technology?<br>1. Domestically<br>2. Indirect import (through trading company)<br>3. Direct import<br>-777. N/A – did not procure, produced in-house<br>-999. Other (describe)<br>C16. Was it necessary to hire new skilled employees, re-train existing employees, employ consulting services, or take any other type of action to adapt to this new processes/technology?<br>1. Hire new skilled employees<br>2. Re-train existing employees<br>3. Employ consulting services<br>4. None of these<br>-999. Other (describe)<br>**Scoring grid:**<br>Score 1 – C13 = 2<br>Score 3 – C15 = -777 or C15 = -999 or C16 = 4<br>Score 5 – C13 = 1 |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (2) Modern manufacturing, rationale | a) Can you take through the rationale to introduce these processes?<br>b) What factors led to the adoption of these lean (modern) management practices?<br>**Scoring grid:**<br>Score 1 - Modern manufacturing techniques were introduced because others were using them.<br>Score 3 - Modern manufacturing techniques were introduced to reduce costs<br>Score 5 - Modern manufacturing techniques were introduced to enable us to meet our business objectives (including costs) | C14. What prompted this establishment to introduce new production processes/new technology?<br>1. The establishment needed to save money/reduce costs<br>2. The establishment imitated other local firms<br>3. The establishment imitated foreign firms<br>4. The firm needed to expand production<br>-999. Other (describe)<br>**Scoring grid:**<br>Score 1 – C13 = 2<br>Score 2 – C14 = 2 or C14 = 3<br>Score 3 – C14 = 1<br>Score 4 – C14 = -999<br>Score 5 – C14 = 4 |
| (3) Process problem documentation | a) How would you go about improving the manufacturing process itself?<br>b) How do problems typically get exposed and fixed?<br>c) Talk me through the process for a recent problem.<br>d) Do the staff ever suggest process improvements?<br>**Scoring grid:**<br>Score 1 - No, process improvements are made when problems occur.<br>Score 3 - Improvements are made in one-week workshops involving all staff, to improve performance in their area of the plant<br>Score 5 - Exposing problems in a structured way is integral to individuals' responsibilities and resolution occurs as a part of normal business processes rather than by extraordinary effort/teams | M11. In 2010 E.C. what best describes what happened at this establishment when a problem in the production process arose? e.g. Finding a quality defect in a product or a piece of machinery breaking down<br>1. We fixed it but did not take further action<br>2. We fixed it and took action to make sure that it did not happen again<br>3. We fixed it and took action to make sure it did not happen again, and had a continues improvement process to anticipate problems like these in advance<br>4. No action was taken<br>-777. Not applicable: no problem arose<br>**Scoring grid:**<br>Score 1 – M11 = 4<br>Score 2 – M11 = 1<br>Score 3 – M11 = -777<br>Score 4 – M11 = 2<br>Score 5 – M11 = 3 |

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| **Indicator** | **Bloom and Van Reenen's questions** | **AUDRI questions** |
|---|---|---|
| (4) Performance tracking | a) Tell me how you track production performance?<br>b) What kind of Key Performance Indicators (KPIs) would you use for performance tracking? How frequently are these measured? Who gets to see this KPI data?<br>c) If I were to walk through your factory could I tell how you were doing against your KPI's?<br>**Scoring grid:**<br>Score 1 - 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)<br>Score 3 - Most key performance indicators are tracked formally. Tracking is overseen by senior management.<br>Score 5 - Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools. | M12. In 2010 E.C., how many key performance indicators were monitored at this establishment?<br>e.g. Metrics on production cost, waste, quality, inventory, energy, absenteeism, deliveries on time<br>1. 1-2 key performance indicators<br>2. 3-9 key performance indicators<br>3. 10 or more key performance indicators<br>4. No key performance indicators<br>**Scoring grid:**<br>Score 1 – M12 = 4<br>Score 3 – M12 = 1<br>Score 4 – M12 = 2<br>Score 5 – M12 = 3 |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (5) Performance review | a) How do you review your Key Performance Indicators (KPIs)?<br>b) Tell me about a recent meeting<br>c) Who is involved in these meetings? Who gets to see the results of this review?<br>**Scoring grid:**<br>Score 1 - Performance is reviewed infrequently or in an un-meaningful way, e.g. only success or failure is noted.<br>Score 3 - Performance is reviewed periodically with successes and failures identified. Results are communicated to senior management. No clear follow-up plan is adopted.<br>Score 5 - Performance is continually reviewed, based on indicators tracked. All aspects are followed up ensure continuous improvement. Results are communicated to all staff | M14. [REPEAT FOR EACH METRIC]<br>In 2010 E.C., how frequently were [METRIC NAME] reviewed by managers at this establishment? Circle all that apply; a manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager.<br>M15. [REPEAT FOR EACH METRIC]<br>In 2010 E.C., how frequently were [METRIC NAME] reviewed by non-managers at this establishment? Non-managers are all employees at the establishment who are not managers as defined above<br>1. Yearly<br>2. Semiannually<br>3. Quarterly<br>4. Monthly<br>5. Weekly<br>6. Daily<br>7. Hourly or more frequently<br>8. Never<br>-999. Other (describe)<br>*There was no value -999, and 8 Never was recoded as 0 Never.*<br>*For each firm, the sum of M14 and M15 for all metrics have been computed. We call it SUM_M14_M15*<br>**Scoring grid:**<br>Score 1 – M12 = 4<br>Score 2 – $SUM\_M14\_M15 \leq 8$<br>Score 3 – $8 < SUM\_M14\_M15 < 31$<br>Score 4 – $31 \leq SUM\_M14\_M15 \leq 48$<br>Score 5 – $SUM\_M14\_M15 > 48$ |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (6) Performance dialogue | a) How are these meetings structured? Tell me about your most recent meeting.<br>b) During these meeting, how much useful data do you have?<br>c) How useful do you find problem solving meetings?<br>d) What type of feedback occurs in these meetings?<br>**Scoring grid:**<br>Score 1 - The right data or information for a constructive discussion is often not present or conversations overly focus on data that is not meaningful. Clear agenda is not known and purpose is not stated explicitly<br>Score 3 - Review conversations are held with the appropriate data and information present. Objectives of meetings are clear to all participating and a clear agenda is present. Conversations do not, as a matter of course, drive to the root causes of the problems.<br>Score 5 - Regular review/performance conversations focus on problem solving and addressing root causes. Purpose, agenda and follow-up steps are clear to all. Meetings are an opportunity for constructive feedback and coaching. | M8. Does the establishment take minutes of management meetings?<br>1. Yes<br>2. No<br>-888. Don't know<br>M9. Does the establishment keep archives of important documents (e.g. old accounts, minutes of meetings)?<br>1. Yes<br>2. No<br>-888. Don't know<br>M10. Do managers ever provide written reports for the general manager/owner on the activities of their units?<br>1. Yes<br>2. No<br>-888. Don't know<br>-777. Not applicable<br>*New variables have been created by recoding "2 No", "-888 Don't know" and "-777 Not applicable" as 1 and 0 otherwise for M8, M9 and M10. Then the sum of those three indicator variables was computed. We call it SUM_M8_M9_M10_rec.*<br>**Scoring grid:**<br>Score 1 – M8 = 2 and M9 = 2 and M9 = 2<br>Score 5 – M8 = 1 and M9 = 1 and M10 = 1<br>Score 2 – SUM_M8_M9_M10_rec <2 and Score != 1<br>Score 4 – SUM_M8_M9_M10_rec $\geq$ 2<br>Score 3 – Score != 1/2/4/3 |

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| **Indicator** | **Bloom and Van Reenen's questions** | **AUDRI questions** |
|---|---|---|
| (7) Consequence management | a) What happens if there is a part of the business (or a manager) who isn't achieving agreed upon results? Can you give me a recent example?<br>b) What kind of consequences would follow such an action?<br>c) Are there are any parts of the business (or managers) that seem to repeatedly fail to carry out agreed actions?<br>**Scoring grid:**<br>Score 1 - Failure to achieve agreed objectives does not carry any consequences<br>Score 3 - Failure to achieve agreed results is tolerated for a period before action is taken.<br>Score 5 - A failure to achieve agreed targets drives retraining in identified areas of weakness or moving individuals to where their skills are appropriate | M34. Under what conditions are employees at this establishment docked pay?<br>Circle all that apply<br>1. Poor performance<br>2. Late arrival<br>3. Absenteeism<br>4. Early departure<br>5. Misconduct/discipline<br>6. Lost/Damage any properties<br>-777. Pay is never docked<br>-999. Other (specify)<br>**Scoring grid:**<br>Score 1 – M34 = -777<br>Score 5 – M34 = 1 or M34 = 2 or M34 = 3 or M34 = 4 and Score != 1/3<br>Score 3 – [(M34 = 5 or M34 = 6) and Score != 1] or Score != 1/5 |

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| **Indicator** | **Bloom and Van Reenen's questions** | **AUDRI questions** |
|---|---|---|
| (8) Target balance | a) What types of targets are set for the company? What are the goals for your plant?<br>b) Tell me about the financial and non-financial goals?<br>c) What does Company Head Quarters (CHQ) or their appropriate manager emphasize to you?<br>**Scoring grid:**<br>Score 1 - Goals are exclusively financial or operational<br>Score 3 - Goals include non-financial targets, which form part of the performance appraisal of top management only (they are not reinforced throughout the rest of organization)<br>Score 5 - Goals are a balance of financial and non-financial targets. Senior managers believe the non-financial targets are often more inspiring and challenging than financials alone. | M13. What types of performance indicators are used at this establishment? Select all that apply<br>1. Production cost metrics<br>2. Sale metrics<br>3. Profit metrics<br>4. Waste metrics<br>5. Quality metrics<br>6. Inventory metrics<br>7. Energy metrics<br>8. Absenteeism/punctuality metrics<br>9. Delivery metrics<br>-999. Other (Describe)<br>*We create an indicator for each level of M13, then sum indicators for "4 Waste metrics", "5 Quality metrics", "6 Inventory metrics", "7 Energy metrics", "8 Absenteeism/punctuality metrics", "9 Delivery metrics". We call it SUM_NON_OP.*<br>**Scoring grid:**<br>Score 1 – M12 = 4<br>Score 2 – SUM_NON_OP = 0 and Score != 1<br>Score 5 – SUM_NON_OP > 2 and Score != 1/2<br>Score 4 – SUM_NON_OP $\leq$ 2 and Score != 1/2/5 |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (9) Target interconnection | a) What is the motivation behind your goals?<br>b) How are these goals cascaded down to the individual workers?<br>c) What are the goals of the top management team (do they even know what they are!)?<br>d) How are your targets linked to company performance and their goals?<br>**Scoring grid:**<br>Score 1 - Goals are based purely on accounting figures (with no clear connection to shareholder value)<br>Score 3 - Corporate goals are based on shareholder value but are not clearly communicated down to individuals<br>Score 5 - Corporate goals focus on shareholder value. They increase in specificity as they cascade through business units ultimately defining individual performance expectations. | M19. In 2010 E.C., who was aware of the production targets at this establishment?<br>1. Only senior managers<br>2. Most managers and some production workers<br>3. Most managers and most production workers<br>4. All managers and most production workers<br>5. All managers and all production workers<br>**Scoring grid:**<br>Score 1 – M17 = 4<br>Score 2 – M19 = 1<br>Score 3 – M19 = 2<br>Score 4 – M19 = 3 or M19 = 4<br>Score 5 – M19 = 5 |
| (10) Target time horizon | a) What kind of time scale are you looking at with your targets?<br>b) Which goals receive the most emphasis?<br>c) How are long term goals linked to short term goals?<br>d) Could you meet all your short-run goals but miss your long-run goals?<br>**Scoring grid:**<br>Score 1 - Top management's main focus is on short term targets<br>Score 3 - There are short and long-term goals for all levels of the organization. As they are set independently, they are not necessarily linked to each other<br>Score 5 - Long term goals are translated into specific short term targets so that short term targets become a "staircase" to reach long term goals | M17. In 2010 E.C., what best describes the time frame of production targets at this establishment? Examples of production targets are: production, quality, efficiency, waste, on-time delivery<br>1. Main focus was on short-term (less than one year) production targets<br>2. Main focus was on long-term (more than one year) production targets<br>3. Combination of short-term and long-term production targets<br>4. No production targets<br>**Scoring grid:**<br>Score 1 – M17 = 4<br>Score 2 – M17 = 1<br>Score 4 – M17 = 2<br>Score 5 – M17 = 3 |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (11) Targets are stretching | a) How tough are your targets? Do you feel pushed by them?<br>b) On average, how often would you say that you meet your targets?<br>c) Are there any targets which are obviously too easy (will always be met) or too hard (will never be met)?<br>d) Do you feel that on targets that all groups receive the same degree of difficulty? Do some groups get easy targets?<br>**Scoring grid:**<br>Score 1 - Goals are either too easy or impossible to achieve; managers provide low estimates to ensure easy goals<br>Score 3 - In most areas, top management pushes for aggressive goals based on solid economic rationale. There are a few "sacred cows" that are not held to the same rigorous standard<br>Score 5 - Goals are genuinely demanding for all divisions. They are grounded in solid, solid economic rationale | M18. In 2010 E.C., how easy or difficult was it for this establishment to achieve its production targets?<br>1. Possible to achieve without much effort<br>2. Possible to achieve with some effort<br>3. Possible to achieve with normal amount of effort<br>4. Possible to achieve with more than normal effort<br>5. Only possible to achieve with extraordinary effort<br>6. Not possible to achieve<br>**Scoring grid:**<br>Score 1 – M17 = 4<br>Score 2 – M18 = 6 or M18 = 1<br>Score 4 – M18 = 2 or M18 = 5<br>Score 5 – M18 = 3 or M18 = 4 |
| (12) Performance clarity | a) What are your targets (i.e. do they know them exactly)? Tell me about them in full.<br>b) Does everyone know their targets? Does anyone complain that the targets are too complex?<br>c) How do people know about their own performance compared to other people's performance?<br>**Scoring grid:**<br>Score 1 - Performance measures are complex and not clearly understood. Individual performance is not made public<br>Score 3 - Performance measures are well defined and communicated; performance is public in all levels but comparisons are discouraged<br>Score 5 - Performance measures are well defined, strongly communicated and reinforced at all reviews; performance and rankings are made public to induce competition | M16. In 2010 E.C., where were the production display boards showing output and other key performance indicators located at this establishment?<br>1. All display boards were located in one place (e.g. at the end of the production line)<br>2. Display boards were located in multiple places (e.g. at multiple stages of the production line)<br>3. We did not have any display boards<br>M25. Do this establishment record individual-level performance measures for managers?<br>1. Yes<br>2. No<br>**Scoring grid:**<br>Score 1 – M12 = 4<br>Score 2 – M16 = 3 and M25 = 2<br>Score 4 – M16 = 1 or M16 = 2 or M25 = 1<br>Score 5 – M16 = 1 or M16 = 2 and M25 = 1 and Score != 1/2/4 |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (13) Managing human capital | a) Do senior managers discuss attracting and developing talented people?<br>b) Do senior managers get any rewards for bringing in and keeping talented people in the company?<br>c) Can you tell me about the talented people you have developed within your team? Did you get any rewards for this?<br>**Scoring grid:**<br>Score 1 - Senior management do not communicate that attracting, retaining and developing talent throughout the organization is a top priority<br>Score 3 - Senior management believe and communicate that having top talent throughout the organization is a key way to win<br>Score 5 - Senior managers are evaluated and held accountable on the strength of the talent pool they actively build | Using questions that are available at W1 and W2<br>L55. Have social contacts (friends/family) of owners and managers helped you identify skilled workers and employees for the establishment?<br>1. Yes<br>2. No<br>L58. Has the establishment ever organized or participated in any formal training for its employees? Please exclude on-job training<br>1. Yes<br>2. No<br>L59. In FY 2010, what percentage of permanent managers and non-manager employees received formal training?<br>**Scoring grid:**<br>Score 1 – L55 = 2 and L58 = 2<br>Score 5 – L55 = 1 and L58 = 1 and L59 (managers) > 0 and L59 (non-managers) > 0 and Score != 1<br>Score 2 – L58 = 2, Score != 1/5 and L55 is not missing<br>Score 4 – L58 = 1 and L59 (managers) > 0 and L59 (non-managers) > 0, Score != 1/5/2/4 and L55 is not missing<br>Score 3 – Score != 1/5/2/4 and L55 is not missing |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (14) Rewarding high-performance | a) How does you appraisal system work? Tell me about the most recent round?<br>b) How does the bonus system work?<br>c) Are there any non-financial rewards for top-performers?<br>d) How does your reward system compare to your competitors?<br>**Scoring grid:**<br>Score 1 - People within our firm are rewarded equally irrespective of performance level<br>Score 3 - Our company has an evaluation system for the awarding of performance related rewards<br>Score 5 - We strive to outperform the competitors by providing ambitious stretch targets with clear performance related accountability and rewards | M22. In 2010 E.C., what were non-managers' performance bonuses usually based on at this establishment?<br>M26. In 2010 E.C., what were managers' performance bonuses usually based on at this establishment?<br>1. Their own performance as measured by production targets<br>2. Their team or shift performance as measured by production targets<br>3. Their establishment's performance as measured by production targets<br>4. Their firms' performance as measured by production targets<br>5. No performance bonuses → M24<br>-999. Other (specify)<br>M24. How do you reward good performance by non-managers?<br>M28. How do you reward good performance by managers?<br>Circle all that apply<br>1. Increase pay<br>2. Promotion<br>3. In-kind gifts<br>4. "employee of the month" title leaderboard<br>5. Contract renewal<br>6. Better access to preferred shift<br>7. None/no reward<br>8. Bonus<br>-999. Other (specify)<br>**Scoring grid:**<br>Score 1 – M22 = 5 and M26 = 5 and M27 = 7 and M28 = 7<br>Score 2 – M22 = 5 or M26 = 5 or M24 = 7 or M28 = 7 and Score != 1/2 and M22 is not missing<br>Score 5 – M22 = 1 and M26 = 1 and M24 != 7 and M28 != 7 and Score != 1/2 and M22 is not missing<br>Score 4 – M22 = 1 or M26 = 1 or M24 != 7 or M28 != 7 and Score != 1/2/5 and M22 is not missing<br>Score 3 – Score != 1/2/5/4 and M22 is not missing |



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| **Indicator** | **Bloom and Van Reenen's questions** | **AUDRI questions** |
|---|---|---|
| (15) Removing poor performers | a) If you had a worker who could not do his job what would you do? Could you give me a recent example?<br>b) How long would underperformance be tolerated?<br>c) Do you find any workers who lead a sort of charmed life? Do some individuals always just manage to avoid being fixed/fired?<br>**Scoring grid:**<br>Score 1 - Poor performers are rarely removed from their positions<br>Score 3 - Suspected poor performers stay in a position for a few years before action is taken<br>Score 5 - We move poor performers out of the company or to less critical roles as soon as a weakness is identified | M32. In 2010 E.C., when was an underperforming nonmanager reassigned or dismissed at this establishment?<br>1. Within 6 months of identifying non-manager under-performance<br>2. After 6 months of identifying non-manager under-performance<br>3. Rarely or never<br>M33. In 2010 E.C., when was an underperforming manager reassigned or dismissed at this establishment?<br>1. Within 6 months of identifying manager under-performance<br>2. After 6 months of identifying manager under-performance<br>3. Rarely or never<br>**Scoring grid:**<br>Score 1 – M32 = 3 and M33 = 3<br>Score 2 – M32 = 3 or M33 = 3 and Score != 1<br>Score 5 – M32 = 1 and M33 = 1<br>Score 4 – M32 = 1 or M33 = 1 and Score != 1/2/5<br>Score 3 – Score != 1/2/5/4 |

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| Indicator | Bloom and Van Reenen's questions | AUDRI questions |
|---|---|---|
| (16) Promoting high performers | a) Can you rise up the company rapidly if you are really good? Are there any examples you can think of?<br>b) What about poor performers – do they get promoted more slowly? Are there any examples you can think of?<br>c) How would you identify and develop (i.e. train) your star performers?<br>d) If two people both joined the company 5 years ago and one was much better than the other would he/she be promoted faster?<br>**Scoring grid:**<br>Score 1 - People are promoted primarily upon the basis of tenure<br>Score 3 - People are promoted upon the basis of performance<br>Score 5 - We actively identify, develop and promote our top performers | M29. In 2010 E.C., what was the primary way nonmanagers were promoted at this establishment?<br>M31. In 2010 E.C., what was the primary way managers were promoted at this establishment?<br>1. Promotions were based solely on performance and ability<br>2. Promotions were based partly on performance and ability, and partly on other factors (e.g. tenure or family connections)<br>3. Promotions were based mainly on factors other than performance and ability (e.g. tenure or family connections)<br>4. Managers are normally not promoted<br>**Scoring grid:**<br>Score 1 – M29 = 4 and M31 = 4<br>Score 5 – M29 = 1 and M31 = 1<br>Score 2 – M29 = 4 or M31 = 4 and Score != 1/5<br>Score 4 – M29 = 1 or M29 = 2 or M31 = 1 or M31 = 2 and Score != 1/5/2<br>Score 3 – Score != 1/5/2/4 |
| (17) Attracting human capital | a) What makes it distinctive to work at your company as opposed to your competitors?<br>b) If you were trying to sell your firm to me how would you do this (get them to try to do this)?<br>c) What don't people like about working in your firm?<br>**Scoring grid:**<br>Score 1- Our competitors offer stronger reasons for talented people to join their companies<br>Score 3 - Our value proposition to those joining our company is comparable to those offered by others in the sector<br>Score 5 - We provide a unique value proposition to encourage talented people join our company above our competitors | L49. Do competing firms in this area actively recruit this establishment's employees?<br>L50. Do competing firms in Addis Ababa actively recruit this establishment's employees?<br>L51. Does this establishment ever recruit employees from competing firms?<br>1. Yes<br>2. No<br>-888. Don't know<br>**Scoring grid:**<br>Score 1 – (L49 = 1 or L50 = 1) and L51 = 2<br>Score 5 – L51 = 1 and L49 = 2 and L50 = 2<br>Score 3 – Score != 1/5 |

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| **Indicator** | **Bloom and Van Reenen's questions** | **AUDRI questions** |
|---|---|---|
| (18) Retaining human capital | a) If you had a star performer who wanted to leave what would the company do?<br>b) Could you give me an example of a star performers being persuaded to stay after wanting to leave?<br>c) Could you give me an example of a star performer who left the company without anyone trying to keep them?<br>**Scoring grid:**<br>Score 1 - We do little to try to keep our top talent.<br>Score 3 - We usually work hard to keep our top talent.<br>Score 5 - We do whatever it takes to retain our top talent. | We have question TM11. How do you retain managers at this establishment, but only for top managers of treated firms at W2. So we used another one.<br>L44. Why does this establishment most commonly lose managers?<br>L47. Why does this establishment most commonly lose nonmanagers?<br>1. Contract ends/run out of work<br>2. Take better paying job<br>3. Retire<br>4. Fired<br>5. Quit due to bad working conditions<br>6. Quit due to long working hours<br>7. Quit due to difficult work/too tiring<br>8. Quit for other reason<br>9. Too far from where they live<br>10. Return home/join family<br>11. Have children<br>12. Disagreement with owner/shareholders<br>13. Quit to get education/training<br>14. Quit to start their own business<br>-777. N/A – don't commonly lose employees<br>-888. Don't know<br>-999. Other (specify)<br>**Scoring grid:**<br>Score 5 – (L44 = -777 or L44 > 8) and (L47 = -777 or L47 > 8)<br>Score 1 – (L44 = 2 or L44 = -888) and (L47 = 2 or L47 = -888)<br>Score 3 – Score != 5/1 |