Caste-Based Clustering of Land Parcels in Two Villages in Uttar Pradesh

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This paper examines if the land parcels in Indian villages exhibit caste-based clustering. Using digitised cadastral maps of two villages in Uttar Pradesh and a unique data set collected by conducting a survey in these two villages, we determine the caste of the owner of each parcel. We then used spatial methods to calculate Moran’s Index for caste-based clustering. In both villages, we observed a statistically significant level of clustering of land parcels based on caste groups. This finding has important implications for social learning in technology adoption, sharing of agricultural inputs, and development of fragmented markets for inputs like groundwater.

1 Introduction

Social networks in village economies function as conduit of information and sharing of resources. Kinship networks tend to be formed based on historically determined ethnic identities. Residential sorting promotes and sustains such networks. There is a lot of evidence on residential sorting of various caste groups in rural India (Kochar et al 2006). However, if the individuals of the social network also work in proximity of each other, they can exchange information about new technologies by way of discussions and observations. They can also exchange inputs or bilaterally trade inputs that can increase agricultural productivity. Therefore, such sorting can give rise to localised markets, especially for goods that are difficult to transport like groundwater, which is traditionally transported in unlined field channels and cannot be transported far due to seepage loss.

In this paper, we examine whether land parcels exhibit clustering along caste lines in two villages of India, Rampur Janak and Hansrajpur of Uttar Pradesh. We obtained the cadastral maps of these villages and digitised these maps. We also conducted an in-person survey of all the farmers who resided in the village and linked the demographic information to the parcels. We use this data to shed light on whether farm neighbours have correlated characteristics.

The rest of the paper is organised as follows: Section 2 provides background information and describes the data collected. Section 3 discusses the methodology. Section 4 discusses the results and Section 5 concludes.

2 Background and Data

There are three main factors that could contribute to the clustering of land parcels based on land.

• Households divisions across generations after the death of the patriarch not only change the structure of the household from joint to nuclear, but also lead to the division of land among sons traditionally (Debnath 2011).

• Before the 1950s, upper caste landowners had holdings in many villages and were absentee landlords in places where they did not live. These villages did not have any upper caste population. Abolition of the zamindari system in the 1950s made the lower caste tenants in absentee landlord villages, owners of their land (Chandra 2004).

• Also, land redistribution in the 1970s allocated marginalised lands to scheduled caste households in many areas (ibid).
These factors can cause members of the same caste to be farm neighbours. But there is no systematic evidence that shows clustering in land parcels along caste lines. In order to fill this knowledge gap, we collected the paper maps of two revenue villages in Uttar Pradesh. We then digitised these maps. These maps associated a khasra number (a unique identifier) with each parcel. Then we conducted a census of all parcels in these two villages. We administered a detailed survey to farmers who reside in the villages. The survey asked them about their demographic characteristics and a variety of questions on agricultural practices. We used khasra numbers to match demographic information to the parcels. The matched spatial data was used to create maps and to calculate Moran’s I as described in the next section.

The summary statistics of parcels are in Table 1.

The two villages have 1,219 and 724 plots, respectively. A large number of plots are owned by farmers who do not reside in the village – the absentee landowners. Our survey was not able to capture the caste information of these landowners. Among the remaining plots, the Other Backward Classes (OBCs) own the most parcels in each village. In one of the villages Hansrajpur, the largest plots are owned by upper castes, while in Rampur Janak the largest plots are owned by scheduled castes.1

### 3 Methodology

We measured spatial autocorrelation (caste similarity) based on parcel locations and parcel owner’s caste. For a set of land parcels,2 we determine if associated characteristics like education and the caste of the owner are in a pattern that is clustered, dispersed or random. We first calculate an index – the Moran’s I Index value and then determine a Z score and p-value evaluating the significance of that index. The null hypothesis is: “there is no spatial clustering of the values associated with the geographic features (land parcels) in the study area (village in this case)”. In general, a Moran’s Index value near +1.0 indicates clustering while an index value near -1.0 indicates dispersion. If the index value is greater than 0, the parcels exhibit a clustered pattern. If the value is less than 0, the parcels exhibit a dispersed pattern.

Moran’s I is given by:

\[
I = \frac{1}{n} \left[ \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} k_{ij} z_i z_j}{\sum_{i=1}^{n} z_i^2} \right]
\]

where \(z_i\) is the deviation of the characteristic for parcel \(i\) from its mean value \((x_i - \bar{X})\), \(k_{ij}\) is the spatial weight between parcel \(i\) and \(j\), \(n\) is the total number of parcels and \(\sum_{i=1}^{n} \sum_{j=1}^{n} k_{ij}\) is the aggregate of all spatial weights.

### 4 Results

We first plot the maps of caste ownership in the two villages. Figures 1 and 2, respectively show these maps. The caste
categories mapped are scheduled castes, scheduled tribes, OBCs, upper castes and absentee landowner parcels. Land-use – barren land, common use land, government-owned land, water bodies and roads – are also shown. The village Rampur Janak in Figure 1 is more heterogeneous in caste of the owners than Hansrajpur in Figure 2. Clustering of parcels is evident from these maps. But we carry out the calculation of spatial autocorrelation and report the Moran’s $I$ results in Figures 3 and 4. Both the villages show statistically significant clusters in terms of caste of the parcel owners. In Rampur Janak (Figure 3), the Moran’s $I$ index value is 0.094 and the $z$ score is 7.88. The index is statistically significant at 1% level. In Hansrajpur (Figure 4), the index value is 0.176 and the $z$ score is 13.8. This $z$ score indicates highly statistically significant clustering in terms of castes. These findings indicate that farm neighbours tend to be from the same castes. Figures 5 and 6 map years of schooling of the parcel owners. The categories are none, primary, upper primary, secondary, upper secondary and graduate. A large number of owners are not educated and very few are graduates. We do not find consistent evidence of clustering on education. Figures 7 and 8 (p 109) show spatial autocorrelation. In Figure 7 for Rampur Janak, the Moran’s $I$ index is 0.08 and the $z$ score is 7.05, whereas in Figure 8 for Hansrajpur, the index is 0.014 and the $z$ score is 1.39. These $z$ scores indicate randomness in Hansrajpur and clustered pattern in Rampur Janak. Farm neighbours are not necessarily similarly educated in both
villages. Rampur Janak also has a higher rate of illiteracy, and the clustered pattern could be indicative that farm neighbours are not literate.

5 Conclusions

Using spatial data and in-person survey data of land parcels in two villages of Uttar Pradesh, we find that land parcels of caste groups exist in spatial clusters. These clusters are highly statistically significant. Other characteristics of farm neighbours like education are not consistently correlated. Preliminary analysis of our survey data indicates that these farm neighbours from the same caste tend to engage in bilateral trade of groundwater. The plot owners with wells sell water for irrigation to their farm neighbours for a price. This can increase agricultural productivity and be more efficient than sinking a large number of wells. In light of rapidly falling water tables, these arrangements can have important implications for water conservation. Examining the implications of such bilateral trade arrangements on efficiency of water use is an important agenda for future research.

NOTES
1 At the time of the survey, some land parcels in the map had subdivided. In case of parcel division due to household break-up or sale of a part of land, we associate the mode of the caste of the new owners of divided parcels to the original parent parcel.
2 Land parcels are polygon features in the cadastral maps of villages.

REFERENCES
A few months ago EPWRF introduced an online database service christened as ‘India Time Series’, www.epwrfits.in. The project envisaged dissemination of data in fifteen modules displaying time series on a wide range of macroeconomic and financial sector variables in a manner convenient for research and analytical work. This is targeted to benefit particularly students, research scholars, professionals and the academic community, both in India and abroad.

This online service is a part of the project funded by the University Grants Commission (UGC) and executed by the Tata Institute of Social Sciences (TISS), Mumbai and the Economic and Political Weekly (EPW).

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