

DISCUSSION PAPER SERIES

DP15219
(v. 2)

**Informational Barriers to Market Access:
Experimental Evidence from Liberian
Firms**

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DEVELOPMENT ECONOMICS

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Discussion Paper DP15219
First Published 28 August 2020
This Revision 13 September 2021

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Abstract

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JEL Classification: D2, O1, O25, D83

Keywords: N/A

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Acknowledgements

We thank David Atkin, Vittorio Bassi, Katarzyna Bilicka, Dave Donaldson, Amit Khandelwal, Tommaso Porzio, Andrea Prat, Eric Verhoogen, and seminar participants at Columbia, Cornell, Dartmouth, Essex, the Graduate Institute of Geneva, the Indian Statistical Institute, Oxford, Yale, Queen Mary, Sciences Po, Zurich, and the webinar series on Firms, Markets, and Development (FIMAD) for helpful comments; Junyi Que for stellar research assistance; the IGC for financial support; IPA and Q&A Liberia for great field-work; and Building Markets for data-sharing and great collaboration. The project was registered in the AEA RCT Registry, ID 0002264.

Informational Barriers to Market Access: Experimental Evidence from Liberian Firms*

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Abstract

Evidence suggests that many firms in poor countries stagnate because they cannot access growth-conducive markets. We hypothesize that overlooked informational barriers distort market access. To investigate, we gave a random subset of medium-sized Liberian firms vouchers for a week-long program that exclusively teaches “sell-ership”: how to sell to corporations, governments, and other large buyers. Firms that participate win three times as many formal contracts a year later. The impact is heterogeneous: informational sales barriers bind for about a quarter of firms. Three years post-training, these firms continue to win desirable contracts, are more likely to operate, and employ more workers.

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1 Introduction

Firms in poor countries often grow slowly (Bloom *et al.*, 2010; Hsieh & Klenow, 2014; Verhoogen, 2020). A large body of work investigates explanations rooted in production constraints—the cost firms incur to produce goods and services (see surveys by McKenzie & Woodruff, 2014; Quinn & Woodruff, 2019).¹ More recently, another strand of research has shifted focus to demand constraints. There is growing evidence that access to bigger and more quality-sensitive markets can raise firm growth (Verhoogen, 2008; Atkin & Donaldson, 2015; Donaldson & Hornbeck, 2016; Hornbeck & Rotemberg, 2019; Goldberg & Reed, 2020), and smaller firms in particular appear to benefit from selling to large buyers (Hoekman & Sanfilippo, 2018; Alfaro-Urena *et al.*, 2020; Abebe *et al.*, 2020).

A natural question is then why some firms are better able to access desirable markets than others. The existing literature considers infrastructure, tariffs, and other traditional market access barriers whose impact in large part depends on a firm’s location and type (such as e.g. its sector, size, or production capabilities).² However, ability to market products appears to vary substantially even across quite similar firms that are located near each other. This suggests that overlooked categories of access barriers may bind for some firms.

The literature on information frictions points towards one (Jensen, 2007; Allen, 2014; Startz, 2021; Atkin *et al.*, 2017b). Several recent studies find that randomly chosen small firms in developing countries can successfully supply large domestic and international buyers (Ferraz *et al.*, 2016; Atkin *et al.*, 2017a; Carrillo *et al.*, 2019). Randomized contract allocation sidesteps the need for suppliers to learn how to navigate a new marketplace and “make” sales. Might large buyers’ complex, unfamiliar input procurement procedures and the pure marketing ability they necessitate on suppliers’ side of the market exclude firms in poor countries from growth-conducive value chains?

In this paper we experimentally enhance Liberian firms’ ability to market their products to corporations, governments, and other large buyers. This is to our knowledge the first attempt to investigate how exogenous variation in individual firms’ ability to *themselves* access a particular market affects performance. The source of demand we focus on—buyers that purchase goods and services through tenders and other formal contracts—is an especially important one. Public procurement alone makes up roughly 12 percent of

¹McKenzie & Woodruff (2014), Quinn & Woodruff (2019) and Verhoogen (2020) point out that the results have been mixed. Most interventions that have raised growth or productivity by loosening production constraints have been tailored to individual firms and/or very expensive.

²This paper especially builds on Donaldson & Hornbeck (2016) and Bold *et al.* (2021). De Loecker & Goldberg (2014)’s review covers more of the existing literature on traditional market access barriers.

worldwide GDP and more in low-income countries (Bosio *et al.*, 2020). Our analysis begins to characterize the extent to which informational market access barriers exclude productive suppliers from growth opportunities.

The paper has three parts. We study the consequences of a seven-day training program that teaches Liberian firms how to construct good bids on tenders from large buyers. First we estimate the average impact a year later on the quantity and quality of contracts won. Next we show how this impact varies across firms. In the final part of the paper we examine the corresponding impact on contracts won as well as measures of growth itself—workers employed and firm survival—*three* years after firms learn how to market their products to large buyers.

With four employees on average, the firms in our sample are by local standards medium-sized. The sample is drawn from a registry of firms in Monrovia—Liberia’s capital city—which is maintained by Building Markets, the non-profit we work with. To be included in the registry, firms have to be formally registered and active. The sample firms come from a wide range of sectors, including “Construction and Renovation” (23 percent), “Food and Beverages” (15 percent), “Home Essentials” (13 percent), and “Handicrafts and Artisans” (12 percent). Like most small and medium-sized firms in poor countries, they have little experience supplying to large buyers and instead sell mostly to final consumers. Eleven percent held a contract awarded through a formal bidding process in the six months preceding the baseline survey.

The seven day-long *Winning-contracts* training our analysis examines aims to change this. Run by the non-profit, it teaches firms how to bid on tenders from corporations, government entities, and other large buyers. Appendix Table A.1 displays examples of such tenders. The training is not sector-specific and its content focuses exclusively on how to participate and succeed in the procurement market. One part covers fundamentals of bidding and common buyer preferences such as favoring “green” suppliers.³ A second part provides practice and feedback on mock bids.

The research team first visited the firms in the treatment group from June to August of 2016.⁴ Research assistants gave the firms’ managers a free voucher to attend the training and information about otherwise similar firms which took the training in the past. The non-profit then ran training sessions throughout the study period. The encouragement (voucher+information) persuaded about 20 percent of firms in the treatment group to take the training. They mostly did so during July – September 2016. Data collection for the first

³This example is illustrative. Most firms in our sample use little energy and would therefore be considered “green”, but few were aware of this before taking the training.

⁴We measure the initial characteristics of firms in the sample frame using periodical baseline surveys conducted by the non-profit. These were also used to stratify the randomization.

endline took place from March – June 2017, and the second from April – May 2019.

In the first part of our empirical analysis, we show that firms that learn how to market their products to large buyers a year later bid on and win more and better contracts. Firms in the treatment group that take the training supply more buyers; win more contracts also through other means than formal tenders; triple their probability of supplying international buyers; and win much larger contracts. This appears to improve bottom-line performance: trained firms earn about USD 10,000 in revenue from contracts over the course of six months above and beyond a control group mean of about USD 5,000.

In the second part of our analysis, we find that informational barriers to market access “bind” for about a quartile of firms. Given the wide dispersion in productivity in poor countries (Hsieh & Klenow, 2009; Syverson, 2011), we do not expect such barriers to ultimately constrain all or even a majority of firms. To categorize firms, we use baseline characteristics to predict how bidding activity responds to the treatment through a double-LASSO regularization procedure (Chernozhukov *et al.*, 2018). Thereafter we compare treated firms of each responsiveness category to control group firms of the same type. The impact of contract-winning knowledge on the four types of one-year outcomes we focus on in the first part of our analysis—measures of bids and contracts won, new buyers, quality of contracts won, and firm performance—is large in magnitude and statistically significant only for top-quartile firms.⁵

In the final part of the paper we show that the group of firms that benefit the most a year after learning how to market their products to large buyers continue to benefit *three* years after the training. They continue to win desirable contracts, pointing toward improved allocative efficiency.⁶ Most notably, top-quartile firms employ more workers and are more likely to operate three years after the week-long training.

This paper uncovers an overlooked informational barrier facing disadvantaged firms and its dramatic consequences. We build on research documenting how complex appli-

⁵Most of the predictors that best predict a firm’s bidding response to learning how to sell to large buyers tend to capture the firm’s activity and success in the formal contract market a priori, perhaps suggesting that informational barriers to market access bind primarily for “upper-tier” slow-growing firms in poor countries. However, the characteristic that *best* predicts bidding-responsiveness is internet access (see Section 4 for details). It thus appears that it is difficult even for Liberian firms with good access to information to learn how to win formal contracts on their own initiative. Instead, information- and communications technology complements such knowledge.

⁶Winning-contracts training expands the set of potential contract-winners. Buyers choose suppliers among potential contract-winners. If they choose the suppliers that have the best capacity to supply their contracts—that is, suppliers are not “fooled” by the training into pursuing contracts that they cannot fulfil, and buyers are not fooled by the sellership that it teaches into mistakenly awarding contracts to such firms—then an increase in the set of potential contract-winners will tend to increase efficiency. The fact that we see top-quartile treated firms continuing to bid on formal contracts three years post-training suggests that doing so benefits them. That they continue to be awarded desirable contracts is hard to reconcile with unsophisticated large buyers being fooled by smaller suppliers’ improved marketing ability.

cation procedures and knowledge barriers constrain qualified-but-underrepresented *individuals'* educational, labor market, and social assistance choices (see e.g. Jensen, 2010; Bettinger *et al.*, 2012; Kling *et al.*, 2012; Chetty & Saez, 2013; Carranza *et al.*, 2020; Hardy & McCasland, 2020; Abebe *et al.*, 2021; Bassi & Nansamba, forthcoming). We add to growing evidence that informational barriers can be surprisingly costly to overcome also for firms (see e.g. Goldfarb & Xiao, 2011; Atkin *et al.*, 2017b; Anderson *et al.*, 2018; DellaVigna & Gentzkow, 2019; Dube *et al.*, 2020; Almunia *et al.*, 2021).⁷ By documenting that large buyers in effect “speak another language” than smaller firms in countries like Liberia, we connect the information-constrained decision-making literature with work on market access and firm growth. We thus begin to unpack how a particular form of inequality-of-opportunity—variation in informational market barriers across suppliers—distorts input markets.⁸

We also contribute to the literature on the causes and consequences of market access.⁹ We do so by providing a first look at the role of access barriers that are qualitatively distinct from the physical and legal ones studied in existing research. We show that informational barriers constructed by buyers help explain why productive firms in developing countries rarely participate in growth-conducive value chains. That access to buyers can be important for firm growth is most clearly shown in studies that exploit random or quasi-random allocation of contracts (Ferraz *et al.*, 2016; Atkin *et al.*, 2017a; Carrillo *et al.*, 2019). This paper to our knowledge provides the first direct evidence on why some firms are able to sell goods and services to a particular market while similar firms in the same location are not.

⁷We know of one other paper that experimentally varies the marketing ability of firms in a developing country—Anderson *et al.* (2018)—but their interest is not market access. They study micro-sized retail entrepreneurs rather than established, formal firms in firm-to-firm markets, and analyze the impact of an intensive 10-week training, rather than a short and narrow program focused on accessing a particular market segment. However, Anderson *et al.* (2018)'s results are consistent with ours in that they find remarkably large impacts of marketing ability on sales and profits in South Africa. Some similarly hands-on consulting programs studied in the literature—e.g. in Bruhn *et al.* (2018); McKenzie & Anderson (forthcoming)—include marketing among multiple modules in a tailored or broad training package, but do not study the impact of enhanced marketing ability itself.

⁸Prior studies document the distortions arising from classical information frictions—constrained contracting, matching, and search—in low-information markets (see e.g. Aker, 2010; Allen, 2014; Jensen & Miller, 2018; Hjort & Poulsen, 2019; Hansman *et al.*, 2020; Startz, 2021). We instead show how firms' own information-constrained ability to sell goods and services affect participation in growth-conducive input markets. Like this paper, Jensen (2007) and Mitra *et al.* (2018) analyze how *sellers'* access to information affects market outcomes.

⁹In addition to the more empirical work cited above—see Verhoogen (2008), Foster *et al.* (2016), and Pozzi & Schivardi (2016) for examples, and Syverson (2011); De Loecker & Goldberg (2014) for overviews of related literatures—there is a burgeoning theoretical literature focusing on how demand forces affect firm dynamics (see e.g. Drozd & Nosal, 2012; Gourio & Rudanko, 2014; Arkolakis *et al.*, 2018), and a growing body of work on industrial policy (see e.g. Lee, 2017; Lane, 2019).

2 Context and Experimental Design

In this section we describe the context Liberian firms operate in, and the design of the experiment we use to investigate how informational barriers to marketing goods and services affect their sales.

2.1 Sample

The sampling frame is a directory of active firms in Liberia akin to the Yellow Pages. The directory is maintained by the non-profit we work with, Building Markets, and listed more than 4,000 firms in 2017. To be included in the sample, firms had to have at least one employee in addition to the owner; be located in Monrovia, the capital city; and have not already taken the Winning-contracts training.¹⁰

Relative to all firms in Liberia’s economic census, firms with between five and 20 employees are over-represented in our sample, while the smallest and bigger firms are under-represented. This is shown in Panel A of Table 1. The firms in the sample span many different sectors, the largest being “Construction and Renovation” (23 percent), “Food and Beverages” (15 percent), and “Home Essentials” (13 percent). We show this and other summary statistics from before the experiment started in Panel B. These data come from periodical surveys the non-profit carries out to keep track of the firms in its directory. The mean number of employees is four, but there is substantial variation in this measure of firm size. Eighty-nine percent of the firms have at least one Liberian owner. Thirty percent of the managers speak at least one local language in addition to Liberian English.

The firms in the sample have little experience supplying to large buyers. Seventeen percent bid on one or more tenders in the six months before being interviewed, and 11 percent won one or more tenders. The average success rate—tenders won relative to tenders the firm bid on—is 29 percent.

2.2 Procurement by large buyers in Liberia

The non-profit we work with attempts to record all formal tenders in Liberia. In 2016, it recorded 1,381 tenders. A little more than half are from public sector buyers such as ministries; a small minority from private companies; and the remainder from international organizations and NGOs. Most tenders are posted publicly: 57 percent in newspapers

¹⁰In addition, since a lot of firms closed down after the 2014-2016 West African Ebola outbreak, only firms that had been in contact with the non-profit after April 2015 (when the outbreak subsided) were included in the sampling frame.

and another 31 percent online. Appendix Table A.1 displays examples of tenders from different types of buyers.

2.3 The Winning-contracts training

We randomly assigned firms in the sample to treatment (772 firms) and control (420 firms) groups. The randomization was stratified on number-of-employees bins, sector, and the geographical zone within Monrovia in which the firm is located. The treatment and control groups are balanced, as shown in Table 1.

The research team visited the treatment group firms starting in June 2016 and gave each one a voucher allowing one person from the firm to attend the Winning-contracts training for free.¹¹ The firms were also asked to answer a survey and given information about the training. This information included the training's content, as well as statistics on how participation correlated with bidding and various measures of success for firms like theirs in the past, as measured in data from the non-profit's periodical surveys.¹²

The training content focuses exclusively on how to bid on and win formal contracts. It is not aimed at raising a firm's productivity: neither of the two training sessions are sector-specific, and there is no mention of management practices, financial planning, product development, or take-up of new technologies.

The first training session lasts five days and is referred to as *General Procurement* training. This session teaches participants the fundamentals of the process of bidding on tenders: how to find tenders and how to bid. The General Procurement session also provides information about supplier and bid characteristics that many buyers require or put weight on when awarding a contract. Examples include environmental awareness, ethical behavior, and sensitivity to cultural differences or persons with disabilities. Clarifying these is an important aspect of the training because many participants say that they find such auxiliary buyer preferences confusing. For example, most small and medium-sized firms in Liberia use little energy and therefore would be considered "green" businesses, but many fail to mention this in their bids.

Completing the first week of training is required to participate in the second training session, called *Bid Compilation* training. This session lasts two days and offers a hands-on toolkit for producing bids. Participants do exercises in which they examine a mock

¹¹The voucher did not have an expiration date and could be used when desired.

¹²As specified in the pre-analysis plan, the voucher was combined with different statistics on how participation correlated with bidding on and winning contracts in the past in several different sub-treatments used to encourage firms to attend the training. However, we do not observe differences in effects of these sub-treatments in either take-up or effect of the treatment. In the analysis presented here, all sub-treatments are combined.

tender, prepare a draft bid, learn to communicate with procurement officers, and undergo evaluation of their bid. The second training session in essence teaches firms how to engage with buyers at the different stages of the tender process.

Almost all firms in the sample that took the training did so from June 2016 to November 2016.¹³ The non-profit offered two to three training sessions per month depending on demand, and a total of eight training sessions. On average 32 attendees from firms in 11 different sectors participated in each training session.

2.4 Data

Our analysis is based on data collected in three rounds: baseline, first endline, and second endline. Firms listed in the non-profit’s directory are asked to answer a phone survey every three to six months. The data collected through these phone surveys were made available to the research team. We refer to the last round before the data collection for the experiment itself as the baseline data.

The research team visited the firms in the treatment group starting in June 2016 to give them the training voucher. We attempted to re-interview all firms in the full sample for the first endline survey between March and June 2017. Out of the 1,192 firms in the sample, we successfully (re-) surveyed 789 firms: 284 in the control group, and 505 in the treatment group. The survey team’s use of a battery of tracking techniques—both phone and in-person search, GPS devices, flexible scheduling of interviews, etc—kept attrition low. Lastly, the research team carried out a second endline survey from April to May 2019. 628 firms were surveyed: 222 in the control group, and 406 in the treatment group. There was no differential attrition across the treatment and control groups in either of the two endlines.¹⁴

3 Reduced Informational Barriers to Selling Goods and Services: Average Impact

In this section we show that the opportunity to learn how to sell goods and services to large buyers enables Liberian firms to bid on and win more and higher-quality contracts.

¹³Three firms took the training in January 2017.

¹⁴This is shown in the last two columns of Panel B of Table 1 for the first endline (corresponding results for the second endline are available from the authors), and holds despite the firms which answered each endline survey being slightly different from firms which did not (as shown in appendix table A.2 and A.3).

Where relevant we show both Intent-to-treat (ITT), or reduced form, and Treatment-on-the-treated (TOT), or IV results. The latter come from regressions like the following:

$$y_i = \beta_0 + \beta_1 \text{Winning-contracts Training}_i + \gamma X_i + \epsilon_i \quad (1)$$

Here y_i is a firm i outcome measured at endline. X_i is a set of controls measured before the experiment, including fixed effects for a firm's sector(s), location, and size-bin. We show results both with and without controls included. $\text{Winning-contracts Training}_i$ is an indicator variable equal to one for firms that participate in the training, and β_1 is the coefficient of interest.

3.1 Take-up of training

The treatment—the voucher and encouragement to attend the training—increases the probability that a firm participates by 19-20 percentage points, as recorded in the non-profit's attendance sheet. This is shown in columns (1) and (2) of Appendix Table A.4.¹⁵ Given this relatively high but incomplete take-up, the ITT estimates of impact are scaled down in magnitude relative to the TOT estimates that follow, but generally of similar statistical significance.

3.2 Number of contracts won

Recall that small- and medium-sized Liberian firms rarely bid on formal contracts. The control group firms in our sample bid on 0.43 tenders during the past six months on average. Winning tenders is even more rare: control group firms won an average of 0.27 contracts through a formal bidding process in the past six months.

Enhanced contract-winning knowledge markedly increases the number of contracts firms bid on and win a year later. We show this in Panel A of Table 2. First, as seen in columns (1) and (2), firms that are induced to participate in Winning-contracts training by the randomized encouragement bid on 0.56 more tenders over a six month period—an increase of more than 150 percent compared to the control group. We find a large positive impact also on the total number of contracts won. Trained firms win more than one additional formal contract over the course of six months—an increase of over 200

¹⁵Those in the control group were not encouraged to attend the training, but four control group firms independently decided to pay to participate. Referring to the IV results as TOT estimates is thus somewhat loose. We measure attendance for the first part of the Winning-contracts training, the General Procurement session. Note also that, following [Abadie et al. \(2017\)](#), we present robust standard errors as there are neither sampling design nor experimental design reasons for clustering in our context, although our results are robust to clustering at the sector level.

percent—as we show in columns (3) and (4). It thus appears that firms that learn how to market their products to large buyers can access a market that otherwise comparable firms cannot.

The benefits of enhanced contract-winning knowledge extend beyond a greater ability to win tenders. To see this, we look at contracts won through other means than a tender process—those that do not require a formal bid—in columns (7) and (8) of Table 2. Trained firms win 200 percent more non-tender contracts. This suggests that Winning-contracts training does not merely flag particular boxes to tick or buzz-words to use, but rather conveys a deeper form of knowledge necessary to effectively convey appeal and qualifications to large buyers.

Treated firms also appear to win substantially more contracts through formal bidding processes—0.27 more compared to a mean of 0.15—as shown in columns (5) and (6). This estimate is not statistically significant, however.

3.3 Contracts won from new buyers

Learning how to market goods and services to large firms and organizations enables Liberian firms to win contracts from many more buyers. We show this in Panel B of Table 2. Firms that participate in the Winning-contracts training more than double the number of buyers they supply; triple their probability of supplying international buyers; and roughly double their probability of supplying both private sector and government/non-profit buyers. That contract-winning knowledge enables firms to win contracts from new *types* of buyers is especially noteworthy.

3.4 Quality of contracts won

The training increases not only the quantity, but also the quality of contracts firms win, as we show in Panel C of Table 2. Treated firms that take the Winning-contracts training more than double their chances of winning long-lasting (six months or more) contracts. They also triple their probability of winning a contract in the top quartile of the contract-value distribution observed in our baseline data; more than triple the value of their biggest contract; and more than quadruple the size of their biggest contract as measured by employees needed to fulfil it.

3.5 Firm performance

Reduced informational barriers to selling to large buyers appears to ultimately improve firms' performance considerably. With the results in panels A – C of Table 2 in mind, this is not surprising. It is for example well-established that exporting often enables firm “upgrading” (Atkin *et al.*, 2017a; Verhoogen, 2020), and there is growing evidence that supplying to foreign buyers operating in the home market can similarly benefit firms in poor countries (Abebe *et al.*, 2020; Alfaro-Urena *et al.*, 2020).

The estimates in Panel C suggest that the total value of contracts won is around USD 10,000, or 200 percent, higher in treated firms that take the Winning-contracts training.¹⁶ We also find that the training increases the number of employees firms need to fulfil their formal contracts by 400 percent—an increase of four workers from a mean of one. Interestingly, firms' *total* number of employees is unaffected a year after the training. The longer-run picture is somewhat different, as we return to in Section 5.

The evidence we have presented in Section 3 shows that the opportunity to learn how to access large buyer markets is remarkably beneficial for small- and medium-sized Liberian firms a year after the training.

4 Reduced Informational Barriers to Selling Goods and Services: Heterogeneity in Impact One-Year-Out

In this section we show evidence that informational barriers to accessing large buyer markets bind for about a quartile of the firms in our sample. The average impact of the Winning-contracts training is in large part driven by these firms.

There is wide dispersion in productivity in developing countries (Hsieh & Klenow, 2009; Syverson, 2011). We therefore do not expect contract-winning knowledge to constrain the growth of all or even a majority of firms. To investigate, we estimate regressions of this form:

$$y_i = \beta_0 + \beta_1 \text{Winning-contracts training}_i + \beta_2 \text{Winning-contracts training}_i \times \text{Category}_i + \gamma X_i + \epsilon_i \quad (2)$$

¹⁶Although remarkably large, this estimate is only marginally statistically significant, perhaps because—as is common in firm surveys—many managers were unwilling to answer questions about the value or sources of their contracts. We treat such missing values as zeroes. Firms in the treatment group were 21 percent more likely not to answer value-of-contracts-won questions, suggesting that we may be underestimating the impact on contract revenue.

To categorize firms, we use the full set of suitable baseline characteristics. We estimate the best linear predictor of the conditional average treatment effect on a firm’s bidding activity through the split-sample LASSO regularization procedure developed in [Chernozhukov et al. \(2018\)](#). Each firm is in a particular quartile of the distribution of the training’s predicted impact on the number of tenders bid-on (see Appendix [A.1](#) for details). We then compare the one-year-out outcomes we considered in Section [3](#) for treated firms relative to control group firms of the same quartile.¹⁷

Reduced informational barriers to selling to large buyers consistently benefit “Quartile 4” firms across all four categories of outcomes we consider. Recall that these are measures of respectively bids and contracts won, new buyers, quality of contracts won, and firm performance. For one of the individual outcomes we focus on—the number of tenders the firm bids on—finding the largest impact for Quartile 4 firms is somewhat mechanical because we categorize firms by their bidding activity response to the training. However, our goal here is simply to quantify what proportion of medium-sized Liberian suppliers informational market access barriers appear to bind for.

Contract-winning knowledge does not benefit quartile 1 and 2 firms. There are signs of some outcomes improving for Quartile 3 firms, but the estimated treatment effects are consistently large in magnitude and statistically significant only for top-quartile firms. We show these quartile-specific results graphically for about half of the outcomes in [Figure 1](#), and the corresponding linear regression results that capture how the estimated treatment effects differ for Quartile 4 compared to the rest of the sample for all outcomes in [Appendix Table A.7](#).

Since the quartile of firms that are most constrained by own marketing ability in large part drive the average treatment effects shown in [Section 3](#), it is not surprising that these firms’ estimated response is large. A year after learning how to sell goods and services to large buyers, they are for example 70 percent more likely to win a formal tender and earn about USD 12,000 or 75 percent more in revenue from formal contracts over a six-month period.

Understanding the characteristics that best predict a firm’s response to learning how to sell to large buyers is beyond the scope of this paper. The split-sample LASSO results that we use to categorize firms provide a starting point for future research. They are shown in [Appendix Table A.6](#). Firms that were somewhat more active and successful in the formal contract market a priori benefit the most. However, the particular characteristic that *best*

¹⁷Note that we find no heterogeneity in take-up of the training across the four quartiles. This simplifies interpretation of the heterogeneity-in-impact results we present next. Understanding why firms for which informational barriers to accessing large buyer markets bind are not more likely to seize an opportunity to learn how to market their products to such buyers is an important question for future research.

predicts training impact is of a different nature: the firm’s internet access. This suggests that information technologies do not themselves allow firms to overcome informational barriers to marketing their products. Instead such technologies positively interact with sellership knowledge.¹⁸

5 Reduced Informational Barriers to Selling Goods and Services: Heterogeneity in Impact Three-Years-Out

In this final section of the paper we show that the benefits of reduced informational barriers to accessing large buyer markets persist over time. The quartile of suppliers that win more and better contracts a year after the training continue to benefit *three* years after the training.

If learning how to market their products to large buyers incentivizes and enables initially disadvantaged firms to bid on and win more and better contracts not only in the short run but also over time, then this points toward improved allocative efficiency. Sustained higher *bidding* activity would indicate that trained suppliers were not “fooled” into pursuing contracts that they did not have the ability to fulfil and to benefit from. Sustained *winning* would indicate that buyers were also not fooled. If sellership persuaded buyers to mistakenly award contracts that would normally have gone to larger “insider” suppliers that are not in our sample to unqualified treated suppliers instead, then they presumably would not continue to award contracts to treated firms over time.¹⁹

We find that the Winning-contracts training benefits “Quartile 4” firms three years after the training—the same group of firms that show large responses one year after the training—across all four categories of outcomes we consider. We show group-specific treatment effects on measures of bids and contracts won, new buyers, quality of contracts

¹⁸Appendix Table A.5 compares Quartile 4 firms with firms from quartiles 1, 2, and 3. In comparison, Quartile 4 firms are bigger, more experienced in applying to and winning tenders, and more likely to use the internet for business purposes. Appendix Table A.8 is identical to Appendix Table A.7, except that we interact Winning-contracts training_{*i*} with a variable capturing the firm’s internet access at baseline instead of the Quartile 4 indicator. The estimated treatment effects are consistently large in magnitude and statistically significant only for firms with internet access. This is not surprising since the split-sample LASSO procedure used to categorize firms shows internet access strongly predicting the impact on bidding activity controlling for the interaction between all other observable firm characteristics and the training (see Appendix A.1 for details).

¹⁹Note that the training in all likelihood shifted contracts across groups within our sample—that is, from the control to the treatment group—to a very limited extent, if at all. First, the firms in our sample rarely bid on—and even more rarely won—formal contracts in the status quo. Second, the research team did not collect data from the control group until the endline, which was therefore likely unaware of the research and training activities. Third, control firms that are located geographically close to treated firms are not less likely to win contracts at endline.

won, and firm performance three years after the training in Figure 2 (and in Appendix Table A.9).²⁰ The firms that did not benefit a year after the training—quartiles 1-3—continue not to do so three years after the training. Quartile 4 firms in contrast continue to benefit as measured through many (but not all) of the outcomes we consider. The improvements are generally somewhat smaller than in the shorter run, but Quartile 4 firms appear to continue bidding on more tenders, winning contracts from international buyers, and employing more workers to fulfil their formal contracts.²¹ We also see marginally significant impacts on measures of firm *growth* three years after the week-long training. We show this in Figure 3. Our estimates indicate that Quartile 4 firms employ about one or 30 percent more workers in total, and are about 12 percent more likely to operate, relative to comparable control group firms, three years after participating in Winning-contracts training.

6 Conclusion

In this paper we uncover an overlooked part of the explanation for why qualified small- and medium-sized firms in poor countries rarely win contracts from large, growth-conducive buyers. We do so through a randomized experiment. We show that a training that teaches how to sell goods and services to governments, corporations, and other large buyers significantly improves Liberian firms' performance. The quartile of initially disadvantaged firms for which informational barriers to accessing the large-buyer market were binding win more and better contracts both one and three years after the week-long training program. Three years out these firms also employ more workers and are more likely to operate. Our findings suggest that overlooked categories of access barriers exclude firms in poor countries from value chains.

²⁰Appendix Table A.10 is identical to Appendix Table A.9, except that we interact Winning-contracts training_{*i*} with a variable capturing the firm's internet access at baseline instead of the Quartile 4 indicator. As in the first endline, the estimated treatment effects are consistently large in magnitude and statistically significant only for firms with internet access.

²¹In addition to the results on sustained winning, we also find no evidence that treated firms—including those in Quartile 4—are less likely to have won a contract from individual buyers or groups of buyers three years after the training conditional on having won one also after one year (results available upon request).

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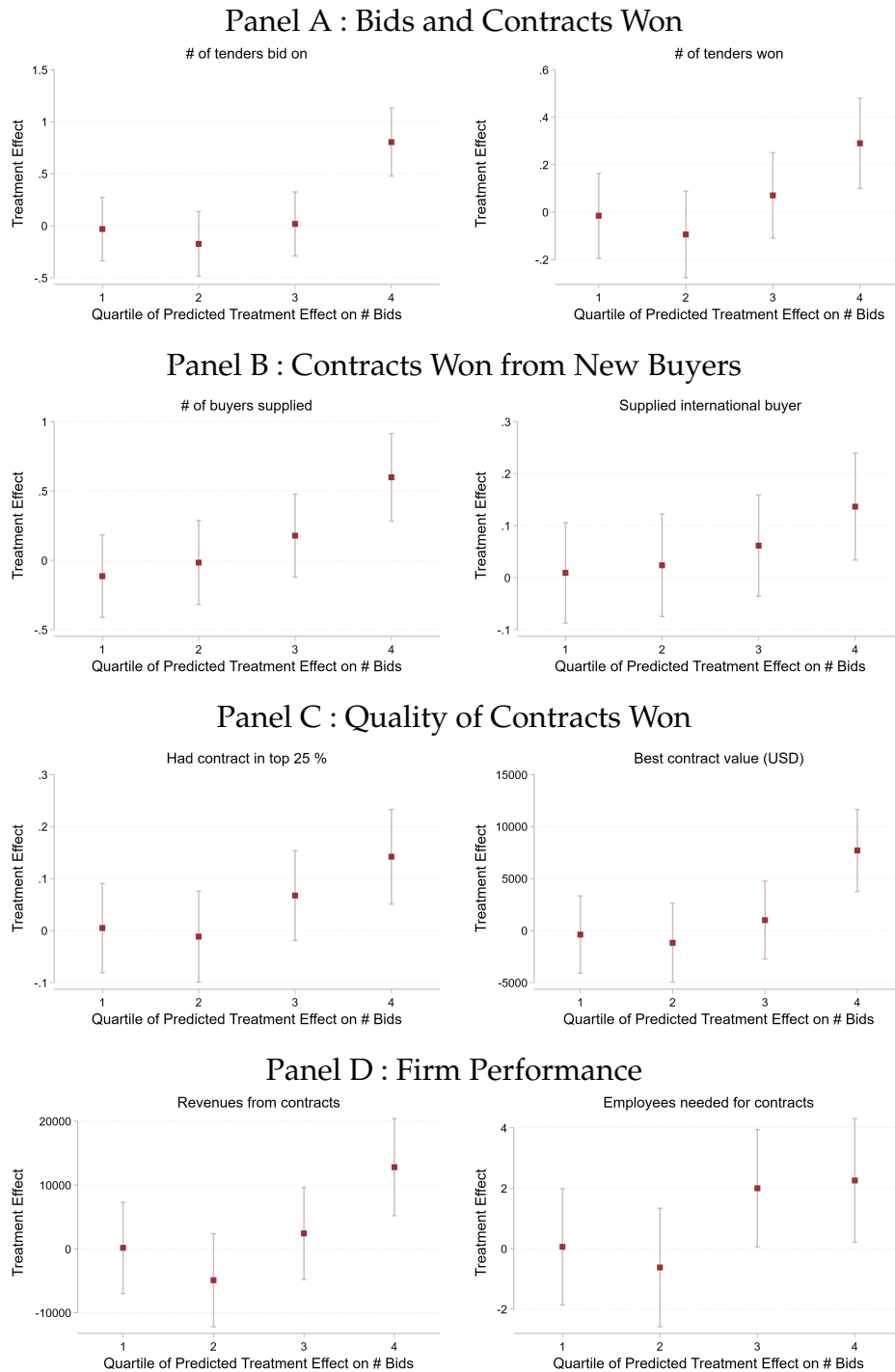
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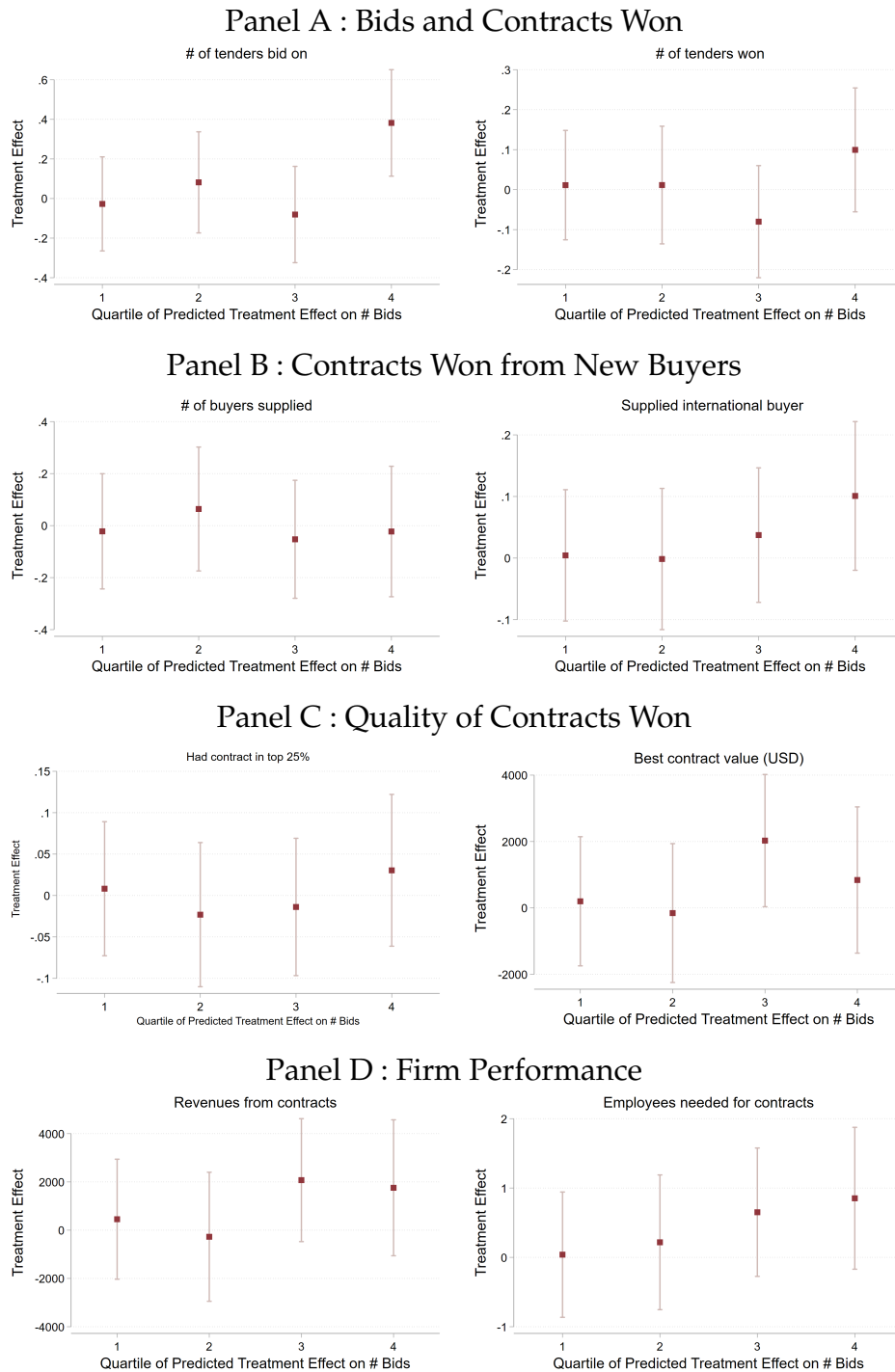
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FIGURE 1: HETEROGENEOUS IMPACT OF CONTRACT-WINNING KNOWLEDGE ONE YEAR OUT



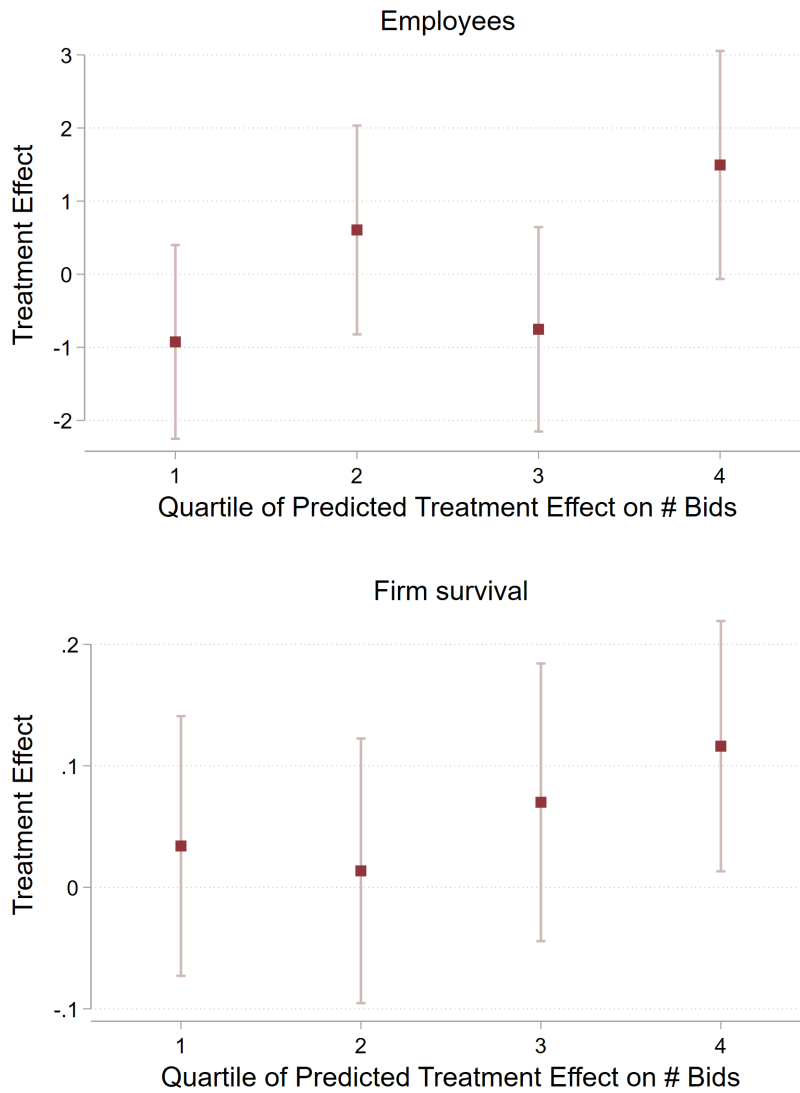
Notes: Each of the panels in this exhibit presents the heterogeneous impact of the contract-winning training on different firm outcomes one year out. For each firm in the sample, a predicted treatment effect on numbers of bids submitted is computed using baseline firm characteristics. We then look at the heterogeneity in the impact of the training by comparing firms across 4 quartiles of the predicted treatment effect distribution. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. All outputs are referring to the period of 6 months preceding the interview.

FIGURE 2: HETEROGENEOUS IMPACT OF CONTRACT-WINNING KNOWLEDGE THREE YEARS OUT



Notes: Each of the panels in this exhibit presents the heterogeneous impact of the contract-winning training on different firm outcomes three years out. For each firm in the sample, a predicted treatment effect on numbers of bids submitted is computed using baseline firm characteristics. We then look at the heterogeneity in the impact of the training by comparing firms across 4 quartiles of the predicted treatment effect distribution. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. All outputs are referring to the period of 6 months preceding the interview.

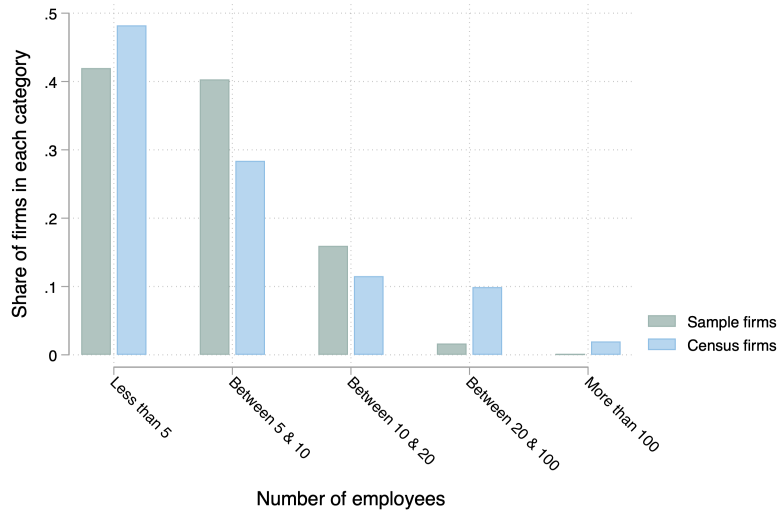
FIGURE 3: HETEROGENEOUS IMPACT ON FIRM GROWTH OF CONTRACT-WINNING KNOWLEDGE THREE YEARS OUT



Notes: Each of the figures in this exhibit presents the heterogeneous impact of the contract-winning training on measures of firm growth three years out. For each firm in the sample, a predicted treatment effect on numbers of bids submitted is computed using baseline firm characteristics. We then look at the heterogeneity in the impact of the training by comparing firms across 4 quartiles of the predicted treatment effect distribution. The figure on top shows the impact the training on employees hired by the firm. The figure below shows the impact of the training on firm survival three years after training. All outputs are referring to the period of 6 months preceding the interview.

TABLE 1: SIZE DISTRIBUTION AND BALANCE TABLE OF SAMPLE FIRMS

Panel A : Size Distribution of Firms



Panel B : Balance Table of Treatment and Control Firms

	Full Sample			Restricted Sample		
	CG Mean	Diff. (T - C)	Std. Error	CG Mean	Diff. (T - C)	Std. Error
Total Number of Employees	4.24	0.27	0.26	4.22	0.14	0.31
Bid on a tender in the past 6 months	0.17	-0.02	0.02	0.17	-0.04	0.03
Number of tenders bid on in the past 6 months	0.43	-0.07	0.09	0.44	-0.09	0.11
Won a tender in the past 6 months	0.11	-0.01	0.02	0.12	-0.02	0.03
Number of tenders won in the past 6 months	0.27	0.08	0.06	0.33	0.13	0.08
Proportion of tenders won (conditional on applying)	0.29	-0.04	0.06	0.30	-0.04	0.07
Ever won a contract lasting 6 months or more	0.73	-0.03	0.07	0.74	0.02	0.09
Speaks at least one Liberian local language	0.30	-0.01	0.03	0.29	-0.05	0.03
Internet Usage (0= Never ; 1= Every Day)	0.45	-0.01	0.02	0.45	-0.01	0.03
Owner is Liberian	0.89	-0.02	0.02	0.91	-0.01	0.02
<i>Firm's Sector</i>						
Construction and Renovation	0.23	-0.00	0.03	0.24	-0.01	0.03
Food and Beverages	0.15	-0.02	0.02	0.17	0.02	0.03
Home Essentials	0.13	0.00	0.02	0.14	0.02	0.02
Handicrafts and Artisans	0.12	0.00	0.02	0.12	0.01	0.02
Business and Consulting Services	0.10	0.00	0.02	0.11	0.02	0.02
Printing and Copying	0.07	-0.00	0.02	0.07	-0.02	0.02
Health, Medicine, Recreation, and Leisure	0.06	0.00	0.01	0.08	0.03	0.02

Notes : Panel A in this exhibit compares the size of firms in the sample with other firms listed in the non-profit's directory who have more than one employee and are located in Monrovia. The bars show the share of firms in our sample in each category and the share of the comparison sample. Panel B in this exhibit presents balance between firms of the treatment and control groups. "Full Sample" refers to the total sample at baseline, "Restricted Sample" refers to firms who responded to the endline survey. The data is based on phone interviews conducted by the non-profit. The number of employees includes the owner or manager of the firm, and unrealistic values are dropped in the data cleaning process.

TABLE 2: AVERAGE IMPACT OF CONTRACT-WINNING KNOWLEDGE ONE YEAR OUT

PANEL A: BIDS AND CONTRACTS WON								
	# of tenders bid on		Total # of contracts won		# of tenders won		# of contracts won w/o tender	
	Treatment-on-the-Treated							
Winning-Contracts Training	0.52* (0.30)	0.56* (0.29)	1.18*** (0.38)	1.01*** (0.35)	0.24 (0.17)	0.27 (0.17)	0.94*** (0.31)	0.74** (0.29)
	Intent-to-Treat							
Voucher + Encouragement	0.14* (0.08)	0.15* (0.08)	0.31*** (0.09)	0.26*** (0.09)	0.06 (0.04)	0.07 (0.05)	0.24*** (0.08)	0.19** (0.08)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.35	0.35	0.48	0.48	0.15	0.15	0.33	0.33
Observations	789	789	789	789	789	789	789	789
PANEL B: CONTRACTS WON FROM NEW BUYERS								
	# of buyers supplied		Supplied international buyer		Supplied private sector		Supplied government or non-profit	
	Treatment-on-the-Treated							
Winning-Contracts Training	0.64** (0.30)	0.56** (0.28)	0.25*** (0.09)	0.20** (0.09)	0.26** (0.10)	0.18* (0.10)	0.20* (0.11)	0.17 (0.11)
	Intent-to-Treat							
Voucher + Encouragement	0.17** (0.08)	0.15* (0.08)	0.07*** (0.02)	0.05** (0.02)	0.07** (0.03)	0.05* (0.03)	0.05* (0.03)	0.04 (0.03)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.40	0.40	0.10	0.10	0.12	0.12	0.17	0.17
Observations	789	789	789	789	789	789	789	789
PANEL C: QUALITY OF CONTRACTS WON								
	Had a contract of more than 6 months		Had contract in top 25%		Best contract value (USD)		Best contract employment	
	Treatment-on-the-Treated							
Winning-Contracts Training	0.33** (0.13)	0.28** (0.12)	0.20** (0.09)	0.19** (0.08)	6306.44* (3560.17)	7353.03** (3610.96)	2.54** (1.09)	2.99** (1.22)
	Intent-to-Treat							
Voucher + Encouragement	0.08*** (0.03)	0.07** (0.03)	0.05** (0.02)	0.05** (0.02)	1634.52* (916.57)	1920.44** (976.95)	0.66** (0.28)	0.78** (0.33)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.23	0.23	0.08	0.08	3022.51	3022.51	0.62	0.62
Observations	789	789	789	789	789	789	789	789
PANEL D: FIRM PERFORMANCE AND GROWTH								
	Revenues from contracts		Employees needed for contracts		Employees			
	Treatment-on-the-Treated							
Winning-Contracts Training	8527.83 (7266.45)	10683.90* (6486.68)	3.30* (1.74)	4.04** (1.80)	-0.13 (1.36)	-0.61 (1.23)		
	Intent-to-Treat							
Voucher + Encouragement	2210.27 (1879.89)	2790.39 (1765.82)	0.86* (0.45)	1.05** (0.48)	-0.04 (0.36)	-0.17 (0.35)		
Controls	NO	YES	NO	YES	NO	YES		
Control Mean	5030.20	5030.20	1.00	1.00	5.89	5.89		
Observations	789	789	789	789	733	733		

Notes : Standard errors are in parentheses and are robust. This exhibit shows results from estimating Equation (1). Each of the panels in this exhibit present the Treatment-on-the-Treated (the IV estimate) and the Intent-to-Treat (the reduced form) estimates of the effect of contract-winning training on bids and contracts won by firms one year out. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. Controls include employment, counties of operation, gender of the owner, sectors, languages used for business, geographical zone and the number of submitted bids. All controls are measured before baseline. All outputs are referring to the period of 6 months preceding the interview, except the number of employees. The lower number of observations for the employees is due to the data cleaning process.

A Appendix

A.1 Lasso Procedure

Following the LASSO procedure in [Chernozhukov *et al.* \(2018\)](#), we estimate the best linear predictor of the CATE of the treatment on the number of tenders a firm bids on as follows:

1. We first split the full sample into two parts, the *auxiliary* sample and the *main* sample. The two are used respectively as the training set and the hold-out set.
2. We then use a LASSO regression of the number of bids on baseline observables estimated on the control group part of the auxiliary sample to predict the number of bids for the full auxiliary sample (control and treatment). A second LASSO regression of number of bids on (i) the predicted output of the first LASSO regression and (ii) the interaction of treatment and baseline observables selects variables which best predict the heterogeneity of the treatment effect observed.
3. We then test the predictive power of the heterogeneity variables selected in the auxiliary sample in step 2 on the main sample. Predicted number of bids is generated on the main sample using the variables selected in step 2 with their associated coefficients from the auxiliary sample. The observed number of bids in the main sample is regressed on the predicted number of bids based on the auxiliary sample. This allows us to test whether variables selected in step 2 accurately describe the observed heterogeneity in treatment effects.²²
4. Finally, we run a cross-validation procedure wherein the main sample is used as the training set and the auxiliary sample as the hold-out set.

The results of this procedure depends on the random split of the sample. We thus bootstrap by repeating the procedure 100 times. Since each of these includes two estimations, the total number of LASSO estimations is 200. Out of these 200 estimations, 196 were validated by the test for the hold-out set heterogeneity variables as good predictors of heterogeneity. Appendix Table [A.6](#) shows how many times each firm characteristic was selected in the set of variables that best explain heterogeneity in treatment effects in the training set. Internet access is by far the variable selected the most times, 194.

²²A variable is said to accurately describe the observed heterogeneity if the p-value of its coefficient on the main sample is smaller than 0.01.

A.2 Tables

TABLE A.1: SAMPLE TENDER DESCRIPTIONS

Buyer Type	Name of Entity	Description
International Government	US Embassy	<i>"The Embassy of the United States of America hereby invites interested reputable and qualified packing and shipping companies to submit proposals for the providing of packing services for miscellaneous items to include employee's household effects to the U.S. Embassy in Monrovia."</i>
NGO	UNDP	<i>"The United Nations Development Programme (UNDP) kindly requests qualified and eligible vendors to submit quotation for the Supply and Delivery of Laptops and Ipads for the UNDP Country Office in Liberia. Quotations submitted by email must be limited to a maximum of 4MB, virus-free and no more than 3 email transactions."</i>
Liberian Government	Ministry of Internal Affairs	<i>"The Ministry of Internal Affairs (MIA) now invites sealed bids from eligible and qualified bidders for the Supply of Stationery (A4, Papers, Cartridges, Carbon papers, and other stationery materials) for County Administration."</i>
Liberian Private	Clinical RM	<i>"ClinicalRM is seeking Expression of Interest from Liberian companies for the installation, maintenance and troubleshooting of electrical works and components at various sites in Monrovia, and Gbarnga. In addition to electrical works, interested companies must be able to install, service and repair generators at sites the previously listed locations according to manufacturer standards and quality."</i>

Notes : This exhibit present descriptions of tenders from the tender registry maintained by the non-profit that we work with. Each tender is characterized by type of Buyer and we selected the tender description of one tender from each Buyer type. These tenders are advertised to firms in our sample by the non-profit.

TABLE A.2: ATTRITION IN THE 1ST FOLLOW UP

	Interviewed	Not Interviewed	Difference	P-Val.
Total Number of Employees	7.08	7.41	0.33	0.82
Bid on a tender in the past 6 months	0.21	0.17	-0.04	0.10
Number of tenders bid on in the past 6 months	0.71	0.55	-0.15	0.21
Won a tender in the past 6 months	0.13	0.09	-0.04*	0.06
Number of tenders won in the past 6 months	0.33	0.19	-0.14*	0.09
Proportion of tenders won (conditional on applying)	0.32	0.27	-0.05	0.46
Ever won a contract lasting 6 months or more	0.73	0.82	0.09	0.21
Speaks at least one Liberian local language	0.32	0.27	-0.05*	0.08
Internet Usage (0= Never ; 1= Every Day)	0.49	0.47	-0.02	0.34
Owner is Liberian	0.92	0.87	-0.04**	0.02
<i>Firm's Sector</i>				
Construction and Renovation	0.25	0.20	-0.05**	0.04
Food and Beverages	0.16	0.16	0.00	0.97
Home Essentials	0.13	0.12	-0.01	0.69
Handicrafts and Artisans	0.12	0.11	-0.01	0.58
Business and Consulting Services	0.10	0.08	-0.02	0.22
Printing and Copying	0.08	0.06	-0.03	0.11
Health, Medicine, Recreation, and Leisure	0.06	0.07	0.01	0.33

This table presents differential attrition between firms who responded to endline interviews and firms who did not for the first followup. The data is based on phone interviews conducted by the non-profit. The number of employees includes the owner or manager of the firm.

TABLE A.3: ATTRITION IN 2ND FOLLOW UP

	Interviewed	Not Interviewed	Difference	P-Val.
Total Number of Employees	6.98	7.36	0.38	0.77
Bid on a tender in the past 6 months	0.20	0.19	-0.01	0.56
Number of tenders bid on in the past 6 months	0.67	0.65	-0.03	0.81
Won a tender in the past 6 months	0.12	0.12	-0.00	0.94
Number of tenders won in the past 6 months	0.29	0.29	0.01	0.94
Proportion of tenders won (conditional on applying)	0.30	0.34	0.04	0.43
Ever won a contract lasting 6 months or more	0.72	0.79	0.07	0.29
Speaks at least one Liberian local language	0.35	0.26	-0.09***	0.00
Internet Usage (0= Never ; 1= Every Day)	0.48	0.49	0.01	0.63
Owner is Liberian	0.93	0.87	-0.06***	0.00
<i>Firm's Sector</i>				
Construction and Renovation	0.27	0.19	-0.07***	0.00
Food and Beverages	0.16	0.15	-0.00	0.87
Home Essentials	0.14	0.12	-0.02	0.26
Handicrafts and Artisans	0.12	0.11	-0.01	0.61
Business and Consulting Services	0.08	0.10	0.02	0.23
Printing and Copying	0.08	0.07	-0.01	0.38
Health, Medicine, Recreation, and Leisure	0.06	0.06	0.00	0.99

This table presents differential attrition between firms who responded to endline interviews and firms who did not for the second follow up. The data is based on phone interviews conducted by the non-profit. The number of employees includes the owner or manager of the firm.

TABLE A.4: EFFECT OF VOUCHER + ENCOURAGEMENT ON TRAINING TAKE-UP

	Winning-Contracts Training	
	(1)	(2)
Voucher + Encouragement for Training	0.19*** (0.02)	0.20*** (0.02)
Controls	NO	YES
Control Group Mean	0.01	0.01
Observations	1192	1143

Standard errors are in parentheses and are robust. This table presents coefficients of the regression of training take-up as recorded by the non-profit on encouragement. Controls include employment, counties of operation, gender of the owner, sectors, languages used for business, geographical zone and the number of submitted bids. All controls are measured before baseline.

TABLE A.5: COMPARISON OF QUARTILE 1,2,3 VS QUARTILE 4

	Quantile 4	Quantiles 1-3	Difference	P-Val.
Total Number of Employees	5.03	3.88	-1.15***	0.00
Bid on a tender in the past 6 months	0.50	0.11	-0.40***	0.00
Number of tenders bid on in the past 6 months	1.51	0.20	-1.32***	0.00
Won a tender in the past 6 months	0.25	0.07	-0.18***	0.00
Number of tenders won in the past 6 months	0.69	0.11	-0.57***	0.00
Proportion of tenders won (conditional on applying)	0.45	0.42	-0.03	0.68
Ever won a contract lasting 6 months or more	0.52	0.22	-0.31***	0.00
Speaks at least one Liberian local language	0.25	0.34	0.09**	0.02
Internet Usage (0= Never ; 1= Every Day)	0.81	0.35	-0.45***	0.00
Owner is Liberian	0.89	0.92	0.03	0.15
<i>Firm's Sector</i>				
Construction and Renovation	0.46	0.19	-0.27***	0.00
Food and Beverages	0.03	0.19	0.17***	0.00
Home Essentials	0.05	0.15	0.10***	0.00
Handicrafts and Artisans	0.03	0.15	0.12***	0.00
Business and Consulting Services	0.26	0.05	-0.20***	0.00
Printing and Copying	0.15	0.06	-0.09***	0.00
Health, Medicine, Recreation, and Leisure	0.01	0.07	0.06***	0.00

Notes : This exhibit compares the characteristics of firms in the top quartile of the predicted treatment effect distribution to firms in the bottom three quartiles. The data is based on phone interviews conducted by the non-profit. The number of employees includes the owner or manager of the firm.

TABLE A.6: RESULTS OF LASSO PROCEDURE

Variable	Times_Kept	Average_Coefficient
How often do you use the Internet for business purposes?	194	0.0959
Total number of employees	120	0.00290
Do you have a prepared business plan?	105	-0.0250
Have you responded to a tender or submitted a bid in the past 6 months?	80	0.0328
Have you ever had a contracts for an international client?	38	0.0329
Have you won a tender in the past six months?	37	0.0837
Have you ever had a contracts for an NGO?	9	0.0273
Do you own any assets that may be used as collateral for credit?	8	-0.0213
The business has a female owner	0	.
At least one of the owners has an Americo-Liberian name	0	.
Do you have a business bank account?	0	.
Have you ever received a loan from a bank or any other entity?	0	.
Of the total number of employees how many are family members of the owner(s)?	0	.
Do you import?	0	.
Have you ever had a contracts for the government?	0	.

Notes : This table presents the results of the LASSO procedure developed in section 5.3.2. The LASSO estimation predicts what variables, interacted with treatment, best explain the heterogeneity if the effect observed. In addition to the set of variables presented here, the LASSO regressions all include sector and geographic controls. The first column shows the number of times each variable was kept out of the 200 LASSO estimations. The second column shows the average coefficient of each variables, across LASSO procedures. The set of variables represents firm characteristics that are usually thought to affect a firm's chances to win a tender (size, ability, connections, etc.). Changing this set, either by dropping some variables or adding additional variables, does not alter the results.

TABLE A.7: HETEROGENEOUS IMPACT OF CONTRACT-WINNING KNOWLEDGE ONE YEAR OUT

PANEL A: BIDS AND CONTRACTS WON								
	# of tenders bid on		Total # of contracts won		# of tenders won		# of contracts won w/o tender	
Voucher + Encouragement x Quartiles 1, 2, and 3	-0.00 (0.07)	-0.05 (0.07)	0.22** (0.11)	0.13 (0.10)	0.02 (0.04)	-0.00 (0.04)	0.20** (0.09)	0.13 (0.09)
Voucher + Encouragement x Quartile 4	0.66*** (0.22)	0.80*** (0.24)	0.62*** (0.21)	0.71*** (0.23)	0.24* (0.13)	0.31** (0.15)	0.39** (0.17)	0.40** (0.18)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.35	0.35	0.48	0.48	0.15	0.15	0.33	0.33
Observations	789	789	789	789	789	789	789	789

PANEL B: CONTRACTS WON FROM NEW BUYERS								
	# of buyers supplied		Supplied international buyer		Supplied private sector		Supplied government or non-profit	
Voucher + Encouragement x Quartiles 1, 2, and 3	0.08 (0.09)	0.01 (0.08)	0.05** (0.02)	0.03 (0.03)	0.06* (0.03)	0.04 (0.03)	0.04 (0.03)	0.02 (0.03)
Voucher + Encouragement x Quartile 4	0.49*** (0.18)	0.58*** (0.19)	0.13** (0.06)	0.13* (0.07)	0.11* (0.06)	0.09 (0.06)	0.10 (0.07)	0.13* (0.08)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.40	0.40	0.10	0.10	0.12	0.12	0.17	0.17
Observations	789	789	789	789	789	789	789	789

PANEL C: QUALITY OF CONTRACTS WON								
	Had a contract of more than 6 months		Had contract in top 25%		Best contract value (USD)		Best contract employment	
Voucher + Encouragement x Quartiles 1, 2, and 3	0.08** (0.03)	0.04 (0.03)	0.03 (0.02)	0.02 (0.02)	91.03 (753.06)	127.74 (813.60)	0.30 (0.22)	0.36 (0.24)
Voucher + Encouragement x Quartile 4	0.13* (0.08)	0.18** (0.08)	0.14** (0.06)	0.14** (0.07)	7508.24** (2926.60)	7835.29** (3084.52)	2.04** (0.93)	2.18** (1.02)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.23	0.23	0.08	0.08	3022.51	3022.51	0.62	0.62
Observations	789	789	789	789	789	789	789	789

PANEL D: FIRM PERFORMANCE AND GROWTH						
	Revenues from contracts		Employees needed for contracts		Employees	
Voucher + Encouragement x Quartiles 1, 2, and 3	-251.16 (1818.79)	-115.21 (1642.88)	0.56* (0.34)	0.64* (0.36)	0.07 (0.37)	-0.26 (0.37)
Voucher + Encouragement x Quartile 4	11580.88** (5313.16)	12377.12** (5412.43)	2.09 (1.51)	2.42 (1.67)	-0.14 (0.86)	0.16 (0.89)
Controls	NO	YES	NO	YES	NO	YES
Control Mean	5030.20	5030.20	1.00	1.00	5.89	5.89
Observations	789	789	789	789	733	733

Notes: Standard errors are in parentheses and are robust. This exhibit shows results from estimating Equation (1). Each of the panels in this exhibit presents the heterogeneous impact of the contract-winning training on different firm outcomes one year out. For each firm in the sample, a predicted treatment effect on numbers of bids submitted is computed using baseline firm characteristics. We then look at the heterogeneity of the impact of the training by comparing firms in the top quartile (Q4) of the predicted treatment effect distribution to firms in the bottom 3 quartiles. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. Controls include employment, counties of operation, gender of the owner, sectors, languages used for business, geographical zone and the number of submitted bids. All controls are measured before baseline. All outputs are referring to the period of 6 months preceding the interview, except the number of employees. The lower number of observations for the employees is due to the data cleaning process.

TABLE A.8: HETEROGENEOUS IMPACT OF CONTRACT-WINNING KNOWLEDGE ONE YEAR OUT FOR FIRMS WITH VS. WITHOUT INTERNET ACCESS

PANEL A: BIDS AND CONTRACTS WON								
	# of tenders bid on		Total # of contracts won		# of tenders won		# of contracts won w/o tender	
Voucher + Encouragement	-0.09 (0.08)	-0.16** (0.08)	0.13 (0.15)	0.02 (0.14)	-0.05 (0.05)	-0.08 (0.05)	0.18 (0.12)	0.10 (0.12)
Voucher + Encouragement x Internet	0.48** (0.19)	0.66*** (0.20)	0.38 (0.24)	0.54** (0.25)	0.24** (0.11)	0.32** (0.13)	0.14 (0.20)	0.22 (0.20)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.35	0.35	0.48	0.48	0.15	0.15	0.33	0.33
Observations	789	789	789	789	789	789	789	789
PANEL B: CONTRACTS WON FROM NEW BUYERS								
	# of buyers supplied		Supplied international buyer		Supplied private sector		Supplied government or non-profit	
Voucher + Encouragement	-0.02 (0.12)	-0.11 (0.12)	0.05 (0.03)	0.02 (0.03)	0.03 (0.04)	0.01 (0.04)	0.03 (0.04)	0.01 (0.04)
Voucher + Encouragement x Internet	0.41** (0.20)	0.56*** (0.21)	0.04 (0.06)	0.06 (0.06)	0.08 (0.07)	0.09 (0.07)	0.04 (0.07)	0.09 (0.08)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.40	0.40	0.10	0.10	0.12	0.12	0.17	0.17
Observations	789	789	789	789	789	789	789	789
PANEL C: QUALITY OF CONTRACTS WON								
	Had a contract of more than 6 months		Had contract in top 25%		Best contract value (USD)		Best contract employment	
Voucher + Encouragement	-0.02 (0.04)	-0.07* (0.04)	0.02 (0.02)	0.01 (0.02)	-316.60 (818.07)	-506.55 (891.97)	-0.06 (0.20)	-0.02 (0.26)
Voucher + Encouragement x Internet	0.22*** (0.08)	0.31*** (0.08)	0.07 (0.05)	0.10* (0.06)	4192.15* (2314.91)	5337.26** (2477.22)	1.56** (0.65)	1.77** (0.73)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.23	0.23	0.08	0.08	3022.51	3022.51	0.62	0.62
Observations	789	789	789	789	789	789	789	789
PANEL D: FIRM PERFORMANCE AND GROWTH								
	Revenues from contracts		Employees needed for contracts		Employees			
Voucher + Encouragement	-2273.95 (2815.53)	-2415.87 (2611.00)	-0.07 (0.31)	-0.07 (0.37)	0.08 (0.47)	-0.57 (0.47)		
Voucher + Encouragement x Internet	9717.45* (5057.44)	11481.81** (5157.88)	2.00* (1.08)	2.48** (1.22)	-0.28 (0.90)	0.91 (0.89)		
Controls	NO	YES	NO	YES	NO	YES		
Control Mean	5030.20	5030.20	1.00	1.00	5.89	5.89		
Observations	789	789	789	789	733	733		

Notes: Standard errors are in parentheses and are robust. This exhibit shows results from estimating Equation (1). Each of the panels in this exhibit presents the treatment effect varies with Internet on different firm outcomes one year out. Internet is a continuous variable from 0 to 1 with 1 indicating that a firm uses Internet for business purposes everyday and 0 indicating that a firm never uses Internet. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. Controls include employment, counties of operation, gender of the owner, sectors, languages used for business, geographical zone and the number of submitted bids. All controls are measured before baseline. All outputs are referring to the period of 6 months preceding the interview, except the number of employees. The lower number of observations for the employees is due to the data cleaning process.

TABLE A.9: HETEROGENEOUS IMPACT OF CONTRACT-WINNING KNOWLEDGE THREE YEARS OUT

PANEL A: BIDS AND CONTRACTS WON								
	# of tenders bid on		Total # of contracts won		# of tenders won		# of contracts won w/o tender	
Voucher + Encouragement x Quartiles 1, 2, and 3	-0.00 (0.06)	-0.03 (0.06)	0.10 (0.08)	0.04 (0.09)	-0.00 (0.04)	-0.02 (0.04)	0.10 (0.07)	0.07 (0.08)
Voucher + Encouragement x Quartile 4	0.30* (0.18)	0.43** (0.20)	-0.04 (0.19)	-0.12 (0.20)	0.07 (0.10)	0.10 (0.10)	-0.10 (0.16)	-0.22 (0.18)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.28	0.28	0.41	0.41	0.11	0.11	0.30	0.30
Observations	628	628	628	628	628	628	628	628
PANEL B: CONTRACTS WON FROM NEW BUYERS								
	# of buyers supplied		Supplied international buyer		Supplied private sector		Supplied government or non-profit	
Voucher + Encouragement x Quartiles 1, 2, and 3	0.03 (0.07)	-0.03 (0.07)	0.03 (0.03)	0.01 (0.03)	0.05 (0.03)	0.03 (0.03)	0.03 (0.03)	0.01 (0.03)
Voucher + Encouragement x Quartile 4	-0.03 (0.14)	-0.06 (0.14)	0.12* (0.07)	0.09 (0.08)	0.16** (0.06)	0.12* (0.07)	0.08 (0.08)	0.08 (0.09)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.31	0.31	0.10	0.10	0.12	0.12	0.17	0.17
Observations	628	628	628	628	628	628	628	628
PANEL C: QUALITY OF CONTRACTS WON								
	Had a contract of more than 6 months		Had contract in top 25%		Best contract value (USD)		Best contract employment	
Voucher + Encouragement x Quartiles 1, 2, and 3	0.03 (0.04)	0.02 (0.04)	-0.00 (0.02)	-0.01 (0.02)	664.52 (475.19)	755.36* (451.23)	0.25 (0.15)	0.25 (0.17)
Voucher + Encouragement x Quartile 4	-0.02 (0.09)	0.05 (0.09)	0.04 (0.07)	0.03 (0.08)	1139.10 (1227.12)	1030.00 (1480.99)	0.46 (0.59)	0.69 (0.66)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.27	0.27	0.07	0.07	1228.07	1228.07	0.27	0.27
Observations	628	628	628	628	628	628	628	628
PANEL D: FIRM PERFORMANCE								
	Revenues from contracts		Employees needed for contracts		Employees		Firm survival	
Voucher + Encouragement x Quartiles 1, 2, and 3	795.08 (589.91)	862.92 (581.58)	0.30* (0.17)	0.30 (0.19)	-0.14 (0.41)	-0.39 (0.39)	0.03 (0.03)	0.03 (0.03)
Voucher + Encouragement x Quartile 4	2188.09 (1447.82)	1919.97 (1761.44)	0.64 (0.69)	0.92 (0.77)	1.38* (0.82)	1.52* (0.88)	0.12** (0.05)	0.10* (0.06)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	1503.27	1503.27	0.32	0.32	5.79	5.79	0.77	0.77
Observations	628	628	628	628	591	591	897	897

Notes: Standard errors are in parentheses and are robust. This exhibit shows results from estimating Equation (1). Each of the panels in this exhibit presents the heterogeneous impact of the contract-winning training on firm outcomes three years out. For each firm in the sample, a predicted treatment effect on numbers of bids submitted is computed using baseline firm characteristics. We then look at the heterogeneity of the impact of the training by comparing firms in the top quartile (Q4) of the predicted treatment effect distribution to firms in the bottom 3 quartiles. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. Controls include employment, counties of operation, gender of the owner, sectors, languages used for business, geographical zone and the number of submitted bids. All controls are measured before baseline. All outputs are referring to the period of 6 months preceding the interview, except the number of employees. The lower number of observations for the employees is due to the data cleaning process. Note that in the data, contracts won in the second follow-up have smaller value (in USD as well as number of employees needed for contracts), which is likely due to Liberia's recession between the two data rounds.

TABLE A.10: HETEROGENEOUS IMPACT OF CONTRACT-WINNING KNOWLEDGE THREE YEARS OUT FOR FIRMS WITH VS. WITHOUT INTERNET ACCESS

PANEL A: BIDS AND CONTRACTS WON								
	# of tenders bid on		Total # of contracts won		# of tenders won		# of contracts won w/o tender	
Voucher + Encouragement	0.03 (0.06)	-0.01 (0.06)	0.13 (0.11)	0.05 (0.11)	0.03 (0.03)	0.01 (0.04)	0.11 (0.11)	0.04 (0.11)
Voucher + Encouragement x Internet	0.04 (0.16)	0.19 (0.17)	-0.17 (0.20)	-0.10 (0.22)	-0.05 (0.10)	-0.02 (0.10)	-0.12 (0.18)	-0.09 (0.20)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.28	0.28	0.41	0.41	0.11	0.11	0.30	0.30
Observations	628	628	628	628	628	628	628	628

PANEL B: CONTRACTS WON FROM NEW BUYERS								
	# of buyers supplied		Supplied international buyer		Supplied private sector		Supplied government or non-profit	
Voucher + Encouragement	0.08 (0.08)	0.01 (0.08)	0.04 (0.03)	0.02 (0.03)	0.03 (0.04)	0.02 (0.04)	0.04 (0.04)	0.03 (0.04)
Voucher + Encouragement x Internet	-0.15 (0.15)	-0.09 (0.16)	0.01 (0.07)	0.02 (0.07)	0.09 (0.07)	0.07 (0.08)	-0.01 (0.08)	0.00 (0.09)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.31	0.31	0.10	0.10	0.12	0.12	0.17	0.17
Observations	628	628	628	628	628	628	628	628

PANEL C: QUALITY OF CONTRACTS WON								
	Had a contract of more than 6 months		Had contract in top 25%		Best contract value (USD)		Best contract employment	
Voucher + Encouragement	-0.03 (0.05)	-0.04 (0.05)	-0.00 (0.02)	-0.02 (0.02)	71.53 (620.27)	-65.41 (467.56)	0.12 (0.18)	0.06 (0.15)
Voucher + Encouragement x Internet	0.09 (0.09)	0.16* (0.09)	0.01 (0.05)	0.05 (0.06)	1454.47 (1089.35)	1989.03* (1060.54)	0.34 (0.43)	0.66 (0.48)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	0.27	0.27	0.07	0.07	1228.07	1228.07	0.27	0.27
Observations	628	628	628	628	628	628	628	628

PANEL D: FIRM PERFORMANCE							FIRM GROWTH	
	Revenues from contracts		Employees needed for contracts		Employees		Firm survival	
Voucher + Encouragement	186.08 (710.33)	13.16 (622.18)	0.10 (0.18)	0.07 (0.16)	-0.41 (0.52)	-0.66 (0.49)	-0.01 (0.04)	0.00 (0.04)
Voucher + Encouragement x Internet	1917.25 (1408.36)	2430.61* (1416.68)	0.55 (0.51)	0.82 (0.57)	1.26 (0.96)	1.52 (0.97)	0.14* (0.07)	0.11 (0.07)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Control Mean	1503.27	1503.27	0.32	0.32	5.79	5.79	0.77	0.77
Observations	628	628	628	628	591	591	897	897

Notes: Standard errors are in parentheses and are robust. This exhibit shows results from estimating Equation (1). Each of the panels in this exhibit presents the treatment effect varies with Internet on firm outcomes three years out. Internet is a continuous variable from 0 to 1 with 1 indicating that a firm uses Internet for business purposes everyday and 0 indicating that a firm never uses Internet. Panel A presents the effect of the training on bids and contracts won by firms, Panel B focuses on the effect on contracts won from buyers not previously supplied to, Panel C looks at the effect on different measures of contract quality and Panel D shows the effect on overall firm performance. Controls include employment, counties of operation, gender of the owner, sectors, languages used for business, geographical zone and the number of submitted bids. All controls are measured before baseline. All outputs are referring to the period of 6 months preceding the interview, except the number of employees. The lower number of observations for the employees is due to the data cleaning process. Note that in the data, contracts won in the second follow-up have smaller value (in USD as well as number of employees needed for contracts), which is likely due to Liberia's recession between the two data rounds.