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Synergy and Learning Effects of Informal Labor-Sharing Arrangements

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Summary. — We study the effects of informal labor-sharing arrangements and other social interactions on farmers' productivity in a developing country context, testing whether these types of social and work interactions lead to productivity gains through learning, synergy, or both. Using a rich panel data set of Ethiopian subsistence farmers, we estimate a distance function of grains production and find large productivity gains (approximately 33% and 29% in 1999 and 2004) from labor sharing due to synergy effects that boost labor productivity. However, labor sharing does not lead to learning as the productivity gains observed in years with labor sharing disappear in following years if the farmers do not continue to engage in labor sharing. Labor-sharing partners are either neighbors, relatives, members of the same funeral and religious associations, or have plots next to each other, which together reduce labor sharing as a single venue for learning. However, the synergy effect is strong enough to warrant the design of extension and outreach policies that recognize and utilize farmers' informal social networks such as labor-sharing arrangements.

Key words — distance function, efficiency, labor exchange, labor sharing, learning, social networks, synergy

1. INTRODUCTION

The influence of social networks on individuals' behavior and success has long been of interest to sociologists, and this interest has recently been picked up by economists. The social network studies in agriculture have mainly focused on the impact of networks on technology adoption and diffusion (Genius, Koundouri, Nauges, & Tzouvelekas, 2014; Krishnan & Patnam, 2014; Liverpool-Tasie & Winter-Nelson, 2012; Maertens & Barrett, 2012; Falco & Bulte, 2013; Conley & Udry, 2010; Bandiera & Rasul, 2006; Munshi, 2004; Foster & Rosenzweig, 1995) and risk sharing (Fafchamps & Lund, 2003; Dercon & Krishnan, 2003). In addition, Santos and Barrett (2010) applied social network theories on the role of identity in farmers' search for information while Krishnan and Sciubba (2009) analyzed the role of the number of links and network architecture in determining the impact of social networks on outcomes. However, what type of networks facilitate learning and the context in which they do that is still an active area of enquiry. Krishnan and Patnam (2014), for instance, found that neighbors are important sources of learning for adoption of agricultural activities in Ethiopia, more so than extension agents whose effects fade away over time. Songsermsawas, Baylis, Chhatre, and Michelson (2016), on the other hand, found that 60% of farmers' revenue is explained by peers, but the peer effects are significant among farmers' self-reported peers, especially among those peers who are farmers' main advisors for agricultural matters, rather than geographically defined neighbors. The mechanisms through which social learning affect technology adoption can have direct implications for the design of agricultural extension and training programs. In many developing countries contact or progressive farmers, who serve as points of contact between extension agents and other farmers, are ubiquitously used as messengers of information (Kondylis, Mueller, & Zhu, 2017). An extension system based on contact farmers presumes that these contact farmers will influence other farmers in their networks to follow their lead and adopt new production practices.

In this study, we focus on an oft-neglected aspect of social networks that can have direct implications on farmers' productivity—the synergy effect from informal labor-sharing arrangements. The synergy effect refers to productivity gains that come from working together such as speed gains and being less bored by tedious agricultural activities or working harder while observed by the labor-sharing partners. In these arrangements, a household head invites members of other households in his network to help him with specific agricultural activities. Labor sharing is used in a wide range of agricultural activities including land preparation and plowing, weeding, harvesting, and threshing, providing opportunity for labor-sharing partners to influence productivity in all stages of production. Labor-sharing use for land preparation and plowing can make required labor available for on-time sowing of crops, while its use for weeding means pest and weeds that can affect crop productivity are checked early on. Labor-sharing use during harvest means quick completion of harvest, which could save a lot of harvest loss, particularly in seasons where untimely rain during harvest periods can destroy crops on the field. Consistent with this synergy effects

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narrative, households in the data that we use for the study, report that they use labor-sharing parties for quick completion of tasks, due to unavailability or expensiveness of hired labor, and for completion of tedious agricultural activities in a group. Other households respond to labor-sharing requests by a farmer not based on wages but in expectation that the household will reciprocate the labor supply when they make a similar request later.

In addition to the synergy effect, the identification strategy described below can also pick up learning effects from previous season labor-sharing arrangements, to the extent that skills and technologies are varied among labor-sharing partners. However, any finding on lack of learning effects may not necessarily imply that social networks are not important for learning. Rather, a finding of no learning effects may be because labor sharing is often done with "like-minded" people on fields with crops that everyone grows and is used to grow, with techniques that do not change much, which does not provide the necessary context for learning to occur. The fact that labor-sharing partners are also relatives, neighbors, and belong to other social and religious associations can also reduce the role it can play as a single venue for learning.

The objective of this article is to analyze the impact of these different interactions and learning opportunities on agricultural productivity using a rich panel data set of Ethiopian subsistence grain farmers. We investigate to what extent involvement in informal labor-sharing arrangements affects productivity above and beyond the direct impact of the additional labor to production. In other words, we want to know whether labor sharing means more than an increase in labor supply. This question will be answered affirmatively if there are increasing returns to working together (synergy) or if labor-sharing facilitates mutual learning. We also examine whether social interactions such as funeral association membership and educational opportunities like extension programs and off-farm work lead to learning that increases agricultural productivity.

We believe our article contributes to the growing literature on rural household networks in at least two ways. First, it expands the role of social networks beyond learning and diffusion of agricultural technologies by exploring the synergy effects of labor-sharing arrangements that can affect productivity and efficiency in a rural agricultural setting. Second, it investigates to what extent ordinary interactions with other farmers can boost productivity through the influence and leadership of some farmers, with implications for the design of production-increasing policies. If observation and interaction with an average farmer is not enough, but rather training and educational opportunities of new technologies and skills are necessary, then it clearly defines what role labor-sharing arrangements, as common as they are, should be expected to play in advancing productivity and efficiency in rural areas. This article should shed light on such policy questions and could point the way toward important agricultural production improvements.

2. SYNERGY *VERSUS* LEARNING EFFECTS

After accounting for the direct impact of labor sharing in production in terms of increased labor supply, we hypothesize that informal labor-sharing arrangements affect agricultural productivity and efficiency in two ways: the synergy effect and the learning effect. The synergy effect is the result of the physical presence of the labor-sharing partners on the farmer's plot and it refers to productivity gains that come from working together such as speed gains and being less bored by tedious agricultural activities or working harder while observed by the labor-sharing partners. The learning effect is the skills learned and information obtained from the labor-sharing partners that the household can put into use to improve its productivity and efficiency even on plots and at times when a labor party is not present.

Labor sharing is expected to have an impact on farmers' current level of technical efficiency based on the current and previous period labor-sharing status. Farmers are, therefore, grouped into four types as shown in Table 1. Type_I farmers are those who do not use labor sharing this year, and do not have prior labor-sharing experience. Type_II farmers refer to those who used labor sharing in the current year, and also have prior labor-sharing experience in at least one of the previous survey rounds. Type_III farmers are those who do not use labor sharing this year but have prior labor-sharing experience. Type_IV farmers are those who use labor sharing in the current year but do not have prior labor-sharing experience. The empirical application in this article uses the Ethiopian Rural Household Survey (ERHS) and though the econometric estimation is undertaken using the 1999 and 2004 survey rounds, we have used the 1994, 1995, 1997, 1999, and 2004 survey rounds to classify farmers based on their history of labor-sharing participation.

Initially, we include labor-sharing participation in the season to see the total effect of labor-sharing participation on farmers' efficiency. The effort to decompose this total effect of labor sharing into synergy and learning effects relies on the comparison of production efficiency among the four labor-sharing types in a subsequent estimation. The key to such decomposition is that synergy, as defined above, requires labor-sharing participation in the current season, while learning from labor-sharing partners can happen in previous labor-sharing uses even if the farmer does not participate in one in the current season. For instance, the learning effect of labor sharing can be discerned if the technical efficiency of type_III farmers is greater than that of type_I farmers. This is because neither type_III nor type_I farmers use labor sharing in the current season. Thus, there will be no synergy effect to consider and the only difference in the efficiency of type_I and type_III farmers should come from the previous periods' participation of type_III farmers, which we called the learning effect. Likewise, the synergy effect of labor sharing can be discerned by comparing the production efficiency of type_II and type_III farmers. Both types of farmers have labor-sharing experiences prior to the current production season, and hence the opportunity to learn from their labor-sharing partners in the past, but type_II farmers use labor sharing in the current season as well with the potential to gain from the synergy effect of labor sharing. Thus, if the efficiency of type_II farmers is greater than the efficiency of type_III farmers, that shows the presence of the synergy effect.

If the technical efficiency of type_II farmers is greater than that of type_III farmers, and the technical efficiency of type_III farmers, in turn, is greater than that of type_I farmers, then labor sharing has both learning and synergy effects. This is because if there were only learning effects, the technical efficiency of households who have used labor sharing both in the current season and in the past (type_II farmers) would be the same as those who did not use labor sharing that year but have used it in a previous season (type_III farmers). If there were only a synergy effect, there would be no difference in the efficiency of type_III and type_I farmers because neither used labor sharing for that season. Using the same arguments to compare efficiency differentials between type_I, type_II,