Competition and Cooperation in Small Firm Networks: Evidence from garment makers in Ghana

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This document describes the analysis plan for the paper with the working title "Competition and Cooperation in Small Firm Networks: Evidence from garment makers in Ghana". This draft was completed and registered prior to the collection and analysis of any follow-up data and therefore provides a useful reference in evaluating the final results of the study.

The plan is outlined as follows: Section 1 presents the motivation, context, sample selection, and experimental design, Section 2 describes the data, Section 3 discusses the specifications to be used in analyzing the data, and Section 4 enumerates the hypotheses to be tested.

1 Introduction

Social networks influence a wide variety of economic and behavioral outcomes. In poor countries, where the flow of information is more limited, formal institutions are often lacking, and markets for credit and insurance may be missing, network connections can be especially economically significant.

Empirical research on firm-level network connections in developing countries has focused to date primarily on agricultural technology adoption. Several influential papers document that in the context of agricultural commodities, social networks can be leveraged to increase technology adoption, agricultural yields, and ultimately incomes (e.g. Bandiera and Rasul, 2006, Conley and Udry, 2010, Foster and Rosenzweig, 1995).

Transferring these findings to other income generating contexts is complicated by the fact that many manufacturing and services firms compete more directly over local demand (which is essentially fixed in the short term) than communities of agricultural producers compete given a wider market or world price. This direct competition puts potentially profit increasing functions of firm-level networks in conflict with co-insurance functions of firm-level networks. As Barr (1998) observes, networks maintained primarily to address uncertainty and income variability generate greater positive spillover effects, but limit the potential for network connections to improve firm performance. The co-insurance motive may also actually limit competitiveness within a network, as firm owners prefer to maintain co-insurance relationships rather than aggressively compete and alienate potential risk sharing partners.

Small and micro enterprise owners in Ghana, and throughout the developing world, maintain complex network relationships within their industries. Our sample, the universe of garment making firm owners in a single mid-size town in the Volta Region of Ghana, is no exception. Baseline data reveals patterns of skill sharing, information sharing, productive input sharing, and outsourcing that suggest these firm-level networks serve an important co-insurance function.

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In this experiment, a random subset of our sample will receive training in a new fashion style. Training will include a technical component, discussion of marketing the new style, and marketing materials. Leveraging baseline heterogeneity in the number and nature of network connections, in combination with the randomized experiment, we seek to characterize the nature of network relationships in our context and measure the effects of different types of relationships on firm performance.

Ex-ante, the overall predictions are ambiguous, but broadly we hypothesize that we will observe both positive direct effects of training on income and positive indirect/spillover effects of training on the income of trained firms' network connections. In addition, we expect these positive spillover effects to be strongest (1) for network connections with a history of skill sharing, (2) in the later weeks of the follow-up panel, and (3) for competition-distant network connections. In addition, we hope to document negative spillover/competition effects of training on firms that are close competitors of trained firms but not co-insurance network connections. Documenting the dynamic ability of trained firms to capitalize on any competitive advantage associated with the new style in the early period, and whether/how that competitive advantage dissipates due to co-insurance skill-sharing norms is a key ambition of this study.

Focus groups and qualitative interviews before the design of the experiment revealed that skill-seeking behavior may be an important skill diffusion channel, as the norm among skill-sharing partners requires positive response to requests for skill-sharing but not proactive/preemptive skill-sharing. Consequently, the experiment will also randomize a subset of the sample to receive information and marketing material about the fashion style, but not direct technical training. We expect these firm owners to seek technical instruction from skill-sharing network connections. More skill-sharing to informed (but not trained) firms would be evidence that the co-insurance mechanism functions imperfectly, where the ability to hide a new competitive advantage allows firm owners to retain that advantage longer.

Finally, we will measure whether spillover effects flow through direct sales, or indirectly through outsourcing, which have potentially different implications for the overall effects of network relationships on total income and income variability.

1.1 Context

Bespoke garment making (made to an individual buyer's size and specification) is ubiquitous in sub-Saharan Africa. Typically garment makers are trained in the skill informally, and while a small portion end up working part of their careers in large garment making factories, most run their own small firms. The typical production technology uses a combination of foot-crank sewing machines, hand sewing and cutting, and electric-powered specialty machines (e.g. embroidery, overlock). Many small firms rent a space, though others work from home, and many own only a foot-crank sewing machine (and outsource other specialty needs). The capital costs to enter the business are consequently relatively low. Customers tend to provide their own fabric, with thread, buttons, and lining provided by the garment makers, and typically all orders are custom (so working inventory is limited). The owner's own labor and sometimes low-paid apprentice labor or better-paid contract labor are thus the highest cost input items.

With relatively little movement on production technology and input prices in the short-term, garment makers compete over (mostly local) customers through reliability, pricing and style. Garment makers in our sample (and in other work with garment makers in Ghana) report style to be the most important determinant of customer diversion and retention. Importantly, style is not a fixed trait. Rather, new tweaks to the fit of garments, add-on pieces of flare, new sleeve or embroidery designs, and different types of pleating or cut-outs become popular and highly requested

trends.

Individual garment makers can become known in the area for being inventive with design, or more typically, new styles in Ghana are designed in Accra and distributed around the country via biannual fashion calendars. These calendars are then hung in garment maker shops and referenced by customers when making garment orders. In our data and qualitative interviews, not knowing a demanded style is a common way to lose a customer to another garment maker.

Network connections between garment makers arise organically through proximity, come from relationships built during informal apprenticeship training, and are facilitated by district level craft associations. Most garment makers report that learning new styles is the primary reason to maintain contacts within the industry, though garment makers also sometimes share workers or capital, outsource orders (or pieces of orders) to each other, and provide other advice.

1.2 Sample

In early 2014, we conducted a thorough census activity, which attempted to identify every garment making firm owner in Hohoe, a mid-size town and the district capital of Hohoe District, in the Volta Region of Eastern Ghana (bordering Togo). The census activity used several different field based research methods for identifying the universe of self-employed garment makers, including referral from the local garment making business association, snowball sampling, canvassing on foot, and random inquiry at a sample of households in each settlement.

Nearly all firms identified in the census activity then participated in the baseline survey mapping several types of network relationships between firms. Inclusion of the full sample in the survey and asking about the full network are important, as recent research has shown that data from a randomly sampled portion of a network can ambiguously bias results (Chandrasekhar and Lewis, 2014).

The full sample in Hohoe town (and an adjoining suburb, Gbi) consists of 445 garment making firm owners, with 99 men and 346 women. 348 of the firm owners in our sample report that their garment making business is their primary economic activity and the mean monthly profits are 218 Ghana Cedis (approximately 70USD at the time of the census activity).

1.3 Experimental Design and Randomization

The randomization is stratified by gender and assigns 15 men and 52 women (15% of each gender strata) to the training group, and 15 men and 52 women (15% of each gender strata) to the information/marketing group. Gender in our context is highly correlated with network degree, profitability, firm size, and several other baseline characteristics, making it prudent to stratify along this observable. In addition, stratifying on gender will ensure that we can also study heterogeneous effects by gender, something suggested by past research on gender differences in competitiveness (Gneezy, et al., 2009, Niederle and Vesterlund, 2005). We will measure network/spillover treatment balance using a specification similar to the following:

$$B_i = \beta_0 + \beta_1 NT_i + \beta_2 NM_i + \beta_3 NF_i + \epsilon_i$$

where B_i is the baseline characteristic of a given firm, NT_i is the number of firm i's network connections assigned to the direct treatment group, and NM_i and NF_i are the number of firm i's total male and female network connections in Hohoe. We expect β_1 to be insignificant and close to zero for all or nearly all baseline observables.

The fashion style we study is called Sharawakil, and involves some intricate twisting of thread to make thicker, woven thread that can be used to create stunning additions to any garment. The

style was developed by a designer in Accra and the technology for creating it (a tiny weaving machine he has constructed from readily available market items that can be easily replicated with instruction) will only be shared with those randomly selected to attend the training. Training treatment firms will also receive a calendar (print advertisement), which depicts men, women, and children modeling different uses of Sharawakil. Calendars in our context are typically hung in the store front of garment making shops as advertisement, and referred to by customers in placing orders. Information treatment firm owners will receive the calendar but not the training.

2 Data

2.1 Census

The census was primarily intended to identify the sample, but also includes measures of profits and sales, GPS information, firm size, firm age, firm owner ethnicity, and owner years of schooling.

2.2 Baseline Survey

The baseline data includes updated basic firm and firm-owner characteristics, including profits, sales, educational background, firm age, and firm size. In addition, it includes a full map of the various network connections between the garment makers in the area. These relationships include gift and loan giving, skill sharing, labor sharing, equipment sharing, price discussions, customer referrals, mentorship, and outsourcing. Firm owners also answered subjective questions about each network connection on relative experience, relative business size, relative work quality, overlap in specialization, and perceived competition for customers.

2.3 Pre- and Post- Panel

Weekly repeated data will be collected for 1 pre-period and 7 post-periods from the date of the training and information intervention. Together these amount to three pre-intervention measures of profits, one pre-intervention measure of network connection, and 7 post-intervention measures of both firm performance and network activity.

The weekly data will collect hours, sales, profits, cost of inputs, prices, and demand for the new style at the firm level. The network activity section will indirectly measure whether the firm owner knows of the style, whether the firm owner knows how to do the style, and from whom did the firm owner gain this information or skills. In addition, it replicates measures of network activity captured in the baseline, including loan giving, skill sharing, labor sharing, equipment sharing, customer referrals and outsourcing[1].

2.4 Customer Survey

Additionally, we will be conducting weekly market research surveys on randomly sampled market-goers from close to each shop. The repeated cross-section will include about 320 surveys per week and collect data on knowledge of the new style, as well as customer diversion between garment making firms.

[1]Note that surveys are still in the field so survey attrition information is not yet available.

3 Specifications

3.1 Direct effect of Training

First, we will estimate whether the training has any measurable direct effects on sales, profits, and other firm level outcomes. Following McKenzie (2012), an ANCOVA specification which stacks the seven post-intervention observations and controls for the mean of the outcome variable in the three pre-intervention rounds is higher power than a difference-in-differences specification if auto-correlation in the outcome variable exceeds 1/# of pre-treatment observations+1 (which is 1/4 or 1/2 in our case, depending on the outcome variable).

While hours and garments produced are likely to have a high enough auto-correlation to justify a differences-in-differences approach, our main outcome variables (sales and profits) are likely to have relatively low auto-correlation. Thus, we anticipate our main specification will be as follows:

$$Y_{it} = \beta_0 + \beta_1 T_i + \beta_2 \bar{Y}_i + \eta_t + \epsilon_{it}$$

where Y_{it} is the outcome variable in round t, $\bar{Y}_i$ is the mean of the outcome variable in any pre-treatment rounds for which we have an observation, T_i is training treatment assignment, and η_t are round dummies. Additionally, we will run tests to determine whether effects are constant across rounds, specifications by round, and specifications which include a vector of other controls.

3.2 Spillover Effects

The main network effects will be measured using specifications of the following form:

$$Y_{it} = \beta_0 + \beta_1 NT_i + \beta_2 NI_i + \beta_3 N_i + \beta_4 \bar{Y}_i + \eta_t + \epsilon_{it}$$

where Y_{it} is the outcome variable in round t, $\bar{Y}_i$ is the mean of the outcome variable in any pre-treatment rounds for which we have an observation, NT_i is the number of network connections invited to the training, NI_i is the number of network connections informed about the new style, N_i is the total number of firm i's network connections in our data, and η_t are round dummies. Additionally, we will run tests to determine whether effects are constant across rounds, specifications by round, and specifications which include a vector of other controls.

The main outcome variables of interest in this section are knowing about the style, ability to do the style, sales, and profits. We will also measure effects on specific types of production-related network activity, including outsourcing, sharing of production inputs, referral of customers, and discussion about prices.

Heterogeneity is particularly important for this section of the paper. Consequently, we anticipate splitting treated network connections into types by competitiveness and pre-existing risk-sharing/co-insurance relationships to measure the propensity to share by dyad type. Thus NT_i, NI_i and N_i will be redefined as the number of a certain type of network connection (skill-sharing, diversion-competitors, same gender, former master-apprentice, etc.). Specifications of this type will allow us to test for equality of coefficients from various types of network connections.

In addition, we anticipate alternative specifications that define NT_i and NI_i as binary treatment variables equal to one where the firm owner has one or more friends in the treatment groups, or as proportions of total friends treated. Controlling for N_i, the total number of eligible network connections, will be linear in the baseline specification, but dummied out in alternate specifications that do not make strong linearity assumptions.

3.3 Standard Errors

Standard errors in the primary specifications will be clustered at the firm/node level. To address potential issues related to non-iid errors in the single large network, we will likely also run randomization inference or permutation tests to calculate p-values and run hypotheses tests.

4 Hypotheses and Outcomes of Interest

We group our hypotheses into (1) direct effects of training, (2) skill-sharing spillover effects, and (3) competition effects. Each of these have important heterogeneity components to them, which are included under the group header. Under the final header we list exploratory hypotheses, about which our priors are more diffuse.

4.1 Direct Effects of Training

H1: Training will increase number of garments sold, sales revenue, hours worked, and profits

The outcomes of interest here include measures of firm performance from the post-intervention/follow-up rounds of the weekly survey. Where possible (for hours, sales, profits in GHC), we will include pre-period data from the census, baseline, and pre-intervention weekly survey.

H2: Training effects will vary by week

Whether direct firm-level effects will be strongest in the earliest weeks after the intervention (when diffusion of the style to other garment makers is in its infancy) or strongest in the later weeks after the intervention (when demand for the style may have grown in anticipation of the Easter holiday) is an open question. We intend to test for differential effects by week.

H3: Training effects will be larger for firms with few skill-sharing relationships at baseline

We expect firms with the strongest skill-sharing network connections at baseline will experience measurably smaller impacts on revenues and profits than firms with the weakest skill-sharing network connections at baseline. Strength of connection will be measured by the number of skill sharing contacts identified in the baseline and the frequency of skill sharing with those contacts. The logic behind this hypothesis is that firms with strong skill-sharing norms/co-insurance relationships will be most likely to share skills and thus least able to capitalize on any competitive advantage associated with knowledge of the new style.

H4: Training effects will be smaller for firms whose competitors also receive training

We expect firms with more direct competitors (as measured by diversion in the customer survey and geographic proximity) attending the training will benefit least from training.

H5: Training effects will be smaller for firms whose skill-sharing network connections receive information about the style

We expect firm owners whose skill-sharing network connections receive information and marketing materials about the new style to share their technical expertise in the fashion style more quickly

and thus benefit less overall from the training.

4.2 Skill-Sharing Spillover Effects

H6: Spillover effects to network connections of trained firms will overall be positive

Spillover effects, as measured primarily by changes in sales, profits, and outsourcing work done, will be positive for firms with network connections who received training.

H7: Positive spillover effects will be larger for firms with more skill-sharing network connections among the firm owners who receive training

We expect spillover effects to be concentrated among dyads with previous experience in skill-sharing. If a firm owner has a network connection with whom he or she has shared skills in the past, he or she will be more likely to learn the new style and more likely to benefit in term of sales, profits, and outsourced work done from the intervention.

H8: Positive spillover effects will be larger for firms who received the information treatment

We expect that firms who receive the information/marketing intervention will be more likely to learn the new style and more likely to benefit in term of sales, profits, and outsourced work done. While the mechanism could be reverse engineering, wherein the firm owner teaches himself or herself the new style, we believe it is more likely the mechanism will be skill seeking behavior. Among those firm owners who have skill-sharing network connections who attended the training, it is those who received information and marketing materials who will be most able to request instruction in the style.

H9: Positive spillover effects to network connections will vary by week

Again, whether the positive spillover effects will be strongest earlier (when those who do benefit from learning the style have the largest competitive advantage) or strongest in later weeks (when more firms have had the opportunity to learn the style) is ambiguous. In general, it will depend on the rate of information diffusion and the ability of firms who know the style to draw customers away from those who don't. We intend to test for differential effects by week.

4.3 Competition Spillover Effects

H10: We will observe negative spillover effects to competitors of trained firms who are not firm-level network connections

Close competitors will be identified in three ways: (1) from the self-identified competitors in the baseline survey, (2) by geographic proximity, and (3) via customer diversion questions in the customer survey. We expect negative spillover effects to bring down sales and profits of competitors of trained firms after the intervention. We expect these to be strongest in competitors who are not skill-sharing network connected to trained firms.

4.4 Potential Channels

H11: Firms that are both skill-sharing and outsourcing connected to trained firms will be the first to learn the new style

Outsourcing partners are useful during busy times, and thus sharing of skills during these times is both profitable for the training firm and bolsters pre-existing co-insurance relationships. Thus, we expect firms that have both a skill-sharing and an outsourcing prior connection to discuss the style first.

H12: Firms that are production input sharing connected but not skill-sharing or outsourcing connected will be least likely to learn the style and benefit from spillovers

An alternative mechanism to outsourcing is to pull labor and capital from low-demand firms temporarily into high-demand firms (via sharing of production inputs, often without pay). For dyads that are production input sharing connected, but not skill-sharing or outsourcing connected, the network-relationship spillovers could actually be negative and income variability increasing.

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