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Characterizing social networks and their effects on income diversification in rural Kerala, India

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Summary. — Income diversification continues to be a key strategy for poor rural households, including those that are progressively developing and those operating under increasing distress. The ability of a household to diversify has been shown to depend upon its demographic and economic characteristics and its physical and social context. This paper considers the effects of intra-village social networks on household income diversification in one of the poorest and most ethnically diverse areas of the Indian state of Kerala. Using techniques adapted from spatial econometrics, we find that social connections within a village magnify the impacts of household characteristics such as education and number of adults by a factor of 3.6 times. Models with alternative measures of network centrality (degree and eigenvector) indicate that the number of network connections that a household has is more important than the centrality of those connections. Finally, we use social contact information to calculate assortative mixing based on caste. The results suggest social stratification in these villages, with higher levels of stratification associated with lower levels of income diversification.

Key words — social networks, income diversification, rural India, network effects, network centrality, social stratification

1. INTRODUCTION

Income diversification by individuals and households is ubiquitous in the rural economies of developing countries (Barrett, Reardon, & Webb, 2001; Ellis, 2000; Martin & Lorenzen, 2016). Why? If markets were complete and costless, income diversification can be interpreted as the opposite of specialization: failure to deepen investment in specific enterprises and thus benefit from economies of scale (Ellis, 2000). With restricted and costly exchange, however, income diversification can be interpreted as the net result of trading off advantages of specialization in specific enterprises with complementarities and economies of scope between enterprises. For example, with thinly-traded labor markets, diversification can be a rational response to seasonality of labor requirements in agricultural enterprises that entail periods of labor surplus and shortage (Ellis, 2000). Or with incomplete credit or insurance markets, diversification can be an appropriate ex ante or ex post approach for managing weather or price risks (Barrett *et al.*, 2001; Ellis, 2000). Income diversification can involve different forms of production agriculture (e.g. cereals, perennials, livestock, horticulture), participation in both production and value addition (e.g. sales, processing), or engagement in both on-farm and off-farm employment (e.g. casual labor, formal sector employment).

Income diversification is thus one of the few strategies available to farm families living in situations of constrained markets, a situation that is prevalent in developing country economies (Stiglitz, 1989). The proximate determinants of diversification vary from case to case, although the literature shows empirical regularities (Barrett *et al.*, 2001; De Janvry & Sadoulet, 2001; Himanshu, Lanjouw, Murgai, & Stern, 2013). For a household on an upward trajectory from poverty to increased prosperity, households diversify income sources in order to absorb seasonal labor shortages, exploit economies of scope between enterprises, or leverage limited financial capital. For a household on a downward trajectory toward worsening poverty, diversification can be a constrained response to expected future income shocks. The motives associated with these upward and downward trends are alternatively described as "opportunity-led or survival-led" (Alobo Loison, 2015), "necessity or choice" (Ellis, 2000), "pull or push" (Barrett *et al.*, 2001), "progressive success or distress" (Martin & Lorenzen, 2016), or "asset-based or insurance-based" (Anderson & Deshingkar, 2005). In many circumstances, households may respond to both types of motivations, especially where a single event, such as a prolonged illness of a breadwinner, can make the difference between moving into or out of poverty (Krishna, 2010).

Regardless of the motives in specific contexts, however, the evidence indicates that most poor rural households benefit from opportunities to diversify farm and non-farm income sources. From a review of evidence from 11 Latin American countries, Reardon, Berdegue, and Escobar (2001) found diversification of rural incomes to be highest in countries with lowest average income, but, controlling for country and region, highest among households with highest average incomes. Barrett *et al.* (2001) review results from Ethiopia, Tanzania, Côte d'Ivoire, and Kenya that show income diversification to be positively associated with household welfare measures. Using data from a nationally representative survey of India, Birthal, Roy, and Negi (2015) find that smallholder households that diversify toward high-value crops have higher per capita household expenditures than household that diver-

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sify less. Of course, it can be difficult to determine causality in such studies: do households diversity more because they have higher income or do they have higher income because they diversify more?

Several household characteristics have been commonly found to influence the extent of income diversification. This includes: (1) positive or negative association with the age of the household head (Agyeman, Asuming-Brempong, & Onumah, 2014; Khatun & Roy, 2012); (2) positive association with amount or value of assets (Agyeman *et al.*, 2014; Ellis, 2000; Khatun & Roy, 2012); (3) positive association with diversity of assets (Martin & Lorenzen, 2016), (4) positive association with availability of household labor (Agyeman *et al.*, 2014; Ellis, 2000; Liu & Lan, 2015), (5) positive association with level of education (Agyeman *et al.*, 2014; Barrett *et al.*, 2001; Khatun & Roy, 2012; Liu & Lan, 2015), and (6) positive association with the prevalence of market or production risks (Alobo Loison, 2015).

Physical context can affect opportunities for diversification. For example, households located near urban centers, mines, or plantations tend to have greater opportunities to earn income in those sectors, while households located near towns, highways, or market centers may have greater opportunities to market raw or processed food (e.g., Agyeman *et al.*, 2014; Joshi, Gulati, Birthal, & Tewari, 2004). Households located in remote forested areas are more likely to rely on the consumption and sale of products gathered from the forest than households located further away (e.g., Belcher, Achdiawan, & Dewi, 2015).

Social context may be an equally important determinant of diversification. In India, for example, caste and ethnicity provide the basis for multi-functional social networks. Rural families use caste-based networks to find marriage partners for girls in other rural areas, for men to identify opportunities for temporary migration, and for families to reduce income risk through gifts and loans (Munshi & Rosenweig, 2016). These gifts and loans function as substitutes for formal insurance and state-sponsored safety nets. Munshi and Rosenweig (2016) propose that rural insurance networks underlie the persistence of large wage gaps between urban and rural India.

In this paper we evaluate the role of intra-village social networks in enabling household income diversification in rural India. Understanding intra-village social networks and their effects can help with the design of rural service programs and the assessment of such interventions. Social network analysis shows who will be included or excluded if advisory services are supplied through focal point, interest group, or affirmative action approaches that target social marginalized groups (Glendenning, Babu, & Asenso-Okyere, 2010). The magnitude of the network effect on diversification also has implications for resource allocation—a larger effect of network on diversification implies that a larger share of resources should be devoted to strengthening those networks. Network approaches can also be used to measure ripple effects as the outcome of a policy intervention spreads through socially connected individuals (a social multiplier effect). While previous studies have examined the role of social networks on economic outcomes such as agricultural technology adoption (Maertens & Barrett, 2013; Matuschke & Qaim, 2009), risk sharing (Fafchamps & Lund, 2003; Munshi & Rosenweig, 2016), labor markets (Calvo-Armengol & Jackson, 2004), and diffusion of micro-finance (Banerjee, Chandrasekhar, Duflo, & Jackson, 2013), only a few previous studies have explored connections between social networks and diversification. No other study has applied the same network analysis and econometric methods to the study of the effects of social networks on diversification.

Cinner and Bodin (2010) use a network analysis approach to map occupations and the connections between those occupations in 27 coastal communities in 5 western Indian Ocean countries (Kenya, Tanzania, Madagascar, Seychelles, and Mauritius). They relate the position of each occupation (e.g. measures of centrality) in the "livelihood landscape" to indicators of socio-economic development and network statistics (e.g. density) to community-level development and population density. Their findings suggest a positive association between specialization and development at the household level, but no particular association at the community level. Baird and Gray (2014) consider income diversification and social networks of exchange as alternative mechanisms that pastoral households use to manage risk and uncertainty in Northern Tanzania, finding that income diversification and inter-household exchange serve as substitutes.

The context for the current study is a small contiguous region within the Western Ghats region of the Indian state of Kerala. The population of the area is comprised of a mixture of ethnic groups and castes, and households engage in a range of livelihood activities. We represent intra-village household-to-household networks through an adjacency matrix derived from household interview data we collected on several dimensions of social contact. These data also allow us to construct standard measures of network centrality of households, as well as village-level measures of social stratification based on social contacts within and between castes and tribes. The data also allow us to use methods adapted from spatial econometrics to estimate network multipliers, i.e. the multiplicative effects of social networks on the determinants of income diversification. To avoid mischaracterization of network statistics, we conducted interviews with all households in each of nine villages, which allowed us to examine complete networks. This is important as sample-based statistics may misrepresent their population counterparts (Costenbader & Valente, 2003; Lee, Kim, & Jeong, 2006).

While Baird and Gray (2014) focus on exchange networks per se, we took an inclusive approach to social networks very similar to the approach that Banerjee *et al.* (2013) took in their study of the effects of social networks on the diffusion of micro-finance in Karnataka, India. This approach is most consistent with a concept of social network as a vehicle for exchanging resources and information. We conclude that intra-village social networks play very important roles in enabling diversification in our study context. Our results indicate the existence of: (i) a social multiplier effect with respect to income diversification, i.e., network diversification is positively associated with own diversification; (ii) a social position effect on diversification, i.e., household centrality is positively associated with income diversification; and (iii) social stratification, i.e., social connections reveal assortative mixing (connections within caste are more prominent than between caste).

This paper proceeds as follows. Section 2 provides a brief description of the study site and sampling, while Section 3 provides a description of the data and the methods used to model social networks, income diversification, and their interrelationship. Section 4 provides results and Section 5 offers a discussion and conclusion.

2. STUDY SITE AND DATA

(a) *Study location*

We conducted this study in nine villages of Meenangadi Panchayat (decentralized territorial unit) in Wayanad District of Kerala, southern India. The primary sources of income in

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