Land Inequality and Landlessness in Pakistan Authors

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Abstract

Measuring the precise nature and causes of land inequality is critical for addressing and implementing policy initiatives related to agricultural productivity, rural development and within-country income distribution. In this study, we argue that measuring land inequality solely among land owners does not provide a complete picture of land allocation among agricultural actors. We analyze land inequality (with or without the inclusion of landless peasants) and landlessness to present a holistic picture of land inequality across all districts of Pakistan. We employ data on 152,582 farm households from two rounds of the district-representative Pakistan Social and Living Standard Measurement Survey to construct Gini and Mean Logarithmic Deviation (MLD) indicators of land inequality and decompose it into within- and between-district inequalities. We found that inequalities measured without including landless peasants portray different picture of land disparities than those based on measures including landless workers. Our main findings are four-fold: 1) Land inequality measured including landless peasants is much higher (Gini = 0.84) than than that without them (Gini = 0.67), and has increased much more between 2007 and 2015 if landless peasants are included (6%) than when measured without them (1%). 2) In 22% of the districts, land inequality without landless peasants decreased between 2007 and 2015 while that measured without them increased. The opposite is true in 5% of the districts. 3) Land inequality without landless workers is higher in irrigated and humid regions with better soil quality and rough terrain while inequality with landless workers is higher in more arid and semi-arid districts. Districts with rough topography face less landlessness in the presence of predominantly-small holder farms, whereas more fertile soil is associated with higher landlessness. 4) Districts based on Pashtun tribal ancestral land distribution rights have the lowest rates of landlessness (20%) while districts with pre-colonial Zamindari-based land distribution show the highest incidence of landlessness (66%). These findings highlight the need for robust tenancy reforms in districts with humid climate, higher land inequality and lower landlessness in order to provide land tenure security to landless tenants and protect them from force eviction by powerful landed elites. Use of information technology in registering land rights through geo-coordinates can be helpful in improving land security and the expansion of the agricultural land markets. Besides, there is a greater need of land redistribution in the southern and south-western districts where landlessness is high despite relatively low extent of land inequality.

Keywords: Land inequality; landlessness; Pakistan.

1 Introduction

Land is an essential input in agricultural production and a source of wealth and political power (Frankema, 2010). Land ownership and tenure play a vital role in agriculture productivity (Vollrath, 2007), efficiency, and agricultural dividends (Zarin and Bujang, 1994). Land ownership modifies the incentives to work and the allocation of farm surplus between land owners and farm workers. Inequality in land ownership has a significant impact on technological investment in agriculture (Banerjee and Iyer, 2005). Concentration of land in the hands of a few can have important

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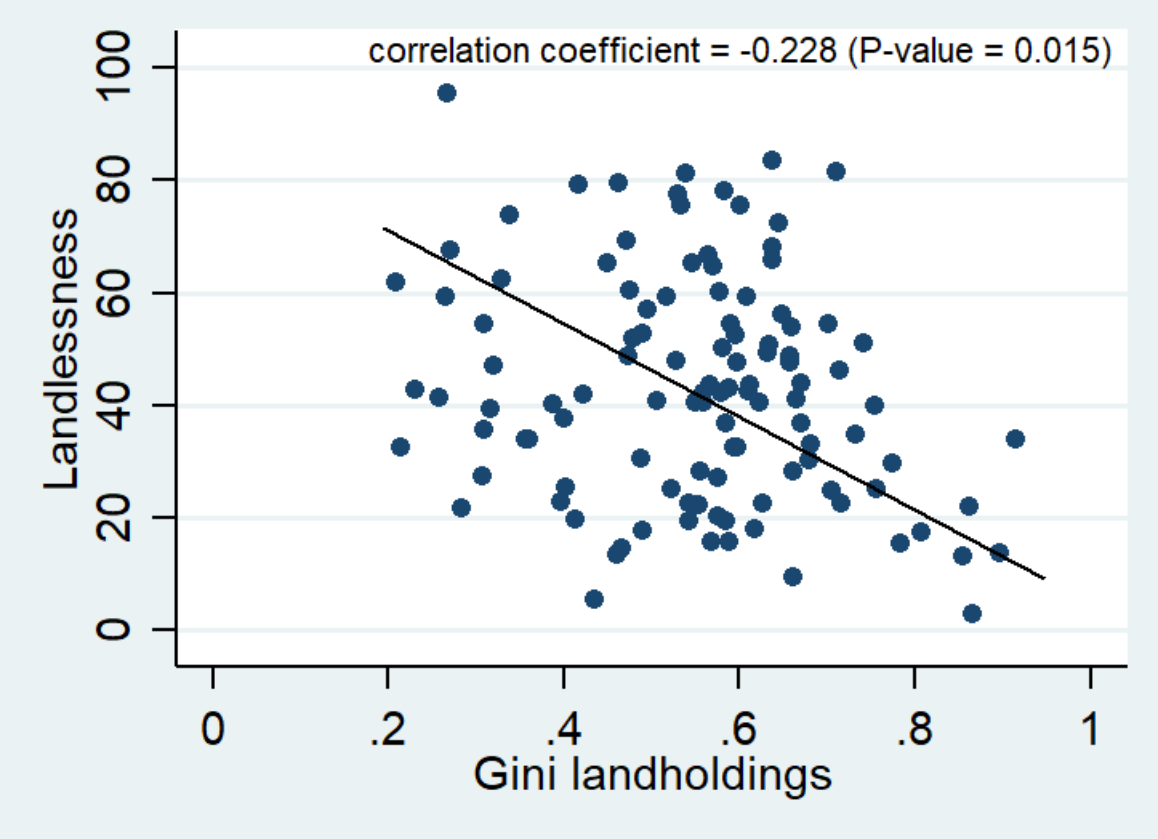
political, economic, and social ramifications for society in the short and the long term (Verwimp, 2005). First, increased land disparity is often related to political power accumulation (Brockett, 1992; Verwimp, 2005). In Pakistan, for example, large rural landowners are among the most powerful political figures, and are often referred to as 'Electables' as they can count on their farm workers and the poor from their clan or tribe to get elected in the assemblies. These powerful landlords often stymie any educational reforms or investments in education and human capital formation that could limit the supply of cheap farm labor (Cinnirella and Hornung, 2016; Galor et al., 2009; Sokoloff and Engerman, 2000; Engerman and Sokoloff, 1994), thus impeding the transition from an agrarian to an industrial economy (Galor et al., 2009). Second, excessive land concentration impedes economic growth (Alesina and Rodrik, 2013; Torsten Persson and Tabellini, 1994). Increased land concentration is also associated with land absenteeism, which decreases farm efficiency and exacerbates landlessness, causing rural poverty and an imbalance in the distribution of agricultural surplus (Boberg-Fazlić et al., 2022; Keswell and Carter, 2014). Third, growing land disparities promote social discontent in the society (Boberg-Fazlić et al., 2022; Castañeda Dower and Pfutze, 2020; Verwimp, 2005).

It is clear from the above discussion that agriculture growth can not be inclusive until it addresses the issues of land inequality and landlessness. Existing literature generally uses land distribution among landholders to study land inequality (e.g., Deininger and Squire (1998)). However, excluding landless peasants from the distribution may not provide a comprehensive picture of land allocation (Erickson and Vollrath, 2004). Let us suppose that only 10 out of 1,000 agricultural agents own land, while the remaining 990 do not. The ten landowners share equal portions of land. Although land distribution in this scenario is ostensibly egalitarian, yet it obscures the story of land inequality. Areas with low apparent land inequality can have high incidence of landlessness. In Pakistan, for example, districts with low land inequality have high rates of landlessness and those with high land inequality have fewer landless peasants (Figure 1). The corresponding correlation coefficient is -0.228 (p-value: 0.015). The two groups of districts differ in geographical and climatic distribution: districts with high land inequality and low rates of landlessness are concentrated in the north and have humid climate, while those with low land inequality and high landlessness are mostly located in the south with a predominantly arid climate.

The comparison of the two measures of land inequality can significantly inform agricultural land policy reforms in Pakistan and beyond. We elucidate how policy choices differ when landless agricultural labour is included in land inequality measurement. In general, if land inequality among landowners is high but the gap between the two indicators of inequality measured including and excluding including the landless farm labour is small, meaningful policy initiatives need to focused on land tenure reforms and strengthening land markets rather than land redistribution per se. This is due to the fact that the majority of the agricultural population owns land, albeit in small amounts. Robust land tenancy reforms and modernization of land markets can encourage smallholders to rent in additional land while encouraging large land owners to rent out uncultivated land. This can help reduce land inequality based on market factors without compromising farm productivity and efficiency. In contrast, policymakers can focus more on land redistribution if land inequality among land owning farm households is low while the gap between the two measures of land inequality, with and without the inclusion of landless labour, is high. Land distribution pattern in such a case is relatively egalitarian but leaves out a large proportion of farm labour with no access to land. Therefore, it is necessary to consider both land distribution and landlessness together in order to paint a complete picture of land distribution (Zarin and Bujang, 1994). In this study, we estimate an alternative measure of land distribution based on all the agricultural population, i.e. including landowners, landless peasants, tenants, and farm laborers, and compare it with estimates of land inequality measured without landless farm labour. We employ data on 152,582 farm households from two rounds of the district-representative Pakistan Social and Living Standard Measurement (PSLM) survey to construct Gini and Mean Logarithmic Deviation (MLD) indicators of land inequality across districts. We obtain the two measures of land inequality and decompose it into within- and between-district inequalities to demonstrate how taking landlessness into account can significantly alter our

Figure 1: Land inequality and landlessness across districts of Pakistan.



Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculations using PSLM 2014-15.

understanding of the land inequality scene.

2 Background

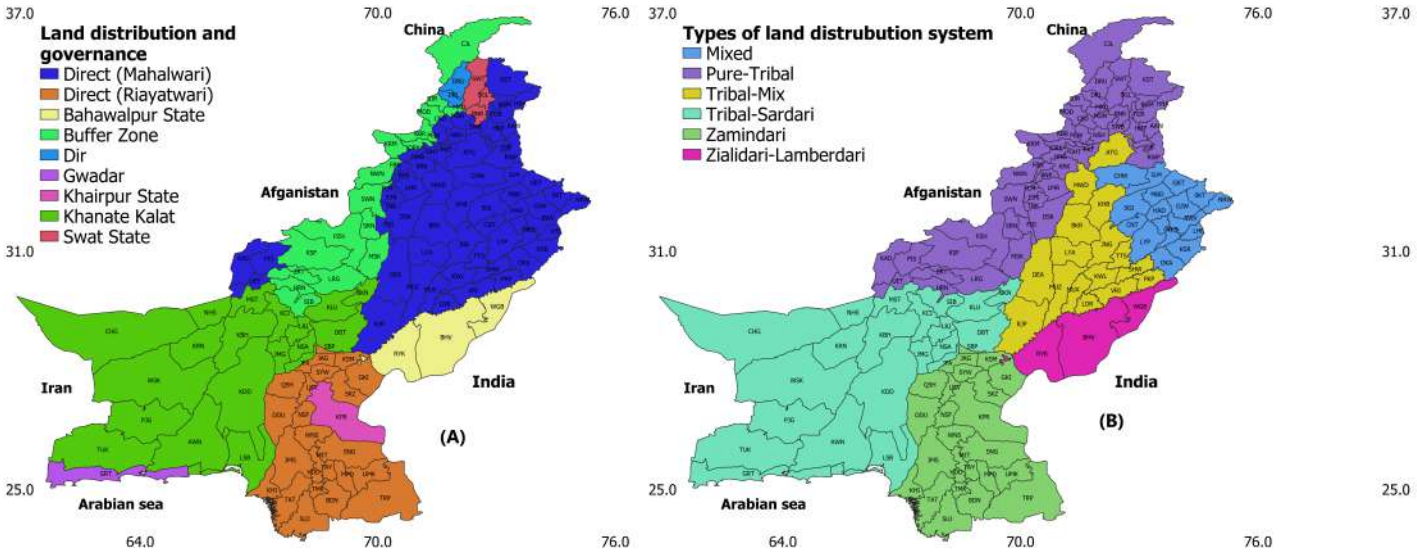
Only 24% (21.4 million hectares) of Pakistan's total land area of 88.2 million hectares is arable, out of which 80% (17.2 million hectares) is cultivated. In Balochistan, the largest province, only 9.4 percent land is cultivable, 43 percent of which is under cultivation. However, in Punjab, the country's most populous province, 58 percent of total land is cultivable, with 92 percent of it under cultivation (Government of Pakistan, 2010).

2.1 Land distribution and landlessness in Pakistan – an overview

2.1.1 Pre-independence patterns of land distribution

The roots of the current patterns of land acquisition and ownership in Pakistan may be traced back to the British colonial system of land ownership and proprietorship rights in the nineteenth century. The colonial regime used land as a key tool to rule over the Indian Subcontinent. Land was used not only as a source of revenue, but also as a political instrument to control the masses and reward the elite for its pliability. Land in the areas of present-day Pakistan was broadly apportioned into three types of land settlement jurisdictions: the then provinces of Punjab and Sindh, and a number of self-governing states. The governance and the land settlement systems prevalent in the various regions during the colonial era are presented in Figure 2.

Figure 2: Land distribution and governance system during the colonial era



Note: Panel A depicts the type of governance system (direct or indirect) and land distribution that existed in various areas of Pakistan during the colonial era, whereas Panel B depicts the basis of land distribution in different areas of Pakistan during the colonial era. Some district names are too lengthy and are instead given by their IATA three-letter codes. The complete names of the districts and their codes are provided in Table-A1 in the appendix.
Source: Authors' estimates using historical archives/literature.

The first of these three jurisdictions, the then province of Punjab, comprised most of present-day provinces of Punjab and Khyber Pakhtunkhwa, and British Balochistan. In these areas, the land revenue system of the Bengal Presidency called 'Mahalwari' was implemented. Household landownership rights were allotted based on common ancestry, tribal conquest and caste hierarchy (Baden-Powell, 1892a)[1] . The second of these land distribution jurisdictions comprised most of today's Sindh province where the Riayatwari system was applied. Land was divided into four groups: 1) major Zamindars, landlords with superior settlement rights, 2) minor Zamindars who manage their land themselves, 3) registered occupants of land where no Zamindar existed, and 4) tenants -'Hari'), who worked for the Zamindar. Large tracks of land were given to prominent personalities for their service to the British Empire. Compared to Punjab's Mahalwari land distribution, land revenue assessment in Sindh under Riayatwari was more rigorous. The third jurisdiction comprised of numerous self-governing princely states. Land allocation in these princely states was based on tribal traditions, tribe fractions, clans, and common ancestry. Table 1 summarizes the land distribution system prevalent in the three groups of jurisdictions during the colonial times and their evolution since independence.

[1]Baden-Powell PT.IV CH.II Vol-II page 620-621

Table 1: The evolution of land-tenure and -ownership systems overtime.

Regions	Pre-colonial	Colonial	Post-independence	Current land distribution
First group	Zamindari	Mahalwari	Legal landownership rights registration based on Mahalwari, with three major land reforms	Land reforms not feasible, but land tenure reforms are indispensable
Second group	Zamindari Faujdars	Riayatwari	Legal landownership rights registration based on Riayatwari, with three major land reforms	Land reforms not feasible, but land tenure reforms are indispensable
Princely states	Zialdari Tribal land distribution	Zialdari Tribal land distribution	Customary and legal landownership rights registration	Land reforms not feasible, but land tenure reforms are indispensable

Note: The first group, the then Punjab, comprised most of present-day Punjab (excluding Bahawalpur state), current-day Khyber Pakhtunkhwa (KPK) (excluding old FATA, Swat, and Dir states), and British Balochistan, which included sections of the present-day Quetta district. Sindh, the Second group, comprises of the present-day Sindh province (except for Khairpur). The third group comprises of the princely states of Kalat and neighbouring states of Lasbela, Mekran, and Kharan (Districts of the present-day Balochistan Province), native states of Dir and Swat (both part of the KP province now), self-governing states of Bahawalpur and Khairpur, and north and north-west Pashtun tribal areas adjacent to the Afghanistan border. Source : Authors' estimates using historical archives/literature.

2.1.2 Post-independence land reforms

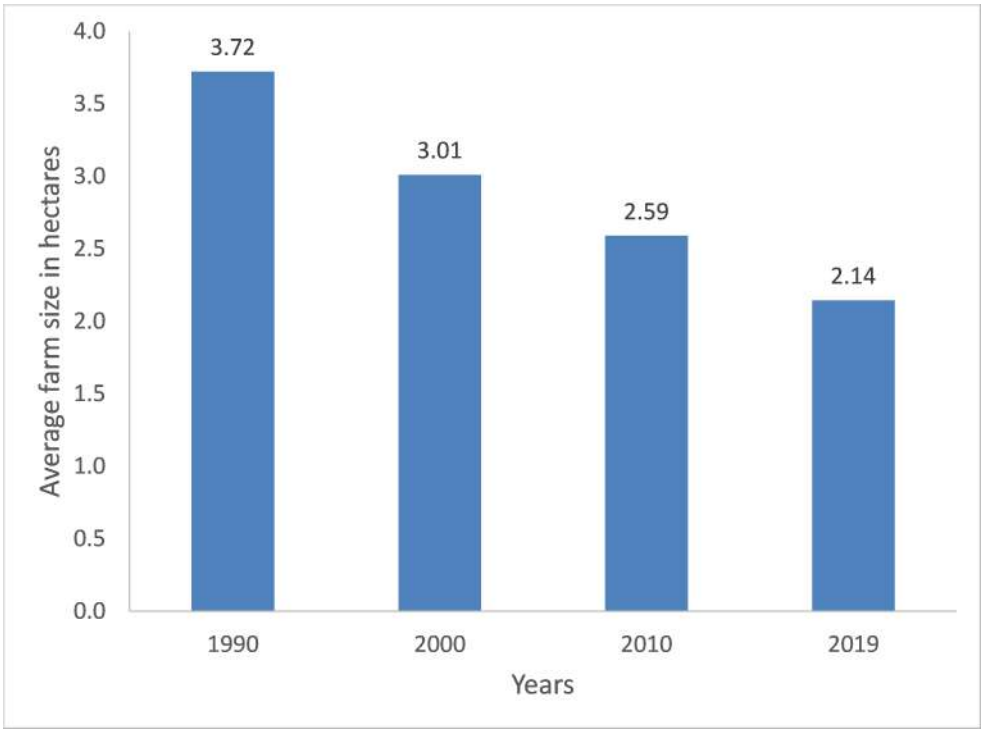
The need for meaningful tenancy and land reforms was being felt even before the independence of the Indian Subcontinent in 1947. The recommendations of the 1947 Government-Haari reform committee led to various provincial Protection and Restoration of Tenancy Right Acts in 1950. These tenancy reforms aimed at protecting the tenants, providing legal cover for tenure security, halting any forced eviction of tenants, and providing access to legal redress. The 1952 provincial tenancy acts and tenancy (amendment) Acts entitled the occupancy tenants with land ownership rights. Land settlement was also required for millions of Muslims who migrated to Pakistan from India after independence. Majority of these migrants were relocated on land vacated by the Hindus and Sikhs who left for India.

At the time of independence, land distribution in Pakistan was highly unequal. More than 900,000 landowners possessed less than 2.02 hectares while 0.12 percent of landowners collectively owned over 15% of the total land (Government of Pakistan, 1959). To rectify the situation, three major reforms (1959, 1972, and 1977) and several minor land reforms were carried out. These reforms were only moderately successful, and landlessness and land inequality still remain high.

2.1.3 Current situation of land distribution and landlessness

According to the 2010 Agriculture Census (Government of Pakistan, 2010), there are about 8.26 million farms in Pakistan. Average farm size has decreased from 3.72 hectares in 1990 to 2.14 hectares in 2019 (Figure 3).

Figure 3: Evolution of average farm size in Pakistan.

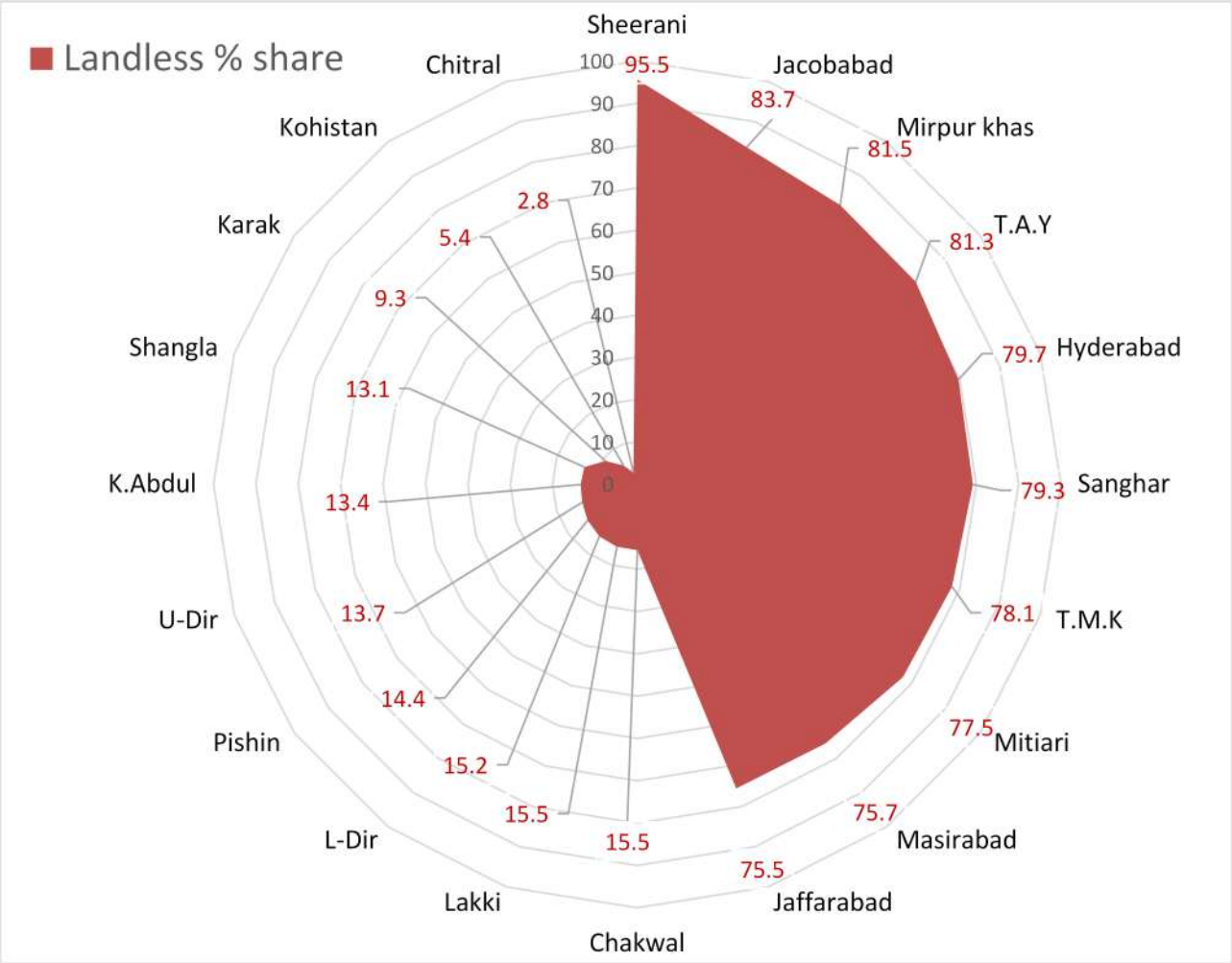


Source: Authors' estimates using HIES and Agriculture Census of Pakistan.

At the same time, area under cultivation and the number of smallholdings (less than 1.01 hectares) has increased. However, the increase in area covered by small farms (3.5 percent) is less than the increase in the landholdings (10%. Small and medium farms cover only 48% of the farm area. 82% of small farms are owner-cultivated, while a much lower proportion (71%) of large farms is owner-cultivated, indicating the presence of widespread land absenteeism. According to the Agriculture Census 2010, only 26% of owner cultivated land on farms larger than 60 hectares is under cultivation, whereas the share is as high as 92% in small farms. Landlessness is rampant, accounting for 44% of the agricultural population. The situation has worsened over time, with 75% of the districts in the country showing increasing rates of landlessness between 2007 and 2015[2] . The top-10 districts have landlessness rates as high as 95%. All of these districts (Sherani, Jacobabad, Mirpur Khas, Tando Muhammad Khan, Hyderabad, Qambar Shedadkot, Tharparker, Matiari, Nasirabad, and Jaffarabad) are situated in the south of the country, either in the provinces of Sindh or Balochistan (Figure 4).

[2]Detailed district-level statistics of land share, landlessness and its growth from 2007 to 2015 are provided in Tables-A2 and -A3 in the appendix.

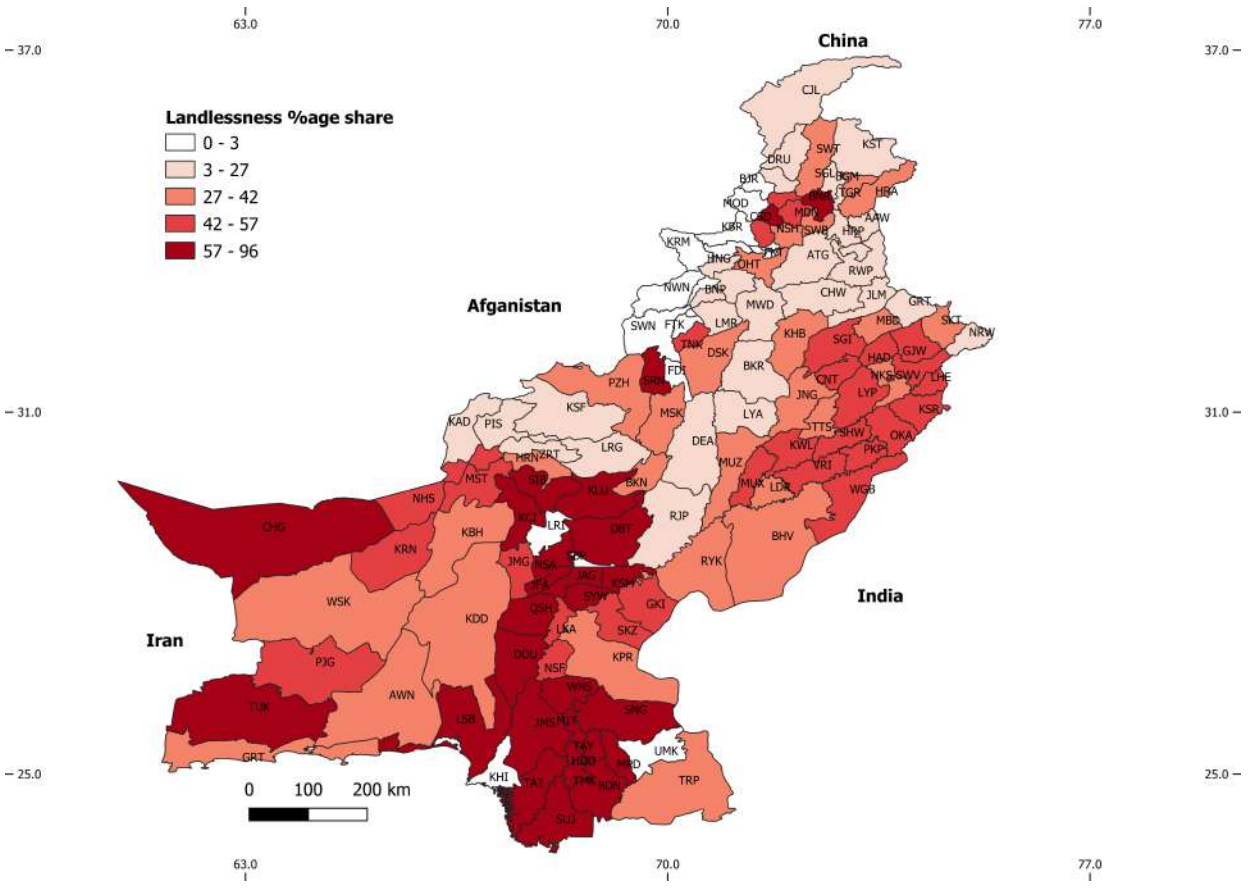
Figure 4: Top and bottom ten districts by share of landless peasants



Source: Authors' calculations using PSLM 2015.

Most of the districts of the Sindh province, where the peasants were denied land ownership rights under the augmented Riayatwari system, fall into the first quartile in terms of the rate of landlessness (Figure 5). The districts in the second quartile are mostly from central Punjab, where village bodies were not determined by tribal ancestral land allocation and where tribes were heterogeneous.

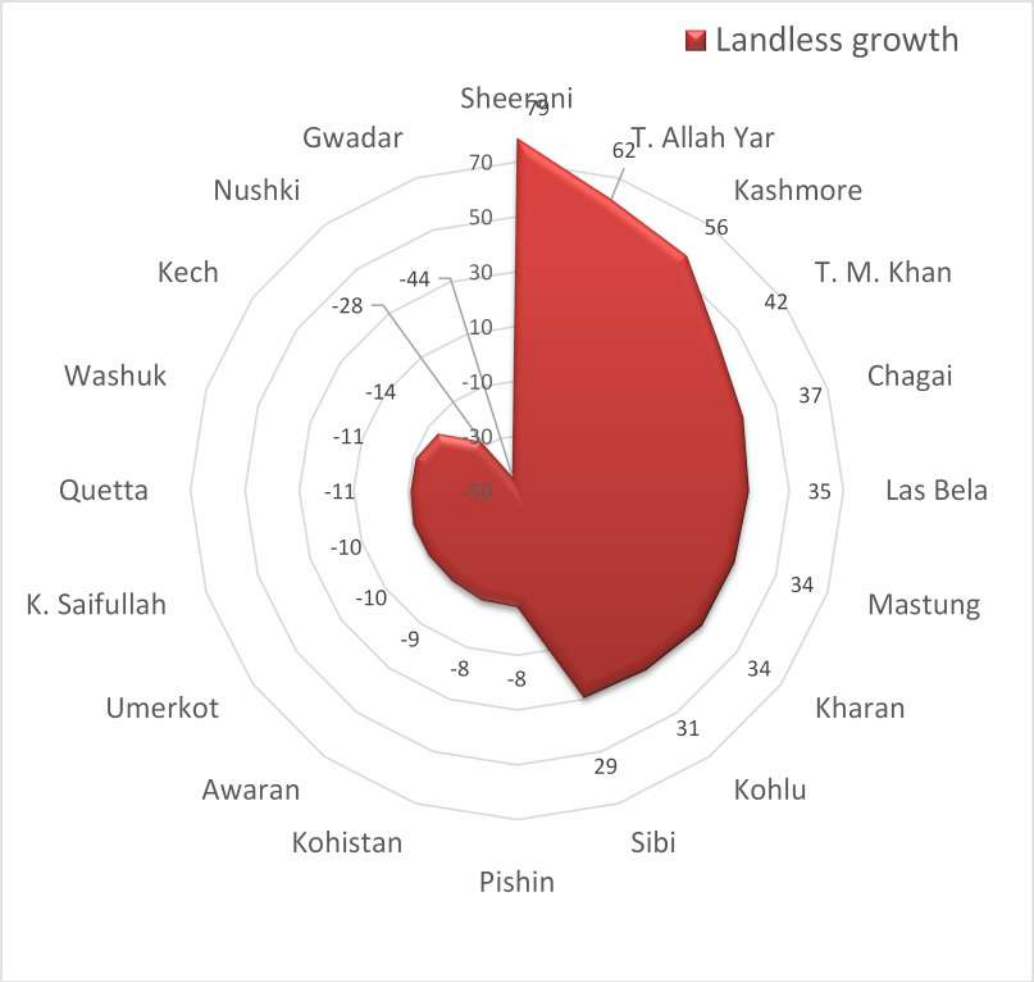
Figure 5: District-wise quartile distribution of the percentage share of landless peasants.



Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculations using PSLM 2015.

The third quartile of districts includes those from Balochistan, the erstwhile Bahawalpur state, and Tharparker and Umerkot districts of Sindh. Majority of these areas practiced a tribal land distribution system for allocating land in the past. The fourth quartile is mostly made up of districts from Khyber Pakhtunkhwa and the neighbouring districts from Punjab, where tribal or Mahalwari land distribution systems were historically practiced. Land distribution in these areas is relatively egalitarian, with landlessness rate as low as 2.8% in Chitral. The bottom ten districts in terms of landlessness are mainly from Khyber Pakhtunkhwa, where tribal and 'Mahalwari' land distribution systems were used prior to and since the British colonial rule. These districts include Chitral, Kohistan, Karak, Shangla, Killa Abdullah, Upper Dir, Pishin, Lower Dir, Lakki Marwat, and Chakwal (Figure 4). These districts have very low rates of landlessness, with rates ranging from 2.8% to 15%. Sherani, Tando Allah yar, Kashmore, Tando Muhammad Khan, Chagai, Lasbella, Mastung, Kharan, Kohlu, and Sibi are also among the top ten districts in terms of the greatest percentage increase in landlessness between 2007 and 2015. Gwadar, Nushki, Kalat, Washuk, Quetta, Killa Saifullah, Umerkot, Awaran, Kohistan, and Pishin are among the top ten districts with the greatest decline in landlessness. (Figure 6).

Figure 6: Top and bottom 10 districts by percentage point change in landlessness.



Note: Table A3 in the appendix contains detailed district-level results of percentage point change in landlessness.
Source: Author's calculation from PSLM 2007-15.

2.2 Nature of the soil

Fundamental factors, such as soil quality, source of soil moisture, and land topography are important in determining land arability. These factors also influence land quality, cropping patterns, and vegetation growth patterns in a given region (Gough et al., 2000a). Understanding the concurrent state of land distribution, therefore, necessitates the knowledge of soil quality, land topography, and source of soil moisture.

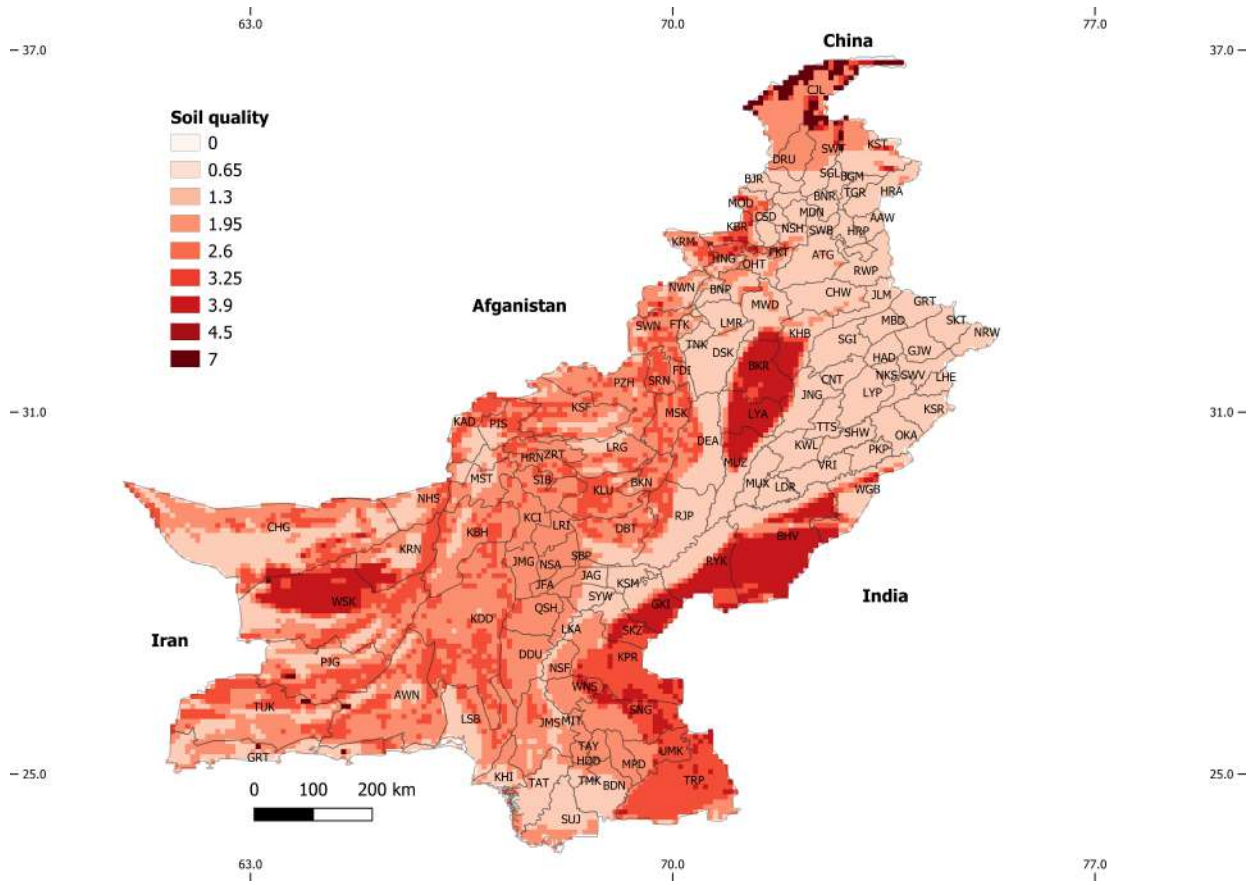
The soil ingredients that determine the pH and salinity of the soil determine the economic value of agricultural land. The pH and salinity of the soil have a significant impact on plant productivity. Most plants prefer neutral soil pH levels ranging from 6 to 7.5pH (Ramirez-Rodriquez et al., 2005). Soil pH outside of this range is harmful to plant growth (Lauchli and Grattan, 2012). Alkanophile plants, such as flowers and shrubs, can, on the other hand, thrive in higher pH soil. Acidophile plants can thrive in acidic soil. Halophiles are plants that can survive in saline soil with high electrical conductivity; these plants are sporadic and are usually unfit for human consumption. Low soil pH inhibits nitrification and increases toxic elements in the soil such as aluminium (Gough et al., 2000b). As a result, soil ingredients play an important role in crop selection and land productivity. More productive land will command a higher price due to increased demand, resulting in more intensive land fragmentation, whereas less fertile land will have the opposite effect (Boserup, 1965). Therefore, soil quality and farm/landholding size are

likely to be inversely associated (Bhalla, 1988; Bhalla and Roy, 1988; G.O.J, 2017).

Figure 7 shows that, on the one hand, all the riverine and adjoining recent river plains of Punjab (except for Bhkkaar, Layyah, and significant areas of Miawali, Bahawalnagar, Bahawalpur, and Rahimyar Khan districts) have fertile soils. Except for the Indus delta areas, districts in upper and lower Sindh also have good loamy and sandy stratified soils. Similarly, almost all of the districts in KPK and upper Punjab have mostly loamy, shallow soil with few rock outcrops, while the valleys have predominantly good loamy and non-calcareous soil. These areas are humid, with annual rainfall ranging from 800mm to 1800mm. Chitral, Kohistan, and Gilgit are mostly mountainous, with rock outcrops and sandy soil. These areas are arid to semi-arid. Glaciers and snowcaps cover some of their area, making agricultural cultivation difficult.

On the other hand, due to soil nature, 80 percent of Balochistan land is unarable. The Aeolian desert plains of Balochistan's Washuk district have mostly hilly sandy soil. Some areas are extremely arid with highly saline soils where electrical conductivities exceeds 15. The rest of Balochistan is mainly mountainous, with rock outcrops and a patchy coating of heterogeneous soil elements. The soil in the valleys is mostly loamy and partially gravelly. The majority of these mountains and valleys are ill suited for agriculture. Due to the presence of calcareous materials, the soil is typically alkaline, with a PH value often exceeding 8. The majority of the Chagai district's soil is highly saline, with electrical conductivity levels exceeding 15. Flowers, oilseeds, small trees, olives, and shrubs are the only types of plants that can be grown in these areas.

Figure 7: Geographical distribution of soil quality in Pakistan.



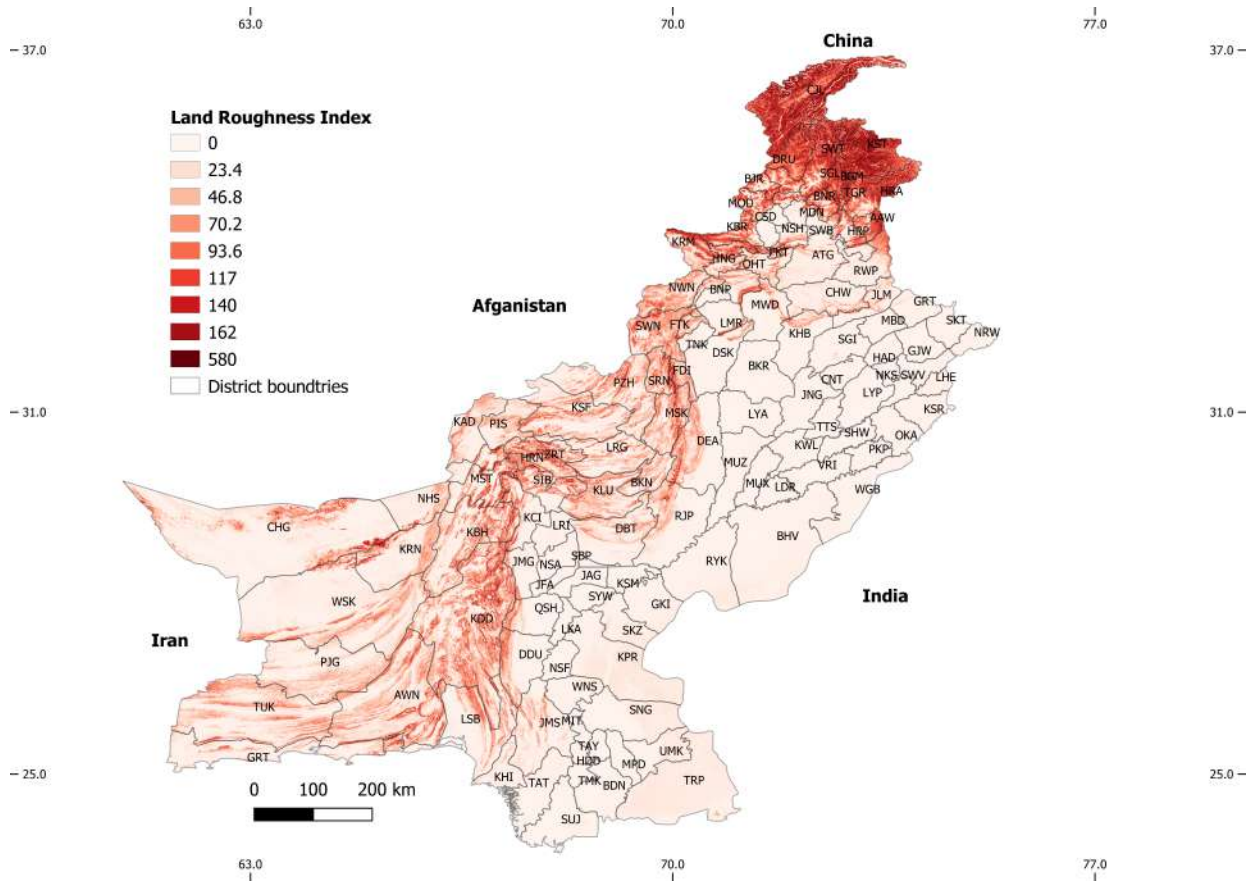
Note: Soil quality is determined by the availability of nutrients in the top 0-100cm layer of soil, measured in terms of soil pH, organic carbon, mineralogy, and total exchangeable basis (REB). The soil quality index ranges from 0 (best soil) to 7 (poorest soil); for more details, see for example (Fischer et al., 2008; Ayaz and Mughal, 2022a). The district codes and full district names are described in the appendix Table A1. Source: Harmonized World Soil Data of IIASA and FAO.

2.3 Land topography

The elevation and roughness of the land are important factors in determining cropping patterns and irrigation. Land in the high altitude piedmont plains is difficult to irrigate with standard canal irrigation system; these areas are frequently irrigated by wells/tube wells or rely on the rainfall. Similarly, high-elevation mountain zones are frequently steep and impractical for regular large-scale cultivation. Rainfall, streams, and rivers are the primary crop irrigation sources in these areas. Because it is extremely expensive to uplift water to these steep areas, the water supply to the foothills and up to the steep piedmont mountains is primarily dependent on rain. As a result, high altitude montane zones and rugged terrains are ideal for small farming, particularly labor-intensive cropping with efficient water utilization. Lowland territory, on the other hand, is frequently flat and relatively easy to irrigate with canals. These plains are better suited to large-scale agriculture. This implies that land elevation and roughness have a significant impact on land fragmentation and consolidation. Figure 8 depicts that the land terrain of the KPK, upper Punjab, and the majority of Balochistan is mainly rough. These zones range from a low-altitude hilly zone (1200m AMSL) to a high-altitude montane zone (4300m AMSL). Despite the fact that the Peshawar, Nowshera, Sawabi, Charsada, Chakwal, Washuk, Chagai, and Kharan are all at low altitude, their land is classified as Piedmont, inter-montane playas and loess plains. However, Washuk lies in the sandy desert zone.

Land in the Punjab and Sindh lies mostly at low altitude and in a variety of climates, including the dry, semi-arid, and sub-humid hot subtropical continental Monsoon zone. The sandy Aeolian deserts of Bahawalpur, Leiah, Rahimyar Khan, Ghotki, Sukkur, Khairpur, and Sangar are part of the hot dry zone. It also includes the piedmont plains on the west of the Indus River and the recent and sub-recent river plains on the east of the Indus River. The semi-arid zone includes Bhakar's sandy desert and the old river plains on the Chenab River's southeast and northwest banks. The humid region includes the piedmont and river plains of the Gujranwala division. Finally, the coastland is completely arid, consisting of tidal flats, estuarine plains, and a sandy desert zone in the southeast. It does, however, include the southwest coastal piedmont plains. The coastland territory is mainly saline and home to rare flora.

Figure 8: Land topography and roughness in Pakistan.

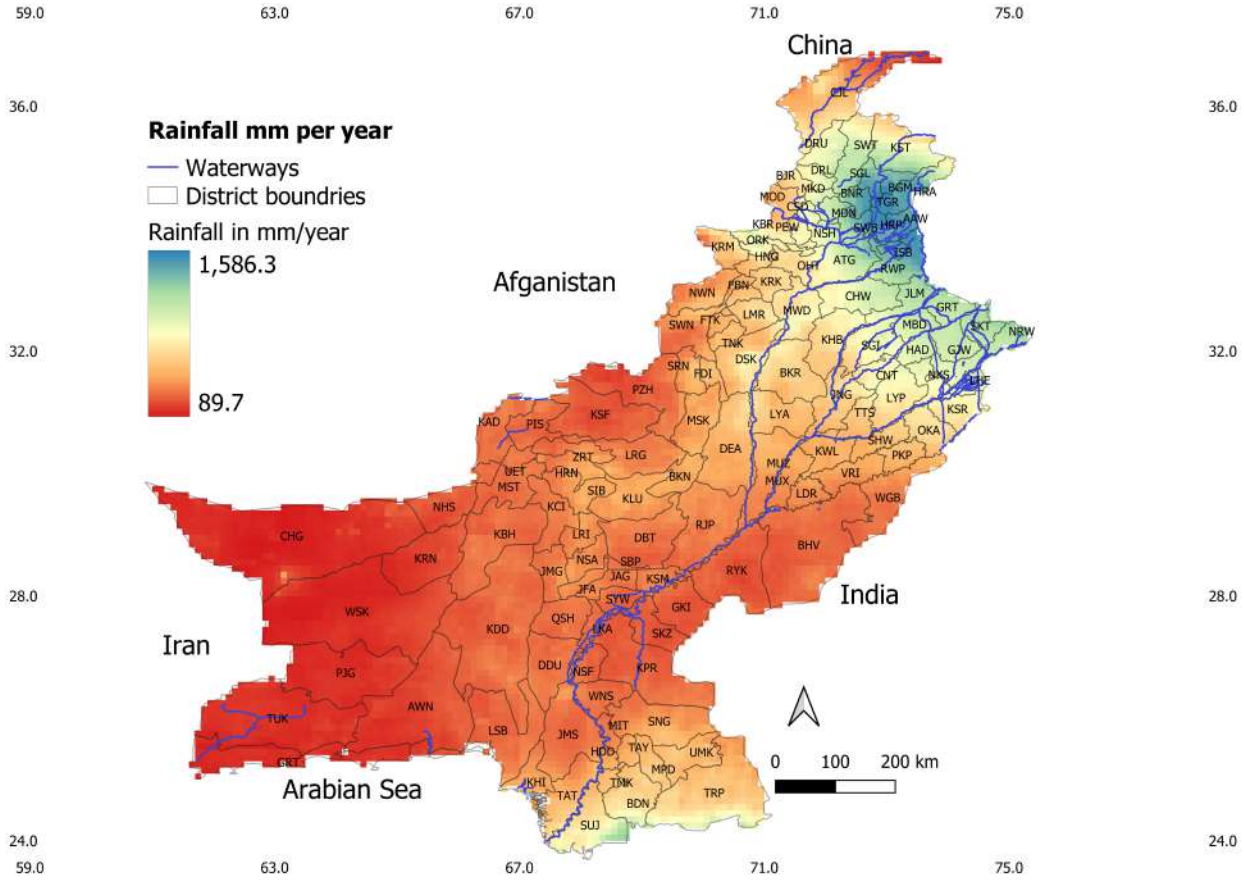


Note: Land roughness is defined as the greatest variation of the central pixel in relation to the eight surrounding pixels; for more details, see for example (Wilson et al., 2007). The district codes and full district names are described in the appendix Table A1. Source: NASA SRTM data.

2.4 Source of soil moisture

Soil moisture is also an important factor in determining land ownership, crop selection, vegetation, and land use in a particular region. The greater the ease and cost of crop irrigation, the higher the land price. Humid and riverbank areas are suitable for both extensive and small-scale farming because cultivating and irrigating both large and smallholdings is cost-effective in these areas. As a result, land in humid and canal-irrigated areas can be expected to be more polarised than land in arid zones. According to Figure 9, the humid zone of Khyber Pakhtunkhwa and Punjab, the arid and semi-arid river plains of Punjab and Sindh, and the Fat Feeder Command area of Balochistan produce more than 80% of the country's food basket. all five rivers in Punjab and the Indus rivers in Sindh flow through this territory. Furthermore, the northern part of Pakistan, as well as the north and northeast of Punjab, get plenty of rainfall. Springs and uncontrolled waterways in the KPK valleys irrigate the most of the Mardan, Malakand, Buner, Charsada, and Swabi districts.

Figure 9: Precipitation, soil moisture and canal irrigation in Pakistan.



Note: The district codes and full names are described in the appendix Table A1.
Source: NASA Earth Data Science System (ESDS) and OSM from Geofabrik.

In contrast, except from canal-irrigated areas, tube-wells are the primary source of irrigation in most areas of the Balochistan and Sindh provinces. Due to low underground water table, a large portion of Balochistan is devoid of any general cropping except for some trees, scrubs, and desert flora. Likewise, districts of Gilgit-Baltistan region in the far north (near the Chinese border) are situated at a substantially high elevation and covered in snow and glaciers. Farming is difficult in these areas and the land is often barren and treeless.

3 Data and Methodology

3.1 Data

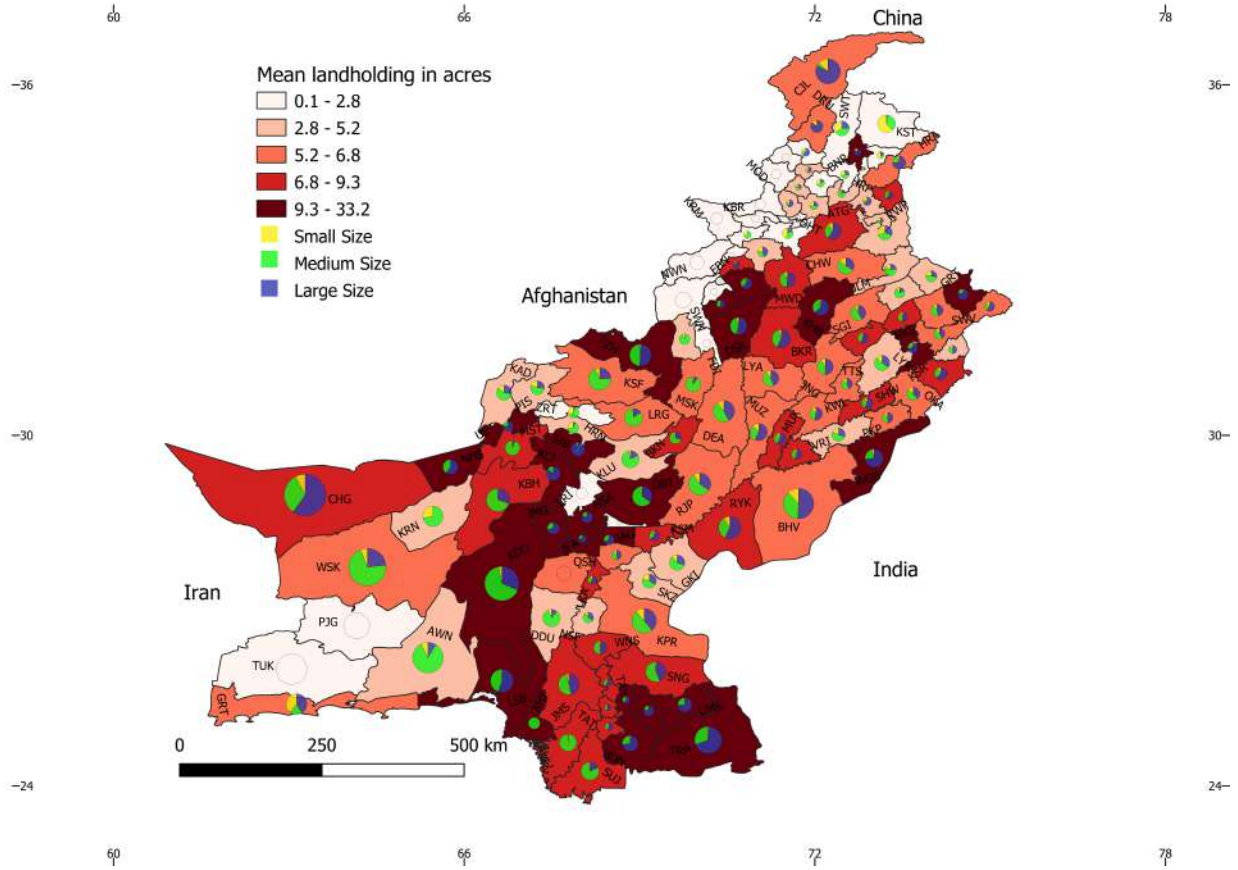
The empirical analysis of this study is based on data from two rounds of the Pakistan Social and Living Standard Survey (PSLM) data. The survey is both district and nationally representative, and includes information on 78,635 farm households in the 2015 round and 73,947 farm households in the 2007 round [3]. In addition to household income, consumption and assets, the survey contains information on the operational status of the household's landholding (owned, rented-in, or rented out for cultivation) as well as the farm's source of soil moisture (irrigation). In the absence of any land or tenancy reforms taking place since 2014, the inferences based on the 2015 data results should still be more or less valid today. Besides, the migration and urbanization trends too have not changed. Land

[3]Data on districts created after the 2007 survey are obtained from the 2009 or 2013 rounds of the survey in which the districts were first included.

fragmentation and exodus from rural areas continues unabated, leading to increasing urban sprawl.

According to the data, 32-33% of the population owns agricultural land, with an average farm size of 2.87 hectares per household. Around 94% of landholdings are small or medium (less than 5 hectares). We group the land holdings into three categories: smallholdings (less than 2.5 acres or 1.01 hectares), medium farms (2.5 to 12.5 acres or 1.01 to 5 hectares), and large farms (more than 12.5 acres or 5 hectares). Figure 10 depicts the district-level mean landholding and percentage share of area by farm of various sizes [4]. On the one hand, in most of the humid and mountainous districts, the percentage share of smallholders is very high in comparison to the corresponding land share. Land in mountainous terrain is typically divided in small parcels. Large landholders, on the other hand, own a sizable portion of land in most arid and semi-arid districts, in spite of their small numbers. This includes districts in the extreme arid zone or desert environment with extensive land estates, such as Sibi, Kachhi, Chitral, Upper Dir, Nasirabad, Tharparkar, Umerkot, Jhal Magsi, Badin, and Bahawalnagar. The relatively higher irrigation cost makes these plains untenable for smallholders.

Figure 10: District-wise mean landholding and percentage share of land area by farm size.



Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculation using PSLM 2015.

Nonetheless, the proportionate share of an area and corresponding number of landholdings for medium-sized farms are roughly equal. Districts with a high proportion of medium-sized landholders include Thatta, Badin, Sujawal, Mastung, Awaran, Kohlu, Barakan, Musakhail, Kharan, Washuk, Kalat, and Khuzdar. These areas have saline or sandy desert soil and a mostly dry climate.

[4] Tables-A4 and -A8 of the apendix provide detailed district-wise estimates of average farm size, land share, corresponding No. of landholding, and percentage change over time across farms of various sizes.

In districts such as Thatta, Awaran, Dadu, Killa Saifullah, Kharan, Kalat, Kech, Mastung, Musakhel, and Khuzdar, where soil is predominantly saline or alkaline, the land share of medium-sized farms is increasing while that of large farms is decreasing. However, in humid areas where farm irrigation is easy or where the soil is clayey and loamy, the opposite is true. Furthermore, the area share of large landholdings has shrunk. However, the decrease in area exceeds the decrease in landholdings, indicating overall land fragmentation and transition from agriculture to non-agricultural businesses.

Overall, the area and number of smallholdings at the national level has increased between 2007 and 2015. However, the increase in area (3.5%) is less than the increase in landholdings (approximately 10%), implying land fragmentation. Most districts experienced land fragmentation, with the exception of some areas in the north where land was already severely fragmented.

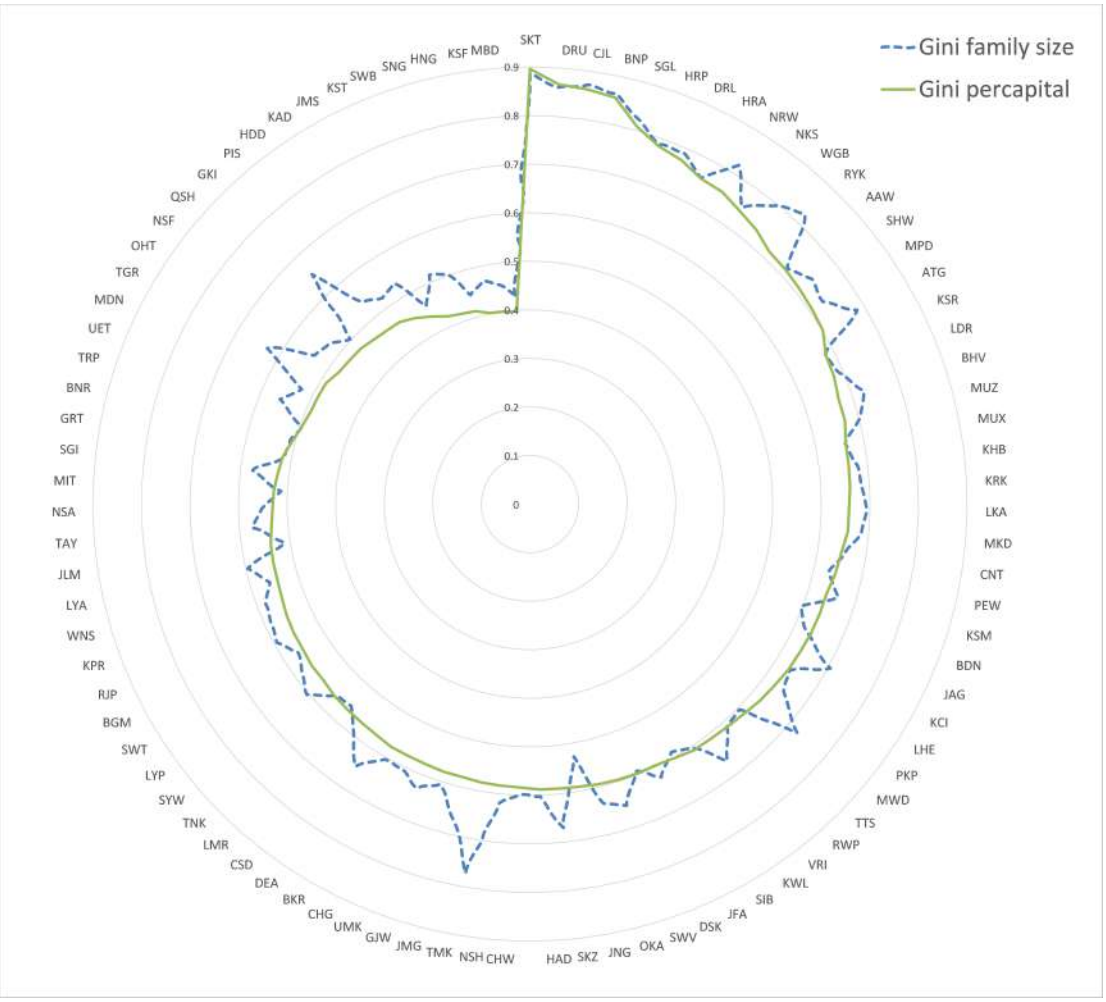
In the absence of significant land reforms in this period, following factors are potentially related to this land defragmentation pattern: first, the custom of egalitarian inheritance among heirs causes land estates to be divided among family members over time. Second, due to land absenteeism and the higher cost of land irrigation on large farms in the arid zone, owners sell unused or excess land when they need cash for agricultural or other business investments.

3.2 Methodology

3.2.1 Measuring land inequality

We measure land inequality, first without and then with landless workers, both at the per capita and the household landholding basis. We find the outcomes of both metrics to be similar (Figure 11), as the average family size of large (more than 5 hectares) and small or medium (less than 5 hectares) farms is practically identical, i.e., 7.09 and 7.05 persons, respectively. In the following, we show land inequality measured on the household landholding basis.

Figure 11: Comparison of Gini of landholding by household and per capita basis.



Source: Authors' calculations using PSLM 2015.

Land inequality among landowners

The intensive-margin inequality portrays the land distribution among landowners. Only the agricultural participants j who own land are included in the distribution. In a general case, the proportion of land ownership l_j by the j^th individual can be expressed as follows:

$$\ell_j \in R: \ 0 < \ell_j < 1 \ \forall \ j \tag{1}$$

The condition $\ell_j > 0 \ \ \forall \ j$ excludes all landless peasants from the distribution.

$$\{j \ \in Z^+ : 1 \leq j \leq n\}$$

The case of perfect equality in intensive-margin land distribution can be described as follows:

$$\ell_j = \frac{1}{n} \ \forall \ j$$

where

$$\{j \ \in Z^+ : 1 \leq j \leq n\}$$

Then

$$\Theta = 0$$

The land distribution is equal based on the intensive-margin if there are just two individuals with equal landownership in an economy with thousands of landless agriculture peasants. In contrast, the case of perfect inequality in intensive-margin land distribution can be illustrated as follows:

$$\ell_j \begin{cases} \simeq 1 \text{ , if } j = k \\ \simeq 0 \text{ others} \end{cases}$$

where $j = k : k$is any specific individual

Then

$$\Theta \simeq \max(\Theta)$$

The above cases are the two extreme scenarios of intensive-margin inequality. All other cases of imperfect land inequality can be represented as follows:

$$\ell_j \in R : 0 < \ell_j < 1 \vdash 0 < \Theta \simeq \max(\Theta) \; if \; \ell_j \neq \frac{1}{n} \; \forall \; j$$

The three cases of intensive-margin inequality Θ are summarized below:

$$\Theta \begin{cases} = 0 if \ell_j = \frac{1}{n} j \quad perfect \; equality \\ \simeq \max(\Theta) \; if \;\; (\ell_j \simeq 1 \; for \; j = k \wedge \ell_j \simeq 0 \;\; \forall \; others) \; max \; inequality \\ 0 < \Theta < \max(\Theta) \; if \; \ell_j \in R : 0 \leq \ell_j < 1 \; \forall j \;\; \wedge \ell_j \neq \frac{1}{n} \; \forall j \; imperfect \; inequality \end{cases}$$

The imposition of strict inequality condition transforms the case of extensive-margin inequality $\mathcal{M}$ into the intensive-margin inequality Θ.

Inequality with landless workers

Extensive-margin land inequality depicts the distribution of land among all agriculture participants, regardless of whether or not they own agricultural land. The fraction of land $\ell_i \in (0, 1)$ that is owned by an individual i out to total population N can be illustrated in terms of extensive-margin inequality as follows:

$$\ell_i \in R : \; 0 \leq \ell_i \leq 1 \; \forall \; i$$

$$\ell_i \begin{cases} => 0, \;\; if \; i = j \quad the \; landholders \\ = 0 \; \forall \; i \neq j \quad the \; landless \end{cases}$$

$$\left\{ i \; \in Z^+ : 1 \leq i \leq N \right\}$$

Suppose that land is distributed evenly among all agricultural participants N, and that each individual shares an equal fraction of landholding $\ell_i = 1/N$, implying that land ownership is equally likely, the scenario of perfect land equality. This type of land distribution can be expressed as follows:

$$\ell_i = \frac{1}{N} \; \forall \; i \quad \wedge \;\; \ell_i > 0 \; \forall i \;\; , \quad symmetric \; land \; distribution \tag{2}$$

Even when land is equally distributed among landholders, extensive margin inequality is not equal to zero in the presence of landlessness. Such that:

$$\ell_i = \frac{1}{N} \; \forall \; i = j \;\; if \;\; \ell_i = 0 \; \forall \; i \neq j, \quad asymmetry \; due \; to \; landlessness \tag{3}$$

$$landlessness = \frac{\sum \; i \neq j}{N} \tag{4}$$

On the other hand, complete extensive-margin inequality occurs when only one person k owns all the land, and

the others have none.

$$\ell_i = \begin{cases} 1 \; if \; i = k \quad complete \; asymmetry \\ = 0 \; \forall \; others \end{cases}$$

The three scenarios above depict extreme cases of extensive-margin inequality. All intermediate cases of imperfect inequality can be expressed as follows:

$$\ell_i \in R : 0 \leq \ell_i < 1 \; \forall \; i \; \vdash 0 < \mathcal{M} < 1 \; if \; \ell_i \neq \frac{1}{N} \; \forall \; i$$

The four cases of extensive-margin inequality $\mathcal{M}$ can be summarized as follows:

$$\text{M} \begin{cases} 0 \; if \; \ell_i = 1N \; \wedge \; \ell_i > 0 \; \forall \; i \quad perfect \; equality \\ > 0 \; if \; \ell_i = 1N for \; i = j \; \wedge \; \ell_i 0 \; \forall \; i \quad inequality \; due \; to \; landlessness \\ \max(\mathcal{M}) if \; \; (\ell_i = 1 \; for \; i = k \; \wedge \; 0 \; \; \forall \; others) \quad perfect \; inequality \\ 0 < \mathcal{M} < \max(\mathcal{M}) \; for \; \ell_i \in R : 0 \leq \ell_i < 1 \; \forall \; i, \; \; \wedge \; \ell_i \neq \frac{1}{N} \; \forall \; i \quad imperfect \; inequality \end{cases}$$

3.2.2 Estimation

We use Gini and MLD (Mean Logarithmic Deviation) indices to quantify various types of land inequity. MLD is more sensitive to the lower end of the distribution, whereas the Gini index is more sensitive to changes in the middle. Unlike MLD, the Gini index has values between zero and one, which are self-explanatory. However, unlike Gini, MLD can be decomposed exactly into its components. The Gini coefficient $\mathcal{G}$ is measured using the following formula:

$$\mathcal{G} = \frac{\sum_{i=1}^{N} \sum_{j=1}^{N} |\ell_i - \ell_j|}{2N^2 \bar{\ell}} \tag{5}$$

Where ℓ_i represents the i^{th} landholdings, $\bar{\ell}$ is the mean landholding, and N is the sample size. Mean logarithmic deviation $\mathcal{H}$ is estimated using the following formula:

$$\mathcal{H} = \frac{1}{N} \sum_{i-1}^{N} ln \left(\frac{\bar{\ell}}{\ell_i} \right) \tag{6}$$

Using MLD, we decompose overall land inequality into within- and between-district inequality as follows:

$$T(\mathcal{H}) = \underbrace{\sum_{d=1}^{D} \left(\frac{N_d}{N} \right) \mathcal{H}_d}_{between \; groups} + \underbrace{\sum_{d=1}^{D} \left(\frac{N_d}{N} \right) \ln \left(\frac{N_d N}{\bar{\ell}_d \bar{\ell}} \right)}_{within \; group} \tag{7}$$

Where, the subscript d in the above formula represents subgroups (districts).

In addition, we use the P90/P10 percentiles to understand land distribution at the extremes. We we use margin plots to analyze the factors x_j and the historical land ownership system z_i prevailed in an area, which help explain the patterns of land inequality across districts. This can be given by the following equation:

$$\mathcal{G}_i = \beta + \sum_{j-1}^{m} \gamma_j x_{ji} + \delta z_i + \varepsilon_i \tag{8}$$

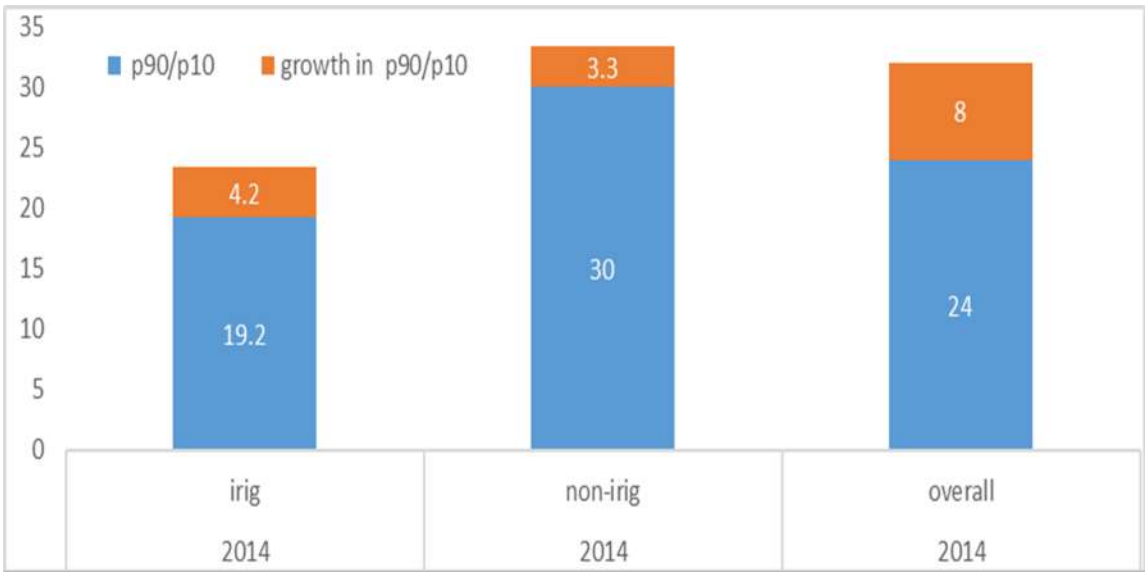
4 Results

4.1 Inequality among landowners

We find high levels of land inequality (Gini = 0.67, MLD = 0.9) in Pakistan. Inequality has increased between 2007 and 2015, with the Gini and MLD indicators showing an increase of 1% and 3% respectively. This increase is mostly concentrated in the upper quintiles, as reflected in the P90/P10 ratio which increased by 8 points to 24 in 2015 (figure 12). Most of the land inequality is within-district, with only 11% of inequality among landowners occurring between districts.

Unirrigated-land inequality remains relatively higher than irrigated-land, with P90/P10 percentile ratios of 30 and 19.2, respectively.

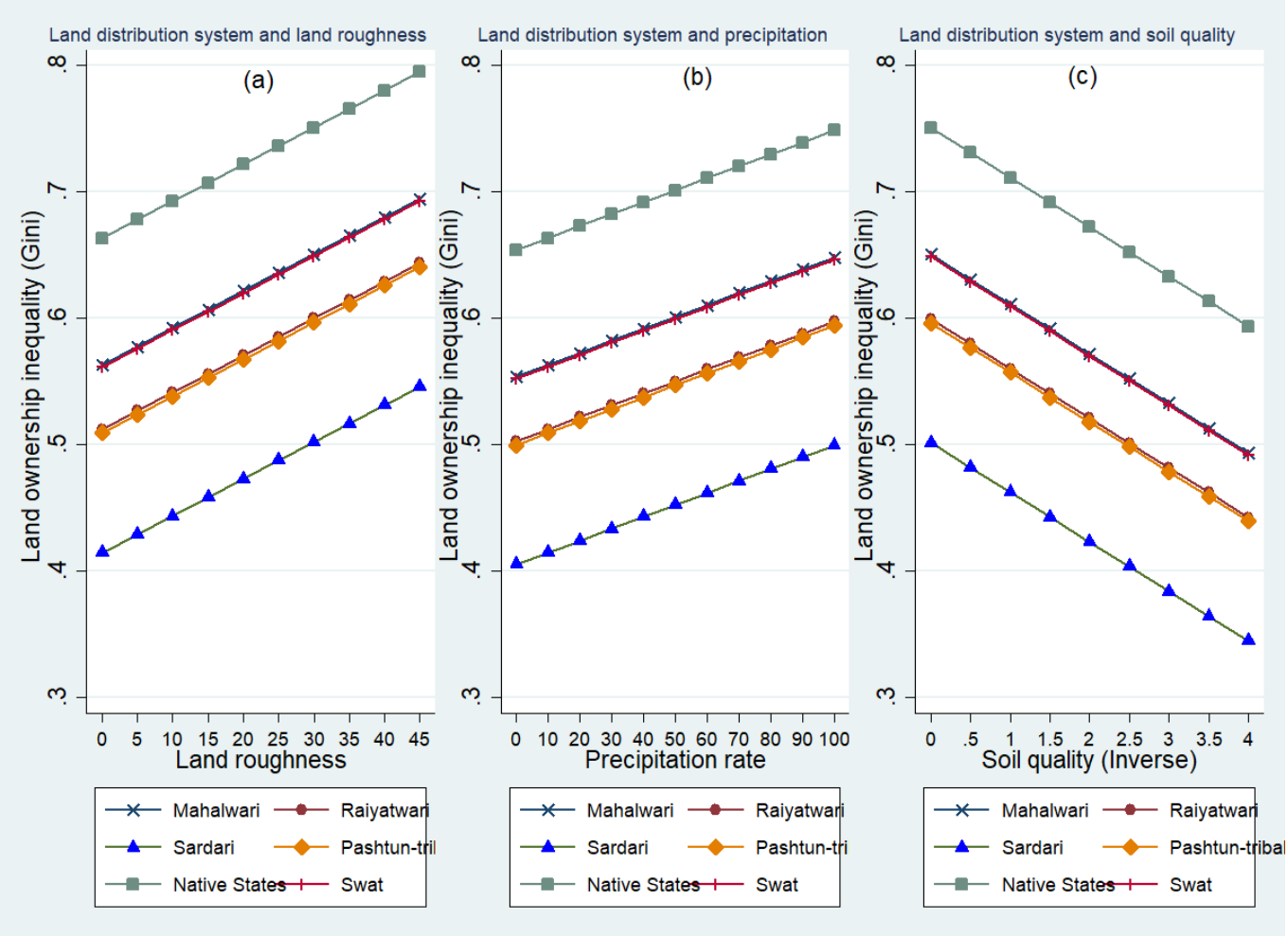
Figure 12: P90/P10 percentile ratio and its growth from 2007-15.



Source: Authors' calculations using PSLM Survey 2007-15.

The share of inequality between districts is higher in un-irrigated landholdings (28%) than that of irrigated land (8%). This is because the pattern of un-irrigated land distribution across the country is different from that of irrigated land. Unirrigated farms in the northern, humid districts are generally small whereas unirrigated farms in the southern, arid areas are often much larger. Irrigated farms, in contrast, show much less variation in size.

Figure 13: Margins plots of land inequality among landowners.



Source: Authors' calculations using PSLM Survey 2007-15.

Figure 13 shows the margins plots of land inequality and its potential determinants. The results show that inequality among landowners is positively associated with soil quality [5] , terrain roughness, precipitation rate, and land irrigation. Furthermore, inequality is lower in Riayatwari, Sardari, and Pashtun tribal land distribution systems, but higher in Mahalwari system and the erstwhile states of Bhawalpur, Khairpur, and Dir.

Figure 14 presents Gini-based quartile distribution of inequality among landowners across districts. The results show that the Gini coefficient values of districts in the first quartile range between 0.64 and 0.91 while those in the second quartile range between 0.57 and 0.64, respectively. Sialkot, Upper Dir, Chitral, Bannu, Shangla, Haripur, Lower Dir, Mansehra, Narowal, and Nankana Sahib are among the top ten districts with the greatest land inequality (Figure 15. Though the ranking within the top ten changes to some extent, the list of districts based on Mean Logarithmic Deviation (MLD) remains the same.

Sialkot has the highest inequality based on land ownership. It is a major industrial city and one of Pakistan's five wealthiest districts. Because of its limited territory and high population density, land for industrial purposes is in high demand. Farm land is both fertile and costly. Historically, land ownership rights in the district were primarily based on tribal ancestral allocation, but some villages or 'Mahals,' later shifted to possession.

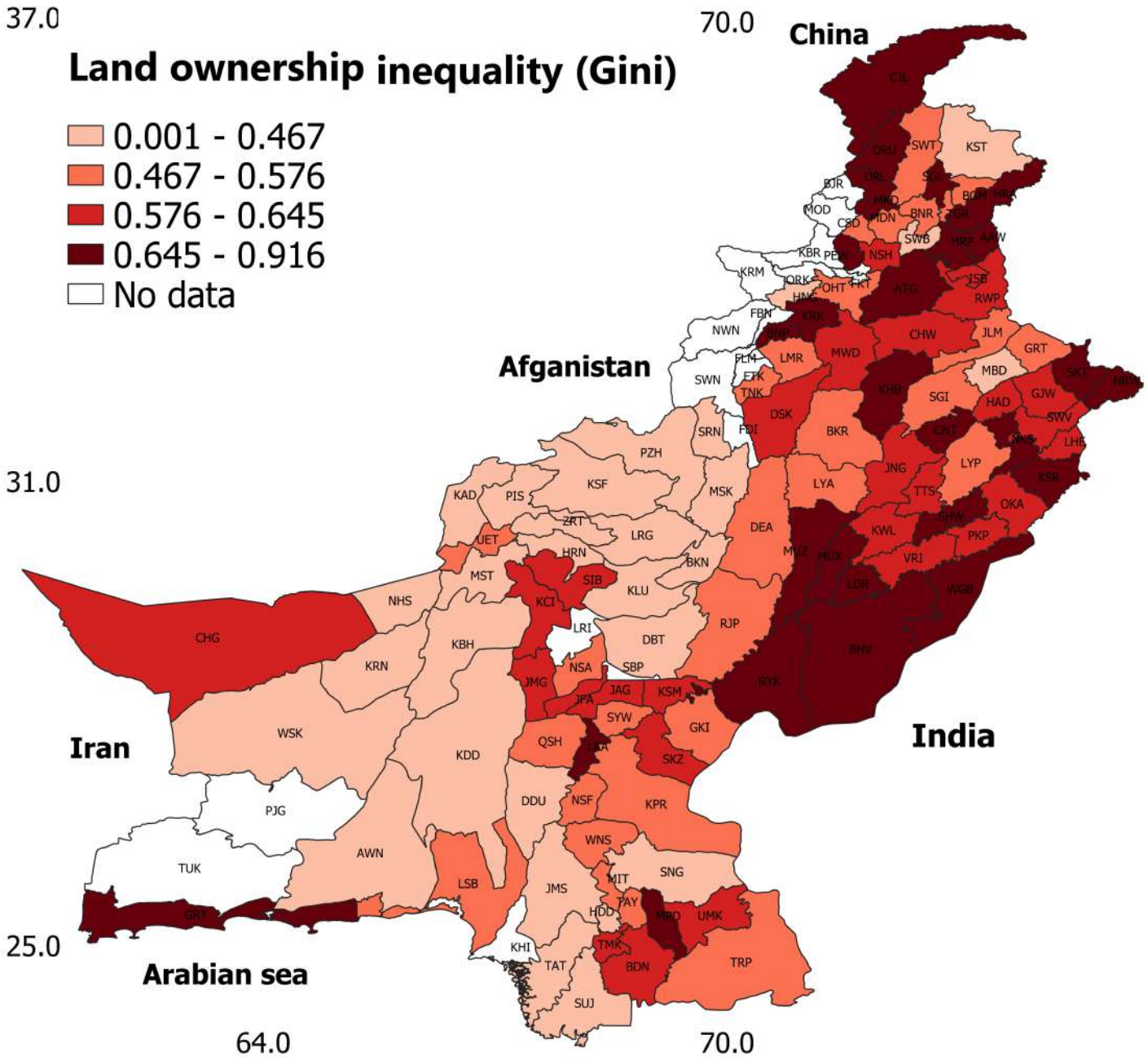
[5]The soil quality ranks from 0 (best) to 7 (worst).

In the district of Upper Dir, the land topography is predominantly mountainous, leaving little land for agriculture. The Dir state (corresponding to Upper and Lower Dir districts) was historically ruled by the Nawab of Dir before merging with Pakistan in 1969. The Nawab's family and their close relatives own the majority of land in Upper Dir. The remaining land is divided into small parcels.

Seven of the top ten most unequal districts are found in Khyber Pakhtunkhwa, with the remaining three located in Punjab. None of the districts in Balochistan or Sindh are among the top ten most unequal districts based on either of the two inequality measures (Gini and MLD). As previously explained, land in these districts was historically allocated based on 'Mahalwari' and tribal land distribution systems, which led to high polarization, particularly in KPK.

In most of the districts lying in the first and second quartiles, land distribution in the pre-colonial era was based on tribal Taluqas, or Ilaqa or Daftar system, and the Mahalwari system afterwards. There are number of reasons for the high inequality observed in these areas. First, large tracks of land (Rukh) were often allocated to landed political elites, while existing family farms got increasingly smaller due to equal inheritance rights among heirs. Second, all of these districts lie in either humid or semi-arid zones, receiving enough precipitation for crop cultivation (figure 9) besides being part of the canal irrigation network fed by the Indus River and its tributaries. As a result, farming on both large and small farms in these districts is viable. Third, except for the erstwhile Bahawalpur state, all districts in the first quartile are small with high population density. Soil quality of these district is the best in the country (figure 7). The demand for the limited amount of fertile land is high, resulting in fragmentation and polarization of land ownership. Finally, districts in the north are mostly hilly or mountainous (figure 8, which limits the average size of the farmholdings.

Figure 14: District-wise quartile distribution of land inequality among landowners (Gini)



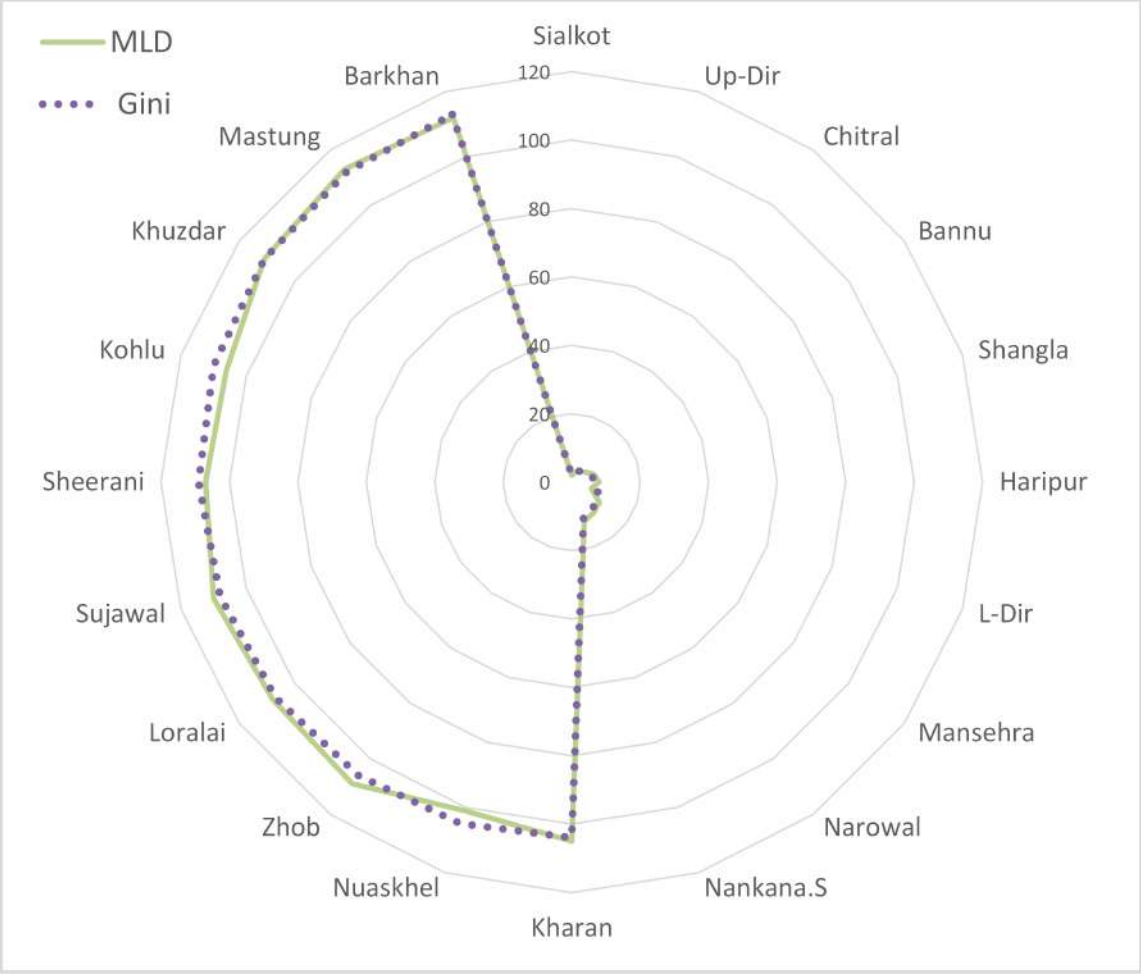
Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculation using PSLM 2015.

In contrast to the first and second quartiles, districts in the third and fourth quartiles are mostly arid and sparsely-populated with low-quality soils. Another contributor to low land inequality in these districts in the south and the south-east is the Riayatwari land distribution system dominant in the Sindh province during the British colonial era. Due to rigorous land revenue assessment, the landed elite declined to accept a land settlement on wastelands (Rukh), which were then allotted to the other tenants (Baden-Powell, 1892a). As a result, though the average land size is high, land distribution in these districts is not very polarized. In the districts in the west and the south west, agricultural land is parceled into relatively large estates among the Sardars. The land is generally

arid and rocky, and the soil is mainly gravelly or alkaline with high pH levels. Although land is abundant, it is not very productive, and the cost of cultivation is high. Irrigation and cultivation of small farms is not cost-effective in these districts. Because of low soil moisture and limited sources of surface water, tube wells are the only source of irrigation, and maintenance costs are high. As a result, agricultural land in these districts is less expensive than in the first and second quartile districts. Land in these areas is primarily used for livestock grazing with sparse crop cultivation.

Eight of the ten bottom districts in terms of inequality among landowners are situated in Balochistan, while the other two are in Sindh, implying that inequality in Balochistan and Sindh is lower than in Punjab and Khyber Pakhtunkhwa. The districts of Thatta, Barakan, Mastung, Khuzdar, Kohlu, Sherani, Sujawal, Loralai, Zhob, and Musakhel have the lowest land inequality among landowners based on both Gini and MLD. Thatta district is located at the Indus Delta's estuary. The Indus Delta plains are typically tidal and estuarial. The soil is poor, sandy, saline, and wet, making agriculture untenable. Cultivation is rare with the exception of a few irrigated plantations on the banks of the Indus River and along the roadside.

Figure 15: Land inequality among landowners (top and bottom ten districts).



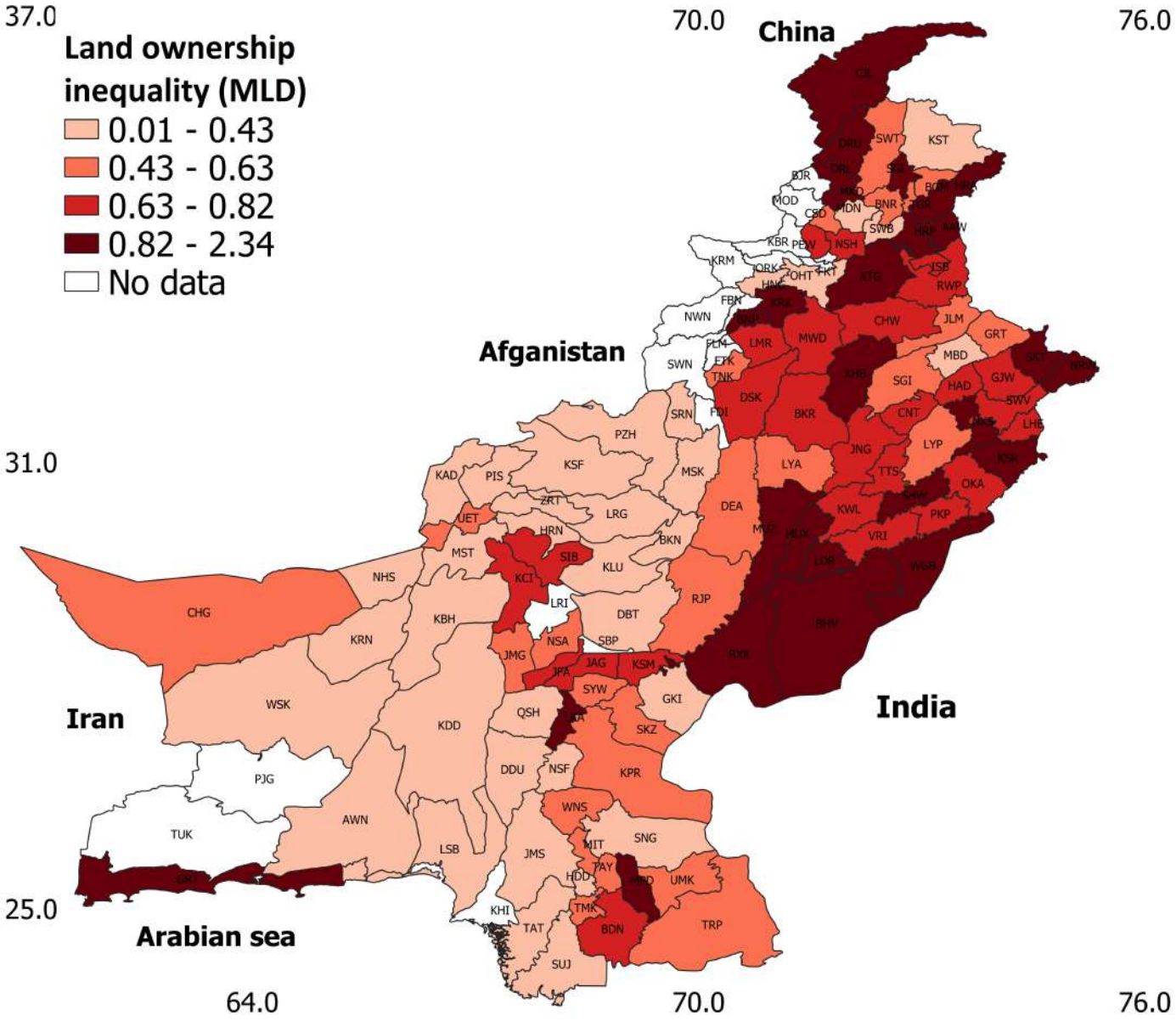
Source: Author's calculation from PSLM Survey 2015.

Overall, the results show that, even though the district rankings based on Gini and MLD differ slightly, the top and bottom ten districts remain unchanged (Figure 15).

The MLD results are remarkably similar to that of Gini, which indicates the land distribution in the middle

and lower tail are pretty identical (figure 16). The detailed results of MLD and Gini are presented in tables-A9 and -A10 in the appendix.

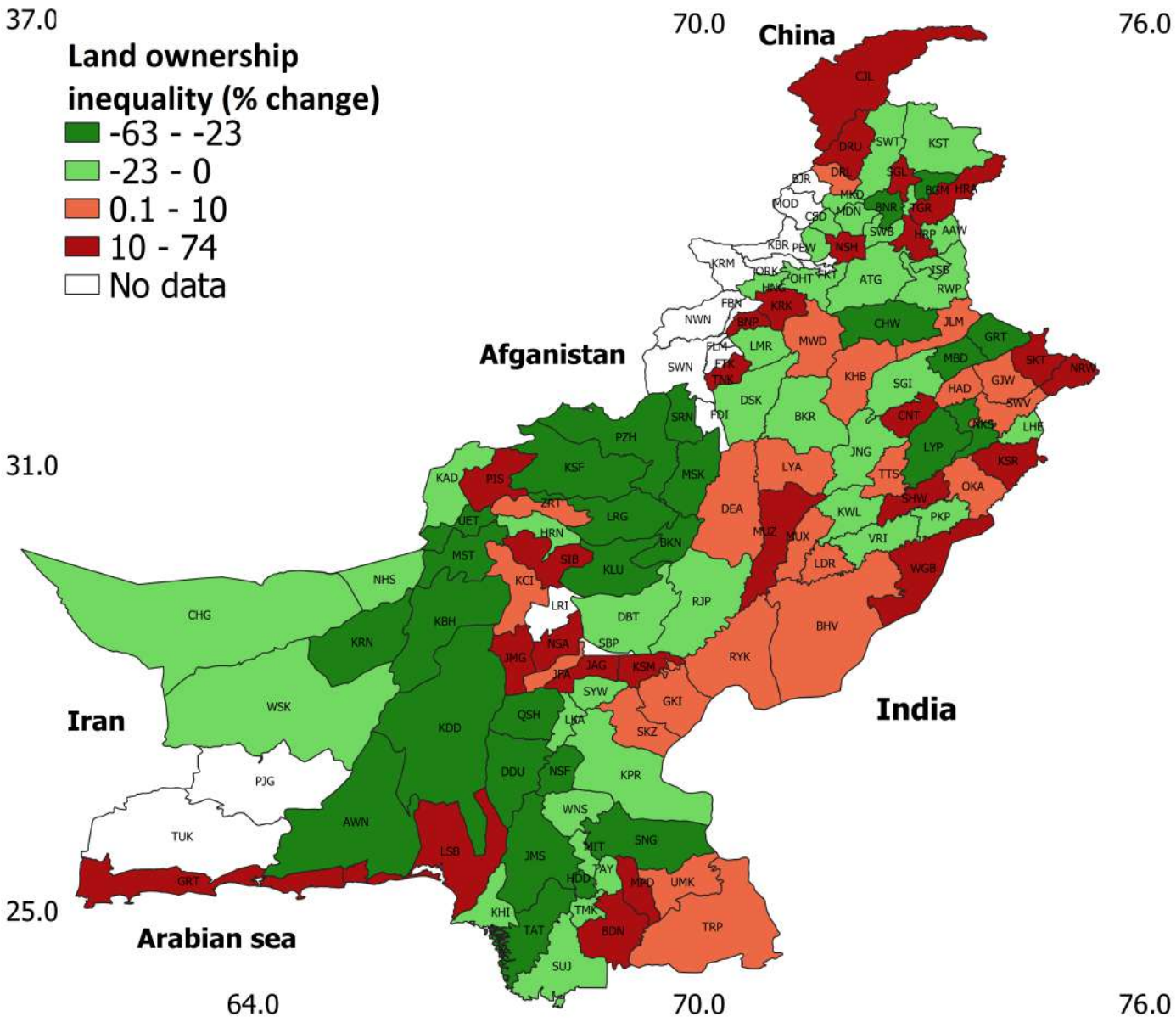
Figure 16: Inequality among landowners by district (MLD).



Source: Authors' calculations using PSLM 2015.

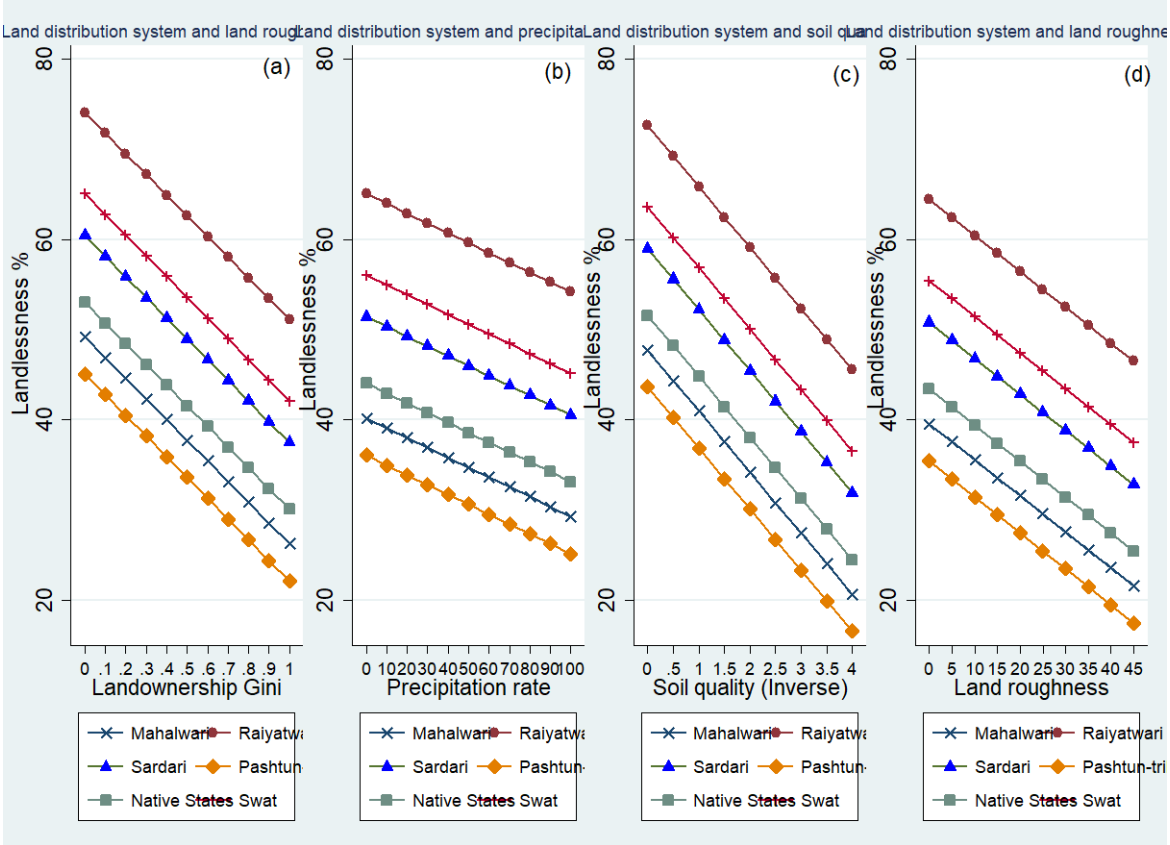
Figure 17 shows the growth in inequality with landowners over time, indicating that most of the districts in which inequality increased between 2007 and 2015 are small. The main source of irrigation in these districts are canals and perennial springs. While the existing medium and small holdings are getting further fragmented through inheritance, large landholders are buying additional land for large-scale progressive farming, leading to further land polarization. In contrast, the districts in which inequality is falling are usually large with arid or semi-arid climate and low-quality soils.

Figure 17: Growth in inequality among landowners from 2007 to 2015 (Gini)



Authors' calculation using PSLM 2007-15.

Figure 18: Margins plots of landlessness in Pakistan.



Authors' calculation using PSLM 2007-15.

The inequality patterns presented above do not match those of landlessness (Figures-4 and -5), as land ownership inequality and rates of landlessness appear to be negatively associated. The margins plots in figure 18 substantiate this assertion.

In the southern and south-western districts, where farms are large and land inequality among landowners is low, majority of the farm workers are landless and must work on the farms owned by the local tribal leaders. In contrast, farmholdings in the central and northern districts are usually small but fertile, and allow smallholder subsistence farming. Consequently, landlessness is low even though inequality among landowners is high.

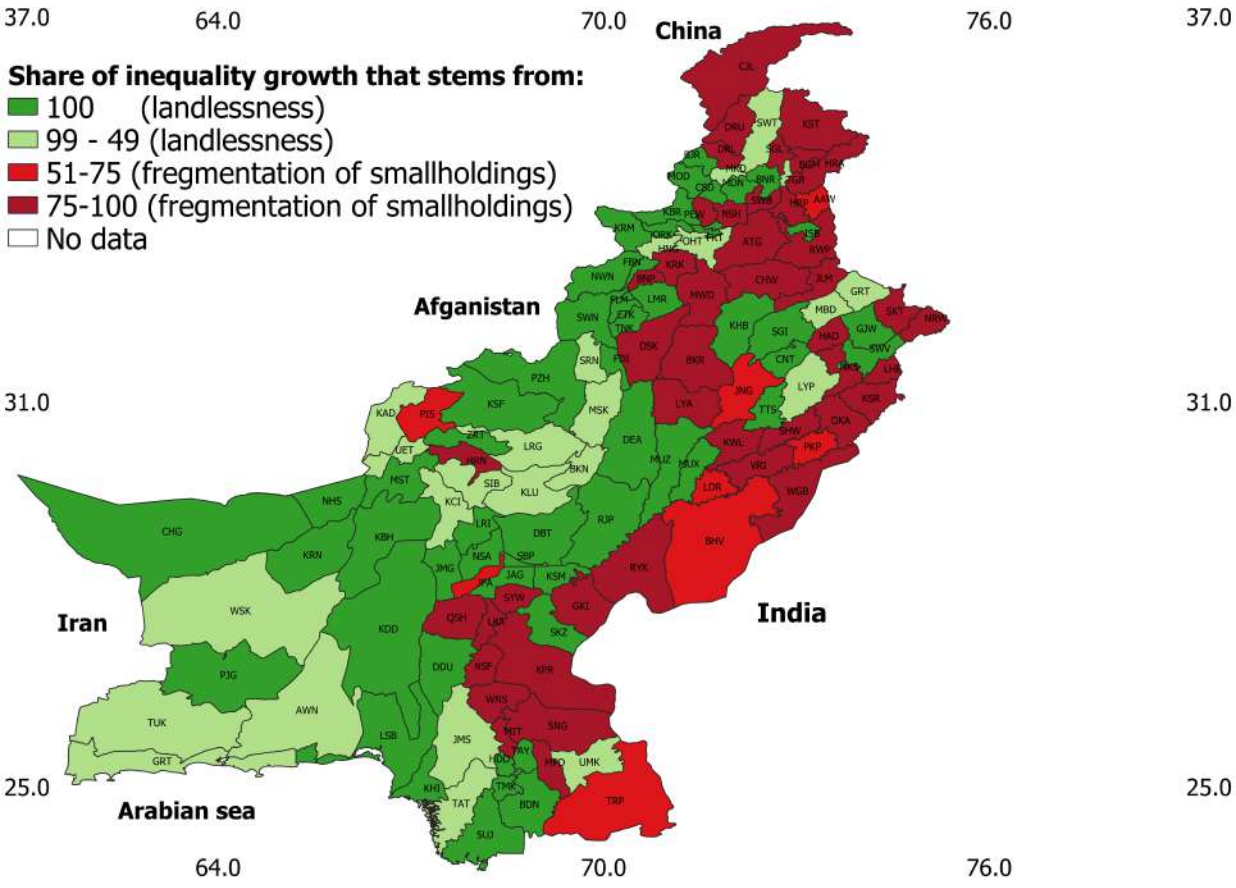
According to the Gini index, the top five districts in terms of the greatest increase in land inequality among landowners between 2007 and 2015 are Gwadar, Chitral, Narowal, Jacobabad, and Upper Dir. Gwadar is a port city where several of the China Pakistan Economic Corridor (CPEC) infrastructure projects have been carried out during the period. Demand for land has risen for housing, industry and hotelling. Chitral and Upper Dir are border districts near Afghanistan and important tourist destinations. Given the mountainous and glacial terrain, little land is available for farming. The ranking based on the MLD measure includes Sialkot rather than Jacobabad. This could be due to the conversion of medium landholders to smallholders as a result of the allocation of a portion of the land for other uses, such as industry and housing, which are more profitable in Sialkot than agriculture. According to Gini, the top five districts with the greatest decrease in land inequality without landless workers are Thatta, Kharan, Sherani, Khuzdar, and Dadu. The land in these districts is not fertile and ill-suited for agriculture. Thatta and Dadu are located in the Indus Delta, which has sandy and saline soil; majority of the land is not arable. In Kharan, much of the land is sandy. The districts of Sherani and Khuzdar are in an arid zone with mostly mountainous terrain and gravelly soil. However, the ranking based on the MLD index includes Nankana Sahib and

Lasbella rather than Sherani and Khuzdar, indicating higher polarisation at the bottom end in Nankana Sahib and Lasbella districts compared to Sherani and Khuzdar. This is possibly due to the lower irrigation cost of cultivating small land in Nankana Sahib and Lasbella compared to Sherani and Khuzdar districts.

4.2 Inequality with landless workers

The level of inequality, and its growth over time, appears to be much stronger when landless workers are included. Results show that the Gini value for overall inequality including landless workers is 0.84 as against 0.67 for inequality measured without landless workers. Due to the rising rates of landlessness, inequality with landless workers has grown more rapadily between 2007 and 2015 compared to inequality among landowners (6% vs 1%). Growth in land inequality in arid and semi-arid regions mainly stems from landlessness, while in more humid areas, fragmentation of smallholdings plays a major role (Figure 19).

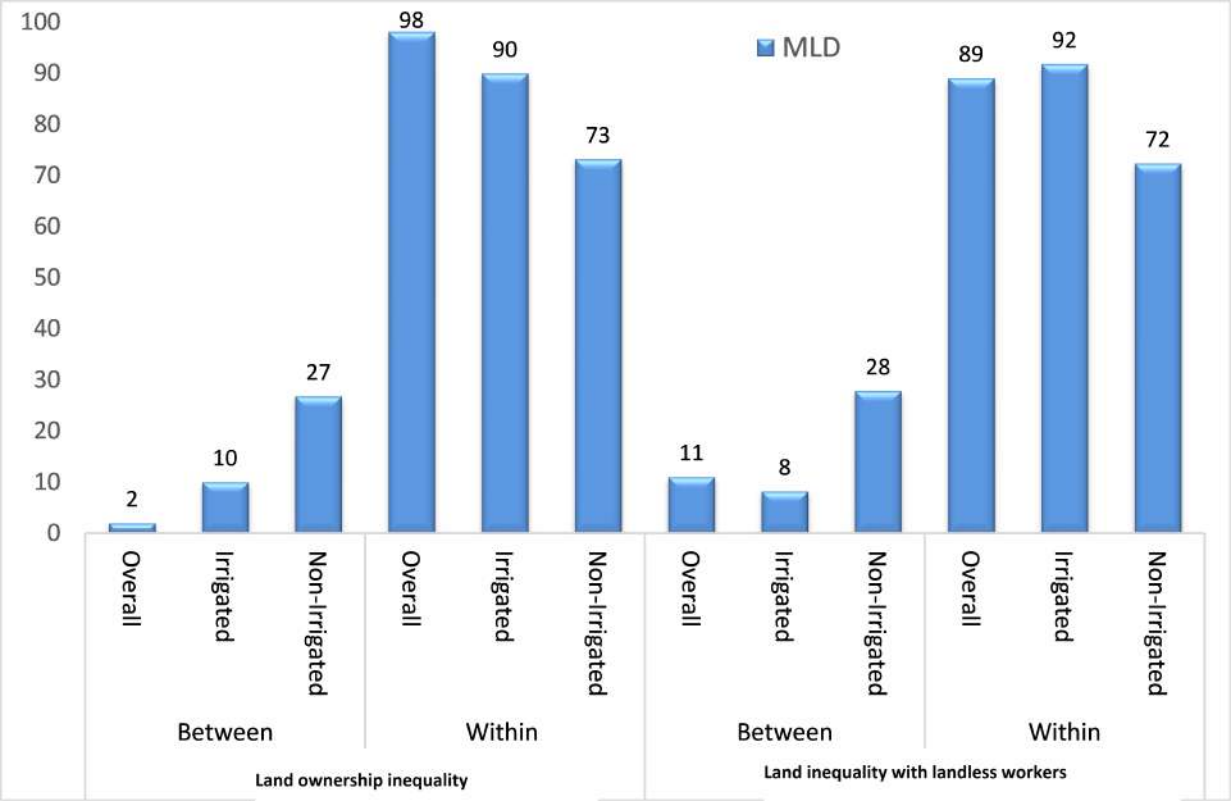
Figure 19: Source of growth in land inequality from 2007 to 2015.



Source: Authors' calculations using PSLM 2014-15.

Just like inequality among landowners, much of the inequality with landless workers is within- and not between-district. Nonetheless, the role of within-district disparities is much stronger, with between-district variation accounting for only 2% of the inequality with landless workers as against 11% of land inequality among landowners (Figure 20). The pattern of between-district inequality is similar in irrigated and un-irrigated areas, with between-district inequality with landless workers in the un-irrigated areas accounting for a slightly higher (10%) share of land inequalities than that found among landowners (8%).

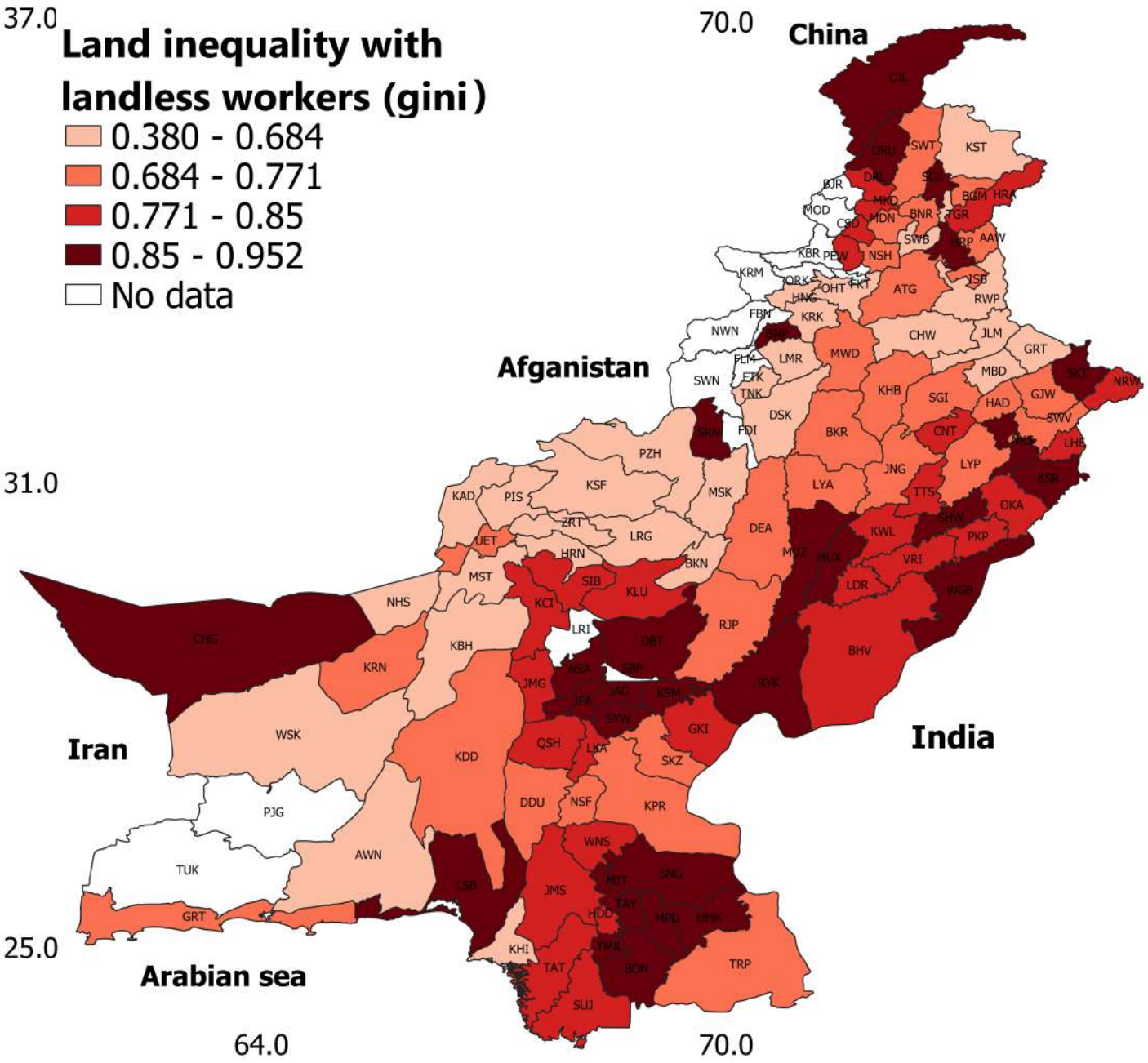
Figure 20: Within and between district inequality with and without landless workers.



Source: Authors' calculations using PSLM 2014-15.

In contrast to inequality among landowners, land inequality measured including landless workers is concentrated in arid and semi-arid districts. Figure 21 presents the quartile distribution of the districts based on inequality with landless workers, which shows that districts with higher inequality are generally either small or have higher rates of landlessness.

Figure 21: Districts' quartile distribution based on the land inequality with landless workers.



Note: The district codes and full names are described in the appendix's Table A1.
Source: Authors' calculations using PSLM 2015.

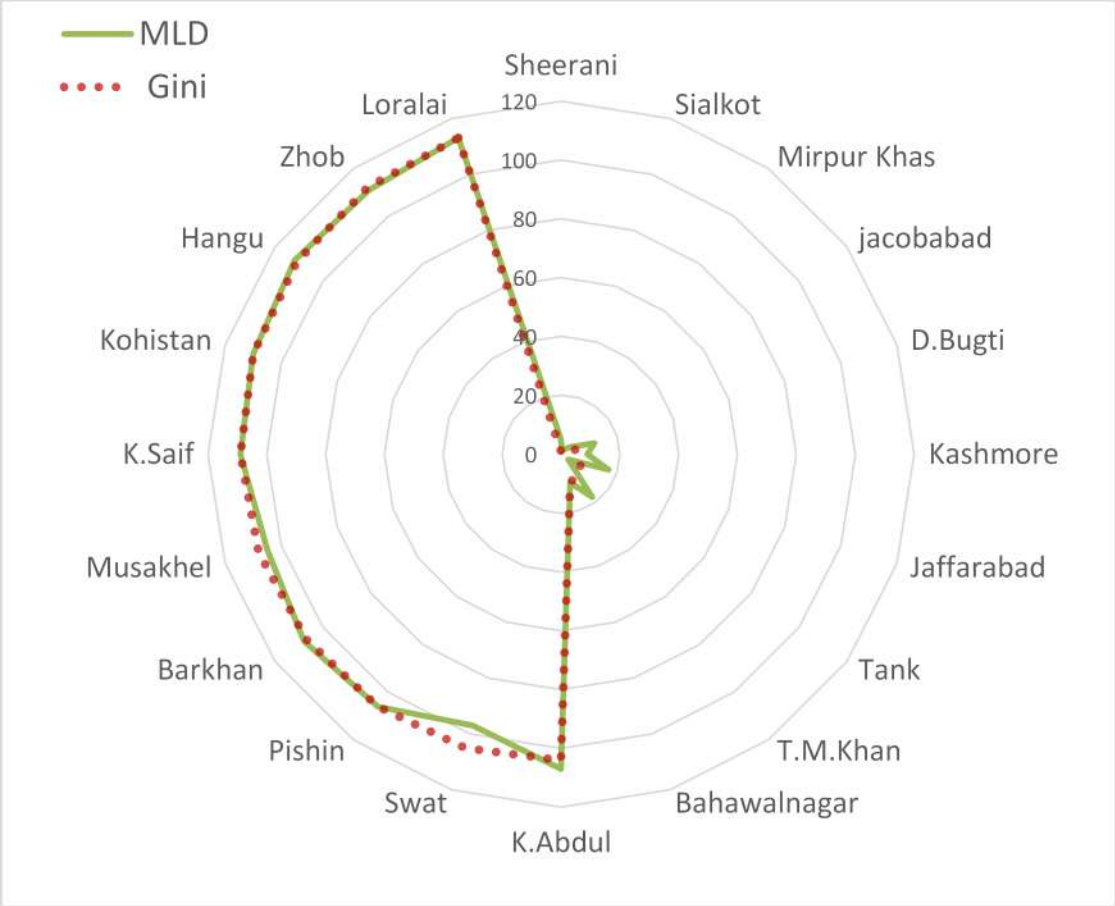
The relatively-high levels of inequality with landless workers observed in the southern districts of Sindh province is associated with the landlord-based Zamindari land distribution system that existed prior to the British era, which was replaced by the Riayatwari system later on. This set up required extensive use of landless farm labor.

The top ten districts in terms of inequality with landless workers include Sherani, Sialkot, Mirpur Khas, Jacobabad, Dera Bugti, Kashmore, Jaffarabad, Upper Dir, Tando Muhammad Khan, and Bahawalnagar. These districts are generally small in area and have high rates of landlessness (figure 22).

Districts in southern Punjab have high levels of both types of land inequality. Historically, the land settlement

practiced in South Punjab was not based on common ancestry or lineage. The 'Mahals' were largely 'Bhaichara' or 'Pattidari', groups of individual landholdings centered around a well or canal. The wells sometimes belonged to the landlords, in which case the farmers paid a rent to use water. In the former-Bahawalpur state, Zaildari or Lambardari land distribution systems were historically predominant. Agricultural land was only in the hands of a few landlords and overlords (Baden-Powell, 1892b), implying that both types of land inequality were high.

Figure 22: Land inequality with landless workers (top and bottom ten districts).



Source: Authors' calculations using PSLM 2015.

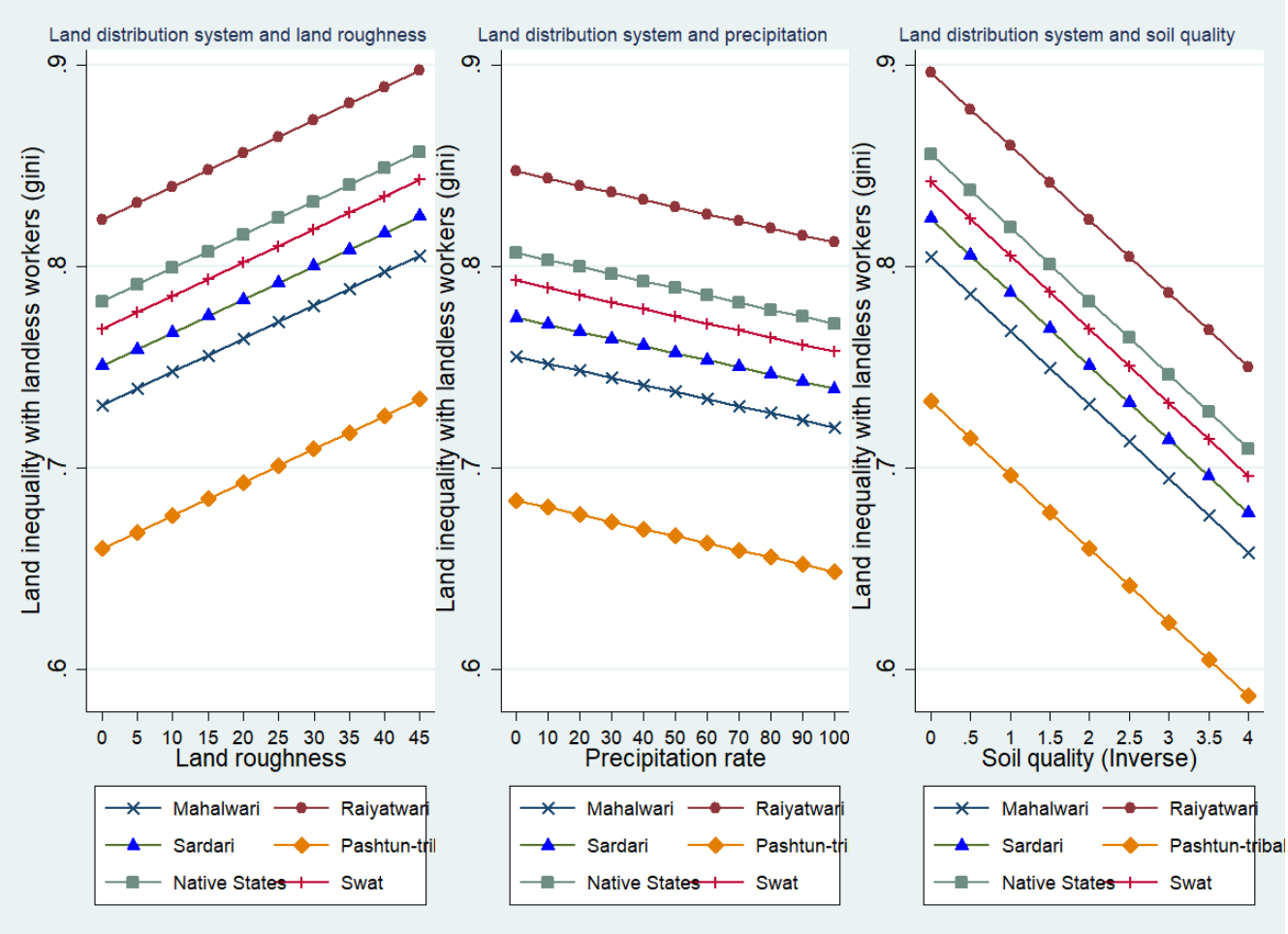
In contrast to the southern districts, districts in the north and the west inhabited by Pashtun tribes have low levels of land inequality with landless workers as the rates of landlessness are low. Landlessness is somewhat higher in Baloch districts where Sardars continue to wield power. Unlike tribal land allocation in Pashtun regions, the tribal chief here used to hold an additional part in each landholding called (Tuman). The land was often apportioned within the tribe based on the number of armed men a clan sent in a battle, rather than on a per capita 'Khula Vash' basis common in the adjoining Pashtun districts.

The bottom ten districts include Loralai, Zhob, Hangu, Kohistan, Killa Saifullah, Musakhel, Barakhan, Pishin, Tor Ghar, and Killa Abdullah. These districts are generally large in size but have low landlessness rates. Seven of these districts are situated in Balochistan, and the remaining three are located in Khyber Pakhtunkhwa.

The above arguments are also substantiated by the margins plots presented in figure 23 which show that, contrary to inequality among landowners, inequality with landless workers is higher in areas with a history of Riayatwari and Sardari land distribution but lower in more egalitarian Pashtun tribal land distribution. Unlike inequality among landowners, inequality with landless workers is negatively associated with the precipitation rate. However,

both types of inequality are positively associated with soil quality and land roughness. Land inequality is higher in districts with more fertile soils.

Figure 23: Margins plots of land inequality with landless workers.

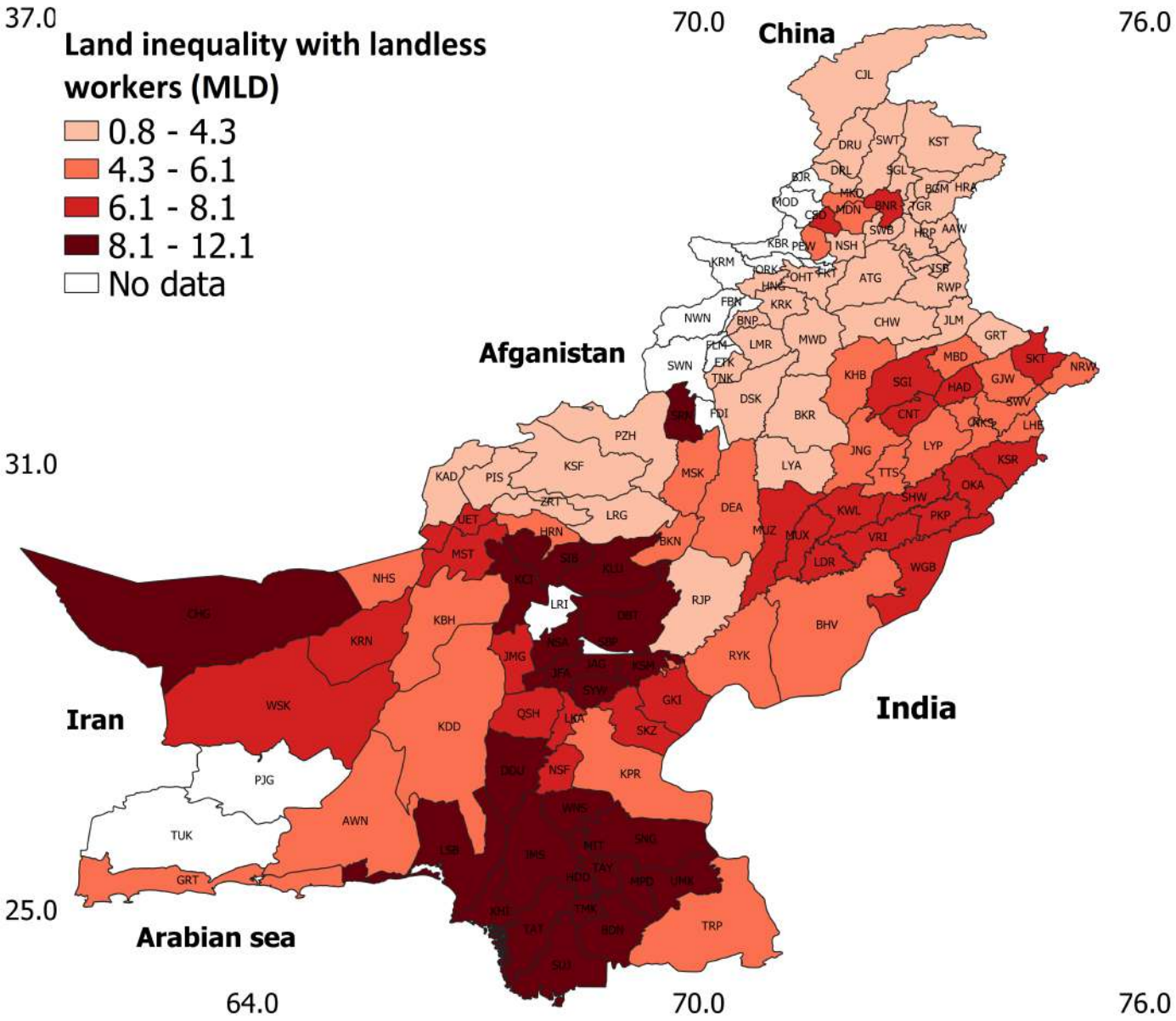


Source: Authors' calculations using PSLM 2007-15.

The MLD results are similar to that of Gini, however, some districts with low rats of landlessness rank lower in terms of inequalities with landless workers compared to those without landless workers (figure 24) [6]

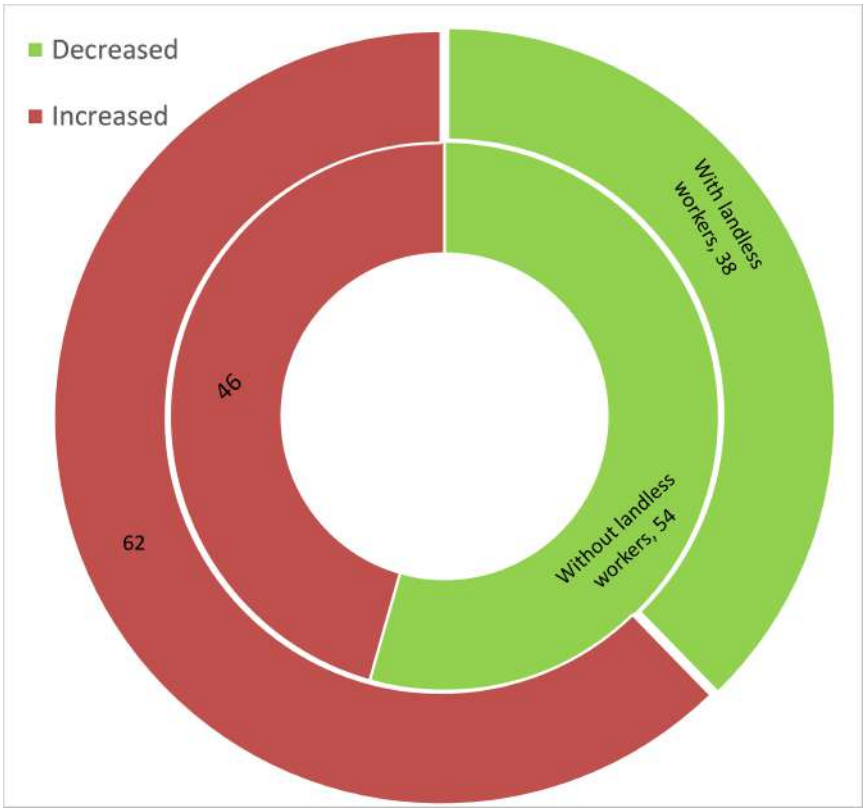
[6]Detailed results of MLD and Gini are presented in tables-A9 and -A10 in the appendix.

Figure 24: Inequality with landless workers by district (MLD).



Note: The district codes and full names are described in the appendix's Table A1.
Source: Authors' calculation using PSLM 2015.

Figure 25: Change in land inequality (2007-15).



Source: Authors' calculation using PSLM 2007-15.

Figure 25 depicts the growth over time in land disparities with landless workers, indicating that 62% of districts experienced an increase, compared to 46% of the districts that experienced an increase in inequality without landless workers.

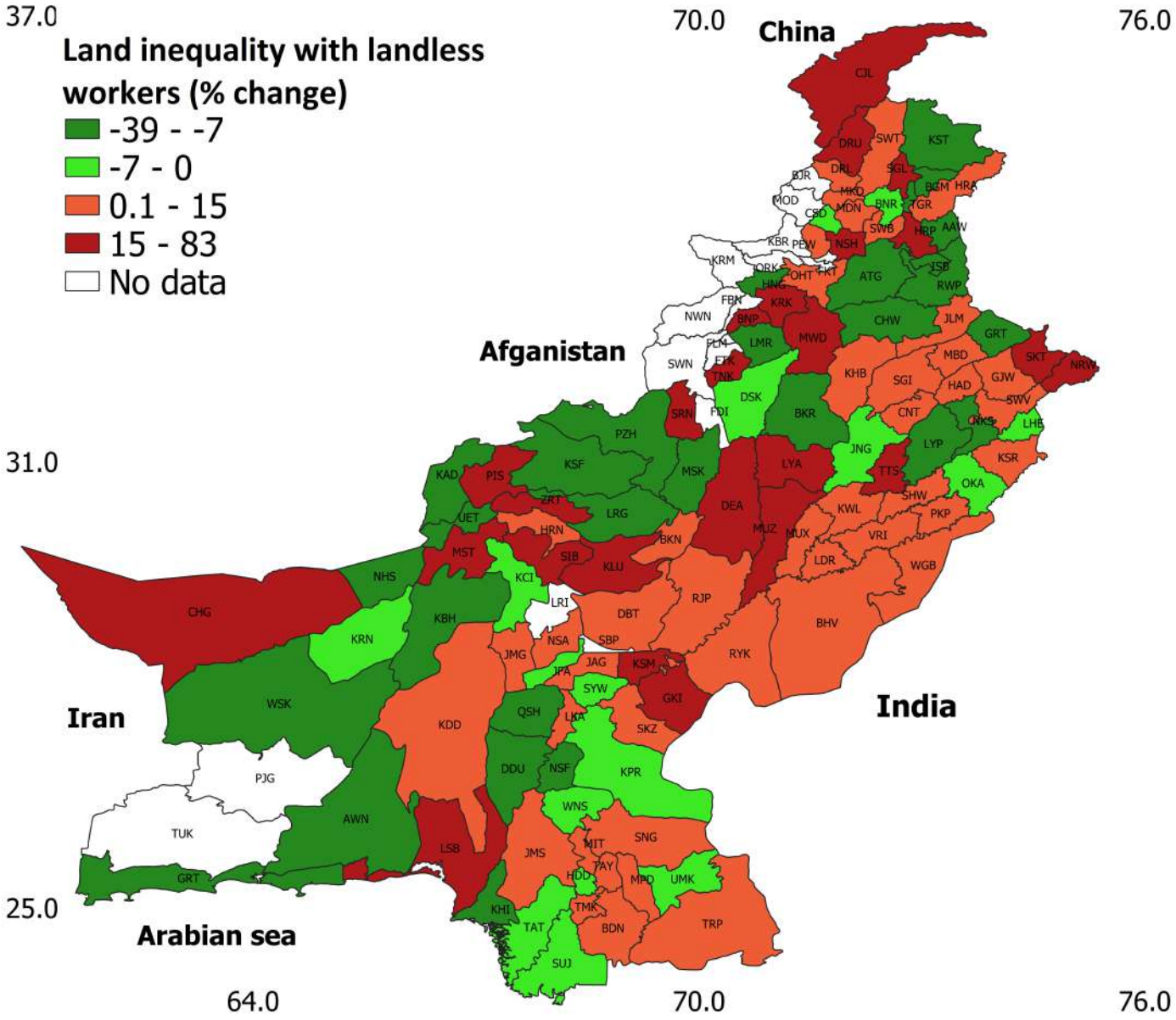
Many of these districts showing increasing land inequality with landless workers are densely populated with fertile soils and increasingly-limited arable farmland (figure 26). Demand for land for industry and housing is outstripping supply in these districts. As land availability for agriculture decreases, a surplus of landless laborers is emerging, resulting in widening land disparities.

Kashmore, Chitral, Sherani, Lasbella, and Jhal Megsi are the top five districts with the highest percentage increase in inequality with landless workers. The rise in land inequality in these districts is due to a sharp rise in landless peasants, except for Chitral where there is no significant increase in landlessness, but some medium landholdings are polarized into large and smallholdings, contributing to increasing land inequality. Lasbella and Sherani are among the top five districts with the highest decline in inequality without landless workers. Still, these districts are among the top five with the highest increase in land inequality with landless workers. This is due to the highest (78 percentage point) increase in landlessness in Sherani and a 35 percentage point increase in Lasbella.

At the other end, the decline in inequality with landless workers is concentrated in larger districts with lower rates of landlessness. With rapid urbanization, increasing numbers of landless peasants are turning towards the cities for better opportunities. This, in turn, is improving per capita land availability and lowering land inequality. Awaran, Nushki, Killa Saifullah, and Rawalpindi are the top five districts with the most significant reduction in inequality with landless workers. The greatest decrease in the districts of Killa Saifullah, Awaran, and Rawalpindi is due to the decrease in landlessness accompanied by land fragmentation. In Rawalpindi, the reason could be a decrease in the number of landless farmers, who frequently migrate to urban areas in search of work. However, in

Nushki, the drop is due to a significant reduction in landlessness as a result of extension in agricultural land.

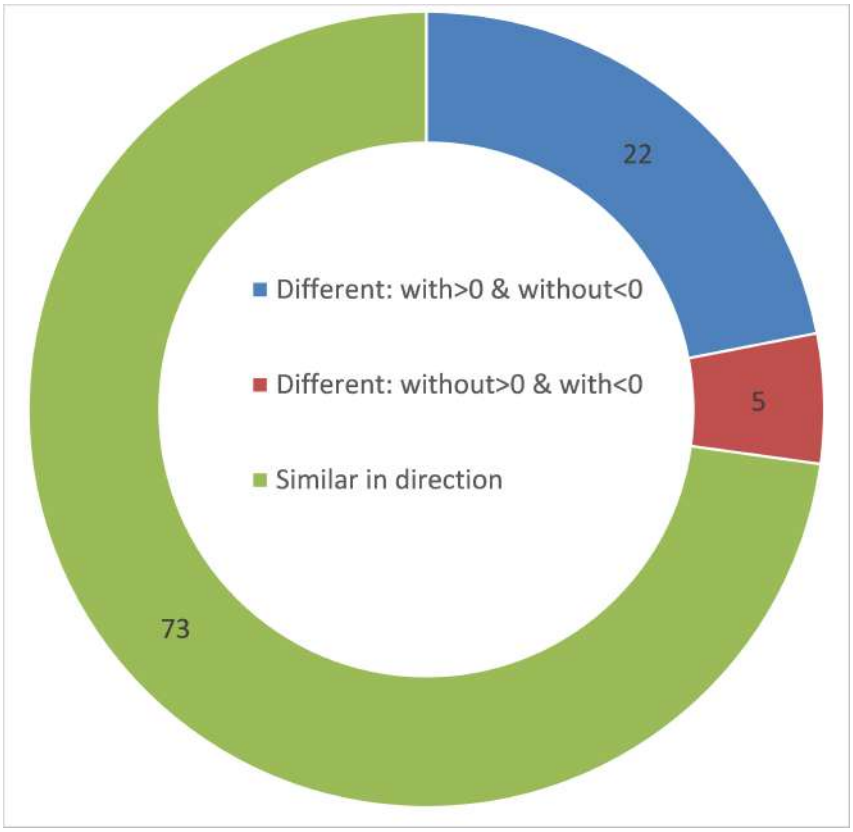
Figure 26: Growth in land inequality with landless workers from 2007 to 2015 (Gini).



Note: The district codes and full names are described in the appendix's Table A1.
Source: Authors' calculations using PSLM 2007-15.

Summing up the discussion, in 73% of the districts, the change in the two types of inequality is in the same direction, even though the increase in inequality measured with landless workers is stronger. Out of the 27% of the districts where the change in the two types of inequality is in the opposite direction, an increase in inequality with landless workers is accompanied by a drop in inequality among landowners in 22% of the districts. The opposite is true in the other 5% (figure 27). This again substantiates the assertion that land inequality estimated among landowner farm households provides us a picture differ from what we see when landless workers are also included, and that land inequality with landless workers portrays a more comprehensive picture of land distribution.

Figure 27: Direction of overtime change in the two inequality measures 2007-15



Source: Authors' calculations using PSLM 2007-15.

Moreover, a shift from agriculture to non-agribusinesses is observed in districts such as Peshawar, Shaheed Benazir Abad, Kharan, Sherani, Dadu, Hyderabad, Lahore, Chagai, Awaran, and Thatta. Some of these districts are witnessing high rates of urbanization, while others have increasingly challenging farming conditions with erratic rainfall and sandy, saline, or alkaline soils.

On the other hand, farming has expanded [7] in 39 out of 114 districts. The districts either lie in the humid zone where water availability is easy or extensive farmland is available for cultivation, or are situated in extended un-irrigated plains. Furthermore, agriculture intensification is observed in 92 of the 114 districts, indicating that arable land per agriculture participant has decreased in the majority of districts. In other words, agriculture production in most districts is becoming more labor-intensive, resulting in lower labour productivity.

Majority of the districts (75%) experienced land fragmentation during the period, while the remaining 25% experienced land consolidation. Districts with the greatest increase in smallholder area are primarily those with readily available irrigation water or with mountainous terrain with sandy-saline soil. Nonetheless, increase in the number of smallholders exceeds the increase in farmland availability, indicating that farmland in these regions is becoming more fragmented.

Furthermore, there is an increase in the land share of medium-sized farms and a decrease in the large-size farms in districts that are mostly dry and where the soil is primarily saline or alkaline, such as Thatta, Awaran, Dadu, Killa Saifullah, Kharan, Kalat, Kech, Mastung, Musakhel, and Khuzdar. However, the opposite is true in humid areas where farm irrigation is easy or where the soil is clayey and loamy.

[7] By agriculture extension, we mean an increase in the agricultural land availability for cultivation.

5 Conclusion and recommendations

In this study, we estimated land inequality in Pakistan, and the role landlessness plays in its measurement. We used data from 78,635 and 73,947 households from the 2015 and 2007 rounds of the district representative Pakistan Social and Living Standard Measurement Survey (PSLM) to estimate Gini and MLD measures of land inequality, with and without landless farm workers. We report the two sets of land inequality measures across districts and observe the changes in inequality patterns over time. We explain these patterns in light of the historic land distribution and climatic, topological and geographical factors prevailing in the area. We find that the patterns of land inequality are significantly different depending on whether or not we include the landless peasants in the measurement. Land inequality measured including landless farm workers is substantially greater than that estimated only among owners of the landholdings. Besides, land inequality has worsened over time much more than what the measure based only on landowners would suggest. Between 2007 and 2015, land inequality with landless workers increased by 1% while that without including landless labor increased by 6%. The growth in land inequality mainly stems from landlessness in the arid- and semi-arid regions and from fragmentation of smallholdings in the humid regions. Furthermore, within -district land inequality has increased in 46% of the districts when focusing only on landowners and in 62% of the districts when landless workers are included. We found that land inequality among the land owners is higher in the districts with humid climate, while inequality including landless workers is higher in arid and semi-arid areas. The differences in terms of historic land distribution systems practiced in the districts are also clear: Inequality among landowners is lower in districts where the Riayatwari- (Gini=0.49) and Sardari (Gini=0.42) systems of land distribution were historically prevalent. However, land inequality including landless workers was substantially higher in these districts (Gini=0.82 and 0.76). In contrast, districts with comparatively egalitarian land distribution based on Pashtun tribal ancestral land rights have the lowest rates of landlessness (20%) and much lower rates of inequality including the landless workers (Gini=0.64), despite showing mid-range levels of inequality among landowning farm households (Gini=0.49).

These findings have important implications for farm productivity and efficiency as well as the food security and welfare of the rural population. In the arid districts, land inequality is high and has worsened over time. On the one hand, decreasing water availability coupled with low soil fertility is making the economic survival of small landholders and landless peasants difficult. This is leading to increasing outflows of unskilled labour from the rural to the urban areas, causing haphazard and uncontrolled growth of major cities. On the other hand, large farms are getting larger, more mechanized and energy-intensive (Ayaz and Mughal, 2022b). Wealth in the rural areas is increasingly getting concentrated in fewer hands, with non-negligible implications for social cohesion and harmony. This trend could be slowed or reversed by focusing on land and tenancy reforms that aim in improving the opportunities for landless peasants and smallholders. First, large tracks of unoccupied state land could be distributed among landless peasants. Second, tax structure needs to be designed in a way that discourages the practice by large landowners of leaving the land uncultivated. This will help increase land availability for renting or sale to small and landless farmers. In humid and canal-irrigated areas, tenancy reforms are required to provide tenure security to landless tenants and protect them from arbitrary eviction by powerful landed elites. The use of information technology, for instance through GPS-based land rights, can help improve the security of agricultural land and facilitate the expansion of agricultural land markets. These reforms that promote better access to land for the landless agricultural workers can also lead to greater political inclusion and better representation of the masses. The methodology employed in this study can be replicated beyond Pakistan in order to present a comprehensive picture of land inequality in both within-country (across regions or districts) and cross-country analyses, particularly where the source of land inequality among agricultural participants is heterogeneous.

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Appendix

List of supplementary tables-A

Table A.1: District names and Codes for representation.

Name	Code	Name	Code	Name	Code
Abbottabad	AAW	Kachhi	KCI	North Waziristan	NWN
Attock	ATG	Kalat	KBH	Nowshera	NSH
Awaran	AWN	Karachi	KHI	Nushki	NHS
Badin	BDN	Karak	KRK	Okara	OKA
Bahawalnagar	WGB	Kashmore	KSM	Orakzai	ORK
Bahawalpur	BHV	Kasur	KSR	Pakpattan	PKP
Bajaur	BJR	Kech	TUK	Panjgur	PJG
Bannu	BNP	Khairpur	KPR	Peshawar	PEW
Barkhan	MST	Khanewal	KWL	Pishin	PIS
Battagram	BGM	Kharan	KRN	Qambar Shahdadkot	QSH
Bhakkar	BKR	Khushab	KHB	Quetta	UET
Buner	BNR	Khuzdar	KDD	Rahim Yar Khan	RYK
Chagai	CHG	Khyber	KBR	Rajanpur	RJP
Chakwal	CHW	Killa Abdullah	KAD	Rawalpindi	RWP
Charsadda	CSD	Killa Saifullah	KSF	Sahiwal	SHW
Chiniot	CNT	Kohat	OHT	Sanghar	SNG
Chitral	CJL	Kohistan	KST	Sargodha	SGI
Dadu	DDU	Kohlu	KLU	Shaheed Benazirabad	WNS
Dera Bugti	DBT	Kurram	KRM	Shangla	SGL
D.G Khan	DEA	Lahore	LHE	Sheerani	SRN
D.I Khan	DSK	Lakki Marwat	LMR	Sheikhupura	SWV
Faisalabad	LYP	Larkana	LKA	Shikarpur	SYW
FR Bannu	FBN	Las Bela	LSB	Sialkot	SKT
FR D.I Khan	FDI	Layyah	LYA	Sibi	SIB
FR Kohat	FKT	Lehri	LRI	Sohbatpur	SBP
FR Lakki Marwat	FLM	Lodhran	LDR	South Waziristan	SWN
FR Peshawar	FPR	Loralai	LRG	Sujawal	SUJ
FR Tank	FTK	Lower Dir	DRL	Sukkur	SKZ
Ghotki	GKI	Malakand PA	MKD	Swabi	SWB
Gujranwala	GJW	Mandi Bahauddin	MBD	Swat	SWT
Gujrat	GRT	Mansehra	HRA	Tando Allahyar	TAY
Gwadar	GRT	Mardan	MDN	Tando Muhammad Khan	TMK
Hafizabad	HAD	Mastung	MST	Tank	TNK
Hangu	HNG	Matiari	MIT	Tharparkar	TRP
Haripur	HRP	Mianwali	MWD	Thatta	TAT
Harnai	HRN	Mirpur Khas	MPD	Toba Tek Singh	TTS

continued

Table A.1: District names and Codes for representation.

Name	**Code**	**Name**	**Code**	**Name**	**Code**
Hyderabad	HDD	Mohmand	MOD	Torghar	TGR
Islamabad	ISB	Multan	MUX	Umerkot	UMK
Jacobabad	JAG	Musakhel	MSK	Upper Dir	DRU
Jaffarabad	JFA	Muzaffargarh	MUZ	Vehari	VRI
Jamshoro	JMS	Nankana Sahib	NKS	Washuk	WSK
Jhal Magsi	JMG	Narowal	NRW	Zhob	PZH
Jhang	JNG	Nasirabad	NSA	Ziarat	ZRT
Jhelum	JLM	Naushahro Feroze	NSF		

Source: Note: The district-codes are similar to the three-letter codes used by IATA. Nevertheless, some districts that do not have an IATA code are represented by the three letter code that is commonly used.

Table A.2: Cultivated area share and its ranking by districts (2015).

District	Values			Rank		
codes	**Overall**	**Irrigated**	**un-irrigated**	**Overall**	**Irrigated**	**un-irrigated**
RYK	5.3	6.2	2.3	1	2	12
SKT	5.2	6.4	0.8	2	1	31
WGB	3.8	4.5	0.9	3	3	28
TRP	3	0	13.5	4	100	1
MUZ	2.8	3.3	1.1	5	4	24
BHV	2.7	3.3	0.7	6	5	35
BKR	2.2	2.3	1.9	7	9	15
JNG	2.2	2.6	0.7	8	6	36
LYP	2.1	2.6	0.2	9	7	57
MUX	2	2.5	0	10	8	89
DEA	1.9	2.2	0.7	12	10	37
LYA	1.9	2.2	0.6	13	11	40
BDN	1.9	2.1	1.3	11	14	18
KHB	1.8	1.1	4.3	14	32	6
SHW	1.8	2.2	0.1	15	12	69
KSR	1.7	1.9	0.8	16	17	32
KWL	1.7	2.2	0.1	17	13	70
LDR	1.7	2.1	0.1	18	15	71
ATG	1.6	0.2	6.5	19	75	2
SWV	1.6	2	0.4	20	16	43
NRW	1.5	1.7	0.8	21	20	33
OKA	1.5	1.8	0.4	22	19	44
RJP	1.5	1.6	0.9	23	23	29
VRI	1.5	1.9	0.2	24	18	58
MPD	1.4	1.7	0.4	26	21	45
SGI	1.4	1.7	0	27	22	90
AAW	1.4	0.5	4.7	25	50	5
TTS	1.3	1.5	0.4	30	25	46
KPR	1.3	1.6	0.1	29	24	72
UMK	1.3	0.6	3.8	31	46	7
DSK	1.3	0.7	3.2	28	42	9
CHW	1.2	0.1	5.3	32	81	3
GJW	1.2	1.5	0.1	33	26	73
NKS	1.2	1.4	0.4	35	27	47
RWP	1.2	0.6	3.3	36	47	8
HRA	1.2	0.2	5.1	34	76	4
CNT	1.1	1.3	0	37	29	92
MWD	1.1	1	1.4	38	35	17
PKP	1.1	1.4	0	39	28	91

continued

Table A.2: Cultivated area share and its ranking by districts (2015).

District	Values			Rank		
codes	**Overall**	**Irrigated**	**un-irrigated**	**Overall**	**Irrigated**	**un-irrigated**
GRT	1	0.9	1.3	40	36	19
SGL	1	0.4	3.1	41	57	10
DRU	1	1.2	0.4	42	30	48
LHE	0.9	1.2	0	43	31	93
WNS	0.9	1.1	0.2	44	33	59
LKA	0.8	1.1	0.1	47	34	74
BNP	0.8	0.9	0.4	45	37	49
LMR	0.8	0.3	2.9	46	64	11
HAD	0.7	0.9	0.1	49	39	76
MBD	0.7	0.9	0	50	40	94
SNG	0.7	0.9	0	51	41	95
GKI	0.7	0.9	0.1	48	38	75
QSH	0.6	0.7	0.3	54	45	55
CJL	0.6	0.7	0	52	43	96
KDD	0.6	0.7	0	53	44	97
JLM	0.5	0	2.2	57	101	13
NSF	0.5	0.6	0.2	59	49	61
JFA	0.5	0.6	0.2	56	48	60
KCI	0.5	0.1	2	55	82	14
KAD	0.5	0.4	1	58	58	27
UET	0.5	0.3	1.1	60	65	25
DDU	0.4	0.5	0.1	61	51	77
HDD	0.4	0.4	0.1	63	59	82
JAG	0.4	0.5	0.2	64	52	62
KSM	0.4	0.5	0.1	65	53	78
SYW	0.4	0.5	0.1	68	54	79
TAY	0.4	0.5	0.1	70	56	81
TMK	0.4	0.4	0.2	71	61	64
HRP	0.4	0.1	1.3	62	83	20
PEW	0.4	0.4	0.2	67	60	63
SWB	0.4	0.5	0.1	69	55	80
TNK	0.4	0.1	1.6	72	84	16
NSA	0.4	0.3	0.4	66	66	50
ISB	0.3	0.1	1.2	73	85	22
MIT	0.3	0.4	0.1	81	63	83
JMS	0.3	0.3	0.4	74	67	51
SUJ	0.3	0.3	0.4	83	69	52
SKZ	0.3	0.3	0.1	84	70	85
TAT	0.3	0.3	0.2	86	71	65
KRK	0.3	0	1.3	76	102	21

continued

Table A.2: Cultivated area share and its ranking by districts (2015).

District	Values			Rank		
codes	**Overall**	**Irrigated**	**un-irrigated**	**Overall**	**Irrigated**	**un-irrigated**
DRL	0.3	0.2	0.8	79	77	34
MDN	0.3	0.3	0.1	80	68	84
SWT	0.3	0.2	0.7	85	78	38
JMG	0.3	0.1	0.9	75	86	30
KSF	0.3	0.1	1.1	77	87	26
LRG	0.3	0.4	0	78	62	98
SIB	0.3	0	1.2	82	103	23
CSD	0.2	0.3	0.1	87	72	86
KST	0.2	0.1	0.6	89	88	41
KBH	0.2	0.3	0	88	73	99
LSB	0.2	0.2	0.3	90	79	56
NHS	0.2	0	0.7	91	104	39
PIS	0.2	0.1	0.4	92	89	53
PZH	0.2	0.3	0	93	74	100
BGM	0.1	0	0.5	96	105	42
BNR	0.1	0	0.4	97	106	54
OHT	0.1	0.1	0.2	100	93	66
MKD	0.1	0.1	0.1	101	94	87
MSH	0.1	0.1	0.2	103	96	67
TGR	0.1	0	0.2	104	107	68
AWN	0.1	0.2	0	94	80	101
BKN	0.1	0.1	0	95	90	102
CHG	0.1	0.1	0	98	91	103
MST	0.1	0.1	0	102	95	105
WSK	0.1	0.1	0	105	97	106
K8	0	0	0.1	108	109	88
DBT	0	0	0	106	108	109
GRT	0	0.1	0	107	98	107
HRN	0	0	0	109	110	110
KRN	0	0	0	110	111	111
KLU	0	0	0	111	112	112
MSK	0	0.1	0	112	99	108
SRN	0	0	0	113	113	113
ZRT	0	0	0	114	114	114

Source: Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculation using PSLM 2007-15.

Table A.3: Landlessness share, its percentage points change, and ranking by districts (2015).

District codes	Landlessness percentage	Rank	Percentage point change	Rank
SRN	95.5	1	78.93	1
JAG	83.7	2	16.97	20
MPD	81.5	3	4.78	61
TAY	81.3	4	62.02	2
HDD	79.7	5	7.84	46
SNG	79.3	6	2.75	75
TMK	78.1	7	41.78	4
MIT	77.5	8	-2.33	94
NSA	75.7	9	10.32	36
JFA	75.5	10	5.80	58
TUK	74.3	11	-14.21	113
DBT	73.9	12	-7.41	105
KSM	72.4	13	56.17	3
LSB	69.4	14	35.25	6
BDN	68.2	15	11.59	31
SUJ	67.6	16		
SYW	66.8	17	-4.72	101
KCI	65.9	18	3.43	69
WNS	65.2	19	2.66	76
JMS	65.2	20	15.62	22
CSD	64.8	21	18.23	18
DDU	62.3	22	6.68	53
TAT	61.9	23	5.65	59
QSH	60.5	24	2.24	79
CHG	60.1	25	37.48	5
SIB	59.4	26	29.48	10
KLU	59.3	27	30.87	9
BNR	59.2	28	27.41	12
PJG	57.1	29	23.62	15
PEW	56.1	30	3.27	72
KSR	54.4	31	6.57	55
SKZ	54.4	32	18.79	17
KRN	54.3	33	33.95	8
LKA	53.9	34	1.47	81
MDN	52.7	35	14.20	25
OKA	52.4	36	-0.71	90
NSF	52.0	37	-0.07	87
WGB	50.9	38	7.11	50
LHE	50.7	39	0.39	84
JMG	50.2	40	18.90	16
PKP	49.4	41	-2.93	95

continued

Table A.3: Landlessness share, its percentage points change, and ranking by districts (2015).

District codes	Landlessness percentage	Rank	Percentage point change	Rank
MKD	48.6	42	7.95	45
GKI	48.6	43	10.47	35
SGI	47.9	44	14.48	24
SWV	47.6	45	9.40	41
CNT	47.5	46	4.53	63
NHS	46.9	47	-27.56	114
SHW	46.1	48	5.63	60
MUX	43.9	49	9.87	38
VRI	43.7	50	3.90	66
TNK	43.5	51	26.39	13
HAD	43.1	52	4.65	62
MST	42.7	53	34.17	7
KWL	42.5	54	4.06	65
LYP	42.3	55	9.54	39
GJW	42.1	56	6.90	52
SWB	42.0	57	2.34	78
KDD	41.4	58	29.12	11
GRT	41.0	59	-44.26	115
TRP	40.7	60	-3.95	97
SWT	40.5	61	16.34	21
TTS	40.5	62	10.53	34
KPR	40.4	63	7.03	51
WSK	40.1	64	-11.03	112
NKS	39.8	65	3.35	71
HRN	39.3	66	6.66	54
MBD	37.7	67	10.71	33
MSH	36.8	68	2.12	80
MUZ	36.6	69	12.43	29
MSK	35.6	70	11.00	32
RYK	34.6	71	3.63	68
KBH	34.0	72	15.57	23
AWN	33.9	73	-9.34	108
SKT	33.8	74	3.71	67
LDR	33.0	75	-5.05	102
JNG	32.5	76	-0.88	91
BKN	32.4	77	9.15	42
DSK	32.4	78	-0.38	89
OHT	30.5	79	13.75	26
BHV	30.3	80	-4.71	100
HRA	29.7	81	2.89	73
KHB	28.2	82	13.57	27

continued

Table A.3: Landlessness share, its percentage points change, and ranking by districts (2015).

District codes	Landlessness percentage	Rank	Percentage point change	Rank
BGM	28.2	83	-4.69	99
PZH	27.3	84	2.80	74
DEA	27.0	85	12.44	28
KSF	25.4	86	-10.02	110
NRW	25.1	87	-2.05	93
GRT	24.9	88	8.85	44
ATG	24.7	89	0.34	85
ZRT	22.7	90	17.42	19
JLM	22.5	91	4.39	64
MWD	22.5	92	0.64	83
AAW	22.5	93	12.12	30
RJP	22.2	94	9.47	40
BNP	22.0	95	9.07	43
LRG	21.5	96	7.13	49
BKR	20.1	97	2.57	77
K8	19.7	98	7.22	48
ISB	19.4	99	7.52	47
LYA	19.4	100	3.37	70
RWP	17.9	101	-3.96	98
TGR	17.7	102	-3.71	96
HRP	17.4	103	-0.10	88
CHW	15.5	104	6.42	56
LMR	15.5	105	-6.72	104
DRL	15.2	106	6.25	57
PIS	14.4	107	-7.62	106
DRU	13.7	108	10.28	37
KAD	13.4	109	-6.04	103
SGL	13.1	110	1.27	82
KRK	9.3	111	-1.93	92
KST	5.4	112	-8.01	107
CJL	2.8	113	0.22	86

Source: Source: Authors' calculation using PSLM 2007-15.

Table A.4: Percentage area share and respective number of landholdings by farm size.

District	% share in area			% share in landholdings			Ranking by area		
codes	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
SIB	0.3	5.2	94.6	6.4	32.1	61.5	110	111	1
KCI	0.2	14.7	85.1	2.6	53.4	44.0	112	104	2
DRU	13.2	2.8	84.0	93.4	2.9	3.7	31	113	3
CJL	13.0	4.2	82.8	91.4	3.5	5.2	33	112	4
BNP	8.3	9.5	82.2	75.4	18.4	6.1	60	110	5
MPD	1.4	17.5	81.1	16.7	54.0	29.4	101	103	6
NSA	1.2	18.0	80.8	11.4	48.6	40.0	104	102	7
SKT	5.6	13.9	80.5	68.4	26.4	5.2	75	105	8
SGL	10.0	9.9	80.1	76.4	18.4	5.3	48	109	9
JFA	1.4	22.5	76.1	14.4	59.8	25.8	100	97	10
PJG	0.8	24.5	74.7	8.3	50.0	41.7	109	93	11
TUK	0.9	24.4	74.7	8.6	60.1	31.3	106	94	12
HRA	6.4	19.3	74.3	59.1	28.0	13.0	72	101	13
NKS	5.0	21.6	73.4	42.8	46.2	11.0	79	99	14
WGB	4.6	22.7	72.7	39.2	45.4	15.4	81	96	15
BDN	2.3	25.2	72.6	18.6	57.2	24.3	93	92	16
JMG	0.9	27.2	71.9	8.6	63.6	27.9	107	88	17
TRP	1.3	28.8	69.8	10.5	57.9	31.5	102	86	18
JAG	3.4	26.9	69.8	25.3	57.3	17.3	89	89	19
TAY	2.5	31.6	65.9	15.8	59.6	24.6	92	81	20
LMR	3.7	31.8	64.5	28.2	50.7	21.1	87	80	21
HRP	23.3	12.3	64.4	90.4	8.2	1.4	16	107	22
KHB	3.9	32.0	64.2	27.1	57.0	15.9	85	78	23
DRL	23.2	13.4	63.4	88.7	7.4	3.9	18	106	24
KSR	10.0	26.8	63.3	53.6	36.4	9.9	49	90	25
KSM	7.9	28.9	63.2	42.7	45.7	11.5	64	85	26
AAW	6.8	32.4	60.8	51.8	35.7	12.6	69	77	27
PEW	19.5	22.0	60.6	71.7	18.9	4.0	23	98	28
TNK	2.6	36.9	60.5	20.1	60.4	19.5	91	66	29
NHS	0.2	39.6	60.2	1.1	61.7	37.2	111	58	30
NRW	11.9	27.5	60.0	64.0	32.0	10.0	37	87	31
MIT	5.1	35.8	59.9	26.9	51.9	14.5	78	69	32
CHG	7.6	32.5	59.7	29.1	56.4	10.9	65	76	33
ATG	10.0	30.0	59.1	53.2	36.8	21.3	47	84	34
MUX	8.4	31.9	58.5	50.3	38.8	9.4	58	79	35
LKA	9.0	32.7	58.3	44.5	50.0	5.5	54	75	36
SHW	9.1	32.7	58.2	51.7	40.8	7.6	53	74	37
CNT	6.4	35.7	57.9	37.5	52.2	10.3	71	70	38
HDD	4.2	38.1	57.6	19.5	53.7	26.8	83	61	39

continued

Table A.4: Percentage area share and respective number of landholdings by farm size.

District	% share in area			% share in landholdings			Ranking by area		
codes	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
MUZ	11.5	31.2	57.3	56.5	34.7	8.8	38	82	40
BKR	5.2	37.5	57.3	31.0	51.9	17.1	76	63	41
RYK	9.1	33.9	57.0	53.5	40.0	6.5	52	73	42
TMK	5.2	37.9	56.9	25.9	59.3	14.8	77	62	43
LDR	8.9	34.8	56.3	46.3	43.4	10.3	57	71	44
LSB	1.2	43.4	55.3	10.0	70.0	20.0	105	48	45
DSK	4.8	41.2	54.0	33.4	51.9	14.6	80	54	46
KWL	10.9	36.0	53.1	49.6	41.8	8.5	42	67	47
HAD	8.1	39.6	52.3	40.8	46.0	13.2	62	59	48
MWD	7.1	41.4	51.5	35.7	55.4	8.9	68	52	49
PZH	2.0	46.6	51.4	10.8	63.3	25.9	97	41	50
BHV	12.2	37.2	50.6	59.2	33.9	6.8	36	64	51
MKD	24.0	25.6	50.4	76.8	16.0	7.2	15	91	52
JNG	8.9	40.8	50.3	42.6	45.8	11.7	56	55	53
WNS	4.5	45.5	50.0	22.2	64.0	13.8	82	44	54
LHE	10.4	40.0	49.5	51.4	40.5	8.1	43	56	55
PKP	11.1	40.0	48.9	48.7	44.3	7.0	40	57	56
SYW	10.3	42.5	47.2	43.9	45.0	11.1	44	50	57
JMS	3.8	49.9	46.3	18.2	66.4	15.5	86	35	58
GJW	9.0	44.9	46.1	43.3	45.7	11.0	55	47	59
KRK	23.3	31.0	45.8	73.9	22.2	3.8	17	83	60
LYA	9.8	46.4	43.8	41.8	48.5	9.7	50	43	61
SNG	2.1	54.1	43.8	9.9	76.6	13.5	96	28	62
TTS	13.5	43.3	43.1	52.6	41.2	6.2	30	49	63
ISB	23.1	33.9	43.0	68.3	25.8	5.8	19	72	64
DEA	10.2	47.9	41.9	42.9	48.9	8.2	45	38	65
SGI	7.2	51.3	41.5	33.0	56.7	10.3	67	32	66
GRT	39.2	19.6	41.2	78.1	18.8	3.1	5	100	67
SWV	12.3	47.0	40.6	47.6	43.7	8.7	35	40	68
KPR	11.4	49.2	39.4	42.6	49.6	7.8	39	36	69
QSH	8.4	52.4	39.2	32.1	59.5	8.3	59	31	70
OKA	13.5	47.5	39.0	51.0	43.5	5.5	29	39	71
DBT	1.9	63.0	35.0	8.8	73.5	17.6	98	20	72
RJP	9.3	56.0	34.7	38.5	54.7	6.8	51	25	73
CSD	20.5	44.9	34.6	65.2	28.3	6.5	21	46	74
NSF	10.1	55.6	34.3	37.5	56.6	5.9	46	26	75
LYP	13.1	52.7	34.2	47.1	46.7	6.2	32	29	76
SKZ	19.6	46.6	33.8	57.0	38.7	4.3	22	42	77
CHW	14.0	52.5	33.4	50.3	44.0	5.7	28	30	78
KDD	2.9	65.7	31.4	15.6	68.8	15.6	90	18	79

continued

Table A.4: Percentage area share and respective number of landholdings by farm size.

District	% share in area			% share in landholdings			Ranking by area		
codes	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
RWP	29.8	39.0	31.2	75.5	21.6	2.9	11	60	80
VRI	18.2	51.2	30.6	60.2	35.7	4.1	25	33	81
GKI	11.0	58.5	30.5	38.4	52.7	8.8	41	22	82
KBH	1.6	68.6	29.8	8.3	75.9	15.7	99	17	83
BKN	0.1	70.3	29.7	0.5	82.0	17.6	113	13	84
GRT	21.9	50.2	28.0	60.8	35.5	3.8	20	34	85
KAD	14.5	57.8	27.7	44.2	49.5	6.3	27	23	86
MSH	27.8	45.3	26.9	71.0	24.6	4.3	13	45	87
PIS	19.1	54.8	26.0	50.3	45.8	3.9	24	27	88
BNR	32.7	41.5	25.8	71.1	27.0	1.9	9	51	89
SWT	34.0	41.2	24.8	74.5	23.4	2.1	7	53	90
KSF	6.4	69.1	24.4	19.4	76.6	4.0	70	16	91
WSK	6.0	70.6	23.4	22.2	67.8	10.0	74	12	92
BGM	54.3	22.8	22.9	90.9	7.5	1.6	3	95	93
JLM	16.4	60.9	22.7	50.6	44.6	4.8	26	21	94
TGR	65.4	12.0	22.6	95.8	2.9	1.3	1	108	95
MDN	32.8	48.4	18.8	69.8	27.4	2.8	8	37	96
SUJ	2.2	79.4	18.4	8.3	85.3	6.4	95	8	97
OHT	45.1	37.0	17.9	79.3	18.4	2.3	4	65	98
SWB	12.8	69.3	17.9	37.1	61.0	1.9	34	14	99
MBD	8.3	74.0	17.8	28.0	66.4	5.7	61	10	100
KLU	3.5	79.1	17.4	11.4	84.8	3.8	88	9	101
LRG	1.3	83.2	15.5	4.1	89.0	6.9	103	6	102
DDU	6.3	82.8	10.9	21.3	76.3	2.5	73	7	103
MSK	4.1	86.3	9.7	11.5	86.5	2.1	84	4	104
AWN	7.4	84.0	8.6	24.6	72.5	2.9	66	5	105
HRN	27.0	65.6	7.4	53.3	45.7	1.0	14	19	106
ZRT	36.1	57.5	6.4	66.2	32.8	1.0	6	24	107
MST	2.2	93.0	4.8	8.5	89.0	2.4	94	2	108
KST	62.4	35.8	1.8	88.9	10.9	0.2	2	68	109
K8	30.8	69.2	0.0	62.7	37.3	0.0	10	15	110
KRN	27.9	72.1	0.0	49.3	50.7	0.0	12	11	111
TAT	0.8	99.2	0.0	4.0	96.0	0.0	108	1	112
SRN	8.0	92.0	0.0	16.7	83.3	0.0	63	3	113

Source: Source: Authors' calculation using PSLM 2015.

Table A.5: Percentage point change in area share and respective number of landholdings by farm size.

District	% point change in area			% point change in No. of landholdings			Ranking by area change		
codes	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
BGM	45.5	0.2	-45.8	29.8	-25.5	-4.4	1	70	109
GRT	38.0	-14.4	-23.5	69.8	-35.4	-34.4	2	97	85
KRN	27.3	55.5	-69.6	39.3	-5.9	-28.7	3	6	114
KST	24.0	-14.8	-9.3	11.3	-10.0	-1.2	4	99	61
BNR	23.4	7.5	-31.0	24.2	-15.0	-9.2	5	50	98
RWP	21.8	18.0	-39.8	15.4	-11.0	-4.4	6	31	104
OHT	16.1	-2.1	-14.0	6.2	-6.5	0.3	7	75	73
ISB	15.9	9.9	-25.8	18.8	-11.5	-7.3	8	42	91
SKZ	15.4	8.6	-24.0	30.6	-15.5	-15.1	9	47	87
MDN	14.6	-8.0	-6.6	15.9	-13.0	-2.9	10	86	53
PIS	14.6	-27.3	12.7	33.8	-32.3	-1.5	11	107	19
HRN	14.4	-15.0	0.5	22.0	-21.3	-0.7	12	100	38
CHW	11.5	32.7	-44.3	23.1	-11.6	-11.5	13	12	108
VRI	11.2	21.7	-32.9	17.2	-9.4	-7.8	14	25	101
ZRT	11.1	-4.3	-6.8	13.9	-12.9	-1.0	15	79	57
CSD	10.9	14.1	-24.9	15.6	-13.5	-2.1	16	36	89
GRT	10.5	20.5	-31.0	9.0	-6.9	-2.2	17	27	99
SWT	9.5	4.7	-14.2	3.5	-0.9	-2.7	18	56	74
PEW	9.4	-12.5	3.1	21.9	-19.8	-2.1	19	94	35
SYW	7.4	9.6	-17.0	23.3	-17.4	-5.9	20	43	76
GKI	7.4	3.7	-11.1	21.6	-18.3	-3.3	21	63	66
JLM	7.2	8.2	-15.4	11.8	-6.9	-4.9	22	49	75
LYP	7.1	25.3	-32.4	4.5	-3.2	-1.3	23	19	100
LHE	7.0	23.1	-30.1	13.9	-4.4	-9.5	24	21	97
CHG	7.0	15.3	-22.3	21.4	6.4	-27.7	25	34	82
PKP	6.5	12.6	-19.0	11.2	-0.3	-10.9	26	37	80
OKA	6.4	4.1	-10.5	15.0	-11.0	-3.9	27	62	63
HRP	6.0	-28.3	22.3	32.2	-27.3	-4.9	28	109	13
QSH	6.0	28.3	-34.3	8.6	3.5	-12.2	29	16	103
KAD	5.9	19.0	-25.0	7.1	-8.2	1.1	30	30	90
LKA	5.9	4.6	-10.4	21.7	-5.4	-16.3	31	58	62
KPR	5.9	5.1	-11.0	14.5	-13.1	-1.4	32	55	65
BHV	5.8	-2.6	-3.2	18.5	-12.5	-6.0	33	77	46
NSF	5.6	22.2	-27.8	8.5	1.5	-10.0	34	24	94
LYA	5.3	-0.7	-4.6	18.0	-14.0	-3.9	35	72	49
KSF	5.1	60.2	-65.3	2.5	43.5	-46.0	36	5	112
KSM	5.0	-10.0	4.9	27.2	-10.4	-16.8	37	91	29
TMK	4.8	12.6	-17.4	22.2	4.4	-26.6	38	38	77
DDU	4.8	61.8	-66.5	6.5	25.6	-32.0	39	4	113

continued

Table A.5: Percentage point change in area share and respective number of landholdings by farm size.

District	% point change in area			% point change in No. of landholdings			Ranking by area change		
codes	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
ATG	4.7	8.6	-13.3	5.8	-4.8	-1.0	40	46	71
HAD	4.6	1.2	-5.8	16.9	-10.4	-6.5	41	67	51
SWV	4.3	3.2	-7.5	9.4	-6.5	-2.9	42	64	59
KWL	4.0	-2.1	-1.8	8.8	-4.9	-3.9	43	76	43
DEA	3.9	8.6	-12.5	10.2	-6.6	-3.6	44	48	69
SGI	3.8	21.0	-24.8	8.6	-2.3	-6.3	45	26	88
TTS	3.8	-2.0	-1.8	12.6	-12.5	-0.1	46	74	42
RJP	3.8	14.9	-18.6	5.4	0.0	-5.4	47	35	79
AWN	3.7	73.5	-80.9	8.3	29.4	-54.1	48	3	115
LDR	3.2	-8.7	5.5	13.6	-16.3	2.7	49	89	27
HDD	3.1	19.7	-22.8	6.6	1.1	-7.7	50	28	84
DSK	3.0	19.6	-22.7	13.1	0.7	-13.8	51	29	83
JNG	3.0	9.0	-12.1	4.9	-1.5	-3.4	52	44	67
BKR	2.9	15.4	-18.2	8.7	-3.2	-5.6	53	33	78
JAG	2.7	-20.6	17.9	19.4	-13.6	-5.8	54	103	14
KDD	2.7	39.5	-42.2	13.4	13.0	-26.5	55	11	107
MWD	2.7	4.1	-6.8	8.5	-1.1	-7.4	56	61	58
MIT	2.6	-7.3	4.7	12.1	-18.7	6.6	57	84	31
MKD	2.5	-5.7	3.2	2.3	-6.1	3.8	58	82	34
KSR	2.0	-16.6	14.5	14.9	-15.9	1.0	59	102	18
TNK	2.0	11.4	-13.4	15.2	1.2	-16.4	60	39	72
RYK	2.0	0.2	-2.2	12.2	-8.8	-3.3	61	69	44
WNS	1.9	25.3	-27.3	4.8	16.2	-21.0	62	18	93
MST	1.9	39.8	-41.7	5.7	9.7	-15.4	63	9	106
SNG	1.8	31.6	-33.4	7.1	13.8	-20.9	64	13	102
KHB	1.8	10.5	-12.3	6.1	4.3	-10.4	65	41	68
MUZ	1.7	-12.3	10.6	11.8	-10.7	-1.0	66	93	20
MUX	1.7	1.3	-3.0	6.5	-0.6	-5.9	67	66	45
BDN	1.5	4.4	-6.0	11.4	3.4	-14.8	68	60	52
JMS	1.4	24.5	-26.0	0.4	9.0	-9.4	69	20	92
KBH	1.4	47.1	-48.5	5.6	24.0	-29.6	70	7	111
KRK	1.4	-34.6	33.2	15.7	-17.3	1.6	71	111	8
TUK	1.3	44.9	-46.2	2.4	35.7	-38.1	72	8	110
TAY	1.3	5.5	-6.7	5.1	6.1	-11.2	73	53	54
MPD	1.2	5.6	-6.8	13.5	9.6	-23.0	74	52	56
TRP	1.1	3.1	-4.3	8.5	-4.7	-3.7	75	65	47
PJG	1.0	-11.4	10.4	6.8	-13.9	7.1	76	92	21
NSA	1.0	-27.2	26.2	9.7	-24.1	14.4	77	106	11
MSH	0.9	-7.3	6.4	5.7	-7.0	1.3	78	85	26
MSK	0.8	39.7	-40.5	-5.9	22.3	-16.4	79	10	105

continued

Table A.5: Percentage point change in area share and respective number of landholdings by farm size.

District	% point change in area			% point change in No. of landholdings			Ranking by area change		
codes	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
LSB	0.8	-4.3	3.5	6.8	-3.3	-3.5	80	78	33
MBD	0.7	27.8	-28.5	-6.8	13.8	-7.0	81	17	95
PZH	0.5	-7.1	6.6	1.9	-5.3	3.4	82	83	25
WGB	0.5	-8.4	7.9	11.0	-7.6	-3.4	83	87	24
JMG	0.3	-4.4	4.1	4.3	7.5	-11.8	84	80	32
UET	0.3	10.5	-10.8	0.6	-0.5	-0.1	85	40	64
TAT	0.1	75.7	-23.9	-4.8	43.0	-20.6	86	2	86
UMK	-0.1	-4.7	4.7	0.8	-3.0	2.2	87	81	30
GJW	-0.2	4.6	-4.4	1.6	0.0	-1.7	88	57	48
KCI	-0.2	-1.0	1.2	-3.2	-2.3	5.5	89	73	37
WSK	-0.2	0.7	-0.5	0.8	-3.7	2.9	90	68	40
DBT	-0.3	-9.8	10.1	-0.7	-7.4	8.1	91	90	23
KLU	-0.5	8.9	-8.5	-9.5	15.8	-6.3	92	45	60
NHS	-0.5	-14.6	15.2	-3.8	-11.5	15.3	93	98	15
SGL	-0.8	-23.7	24.4	20.0	-21.4	1.4	94	105	12
LRG	-0.9	30.5	-29.6	-7.2	18.2	-10.9	95	14	96
BNP	-0.9	-14.2	15.1	18.5	-18.1	-0.3	96	96	16
LMR	-1.2	-0.1	1.3	-3.6	-1.6	5.2	97	71	36
CNT	-1.4	-13.4	14.7	0.8	0.0	-0.9	98	95	17
DRL	-1.8	-8.5	10.3	10.7	-11.7	1.0	99	88	22
BKN	-1.9	22.7	-20.7	-9.5	17.8	-8.3	100	23	81
JFA	-1.9	5.3	-6.7	-15.7	2.2	-16.7	101	54	55
NKS	-2.0	-58.6	60.6	17.6	-24.5	6.9	102	115	3
SIB	-2.0	-38.8	40.7	-6.5	-36.0	42.5	103	113	6
SRN	-2.0	30.3	0.0	-18.5	19.8	0.0	104	15	39
NRW	-3.2	-42.7	45.9	16.6	-17.3	0.7	105	114	5
K8	-3.6	22.7	58.5	-7.9	11.1	-0.5	106	22	4
TGR	-3.9	4.5	-0.6	-1.3	1.2	0.2	107	59	41
AAW	-4.1	17.1	-13.0	-26.1	17.2	8.9	108	32	70
SHW	-6.3	-20.8	27.1	1.1	-4.7	3.6	109	104	10
SKT	-8.7	-27.8	36.5	13.5	-12.4	-1.1	110	108	7
SWB	-10.8	5.8	5.0	-20.0	20.3	-0.3	111	51	28
HRA	-14.8	-15.6	30.5	-10.8	1.9	8.8	112	101	9
CJL	-28.1	-34.6	62.8	12.5	-16.5	4.0	113	112	2
DRU	-34.9	-30.5	65.4	6.1	-9.5	3.4	114	110	1
KHI		83.4	-5.3		30.7	0.3		1	50

Source: Source: Authors' calculation using PSLM 2007-15.

Table A.6: Area and number of landholdings percentage change and it's rank 2007-15.

District codes	Area change	Holdings change	Rank	District codes	Area change	Holdings change	Rank
DRU	221.9	10.3	1	SYW	-36.7	21.3	59
NHS	213.6	129.3	2	HRP	-37.1	-17.1	60
UMK	169.7	126.2	3	PIS	-40.0	-8.3	61
TGR	156.9	118.8	4	PJG	-43.3	-36.5	62
LDR	153.4	200.6	5	TNK	-43.9	-19.0	63
NKS	152.6	17.7	6	LRG	-44.7	-21.6	64
SKT	124.4	-6.3	7	KSR	-45.3	-45.9	65
CJL	112.2	-17.4	8	SWV	-46.1	-28.2	66
KST	102.7	177.2	9	KLU	-46.4	-29.1	67
SIB	100.1	-52.1	10	TAY	-48.0	-32.1	68
SGL	97.0	33.4	11	QSH	-48.1	26.0	69
RYK	96.5	137.9	12	MKD	-48.8	-38.7	70
NRW	94.0	19.7	13	JMS	-49.5	-14.7	71
MUZ	87.7	93.3	14	SGI	-50.1	-15.8	72
KHB	82.1	146.9	15	OKA	-50.2	-30.1	73
CNT	72.7	34.6	16	ISB	-53.2	12.1	74
DBT	72.3	61.9	17	DRL	-58.0	-40.5	75
KWL	59.8	83.7	18	GJW	-58.1	-54.0	76
DEA	57.7	115.5	19	GRT	-60.5	33.3	77
KAD	53.4	114.4	20	MDN	-61.1	-44.5	78
MWD	47.6	87.8	21	CHW	-61.8	26.4	79
BHV	42.9	101.8	22	KPR	-63.5	-45.2	80
MIT	38.8	58.8	23	NSF	-66.3	-38.0	81
KCI	33.9	11.5	24	BGM	-67.4	60.3	82
TTS	33.1	58.2	25	GRT	-67.5	-42.1	83
BKR	23.6	115.5	26	MPD	-67.9	-49.6	84
HRN	22.6	71.3	27	MSK	-68.4	-44.5	85
HRA	20.9	-38.7	28	MSH	-68.6	-64.8	86
NSA	19.2	-10.3	29	CSD	-68.9	-33.8	87
BKN	14.9	20.6	30	VRI	-69.0	-30.7	88
SHW	14.2	-23.8	31	KSF	-69.4	13.6	89
KSM	12.2	30.0	32	K8	-70.1	-68.7	90
JNG	9.8	46.5	33	MST	-71.5	-52.9	91
HAD	8.7	46.0	34	KBH	-72.6	-40.3	92
ATG	6.5	73.2	35	LYP	-73.5	-46.8	93
BNP	4.8	-17.1	36	SWT	-73.5	-65.4	94
WSK	2.5	-8.2	37	BNR	-75.0	-41.3	95
TRP	1.9	40.1	38	LKA	-76.6	-63.4	96
JMG	1.9	-14.6	39	LSB	-76.8	-78.6	97

continued

Table A.6: Area and number of landholdings percentage change and it's rank 2007-15.

District codes	Area change	Holdings change	Rank	District codes	Area change	Holdings change	Rank
KRK	-1.8	-12.0	40	RWP	-76.9	-25.3	98
LYA	-5.2	27.6	41	OHT	-77.0	-65.1	99
LMR	-9.0	-10.9	42	UET	-77.8	-60.4	100
WGB	-10.3	-22.3	43	SKZ	-78.6	-53.7	101
BDN	-10.9	14.4	44	SNG	-78.7	-55.1	102
MUX	-12.2	6.1	45	TMK	-79.2	-57.0	103
PZH	-12.4	-13.1	46	KDD	-80.5	-57.9	104
PKP	-12.4	47.3	47	PEW	-81.4	-75.6	105
TUK	-14.0	71.1	48	TAT	-84.2	-61.5	106
AAW	-15.1	-8.3	49	AWN	-87.1	-19.8	107
ZRT	-17.0	0.0	50	CHG	-88.8	-67.3	108
MBD	-19.3	-0.9	51	LHE	-92.5	-80.2	109
DSK	-22.6	36.0	52	HDD	-92.9	-83.9	110
JAG	-27.9	-31.8	53	DDU	-93.1	-77.7	111
SWB	-32.4	-53.1	54	SRN	-93.7	-91.9	112
GKI	-32.6	2.2	55	KRN	-94.6	-55.3	113
RJP	-33.5	0.0	56	KHI	-99.6	-98.9	114
JLM	-33.6	1.8	57	WNS	-100.0	-17.5	115
JFA	-36.7	-8.5	58				

Source: Source: Authors' calculation using PSLM 2007-15.

Table A.7: District wise percentage share of irrigated area and the number of landholdings 2015.

Codes	Area share	Holdings	Rank	Codes	Area share	Holdings	Rank
KHI	100.0	100.0	1	LYA	88.8	95.5	58
PKP	100.0	99.6	2	RJP	88.8	92.9	59
SNG	99.9	99.1	3	TMK	88.8	90.7	60
MUX	99.6	98.6	4	NRW	88.7	75.9	61
LHE	99.6	97.3	5	PEW	88.5	88.7	62
MBD	99.3	98.6	6	QSH	87.5	90.9	63
CNT	99.2	98.8	7	MKD	87.3	87.2	64
KWL	99.2	98.0	8	BNP	86.9	82.7	65
SGI	99.1	97.3	9	KRN	85.8	73.1	66
CJL	99.0	95.1	10	RYK	85.8	96.9	67
LDR	98.6	98.4	11	BDN	85.1	87.4	68
KDD	98.3	99.0	12	TAT	84.7	81.2	69
GJW	98.3	97.6	13	NSA	84.0	81.9	70
VRI	98.3	96.8	14	HRN	83.3	82.2	71
SHW	98.1	97.2	15	BKR	81.8	84.5	72
LRG	98.1	98.6	16	GRT	81.4	59.4	73
KPR	98.0	97.7	17	ZRT	80.9	87.1	74
LYP	98.0	96.9	18	CHG	79.6	65.5	75
GKI	98.0	97.0	19	MWD	75.6	88.0	76
HAD	97.9	98.4	20	JMS	69.0	64.5	77
AWN	97.9	97.1	21	GRT	69.0	67.2	78
SWB	97.4	96.2	22	MSH	68.9	78.3	79
KBH	97.4	96.3	23	LSB	65.2	67.5	80
LKA	97.3	94.5	24	KAD	59.5	63.9	81
BKN	96.6	97.6	25	DSK	59.3	72.1	82
WGB	96.4	97.4	26	PIS	57.7	65.2	83
OKA	96.1	98.5	27	OHT	52.4	55.2	84
MSK	95.9	95.8	28	UET	49.7	33.3	85
MIT	95.8	93.5	29	KHB	45.2	59.7	86
KLU	95.7	93.3	30	DRL	44.4	33.5	87
KSM	95.6	96.6	31	K8	43.5	41.8	88
MST	95.6	96.3	32	SWT	40.9	25.5	89
DBT	95.2	97.1	33	KST	37.3	35.4	90
BHV	95.0	94.3	34	UMK	37.1	50.2	91
SKT	94.6	91.7	35	RWP	36.3	24.5	92
WSK	94.6	87.8	36	BNR	35.5	28.3	93
JFA	94.6	95.9	37	SGL	35.0	30.3	94
WNS	94.2	97.6	38	ISB	27.8	22.5	95
SYW	94.0	95.9	39	AAW	26.5	9.0	96
JAG	93.9	96.7	40	JMG	20.8	16.4	97

continued

Table A.7: District wise percentage share of irrigated area and the number of landholdings 2015.

Codes	**Area share**	**Holdings**	**Rank**	**Codes**	**Area share**	**Holdings**	**Rank**
MPD	93.6	95.2	41	HRP	19.8	10.6	98
TAY	93.5	91.2	42	NHS	18.5	27.7	99
TTS	93.3	94.9	43	LMR	18.4	21.1	100
NKS	93.2	92.5	44	TNK	15.6	13.4	101
DDU	93.1	93.8	45	TGR	15.5	11.4	102
SKZ	93.0	92.5	46	KSF	15.2	18.9	103
DEA	92.9	90.7	47	KCI	13.4	18.1	104
SWV	92.7	93.9	48	HRA	10.6	19.2	105
MUZ	92.5	94.0	49	ATG	9.8	16.4	106
KSR	92.4	91.4	50	CHW	8.9	9.2	107
PZH	92.2	90.4	51	SIB	8.7	17.9	108
DRU	91.5	63.6	52	SRN	8.0	8.3	109
NSF	91.5	91.4	53	JLM	7.7	10.7	110
CSD	91.3	91.3	54	KRK	7.5	17.1	111
MDN	91.2	88.7	55	BGM	6.7	3.7	112
HDD	91.0	95.1	56	TRP	1.9	3.2	113
JNG	90.5	92.1	57				

Source: Source: Authors' calculation using PSLM 2015.

Table A.8: Districts' mean landholdings and its ranking 2014-15.

District	Values in acres			Ranking		
codes	**Overall**	**Irrigated**	**Un-irrigated**	**Overall**	**Irrigated**	**Un-irrigated**
RYK	7.15	6.659	24.921	47	56	5
SIB	33.262	18.772	36.546	1	5	1
KCI	26.985	18.263	28.923	2	6	3
DSK	10.327	7.614	14.53	22	43	16
SKT	15.637	16.48	6.524	5	7	52
WGB	12.094	11.856	18.825	13	15	7
BNP	9.185	9.925	5.984	27	22	54
HRA	6.837	4.628	7.235	52	88	44
KWL	5.942	5.993	3.743	65	61	79
OHT	2.246	2.32	2.157	110	110	99
TRP	14.036	7.861	14.149	10	41	18
SWV	6.707	6.712	6.842	54	55	47
NSA	15.804	15.584	16.45	4	9	10
BDN	14.675	14.476	15.977	8	10	11
KHB	11.801	9.314	15.622	15	24	13
JMG	15.349	20.202	14.461	7	3	17
DBT	12.268	12.194	15	12	14	14
LSB	12.081	12.255	11.799	14	13	22
UET	12.483	20.218	9.144	11	2	32
NKS	10.61	10.572	11.102	19	19	26
LDR	7.523	7.582	4.732	42	44	66
TNK	11.786	16.044	11.243	16	8	25
PZH	10.703	10.868	7.845	18	18	40
SGL	10.568	11.599	10.167	20	16	28
NHS	11.611	8.398	12.832	17	34	21
CNT	8.858	8.907	5.348	30	27	60
SHW	7.849	7.931	4.861	38	39	65
BKR	8.857	8.519	10.668	31	30	27
KDD	9.539	9.523	13	25	23	19
TAY	9.799	9.95	7.61	23	21	43
BKN	9.375	9.312	12.95	26	25	20
MPD	20.233	20.064	23.622	3	4	6
JFA	14.628	14.017	29.553	9	11	2
CHG	9.047	10.931	5.208	29	17	62
BHV	5.721	5.72	5.739	70	68	57
UMK	15.633	12.355	18.518	6	12	8
HAD	7.498	7.468	9.159	43	45	31
LMR	9.675	8.881	9.957	24	28	29
MUX	6.999	7.039	2.13	50	51	100

continued

Table A.8: Districts' mean landholdings and its ranking 2014-15.

District	Values in acres			Ranking		
codes	**Overall**	**Irrigated**	**Un-irrigated**	**Overall**	**Irrigated**	**Un-irrigated**
KBH	9.056	9.137	7.221	28	26	45
OKA	5.381	5.17	17.813	75	75	9
MWD	7.205	5.978	14.773	46	62	15
LYA	6.038	5.835	11.78	62	64	23
MIT	8.31	8.597	4.351	34	29	71
TMK	8.759	8.516	11.418	32	31	24
GRT	6.465	8.13	1.411	55	37	106
GJW	6.153	6.194	4.329	60	59	72
AAW	7.545	25.613	5.907	41	1	55
DEA	5.994	6.171	4.585	64	60	68
TTS	5.522	5.412	7.653	74	71	42
SGI	6.778	6.911	1.837	53	54	103
JNG	6.362	6.322	6.922	56	57	46
ATG	8.201	4.834	9.015	35	83	33
SUJ	7.339	7.706	6.6	44	42	50
MST	7.034	6.981	9.588	49	52	30
PKP	5.807	5.821	0.7	68	65	113
TAT	6.976	7.334	5.333	51	46	61
NRW	6.053	7.194	2.724	61	48	91
KSF	6.169	4.544	6.598	59	90	51
JMS	7.868	7.947	7.705	37	38	41
SNG	8.186	8.229	1	36	36	110
RJP	6.005	5.732	8.597	63	67	35
MUZ	5.933	5.784	8.433	66	66	36
LRG	6.317	6.278	8.244	57	58	37
WNS	8.425	8.516	6.638	33	32	49
WSK	6.311	6.978	2.094	58	53	101
SWB	4.927	4.982	3.497	82	80	84
LYP	5.113	5.168	3.252	79	76	87
LHE	4.92	5.018	1	83	79	111
KSR	7.27	7.176	8.223	45	49	38
MBD	5.088	5.135	2.25	80	77	98
CHW	5.667	4.516	5.795	72	91	56
HDD	7.602	7.277	15.729	40	47	12
SYW	5.75	5.606	8.712	69	70	34
JAG	10.527	10.035	25.481	21	20	4
DRU	5.673	8.47	1.143	71	33	109
VRI	4.579	4.66	2.528	92	86	93
SKZ	5.186	5.276	3.962	78	72	76
CJL	5.655	5.873	1.149	73	63	108

continued

Table A.8: Districts' mean landholdings and its ranking 2014-15.

District	Values in acres			Ranking		
codes	**Overall**	**Irrigated**	**Un-irrigated**	**Overall**	**Irrigated**	**Un-irrigated**
KPR	5.204	5.244	3.571	77	73	82
QSH	5.81	5.706	6.727	67	69	48
SRN	4.592	4	4.638	91	95	67
DDU	4.892	4.848	5.655	85	82	58
AWN	4.988	5.038	3.574	81	78	81
MSK	5.223	5.214	5.57	76	74	59
KLU	4.675	4.731	3.908	88	85	77
JLM	4.8	2.4	5.129	86	109	64
GKI	4.902	4.941	3.532	84	81	83
LKA	7.775	7.931	4.114	39	40	74
KAD	4.615	3.992	6.096	90	96	53
NSF	4.756	4.771	4.556	87	84	69
GRT	3.834	4.026	3.432	94	94	86
PIS	4.129	3.501	5.186	93	100	63
KSM	7.067	7.045	7.848	48	50	39
ISB	3.784	3.912	3.745	95	97	78
PEW	4.638	4.658	4.497	89	87	70
HRP	3.615	8.283	3.131	97	35	88
CSD	3.638	3.639	3.629	96	99	80
MSH	2.923	2.743	3.468	102	105	85
KRK	3.593	1.719	3.986	98	112	75
KRN	3.088	3.796	1.555	99	98	105
K8	2.801	2.87	2.748	107	104	90
MDN	2.564	2.599	2.279	109	108	96
BNR	2.843	3.498	2.619	105	101	92
ZRT	2.827	2.62	4.187	106	107	73
HRN	2.852	2.932	2.421	103	103	94
BGM	1.621	2.737	1.576	111	106	104
DRL	2.847	4.093	2.265	104	92	97
SWT	2.626	4.056	1.938	108	93	102
RWP	2.95	4.591	2.363	101	89	95
MKD	3.038	3.094	2.795	100	102	89
KST	1.324	1.278	1.357	112	113	107
TGR	1.028	2.06	0.932	113	111	112

Source: Source: Authors' calculation using PSLM 2015.

Table A.9: District wise land inequality measures and rankings (2014-15).

District codes	Values			Ranking		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
SKT	2.337	0.92	0.951	1	1	2
DRU	2.077	0.9	0.91	2	2	8
CJL	1.812	0.87	0.876	3	3	18
BNP	1.804	0.86	0.872	4	4	20
SGL	1.715	0.86	0.883	5	5	17
HRP	1.39	0.81	0.855	7	6	26
DRL	1.275	0.78	0.83	8	7	38
HRA	1.393	0.77	0.815	6	8	42
NRW	1.16	0.76	0.836	10	9	35
NKS	1.149	0.76	0.862	11	10	23
WGB	1.135	0.74	0.894	12	11	10
RYK	1.107	0.73	0.861	13	12	24
AAW	1.173	0.72	0.748	9	13	65
SHW	1.019	0.71	0.851	14	14	29
MPD	0.993	0.71	0.949	16	15	3
ATG	1.012	0.71	0.769	15	16	59
KSR	0.968	0.7	0.874	17	17	19
LDR	0.922	0.68	0.817	20	18	41
BHV	0.933	0.68	0.833	18	19	37
MUZ	0.892	0.67	0.852	22	20	28
MUX	0.928	0.67	0.853	19	21	27
GRT	0.912	0.67	0.736	21	22	71
KHB	0.826	0.66	0.756	24	23	60
KRK	0.832	0.66	0.66	23	24	91
LKA	0.818	0.66	0.846	25	25	31
CNT	0.816	0.66	0.845	27	26	32
MKD	0.817	0.66	0.779	26	27	53
PEW	0.796	0.65	0.774	28	28	56
KSM	0.754	0.65	0.921	34	29	6
JAG	0.745	0.64	0.943	35	30	4
BDN	0.761	0.64	0.886	31	31	15
KCI	0.738	0.64	0.833	36	32	36
LHE	0.77	0.63	0.779	29	33	54
PKP	0.769	0.63	0.848	30	34	30
MWD	0.725	0.63	0.746	38	35	66
TTS	0.735	0.62	0.797	37	36	49
RWP	0.707	0.62	0.665	40	37	90

continued

Table A.9: District wise land inequality measures and rankings (2014-15).

District codes	Values			Ranking		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
VRI	0.756	0.61	0.841	32	38	33
KWL	0.7	0.61	0.806	41	39	45
SIB	0.756	0.61	0.817	33	40	40
JFA	0.664	0.6	0.912	45	41	7
DSK	0.709	0.6	0.683	39	42	86
SWV	0.694	0.6	0.755	42	43	62
OKA	0.663	0.6	0.807	46	44	44
JNG	0.686	0.59	0.771	43	45	58
SKZ	0.618	0.59	0.75	54	46	64
HAD	0.662	0.59	0.771	47	47	57
CHW	0.647	0.59	0.649	49	48	93
ISB	0.644	0.58	0.693	50	49	83
MSH	0.653	0.58	0.701	48	50	82
TMK	0.604	0.58	0.903	57	51	9
JMG	0.607	0.58	0.813	56	52	43
UMK	0.6	0.58	0.89	59	53	14
GJW	0.682	0.58	0.742	44	54	67
CHG	0.596	0.58	0.884	60	55	16
DEA	0.626	0.58	0.754	53	56	63
BKR	0.631	0.58	0.686	52	57	85
CSD	0.604	0.57	0.789	58	58	51
LMR	0.639	0.57	0.612	51	59	99
TNK	0.61	0.57	0.675	55	60	88
SYW	0.574	0.56	0.872	62	61	21
SWT	0.572	0.56	0.726	64	62	74
LYP	0.573	0.56	0.737	63	63	70
BGM	0.549	0.56	0.721	66	64	76
RJP	0.575	0.55	0.722	61	65	75
KPR	0.538	0.55	0.72	68	66	77
WNS	0.528	0.55	0.826	71	67	39
LYA	0.53	0.54	0.736	70	68	72
JLM	0.564	0.54	0.653	65	69	92
TAY	0.506	0.54	0.891	73	70	13
NSA	0.516	0.53	0.893	72	71	11
MIT	0.504	0.53	0.892	74	72	12
SGI	0.531	0.53	0.739	69	73	69
GRT	0.493	0.52	0.611	75	74	100

continued

Table A.9: District wise land inequality measures and rankings (2014-15).

District codes	Values			Ranking		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
BNR	0.476	0.52	0.74	76	75	68
TRP	0.464	0.51	0.71	77	76	78
UET	0.544	0.5	0.701	67	77	80
MDN	0.412	0.49	0.701	80	78	81
TGR	0.438	0.49	0.576	78	79	105
OHT	0.409	0.49	0.645	81	80	94
NSF	0.401	0.48	0.735	83	81	73
QSH	0.396	0.48	0.801	84	82	46
GKI	0.408	0.47	0.779	82	83	55
LSB	0.427	0.47	0.859	79	84	25
PIS	0.371	0.47	0.57	85	85	106
HDD	0.366	0.46	0.839	86	86	34
KAD	0.364	0.46	0.587	87	87	104
JMS	0.36	0.45	0.801	88	88	48
KST	0.313	0.44	0.497	91	89	111
SWB	0.344	0.42	0.594	89	90	103
SNG	0.299	0.42	0.866	92	91	22
K8	0.317	0.41	0.484	90	92	112
KSF	0.279	0.4	0.505	95	93	110
MBD	0.287	0.4	0.621	93	94	97
ZRT	0.264	0.4	0.595	96	95	102
WSK	0.285	0.39	0.667	94	96	89
AWN	0.225	0.36	0.609	98	97	101
KBH	0.256	0.36	0.676	97	98	87
DBT	0.223	0.34	0.932	99	99	5
DDU	0.2	0.33	0.756	100	100	61
NHS	0.178	0.32	0.623	103	101	96
HRN	0.179	0.32	0.613	102	102	98
KRN	0.168	0.31	0.705	104	103	79
MSK	0.164	0.31	0.549	105	104	109
PZH	0.188	0.31	0.475	101	105	113
LRG	0.13	0.28	0.39	109	106	114
SUJ	0.135	0.27	0.801	108	107	47
SRN	0.125	0.27	0.952	110	108	1
KLU	0.137	0.27	0.786	107	109	52
KDD	0.153	0.26	0.687	106	110	84
MST	0.107	0.23	0.638	111	111	95

continued

Table A.9: District wise land inequality measures and rankings (2014-15).

District codes	Values			Ranking		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
BKN	0.075	0.21	0.553	113	112	108
TAT	0.082	0.21	0.796	112	113	50

Source: Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculation using PSLM 2007-15.

Table A.10: District wise percentage change in various land inequality measures 2007-15

District codes	Percentage change			Ranking of percentage change		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
GRT	202	74	-21	3	1	109
CJL	258	65	59	1	2	2
JAG	145	64	7	6	3	45
NRW	158	59	37	5	4	6
DRU	236	56	36	2	5	7
KSM	120	54	83	7	6	1
JMG	109	47	37	8	7	5
TUK	80	46	8	14	8	39
SKT	185	43	28	4	9	11
SHW	105	38	14	9	10	29
KRK	82	35	27	12	11	12
PIS	73	35	23	17	12	15
HRP	104	33	31	10	13	8
SIB	97	31	19	11	14	24
NSA	80	30	7	13	15	48
BNP	80	22	18	15	16	25
WGB	58	20	11	19	17	31
HRA	76	20	15	16	18	28
MPD	55	20	7	20	19	42
CNT	37	19	8	25	20	41
SGL	65	19	17	18	21	26
PJG	41	17	3	22	22	65
BDN	37	15	7	23	23	44
MUZ	34	15	21	26	24	18
KSR	37	14	11	24	25	32
MSH	23	14	21	30	26	19
TNK	26	14	20	29	27	21
LSB	43	13	38	21	28	4
UMK	27	10	-3	28	29	81
SKZ	15	10	7	37	30	43
LDR	22	9	3	31	31	64
BHV	20	9	6	34	32	52
DRL	29	9	15	27	33	27
HAD	20	9	6	33	34	49
MWD	20	9	19	32	35	23
LYA	14	7	24	38	36	14
RYK	19	7	8	35	37	40

continued

Table A.10: District wise percentage change in various land inequality measures 2007-15

District codes	Percentage change			Ranking of percentage change		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
TRP	13	5	4	40	38	60
KCI	9	5	-1	45	39	73
MUX	11	5	7	43	40	47
GKI	15	5	22	36	41	16
JLM	10	5	11	44	42	33
OKA	6	4	0	47	43	72
TTS	13	4	19	41	44	22
WNS	1	4	-2	53		77
ZRT	5	3	29	49	45	10
SWV	11	2	6	42	46	53
GJW	14	2	8	39	47	38
DEA	6	2	22	46	48	17
KHB	-1	2	9	55	49	37
JFA	6	1	-1	48	50	74
TGR	3	0	-15	51	51	104
MIT	3	0	0	50	52	71
HRN	0	0	9	54	53	35
LKA	-1	-1	0	56	54	70
PKP	-7	-1	2	60	55	68
PEW	-10	-2	4	63	56	61
KWL	-9	-2	6	62	57	51
RJP	-9	-3	4	61	58	57
MKD	-6	-3	9	58	59	36
MDN	-13	-3	10	64	60	34
TMK	-7	-4	5	59	61	54
DSK	-5	-5	-1	57	62	76
WSK	1	-5	-7	52	63	87
SYW	-17	-8	-2	66	65	78
LHE	-19	-8	-4	69	66	83
CHG	-21	-8	25	75	67	13
KPR	-18	-9	-5	68	68	84
TAY	-20	-10	1	71	69	69
NHS	-29	-10	-29	79	70	112
JNG	-18	-10	-2	67	71	79
ATG	-24	-10	-7	76	72	90
VRI	-17	-11	3	65	73	62
SWB	-21	-11	6	72	74	50

continued

Table A.10: District wise percentage change in various land inequality measures 2007-15

District codes	Percentage change			Ranking of percentage change		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
LMR	-19	-12	-13	70	75	99
SWT	-24	-12	7	77	76	46
SGI	-21	-12	2	73	77	67
DBT	-21	-15	4	74	78	59
BKR	-29	-16	-7	80	79	89
K8	-27	-16	-9	78	80	94
AAW	-33	-17	-14	81	81	103
KAD	-36	-17	-16	83	82	106
OHT	-37	-18	4	85	83	56
CSD	-36	-18	-6	82	84	86
ISB	-41	-19	-7	87	85	91
KST	-46	-21	-16	94	86	105
RWP	-47	-22	-21	96	87	110
CHW	-45	-23	-18	90	88	108
BNR	-44	-23	-3	89	89	80
KSF	-54	-23	-28	101	90	111
NSF	-45	-24	-7	92	91	88
NKS	-82	-24	-13	113	92	100
JMS	-43	-24	4	88	93	58
PZH	-41	-24	-14	86	94	102
KBH	-36	-25	-13	84	95	98
GRT	-47	-25	-18	95	96	107
MBD	-49	-27	3	97	97	63
HDD	-52	-27	-4	99	98	82
LYP	-52	-27	-12	100	99	97
MST	-45	-27	29	93	100	9
UET	-45	-28	-10	91	101	95
SNG	-51	-29	2	98	102	66
MSK	-55	-30	-11	102	103	96
QSH	-58	-31	-7	104	104	92
KLU	-60	-31	20	105	105	20
BGM	-61	-31	-13	106	106	101
AWN	-57	-35	-31	103	107	113
LRG	-62	-36	-33	107	108	114
BKN	-67	-40	5	109	109	55
DDU	-71	-45	-8	110	110	93
KDD	-63	-46	13	108	111	30

continued

Table A.10: District wise percentage change in various land inequality measures 2007-15

District codes	Percentage change			Ranking of percentage change		
	Inequality among landowners		Inequality with landless workers	Inequality among landowners		Inequality with landless workers
	MLD	Gini	Gini	MLD	Gini	Gini
SRN	-73	-46	59	111	112	3
KRN	-79	-52	-1	112	113	75
TAT	-86	-63	-5	114	114	85

Source: Note: The district codes and full names are described in the appendix Table A1.
Source: Authors' calculation using PSLM 2007-15.