

## RESEARCH STATEMENT

Lori A. Beaman

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### I. Overview

My research is in the field of development economics, with a focus on three main topics: the role of social networks in the labor market, agricultural technology adoption, and women's mobility. I describe each of these research areas below. One distinguishing characteristic of developing countries compared to most rich countries is a lack of formal institutions and a corresponding reliance on informal institutions. This means that social networks are likely to play a ubiquitous role in the lives of the poor in developing countries, from how they access the labor market, gain information about agricultural technologies and the types of financial tools they use. A central theme across my research agenda is how social networks affect the spread of information and influence decisions of the economic agents. My research uses a range of methods, employing field and hybrid-field experiments, collecting novel data, and using theory to guide my interpretation of empirical findings.

#### Social Networks and Labor Markets

The use of networks as part of job search is a widespread phenomenon: survey evidence suggests 30-60% of jobs in the U.S. are found through informal channels (Ioannides and Loury, 2004). There is of course an extensive literature on the topic in sociology, including the seminal work by Granovetter (1972). Economists often think that social networks are important in the labor market because they help smooth away frictions (e.g. search costs, information asymmetries). The first question I asked in this area was whether the size and quality of one's social network had a causal effect on one's labor market outcomes. In Beaman (2012) I show that a larger network can either enhance or hinder an individual's employment prospects. Theoretically, there is competition within the network in the short run over available job referrals when an individual's network increases in size, leading to a decline in the probability of a network member becoming employed. In the longer-run, however, more job information is available, and thus a larger network is valuable. To test the model, I use data on political refugees recently resettled in the U.S. and argue that the placement of refugees across cities generates plausibly exogenous variation in the size of the network. The empirical results show that an increase in the number of network members who arrive in the U.S. one year earlier lowers the probability of employment for a new arrival, while additional tenured network members improve labor market outcomes for recently arrived refugees.

This work (along with Munshi (2003), Bayer et al (2008), and others) shows that social networks significantly influence individuals' labor market outcomes, in this case for those in the poorest segment

of the U.S. population. This led me to ask *why* firms would use social networks when making hiring decisions. One hypothesis coming from the seminal work by Montgomery (1991) is: do employee referrals help reduce asymmetric information? In Beaman and Magruder (2012), we use a hybrid laboratory-field experiment in Kolkata to show that some workers have useful information about fellow network members. However, workers also face incentives created within their social network which may mean they do not always refer the best person for the job. We propose that social incentives created by the network create tradeoffs between an employee's desire to refer the person he thinks is most qualified for a position and the person who gives him the highest social payments. To test this, we created a laboratory experiment in the field in Kolkata, India. The starting point is that once participants arrive at our laboratory, complete a task, and we pay them for it, we have essentially given them a casual day-job. We can then allow them to find referrals for our experiment and offer them different contracts for making the referral, so that some are (at random) offered a fixed fee which they receive for making any referral, while others are offered a performance incentive which they receive only if their referral performs sufficiently well. We document that individuals do face a tradeoff between socially-preferred referrals and incentives given to them by their employers, as they refer relatives more frequently in the absence of performance-based incentives and more socially distant coworkers in the presence of performance incentives. However, while we find that all individuals on average change their referral choice, only high ability people do so in a way which results in more skilled referrals coming in when given performance pay. We therefore confirm that high ability people have the right information to screen on their employers' behalf, but they only reveal that information if properly incentivized. Low ability people, by contrast, show little evidence of having useful information.

Though networks may help address a market failure - hidden information – Beaman and Magruder (2012) also shows that employees may favor some individuals within their network over others, for reasons unrelated to the task at hand. This highlights a broader concern: social networks' role in the labor market may reinforce existing inequalities, as shown theoretically by Calvo-Armengol and Jackson (2004). Given my earlier work on the gender gap in political representation, discussed below, one group to focus on is women. While the gender gap in labor force participation has declined sharply in the last 30 years, women continue to earn less than men in countries around the world. There is a large literature in economics on why women earn less than men, though the literature has focused on explanations like labor market discrimination (taste-based or statistical) or differences in human capital accumulation. Another possibility, highlighted by sociologists (for example, Fernandez and Sosa, 2005), is that hiring processes themselves, and in particular employee referrals, create occupational segregation and accordingly income disparity across genders. On the other hand, women could benefit from referrals if they have worse observable characteristics than men, but good characteristics that are hard for firms to observe. Therefore, it remains an open question whether women are made worse off by firms using employee referrals.

In Beaman, Keleher and Magruder (2013), we designed an experiment to look at referral patterns of men and women and their implications for women's access to labor market opportunities. We worked with a survey firm in Malawi which was hiring enumerators to learn whether relying on social networks for referrals excludes women. We advertised enumerator positions using conventional methods (flyers in the case of Malawi) and then asked those applicants to make referrals. To learn about our referrers' preferences on referring both men and women, we randomized along two dimensions: first, the gender of the referral. Applicants were told either that they must refer a man, they must refer a woman, or they could refer someone of either gender. Second, in a cross-cutting randomization, the bonus for making a referral also varied such that referrers would either receive a fixed fee for making any referral or a premium for referring someone we would actually hire. We find that in this context, the use of referrals disadvantaged qualified women. While 38% of applicants using conventional methods were women, only 30% of referred applicants were women. This happens primarily because 80% of men choose to refer other men, when given a choice. Women showed less evidence of gender bias, but they systematically referred low quality applicants. As a result, neither men nor women are likely to refer qualified women, even though we can also show that men are perfectly willing to make good quality female referrals when prompted. We also show that productive information is different between men and women: the best referrals are achieved when men refer other men under a performance pay structure. As a result, we conclude not only that the use of referrals can disadvantage women but that employers may have incentives to encourage/allow this disadvantage. This result suggests the need for creative policy to overcome this labor market disadvantage.

### Agricultural Technology Adoption

The majority of the world's poor relies on agriculture for income and employment. An important puzzle within development economics is why small scale farmers – particularly in Africa – do not use basic technologies that have the capacity to dramatically improve agricultural output. These technologies include chemical fertilizer, inter-cropping, new crops, soil management, and pest management to name but a few. Improving the adoption of these technologies could increase incomes and substantially reduce poverty among the poorest of the poor. There are a number of potential explanations for why farmers do not adopt these technologies. One of the channels I have investigated – given my work on social networks – is whether information is a barrier, and how social networks can be harnessed to improve dissemination of information about agricultural technologies. In a second project I look into the role of capital constraints.

### *Role of Social Networks*

In Beaman, BenYishay, Magruder and Mobarak (2015), we collaborated with the Ministry of Agriculture in Malawi to understand how new agricultural technologies diffuse through farmers' social networks, and whether policymakers can more effectively use existing social networks to encourage the adoption of seemingly beneficial technologies. We use a new methodology combining a field experiment with model-based simulations to select partner farmers using a linear threshold diffusion model. The objective is to learn how to select the two farmers whose adoption would induce the most robust social contagion, and thus result in the greatest village-level adoption of conservation agriculture techniques. In the model, a farmer will only adopt once they know at least  $\lambda$  other farmers who have adopted. When farmers have a low threshold,  $\lambda$ , generating diffusion is easy and adoption is maximized by spreading out the two seeds within the network. However, if farmers have a threshold above one, the diffusion process has properties of complex contagion, and it is critical to cluster the seeds together in the same part of the network. To test whether farmers need multiple contacts to spur adoption, we first conducted social network censuses to measure the network structure in 200 villages. We then used the social network census combined with the theoretical model to conduct simulations that informed the selection of seed farmers. The 200 villages were then randomly assigned a targeting strategy – based on different parameter values of the threshold model (an average of 1 or an average of 2). In our methodology, the field experiment allows us to identify characteristics of the underlying diffusion process. The form of the treatment itself is driven by the economic models, and this was done prior to the implementation of the project. Using data on farmers' adoption patterns over the subsequent 2-3 years, we find that the choice of *who* to train in the village has implications for the adoption patterns of new technologies, and the adoption patterns are most consistent with a diffusion process with complex contagion properties - which makes technology adoption slower to spread. Structural estimation of the simple model suggests that about 60% of farmers need to know two farmers who have previously adopted before they themselves will be ready to adopt.

I implemented a smaller-scale experiment in Mali on dissemination of information within social networks on composting. Relying on social network data collected in 52 villages, we selected seed individuals based on their social network characteristics, including betweenness centrality and degree (number of connections), and compare the observed diffusion process to a benchmark of randomly selected seeds. In Mali, men and women in the same household cultivate separate plots. Unlike in Malawi, this enables us to look *within* the household at how information about an agricultural technique spreads to men vs women in the village. Our motivation is similar to what I found on social networks in the labor market: targeting central individuals in the village may be advantageous for increasing adoption on average, but it may come at the cost of excluding individuals who are not well connected - in this case women. This project is currently work-in-progress and is joint work with Andrew Dillon.

*Capital Constraints*

A second project on agricultural technology adoption focuses on a more neoclassical explanation: capital constraints. In one component of the larger project, we distributed fertilizer to randomly selected farmers in southern Mali in order to assess if there are profitable investments in cultivation that farmers are failing to make.<sup>1</sup> Beaman, Karlan, Thuysbaert and Udry (2013) finds that recipient farmers use the free fertilizer on their plots, agricultural output increases, but the estimated impact on profits is not significant and quite imprecise. We further observe that in response to using more fertilizer, farmers re-optimize their other inputs, including increasing complementary inputs like labor and herbicides. This paper makes a small but important methodological point that one cannot easily isolate the marginal returns to fertilizer since in all real-world scenarios (unlike in field trials), farmers respond to a change in one input by potentially altering other inputs – making it impossible, and also not particularly meaningful, to isolate the returns to just one input.

The return to investment in productive activities depends on many factors, including underlying heterogeneity, and a primary role of financial markets is to permit investment flows to respond to this variation. In Beaman, Karlan, Thuysbaert and Udry (2015), we study this process of allocation across farmers in poor villages in Mali, in the context of the expansion of a microcredit program. We measure the distribution of returns to agricultural investment in the general population of rural Mali, and also among a selected sample of non-borrowers. We partnered with a micro-lender in Mali to randomize credit offers at the village level. Then, in no-loan control villages, we gave cash grants to randomly selected households. These grants led to higher agricultural investments and profits, thus showing that liquidity constraints bind with respect to agricultural investment. In loan-villages, we gave grants to a random subset of farmers who (endogenously) did not borrow. These farmers have lower – in fact zero – marginal returns to the grants. Thus we find important heterogeneity in returns to investment, and strong evidence that farmers with higher marginal returns to investment are selected into lending programs. Farmers are therefore aware of the heterogeneity in expected returns. The paper further investigates whether selection is driven by farmer demand, lender screening, or both, using a theoretical model where farmers have two dimensions of heterogeneity: a factor which affects average output and a factor which affects the marginal return to inputs. Farmers with higher marginal returns should select into lending, but farmers with too-low average output may not be allowed to borrow, especially in the context of limited liability. We find evidence in the data consistent with both self-selection and lender-driven selection.

### Women's Mobility

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<sup>1</sup> Duflo, Robinson and Kremer (2008) found that some levels of fertilizer and hybrid seed usage were highly profitable, but levels recommended officially by the Ministry of Agriculture in Kenya were not profitable.

Throughout much of the developing world and in certain contexts in rich countries, women's mobility – defined broadly as their ability to serve in political office, gain access to the labor market, run their own small businesses – is constrained. My work in this area has largely focused on India's experience with political reservations, though the topic is a cross-cutting theme in my research as shown by Beaman, Keleher and Magruder (2013) and work in progress by Beaman and Dillon (2015). The Beaman, Karlan, Thuysbaert and Udry (2015) project also has planned follow up work focusing on women's access to capital.

India's political affirmative action policy (quotas) is a sweeping piece of legislation that has brought an unprecedented number of women into power at the local level. In Beaman, Chattopadhyay, Duflo, Pande and Topalova (2009), we look at the impact of the quotas on women's ability to become political leaders at the local level. We find that after ten years of quotas, women are more likely to stand for, and win, elected positions in councils which were randomly required to have a female president in the previous two elections. We provide experimental and survey evidence on one channel of influence: changes in voter attitudes. Prior exposure to a female chief councilor improves perceptions of female leader effectiveness and weakens stereotypes about gender roles in public and domestic spheres. This project was my first opportunity to use "laboratory methods" in the field, a method that I have built on subsequently in work such as Beaman and Magruder (2012). In order to get a clean measure of bias against female leaders, which is not confounded with differences in the performance of the politicians which is largely unobserved, we used an experimental technique. Villagers were asked to evaluate the effectiveness of hypothetical leaders as described through vignettes and recorded speeches. The only variation across respondents was that leader gender was experimentally manipulated. In every village, half the respondents received "male" politician and the rest "female" politician vignettes and speeches. All other aspects of the speech and vignette were identical. We also implemented the Implicit Association Test (IAT), the first time as far as we know the test was implemented in a field setting in a developing country with an illiterate population. We then used these measures to show that exposure to a female leader, again for at least two electoral cycles or 10 years, reduced bias against women leaders.

Is India's political affirmative action policy likely to have longer-term benefits to women in politics and beyond? In Beaman, Duflo, Pande and Topalova (2012), we show that the policy is affecting a broader set of outcomes which are promising for the future. The data demonstrates that in villages which had a female leader for 10 years, the initial gap in aspirations between boys and girls for, as an example high education jobs, narrows. We see a similar catching up of parents' aspirations for their daughters relative to sons. There is also a narrowing in the gap in educational attainment in secondary school between girls and boys in these villages which previously had women council presidents. We argue that the female leaders are serving as role models for younger girls in the village, as we do not find any evidence that female leaders are implementing policies which would directly increase girls' secondary schooling relative to boys.

Related papers have also come out of this project, including a Brookings Institute paper in the *India Policy Forum* series and a book chapter in an edited volume published by *Oxford University Press*.

Closing the educational achievement gap between girls and boys is a critical step to improving women's overall economic opportunities. However, education alone may not be sufficient to ensure women's equal access to labor market opportunities, in order to achieve those high education jobs girls are aspiring to have. Beaman, Keleher and Magruder (2013), discussed above, lies at the intersection of my interest in social networks and women's mobility and highlights that additional constraints may exist in the hiring process itself that prevent qualified women from getting these types of jobs. These constraints are harder for policymakers to affect.

In very poor, rural contexts, increased economic opportunities for women will come in the form of agriculture and self-employment. In Beaman, Thuysbaert and Karlan (2014), we use a field experiment to evaluate a village-based savings group program that targets women in Mali. Savings groups is a growing alternative to microfinance since it is much lower cost and has the potential to reach more remote locations. We find improvements in food security, consumption smoothing, and buffer stock savings. Although we do find suggestive evidence of higher agricultural output, we do not find overall higher income or expenditure. We also do not find downstream impacts on health, education, social capital, and female decision-making power. On net, improved food security is an important factor in well-being, but we do not observe dramatic improvements in economic opportunities – consistent with recent evidence on traditional microfinance products targeting small enterprise development.

### Other works

Many micro-enterprises in Kenya have low productivity. One common, yet puzzling, experience I have had and witnessed in multiple African countries is that sales transactions can't be completed because the vendor has insufficient small change, or the client has to wait for the vendor to go seek out change to complete the sale. Beaman, Magruder and Robinson (2014) documents this behavior in the context of Western Kenya and looks for potential explanations. Our survey estimates that Kenyan entrepreneurs are losing 5-8% of profits due to lost sales, which occur both because change cannot be made and because these entrepreneurs miss out on sales while spending 2 hours per week away from the store hunting for change. We use two interventions designed at redirecting entrepreneurial effort towards small change to test whether limited attention is leading to lost sales and missed profits in meaningful ways. First, we randomize enrollment into a study which frequently surveys entrepreneurs about recent experiences with losing business because of insufficient change on hand (what we call "changeouts"). The survey effectively made change problems more salient without otherwise impacting the entrepreneurial decision problem. Second, we work with a random subset of entrepreneurs to calculate the profits lost due to changeouts.

We use a mix of self-reported and objective measures to confirm that both interventions are successful at reducing changeouts. We document that more treated entrepreneurs have more cash on hand when we come to visit, and that they have higher sales and profits. We conclude that the most likely explanation for these results is that these small firms were not perfectly attentive to change management prior to the interventions.

In 2008-2009, I started three large field projects<sup>2</sup> in Mali. I first needed to deal with a basic but important methodological issue when working in Mali, though the issue affects data collection efforts in many other contexts as well. Household structure in Mali is complex, and I needed to better understand what the relevant decision-making units are in order to design a survey which would (i) appropriately address questions to the right actors and (ii) sample units to optimize around the right “household” unit to have appropriate statistical power in the empirical work. Beaman and Dillon (2012) came out of that process: we conducted a survey experiment where we randomized the definition of the household used across sampling units in our survey. The four different definitions were all variants commonly used in the literature, emphasizing more or less the role of eating out of a common pot and having joint agricultural production. We observed that many of the household statistics we constructed out of the data were sensitive to how we defined the household. Emphasizing either common consumption or common production generated a different grouping of individuals into the household, and the “right” household unit likely depends on the research question of interest. This was instructive for me in designing the surveys for the work in Beaman, Karlan, Thuysbaert and Udry (2015) and Beaman, Karlan and Thuysbaert (2014). The paper is also a contribution to the literature on survey design and measurement and highlights that we face a tradeoff when collecting data in developing countries: we want researchers to use standard household definitions so that we can make comparisons across countries and over time, but that comes at a cost of not being able to tailor the survey design for the specific question of interest in any given study.

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<sup>2</sup> A third project, with Andrew Dillon, has been on hiatus due to security concerns in Mali since 2012.



## II. References by the author

### Published Papers

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Beaman, Magruder and Robinson (2014) "Minding small change among small firms in Kenya." *Journal of Development Economics*, vol 108, pp. 69-86.

### Submitted Papers

Beaman, Karlan, Thuysbaert and Udry (2015) "Selection into Credit Markets: Evidence from Agriculture in Mali."

Beaman, BenYishay, Magruder and Mobarak (2015) "Can Network Theory-based Targeting Increase Technology Adoption?"

### Working Papers

Beaman, Keleher, and Magruder (2013) "Do Job Networks Disadvantage Women? Evidence from a recruitment experiment in Malawi."

Beaman, Karlan and Thuysbaert (2014) "Saving for a (not so) Rainy Day: A Randomized Evaluation of Savings Groups in Mali."

### **Other Publications**

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### **Work in progress**

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### **III. Other References**

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