Land Acquisition and Corporate Investment in India– Impact of the Historical Land Ceiling Legislations*

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Abstract: There is a growing debate about land acquisition for infrastructure and industries in many densely populated countries. In this context, the present paper assesses the impact of the historical land ceiling legislations, largely implemented during 1960-85 to promote distributional equity, on corporate investment in India. We argue that the implementation of the land ceiling legislations had increased the transaction costs of buying land and also the price premium firms pay when acquiring land, thus inducing firms to invest less in land and capital. The detrimental ceiling effect is more pronounced when the ceiling size is more restrictive as for the most fertile land. Arguing that the variation in land ceiling size across the Indian states over time was largely dependent on choice of crops or soil fertility and as such could be treated as independent of the state authorities, our results support the conjecture that more restrictive land ceiling size has led to lower investment in both fixed and total capital output ratios at the state-level (1960-85). Further analysis of firm-level (1996-2012) data confirms that the ceiling effect persists in the long run, thus identifying an unintended consequence of land ceilings for economic growth in the Indian states.

JEL classification: O4, Q1

Keywords: Land reform legislations, Land ceiling size; Transaction costs of land acquisition; Corporate investment; Fixed and total capital-output ratios; More and less land-intensive sectors; India.

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1. Introduction

In security of land tenure is a socio-political issue predominant in most land scarce and predominantly agrarian countries. Customary land rights offer access to land and security of tenure to many poor households that ensures equity in the distribution of land. It may also trigger more investment in land and thereby land productivity and efficiency. Most land reform agendas are thus driven by equity and efficiency considerations.

Access to industrial land and land acquisition for new factories and infrastructure has of late become a major economic and political issue in many densely populated developing and emerging countries striving for economic growth through industrialisation. India is surely an important case in point. It is a land scarce country with immense pressure on land to feed its growing population. Land policy has thus been a major economic issue in India ever since independence. More recently, as India strives for becoming a global superpower through liberalization and industrialization, the tussle between farmers and industrialists/governments has often become a politically explosive issue, sometimes leading to political unrest and violence.

The Tata Nano Singur has been a landmark controversy in this respect that highlights the problem of land acquisition for industrialisation. The project initiated in 2007 required takeover of 997 acres (4.03 km^2) of farmland to have Tata build its factory. This was opposed by environmental activists, unwilling farmers and opposition parties in the Indian state of West Bengal. To a large extent, farmer's opposition was dictated by the undervaluation of multi-cropped land (Ghatak et al. 2013). Finally, Tata had to pull out and relocate to Sanand in Gujarat in 2008 without further controversy. In this context, we shed light on both the causes and consequences of firms' difficulty to purchase land. Specifically, we ask whether the historical land reforms that followed India's independence have an effect on corporate investment in the subsequent years.

Our conjecture is that India's land reforms legislations, especially those related to size of land ceilings, ultimately increased the transaction costs of buying land and the price premium firms pay when acquiring land. In reaction to higher land costs, firms find it optimal to invest less in land and capital.

Transaction costs increase after India's land reforms because, by imposing land ceilings, the reforms redistribute land from a few large land owners to many small owners. A firm looking to acquire a plot of a given size has to negotiate and buy land from a larger number of owners after the reform than before. Each of these acquisitions is costly, and the larger their number, the larger are the transaction costs.

Much for the same reason, the price premium that firms pay to acquire land is higher after India's land reforms. Once a firm acquires a substantial number of parcels of the plot it wants to buy, the landowners of the remaining parcels, knowing that it is costly for the firm to engage in multiple new transactions for a different plot, may refuse to sell or demand a premium – a rent – above the market price of their land.

Transaction costs and a land price premium dis-incentivise firms from investing in land. The disincentive extends to capital investments especially when land and capital are complements – such as in the case of the automobile sector (Ghatak et al. 2013) – or, when capital cannot easily substitute land.

The results from our empirical analysis are supportive of the conjecture that India's land reforms lead to less corporate investment. Using a data set of publicly traded companies between 1996 and 2012 together with historical state-level panel data for sixteen major Indian states from 1960 to 1985, we compare the ratios of fixed and total capital shares (in relation to total output at the state-level and total assets at the firm-level) across sample states with different land ceiling sizes. Our identification mechanism relies on the fact that the ceiling size is beyond the control of the state authority. This is because, by and large, land ceilings were

determined by the share of food crops before 1971 and by the quality of the soil from 1971 onwards. Neither characteristic can be changed by the state government since the choice of crops grown on a plot is a decision of the land user, and soil quality is determined by the nature and historical state boundaries. As such land ceiling sizes can be considered exogenous.

The paper integrates different strands of the literature, namely, the traditional corporate investment literature, the industrial economics literature and also the development economics literature (see section 3 for further details). To the best of our knowledge, ours is the first paper in this respect and contributes to the ongoing debate on land acquisition policies in land scarce countries. In doing so, we control for the traditional determinants of corporate investment including firm age, size, growth opportunities. Second, we take account of the industrial location literature in that we argue that access to land as determined by the local legislations could be a key driver of investors' choice of industrial location. Finally, our central hypothesis and the subsequent empirical analysis is in spirit close to the theoretical argument of Roy Chowdhury (2012), who argued that, in the absence of politicization, more fragmentation increases the possibility that land owners refrain from selling their land and demand a premium above the market price of land. Our work identifies a possible channel through which exogenous variations in land ceiling legislations across the Indian states may lead to land fragmentation and also increase transaction costs of acquiring land, thus creating a bias against investment in land-intensive industries in the states with most fertile land. In particular, our results confirm our conjecture that India's land ceilings legislations have led to less corporate investment in both fixed and total capital shares in our sample. This not only holds for the historical state-level data (1960-1985) but also persists at the firm-level in recent years 1996-2012. We show that the average size of cultivable land per household/person tends to be lower in states with lower ceiling size as determined by the historical land ceiling legislations, thus increasing land fragmentation and also the transaction costs of land acquisition. We check the

robustness of our baseline estimates and rule out that these results do not reflect the effects of labour militancy, lack of physical infrastructure or the lack of implementation of the land ceiling legislations. We also identify evidence of the heterogeneous impact of the land ceiling size across low/high land intensive firms (relative to industry median land intensity): whereas the restrictive land ceiling size has had no significant effects on capital investment in firms operating in less land intensive industries, it has had a significantly detrimental effect on investment in fixed capital among more land intensive firms. These results have significant implications for land acquisition policies for industries and infrastructure not only in India, but also beyond its border.

The rest of the paper is organized as follows. Section 2 provides a brief background of the land reform policy in India. A review of the literature and hypothesis are described in section 3. Section 4 describes the data and the variables generated for the analysis. The regression model is provided in section 5. Results and tests for robustness are produced in section 6 & 7 respectively. The final section concludes.

2. Background, Literature and Hypotheses

2.1. Background

Land policy has been a major economic issue in India ever since independence. Unequal land distribution, expropriate tenancy contacts, Zamindari system were a common feature of the Indian economy. In a land-scarce country with a significant population below the poverty line, there was an obvious argument in favour re-distribution. Land reforms aim at redistribution of excess agricultural land over and above a land ceiling taken from the rich landlords to the landless poor with a view to confer land rights. While equality remains a central argument in favor of land re-distribution, one cannot also ignore the efficiency issues. Shaban (1987),

suggests that owner- cultivated plots of land tend to be more productive than those under sharecropping tenancy. This suggests land re-distribution may promote both equality and efficiency. According to Banerjee (1999), small farms tend to be more productive than large farms.

In 1949 state governments were given the right to adopt and implement land reform legislations. This had led to significant variations across states and over time in terms of the number and nature of the legislations enacted within India's federal structure, the level of support or otherwise from existing or new institutional arrangements, and the degree of success in implementation.

Besley and Burgess (2002) classified the land reform legislations into four major categories:

1. Tenancy reform: These include attempts to regulate tenancy contracts both via registration and stipulation of contractual terms, such as shares in share tenancy contracts, as well as attempts to abolish tenancy and transfer ownership to tenants. tenancy reform, imposed regulation that attempted to improve the contractual terms faced by tenants, including crop shares and security of tenure
2. Abolish intermediaries: large feudal landowners (Zamindars) were given the rights to collect offerings from peasants in exchange for a land tax paid to the state since the British land-revenue system. This system was considered exploitative, and abolition of intermediaries was aimed at curtailing the power of these large landowners and ensuring that the cultivator of the land was in direct contact with the government, which minimized unjust extraction of surplus by the landowner.
3. Ceilings on landholdings: this refer to fixing a maximum size of land holding that an individual/family can own with a view to redistributing surplus land to the landless.

4. Consolidation of disparate landholdings: this made sure that small plots of land belonging to the same small landowner but situated at some distance from one another could be consolidated into a single holding to boost viability and productivity.

Our analysis focuses primarily on the role of ceiling legislations defining the ceiling size. By 1961-62, ceiling legislations were passed in all the States. The size of the ceiling varied from state to state, and were different for food and cash crops. The unit of application of ceiling also differed from state to state. In some states, ceilings were based on 'land holder', whereas in other states ceilings were based on 'family'. In order to bring about uniformity and comparison, a new policy was evolved in 1971 based on irrigation / fertility of the land. Land ceilings were imposed on three categories of land i.e. land irrigated with two crops; land irrigated with one crop and Dry land. (http://planningcommission.nic.in/reports/articles/venka/index.php?repts=m-land.htm). The latter made the size of ceiling a function of land fertility in the states, as determined by the historical formation of the states, and as such could be beyond the influence of the states. Appendix Table A1 summarises the land ceiling sizes across the Indian states after 1971 legislations. While there has been some national guidelines about the size of the ceilings on most fertile (irrigated with two crops), less fertile (irrigated with one crop) and dry land, there have been variations in the ceiling sizes for different types of land across the Indian states, as is evident from Table A1. However, the ceiling size was much smaller for the most fertile land than for the less fertile or dry land and this holds in all the sample states. Most of these ceiling legislations were passed during 1960-85, thus justifying our focus on 1960-85. We exploit the inter-state variation in the ceiling size legislations across the Indian states over time to analysing the historical legacy of land ceilings on corporate investment.

The union or the state government can acquire private land for the purpose of industrialization, development of infrastructural facilities or urbanization of the private land.

This is referred to as Land acquisition in India. The affected owners are in return provided compensation, rehabilitation and resettlement. Until 2013, land acquisition was governed by the Land Acquisition Act of 1894. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR) came into force from 1 January 2014. It aims to meet the twin objectives of farmer welfare; along with expeditiously meeting the strategic and developmental needs of the country. More recently, attempts were made to amend the LARR as the new BJP government at the centre attempted to introduce the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill, 2015, popularly known as the Land Bill. The new Bill aims at making it easier to acquire land for certain kinds of industrial activities by exempting certain investment projects from obtaining consent from land holders. However, the Bill that aims to streamline the currently cumbersome process of land acquisition was not approved following farmer protests all over India,[1] because it adversely affects the country's poorest and most vulnerable – its forest-dwelling tribes and farmers. Attempts are now being made to correct the perception of 'pro-corporate' and 'anti-farmer' land bill to satisfy the dual objectives of development and welfare. In this context, it is important and timely to study the impact of land reforms on corporate investment.

The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 defines 'consent' clause as "land can only be acquired with approval of the 70% of the land owners for PPP projects and 80% for the private entities. Generally there are more landowners to get the consent from in states with more fragmented land caused by the ceiling legislations, thus raising the transaction costs of acquiring land. Variation in land compensation across India is another complication for investors. Land compensation depends

[1] According to K. Nagaraj (2008), every seventh suicide in India is a farmer suicide. While the reasons behind the suicides are usually crop failure and mounting debts, amendments in the proposed land bill – is quite unfriendly to farmers who believe they are unfairly compensated. This has undoubtedly spread fear and unrest among farmers.

on the market value of the land which is likely to be higher in more populous states with greater population density and greater soil fertility.

The compensation for the acquired land is based on the value of the agricultural land, which ignores the price increases and as such, deprives the current owners. Secondly, if the prices are left for the market to determine, the small peasants could never influence the big corporate tycoons. Also it is mostly judiciary who has awarded higher compensation than bureaucracy (Singh 2007). Public protests about unfair compensation schemes are common and adds to the costs as it further delays transactions.

2.2. Literature review

We integrate different strands of the literature to develop our central hypothesis: the first is the traditional corporate investment literature that focuses on different firm-level characteristics influencing corporate investment. The second is the industrial economics literature which explores the determinants of firm's location choice and finally, there is now an emerging development literature that examines the role of various public policy interventions including Land Reforms on output, growth and poverty.

Corporate investment Literature: Modigliani and Millier's (1958) theory of the irrelevance of financial structure and policy on real investment decisions suggest that under perfect market conditions and when all firms have equal access to the capital markets, external funds and internal capital are perfect substitutes and the structure of the firm does not affect investment decisions. Perfect market condition do not, however, exist in the real world, which in turn suggests that investment may be affected by financial factors such as availability of internal funds, access to credit market etc. Meyer and Kuh (1957) were the first among others to emphasize the significance of financial conditions of a firm on investment decisions.

This finding when applied to capital investment led to the development of several theories of investment demand including the neoclassical theory of investment demand by Dale & Jorgensen (1967); Accelerator theory of Clark (1917) and Samuelsson (1939a and b), Q-Theory of investment suggested by Brainard & Tobin (1968) and Tobin (1969); Expected Profits (Jorgensen & Siebert, 1968), and Liquidity Theory (Meyer and Kuh (1957) & Anderson (1964) amongst others. Various theories suggested different firm level variables affecting investment decisions. Jorgensen & Siebert, (1968) do a comparison of the alternative theories of corporate investment behavior.

In 1988, Fazzari, Hubbard & Petersen introduced the theory of financial constraints. They studied the relation between corporate investment and cash flow to test for the presence and significance of financing constraints. According to them investment behavior of a company can be explained by the pecking order theory. Cost of external finance increases considerably due to information asymmetry and agency costs. Initially firms prefer to finance internally through their operating cash flow, in an attempt to minimize the cost of capital. Only when the company's internal funds are insufficient to meet its investment needs, it resorts to external financing. Therefore, the higher the investment–cash flow sensitivity, the higher the implicit costs of external financing and the higher the financial constraints. They classify firms with low-dividend pay-outs as 'most financially constrained' while those with high dividend pay-outs as 'least constrained' firms, and then measure sensitivity by regressing investment on cash flow, controlling for investment opportunities using Tobin's Q. Their results suggest higher investment-cash flow sensitivities as evidence of greater financing constraints.

Fazzari et al.'s way of classifying firms as more or less constrained based on dividend pay-outs was criticized by Kaplan & Zingales (1997). They argued that firm's dividend policy is a choice variable and firms may decide to pay less dividend even though they could pay out more. Choosing to pay low dividends does not necessarily mean financially constrained. Their

classification was based on qualitative and quantitative information taken from financial statements. If firms had more funds than required to finance their investment, they were classified as "never constrained" while if they do not have access to more funds than needed to finance their capital expenditure, they were classified as "likely constrained". Their findings suggest the investments of 'likely constrained' firms are less sensitive to cash flows than the investments of 'never constrained' firms. Debate on whether investment cash-flow sensitivities to be a good measure of financing constraints or not is still going on.

As Moyen (2004) demonstrates with simulated data, it is hard to identify firms with financing constraints, and the investment cash flow sensitivity critically hinges on the classification procedure used. While some methods of financial constraint identification show low sensitivity between investments and cash flows, others show just the opposite".

Studies have also been conducted to test for factors affecting financial constraints; Lian and Cheng (2007) argue that companies that tend to over-invest are the ones with fewer financial constraints as they appear to have a stronger investment-cashflow sensitivity, while those who under-invest face severe financial constraints. According to them information asymmetry is the main reason for investment-cashflow sensitivity. Wang et al. (2008) support this however they argue that asymmetric information theory cannot fully explain the relationship between financial constraints and investment–cashflow sensitivity.

More recent literature establishes a direct correspondence between investment decisions and regulatory conditions or various laws passed on in a country. La Porta et al. (1997, 2002) for instance, are the first to study how investor protection affects corporate valuation. They argue that the legal environment of a country is an important determinant of the development of its capital market. They provide evidence of higher valuation of firms in countries with better investor protection. Further Agrawal (2013) studied the impact of an investor protection law namely, "blue sky laws", on corporate behavior and value. He tries to identify the casual impact

of the investor protection law on firms in the manufacturing sector, by comparing the impact of the blue sky law on firm in states which introduced this law relative to those located in control states that did not introduce the law. Results support theories that predict a significant positive impact of investor protection laws on corporate financing and investment policy.

Djankov et al. (2010), study the impact of corporate taxes on investment and entrepreneurship. "Using data on effective first-year and five-year corporate income tax rate for 85 countries, they provide evidence of a large and significant adverse effect of effective corporate tax rates on corporate investment and entrepreneurship. In other words, higher effective corporate income taxes are associated with lower investment in manufacturing but not in services, a larger unofficial economy, and greater reliance on debt as opposed to equity finance. Their results are robust after controlling for other tax rates, including personal income taxes and the VAT and sales tax, for measures of administrative burdens, tax compliance, property rights protection, regulations, economic development, openness to foreign trade, seignorage, and inflation".

Tarantino (2013), examines a link between bankruptcy law and investment decisions. He argues that the adoption of soft bankruptcy law (resembling the chapter 11 of the federal bankruptcy law, US) encourages the choice of investment that favours the achievement of long-term results. However, soft bankruptcy can lead to the choice of investments that are biased towards the achievement of short-term outcomes. Adoption of bankruptcy code increases the renegotiation power of entrepreneurs, which can allow lenders to increase recovery rates on the one hand but also weakens the weakens the contract's ability to solve the moral hazard problem embedded in the production project.

Industrial Economics Literature: This focuses on the location choice of industries. A review of the literature on industrial location and its determinants is vast and beyond the scope off the paper. The classical location theory was formulated by Webber (1929). Industrialization

is argued to follow the classic "virtuous Cycle" principles i.e. firms locate where other firms are already located to realize existing benefits. Extensive reviews are provided by Henderson (2003), Head et. al (2004).

Deichmann et al. (2008) provides a survey on the important factors of industrial location in developing economies. According to them, factor prices (wage); utility service (Electricity and power); labor and regulation; market access and transport, firms in supplier industry; firms in own industry etc. are key factors affecting industrial choice. Lall and Chakravorty (2005) list five sets of determinants namely, land, capital, labor, infrastructure, regulation and spatial determinants of new investment. Using proxies for each of these determinants they show that investments are biased towards existing industrial cluster. Mukin and Nunnenkamp (2010), study the same for foreign investors. Foreign investors also prefer to locate where other foreign investors are already present. Physical infrastructure as measured by the proximity to national highways, airports, ports etc. is of prime importance to foreign investors as such they mainly invest in metropolitan cities. However none of these studies consider the constraints for land acquisition and their potential impact on corporate investment which remains the focus of the present study, especially in the context of land ceiling legislation.

. *Development literature:* Existing studies have examined the effects of land reform policy on poverty, productivity, sustainable development etc. Sazanna and Davis (1973) examine both theoretically and empirically, the effectiveness of a land tax as a regulatory tool for boosting agricultural output and productivity. According to them land taxation policy is not an effective device for increasing agricultural output and productivity. Besley and Burgess (2002) study the impact of various land reforms legislations on growth and poverty. Using a state-level panel of 16 major states from 1958 to 1992, they examine whether land reform legislation is associated with poverty reduction. They also provide a systematic description of these laws and their amendments that were passed in individual states over time to identify the effect of

land reform on productivity and poverty. They generate a cumulative variable that aggregates the number of legislative reforms to date in any particular state. Controlling for state and year fixed effects, and a number of time varying economic and policy variables, they find that the lagged version of their cumulative land reform variable has had a negative and significant effect on poverty. Interestingly, they find that this is due primarily to the tenancy reform component of land reform. Abolition of intermediaries had a negative effect on poverty, but no effect on productivity. Imposing a ceiling on landholdings does not seem to have had much effect on either poverty or productivity, while land consolidation had a positive effect on productivity without having any effect on poverty. The authors conclude that land reforms did not have much effect on the distribution of land and seems to have operated mainly through altering the contractual relations in agriculture.

More recently, Roy Chowdhury (2012) theoretically argues that, in the absence of politicization, more fragmentation increases the possibility that land owners refrain from selling their land and demand a premium above the market price of land. Ghatak and Mookherjee (2014) argued how farmers displaced by acquisition of agricultural land for the purpose of industrialization ought to be compensated.

We integrate various strands of the literature discussed above to develop our hypothesis linking the size of land ceiling legislations and the resultant investment in capital that remains little understood in the literature.

2.3. Hypothesis development

While access to land is a key determinant of industrial production, especially for land-intensive heavy industries, the literature on the effects of possible constraints on land acquisition on

corporate investment remains rather non-existent. In this respect we exploit the exogenous variation in the land ceiling size across the Indian states and over time to explore its possible impact on land acquisition for industries and infrastructure and the resultant effect on corporate investment.

While the Indian land reform legislations had different components (see discussion in Section 2.1), we particularly focus on the land ceiling legislations: imposing a land ceiling creates surplus land over and above the size of ceiling, which gets allocated to the landless. Prior to 1971, land ceilings were based on the size of the landholder or the household in some states while in others on the kinds of crop irrigated on the land. Since 1971, however, a new land ceiling policy has been adopted that used the quality of the soil to classify land as 1) most fertile land that is land irrigated with two crops 2) less fertile land as the land irrigated with one crop and 3) dry land or infertile land to impose ceilings. This was considered to be an effective criteria and so no further changes were made in land ceiling policy afterwards. Since the geographic boundaries of the sixteen major states remained unchanged over 1960-85, one can argue, without any loss of generality, that lower the land ceiling size, the greater is the land fragmentation after the implementation of the ceiling legislations. Since states with most fertile land faced a more restrictive land ceiling size compared to those with less fertile or infertile land, it can be argued without any loss of generality that land is more fragmented if ceiling size is more restrictive.

Implementation of the land ceiling legislations thus redistributes land from a few large land owners to many small owners. A firm looking to acquire a plot of a given size therefore needs to negotiate and buy land from a larger number of owners after the reform than before. Each of these acquisitions is costly, and the larger their number, the larger the transaction costs.

Much for the same reason, the price premium that firms pay to acquire land is higher after India's implementation of the land ceiling legislations. Once a firm acquires a substantial number of parcels of

the plot it wants to buy, the landowners of the remaining parcels, knowing that it is costly for the firm to engage in multiple new transactions for a different plot, may refuse to sell or demand a premium – a rent – above the market price of their land.

Accordingly we hypothesize:

H1: The higher (lower) the size of ceiling on most fertile land (in acres) in a state, higher (lower) is the level of corporate investment, keeping the size and fertility of land unchanged.

In other words, our conjecture is that India's land ceilings legislations ultimately increased the transaction costs of buying land and the price premium firms pay when acquiring land. In reaction to higher land costs, firms find it optimal to invest less in land and capital.

2.4. Transaction costs of acquiring land for industries in India

Presence of transaction costs is key to building our central hypothesis. In this section, we therefore try to identify different components of these transactions costs involved in acquiring land for industrialisation and infrastructure development.

First, implementation of land ceilings legislations attempts to create a surplus, which is then redistributed among landless labourers, thus giving rise land fragmentation and multiple small landholders. Thus in order to get a given amount of land, an industrialist would require to get consent from more landowners, especially in states with more restrictive land ceiling size. Figure 2 illustrates this point that there is a positive relationship between size of land ceiling and the average size of cultivable landholding in our sample. The latter may enhance transaction costs of negotiation especially if some of them disagree, thus raising the total transaction costs of acquiring land in the states with lower land ceilings. Further Table 2 compares average cultivable land holding in low ceiling states before and after 1971. There is indeed some confirmation that average cultivable landholding per household and that per person was significantly lower after the 1971 legislation in our sample (see further discussion in section 6.1).

The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 defines a **'consent'** clause as "land can only be acquired with approval of the 70% of the land owners for PPP projects and 80% for the private entities." A major issue in acquiring productive land for industrial purposes is the compensation to be paid to land owners. This is where the scuffle between land owners and acquires aggravates. While land owners believe they are unfairly compensated, big industrialists aim to reduce their costs in arriving at an agreed compensation and often they have more bargaining power over the small land owners in this respect.

While the land market across India is not very active, Chakrabarty (2013) shows that urban land prices are significantly higher than the comparable incomes. Further there are striking inter-city differences: price per square foot of land is the highest in Mumbai, closely followed by Bangalore in the south and the capital city Delhi in the north of the country though the ranking in terms of per square feet price changes when we consider land price per acre. Singh (2016) then computes the fundamental value of land for urban homes as the opportunity cost of land that could have been used in agriculture. Accordingly, he shows that the maximum fundamental value of land is much smaller than the market value of land as shown by Chakrabarty (2013) which is arguably consistent with the fact that, by and large farmers have low incomes primarily derived from production of crops on land. Singh went on to argue that the fundamental value of land would then vary with agricultural productivity that determines the amount of crops produced on land, other things remaining unchanged. As such we argue that the price per acre of agricultural land would vary with the land fertility.

The compensation for the acquired land is based on the value of the agricultural land, which ignores the price increases and deprives the current owners. Secondly, if the prices are left for the market to determine, the small peasants could never influence the big corporate tycoons. Also it is mostly judiciary who has awarded higher compensation than bureaucracy

(Singh 2013). Public protests about unfair compensation schemes are common that further add to the costs as these protests also tend to delay transactions and start of production.

3. Data

3.1. State-Level Data

We have compiled and processed the data from a variety of sources. The data is collected for 16 major Indian states for a period of 25 years starting from 1960 to 1985. This gives us a state-year panel data with 420 state-year observations. Following is a list variables used in our analysis along with the sources they have been taken

1. Dependent variable: We use two measures of investment. First, we use fixed capital-output ration as a proxy for investment in fixed capital at the state-level. Note that fixed capital refers to any fixed assets including property, plant and equipment which are not used up in the production (e.g., see Blomstrom et. al. (1993)) and we calculate fixed capital as a share of total value added. Second, we also consider share total capital as a ratio of total value added and consider this to be a proxy for investment in total capital; note that total capital is the sum of fixed and working capital. The main source of the data is the Indian Annual Survey of Industries (ASI) in this respect.

(a) Key explanatory variable: It relates to different measures of land ceiling legislations as explained below. Size of Ceiling is the maximum area (in acres) of land that an individual can hold in a state and varies with the land fertility in a state at a given point of time. In this respect, we distinguish between ceiling size for more/less fertile land and also infertile land. In general, we find that the size of the ceiling is lowest in states with most fertile land and since we aim to assess the adverse effect of low ceilings on corporate investment, we consider the effect of two possible ceilings size measures. First, ceiling size on most fertile land as they are the lowest possible ceilings and

second, average ceilings size which is the simple mean of ceiling size of a state at a given time on all kinds of land i.e. most fertile land; less fertile land and dry /infertile land in a state. Data is collected from the Department of Land Resource, Government of India. It was made available in the Agriculture Statistics. At a Glance 2014 (see Appendix Table A1).

3.2. Firm-Level Data

We obtain firm-level panel data from Orbis provided by the Bureau van Djik from 1996 to 2012. We obtain ownership information for the same firms from Prowess database available from the Centre for Monitoring the Indian Economy or CMIE for short. We then extract the location of firms from the addresses of their headquarters. Finally we add/merge firm-level data with state-level land-ceiling size measures available from the Planning Commission.

1. Corporate investment measures: In order to make our state-level results to be comparable to the firm-level ones, we consider fixed capital as a ratio of total assets and total capital as a ratio of total assets as measures of investment. Fixed capital includes any investment within the measurement period in physical assets, such as real estate, infrastructure, machinery, etc. While working capital of a firm may vary from year to year, fixed capital investment is a good measure of steady long-term investment of a firm. Since this outcome variable is comparable to the state-level outcome, we can compare the effects of various land reform variables on both state-level and firm-level outcomes.
2. Key explanatory variable: As with the state-level data, we consider two land ceiling measures: (i) size of ceilings for most fertile and (ii) average ceilings size for the firm-level data too.

We also include a number of control variables in both state- and firm-level analysis as we attempt to minimise the omitted variable bias. This is discussed in detail in Section 4.

3.3. Data description

We start by plotting sample firms' location across the Indian states. The green dots in Figure 1 show the distribution of sample firms across Indian states. Evidently, there is a clustering of these firms in the western states of Gujarat, Maharashtra, and also in and around Delhi/Haryana/Punjab. Table 1 reports the summary statistics of key regression variables both for the state and the firm-level data.

In Table 2B we consider the mean comparisons of investment in fixed and total capital shares before and after the introduction of the latest 1971 ceiling legislations for the states in the top 10th percentile and bottom 10th percentile in the distribution of average ceiling size – large and small ceilings states, respectively. We find no significant mean difference in fixed and total capital per unit of output between states with small and large ceilings sizes before 1971. However, the mean difference in fixed and total capital per output between these two groups of states becomes significant after the implementation of the 1971 ceiling legislations. In particular, fixed and total capital per output are larger in the states with larger ceiling size in our sample. In other words, results in Table 2B confirm a positive relationship between average ceiling size and investment in capital-output ratios, but only in the post-1971 years.

4. Empirical strategy

In this section we use a multiple regression framework to test the hypothesis of our interest.

4.1 State-level analysis:

Our simple baseline regression for the s-th state in t-th year is of the following form:

$$Y_{st} = \alpha_0 + \alpha_1(Most\ fertile\ ceilings_{st}) + \alpha_2 X_{st} + \sum \tau_t + \epsilon_{st} \quad (1)$$

Where Y_{st} is a measure of investment in fixed and total capital shares in state s at time t, *Most fertile ceilings* is the key explanatory variable indicating the size (in acres) of the administrative ceiling imposed on most fertile land. As indicated above, the ceiling size was imposed according to the nature of the crop in the pre-1971 years and then from 1971 onwards it was number of crops produced on the land which in turn reflects the soil quality/ fertility; in particular, we consider the ceiling size on the most fertile land which was irrigated with two crops which the most restrictive ceiling size by construction. X_{st} is the set of various state level controls that may also affect capital investment decision, and τ_t captures the unobserved year-specific factors (i.e., political changes, policy changes over time) that may also influence investment with a view to minimise the omitted variable bias of our estimates, if any. We include the following controls X for the state-level analysis:

(a) Log (state output): log of (Net State Domestic Product) available from the World Bank. This allows us to control for state-level prosperity

(b) Population density: The population estimates are constructed using Population Census data (Census of India, Registrar General and Census Commissioner, Government of India). We construct population density as the ratio of total state-level population to geographic size of the state. This controls for the population pressure on land.

(c) Percentage share of SC/ST Population: Scheduled caste (SC) and scheduled tribe (ST) are constitutionally regarded as the backward castes in India who tend to be over-represented among the Indian poor. Traditionally they are less educated too. So the states with more SC/ST population shares could be major beneficiaries of the land redistribution programme while their predominance in

a state may also indicate lower human capital status of the state which may discourage corporate investment.

(d) Percentage share of Urban to Rural population: In general more urbanised states are more industrialised and more developed with better human and physical infrastructure, thus may be better placed for attracting more corporate investment.

(e) Literacy rate: Total Literate/ total population *100. State-level literacy rate reflects the human capital of the state which is a major determinant of industrial productivity.

(f) Soil fertility: ratio of net sown area to total land area in the state. We include this control to rule out the competing explanation that higher land prices may influence corporate investment.

In an alternative specification, we replace the ceiling size for the most fertile land with the average ceiling size in operation in the s-th state in t-th year:

$$Y_{st} = \alpha_0 + \alpha_1(Average\ ceiling\ size_{st}) + \alpha_2 X_{st} + \sum \tau_t + \epsilon_{st} \qquad (2)$$

Average ceiling size is the average of the ceiling sizes for most fertile, less fertile and dry land in a state "s" at time "t". All other controls remain as in equation 1.

4.2 Firm-level analysis

To study the long run effects of the historical land ceiling legislations, we next carry out the firm-level analysis for the period 1996-2012. As with the state-level analyses, we consider the impact of ceiling size imposed on most fertile land and also the average ceilings size on share of fixed and total capital in a bid to make the firm-level analysis comparable to the state-level ones described in section 4.1.

Accordingly we consider the following regression model for the i-th firm in year t in our sample as follows:

$$Y_{ist} = \beta_0 + \beta_1(Most\ fertile\ ceilings_{st}) + \beta_2 Z_{ist} + \sum S_j + \sum \tau_t + \sum I_k + \epsilon_{ist} \quad (3)$$

Where Y_{ist} is a measure of corporate investment for firm *i*, in state *s* at time *t.* As with the state-level analysis, we consider the share of fixed and total capital investment in the firm as the two possible outcome variables. While share of fixed capital is proxied by gross fixed assets as a share of total assets, total capital is the sum of fixed and working capital (measured by the current liability provisions). Among the set of firm-level control variables Z, we include firm size (log of total assets), age of the firm in year since the date of incorporation and also the identity of the controlling owner (private or state controlled) of the firm. Among the dummies representing various unobservable factors, I refers to the unobserved industrial sector dummies (capturing, e.g., the effect of sectoral movements), τ the unobserved year-specific factors (capturing e.g., government turnover or policy changes) and S the unobserved state-specific factors (capturing e.g., soil fertility, population density and other possible state-level factors) that may also influence investment.

After controlling for all these factors, the key coefficient of interest for us is β_1 – we use the data at our disposal to see if the estimated β_1 is positive or not. As before, we also estimate equation (3) by replacing ceiling size for most fertile land with the average ceiling size in the state in an alternative specification.

4.3. Heterogeneous impact

Finally, we consider the distribution of land intensity as defined by the land held as a share of total assets of all sample firms to classify them into high/low land intensity firms depending on whether they are above/below the median land intensity of the particular industry. Firms above the median industry-level land intensity are called high land-intensive firms and vice versa for

the firms below the median land intensity as indicated by the dummy variable HighLandIntensity. We then run regression (4) to see if there is any heterogeneous impact of the ceiling size on these two groups of firms:

$$Y_{ist} = \beta_0 + \beta_1(Most\ fertile\ ceilings_{st}) + \beta_2 * HighLandIntensity + \beta_{12} *$$
$$Most\ fertile\ ceilings_{st} * HighLandIntensity + \beta_3 Z_{ist} + \sum S_j + \sum \tau_t + \sum I_k + \epsilon_{ist} \quad (4)$$

Naturally, we can only do this for the firm-level data and we do so by including an interaction term between HighLandIntensity and the particular land ceiling variable (ceiling size for the most fertile land or average ceiling size for any land in the state). So the coefficient of interest for us is the estimated value of β_{12} (see further discussion in section 6.2.) that accounts for the effect of the ceiling size for the most fertile land on the investment in fixed and total capital depending on whether the firm has high/low land intensity.

5. Results

This section reports and analyses the estimates of our regression equations (1)-(4). Sub-section 5.1 discusses the regression estimates of fixed and total capital investment using the state level data while sub-section 5.2 discusses the long run effects of land reform legislation using the firm-level data for 1996-2012, testing the validity of hypotheses H1. Section 5.3 tests the robustness our baseline regressions shown in Sections 5.1 and 5.2 respectively while Section 5.4 checks the presence of heterogeneous effect of the land ceiling legislations among high/low land intensive firms in our sample.

5.1 State-level Results

In this sub-section, we first analyse the baseline estimates of total and fixed capital-output

ratios, with a view to test the validity of our central hypothesis H1, using the historical state-level data. Tables 3-4 report the effects of ceiling size on most fertile land on state level investment in fixed and total capital shares respectively. Columns (1) to (7) show fixed capital share estimates for various specifications using regression equation (1). Note that the estimated coefficient of the ceiling size for the most fertile land is positive and statistically significant in each column, irrespective of the specification. Estimates shown in column (7) is our most preferred specification as it controls for most variables thus helping to minimise the omitted variable bias. In a similar vein, we consider the effect of ceiling size on most fertile land on total capital share as summarised in Table 4. In this case the effect of ceiling size on total capital share is only significant in the final specification as in column (7) and the estimated effect is positive and significant too, controlling for all other factors that may also influence investment in total capital share. These two sets of estimates lend support to hypothesis H1 in that the greater land ceiling size significantly boosts corporate investment in fixed and total capital shares, ceteris paribus. This is because higher (lower) size of ceiling reflects less (more) fragmented land which in turn lowers (increases) the transaction costs of acquiring land irrespective of the quality of the land, thus providing support to H1.

We further consider the effect of average ceiling size on both fixed and total capital shares at the state-level. In view of regression equation (2), we summarise the estimates in Table 5 (fixed capital share) and Table 6 (total capital share). As before, we consider the final specification summarised in column (7) of each table. The estimated coefficients of average ceiling size are positive and statistically significant in column 7 for both fixed and total capital shares respectively. We also find direct evidence supporting the mechanism behind our conjecture as highlighted in Figure 2. Specifically, we find smaller land plots in states with more restrictive ceilings.

5.2 Firm-Level Results

In this section, we consider the estimates of Equation (3) using firm-level data for 1996-2012. These estimates are shown in Table 7 using two measures of land ceiling sizes, namely, ceiling size on most fertile land and also the average ceiling size as we test the validity of hypothesis H1). Columns (1)-(2) show the estimates of investment in fixed and total capital shares using ceiling size on most fertile land while columns (3)-(4) do the same using average ceiling size.

The firm-level estimates shown in Table 7 appear to be rather similar to what we have seen in the state-level regressions (see Tables 3-6). This is especially true when we consider the effect of average ceiling size for the investment in fixed and total capital shares shown in columns (3) and (4) respectively. The estimated coefficient of average ceiling size variable is positive and statistically significant in both columns (3) and (4). If, however, we consider the coefficient estimate of ceiling size on most fertile land in columns (1) and (2) respectively for fixed and total capital share, we find that the coefficient estimate is negative (but insignificant) for fixed capital share, but positive and statistically significant for total capital share. In other words, controlling for all other firm, industry and state-level observed and unobserved factors, there is full support for H1 for total capital share irrespective of the measure of ceiling size used. But the corresponding effect on fixed capital share is rather weaker in the long-run for our firm-level analysis, especially when using the ceiling size for the most fertile land.

5.3. Eliminating competing explanations

While we interpret the evidence in Tables 3 through 7 as suggesting that lower land ceilings significantly lower corporate investment in fixed and total capital shares, one could use the same evidence to support the reverse causal relation: states with expectations of low investment set more restrictive ceilings. To this point we note that ceiling sizes were not under the control of state governments. By and large, land ceilings were determined by the share of food crops

before 1971 and by the quality of the soil from 1971 onwards. Neither characteristic can be changed by the state government since the choice of crops grown on a plot is a decision of the land user, and soil quality is determined by nature. As such land ceiling sizes are exogenous to state governments.

Next, we try to rule out that our ceiling results are not reflecting the effect of any confounding factor. To this end, we first consider the role labour militancy which can distract investors from a state. In order to test if this is the case, we control for annual number of man-days lost because of strike activities in a state while determining fixed and total capital investment. In particular, we measure labor Militancy by the natural logarithm of the total Man days lost in industrial disputes and include it as an additional control in determining capital investment measures. We get this data from Besley and Burgess (2002) who study the effect of labor regulations on investment, employment, productivity and output in the manufacturing sector. They suggest that pro-worker amendments in the Industrial Disputes Act are associated with lower investment, employment, productivity and output in registered manufacturing. Results shown in Table 8 suggest that the state-level ceiling effects (see Tables 3-6) persist even after we control for labour militancy, thus ruling out the possibility that our results are capturing this possible confounding event.

It is a well-established fact in the industrial location literature that firm's location choice is significantly affected by infrastructural facilities in a prospective location (e.g., see Deichmann et al., 2008). Metropolitan cities with access to good physical infrastructure, including roads, railways, airport, are usually observed to form industrial clusters. It is thus imperative for us to assess if our baseline regression results hold even after controlling for the proxies for local infrastructure. In the absence of a better alternative, we use firm locations to create city dummies to proxy for infrastructural facilities. Naturally we can do this only for the firm-level data with a view to rule out that the adverse effects of restrictive ceilings that we find in our

sample are not due to lack of infrastructural facilities. Results reported in Table 9 confirms the validity of our baseline firm-level results as summarised in Table 7. Once again we get positive ceiling size effect on total capital shares, thus confirming the robustness of our results.

Finally, there is a general consensus that despite the firm commitment of the Government of India, the ceiling legislations were not implemented uniformly across all the Indian states, thus limiting their success. With the exception of Kerala and West Bengal and to a lesser extent Bihar and Jharkhand after 1981-82 (see Srinivasan 2007), in many states Gini coefficient in the distribution of land went up in many states, most notably in Punjab and Haryana. It is therefore imperative to assess if our ceiling effects hold if we drop the two most land reform intensive states namely, West Bengal and Kerala, from the sample. Accordingly, we next drop these two states from the sample of states and rerun our capital investment regressions for both the state and firm level analyses. Table 10 reports the regression estimates of both fixed and total capital shares for the state - level (1960-85 – see Panel A) and firm- level analysis (1996-2012: see Panel B) respectively. Evidently, the Table 10 Panel A results highlight the robust, positive and statistically significant ceiling effects on both fixed and total capital shares at the state level irrespective of the choice of ceiling measure and reaffirm what we have found in Tables 3-6. The firm-level results without the states of Kerala and West Bengal (see Panel B of Table 10) too reaffirm the same pattern as in Table 7 results in that larger ceiling size significantly boost both total capital shares over 1996-2012, after controlling for all other factors that may also influence corporate investment in this respect. The effect as before remains insignificant for the fixed capital shares.

5.4. Heterogeneous impact of the reform

So far, we have found that the restrictive ceiling size significantly lowers both fixed and total capital shares at the firm-level analysis (e.g., see Table 10). In this section we assess the

differential impact of land ceiling size for low/high land intensive firms (relative to industry median land-intensity). In doing so, we first classify low/high land intensity firms as follows: a firm has higher land intensity if its land to total assets ratio is greater than the industry median land to total assets ratio. Accordingly we estimate equation (4) where we not only include the ceiling size (for most fertile land and also the average in alternative specifications) and the binary variable indicating high/low land intensity of the firm, but also their interactions. As in Table 7, we continue to control for the same set of explanatory variables with a view to minimise the potential omitted variable bias. The coefficient of interest for us is the interaction term β_{12}. These estimates, as summarised in Table 11, suggest that the estimated interaction term β_{12} is positive and statistically significant, but only for the fixed capital shares irrespective of the choice of ceiling size measure and complements the results summarised in Table 7, for example. In particular, there is evidence that larger ceiling size increases the fixed capital investment, but only for higher land intensive firms. In contrast, the non-interacted ceiling size variable on its own is negative and statistically significant so that higher ceiling size significantly lower investment in fixed capital if the firm is not highly land intensive. As before ceiling size on its own has a positive impact on total capital investment though the effect is statistically significant only when we use the average ceiling size.

6. Concluding comments

The paper examines the impact of historical land ceiling legislations on corporate investment in the Indian states. We argue that the transaction costs of acquiring land for industries increase after the implementation of the land ceilings as it gives rise to smaller land holdings and also increase the land price premium. Arguing that the land ceiling size is exogenous because it is based on the choice of crops produced before 1971 and then on soil fertility after 1971, we

assess the impact of land ceiling size on most fertile land and also average land ceilings size on corporate investment in fixed and total capital shares both at the state level (1960-85) and also at the firm level (1996-2012). Results provide support to our conjecture that restricted land ceiling size tends to significantly lower investment in fixed and total capital shares at the state-level, after controlling for various observable and unobservable factors helping to minimise the omitted variable bias of the estimates. These results seem to persist over the long run 1996-2012 in our firm-level panel data too, especially for the investment in total capital. We check the robustness of our estimates and rule out that these results do not reflect the effects of labour militancy, lack of complementary physical infrastructure or the lack of implementation of the land ceiling legislations. Further analysis highlights that the adverse ceiling effect on capital investment, especially for fixed capital, tends to be more pertinent when firms are more land intensive (relative to industry level land intensity). We also find direct evidence supporting the mechanism behind our central result. In particular, we show that the size of household landholdings is smaller in states with more restrictive ceilings (see Figure 2), thus leading to higher transaction costs of acquiring land for industries in these states.

While the government commitment to land reforms in general or land ceilings in particular arises from the consideration of social justice, these results highlight an unintended consequence of land ceilings on corporate investment in our sample. Ultimately, lower investment leads to lower economic growth. While one cannot reverse the adverse effects of historical land reform in a land scarce economy with growing population to feed, options for future policy development surely necessitate a closer scrutiny.

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Tables

Table 1: Summary Statistics

Variable	Observation	Mean	Std. Dev.
State-Level Data			
Dependant Variable : Fixed Capital share	416	1.773029	.8924956
Independent Variables			
Size Of Ceilings (in acres)			
Land irrigated with two crops i.e. Most fertile Land	224	15.1875	2.726818
Land irrigated with one crop i.e. Less fertile land	224	22.25	6.233858
Dry Land	224	44.5	23.56862
No. of Ceilings	416	.7019231	.739649
Land Reform composite	416	2.283654	2.47227
Controls			
Log(state Output)	416	12.32932	1.080591
State size	416	162401.9	102284.6
Population density	411	265.8527	175.5333
State output	296	25434.36	15506.14
Literacy rate	372	62.16591	8.002582
% Share (ST/SC) pop.	411	.2146579	.0817068
% Share (Rural/Urban) Pop.	410	.2005501	.0733171
Log (Labor Militancy)	405	12.7444	1.9909
Firm-Level Data			
Dependant Variable : Fixed Capital Share	7.109	62.8222	4406.095
Independent variable			
Ceilings	12,053	1.125529	.7415345
Land Reform composite	56,372	3.568456	3.690951
Controls			
Log (Total. Assets)	45,905	6.238249	1.983545
Age of the firm	56,338	22.00181	17.9924
Population Density	49,419	427.5381	230.1478

Table 2. Mean comparisons of average cultivable landholding in low ceiling states before and after 1971 ceiling law for those below 90th percentile

	States with small ceilings (p90=0)		t-statistics
	Before 1971 State-level data	After 1971	
Average cultivable landholding per household (acres)	0.035	0.028	2.2339**
Average cultivable landholding per person (acres)	$1.35*10^{-9}$	$8.34*10^{-10}$	5.6410***

Note: The table compares average cultivable land holding (per household and per person) before and after the 1971 ceiling law in low ceiling states, i.e., when the ceiling size is below the 90th percentile value.

Table 2B. Mean comparisons of the capital shares before and after 1971 ceiling law.

The table compares means of capital shares (both fixed and total) in low and high ceiling states before and after 1971 ceiling law. *** p<0.01, ** p<0.05, * p<0.1

Before 1971	Large ceilings (top 10th percentile)	Small ceilings (bottom 10th percentile)	Difference- t-statistics
Fixed capital share	2.09	2.14	0.2010
Total capital share	2.09	2.15	0.2045
After 1971			
Fixed capital share	2.17	1.62	2.4314**
Total capital share	2.17	1.63	2.4304**

Table 3: Impact of ceiling size (most fertile land) on state level share fixed capital using state-level data.

The table shows the effects of land ceiling size on fixed capital formation. In this case we consider the ceiling size (in acres) imposed on the most fertile land. Investment is measured as the share of fixed capital to total value added at the state level.

	Share of Fixed Capital						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ceiling size: Most fertile land	0.026*	0.029**	0.027*	0.031**	0.035**	0.039***	0.077***
	(0.014)	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)	(0.017)
Net state domestic product		-0.001	-0.000	-0.000	-0.002	-0.002	-0.006**
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Population Density			-0.000	-0.000	-0.000	-0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share ST/SC pop				-1.793***	-1.419***	-1.299**	-0.538
				(0.454)	(0.541)	(0.540)	(0.572)
Urban pop share					1.356*	1.362	3.033***
					(0.742)	(0.840)	(0.878)
Literacy rate						0.002	-0.000
						(0.008)	(0.008)
Soil fertility							-5.929***
							(1.587)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.573***	1.548***	1.634***	1.993***	1.627***	1.620**	1.236*
	(0.289)	(0.289)	(0.310)	(0.316)	(0.388)	(0.681)	(0.669)
Observations	416	416	411	411	410	372	372
R-squared	0.123	0.123	0.127	0.153	0.162	0.164	0.198

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The table shows the effects of ceiling size on most fertile land on investment in fixed capital (as share of total value added).

Table 4: Impact of ceiling size (most fertile land) on share total capital at the state-level

	Share of total capital						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Most fertile ceilings	0.007	0.013	0.016	0.022	0.022	0.020	0.059***
	(0.016)	(0.016)	(0.017)	(0.015)	(0.015)	(0.015)	(0.016)
Net state domestic product		-0.003	-0.003*	-0.003	-0.003	-0.005*	-0.008***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Population Density			0.000	0.000	0.000	0.000	0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share ST/SC pop				-2.545***	-2.506***	-2.921***	-2.164***
				(0.465)	(0.558)	(0.602)	(0.626)
Urban pop share					0.258	0.601	2.266**
					(0.776)	(0.844)	(0.881)
Literacy rate						-0.010	-0.012
						(0.008)	(0.007)
Soil fertility							-5.910***
							(1.577)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.150***	3.083***	2.996***	3.506***	3.493***	4.627***	4.244***
	(0.329)	(0.332)	(0.348)	(0.349)	(0.446)	(0.710)	(0.717)
Observations	416	416	411	411	410	372	372
R-squared	0.114	0.119	0.125	0.172	0.174	0.203	0.234

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The table shows the effects of ceiling size on most fertile land on investment in total capital (as share of total value added).

Table 5: Impact of average ceiling size on fixed capital share using state-level data.

	Share of fixed capital						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Average Ceilings Size	0.007*	0.007*	0.005	0.010**	0.009*	0.011**	0.014***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Net state domestic product		-0.001	-0.000	-0.000	-0.001	-0.001	-0.003
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Population Density			-0.000	-0.000	-0.000	-0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share ST/SC pop				-2.036***	-1.778***	-1.609***	-1.243**
				(0.469)	(0.604)	(0.606)	(0.616)
Urban pop share					0.803	0.836	1.661*
					(0.823)	(0.924)	(0.916)
Literacy rate						0.004	0.002
						(0.008)	(0.008)
Soil fertility							-3.579***
							(1.371)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.789***	1.787***	1.882***	2.202***	2.081***	1.831***	1.875***
	(0.224)	(0.225)	(0.254)	(0.258)	(0.288)	(0.651)	(0.647)
Observations	416	416	411	411	410	372	372
R-squared	0.122	0.122	0.123	0.154	0.158	0.162	0.178

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The table shows the effects of average land ceilings on fixed capital investment. In this case size of the ceilings (in acres) is an average of ceilings imposed on all kinds of land. Investment is measured as the share of fixed capital to total value added.

Table 6: Impact of average ceiling size on total capital share using state-level data.

	Share of total capital						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Average Ceilings Size	-0.008**	-0.007*	-0.006	0.001	0.000	-0.000	0.003
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Net state domestic product		-0.002	-0.002	-0.002	-0.002	-0.004*	-0.006**
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Population Density			0.000	0.000	0.000	0.000	0.001**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SC/ST pop. share				-2.512***	-2.512***	-2.929***	-2.546***
				(0.482)	(0.604)	(0.642)	(0.647)
Urban pop share					0.102	0.544	1.407
					(0.825)	(0.913)	(0.916)
Literacy rate						-0.011	-0.013*
						(0.008)	(0.008)
Soil fertility							-3.747**
							(1.468)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.478***	3.471***	3.413***	3.808***	3.855***	4.974***	5.020***
	(0.250)	(0.251)	(0.282)	(0.292)	(0.343)	(0.703)	(0.705)
Observations	416	416	411	411	410	372	372
R-squared	0.120	0.123	0.126	0.169	0.170	0.200	0.216

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.The table shows the effects of average land ceilings on total capital share. In this case size of the ceilings (in acres) is an average of ceilings imposed on all kinds of land. Investment is measured as the share of fixed capital to total value added.

Table 7: Long term Effects of ceiling size: Investment estimates using firm level data, 1996 to 2012.

VARIABLES	(1) Fixed capital/ta	(2) Total capital/ta	(3) Fixed capital/ta	(4) Total capital/ta
Most fertile ceilings	-0.00384**	0.0196***		
	(0.00186)	(0.00388)		
Average Ceilings Size			0.00139*	0.00927***
			(0.000842)	(0.00180)
Log(total assets)	-0.0859***	-0.153***	-0.0853***	-0.153***
	(0.00644)	(0.0162)	(0.00646)	(0.0162)
Age	-0.000521	0.0117***	-0.000588	0.0116***
	(0.000470)	(0.00180)	(0.000468)	(0.00181)
Private ownership	-0.0471**	0.222*	-0.0401*	0.194*
	(0.0227)	(0.121)	(0.0228)	(0.117)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Constant	2.139***	2.695***	2.041***	2.728***
	(0.114)	(0.246)	(0.114)	(0.247)
Observations	4,835	1,116	4,835	1,116
R-squared	0.481	0.675	0.481	0.674

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Investment is measured by the share of fixed and total capital to total assets respectively.

Table 8: Robustness 1: Fixed and total capital shares estimates using state-level data, after controlling for labour militancy.

VARIABLES	(1) Fixed capital	(2) Total Capital	(3) Fixed capital	(4) Total Capital
Most Fertile Ceilings	0.066***	0.060***		
	(0.019)	(0.018)		
Average ceilings			0.009*	0.001
			(0.005)	(0.005)
Net state domestic product	-0.006**	-0.008***	-0.004	-0.007***
	(0.003)	(0.002)	(0.003)	(0.002)
Population density	-0.000	0.001*	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Share ST/SC Pop	-1.270*	-2.144***	-1.952***	-2.768***
	(0.746)	(0.807)	(0.710)	(0.767)
Urban pop share	2.155*	2.186*	0.892	1.042
	(1.163)	(1.220)	(1.077)	(1.140)
Literacy rate	-0.006	-0.012	-0.006	-0.016*
	(0.009)	(0.009)	(0.008)	(0.009)
Soil fertility	-5.326***	-5.850***	-3.158**	-3.496**
	(1.678)	(1.690)	(1.419)	(1.534)
Log (man days lost)	0.063	0.012	0.076*	0.039
	(0.044)	(0.048)	(0.041)	(0.045)
	(0.663)	(0.667)	(0.676)	(0.675)
Year FE	Yes	Yes	Yes	Yes
Constant	1.546**	4.134***	2.199***	5.011***
	(0.682)	(0.740)	(0.654)	(0.727)
Observations	368	368	368	368
R-squared	0.206	0.229	0.189	0.211

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Investment is measured respectively by the share of fixed capital to value added and total capital to value added. Labour militancy is measured by the number of man-days lost because of strike actions taken by the labour unions per year. Columns (1) and (2) show the estimates using ceiling size for most fertile land while columns (3) and (4) show those using average ceilings in the sample states.

Table 9: Robustness 2: Fixed and total capital share estimates using firm-level data, after controlling for the city dummies

VARIABLES	(1) Fixed capital share	(2) Total capital share	(3) Fixed capital share	(4) Total capital share
Most fertile land ceiling	0.00422**	0.0201***		
	(0.00189)	(0.00397)		
Average Ceilings Size			0.00114	0.00967***
			(0.000866)	(0.00186)
Log(total assets)	-0.0862***	-0.157***	-0.0854***	-0.157***
	(0.00645)	(0.0161)	(0.00646)	(0.0161)
Age	-0.000143	0.0134***	-0.000305	0.0133***
	(0.000504)	(0.00185)	(0.000501)	(0.00185)
Private ownership	-0.0469**	0.324**	-0.0400*	0.300**
	(0.0227)	(0.127)	(0.0228)	(0.123)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Constant	2.190***	2.628***	2.084***	2.656***
	(0.115)	(0.247)	(0.115)	(0.247)
Observations	4,835	1,116	4,835	1,116
R-squared	0.481	0.679	0.481	0.678

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness 3: Fixed and total capital shares estimates using firm-level data, after dropping West Bengal and Kerala (two most land reform intensive states)

Panel A: State-level data				
VARIABLES	(1) Share fixed capital	(2) Share total capital	(3) Share fixed capital	(4) Share total capital
Most Fertile Ceiling size	0.102***	0.073***		
	(0.018)	(0.017)		
Average ceilings			0.0230***	0.00529*
			(0.00617)	(0.00634)
Net state domestic product	-0.000***	-0.000***	-0.00404	-0.00705***
	(0.000)	(0.000)	(0.00257)	(0.00251)
Population Density	0.000	0.001**	1.96e-05	0.000880**
	(0.000)	(0.000)	(0.000457)	(0.000380)
Share SC/ST	-1.560**	-2.605***	-2.652***	-2.910***
	(0.633)	(0.725)	(0.762)	(0.834)
Urban pop share	1.440	1.598*	-0.605	0.751
	(0.883)	(0.937)	(1.017)	(1.120)
Literacy rate	0.018**	-0.002	0.0230***	-0.00141
	(0.008)	(0.009)	(0.00713)	(0.00873)
Soil fertility	-6.153***	-6.431***	-3.200**	-4.017***
	(1.574)	(1.612)	(1.375)	(1.504)
Year FE	Yes	Yes	Yes	Yes
Constant	-0.117	2.771***	0.930*	3.788***
	(0.592)	(0.677)	(0.494)	(0.624)
Observations	322	322	322	322
R-squared	0.242	0.260	0.219	0.234

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Panel B: Firm-level data				
VARIABLES	(1) Fixed capital share	(2) Total capital share	(3) Fixed capital share	(4) Total capital share
Most fertile land ceiling	-0.00668***	0.0129***		
	(0.00189)	(0.00458)		
Average Ceilings Size			-0.000105	0.00730***
			(0.000938)	(0.00235)
Log(total assets)	-0.0996***	-0.154***	-0.0982***	-0.156***
	(0.00701)	(0.0175)	(0.00703)	(0.0175)
Age	0.000165	0.0158***	-0.000150	0.0159***
	(0.000534)	(0.00236)	(0.000532)	(0.00233)
Private ownership	-0.0968***	0.20	-0.0860***	0.217
	(0.0253)	(0.137)	(0.0257)	(0.136)
Industry FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Constant	2.177***	-0.0657	2.076***	1.541***
	(0.119)	(0.347)	(0.119)	(0.421)
Observations	4,274	997	4,274	997
R-squared	0.487	0.677	0.485	0.678

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Heterogeneous effects of ceiling size on higher land-intensive firms: Investment in fixed and total capital share estimates using firm level data

VARIABLES	(1) Fixed capital	(2) Total capital	(3) Fixed capital	(4) Total capital
Most fertile ceiling size	-0.0214***	0.00105		
	(0.00635)	(0.0187)		
High land intensity	-0.308***	-0.560	-0.208**	-0.260
	(0.0982)	(0.355)	(0.0821)	(0.221)
High land intensity*Most fertile ceiling	0.0182***	0.0199		
	(0.00660)	(0.0206)		
Average ceilings			-0.00393*	0.00802*
			(0.00234)	(0.00423)
High land intensity*Average ceiling			0.00556**	0.00141
			(0.00242)	(0.00499)
Firm size	-0.0863***	-0.157***	-0.0857***	-0.156***
	(0.00645)	(0.0163)	(0.00648)	(0.0163)
Firm age	-0.000480	0.0111***	-0.000534	0.0113***
	(0.000472)	(0.00210)	(0.000470)	(0.00204)
Private ownership	-0.0473**	0.228*	-0.0414*	0.198*
	(0.0227)	(0.122)	(0.0228)	(0.118)
Industry FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Constant	2.462***	3.058***	2.221***	3.017***
	(0.160)	(0.428)	(0.139)	(0.371)
Observations	4,835	1,116	4,835	1,116
R-squared	0.105	0.259	0.110	0.271

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Investment is measured as the share of fixed assets to total assets in columns (1) and (3) and share total capital to total assets in columns (2) and 4. A firm has high land intensity if its land to assets ratio is greater than the corresponding industry-level median land to assets ratio. The coefficient of particular interest is the interaction between the ceiling size variable and the high land intensity variable that helps us to capture the effect of land ceiling size on heterogeneous firms with high/low land intensity

Figure 1. Location of sample firms across Indian states

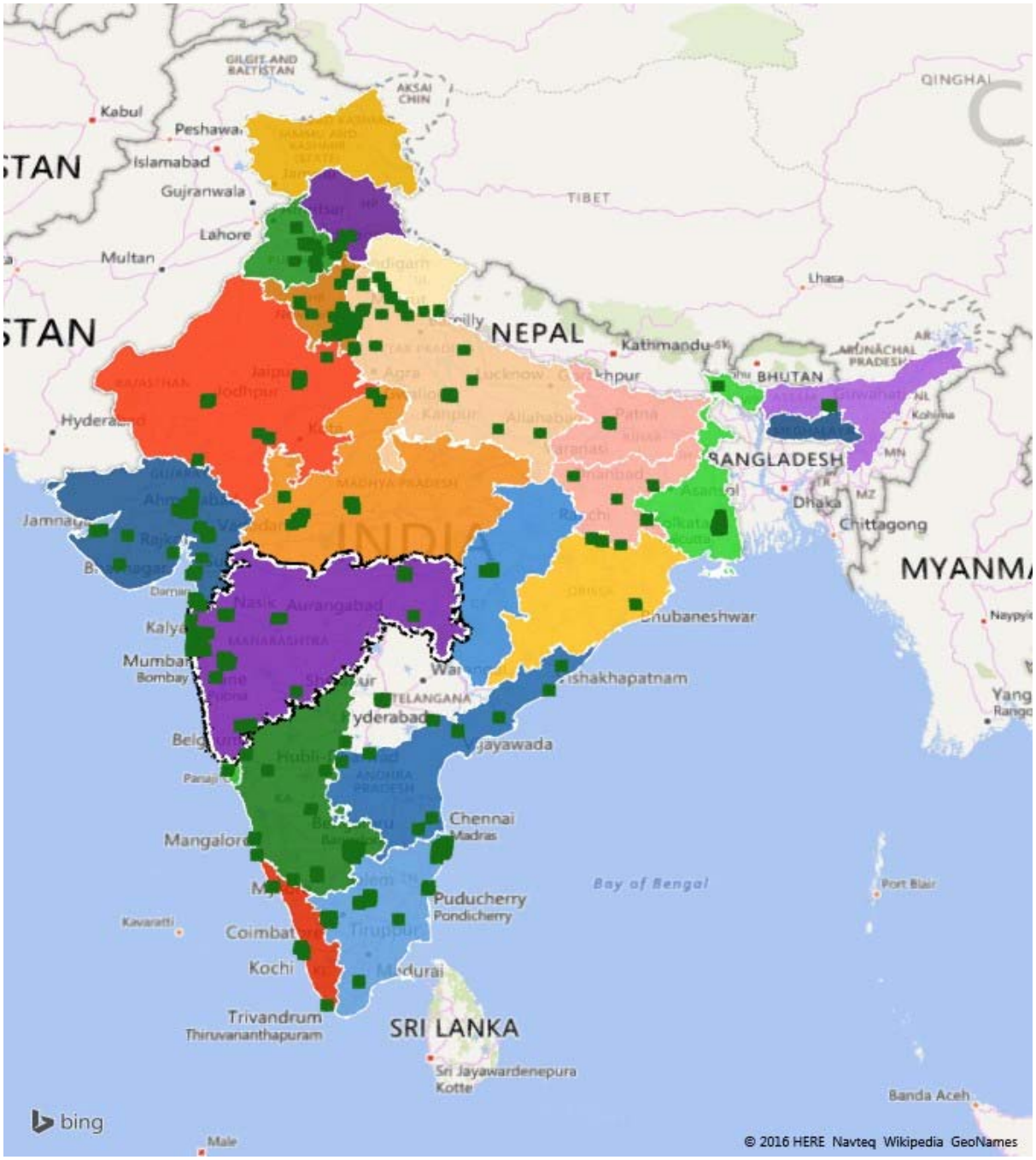
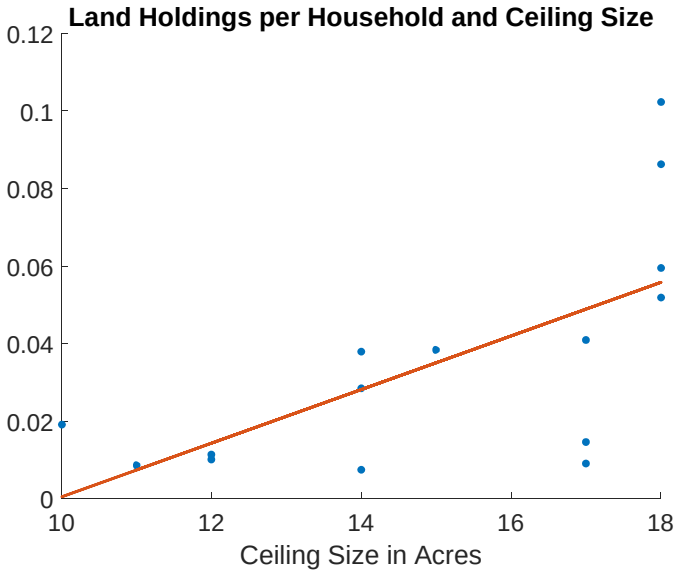


Figure 2. This figure shows the time series average of cultivable land holdings per household for different levels of the ceiling size for most fertile land. The red line represents the fitted values of the regression of land holdings on the ceiling size for most fertile land.



Appendix Table A1. Size of ceilings (in Acres) as levied by different Indian states based on the quality/fertility of the land.

Table 17.1 Ceilings on Landholdings

(In Acres)

State	Irrigated Land with Two Crops	Irrigated Land with One Crop	Dry Land
(1)	(2)	(3)	(4)
As recommended in 1972 National Guidelines	10-18	27	54
Proposed in Agenda Notes 1985 of Regional Minister's Conference	12	18	30
Andhra Pradesh	10 to 18	15 to 27	35 to 54
Assam	17	17	17
Bihar	15 to 18	25	30 to 45
Gujarat	10 to 18	15 to 27	20 to 54
Haryana	18	27	54
Himachal Pradesh	10	15	30 to 70
Jammu & Kashmir	9 to 12.5	9 to 12.5	15 to 23 (in Ladakh 19)
Karnataka	10 to 20	25 to 30	54
Kerala*	12 to 15	12 to 15	12 to 15
Madhya Pradesh	18	27	54
Maharashtra	18	27	54
Manipur	12	12	15
Mizoram	nil	nil	nil
Odisha	10	15	30 to 45
Punjab	17	27	51
Rajasthan	18	27	54 to 175
Tamil Nadu	12	30	60
Sikkim	12.5	12.5	50
Tripura	10	10	30
Uttarakhand	18	27	45
Uttar Pradesh	18	27	45
West Bengal	12	12	17
Andaman & Nicobar Islands	nil	nil	nil

Source: Department of Land Resources, New Delhi.

Note: 1. The actual limits for lands in Karnataka and Uttar Pradesh are higher due to classification of land.

2. The actual ceiling limits in Himachal Pradesh and Rajasthan are higher due to hilly terrain and desert lands.

3. 1 Acre = 0.404686 Hectare.