Thin Business Networks and Supply-Chain Frictions: The Impact of a Network Technology on Small Businesses in Tanzania

Pre-Analysis Plan

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Abstract

Substantial information frictions along supply chains of small firms can generate bottlenecks which slow the dissemination of competitive terms of trade and other market information. This research investigates whether lowering search costs decreases information frictions and improves small firms' ability to source and sell goods in their local area. It leverages the scale-up of a digital phonebook application that effectively lowers the cost of accessing new business and customer networks. Participating small firms are split into a control and treatment group with two variations - 1) a business listing targeting input markets, and 2) a business listing targeting customers in output markets. The design allows for comparing the extent to which input or output business networks constrain business performance in rural markets and whether lowering the cost of initial contact improves firm productivity.

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1 Introduction

1.1 Motivation

An important determinant of market efficiency is the extent to which all actors have access to the same information and can employ it productively. Substantial information frictions along supply chains of small firms can generate bottlenecks which slow the dissemination of competitive terms of trade, limiting firms' capacity to coordinate supply and demand (Wright et al., forthcoming). One source of information friction comes from search costs. High search costs imply that firms face high barriers to acquiring new information about input prices, new goods and services, and other productivity enhancing opportunities. Economic theory suggests that lowering search costs along a supply chain can improve firm productivity (Bernard et al., 2019) and increase aggregate output (Oberfield, 2018). In developing country settings, alleviating constraints to improving productivity for small and medium enterprises (SMEs) is critical for increasing output and improving incomes.

This research focuses on the nexus of supply chain market efficiency and firm network formation and asks if lowering search costs in input and output markets improves firm productivity. A common factor that exacerbates both input and output market frictions is that SME owners in rural markets typically have thin business networks and operate in contexts with limited information about broader market movements or opportunities - leading to market fragmentation in isolated geographic areas.

Under excessive market fragmentation, which is more likely to occur in disconnected rural markets, excessive search costs limit firms' ability to engage in business transactions outside of their local market network. Jensen and Miller (2018) showed that mobile phone proliferation initially increased market integration in the fish market in the Indian state of Kerala, which in turn lowered the cost of acquiring information in complementary markets (boat-building) across geographically dispersed areas, causing high-productive builders to grow and gain market share. The ability to mobilize resources to invest in business assets and make adjustments that respond to changes in the market environment are important elements of a firms' information set.

Policymakers and researchers have shown interest in investing in programs and policies that improve productivity for small firms. Prior research has examined the role of access to capital and credit (de Mel et al., 2008), management and business training (Bloom et al., 2013; McKenzie and Woodruff, 2014), and has begun unpacking the role of networks to disseminate knowledge and improve business practices (Fafchamps and Quinn, 2016; Cai and Szeidl, 2018; Hardy and

McCasland, 2018). Many SMEs face barriers to expansion from the input side and from the output side of their supply chains. For inputs, incomplete markets for finance, labor, energy, and input supplies create frictions that prevent enterprises from reliably meeting local demand for goods and services. For outputs, small firms in rural and urban areas may have few avenues for reaching new customers or accessing new markets.

There is little doubt that both input and output markets matter for small firms. Yet, few studies have directly examined the intersection of firms' input market relationships with their output market customer base. A recent exception is Anderson et al. (2018), who compare two variations of business training designed to improve upstream financial management skills and downstream advertising and market skills. This research addresses this gap by exploring the role of network-related supply chain frictions in limiting firm growth and constraining small and medium enterprises (SME) performance in Tanzania. It is designed to compare network formation on both sides of a market as a basis to learn whether productivity improvements are more readily facilitated by increasing access to upstream markets or downstream customer bases.

A firm's capacity to refresh their information set is determined in part by the quality and quantity of network links in their supply chain. We expect that subsidizing search costs should increase contact between firms and customers that otherwise would not have met. As contact in input, or upstream markets increases, information and opportunities are more likely to disseminate across networks. Likewise, as contact with output markets, or downstream customer base increases, firms are more likely to access new customer base. The objective is to learn how exogenous changes to firms' information and network structure affect their ability to source inputs and access output markets, laying the groundwork for increases in productivity and growth.

This pre-analysis plan describes the research design and empirical strategy for a field experiment that increases access to contact information for upstream suppliers and downstream customers. The treatment makes use of a new mobile phone application that connects users to a platform with businesses contact information from a variety of sectors in urban and rural areas. Participating small firms are split into a control and treatment group with two variations - 1) a business listing targeting wholesale firms that are upstream of the participating firm's supply chain, and 2) a business listing targeting customers that are downstream of their supply chain. The design allows comparing the extent to which upstream or downstream business networks constrain business performance in rural markets and whether lowering the cost of initial contact improves firm productivity. The plan describes the background of the program, and then provides experimental design details on

sampling strategy, power calculations, data collection and hypothesis, followed by a description of outcome variables and testing strategies.

1.2 Research Questions

The setting encompasses rural and urban areas in order to consider how trade networks that move goods and services back and forth are formed and sustained. This study is designed to examine the extent to which a phone-based technology is capable of ameliorating information and network market frictions by lowing the cost of acquiring new connections in upstream and downstream business markets. The research questions are related to network formation, product prices and availability, search and transaction costs, and the geographic extent of business activities. The underlying premise is that small firms cannot easily acquire information about potential buyers and suppliers and providing information on new contacts helps firms to source and sell goods and services more efficiently.

1.2.1 Causal Evidence about Supply Chains and Business Outcomes

Random assignment as specified in this experimental design will generate exogenous variation in the number of upstream and downstream contacts for firms. This variation effectively lowers the cost of acquiring new contacts and can be used to causally identify the impact of lowering search costs on firm network formation and business outcomes. Part of the random assignment creates additional variation in whether those contacts will be targeted for upstream or downstream business engagement and allows comparing which side of network supply chains causes larger changes to firm operations.

1. **Network formation:** Will firms utilize new contact information to acquire market information?
    - How often do treated firms appear in searches in the eKichabi platform?
    - Do platform users contact firms to acquire market information?
    - Do firms contact input suppliers to acquire market information?
        - *Mechanisms:* Firms access new networks and increase search activities to compare prices, availability, and quality of goods and services, and other market information.
2. **Business outcomes:** Does increasing network size improve business outcomes?

- Upstream: Do firms source goods more efficiently?
  - *Mechanisms:* Firms utilize new information to increase their bargaining power and negotiate better contracts with suppliers. This can include lower prices for sourced goods, fewer days to terminate a transaction, more favorable terms of credit, or fewer stock-outs.
- Downstream: Do firm sales and transactions increase?
  - *Mechanisms:* Firms access a new customer base equivalent to an outward shift in their demand curve.

3. **Comparing upstream and downstream:** What are the relative effects of supply or demand-side network expansion on improving firm outcomes?
   - Does one side generate new business partnerships?
   - Does either increase firm productivity?
     - *Mechanisms:* Firms that access upstream networks improve their sourcing efficiency and lower total costs.
     - *Mechanisms:* Larger customer base increases total firm revenue.

1.2.2 Descriptive Evidence about Supply Chains

If the intervention does not generate significant changes in business outcomes, information generated through surveys and platform usage will be useful to understand the status-quo network structure of small firms in rural and urban Tanzania. Little information from this setting exists about price trends that rural firms face, their bargaining power relative to their suppliers, and broadly the role of supply chain networks in the development of businesses and markets. Specifically, new descriptive evidence about supply chain frictions will inform the following research questions:

- Is there evidence that small firms have relatively limited options when negotiating contracts with suppliers?
- Is there evidence that some types of firms crowd-in certain sectors to the point that they become unprofitable, particularly in rural areas?
- To what extent do transaction costs attenuate gains made from improvements in market efficiency?

In the course of learning about firm networks, results from this experiment will inform researchers and policymakers about what types of technology can move the needle on a firms' ability to invest in their business and improve their operations.

1.3 Program Background

This research is part of an ongoing program in central Tanzania to develop and market digital telephone directories that operate on all types of phones. The eKichabi Platform is the name for the electronic version of the phone directory. The word *eKichabi* is a portmanteau for "electronic Business Book", or *Kitabu cha Biashara* in Swahili. The application is accessible through a USSD short code and is organized through a menu system similar to those used for mobile phone top ups and and mobile money transactions commonly seen in developing countries. The phone application organizes participating firms by location and sector and guides users through a set of menus to reach a screen that displays the firm's contact information, location, sector and product specialities (see Dillon et al. (2018) and Weld et al. (2018) for more details).

One of the core objectives from that study was to measure changes in the number of business phone calls and to model search behavior of farming households. The key findings were that i. treated firms received substantially more business-related phone calls, ii. treated households increased their search activities to learn crop prices and source inputs. For secondary business outcomes, there were no significant changes in revenue and employment, yet phone-based transactions increased as measured by higher mobile money usage.

2 Research Design

2.1 Description of Intervention

The program targets 3 types of participants linked through urban-to-rural supply chains: upstream urban suppliers, rural firms, and downstream rural consumers. The intervention focuses on the middle link of the supply chain: rural firms. Rural firms from small to medium sized commercial centers are split into a control group and a treatment group with two variations - A) a business listing that targets upstream wholesalers in the firms' input market, B) a business listing that targets downstream consumers in the firms' output market, and C) a control group.

Random assignment at the firm level generates variation in the likelihood that rural firms communicate with upstream and downstream contacts. This variation effectively lowers the cost of

increasing business network size and can be used to identify the impact of lowering search costs on management and business outcomes. Further, the two separate treatment arms will differentially lower search costs for one side of the supply chain but not the other which permits comparing outcomes between upstream and downstream treatment groups.

The objective is to encourage contact between rural firms and new potential customers or new suppliers. The first step is to randomly select communities for firm enrollment. After, within communities, individual firms that agree to participate will be randomized into treatment arms and control. Figure 1 shows the experimental design. The "upstream" treatment addresses perceived shortcomings on the input supply-side of urban-to-rural supply chains. Enterprises in this group will be able to use the mobile directory, will have their business listed toward the top of search when wholesales firms use the directory. The "downstream" treatment will increase firms' exposure to the pool of potential new customers by promoting the firm's listing during searches by customers from surrounding communities.

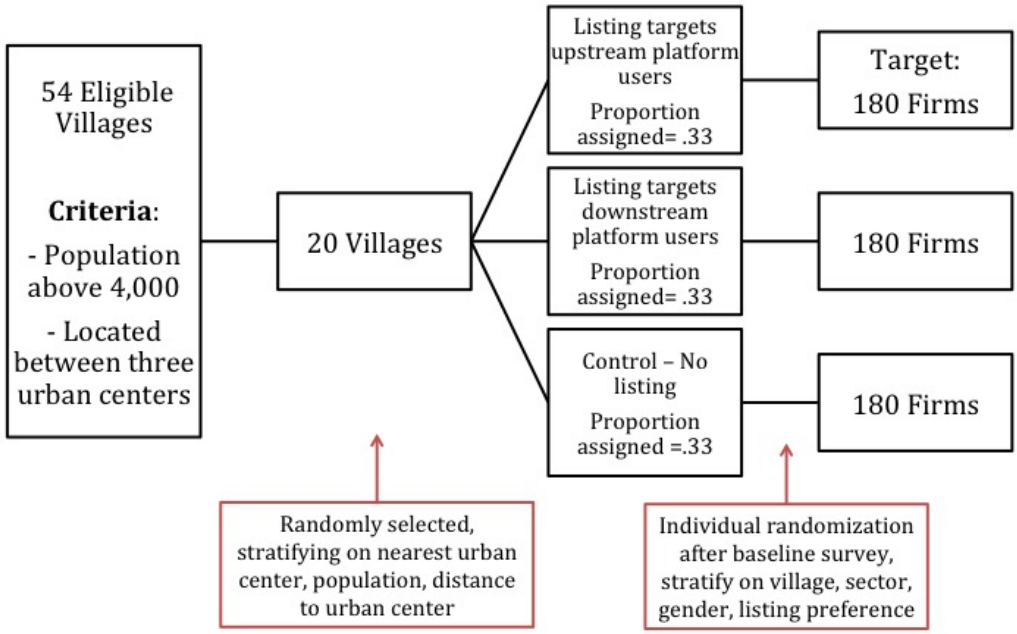

Figure 1: Experimental Design

2.1.1 Platform Users

These treatments intend to connect listed *rural firms* (the target of the intervention) that have their contact information in the eKichabi platform with *platform users*, defined as other firms or consumers that dial into the eKichabi platform to connect with listed firms. The design of the eKichabi phone application mirrors that of a technology platform which connect buyers and sellers by listing information for actors on one side of the trade. This study measures and tracks outcomes for rural firms, rather than platform users since we want to drive search activity directly to the eKichabi phone application. To understand how this matters, consider the alternative option where we provide customer information directly to listed firms assigned to downstream treatment. Since customers themselves are not listed in the platform, we would not be able to observe search outcomes in the platform and would not accumulate any information about whether a platform application of this type is useful to users in this setting.

2.1.2 Listing Order and Visibility within eKichabi Platform

The eKichabi platform permits the research team to specify a listing order for firms based on string search queries, locations, and/or sectors. Then, we can assign pre-specified phone number to view each list. This means that some firms will be listed toward the top any given search and search order can be determined by randomizing the top search result. Similar to searches in any online platform, we assume that search order corresponds to higher exposure for firms at the top of the search list (Varian, 2007; Athey and Ellison, 2011; de Cornière, 2016). Given that higher exposure could inadvertently prioritize some listed firms over others, the firm listing order will be randomized for each new user that accesses the platform. In expectation, no firm in either arm will appear at the top of all searches within their assigned treatment arm.

The eKichabi platform also permits constraining the visibility of sets of firms. The research design partitions firms into control plus two treatment groups. Group A will be constrained to view only upstream firms in urban areas (the typical location of wholesale firms and input providers). Customers in rural areas will be constrained to only observe group B firms. Firms in Group B will be able to search other Group B firms but will not have access to urban firms in their upstream market. Likewise, Group A firms will not be visible to customers, but can search other Group A firms and upstream firms. Figure 2 summarizes these relationships.

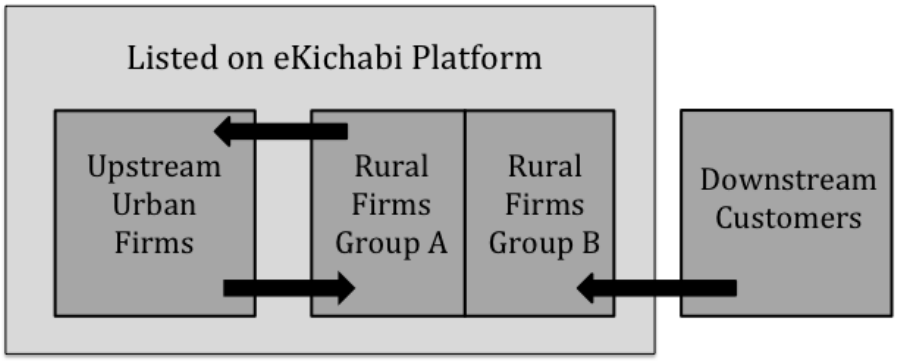

Figure 2: Firm Visibility on eKichabi Platform

As described above, the first limitation on setting visibility restrictions is that the platform lists businesses but does not list customer contact information. Therefore, treatment assignment to group A or B can be thought of as increasing the probability that the firm communicates with upstream firms or downstream customers. A second limitation is that only known phone numbers can be assigned. Through the course of fieldwork, the research team will collect phone numbers from upstream firms and downstream customers and assign them as prescribed. But, the platform app is currently live and accessible throughout Tanzania. Therefore, new, unknown phone numbers will be randomly assigned to view group A or group B, which could potentially add noise to final outcomes. However, this concern is minor because there has not been any concerted effort to advertise eKichabi outside of the current research project. We anticipate that most purposeful usage of eKichabi platform will come from program participants. Regardless, the research team plans to follow-up with platform users to learn about their usage patterns. These surveys will help reveal the extent to which unknown phone numbers are active calling numbers listed on the platform.

2.2 Sampling

2.2.1 Sampling Frame

There are five administrative levels in Tanzania - region, district, ward, village and subvillage. The 2012 population and housing census by the Tanzanian government lists population at the village level. Two regions in central Tanzania have been identified for expanding the digital directory - Dodoma and Singida. Three urban centers bound a trading area that encompasses the western half

of Dodoma region and the southern half of Singida region - Singida City, Dodoma City, and Manyoni town. Villages located within wards connecting these three urban hubs will be purposefully selected as the pool of sample villages. This increases the likelihood that firms in selected communities trade with the chosen urban areas and ensures that the phone directory lists firms that are relevant to their local commercial area.

Within chosen wards, villages with a population above 4,000 people will be targeted for enrollment in the phone directory so that there is sufficient density of potential businesses to invite for enrollment. There are 54 eligible villages that fit the population criteria within the study area. Of these eligible villages, 20 will be randomly selected after stratifying on primary urban center, distance to urban center, and population. A secondary list of 2-5 additional villages per district will be selected in case any circumstances arise that prevent data collection in that area. Firms in urban areas will also be invited to enroll in the platform and will be used as the pool of upstream firms in the intervention (see Section 2.1 above). Previous experience showed that we can expect to enroll 72% of invited firms. With an estimate of 25-30 businesses per village, the expected sample size of rural firms is 500-600.

2.2.2 Sample Characteristics

This sample area is located in the semi-arid central region of Tanzania. Table 1 compares characteristics from the sample regions with the national average. All three regions are less urban than the national average, have lower rates of non-farm employment and have lower mobile phone ownership rates. For a phone based study like this one, access to a mobile phone is required to participate and is part of the selection criteria. However, the first filter for participation is business ownership, which tends to overlap with phone ownership. Almost no businesses in the previous study declined to participate due to a lack of access to a phone.

Table 1: Characteristics of Sample Regions and National Average

	Dodoma Region	Singida Region	Tanzania
Population (millions)	2.3	1.5	50.1
Urban	16.2	14.7	29.6
Average HH Size	4.6	5.3	4.9
Literacy Rate	67.5	67.1	71.8
Mobile Phone Ownership Rate	49.5	54.7	63.9
Non-Farm Primary Employment	28.2	31.4	37.2
Land Area (Sq. km)	41,000	49,300	883,300
Population density (/sq km)	55.12	30.4	56.7
Average Rainfall (mm/year)	495.7	732	1100

To get a sense of the distribution of attributes of the targeted firms, Table 2 shows means and standard deviations of a set of firm characteristics using endline control firms from the previous study.[1] It includes the number of incoming and outgoing business calls, total number of customers, number of suppliers contacted, revenue, total costs, and number of workers. The previous survey had a 2-day recall window, unless otherwise specified. The new survey will use a different recall window that improves our ability to capture changes in upstream relationships. For example, the variable 'Suppliers Contacted' has a low mean - .19 for all businesses, .29 for retail businesses - which is a result of the narrow 2-day recall window.

[1]Table 2 also corresponds to the sample of firms used to inform means and standard deviations used in power calculations. See Section 2.4

Table 2: Endline Control Firms Characteristics

	(1)	(2)		(3)		(4)	
	All Firms	Retail Sector	Non-Retail Sector	Woman-Owned	Man-Owned	Urban	Rural
Incoming Bus. Calls	7.2	6.28	7.97	9.67	6.76	10.93	5.71
	(9.12)	(8.74)	(9.4)	(13.34)	(8.12)	(11.92)	(7.25)
Outgoing Bus. Calls	3.78	3.1	4.34	4.78	3.61	5.61	3.06
	(4.8)	(3.49)	(5.62)	(6.03)	(4.55)	(5.75)	(4.17)
Total Customers	13.11	16.11	10.85	12.85	13.16	13.57	12.91
	(17.83)	(17.05)	(18.15)	(14.24)	(18.4)	(18.6)	(17.54)
Suppliers Contacted	.19	.29	.11	.24	.18	.3	.14
	(.71)	(.9)	(.51)	(1.06)	(.63)	(.97)	(.56)
Revenue	197.83	203.26	192.57	249.4	188.97	393.58	112.47
	(319.41)	(338.1)	(301.88)	(374.18)	(309.49)	(454.5)	(182.95)
Total Costs (1 month)	149.42	163.17	138.03	160.93	147.32	268.27	98.81
	(174.77)	(183.48)	(166.93)	(191.16)	(171.94)	(201.37)	(133.58)
Workers (1 week)	1.33	1.48	1.21	1.28	1.34	1.77	1.14
	(1.83)	(1.72)	(1.92)	(1.49)	(1.89)	(2.19)	(1.62)
Observations	301	136	165	46	255	92	209

Notes: Table reports means and standard deviations in parenthesis. All variables are two-day recall window, unless noted otherwise. The top 1% of the distribution was winsorized. Monetary values are reported in thousands of TZ shillings.

The first column is the full sample and columns (2)-(4) divide the sample by the subgroups of interest for heterogeneous treatment effects (further detail described below). The second column compares retail to non-retail firms. This comparison matters because retail firms are the most likely to trade across space and source goods at regular intervals to sell in their local markets. The types of firms in the non-retail category include those working in skilled trades (mechanics, construction workers, welders, tailors), and millers. Even within non-retail, many firms source goods or services (for example machine parts or other inputs). But, non-retail firms are less likely source at regular intervals or with the same frequency as retail firms. The variable for mean number of suppliers contacted bears this out - retail firms tended to contact .29 suppliers, while non-retail firms only reached out to .11 suppliers (again, with a large number of zeros due to the narrow-recall window).

The third column shows differences between women's and men's-owned businesses. An emerging

literature has begun to examine the gender earnings gap to learn what specifically constrains women more than men while managing small businesses (Nix et al., 2016; Campos and Gassier, 2017). Here, wide differences between women's and men's-owned enterprises are not apparent. On average, women received and made more business calls, had higher revenue, and contacted more suppliers, but had slightly fewer customers and hired fewer workers. This may be based on selection of women's firms into directory participation.

The final column (4) compares rural and urban firms. As mentioned above, firms in large cities are not the primary targets for this intervention. Rather, firms located in small-medium-sized villages located in between two large cities will be the main focus. On average, these rural firms made and received fewer business calls, had lower revenue, hired fewer workers, and contacted fewer suppliers.

2.3 Assignment to Treatment

Treatment will be assigned at the individual firm level using statistics software after the baseline survey is implemented. Unit-level randomization was chosen to maximize power and because firm-to-firm spillovers are expected to be minimal. Data from rural control firms in the first study also showed low intracluster correlation (ICC) within villages for key outcome variables, providing evidence that outcomes are not tightly related among neighboring firms. For incoming and outgoing business calls, the within village ICC was 0.06 and .03 respectively. This signals that within community similarities are unlikely to drive results. Along with gains to power in order to detect differences on business outcome measures, the benefits from individual randomization outweigh its costs. Yet, as explained below, village dummies will be used as one of the strata variables.

As suggested in Athey and Imbens (2017), strata will contain 6 firms (two times the number of invervention arms). Strata will be assigned using the optimal greedy algorithm using R package `blockTools`, suggested by Moore (2012). This method is preferred in this setting because there is variation in the number and sector of firms per village. If strata were created by partitioning firms by village, sector, and gender, there would be too few firms per strata to optimally estimate sampling variance (Imbens and Rubin, 2015). The `blockTools` package assigns firms to strata by minimizing the maximum multivariate distance of firms within strata based on pre-selected variables.

Enrolled rural firms that complete a baseline questionnaire will be grouped into strata based on village, sector, gender, and a self-reported measure of whether the firm places greater weight on

accessing upstream contacts or downstream contacts. The measure of firm treatment preferences is used to ensure that firms have a strong preference for either treatment are dispersed across arms. As discussed in Section 2.2.1, villages are randomly selected from a list after stratifying on distance to the urban center and population. It is reasonable to anticipate that some features of villages (such as market size or remoteness) could influence intervention outcomes so that including village as a strata variable is appropriate.

2.4 Statistical Power

Power calculations were estimated by assuming a level of 0.8 and setting size to .05. Calculations are assume a sample size of 500 firms, the lower bound on the expected sample size of 500-600 firms. A sample size of 500 units with 166 units per treatment arm is powered to pick up differences in outcomes greater or equal to 0.15 standard deviations. Attrition from the sample is likely to occur in this setting because it is common for firms to open and close seasonally. Assuming a 10% balanced attrition rate from the sample, each arm shrinks to 150 firms powered to pick up changes greater or equal to 0.16, requiring a five percent increase in differences in outcomes relative to the case without attrition.

Table 3 shows means and standard deviations for similar variables to those that will be studied for this program. Means and standard deviations for a two-day recall of incoming business calls, outgoing business calls, number of suppliers, and number of customers from 209 rural control firms surveyed for endline data collection from initial phone directory study.[2] It also includes means and standard deviations from 66 store surveys taken during the 2015 endline survey. Store owners were asked to provide retail and wholesale prices for a few key local commodities, including rice and beans.

[2]The reported number of suppliers is near zero because the recall period was narrow. The endline survey question asked "Over the previous two days, how many suppliers did you contact?" A longer recall window would have picked up a higher number of suppliers.

Table 3: Power Calculations

Variable	Mean	SD	MDE Individual	MDE ICC=0.10	MDE SCR†
Incoming Bus. Calls	5.71	7.25	1.18	2.83	2.23
Outgoing Bus. Calls	3.06	4.17	.68	1.63	1.28
No. Suppliers	.14	.56	.09	.22	.17
No. Customers	12.91	17.54	2.85	6.84	5.4
Rice TZS/kg - Retail	1851	180	29.21	70.1	55.42
Rice TZS/kg - Wholesale	1507	187	30.34	72.82	57.6
Beans TZS/kg - Retail	1870	195	31.64	75.94	60.02
Beans TZS/kg - Wholesale	1536	242	39.27	94.25	74.53

†SCR computed assuming 150 firms in each arm with 3 post surveys.

The third column, MDE Individual, shows the minimum detectable effect (MDE) for each variable under the assumption of individual random assignment, with zero intracluster correlation. The next column, MDE-ICC, shows the the minimum detectable effect after allowing for a design effect that incorporates an ICC of 0.10. Both are shown to provide bounds for the minimum detectable effect is for this setting, giving a lower bound with no intracluster correlation and an upper bound that incorporates a penalty of within village correlation.

To incorporate benefits from additional follow-up survey rounds, the final column of the table, MDE SCR (serial correlation robust), shows the minimum detectable effect using the procedure recommended by Burlig et al. (2017) that permits arbitrary serial correlation and is useful in settings where there is more than one follow-up survey. The results reported are calculated for three follow-up surveys, and provides a middle ground between the conservative MDE-ICC calculations and the more generous individual-assignment calculations.

The serial correlation robust estimates embed power gained by adding additional post-treatment follow-up surveys. This improvement occurs because a larger panel increases the signal in estimates and improves precision (up to a point). Although ICC is typically thought of as increasing the minimum detectable effect through unaccounted spatial correlation, SCR calculations account for this. In fact, the SCR estimates embed cross-sectional correlation within clusters (typical ICC) and within-unit correlation. The results presented in the MDE-SCR column in Table 3 are upper-bounds on MDE calculations because ICC was set to zero. If ICC were incorporated, it would lower the the unexplained variance and therefore decrease the MDE.

3 Data Collection

The research team is based in Dodoma City and has 4 years experience working on this project. We collaborate with a Tanzanian university, the Institute for Rural Development and Planning (IRDP), and work with local professors and several long-term team-members. The research team has secured permission through the designated authority at IRDP to work in the regions described here.

3.1 Fieldwork Activities

The process of introducing eKichabi to new participants is well-tuned. After selecting locations, the team travels to the community, meets the local leader, shares research permission letters and asks to walk around the community and introduce the program to firms from a variety of sectors. After a firm agrees to participate, the research team will record their business contact information and administer the baseline survey questionnaire.

After collecting baseline questionnaires with participating firms in the sample communities drawn from rural areas, the research team will visit the three urban centers in this region - Dodoma City, Singida City, and Manyoni Town. Wholesale and retail firms will be invited to list their business contact information in the eKichabi platform. This pool of firms will be treated as the 'upstream' firm group. Their phone contact information will be made available for firms in the upstream treatment arm.

Finally, the last stage of fieldwork will involve randomly selecting smaller communities in areas near to rural firms and requesting a community meeting to introduce the eKichabi phone application. These are communities with few local businesses and populations less than 4,000 people. Households in these small rural communities typically have to travel to neighboring towns to purchase goods and services. During community meetings, attendees will be taught how to use eKichabi and provided with examples of use-cases.

3.2 Timeline

The treatment intervention will begin in June 2019 and run until February 2020. The short-term intervention will allow the research team to follow-up relatively quickly with firms and have a higher probability of capturing short-term changes to their business operations. Baseline data collection will occur in June-July, 2019 and follow-up phone surveys will take place in the subsequent

months through February 2020. The baseline and follow-up questionnaires are designed to tease out upstream and downstream relationships. The baseline questionnaire will be conducted in person during the enrollment process. Follow-up surveys will take place after the baseline questionnaires will be conducted by phone. These phone calls will be shorter than a typical questionnaire and designed to pick up changes in the primary and secondary outcome variables. It also enables us to collect multiple follow-up rounds within a short time frame. We expect to administer two follow-up surveys and if the budget permits, a third will be added.

3.3 Survey Instruments

1. **Enrollment application questionnaire:** The research team has already piloted and launched an enrollment application that collects a brief enrollment questionnaire with information that will be provided publicly in the directory - business name, location, sector, sub-sector, and up to two phone numbers as well as a few non-public variables of interest to the research team - owner consent, business owner name, owner age, business age, number of employees, and gender of the owner.

2. **Baseline questionnaire:** The enrollment application can function as a stand alone app or can be augmented with an additional survey questionnaires using ODK software. All participating firms in treatment communities will be asked all questions from the baseline questionnaire in person at the moment of the initial enrollment interview. The baseline will collect firm data on upstream activity, downstream activity, input and output prices, and general firm characteristics.

3. **eKichabi Platform data:** As described in the background section above, one outcome of the initial study was to motivate the creation of a digital version of the phone directory that is accessible through any type of mobile phone. The digital directory was launched in 2017-18 and permits researchers to directly observe search behavior of listed firms by matching phone numbers to search records. The eKichabi platform provides detailed microdata on outcome variables related to search activity of users, including user phone number, time, date, search strings, and search results. User phone numbers will be matched to firms in the study. Thus, we can observe search behavior by all enrolled firms, which provides a precise measure of technology uptake.

4. **Follow-up Phone Surveys:** The final data collection instrument will be collected by phon-

ing participants for follow-up questionnaires. These questionnaires will focus on follow-up questions that were established during the baseline.

4 Outcomes and Measurement

4.1 Primary Outcome Variables

- Communication with supplier contacts
- Communication with customer contacts
- Indicator for conducting business outside their local market

4.2 Secondary Outcome Variables

- Sourcing costs efficiency (composed of travel costs, transaction days, cost of goods purchased)
- Indicator for stock-outs of primary goods
- Business performance index (composite index of revenues, number of customers, hours worked, workers hired, inventory management and marketing practices)
- Changes in input and output prices

4.3 Measuring Primary Outcome Variables

Supplier and Customer Communication: The first set of primary outcomes concentrate on firm communication with suppliers and customers. There are two sources for each of these outcomes. First, platform user data will be used to construct a variable of whether firms appeared in searches made by users of eKichabi. But, we will not know whether phone calls or in-person contact happens after the search. Therefore, a second question will be asked during surveys and used to construct a variable of whether a firm increased communication with either upstream or downstream contacts, and whether those contacts are new. These questions are shown in "Phone Usage" section of the baseline survey in the appendix. They will also be aggregated into an index to capture the mean effect across different measures of phone usage (calls received, calls made, new contacts).

Increasing communication with suppliers and customers provides evidence that firms' network has increased as a result of being listed in eKicahbi platform. The theory of change for this study assumes that if search costs decrease, firms will increase their search activity by communicating with new entities in their input and output markets. For example, firms in the upstream treatment

may increase contact with firms in wholesale markets to inquire about prices, products, sales terms, and other business information. Likewise, firms assigned to downstream may increase contact with a customer base and learn more about what types of products are preferred in their area.

Business Activity Outside the Local Market: The variable for conducting business activity outside their local market is designed to pick up changes in the geographic area over which the firm conducts business. Firms are asked to list locations of suppliers and customers. This variable will equal one if a firm indicates that they sold or sourced goods or services outside of their village. If firms increase contact with firms and customers from outside their local market, it suggests that the search cost subsidies facilitated an increase in economic activity across space. The primary outcome will be for any activity outside the local market but it can also be decomposed into two separate measures of upstream and downstream business activity. Should this variable exhibit low variation (for example, if most firms report having customers that come from outside of their village), it will instead be constructed as a location diversity index using questions that elicit the total number of different locations for customers and suppliers.

4.4 Measuring Secondary Outcome Variables

Sourcing Costs Efficiency: Survey questions about firms' upstream activity will be used to construct one of the secondary outcome variables - sourcing costs efficiency. Sourcing efficiency is defined as the total value of a sourcing transaction divided by the transaction cost. Two variables provide proxies for transaction costs - number of days to complete the transaction and the total transportation cost associated with acquiring goods/services. The number of days variable captures the lag time between contacting suppliers, negotiating prices, and obtaining the good or service.

The total value of sourced inputs will be weighted by transaction costs in order to distinguish firms that make large orders and incur large transaction costs from those that make smaller orders and incur large transaction costs. Those with high transaction costs relative to their total sourcing value are the firms that could most benefit from changes in their supply networks since those costs will deplete the total value to the firm and either require them to charge higher prices or have lower profits. We will also explore transaction cost weighted by distance. It is possible that transaction costs increase if firms begin to source from further locations. In that case, the relative cost by distance is a better comparison to learn about efficiency gains.

Transportation costs measure the exact expenditure by the firm to source the good, and includes transport costs to reach the supplier, delivery costs to ship the good, and any taxes paid.

Well-measured transaction costs are essential to address the hypothesis that increasing access to supplier information increases firm's input efficiency.

Indicator of Stock-outs: Survey questions will ask firms whether they had customers ask for a product they did not have in stock. If firms indicate that customers often request goods or services which the firm does not have in stock or available, it would provide evidence that the firm is supply-constrained, and unable to source inputs well-enough to meet demand by customers. If stock-outs decrease as a result of treatment, it provides evidence that increasing network opportunities could improve availability of goods in local market areas.

Business performance index: Measurements of revenue and profits are often fraught with concern over measurement error and social desirability bias. Instead of collecting information on profits, business performance will instead focus on revenues, hours worked, number of workers, number of customers. These variables proxy for business activity and are well-measured in this setting. Variables will be aggregated into a business performance index. Firms are also asked a series of questions following McKenzie and Woodruff (2017) related to inventory and marketing management practices. Each group of questions are designed to tease out the extent to which firms employ marketing or inventory management practices in the course of running their business (refer to baseline survey in appendix for full list of questions). McKenzie and Woodruff showed that higher management practice scores are linked with higher firm productivity and higher likelihood of survival.

Prices on recent transactions: Respondents will be asked to select three or four primary goods and asked to provide the price they paid for that good. If it is a retail good, they will be asked the retail price. Otherwise, service-oriented firms will be asked the price for their most common services. Those items will then be stored and asked again during follow-up surveys in order to learn whether the firm sources or sells goods at different prices. The hypothesis is that increased contact with upstream firms and customers increases firms ability to engage in price search activities. Input and output prices will be aggregated into a firm-level price index and assessed by comparing to the control group mean and the wholesale price index collected from firms located in urban areas.

4.5 Index Construction

Index aggregation improves statistical power by testing fewer outcomes. Indices will be constructed following Kling et al. (2007) which employs a procedure that sums equally-weighted z-scores computed for each component within an index. The z-scores are calculated at the unit-level by subtracting the control group mean and dividing by the control group standard deviation. The index captures the net change for a given set of related outcomes (in this case, business performance measures, prices, and communication). The authors also suggest an imputation procedure for outcomes with missing information. It effectively fills in missing data with the treatment group mean. Non-response for sensitive outcomes (anything relating to revenues and costs) is common by small business owners in Tanzania. If missing values are common, the imputation procedure will be used and non-imputed results will be reported in the appendix.

A second approach proposed in Anderson (2008) utilizes a related standardization procedure but weights components by the inverse covariance matrix of outcomes estimated by efficient generalized least squares. It has the effect of down-weighting components with little variation across units. If some variables used for index construction have less than 10% variation in final outcomes, indices will utilize Anderson's procedure.

4.6 Other Variables

4.6.1 Controls in Treatment Effects Estimation

Adding control variables to the right-hand side of a causal inference model can improve precision of estimates by reducing the residual sampling variance. As described in Ludwig et al. (2019) and Wager et al. (2016), a machine learning algorithm can select controls among baseline covariates without biasing estimated treatment effects or foregoing other pre-specified controls. In this study, a variable for each strata will be included in estimation, baseline outcome variables (as is common in ANCOVA specifications), as well as any balance variable that is significantly different between treatment and control. A machine learning procedure described in Ludwig et al. will be used to produce a unit-level prediction index which can be added as a control variable to estimations at no cost to power (ideally improving it) while preserving typical asymptotic inference procedures.

4.6.2 Listing Priorities Index

Since the eKichabi platform is a tool that connects firms with customers and other firms located outside the local market, the baseline survey will include a set of questions designed to elicit firm preferences on where to expand their network geographically. The goal is to to differentiate firms based on their listing priorities - that is, whether a firm prefers a listing that connects them to rural communities (their downstream market) or to urban firms located in cities (their upstream market). The set of questions will ask firms to compare two geographies - one relatively near and the other relatively distant - and allocate 10 tokens between them. For example, if comparing a nearby village (relatively near) to a city (relatively far) a firm may choose 8 tokens for the nearby village and 2 tokens for the city, while another firm may prefer 4 for the nearby village and 6 for the city. The question will repeat for a set of six geographic comparisons. These comparisons will be aggregated into an index by taking the average of the number of tokens after orienting comparisons by nearest-furthest. This variable will be used as a strata variable as described in Section 2.3. Piloting this set of questions affirmed that there is variation in responses that is arguably correlated with firms' desire to expand their geographic network, an important dimension of heterogeneity.

4.6.3 Choice Experiment

An exploratory discrete choice experiment was created for baseline firms. It is designed to elicit trade-offs on four attributes of a typical sourcing contract: price, preference for new versus old suppliers, delivery terms, and provision of credit. Firms examine different pairs of contracts each with four attributes and indicate which contract they prefer. Pilot data showed that some firms have stronger attachment to their suppliers relative to others, picking a contract in which they pay a higher price in order to keep their existing supplier.

Unpacking supply chain networks is important since there is evidence that supplier-firm relationships can significantly contribute to firm productivity. Using a survey of manufacturing firms in Vietnam, Mcmillan and Woodruff (1999) found that downstream firms are more likely to obtain credit from their upstream supplier if they have fewer options because the supplier benefits from the credible threat of holding-up shipments if the downstream customer does not pay their debts. Their work confirmed the importance of business relationships in supply chains in circumstances with weak contract enforcement. But, this arrangement also reduces the downstream firms' bargaining power relative to their suppliers and it was not clear how this asymmetric power af-

fected firms ability to add new products or grow their businesses. In a similar vein, a recent paper by Brooks et al. (2018) studying microenterprise mentors showed that an important mechanisms through which mentors influenced mentee firm outcomes was by introducing them to higher quality suppliers. Results from this discrete choice experiment could shed light on these relationships but is not a primary outcome for the purposes of this pre-analysis plan.

5 Empirical Analysis

5.1 Balance Checks

Balance checks will compare key baseline covariates:

- Business characteristics: sector, firm age, number of employees
- Owner characteristics: Gender, age, education level
- Indicator for smartphone ownership
- Distance to urban center
- Number of self-reported competitors

The balance table will compare the means for the treatment groups, control group, number of observations, and t-tests for differences between the groups. Any covariate that is not balanced at the 10% level will be used as a control variable in treatment effects regressions. It will also report a joint F-test to test if balance variables as a group are different across assigned arms.

5.1.1 Attrition

Two types of attrition rates will be compared, 1) by assigned groups, and 2) by baseline covariates. The first compares differential attrition by treatment status and tests whether the difference is statistically different. Yet, the test is interpreted with caution. A simple comparison of attritors and non-attritors by assigned groups is still subject to selection bias since unobservable characteristics could drive differences in attrition. Yet, it is useful to rule out treatment-related attrition. If treatment groups have higher attrition rates, some foreseeable reasons might be if participants change their businesses in response to treatment, or perhaps learn new opportunities and migrate to another community. A related concern is if treatment-related attrition increases firm exit. For example, firms may increase their network and learn information that discourages them from investing further in their business and decide to close.

The second type of attrition rate based on baseline covariates serves to rule out selective attrition on observables. A regression with the attrition status as the independent variable and the baseline balance covariates interacted with treatment status on the right-hand side will be run along with an F-test of joint significance of regressors. If the F-test rejects the null of no difference, Lee Bounds will be estimated and reported in an appendix. If differential attrition by assigned groups and selective attrition on observables do not appear problematic, making the additional assumption that unobservables do not drive differences preserves identification of the average treatment effect (ATE) for the study population (Ghanem et al., 2019). Here, the empirical strategy estimates an intent-to-treat (ITT), which equals the ATE under the assumption of perfect treatment compliance.

Treatment related attrition and treatment-induced firm exit are minor possibilities. In the previous study, there was no differential attrition based on observables or on treatment status. And, Table 4 shows that firm exit was common but was not significantly related to treatment status. Seasonal firm closures is common in this setting as some firms pop-up to take advantage of the busy agricultural season. For better or worse, small firm entry and exit is a common element of small enterprise environment in developing countries (McKenzie and Paffhausen, 2017). With a narrow study timeline that overlaps with the agricultural season, we expect that many firms will be active during the entire period.

Table 4: Differences in Means for Closed and Open Firms in 2015 Endline Survey

	(1)		(2)		T-test
	Open		Closed		Difference
Variable	N	Mean (se)	N	Mean (se)	(1)-(2)
Treat	795	0.574 (0.018)	95	0.589 (0.051)	-0.016
Female Owner	778	0.162 (0.013)	95	0.158 (0.038)	0.004
Age	778	39.532 (0.403)	95	40.253 (1.039)	-0.720
Education	778	3.132 (0.052)	95	2.537 (0.130)	0.596***
Rural	795	0.868 (0.012)	95	0.937 (0.025)	-0.069*

Notes: The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

5.2 Treatment Effects

5.2.1 Intent to Treat

To estimate the causal effect of treatment on the outcome variables, we will run ANCOVA specifications. ANCOVA improves precision of estimates by including baseline values of outcome variables as controls in regressions. It is particularly useful in settings where outcome variables exhibit constant auto-correlation and are measured with noise. Presenting post-treatment data from numerous randomized evaluations with firms, McKenzie (2012) shows that auto-correlation of firm profits in Ghana and Sri Lanka are relatively constant, falling between 0.2 and 0.4. He finds that ANCOVA is preferred to differences-in-differences specifications for constant auto-correlation below 0.5.

To estimate the Intent to Treat (ITT) causal effect, the following ANCOVA specification will be used:

$$Y_{it} = \alpha + \beta_1 T_i^{US} + \beta_2 T_i^{DS} + \gamma Y_{i,t=0} + \delta BLMiss_{i,t=0} + \theta X_{it} + \lambda_t + \epsilon_{it} \quad (1)$$

Y_{it} represents the outcome variable of interest, T^{US} and T^{DS} are the treatment indicator variables that represent whether firms were assigned to the upstream or downstream treatment groups. The intent to treat estimates are identified by β_1 and β_2, and are interpreted as the effect of being assigned to either upstream (β_1) or downstream (β_2) treatments on the outcome of interest. To compare treatment arms, a test of $\beta_1 \neq \beta_2$ will be conducted for each specification to determine whether the two treatment arms had significantly different outcomes.

The subscript t indexes event time and is set to zero for the baseline value. $Y_{i,t=0}$ are the baseline values of the dependent variable and $BLMiss_{i,t=0}$ denotes values that are missing at baseline due to firm non-response. Including the 'missing at baseline' variable allows the ITT estimate to keep any firms which do not provide answers to specific questions during baseline rather than dropping them, which would be the case under a differences-in-differences specification. The vector X_i will be used to control for covariates that are imbalanced after randomization, as well as randomized strata dummies, and the machine-learning produced index. The term λ_t captures any survey-specific time shocks.

The ITT will be reported as the primary treatment effects of interest. An ITT estimate is useful to understand how treatment assignment causes changes in outcomes. In some cases, experimental research also reports estimates of the average treatment on treated (ATT) or local average treatment effect (LATE) using measures of treatment uptake among units assigned to treatment.

However, here 'uptake' can be measured through two separate channels. First, if the assigned firm engages in *search* on the eKichabi platform. Second, if the assigned firm is *found* on the eKichabi platform. As a consequence, it is not possible to separate these two channels using one instrument (treatment assignment) because engaging in search and being found have different consequences for firm outcomes.

This dual nature of the platform (firms can both search and be found) has consequences for interpreting the average treatment effect (ATE) as well. An ITT estimate is equivalent to the ATE under perfect compliance. That is, no units in the control group are treated and no units in the treatment group refuse. Here, the research team manages the firm listing on the application platform so that treatment compliance is guaranteed and all firms and consumers can access a version of the platform (the version assigned by the research team). But, not all firms are guaranteed to be found in searches by consumers nor will all firms choose to search within the platform itself. The treatment assignments are designed to exogenously increase the probability that a firm engages with either their upstream input market or their downstream output market. Therefore, an ITT estimate best captures the most relevant treatment effect under these experimental conditions.

5.2.2 Spillovers

Randomization at the unit-level requires that the stable unit treatment value assumption (SUTVA) holds, implying that there are no spillovers between units in different treatment conditions. As in any unit-level randomization, theoretical spillovers are possible and steps should be taken to verify that they are minimal. There are two sources of spillovers in this experimental design - extensive margin (required to be minimal by SUTVA) and intensive margin (a deliberate feature of the experimental design).

The first is an extensive margin spillover (externality) between firms within the same village. For example, a negative externality would occur if being listed in eKichabi drives treated firms to deprive non-treated firms of market share. The previous study employed a spillover randomization design and did not find any evidence that non-treated firms were worse off as a result of having their directory listing delayed. This study design opted to not explicitly test for inter-firm spillovers. After the study ends, all firms will be listed in the platform so that any potential gains driven by exclusivity in the eKichabi platform are temporary and will be bid away once the full sample is listed.

A positive externality on non-listed firms would occur if changes to the bargaining or demand

structure of listed firms also improved bargaining or aggregate demand for non-listed firms. For example, if a firm's connection to upstream suppliers leads them to access lower prices and firms in their neighborhood also gain access to those lower prices or better market terms. Ruling out this type of spillover requires assuming that firms internalize benefits of being listed on eKichabi. In other words, since firms operate in a competitive environment, their private gains are not shared with their neighbors. As a check, firms will be asked if they source inputs in a group to provide evidence that firms do not engage in collective bargaining.

The second type is an intensive margin spillover within firms themselves. The first set of ANCOVA estimations examine the intensive margin spillover by comparing a shared group of outcomes for different treatment statuses. If a firm that was targeted for upstream treatment also boosts their downstream market contact, it suggests that the upstream treatment had a positive externality for downstream activities of the same firm. As an example, a firm in the upstream treatment arm meets a new supplier and begins to source a new product that increases the total number of customers. The research is designed to capture intra-firm spillovers and it is in fact a part of the research question.

5.3 Heterogeneous Effects

There are three groups of interest for heterogeneous treatment effects - retail and service-oriented firms, gender of the firm owner, and firm location.

5.3.1 Retail and Service Firms

Retail firms are an important sector of interest because they are more likely to trade frequently with input suppliers located in urban areas. Common retail firms in this setting include sellers of staple grains and other foodstuffs, clothing, and pharmacies. They also constitute the majority of small businesses in rural areas. The other major subgroup of businesses are service-oriented, usually in skilled trades (tailors, welders, mechanics, etc). Many of these skilled trades businesses are less likely to source materials at regular intervals compared to retail firms. Many service-oriented firms produce relatively similar goods, but may differentiate themselves based on quality more so than retail firms and may be more likely to be found in customer searches.

5.3.2 Gender

Women-owned enterprises constitute an important subpopulation of businesses since women are less likely to access capital and more likely to face legal and labor market discrimination (Campos and Gassier, 2017) and may crowd into less profitable sectors (Hardy and Kagy, 2018). We anticipate that 15-20% of the sample will be women-owned enterprises. Part of the reason that a gender-based profit gap may exist is because women are less likely to access new business networks. In the previous sample, women are over-represented among small street vendors and underrepresented among large wholesalers. Examining differences in treatment outcomes based on gender will provide information about the extent to which women-owned businesses are more or less likely to engage in search behavior or build new business partnerships.

5.3.3 Location

Firms located in rural areas face higher transaction costs and are less likely to access new technology. Comparing firms based on their location will provide information about how these transaction costs attenuate potential gains from new technology. For example, in a similar setting, Aggarwal et al. (2018) used structural estimation techniques to find that a one standard deviation increase in travel time corresponds to a 20-25% lower input adoption rate and output sales among farmers in remote areas. The main hypothesis for this setting is that increasing access to contact information could improve rural firms' ability to source and sell goods and services. However, as distance from the main goods-exporting urban centers increases, gains to new information could remain lower than the costs of acquiring those goods.

5.4 Standard Error Adjustments

Standard errors will be clustered at the strata level. As a robustness check, p-values will also be computed by using randomization inference (Athey and Imbens, 2017). Randomization inference is similar to a resampling strategy like bootstrapping. But instead of resampling to improve finite sample inference, randomization inference re-assigns treatment and re-estimates treatment effects under the placebo assignment. Iterating through different placebo treatment assignments generates a distribution of treatment estimates. The probability that a value as large as the actual treatment effect is computed and that becomes the pvalue for that hypothesis. Similar to finite sample inference, only pvalues below 0.10 percent threshold will be noted as significant findings. Randomization

inference is useful in settings with relatively few clusters. Here, unit-level randomization allows us to employ standard finite sample inference procedures. Randomization inference allows iterating over clusters and within clusters, which is useful as a placebo test to check whether village-level differences drive differences.

5.5 Multiple Hypothesis Testing

Multiple hypothesis testing will be employed using family-wise error rate following Benjamini and Hochberg (1995) by setting the false discovery rate to 5%. Primary outcomes will be grouped by family according to whether they pertain to business communication in upstream and downstream markets. Secondary outcomes will not use multiple hypothesis test corrections because outcomes do not sort into groupings. This plan specifies that the indices will be used for measures of business performance, prices, and communication. One purpose for this is that fewer tests are required, reducing the likelihood of a false positive. Q-values will be reported following Anderson (2008). Similarly, heterogeneous treatment effects will use multiple hypothesis corrections for primary outcomes within each subgroup, but will not correct across subgroups.

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eKichabi Baseline Survey

Do you consent to participate?

- ◯ Yes
- ◯ No

Firm Enrollment

Region

_____

District

_____

Ward

_____

Village

_____

Subvillage

_____

What is your name?

_____

Are you the owner?

- ◯ Yes
- ◯ No
- ◯ Chairperson

If not, can you confirm that the owner gives permission?

NOTE: Let the respondent decide whether they have permission to list the business. Sometimes, they feel ready to list without directly talk to the owner. Others prefer to call. Wait with them while the call. Feel free to talk on the phone with the owner and tell them about the project to get permission. If someone prefers to talk first, offer to call in a few days to confirm. In this case, encourage them to proceed with the survey.

- ◯ Yes
- ◯ Call back for permission

Gender of the owner

- ◯ Female
- ◯ Male

Firm Name

NOTE: Please help the respondent choose an appropriate business name. We will not accept first and last name (in part to protect privacy). Instead, ask them to come up with a name. It can be simple like a Asha Shop or Johny Boda.

_____

Phone Number

_____

Network

- ◯ Airtel
- ◯ Vodacom
- ◯ Tigo
- ◯ Halotel
- ◯ TTCL
- ◯ Other

Specify other network:

_____

Phone of owner or manager?

- ◯ Owner
- ◯ Manager

Sector

- ◯ Wholesale
- ◯ Retail
- ◯ Transport
- ◯ Hiring and Labor
- ◯ Agri Processing
- ◯ Repairs
- ◯ Non-Agri Services
- ◯ Financial Services

Subsector

Specify other subsector:

The respondent may choose from 1-3 crop or livestock. If none, select 'none.'

- [ ] None
- [ ] Maize
- [ ] Rice
- [ ] Beans/legumes
- [ ] Fruits
- [ ] Vegetables
- [ ] Cereals
- [ ] Groundnuts
- [ ] Sunflower
- [ ] Sesame
- [ ] Grapes
- [ ] Charcoal
- [ ] Forestry
- [ ] Other crop
- [ ] Cow
- [ ] Butchered meat
- [ ] Milk
- [ ] Goat
- [ ] Chicken
- [ ] Eggs
- [ ] Fish
- [ ] Other livestock

Specify other crop:

Specify other livestock:

What year did this business start?

Note: Enter date in format YYYY. If this year, write 2019.

_____

Firm Size

(Include the respondent)

_____

Gender of the respondent

- ◯ Female
- ◯ Male

Age

_____

What was the highest level of schooling the owner achieved?

- ◯ No School
- ◯ Primary School (Incomplete)
- ◯ Primary School (Completed)
- ◯ Secondary School (Incomplete)
- ◯ Secondary School (Completed)
- ◯ Vocational training / adult literacy
- ◯ University (Completed)

Does the firm have a second phone number?

- ◯ Yes
- ◯ No

Secondary Phone Number

_____

Second Network

- ◯ Airtel
- ◯ Vodacom
- ◯ Tigo
- ◯ Halotel
- ◯ TTCL
- ◯ Other

Specify other network:

_____

Phone of owner or manager?

- ◯ Owner
- ◯ Manager

General Business

Since May of last year, was this business open every month?

NOTES: Some examples of seasonal businesses: Businesses that buy and sell agricultural products, hotels, restuarants, people taking advantage of the busy period (such as dalali that buy maize crops).

- ◯ Yes, operated all year
- ◯ No, only some months

If no, how many months out of 12 was this business open?

Write 1-11.

_____

Over the past month, on how many days of the week has this enterprise operated, on average?

NOTE: If someone works at a gulio or mnada once per week, they would say that they only operate one or two days per week. Some mnada or gulio workers travel around each week.

_____

Over the past month, on average, how many hours per day did this enterprise operate?

_____

Does this enterprise have regular access to electricity at an office/storefront?

NOTE: We want to know whether the business has electricity access most days of the week. It may include solar, a generator, or Tanesco electricity.

- ◯ Yes
- ◯ No

Do you operate any other businesses?

- ◯ Yes
- ◯ No

If yes, how many other businesses?

_____

If yes, which sector?

- ☐ Wholesale
- ☐ Retail
- ☐ Transport
- ☐ Hiring and Labor
- ☐ Agri Processing
- ☐ Repairs
- ☐ Non-Agri Services
- ☐ Financial Services

Phone Usage

Over the past two days (not including today), how many business-related phone calls did you *receive* on this phone number (including missed calls)?

_____

[ENUMERATOR: Please check 'yes' if you were able to confirm by counting on the phone]

- ◯ Yes
- ◯ No

Of those calls, how many were from *customers*?

_____

Of those calls, how many were from *suppliers* or business service providers?

_____

Over the last two days, how many *missed* calls did you receive with this phone number?

_____

How many phone calls did you *make* over the last two days to *customers*?

_____

How many phone calls did you *make* over the last two days to *suppliers* or business service providers?

_____

How many business-related *texts* did you *receive* over the last two days, using this phone number?

_____

How many business-related *texts* did you *send* over the last two days, using this phone number?

_____

In the past month have you used any mobile money services to receive or make payments to *customers*?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

In the past month have you used any mobile money services to receive or make payments to *suppliers*?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

Phone Voucha (any)

_____

Do you have a smart phone?

- ◯ Yes
- ◯ No

Costs and Employment

Does this business have any paid employees at present?

NOTE: Employees NOT INCLUDING the owner

- ◯ Yes
- ◯ No

How many paid workers provided work to this business over the last month (excluding the owner)?

_____

What was the total paid for employee costs over the last month?

_____

Does this business have any unpaid employees at present?

(Including family members that are not directly paid a wage or salary)

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

How many unpaid workers provided work to this business over the last month (excluding the owner)?

_____

Sales and Customers

Over the previous week for this business (excluding today), did you make any sales?

- ◯ Yes
- ◯ No

On the most *recent day* that the firm was open (excluding today), how many sales transactions took place?

_____

On the most *recent day* that the firm was open, what were total sales?

_____

Now, over the past month, think of the *best day* of business that you had. What were sales on that day?

_____

Over the past month, think of the *worst day* of business that your had. What were sales on that day?

_____

Over the past month, think of an *average day* of business that you had. What were sales on that day?

_____

Over the previous week for this business, were any sales made on credit?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

What was the total value of sales on credit over the previous week?

_____

Over the past month, have any customers come to your business looking to purchase an item that you did not have in stock at that moment?

[NOTE: This question refers to items that the firm normally has in stock]

- ◯ Yes
- ◯ No

» If yes, what were the most-requested items? (List up to three, in order of importance)

Item 1

_____

Item 2

_____

Item 3

_____

How many businesses in your village offer the same service as you?

_____

Over the past week, from which places did customers come and make purchases?

[NOTE: Check all that apply]

- [ ] This subvillage
- [ ] This village
- [ ] Surrounding villages in this ward
- [ ] Villages from this district
- [ ] Dodoma City
- [ ] Singida City
- [ ] Other

Specify other location:

_____

Of those, which was the most important source of customers?

[Choose only one]

- ◯ This subvillage
- ◯ This village
- ◯ Surrounding villages in this ward
- ◯ Villages from this district
- ◯ Dodoma City
- ◯ Singida City
- ◯ Other

Business Practices

» Buying and stock-control

In the last three months have you attempted to negotiate with a supplier for a lower price on raw materials?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

If yes, were you successful in obtaining a lower price?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

In the last three months, have you compared the prices or quality offered by alternate suppliers or sources of raw materials to the supplier or source you have?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

How frequently do you run out of stock of these inventories or raw materials?

- ◯ Never, I always have enough on hand
- ◯ Infrequently, every 6 months or so
- ◯ Once every three months
- ◯ Once a month
- ◯ Once every 2 weeks, or more than once per two weeks

How long does it take to obtain goods for which you have run out of stock?

- ◯ One day or less
- ◯ More than a day, less than a week
- ◯ One week
- ◯ More than a week, less than a month
- ◯ A month or more

» Marketing

Over the last three months, have you visited one of your competitor's businesses to see what prices they are charging?

- ◯ Yes
- ◯ No
- ◯ No competitors/NA

Over the last three months, have you visited one of your competitor's businesses to see what products they have available for sale?

- ◯ Yes
- ◯ No
- ◯ No competitors/NA

Over the last three months, have you asked your existing customers whether there are any other products they would like you to sell or produce?

- ◯ Yes
- ◯ No

Over the last three months, have you lowered the price for a customer that purchased a *large quantity* of goods or services?

- ◯ Yes
- ◯ No

Over the last three months, have you lowered the price for a customer that purchases frequently (about once a week or more)?

- ◯ Yes
- ◯ No

In the last three months have you used a special offer to attract customers?

- ◯ Yes
- ◯ No

In the last six months, have you done any form of advertising?

- ◯ Yes
- ◯ No

Suppliers and Business Services

Over the past three months, has this business purchased inputs from the same suppliers?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

If no, why not?

Choose one answer:

- ◯ I purchase from an mnada/gulio, from different sellers
- ◯ I purchase from the main market in town, but different suppliers each time
- ◯ I purchase from different suppliers each time
- ◯ I do not regularly purchase inputs for this business
- ◯ Other

Explain other

_____

From which locations?

- ◯ This village
- ◯ Surrounding village
- ◯ Dodoma City
- ◯ Singida City
- ◯ Other
- ◯ Not sure

Specify location

Choose one or multiple answers:

_____

» Supplier Network

Think of all of the suppliers of goods and services that you've contacted in the previous 3 months. Can you tell me the names or location?

Supplier 1

_____

What Year did you first meet as a supplier?

yyyy _____

What is their business sector?

- ◯ Goods wholesaler (the interviewee buys in bulk)
- ◯ Intermediate retailer (the interviewee buys at retail prices)
- ◯ Fundi
- ◯ Transporter
- ◯ Financial Services
- ◯ Other

Specify other sector:

_____

Have they ever sold you goods or services on credit?

- ◯ Yes
- ◯ No

Where is their business located?

- ◯ This village
- ◯ Surrounding village
- ◯ Dodoma City
- ◯ Singida City
- ◯ Other
- ◯ Not sure

Specify other location:

_____

How did you first meet this supplier?

- ◯ They are a friend or family member
- ◯ Through a friend/family member
- ◯ Through a business collegue
- ◯ They came to my village
- ◯ I went to their location in another village/city
- ◯ Through flyers
- ◯ Other

Specify other meeting:

_____

Do you have their phone number?

- ◯ Yes
- ◯ No

We would like to invite many businesses to join eKichabi. Can you share their phone number so that we can invite them to join?

- ◯ Yes
- ◯ No

Write phone number:

_____

How do you usually contact them?

Choose up to three:

- [ ] I travel to their business as needed
- [ ] I travel to their business on a fixed schedule
- [ ] They pass through this village at irregular intervals
- [ ] They pass through this village on a fixed schedule
- [ ] I call them to have items shipped
- [ ] Other

Specify other contact:

_____

What was the value of the supplies that you purchased?

[Note: Includes purchase of inventory, inputs, and any services that were business-related. An answer of '0' implies that the business made literally no purchases over the past 6 months to support their business]

_____

» » Most recent purchase

How many suppliers did you communicate with?

[Note: Includes phone calls and face-to-face interaction. Should be at least one if the respondent has purchased any inputs over the last 6 months]

_____

How many suppliers did you purchase from?

_____

Did you pay any transportation costs to obtain these goods or services?

[Note: Make sure to ask if the respondent travelled and include their bus fare]

- ◯ No, I purchased from a seller located in town
- ◯ No, other reason
- ◯ Yes, I paid for my travel costs to another village/town
- ◯ Yes, I paid for my travel costs (bus only)
- ◯ Yes, I paid for goods to be shipped to my location
- ◯ Not sure/Does not know

Explain other reason:

_____

What was the total amount paid for transportation costs?

_____

Did any of your suppliers give you credit for this purchase?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

What was the total value of purchases on credit?

_____

How many days did it take from start to finish to complete this transaction?
[Note: The first day is when the respondent first planned to make a purchase and the last day is when the goods arrived to their location]

_____

Did this business buy these goods collectively in a group?

- ◯ Yes
- ◯ No
- ◯ Don't Know/Not Sure

If yes, how many are the group?

_____

Input and Output Prices

Please choose the most common items that you are currently selling (up to four):

- ☐ Rice - middle grade
- ☐ White ugali flour
- ☐ Beans
- ☐ Sugar
- ☐ Maize grain
- ☐ Water

Please choose the most common items that you are currently selling (up to four):

- [ ] Water
- [ ] Soda
- [ ] Juice
- [ ] Beer

Please choose the most common items that you are currently selling (up to four):

- [ ] Tomato
- [ ] Banana
- [ ] Onion
- [ ] Spinach
- [ ] Irish potato
- [ ] Sweet Potatoes

Please choose the most common items that you are currently selling (up to four):

- [ ] Maize grain
- [ ] Rice - middle grade
- [ ] White ugali flour
- [ ] Beans
- [ ] Tomato
- [ ] Banana
- [ ] Onion
- [ ] Spinach
- [ ] Irish potato
- [ ] Sweet Potatoes

Please choose the most common items that you are currently selling (up to four):

- [ ] Women's Shirt
- [ ] Men's Shirt
- [ ] Dress
- [ ] Skirt
- [ ] Men's pants
- [ ] Men's suit
- [ ] School Uniform

Please choose the most common items that you are currently selling (up to four):

- [ ] Rice with beans
- [ ] Rice with meat
- [ ] Ugali with beans
- [ ] Ugali with meat
- [ ] Rice with Fish
- [ ] Beans only
- [ ] Chapati
- [ ] Beef Soup
- [ ] Fries
- [ ] Fries with egg
- [ ] Meat Skewer

Please choose the most common items that you are currently selling (up to four):

- [ ] Shave child's hair
- [ ] Shave man's hair
- [ ] Hair straighten
- [ ] Hair plait
- [ ] Wash hair

Please choose the most common items that you are currently selling (up to four):

- [ ] Paracetomal
- [ ] Amoxicillin
- [ ] Diclopar
- [ ] Mifupen
- [ ] Piriton
- [ ] Mucolyn

Please choose the most common items that you are currently selling (up to four):

- [ ] Print
- [ ] Photocopy
- [ ] Small envelope

Please choose the most common items that you are currently selling (up to four):

- [ ] Fertilizer
- [ ] Pesticide
- [ ] Maize seed
- [ ] Other seed
- [ ] other

What are the four most common products or services you sell? [Or, select from pre-specified list for certain sectors]

Good/service1

_____

Good/service2

_____

Good/service3

_____

Good/service4

_____

» Selling Price Detail

What was the price in your *most recent sale* of ?

Selling price :

_____

Units - :

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity - :

_____

Explain type of good - :

_____

Specify other units - :

_____

» Selling Price Detail

What was the price in your *most recent sale* of ?

Selling price

_____

Units

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity - :

_____

Explain type of good - :

_____

Specify other units - :

_____

» Selling Price Detail

What was the price in your *most recent sale* of ?

Selling price

_____

Units

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity - :

_____

Explain type of good- :

_____

Specify other units- :

_____

» Selling Price Detail

What was the price in your *most recent sale* of ?

Selling price:

_____

Units:

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity - :

_____

Explain type of good - :

_____

Specify other units - :

_____

» Buy

» » Buying Price Detail

What was the most recent price that you purchased ?

Buying price

_____

Units

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity - :

Specify other units - :

» » Buying Price Detail

What was the most recent price that you purchased

Buying price

_____

Units

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity- :

_____

Specify other units- :

_____

» » Buying Price Detail

What was the most recent price that you purchased

Buying price- :

_____

Units- :

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity- :

_____

Specify other units- :

_____

» » Buying Price Detail

What was the most recent price that you purchased

Buying price

_____

Units

- ◯ Unit
- ◯ Bucket
- ◯ Large Sack
- ◯ KG
- ◯ Meter
- ◯ Inches
- ◯ Liter
- ◯ Box
- ◯ Carton
- ◯ Dozen
- ◯ Plate
- ◯ Head
- ◯ Distance - km
- ◯ Time - hours
- ◯ Other

Quantity - :

_____

Specify other units - :

_____

How much is bus fare from this village to Dodoma (one way)

_____

» Choices

Next, I'd like to learn more about how businesses evaluate the value of contracts with suppliers and customers. First, I'll show you two cards. Each card has different characteristics of supplier contracts. After looking at each contract, let me know which would be preferred.

Choice A

- ◯ Card 1
- ◯ Card 2

Doesn't want either

- [ ] Doesn't want either

Choice B

- ◯ Card 3
- ◯ Card 4

Doesn't want either

- [ ] Doesn't want either

Choice C

- ◯ Card 5
- ◯ Card 6

Doesn't want either

- [ ] Doesn't want either

Choice D

- ◯ Card 7
- ◯ Card 8

Doesn't want either

- [ ] Doesn't want either

Choice E

- ◯ Card 9
- ◯ Card 10

Doesn't want either

- [ ] Doesn't want either

Choice F

- ◯ Card 11
- ◯ Card 12

Doesn't want either

- [ ] Doesn't want either

» Choices

Next, I'd like to learn more about how businesses evaluate the value of contracts with suppliers and customers. First, I'll show you two cards. Each card has different characteristics of supplier contracts. After looking at each contract, let me know which would be preferred.

Choice G

- ◯ Card 13
- ◯ Card 14

Doesn't want either

- ☐ Doesn't want either

Choice H

- ◯ Card 15
- ◯ Card 16

Doesn't want either

- ☐ Doesn't want either

Choice I

- ◯ Card 17
- ◯ Card 18

Doesn't want either

- ☐ Doesn't want either

Choice J

- ◯ Card 19
- ◯ Card 20

Doesn't want either

- ☐ Doesn't want either

Choice K

- ◯ Card 21
- ◯ Card 22

Doesn't want either

- ☐ Doesn't want either

Choice L

- ◯ Card 23
- ◯ Card 24

Doesn't want either

- [ ] Doesn't want either

List Priorities

For each option, allocate tokens according to the choice that you most prefer.

As you know, the eKichabi app connects buyers and sellers of goods. We would like to learn more about which type of businesses contacts you are most interested to make. I'm going to give you these 10 tokens and this card. Each card contains 2 options. For each option, allocate tokens to the choice that you most prefer. Since there are 10 tokens, you may divide them according to the strength of your preference. For example, 10 tokens in column A and 0 in the other column B would indicate that you have a strong preference for Column, while 5 tokens on each column would indicate that you equally prefer promotion for the groups in Column A and Column B. And, you can do any split that you want, such as 6 and 4, 7 and 3, 8 and 2, etc.

Suppliers

_____

Customers

_____

Compare:

Dodoma

_____

Nearby village

_____

Compare:

This village

_____

Nearby village

_____

Compare:

Dodoma

_____

Nearby Village

_____

Compare:

Dodoma

This village

Compare:

Bahi Sokoni

Dodoma
