AGRICULTURAL MARKET IMPERFECTIONS AND FARM PROFITABILITY IN INDIA

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2021

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September 2021

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Abstract

The gap between the incomes of agricultural workers vis-a-vis non-agricultural workers in India has widened since the 1990s and improving farmers' income has emerged as the key policy focus in recent times. In realizing this objective, functioning of the markets is very critical as market imperfections can increase the production and transaction costs of farmers and can have a crucial bearing on farm income. The present study, based on primary data, attempts to explore imperfections (if any) in important markets viz. output, input, factor and credit markets. The study also takes into account the asset base, skill endowments, coping mechanisms of farmers in the face of economic hardships and their social capital. Some of the important government programs have also been analyzed. The study was conducted in four states – Bihar, Gujarat, Madhya Pradesh and Punjab. Based on multi-stage sampling methodology, 1800 households spread over 45 villages and 21 districts were surveyed across four states. Tabular analysis has been complemented by an econometric analysis using data at the household level. The results show a strong inverse relation between land productivity and farm size and this was almost entirely driven by an intensive use of family labour on smaller farms. There was little evidence of differences in intensity of use of any other factor or input. This underlines the prevalence of imperfections mainly in the land and labour markets. The per capita income increased with the farm size though, underlining the positive impact on income of better access to technology and credit of larger farmers.

Agricultural market imperfections and farm profitability in India[1]

C.S.C.Sekhar and Namrata Thapa

1   Introduction

Policy concerns in Indian agriculture have been changing every decade or so in the last fifty years. During the mid-1960s, self-sufficiency in food production was the overarching policy concern, which was instrumental in promoting green revolution. Due to the regional inequalities that emerged in the wake of green revolution, balanced agricultural growth became the policy focus in the 1980s. The fiscal burden and resource degradation due to increasing subsidies; severe stagnation in growth of agriculture and food production for nearly a decade starting from the mid-1990s, led to the launch of focused initiatives such as RKVY (RashtriyaKrishiVikasYojana) and NFSM (National Food Security Mission) in 2007. NFSA (National Food Security Act) was enacted in 2012 to provide economic access to food. All these measures helped in improving growth rate of agriculture and increasing food production. However, viability of farming continued to be a major concern. The gap between the annual income of an agricultural and non-agricultural worker increased from Rs 25,398 in 1993–94 to Rs 54,377 by 1999–2000. In the next ten years, this gap increased further to Rs 1.42 lakh (Niti Ayog 2020). Since 68% of the total number of operational holdings in the country were marginal (less than one hectare) as per the *Agricultural Census 2015-16*, and 18% were small landholdings (1-2 hectares), the erosion in relative position was probably more pronounced for small and marginal farmers.

Nearly 58% of the rural households in India (about 90.2 million) are agricultural households[2] (*Key Indicators of Situation of Agricultural Households in India*, NSSO, 2014, hereafter referred to as NSSO 2014). Agricultural activity (which includes cultivation, livestock and other agricultural activities) formed the principal source of income for a majority of the agricultural households in all the states, except the state of Kerala. For an average agricultural household in 2012-13, nearly 60% accrued from cultivation & livestock while nearly 32 percent came from wage/ salary employment, out of a total annual income of Rs 6426/. However, it is notable that at the lowest rung, owning less than 0.01 hectares, wage/salary employment is the principal source of income for 56% and livestock for another 23% of the farm households (NSSO, 2014). Thus wage labour and livestock, in addition to cultivation, are crucial for maintaining the sustenance of the households and to improve the economic condition of farmers, addressing the problems related to cultivation, livestock and wage employment is imperative. The present study is an attempt at identifying the market imperfections in these sub-sectors of the agricultural economy.

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[2]Earning more than Rs. 3,500/- from agriculture and having at least one member employed in agricultural activity during the last 365 days.

The current policy priority of the Indian government is focused on ensuring a minimum level of income to farmers. The present government, while assuming office in 2014, had announced doubling farmers' income as one of its major objectives. The major pathways to increase farmers' income are increasing productivity, reducing cost of production and ensuring higher output prices. However, the precondition is that the output, factor and input markets are free from any major imperfection. Also, since marginal and small farmers supplement their income through wage labour, labour market imperfections are not binding either.

In the output markets, prices received by farmers vary by the region, season and the marketing channel and have a crucial bearing on a farmer's income. Also, the support received from the government through support prices, procurement, input provision, subsidies and credit can go a long way in mitigating the economic hardship of the farmers. In the input markets, an estimated 24% is spent on fertilizer and manure; 21% on human labour and nearly 11% on seeds. In the livestock sector, 77% of the expenditure is incurred on animal feed. Hence, a careful analysis of these input markets and reduction of costs in these markets is important to improving the viability of crop production and livestock rearing.

Credit is a very vital component of the rural economy. Nearly half of the estimated 90.2 million agricultural households are reported to have been indebted and about a quarter of these households have reported to have borrowed from moneylenders. What is the access to credit sources of different farmer categories – small, marginal etc? What are the bottlenecks in the credit market? These are important issues that need careful examination.

Thus, recognising the existence of rural market imperfections in the product and factor markets, the study attempts to understand the functioning of output, input and factor markets and their possible effect on farm profitability. The extent of government support structures available to the farm households are also analysed. Furthermore, it is important to understand strategies adopted by farm households to cope with constraints associated with market imperfections and maintain steady consumption overtime and maximise their profits. The coping strategies undertaken by the farm households in the face of economic risks are also analyzed.

The remainder of the paper is organised as follows: section 2 provides the review of literature. Section 3 discusses the data sources and methods employed. Section 4 presents the empirical analysis which is broadly categorised as sample characteristics, results based on tabular analysis and econometric analysis. Section 5 concludes and draws a few important policy implications.

2 Review of literature

Markets perform multiple roles. These include distribution of inputs and outputs spatially and temporally, transformation of raw commodities into value-added products and transmission

of information and managing of risk (Barret and Mutambatsere 2008). According to the first welfare theorem of neo-classical economics, competitive market equilibria ensure an efficient allocation of resources and hence maximise aggregate welfare. However, in reality agricultural markets in developing countries function far less effectively than what the abstract textbook models assume (Barret and Mutambatsere 2008; Harris-White 1999). The inefficiencies are the result of incomplete or unclear property rights, imperfect contract monitoring and enforcement, high transaction costs and binding liquidity constraints which were not accounted for by the neo-classical theory. Market imperfections defined in terms of deviation from perfect market conditions are a common phenomenon in rural markets of developing countries (De Janvry, Fafchamps and Sadoulet 1991; Holden, Shiferaw and Pender 2001).

Recognising the limitations of the neoclassical economic theory, New Institutional Economics (NIE) has incorporated the ideas of incomplete markets, uncertainty and transaction costs. NIE conceptualised market institutions as a means of minimising costs associated with issues of organising information, transactions and property rights under uncertainty (Bardhan 1989; Williamson 1993 as cited in Ali Jan and Harriss-White 2012).It is important to recognise that agricultural markets in the real world are diverse and complex. Besides acting as price channels, markets are also conduits for inter-sectoral transfer of resources through the distribution of savings and reinvestment of profits and also arenas of exploitation of labour and petty producers (Ali Jan and Harriss-White 2012).

It is well understood that the major goal for agriculture is to improve economic, environmental and social sustainability. Particularly for farm households, economic sustainability is the main concern since like any other activity, the ability to continue in agriculture too depends on the capacity to remain financially viable over time. Farm profitability has critical implications for farm survival, food security and farmers' welfare (Tey and Brindal 2015). In the context of increasing cost of cultivation and inadequate output price realisation, among others, improving the functioning of factors as well as product market in rural areas is a key concern for the welfare of farm households. Presence of market imperfections pose constraints on the production and consumption decisions of farm households. In case of imperfections in factor markets, the factor price ratios implicitly faced by the farm households will differ (Brandt 1987). This implies that under the assumption of profit maximisation, optimal factor combinations will differ among farm households along with the output-input ratios (ibid). For instance, if factor markets in rural areas operate effectively, households with small landholdings and unable to absorb the supply of family labour should be able to hire out some of their labour or rent additional land to overcome the constraint (Brandt 1987). However, when land and labour markets function imperfectly, these same households must use their land more intensively by applying more labour and other inputs per unit of land (ibid). Market imperfections are also more likely to adversely affect small and poor farmers than large and rich farmers (Holden and Binswanger 1998). For instance, poor farmers are more probable to be rationed out of credit markets and thus will have less ability to solve their problem through consumption smoothing (coping strategies).

Further, poverty is transmitted across generations through imperfect markets (Singh and Binswanger 1988).

To address the inefficiencies created by rural market imperfections, government interventions - in the form of support prices, procurement, input provision, subsidies–also assumes importance. Along with it since market imperfections and constraints are so pervasive for the farm households; they devise strategies to reduce the welfare costs of these market failures with meagre resources at their disposal (De Janvry and Sadoulet2006). Thus, it is important to identify the coping strategies undertaken by the farm households in such an adverse context.

Keeping these issues in view, the existing studies on rural market imperfections is reviewed in the following section.

2.1 Rural market imperfections

Rural market imperfections can be viewed in terms of factors such as land, labour and credit; and output markets. Drawing from existing studies, imperfections related to each of the factors, causes for the existence of these imperfections and constraints posed by them on farm households are discussed in brief.

a)   *Labour market imperfections*

To carry out farming activity, while small farms mainly rely on family labour, large farms have to depend on hired labour either on a permanent or a seasonal basis. Family labour being the residual claimant as well as bearer of residual risks is considered to be well-motivated. Hired labour, on the other hand, is considered to require continuous supervision as they do not put in much effort and judgement as family labour (Heltberg 1998). Unlike in case of family labour, supervisory costs are incurred while using hired labour. Along with supervisory costs, there are search and hiring costs incurred for outside workers. Labour market imperfections arise due to moral hazard problems related to hired workers. Further, labour markets may not exist for some or all types of labourersor may exist only in certain seasons (Heltberg 1998).

b)   *Land market imperfections*

Land market imperfections are associated with the assumption of sticky operational holding due to imperfect land rental markets and inflexible owned holding due to sales market imperfections. The imperfections in land rental markets arise due to the uncertainty created by ambiguous and inexpedient land reform legislation, by Marshallian inefficiency and by transaction costs (Skoufias 1995 as cited in Heltberg 1998).

There exist certain land reform legislations (for instance 'land to the tiller' legislation) which can make long-term lease contracts in land a risky venture for the landowner. Since the land owners fear that if laws are enforced, the land could be allotted to the tenants. Thus, renting

out land is associated with cost related to the probability of property loss. Such real or perceived risk from land reform can impede the smooth functioning of the land rental markets.

Further, Marshallian inefficiency would also cause lower input use and lower profit on plots that involve share tenancy (Cheung 1969; Stiglitz 1974 as cited in Holden, Shiferaw and Pender 2001). Share tenancy, one form of land rental agreement, involves paying of rent as a fixed proportion of the harvest. Under such an arrangement, tenants lack the incentive to invest as compared to an owner-cultivator because the tenant's marginal returns to effort and input are much less than the relevant marginal products (Unal 2012). Thus, fixed rent tenancy and owner cultivation were viewed to be more efficient than sharecropping.

There are studies which had analysed the relative efficiency of different tenurial contracts. Johnson (1950) posited that sharecropping is efficient as it served a functional role of disciplining the tenants. Knight (1957)'s agricultural ladder hypothesis stated that tenancies have a hierarchy based on productivity – the landowners are at the top followed by fixed-rent tenants, sharecroppers and finally the landless labourers are in the bottom rung. According to Cheung (1969), transaction costs differ among tenancies with sharecropping having relatively higher transaction cost (both bargaining and enforcement costs) compared to fixed rent tenancy (bargaining cost) and wage contracts (enforcement costs). However, different levels of risks are related to different forms of tenancy. For instance, in fixed rent tenancy, all the risks are borne by the tenants; in wage contracts, all the risks are borne by the landlord; and risks are equally shared in share tenancy. Despite differing transaction costs, due to the benefits in risks sharing, all forms of tenancy are efficient. Stiglitz (1974) pointed out that where enforcement cost is high, fixed-rent tenancy is preferred and when the tenant is risk averse, sharecropping is preferred. With an improvement in credit or insurance markets, farmers can manage risks by diversifying their portfolios. Thus share cropping can be expected to disappear. Other explanations for the existence of varied forms of tenancies are related to uncertainty and factor market imperfections in rural areas (Rao 1971; Bardhan 1977). It is argued that in the real world, markets are imperfect, many inputs are indivisible, managerial skills vary across individuals and uncertainty prevails – all these factors either separately or through their interaction may result in the existence of various forms of tenancies (Nabi 1985).

Land sales markets are also subject to several imperfections. Land sales markets may be thin or non-existent or distorted for various reasons. For instance, selling of land to outsiders may be restricted in some parts of the world. Crop failure is also a major reason. Although crop failure is a covariate risk (all the households in a geographic region face a similar risk), the richer farmers owning larger landholdings, are able to cope relatively better due to their better access to credit markets and asset position. At the same time, absence of insurance markets and poor access to credit markets necessitate exploring other means of consumption smoothing by the poor households, which leads to distress sales of land, often to the richer farmers of the region. This further distorts the already skewed land distribution in favour of large farmers. Even in times of better harvest, land prices are often much higher than the expected average returns from farming because of the insurance, inflation-hedge, savings,

prestige and collateral value functions of land. This implies that even if credit for land purchases was available, non-farm income would still be needed to service the debt (Binswanger and Deininger, 1997). Thus, because of all these factors, the actual distribution of land is likely to deviate substantially from the optimal distribution that would maximize output or efficiency.

The land rental markets are usually more active than that of land sales market. Imperfections and interventions in land rental and sales markets restrict the farmers from efficiently matching owned and operated farm size to their endowment of family labour and other fixed assets (Heltberg 1998). Access to land is crucial for the well-being of the socially vulnerable groups in terms of sustaining their livelihood as well as cultural and social identity. Hence, a proper functioning of land market (both rental and sales) is important to achieve efficiency and equity and thus, improve the livelihoods of the rural population.

c)   Credit market imperfections

Since risk and asymmetric information is inherent in agriculture, the amount of credit supplied to the farm sector is rationed by the formal financial institutions (Heltberg 1998). For the purpose of getting loans, farmers need to submit collateral in the form of land or other fixed assets to the financial institutions. Thus the farm households face liquidity or credit constraint. The lack of access to credit can limit the ability of farmers to rent or purchase the required inputs such as land, labour, fertilisers and so on.

Several theoretical and empirical studieshave established that the credit markets in developing countries work inefficiently due to a number of market imperfections. There are issues of moral hazard, adverse selection and asymmetric information. To avoid the problem of moral hazard, collateral can be used. However, either due to lack of assets or assets that are hard to collaterize, the lenders will deem the farmers to be less creditworthy (Holden and Binswanger 1998).

d)   Product market imperfections

It can be understood that market imperfections include missing markets (an extreme case of market imperfection), partly missing markets (rationing, seasonality), thin markets (imperfect competition) and interlinked markets (Holden and Binswanger 1998; Holden, Shiferaw and Pender 2001). The causes of pervasive market imperfections are covariate risk, asymmetric information, moral hazard and transaction costs.

To overcome the problem of non-existence of a complete set of markets different transactions are undertaken by the same participants in an interlocking system of exchange. As such rural transactions are characterised by interlinkage. The widely observed phenomenon in Indian agricultural markets is that of interlocked factor markets – it is a situation where two markets are locked together in an inter-temporal contract by binding two distinct transactions in one contract (Ali Jan and Harriss-White 2012). The private insurance markets are poorly

equipped to address these issues in countries like India, mainly because of the insurer's vulnerability & ruin (Cramer-Lundeberg, 1903, 1930) associated with the large systemic & covariate risk inherent in agriculture and the large transaction costs associated with dealing with millions of small farmers.

Market failures eventually give rise to alternative institutional arrangements for what markets cannotprovide (Binswanger and Mcintire 1987 as cited in De Janvry et al. 1991). These arrangements could be in the form of extended family system, labour exchange, and share contracts and so on. However, due to lack of clear property rights and imperfect information these arrangements are said to suffer from high efficiency costs. Thus to achieve greater efficiency and welfare, De Janvry et al. (1991) emphasise the need for carefully balancing the relative merits of improved market performance and of improved institutions' performance.

Datta-Chaudhuri (1990) too points out that market failures create serious obstacles to the process of growth in backward economies. The study argues that the focus of the development economists in the 1940s and 1950s was on a limited class of market failures related to investment decisions. Hence, this translated into development policies by the government giving strong emphasis to investment planning. It was believed that once physical capital was put in place, the subsequent problems of production and productivity will be automatically resolved. However, subsequent development experiences and research showed that market failures were associated with the operation of installed capacities, where learning process is of crucial importance. The state can play an important role in building the learning capacity of the economy, by recognising the following two points. One is that though the markets operate inadequately in certain conditions, they do play an important role in disciplining producers against wasteful use of resources. The other is that in a changing environment, the required institutional changes do not always happen automatically. In this regard, the state can promote and support the right kind of market institutions. In instances where market signals are not effective, appropriate non-market institutions needs to be created. For developing societies, it is important to develop a mutually supportive structure of market and non-market institutions. The state can correct market failures through a mix of market-excluding and market-complementing interventions, in case of commissions and omissions respectively (Dreze and Sen 1995, Sekhar 2005)[3].

Thus there exists a vast literature that has established the presence of imperfections in factor and output markets in rural areas of developing countries and the causes for their existence particularly in terms of high transaction costs and imperfect information. The role of the state has also been rightly emphasised in overcoming market failures. However, most of the studies have dealt with factor market imperfections and product market imperfections disparately. Moreover, the studies focusing on factor markets have emphasised particularly on individual factor markets such as credit, labour or land separately as per the context of

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[3]Market failure can result from either a commission or omission by the market.The error of commission involves doing something detrimental to society's interests whileanerror of omission involves omitting to do something that is beneficial to society.

their study. Thus, in our study, along with inputs such as land, labour, capital, we would also consider market for indivisible assets such as draft animals/livestock that exist in terms of farm households buying and selling the animals as well as taking it on rent, which was not considered by the existing studies.

2.2 Farm household behaviour in the context of rural market imperfections

It is important to understand farm household behaviour in the context of market imperfections. Farm household behaviour can be decomposed into production and consumption decisions (De Janvry, Fafchamps and Sadoulet 1991). The household as a producer chooses the level of inputs and output that maximises their profit. The household as a consumer chooses the levels of consumption (food, leisure and manufactured goods) that maximises their utility. De Janvry, Fafchamps and Sadoulet (1991) argue that market failure, a subcategory of market imperfection, is a feature of the household and not commodity specific. Market fails when transaction cost incurred through market exchange creates disutility greater than the utility gain that it produces. This results in market not being used for transactions. For transaction to occur either an alternative institutional arrangement will emerge as a complete or a partial substitute for what market do not provide or the transaction does not happen at all. Non-existence of market is an extreme case of market failure. Generally, the market exists but the gains for a particular household may be below or above the cost. Thus, some households will use the market while some will not. 'In general, markets exist, but they selectively fail for particular households, making the corresponding commodity non-tradable for the household' (De Janvry, Fafchamps and Sadoulet1991: 1401).

Rural economies are characterised by complex behavioural interactions (Singh, Squire and Strauss 1986). Most of the agricultural households produce partly for sale and partly for self-consumption. They also purchase some of their inputs such as labour and fertiliser while some inputs such as family labour are supplied by themselves. Singh, Squire and Strauss (1986) argue for the use of agricultural household models to capture these complex interactions theoretically and empirically rather than traditional approach in which production and consumption decisions are examined separately.

Studies have shown that market imperfections cause the production and consumption decisions of farm households to be non-separable (Holden and Binswanger 1998; De Janvry 2006). Non-separability implies that consumption needs and asset distribution may have significant effect on production decisions. For instance, at the beginning of the production period, farm households are faced with the decision of allocating their resources between current period consumption and purchase of inputs for production and investment. The households who are unconstrained in the capital market can separate their consumption decisions from farm decisions - they can choose production inputs optimally for the production process they face.

In such a situation, the levels of inputs in production and investment will not be affected by the level of credit they receive. However, in case of credit constrained household, they have to choose between the investments they make and inputs they buy depending on the level of credit they receive. This will have an adverse effect on production for the constrained households (Foltz 2004).

Based on the insights from aforementioned studies, the behaviour of farm households under market imperfections can be characterised in terms of their production and consumption decisions being non-separable -- households' decisions regarding production (use of inputs, choice of activities, desired production levels) are affected by its consumer characteristics (consumption preferences, demographic composition and so on) (De Janvry and Sadoulet 2006).

2.3 Implications of rural market imperfections for agricultural productivity

Market imperfections have a significant effect on the production and consumption decisions of the farm households. Studies have mainly examined the implications of rural market imperfections on relationship between farm-size and productivity (Heltberg 1998, Holden,Shiferaw and Pender 2001), profitability (Foltz 2004; Foster and Rosenzweig 2010), efficiency (Udry 1996) and sustainability (Holden and Binswanger 1998).

Chayanov (1926) first documented that small farms produced more output per unit of land in Russia, in India by Sen (1962), Bardhan (1973), and Rosenzweig and Binswanger (1993); and in Brazil, Pakistan, and Malaysia by Berry and Cline (1979). Holden and Binswanger (1998) provides an extensive survey of research findings on decision making by small farmers, in the context of market imperfections particularly related to intertemporal markets such as credit and insurance; and risks faced by them. They examine the implications for efficiency and sustainability of natural resource management. They point out that market imperfections are more likely to adversely affect small and poor farmers than large and rich farmers. They further argue that new policies to stimulate sustainable rural development are required. Such policies can be made effective by building it on an understanding of the decision making environment and behavioural responses of small farmers.

A study by Foster and Rosenzweig (2010) on barriers to farm profitability in India tries to explore the relationship among scale (size of land ownership holdings), credit market, labour use and profitability. Using panel data, their analysis shows that farms with larger owned landholdings are more mechanised, use less labour per acre and have higher profitability per acre and also face lower credit cost.

Heltberg (1998) uses the framework of land, labour, credit and risk market imperfections to explain the size-output and size-profit relationship of farm households in Pakistan. The study has used three different output variables: farm value-added (crop and livestock output less all cash inputs), return to owned land (farm value-added plus rental payment received for land

rented out) and crops profits (the value of crop production less cash inputs and family labour). Their study shows the presence of an inverse size-output relationship.

The study by Udry (1996) on efficiency and market structure in the context of African countries found evidence of imperfections in land and labour markets in Kenya and of imperfections in capital and insurance markets in Burkina Faso. As illustrations, the study focuses on labour and land market imperfections and its effect on efficiency.

Foltz (2004) explores the effect of access to capital on agricultural profits and investment with respect to Tunisian agriculture. The study uses net revenue (pseudo-profit) function in order to account for possible imperfections in capital, land and labour markets. Credit market constraints did have a negative effect on farm profitability. It was found that better access to credit market will improve the profitability of larger number of farmers, though not necessarily the poorest. An improvement in access to credit would have a significant effect on the land market as well in terms of increased demand for buying or renting of land.

Holden, Shiferaw and Pender (2001) analyses how market imperfections affect land productivity in a degraded low-potential cereal-livestock economy in the Ethiopian highlands. They use three different selection models and two least squares models with HCCME (HC3) correction of standard errors to test whether there are significant market imperfections affecting land productivity at the farm plot level. Empirically, they test whether land productivity at the plot level is a function of owned farm size, household (male and female) labour force per unit of land and owned oxen per unit of land. If any of the variables are significant, it indicates the presence of factor market imperfections and significant transaction costs. However, if the factor endowments are insignificant, it would indicate that the factor markets function reasonably well or the factors are in abundant supply for all. Their analysis shows that there are significant market imperfections in labour and land markets and these imperfections affect plot level land profitability. They found that land productivity increased with household labour force but they did not find a significant inverse farm size-land productivity relationship.

Due to the effect of market imperfections on production and consumption decisions, on the one hand, it would affect the profitability of the farm households in terms of the factor mix that they use and on the other hand, it would affect the ability to undertake consumption smoothing (coping strategies) by the households.

2.4 Literature in the Indian context

There is a vast amount of literature on rural market imperfections in India. The patterns observed in other parts of the world were witnessed in India as well. The inverse relationship between land size and land productivity on one hand and the direct relationship between land size and labour productivity on the other are now well-established in literature and have

become the *stylized facts (see* (Khusro 1964, Sen 1962 and 1966, Rudra 1968, Bhagawati-Chakravarthy 1969, Srinivasan 1972, Bardhan 1973, Heltberg 1998).

The result that small farms produced more output per unit of land was first noted in India by Sen (1962), Bardhan (1973), and Rosenzweig and Binswanger (1993); and in Brazil, Pakistan, and Malaysia by Berry and Cline (1979). This inverse relationship (IR) was puzzling as there was considerable evidence at the time in favour of constant returns to scale for agricultural production in different countries (e.g., Hayami and Ruttan 1970; Bardhan 1973; Berry and Cline 1979; Fulginiti and Perrin 1993). Also, if IR existed and markets functioned perfectly then farmers would subdivide their lands and increase productivity, thereby eventually eliminating IR. Thus understanding this phenomenon has important policy implications for addressing market imperfections (Assuncao and Braido 2007). The first strand of literature focussed mainly on this aspect. Initially the emphasis was on single market failures. Chayanov (1926), Sen (1962), Carter (1984), and Carter and Wiebe (1990) found that peasant households applied family labour more intensively because the opportunity cost of their time is low. Sen (1962) proposed 'labour dualism' based on a Malthusian explanation to understand this. The missing labour markets for women and children, non-clearing labour markets due to low wage rates (below the reservation wage) and lower skill endowments of rural labour (that prevent them from moving to urban occupations) are some of the factors considered responsible for this intensive application of family labour on small farms. This, *ceteris paribus,* leads to *higher land productivity*, because of the better quality and commitment of family labour (in comparison to hired labour). However, given that there are limits to increasing land productivity beyond a certain threshold and due to better access to credit of large farmers which results in higher farm investment and mechanization, the *output/income per capita* is expected to be higher on large farms. *Thus, the output per unit land is inversely proportional and output per capita is directly proportional to the land size.*

Now the natural question that arises is the following. Why can't the small farmers augment their landholdings through land leasing or purchase, so that they can realize higher per capita income? This led to hypothesis of multiple market failures in the factor and product markets as the reason for IR and the resulting inter-linkages among these markets (Braverman and Stiglitz 1982, Basu 1983, Feder 1985). Feder (1985) noted that a single market failure is insufficient to generate the inverse relationship. Under constant returns to scale, there need to be multiple market failures simultaneously to prevent land subdivision and distort the shadow price of labour and some other factors. If imperfections in the labour market cause the peasant's shadow price of time to differ from the market wages, and if failures in the land or/and rental markets prevent them from augmenting their landholdings, then an inverse relationship is a very likely possibility. Thus, imperfection (failure) of land markets has come to be considered as the additional factor for IR. Labour supervision costs (Bardhan 1973, Feder 1985, Eswaran and Kotwal 1986, and Bhalla 1986) and distress sales by small farmers (Bhagwati and Chakravarty 1969) were further added to the list of possible factors for IR.

The multiple markets failures are also hypothesized to result in inter-linkages among markets. In the Indian context, it was initially confined to sharecropping contracts but was later extended to relations between traders and moneylenders to explain a range of contracts they make with farmers and labour. These interlocked markets existed as a response to reducing risks and uncertainties inherent in agrarian production and minimising transaction costs in the context of incomplete or non-existent markets (Bardhan 1980; Bardhan 1983; Bardhan 1989).

Basu (1983) looks into the reasons for the emergence of isolation and interlinkage in rural markets in underdeveloped economies. He analyses the relationship between landlord and labour in rural market. The presence of potential risk in credit markets (the risk of default if a loan is given to a carelessly chosen borrower) is argued to give rise to interlinkage in the rural markets. Further, the presence of this potential risk also results in isolation.A labourer who is charged exorbitant interest rate by his landlord cannot go to another peasant's landlord for his loan. Another landlord will not give him a loan because there is a chance of default by the peasant over which this landlord has no control. In such as case, government intervention could ensure that the peasants always had to repay their debts along with interest rates. This could result in breaking down of isolation and the lowering of interest rates. However, since such government intervention does not exist, the only option left to the peasant to avoid paying high rate of interest is to persuade another landlord to employ him and thus make a switch to this landlord. The worth of the switch would depend jointly on the interest charged by the landlord as well as the wages that the landlord is willing to offer.

However, the lender's risk hypothesis cannot explain the presence of usurious interest rates in the rural areas. Studies have challenged this hypothesis based on the empirical evidence that rural landlord faces very little risk while giving loan to the borrower as loans are repaid in terms of confiscated land or bonded labour, even if not in cash (Bhaduri 1977; Roth 1979 as cited in Basu 1983). The landlord ensures that the debtor is one over whom he has control, thus there is no risk of default when the landlord gives a loan.

Land quality and not market imperfections, was proposed as a major factor for the existence of IR by Khusro (1964). He showed in an important study, how adjustments for land quality diminish and even eliminate IR. Khusro's study was based on highly aggregate land productivity and land tax revenue (i.e. land quality) data. Since adjustments to land taxes are conducted only at long intervals, often spanning more than a decade, it is very difficult to verify Khusro's results with farm level data. Carter (1984) is on similar lines and finds that the inverse relationship weakens when intra-village soil quality differentials are included but inter-village differences do not change IR. Carter's findings, however, remain unconvincing mainly because direct data on soil quality is absent in his study. Bhalla and Roy (1986) and more recently Assuncao and Braido (2007) find that market failures and household level heterogeneity are not adequate to explain IR and unobserved factors such as soil quality are the more likely determinants.

According to several studies, concerns related to risk could generate the inverse relationship (Srinivasan 1972, Rosenzweig and Binswanger 1993, and Barrett 1996). Srinivasan (1972)

has theoretically shown that under considerations of uncertainty and no imperfections in input markets, it would be optimal for a small farmer to apply more labour and achieve higher land productivity than a larger farmer.

There is some evidence of weakening of these inter-linkages, particularly of the IR in India in recent times, due to the effect of technology (Deininger et al. 2018, Barrett et al. 2010) and when total factor productivity measures are used instead of partial measures of productivity (Rada and Fuglie 2019). Based on the foregoing analysis, the effects of different types of market failures on small and marginal farmers can be summarized as follows:

Effect of market imperfection on small and marginal farmers

Market imperfection	Production / Consumption	Effects on small and marginal farmers
Land	Production	Lack of ability to reap economies of scale in production, marketing
		lack of access to credit (collateral) and insurance markets; absence of an inflation hedge
		Lower per capita output
	Consumption	Lack of access to credit (collateral) from institutional and non-institutional sources (mortgage); large transaction costs due to adverse selection and asymmetries of information etc.
Labour	Production	Intensive use of labour per unit of land which leads to *higher output per unit of land but lower profitability at market wages*; no supervision costs since family labour is motivated.
	Consumption	Leads to *lower output per person* and *lower profitability at market wages*; leads to outmigration of male members and increases workload and drudgery for women.
Credit	Consumption smoothing	Leads to distress sales of land and livestock. Distress land sales lead to further skewing of land distribution in favour of large farmers. Distress sales of livestock exacerbate poverty.
		Increases drudgery for women as they need to undertake wage labour to supplement income
	Production	Cannot reap scale economies by augmenting land through lease or purchase
		cannot attain higher productivity through intensive use of inputs

| Insurance | Production | Makes subsistence a priority. Inhibits high return but risky crops, thus making production and consumption non-separable (DeJanvry and Sadoulet 2006). |
| | Consumption | Increase vulnerability of poor households to idiosyncratic shocks, such as crop failure, illness or death |

Source: Author's compilation

3 Data source and methods

3.1 Sampling methodology

The study was conducted in four states – Bihar, Gujarat, Madhya Pradesh and Punjab. Given the objectives, it is important to study imperfections of the markets in different agro-climatic and socio-economic settings. Thus, a multi-stage sampling methodology was adopted for the study. The first stage unit (FSU) is the district. One district was selected from each agro-climatic region in the state. The districts were so chosen that there existed variation in the cropping pattern across the districts. From each district, two villages were selected with sufficient geographic spread and which are not contiguous. A complete household listing was carried out in the selected villages. For very large villages (>500 households), listing of at least 300 households from all the locations in the village has been carried out. This village listing formed the sampling frame for the study. From each village a sample of 50 farmers has been selected with representation from each land size category. The households from the land size categories i.e. marginal (<1 hectare), small (1-2 hectares), medium (2.1- 4 hectares), large (4.1-10 hectares) and very large (>10 hectares) was selected using stratified random sampling with PPS method (probability proportional to size), with a minimum of two households from each category. Details of the villages and the number of households in each village are presented in *Appendix A.1.* A total of 1800 households have been surveyed across four states, 21 districts and 45 villages.

A structured questionnaire was used to elicit the required information from the selected households. Broadly, the aspects covered were basic household information; production and disposal of crops produced; input usage and expenses for crop production; disposal of produce and value of output from animal husbandry; input usage and expenses on animal husbandry; labour demand and supply for farming and livestock operations; purchase & sale of productive assets; government support (MSP, PM-ASHA, PM-KISAN, access to technical advice); credit and crop insurance; problems in farming, economic risks, coping strategies and social networks. The reference year of the study was July 2018 to June 2019.

3.2 Methods

Tabular analysis as well as econometric methods (OLS and tobit) have been used. It was observed from the extant literature that imperfections in labour and land markets manifest most likely in the form of decreasing land productivity and increasing per capita output as the

farm size increases. It is also likely that larger farms face supervision constraint; make more intensive use of inputs and land; possess better access to mechanization and credit, all of which could have a positive impact on per capita output. Hence, the following hypotheses have been tested using the household data.

1) Is there an inverse relation (IR) between land productivity and farm size?
2) Is there a direct relation between per capita output (labour productivity) and farm size?
3) Does the ratio of family labour to hired labour decrease with farm size? (supervision constraint)
4) Does consumption of fertilizers vary with farm size? (input intensity)
5) Does cropping intensity vary with farm size? (intensive use of land)
6) Does access to bank credit vary with owned land? (credit constraint or 'collateral' effect)

Since many of these endogenous variables are dependent on region-specific, agro-economic factors on the supply side such as soil and weather type, marketing infrastructure, bank density etc, which vary across states and even across villages, we control for the state and village effects in our analysis through the use of appropriate dummies. We also test for the differences in the marginal effects of our *variable of interest* (farm size) across villages (and states) through appropriate interactions. However, since we do not have data at different points of time or plot level data, we are unable to control for household level effects. This is a limitation of our analysis. Since heteroscedasticity is a persistent problem in cross-section studies, which is also the case in our data, we have used White's heteroscedasticity-corrected standard errors.

While OLS has been used for testing the hypothesis 1 to 5, the hypothesis on bank credit (6) is tested using Tobit estimation. This is because there were a large number of farmers who have not borrowed from the bank (zero borrowing). Also, amount borrowed is always greater than zero. This means that the distribution of borrowers is left censored and is lumped at zero. Thus, OLS is not an appropriate methodology and therefore we have used Tobit for estimation.

The estimated equations are as follows. The expected sign, *a priori*, is indicated below each variable.

3.3 Econometric Model

1. Land productivity-farm size relationship (negative with operated area)

$$VAl\,perha = f\,(\text{SD or VD, OPA, FLPD/HLPD, OWA, \%IA, FERT/ha, interactions of VD with OPA or OWA})$$
$$\text{+/-}\qquad\text{-}\qquad\text{-}\qquad\text{+}\quad\text{+}\quad\text{+}\qquad\qquad\text{+/-}$$

2. Output per capita-farm size relationship (positive with operated area)

$VA1 per capita = f$ (SD or VD, OPA, FLPD/HLPD, OWA, %IA, FERT/ha, interactions of VD with OPA or OWA)

+/-   +   -   +   +   +   +/-

3. Ratio of family labour to hired labour (supervision constraint)

$$FLPD/HLPD = f (SD\ OR\ VD, OPA, CI,\ interactions\ of\ VD\ or\ SD\ with\ OPA\ )$$

+/-   -   +   +/-

4. Fertilizer consumption per hectare

$$FERT/ha = f (SD\ or\ VD, OPA,\ \%\ IA,\ \%RICWHT,\ interactions\ of\ VD\ or\ SD\ with\ OPA)$$

+/-   +   +/-   +   +/-

5. Cropping intensity

$$CI = f (SD\ or\ VD, OPA,\ \%\ IA,\ FLPD/HLPD,\ interactions\ of\ VD\ or\ SD\ with\ OPA)$$

+/-   +   +/-   +   +/-

6. Bank credit per hectare

$$BANCRE = f (SD\ or\ VD, OWA,\ interactions\ of\ VD\ or\ SD\ with\ OWA)$$

+/-   +   +/-

Notation of the variables

L_ denotes natural log

L_VA1PERHA: Value added per hectare (Rs/ha)

L_OPAREA: Operated area (ha)

L_OWN_LAND: Owned land (ha)

PER_IRR_OP: Percentage of irrigated area to operated area (%)

PER_AR_PDWHSUG: Percentage of area under paddy, wheat and sugarcane to total area(%)

L_EXP_FERT_HA: Expenditure on fertilizer consumption (Rs/ha)

L_VA1PERPRN: Value added per capita (Rs/ha)

RATIO_FL_HL_DAYS: Ratio of person-days of family labour to hired labour (%)

CI_CROP_INTEN: Cropping intensity (GCA/operated area)

AMT_GOVBNK: Amount borrowed from Bank (Rs/ha)

4 Analysis and discussion

Before we turn to the analysis of our results, a brief overview of the sample region is presented here.

4.1 Sample households: an overview

A) **Demographic composition:** Majority of the sample households belonged to the marginal landholding category (34 percent), followed by small (30 percent), medium (22 percent), large (11 percent) and very large (3 percent) landholdings (Table 1).The average landholding size was highest in MP (3.34 ha) followed by Punjab (3.22 ha), Gujarat (2.10 ha) and Bihar (1.84 ha). Around, 47 percent of the households belonged to OBC category followed by general (37 percent), SC (8 percent) and ST (7 percent) (Table 2). The marginal and small farmers mostly are from the SC and ST category while the large farmers mostly consisted of general category households. The principal occupation of majority of the households was cultivation (97 percent) (Table 3). Within each of the landholding categories too, over 90 percent of the households were mainly engaged in cultivation as their primary occupation. In Bihar and MP all the sample households (100 percent) were engaged in cultivation.However, cultivation is the predominant occupation for medium, large and very large categories while marginal and small farmers seem to supplement cultivation with wage labour and other sources of income.

B) **Productive assets**

Milch animals were the predominant livestock asset in our sample regions in the higher land categories while small ruminants were owned mostly by the small and marginal farmers (Table 4). Punjab appears to be an exception though where large farmers seem to own relatively more number of bullocks.Across the landholding categories, majority of households in the 'very large' and 'large' category possessed tractor/tractor trolley/tiller (23 percent respectively), which is on the expected lines.

C) **Cropping pattern**

The marginal and small farmers are mainly engaged in paddy and wheat cultivation, possibly owing to lower yield risk, while 'large' and 'very large' categories are relatively more likely to opt for riskier crops(Table 5). There is growing evidence that the preference for paddy and wheat by marginal and farmers is mainly due to the lower yield risk of these crops (Chatterjee et al. 2020). The exception is Punjab, where all categories of farmers grow mainly paddy and wheat because of extensive irrigation and assured price support.

4.2 Results of the tabular analysis

There is no clear pattern in value of output and input costs (Table 6 to 7). Therefore, we look at the value-added per unit area and per capita. Aggregating all the crops and netting out the paid-out costs on inputs (excluding family labour), we find no discernible link between value added (per unit area) and farm size (Table 8). This is mainly due to the opposite trends in the output value and input costs. This is in keeping with the recent evidence which shows a weakening of IR (Barrett et al 2010, Deininger et al. 2018). But when *the cost of family labour is imputed using market wage rates,* value added per hectare increased with farm size (Table 9). This indicates that the main advantage of smaller landholdings is the availability of

cheap family labour, which vanishes when market wage rates are imputed for computing cost of labour. However, caution is needed here since imputing market wage to family labour may not be totally appropriate because of missing or incomplete markets, particularly for women and children of the household. Use of an appropriate shadow price, instead of market wage, will be more informative. *Value added per capita (farm income per capita) increased with farm size in all the states showing greater viability of larger farms.*

4.3 Perceptions of farmers

A) Crop sector

Except Punjab, a large majority of farmers in MP, Gujarat and Bihar are dissatisfied with sale of crops (Table 10). Receiving a lower price than in the market, delayed payments, deductions from the payments for loans and faulty weighing are some of the problems reported by farmers. As for reasons for receiving lower prices, farmers reported lack of government purchase or lack of a minimum purchase price, presence of very few buyers in the market and collusion of buyers as some of the reasons (Table 11). On the side of inputs, except in Gujarat and few inputs in other states, prices of most of the inputs have been reported to be reasonable. Out of those who found prices of inputs to be on the higher side, majority cited lack of government sale or an upper price limit, lack of subsidies and collusion of sellers as the reasons. Thus, in the output as well as input markets, farmers seem to express a need for greater role of the government, both through direct participation and better regulation of private players.

B) Livestock sector

The sale value of livestock products and cost of inputs increased with farm size. In all the states, except Bihar, majority of the farmers expressed dissatisfaction with sale of milk and that they received a lower price than the market price. Lack of government purchase or a minimum purchase price have been reported to be the major reasons for receiving lower prices for livestock products. On the side of inputs, majority of the farmers felt that the prices of inputs are reasonable, except for concentrates.

C) Labour Market

On the demand side for labour, in all the four states, the average person-days per ha of family labour and farm servants show an inverse relationship with farm size, indicating that the smaller landholdings are using more family labour (Table 12). As for hired labour, although a majority of farmers reported wage rate to be reasonable, the remaining cited MNREGS and limited labour supply as the major reasons for unreasonable wage rates. However, participation in MNREGS as a possible reason for higher wage rates seems unfounded as can be seen below.

On the supply side of labour (households participating in labour market), only 9 percent of the households were engaged in MNREGS and these households mainly belonged to the marginal and small categories (Table 13). The remaining households were engaged on other farms. The main problems reported by households engaged in wage labour were that the work was available for a very limited period of time in a year and the wages were very low (Table 14). This does not seem to support the view that MNREGS is the reason for higher

wage rates, as reported by few of the farm households. It appears that there is a greater need to increase the availability of employment under MNREGS.

D) Credit Market

Majority of the respondents have borrowed from institutional sources such as cooperative society and government banks (Table 15). While the marginal farmers mainly borrowed from the cooperative society, large farmers mostly borrowed from government banks. The interest rates ranged widely from 7% in the institutional sources to 22-24% by the money lenders/fellow farmers (Table 16). It is interesting to note the reasons cited for non-repayment of the loans. Marginal and small farmers mostly reported income being less than expenditure as the most important reason whereas the larger categories of farmers reported expected debt waiver as the reason for non-repayment of loans (Table 17)!

E) Insurance market

The proportion of households that insured their crop was higher in case of certain crops like cotton and groundnut and incidentally these are the crops that reported higher crop loss (Table 18). The proportion of households that received compensation is very low, showing that the functioning of insurance market in these states needs a lot of improvement. Insurance was lower for crops like paddy, wheat and soybeans. None of the farmers in Punjab has insured their crops.

The reasons for not insuring are also revealing. Lack of awareness about insurance in general or about existence of the facility for insurance have been reported as the main reasons in Bihar, Gujarat and MP (Table 19). In Punjab, the main reason is 'no need for insurance', possibly due to extensive irrigation and assured MSP in the state. Thus, awareness about insurance needs to be increased and claim settlement also needs to be improved. The implicit insurance function of irrigation and effective support price, as in Punjab, needs to be recognized.

F) Problems in farming

Nearly 90 percent of the households in the sample reported that their present income from farming is inadequate (Table 20). Multiple reasons were reported for this inadequacy. Generally, small land size and non-remunerative price were reported mostly by marginal and small farmers while pest problem was reported by the larger size groups. As for economic risks faced, farmers reported lack of capital/finance, sharp fluctuations in input / output prices and lack of access to inputs as the major risks. Punjab is an exception though, where seasonal unemployment was reported as the major economic risk, mainly by the households in the marginal and small category.

Reducing household consumption, borrowing money from friends and relatives, taking children out of school and deferring social functions were some of the coping strategies adopted by the sample households (Tables 21 to 24). Marginal and small farmers resorted to the first three while the larger categories adopted the last. Thus, access to consumption credit needs to be improved.

4.4   Government Support programs

A) MSP and public procurement

Although MSP has been in operation in the country for more than five decades, only half of the sample households (52 percent) were aware of MSPin our sample regions (Table 25). Percentage of households reporting awareness of MSP for paddy was the least in marginal category (35 percent). Very few paddy farmers reported awareness in Bihar (2%) while about 50% were aware in Gujarat. In MP and Punjab, awareness was 100 percent. In Bihar, none of the households sold to any public agency, possibly because of absence of public procurement in the state. In Gujarat again, none of the households sold to any public agency because the procurement agency did not operate in the region. In MP, about 24 percent could not sell to public agencies because of the 'poor quality of the crop'. In Punjab, farmers almost entirely operated through the arthiyas (commission agents) and therefore knew very little about the public agency procuring their crop. The knowledge and awareness about MSP needs to be improved and assured procurement is needed to make MSP effective.

B) PM KISAN

PM KISAN, the flagship program of the Union Government to provide direct payments to farmers, though functioning reasonably, the performance across states varied quite a bit (Table 26). In MP and Punjab, the percentage of households that have received payment was relatively lower at 43 percent and 48 percent respectively than in Bihar (78 percent) and Gujarat (74 percent). The average payment received also followed a similar pattern with payments in MP (Rs 2327 per household) and Punjab (Rs 3324) being lower compared to Bihar (Rs 4703) and Gujarat (Rs 4606).

However, it is encouraging to note that across the states, the percentage of households receiving payment was relatively higher in the marginal and small categories than in the medium, large and very large categories. Time taken for receiving payment was more or less the same across the landholding categories.

C) Technical Advice

The sample households were mainly reliant on sources such as private commercial agents, progressive farmers, extension agents and radio/tv/newspaper/internet for technical advice, in that order. The pattern was not much different across the landholding categories. Majority of the households in the sample had adopted the recommended advice from the sources accessed. As for accessing veterinary department for advice, except in Bihar where fifteen percent of the households accessed veterinary department for advice, the figures were abysmally low in other states. Thus, performance of public extension system, particularly in veterinary services, needs to be improved.

D) Social capital

Across states, majority of the respondents have membership of dairy cooperatives / agricultural /credit cooperative societies. Membership of marginal farmers is relatively lower. In Bihar, Gujarat and MP most of the members are active members while in Punjab the majority are ordinary members. Thus, it appears that most of the farmers have a very modest social capital, particularly the small and marginal farmers.

4.3 Econometric analysis

The results in the tabular analysis discussed above are averages for different land categories, across states and the overall sample. Effects of other possible explanatory factors are not factored into that analysis. To overcome these limitations (of tabular analysis), we have carried out a more systematic econometric analysis using household data and the results are as follows.

Land Productivity

Available empirical evidence indicates that small farms show higher intensity of family labour due to factors like non-clearing labour markets owing to wage rate falling below the reservation wage, lower skill endowments, missing markets for women, children and certain types of labour. The better quality and commitment of family labour on small farms (in comparison to hired labour) and the higher supervision costs (of the hired labour) on large farms are expected to lead, *ceteris paribus,* to decreasing value added per hectare (output net of costs) with increase in farm size. The question that arises is whether this effect remains the same across states and villages or do these vary?

Thus, six different models have been estimated to test these hypotheses. Models 1-3 include state dummies; interactions between state dummy and operated area; and interactions between state dummy and own area respectively. The next three models, Models 4-6, use village dummies instead of state dummies. The state and village dummies are expected to capture the state and village level heterogeneity respectively. The interactions help to discern the slope differences, if any, across states and villages. The state of Bihar and village Kesabe (Bihar) constitute the base group in these two sets of regressions. Proportion of irrigated area and fertilizer consumption per hectare has been included to account for higher yield due to these inputs. Proportion of area under MSP[4]-supported crops has been included to factor in the better price realization of farmers due to MSP, which in turn, may help realize better value added per capita. Since owners of large farms are expected to have better access to credit and technology, which in turn can have a positive effect on the output, we have included this variable and its interaction with state and village dummies. The results are presented in **Error! Reference source not found.**.

In all the three models 1-3, our variable of interest which is the operated area (farm size), shows a negative and a statistically significant effect on land productivity. A one percent increase in farm size leads to a decrease in land productivity ranging from 0.26 percent to 0.33 percent. This is strongly suggestive of the presence IR. This is different from the results of our tabular analysis. It needs to be noted that in our tabular analysis, the other relevant factors such as irrigation, fertilizer usage and state-specific effects have not been controlled

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[4] MSP refers to the statutory minimum support price, which is the assured price announced by the central government, effective mainly for wheat and rice.

for. Once all these other factors are controlled for, the relation between value added and farm size becomes sharper.

The owned area also shows the expected positive effect (0.40 to 0.42) and is statistically significant, showing the positive effect of better access to credit, mechanization etc on land productivity. The percentage of irrigated area (to total cropped area), area under MSP crops and fertilizer consumption (per ha) – all these variables show statistically significant and positive effect on land productivity. The intercept dummies are significant for all three states but the slope dummies are not, showing sizeable level differences but very little difference in marginal effects (of operated area) across states.

In the next three models, Model 4-6, we control for village level heterogeneity. The effect of operated area (farm size) is negative and significant in all three models, ranging from -0.32 to -0.53. The coefficient value increases from -0.32 to -0.53 and the Adjusted R square also increases significantly when interaction terms are included. Many of the interaction terms are statistically significant showing that the marginal effect of farm size on land productivity varies across villages. The interaction term is significant in nearly 21 villages, out of 44 villages for which village interaction dummies were included showing that the marginal effect does vary across villages (Table). The coefficient of owned land also shows a significant positive effect, as expected *a priori* (0.32 to 0.48). Coefficients of area under MSP crops and fertilizer consumption show little change from Models 1-3 and are statistically significant. The only notable change from Models 1-3 is in the effect of percentage area irrigated, which although positive, is statistically insignificant suggesting that irrigation is perhaps not an important factor in determining land productivity once village level heterogeneity is accounted for.

Value added per capita
Due to better access to credit of the large farmers and the resulting farm investment and mechanization, *output per capita (or income per capita) is expected to be much higher for large farmers*. We test this hypothesis using six models with the same set of explanatory variables used in the previous set of regressions (of value added per hectare). The only difference is that the dependent variable is 'value added per capita'.

As expected, the operated area shows positive and significant effect on the dependent variable (Table 28). This is in agreement with the results in the section on tabular analysis related to the crop sector. All other explanatory variables, except irrigation, show significant positive effect. Irrigation, as in the previous set of regressions, is insignificant when village level heterogeneity is controlled for. The coefficients are robust across specifications. The interaction term is significant in 18 villages showing that the marginal effect varies across villages (Table).

Labour use
As discussed in section 2, intensive use of family labour on small farms and the supervision constraint faced by them are hypothesized to be the main factors behind the IR. If true, this implies that the ratio of family labour to hired labour is highest in the smallest land category

and declines as the farm size increases. We formally test this with equation 3, wherein ratio of the person days of family labour to hired labour is regressed on farm size. We have controlled for cropping intensity (ratio of total cropped area under various crops to the operated area) to control for intensive use of land. We have included state & village dummies; and their interactions with operated area. The results support the hypothesis regarding family labour use. The farm size has a negative and significant effect on the dependent variable while the cropping intensity is insignificant (Table). The interaction term is significant in 28 villages indicating that the marginal effect varies considerably across villages (Table). These results confirm the hypotheses about the intensive use of family labour on marginal & small farms and the supervision constraint faced by the larger farms. These results are in agreement with the results of the tabular analysis related to labour market.

Fertilizer Consumption Expenditure

Is it possible that the IR is due to factors other than intensive labour use? To check this, we test the relation by regressing fertilizer consumption expenditure per hectare on operated area (farm size). Since fertilizer consumption expenditure is expected to be more for irrigated farms and for crops like rice, wheat and sugarcane, we control for percentage of irrigated area and area under these crops. The results do not support the hypothesis that fertilizer consumption is higher on smaller farms (Table). This is in agreement with the results from our tabular analysis on crop sector. However, the interaction term is significant in 18 villages indicating that the marginal effect varies across villages (Table).

Percentage of irrigated area and area under paddy, wheat and sugarcane show positive and statistically significant effect when village-level heterogeneity is accounted for (the economic effect of these variables or magnitude of the coefficient is small though). Thus, it can be inferred that the fertilizer consumption is not explained by the farm size but more by irrigation and area under fertilizer-intensive crops. In other words, there is no evidence of intensive use of fertilizer on small (or large) farms.

Cropping intensity

Next we turn to cropping intensity. Is it possible that the observed IR is due to an intensive use of land, and not labour or fertilizer? To test this, we regress cropping intensity on farm size, percentage of irrigated area and ratio of family labour days to hired labour days. Cropping intensity is expected to be higher on farms with better irrigation and with committed and better quality and labour. The results do not seem to support the hypothesis of more intensive use of land on smaller farms (Table). The percentage of irrigated area has a significant positive effect on the dependent variable. The interaction term is significant in 18 villages indicating that the marginal effect varies across villages (Table).

Bank Credit

Access to formal credit from the banks is expected to affect value of the output through higher use of inputs and complementary investment. Also, because of the collateral value of land, small farmers may not be considered credit-worthy and may have relatively less access

to bank credit than the larger farmers. We test this hypothesis by regressing amount of bank credit per hectare on owned area. We use owned land since only owned land can be used as collateral and not the operated land. Although the total number of observations in our sample is 1798, only 556 observations are left after censoring at zero. Thus, we could not use the either village dummies or any of the interaction terms because of the degrees of freedom constraint and only used the state dummies. The results show that the owned land has a positive and significant effect on the credit availability (Table 32). This is broadly in keeping with the results of our tabular analysis on credit market. The state dummies are also positive and significant, indicating that the credit availability in Gujarat, MP and Punjab is significantly higher than in Bihar (Table 38). However, due to the absence of the interaction terms, it is not possible to say anything about the differences in marginal effects across states, if any.

5   Conclusions and policy implications

Economic viability of farming and farmers' well-being continue to be major concerns in India. Keeping this in view, the study makes an attempt towards examining the imperfections in product, input and factor markets that can have a crucial bearing on farm income.

Our results from tabular analysis did not reveal any systematic pattern between farm size and land productivity. However, when we control for all the important factors and the state and village level heterogeneity through a systematic econometric analysis, a strong IR emerges. This IR appears to be almost entirely driven by an intensive use of family labour on small farms. There is little or no evidence of such intensive use in case of any other factor or input. There is also evidence of a binding supervision constraint for large farms. The *value added per capita* or the *per capita income* increases with farm size, underlining the possible effect of better access of large farmers to technology and credit.

In the credit market, the small & marginal farmers are more dependent on co-operative societies whereas the large farmers reported better access to banks. Small & marginal farmers reported seasonal unemployment (particularly in Punjab) and financial difficulties as the main reason for non-repayment of loans while large farmers reported expected loan waivers as the reason for non-repayment. Small & marginal farmers resorted to more drastic measures like reducing consumption expenditure and taking children out of school to cope with economic risks. They borrow mostly from non-institutional sources, often at very high interest rates. Most of these farmers have a very modest social capital. Awareness about MSP and insurance programs is very low. Claim settlement under crop insurance does not appear satisfactory. In their feedback, all farmers stressed the need for government intervention through direct participation in the markets and also regulation of the markets to ensure remunerative prices for their output and affordable prices of inputs.

Some of the important policy implications that emerge from the study are:

1. Labour market imperfections need to be addressed through expanding rural employment opportunities and land market reforms need to be initiated through easier

leasing of land. *The Model Land Leasing Act 2016* (GoI, 2016) may be a good starting point.

2. There is a greater need for improving the functioning of MNREGS and to increase the availability of employment under MNREGS.

3. Strengthening of primary agricultural cooperative societies is necessary for better access to credit of the marginal & small farmers.

4. The moral hazard problem among large farmers in the credit market needs to be addressed.

5. Given the drastic measures by small & marginal farmers in the face of economic hardships, improving their access to consumption credit is extremely important.

6. Awareness about insurance needs to increase and claim settlement needs to be improved. The inter-state variations in functioning of PM-KISAN need to be addressed. Performance of public extension system, particularly in veterinary services, needs improvement.

Tables

Table 1: Distribution of households across the landholding categories

Landholding Categories	Bihar		Gujarat		MP		Punjab		overall	
	No. of Hhs	Percent	No. of Hhs	Percent	No. of Hhs	Percent	No. of Hhs	Percent	No. of Hhs	Percent
Marginal	130	43	315	39	81	20	80	27	606	34
Small	87	29	239	30	113	28	94	31	533	30
Medium	51	17	156	20	121	30	70	23	398	22
Large	27	9	76	10	57	14	44	15	204	11
Very Large	5	2	14	2	28	7	12	4	59	3
Total	300	100	800	100	400	100	300	100	1800	100

Table 2: Distribution of households by social group across the landholding categories

Landholding Categories	Bihar					Gujarat					MP					Punjab				Overall				
	Gen	OBC	SC	ST	Total	Gen	OBC	SC	ST	Total	Gen	OBC	SC	ST	Total	Gen	OBC	SC	Total	Gen	OBC	SC	ST	Total
Marginal	25	99	5	1	130	83	127	54	51	315	8	58	10	5	81	61	13	6	80	177	297	75	57	606
%	19	76	4	1	100	26	40	17	16	100	10	72	12	6	100	76	16	8	100	29	49	12	9	100
Small	20	64	2	1	87	90	94	20	35	239	3	86	14	10	113	86	8	0	94	199	252	36	46	533
%	23	74	2	1	100	38	39	8	15	100	3	76	12	9	100	91	9	0	100	37	47	7	9	100
Medium	17	33	1	0	51	78	49	10	19	156	13	96	10	2	121	68	2	0	70	176	180	21	21	398
%	33	65	2	0	100	50	31	6	12	100	11	79	8	2	100	97	3	0	100	44	45	5	5	100
Large	5	21	1	0	27	42	21	5	8	76	7	48	2	0	57	41	3	0	44	95	93	8	8	204
%	19	78	4	0	100	55	28	7	11	100	12	84	4	0	100	93	7	0	100	47	46	4	4	100
Very Large	4	1	0	0	5	10	4	0	0	14	2	25	1	0	28	11	1	0	12	27	31	1	0	59
%	80	20	0	0	100	71	29	0	0	100	7	89	4	0	100	92	8	0	100	46	53	2	0	100
Total	71	218	9	2	300	303	295	89	113	800	33	313	37	17	400	267	27	6	300	674	853	141	132	1800
%	24	73	3	1	100	38	37	11	14	100	8	78	9	4	100	89	9	2	100	37	47	8	7	100

Table 3: Distribution of households by principal occupation across the landholding categories

Categories	Bihar		Gujarat								MP		Punjab					Overall								
	C	Total	C	AL	D	NAL	SLE	SE	P	Total	C	Total	C	NAL	SE	R	Total	C	AL	D	NAL	SLE	SE	P	R	Total
Marginal	130	130	285	1	4	0	14	11	0	315	81	81	66	5	8	1	80	562	1	4	5	14	19	0	1	606
%	100	100	90	0	1	0	4	3	0	100	100	100	83	6	10	1	100	93	0	1	1	2	3	0	0	100
Small	87	87	227	0	3	1	6	1	1	239	113	113	90	0	4	0	94	517	0	3	1	6	5	1	0	533
%	100	100	95	0	1	0	3	0	0	100	100	100	96	0	4	0	100	97	0	1	0	1	1	0	0	100
Medium	51	51	154	0	1	0	0	1	0	156	121	121	70	0	0	0	70	396	0	1	0	0	1	0	0	398
%	100	100	99	0	1	0	0	1	0	100	100	100	100	0	0	0	100	99	0	0	0	0	0	0	0	100
Large	27	27	76	0	0	0	0	0	0	76	57	57	44	0	0	0	44	204	0	0	0	0	0	0	0	204
%	100	100	100	0	0	0	0	0	0	100	100	100	100	0	0	0	100	100	0	0	0	0	0	0	0	100
Very Large	5	5	13	0	1	0	0	0	0	14	28	28	12	0	0	0	12	58	0	1	0	0	0	0	0	59
%	100	100	93	0	7	0	0	0	0	100	100	100	100	0	0	0	100	98	0	2	0	0	0	0	0	100
Total	300	300	755	1	9	1	20	13	1	800	400	400	282	5	12	1	300	1737	1	9	6	20	25	1	1	1800
%	100	100	94	0	1	0	3	2	0	100	100	100	94	2	4	0	100	97	0	1	0	1	1	0	0	100

Please note: C- cultivation; AL- Agricultural labour; D- Dairy; NAL-Non-agricultural wage labour; SLE- Self-employed; SE- Salaried employed; R-Remittances; P-Pension.

Table4: Distribution of households by livestock possession across landholding categories

categories	Bihar					Gujarat					MP						Punjab					overall							
	MC	MB	B	G	Total	MC	MB	B	S	Total	MC	MB	B	G	P	Total	MC	MB	B	Pi	Total	MC	MB	B	G	S	P	Pi	Total
Marginal	47	7	2	6	62	68	101	21	1	191	35	17	10	6	0	68	25	40	4	26	95	175	165	37	12	1	0	26	416
%	76	11	3	10	100	36	53	11	1	100	51	25	15	9	0	100	26	42	4	27	100	42	40	9	3	0	0	6	100
Small	36	6	1	4	47	82	115	36	0	233	61	36	18	9	1	125	41	45	8	37	131	220	202	63	13	0	1	37	536
%	77	13	2	9	100	35	49	15	0	100	49	29	14	7	1	100	31	34	6	28	100	41	38	12	2	0	0	7	100
Medium	20	2	0	0	22	64	75	36	0	175	50	41	17	7	0	115	37	55	14	53	159	171	173	67	7	0	0	53	471
%	91	9	0	0	100	37	43	21	0	100	43	36	15	6	0	100	23	35	9	33	100	36	37	14	1	0	0	11	100
Large	13	2	0	0	15	29	48	17	0	94	26	24	3	0	0	53	22	35	28	38	123	90	109	48	0	0	0	38	285
%	87	13	0	0	100	31	51	18	0	100	49	45	6	0	0	100	18	28	23	31	100	32	38	17	0	0	0	13	100
Very Large	5	0	0	0	5	7	5	2	0	14	14	19	1	0	0	34	8	10	9	11	38	34	34	12	0	0	0	11	91
%	100	0	0	0	100	50	36	14	0	100	41	56	3	0	0	100	21	26	24	29	100	37	37	13	0	0	0	12	100
Total	121	17	3	10	151	250	344	112	1	707	186	137	49	22	1	395	133	185	63	165	546	690	683	227	32	1	1	165	1799
%	80	11	2	7	100	35	49	16	0	100	47	35	12	6	0	100	24	34	12	30	100	38	38	13	2	0	0	9	100

Please note: MC- milch cows; MB- milch buffaloes; B- Bullocks, G- Goats; S-Sheep; P- Poultry, Pi- Pigs

Table 5: Gross cropped area under different crops across the landholding categories (in ha)

Landholding categories	Bihar							
	Paddy	Maize	Wheat	Masur	Gram	Potato	Onion	GCA
Marginal	23	33	21	13	7	2	1	100
%	23	33	21	13	7	2	1	100
Small	36	53	34	20	10	4	2	158
%	23	33	21	12	6	3	1	100
Medium	37	53	35	23	8	2	1	159
%	23	34	22	14	5	1	1	100
Large	43	62	42	28	11	1	1	188
%	23	33	23	15	6	1	1	100
Very Large	16	22	14	7	3	2		64
%	24	35	23	11	5	3	0	100
Total	153	224	146	90	40	11	5	670
%	23	33	22	13	6	2	1	100

Table 5contd…

Landholding categories	Gujarat																						
	Paddy	Bajra	Jowar	Maize	Wheat	Gram	Tur	Sugarcane	Cumin	Other Spices	Mangoes	Other Fruits	Onion	Other Vegetables	Groundnut	Castorseed	Sesamum	Rapeseed & Mustard	Cotton	Tobacco	Guar	Other Fodder Crop	GCA
Marginal	77	13	0	8	42	1	6	7		1	3	2		1	12	14	1	9	25	15	1	10	247
%	31	5	0	3	17	0	3	3	0	0	1	1	0	0	5	6	0	4	10	6	0	4	100
Small	79	41	2	3	46		6	14	4	1	2	6	8	2	40	16	9	36	76	31	6	30	459
%	17	9	0	1	10	0	1	3	1	0	0	1	2	0	9	3	2	8	17	7	1	7	100
Medium	80	24	6	5	45	3	6	23	10	5	5	5	0	2	54	19	14	27	137	31	3	18	523
%	15	5	1	1	9	1	1	4	2	1	1	1	0	0	10	4	3	5	26	6	1	3	100
Large	104	30		1	60	2	7	29	14	2	3	8	6	1	44	12	7	18	110	38		16	512
%	20	6	0	0	12	0	1	6	3	0	1	2	1	0	9	2	1	4	21	7	0	3	100
Very Large	40	14			7			4	2	6		3	0		29		6	4	85	39		6	245
%	16	6	0	0	3	0	0	2	1	2	0	1	0	0	12	0	2	2	35	16	0	2	100
Total	380	123	8	17	200	6	26	77	31	14	13	23	10	6	178	62	37	95	433	154	11	79	1980
%	19	6	0	1	10	0	1	4	2	1	1	1	1	0	9	3	2	5	22	8	1	4	100

Table 5 contd…

Land holding Categories	MP										Punjab								
	Soybean	Paddy	Urad	Wheat	Gram	Peas (Pulses)	Garlic	Onion	Masur/Other Pulses	GCA	Paddy	Wheat	Fodder Crops	Maize	Cotton	Sugarcane	Potato	Moong	GCA
Marginal	35	17	1	33	18		0.20			104	28	50	6	20	2	0	0	0	106
%	33	16	1	32	18	0	0	0	0	100	26	47	6	19	2	0	0	0	100
Small	98	53	8	79	67	0	1	0	1	307	74	118	12	41	3	0	2	0	249
%	32	17	3	26	22	0.13	0	0.13	0	100	30	47	5	16	1	0	1	0	100
Medium	237	73	15	178	134	2	7	2	1	649	146	158	15	12	3	3	6	0	343
%	37	11	2	27	21	0	1	0	0	100	43	46	4	4	1	1	2	0	100
Large	283	29	6	208	94	1	7	2	4	634	234	214	13	11	1	4	28	18	522
%	45	5	1	33	15	0	1	0	1	100	45	41	2	2	0	1	5	3	100
Very Large	474	1	5	358	92	5	8	4	8	955	138	130	4	2	0	10	8	6	300
%	50	0	1	37	10	1	1	0	1	100	46	43	1	1	0	3	3	2	100
Total	1127	173	35	856	406	8	23	8	14	2649	620	670	50	86	9	17	44	24	1520
%	43	7	1	32	15	0	1	0	1	100	41	44	3	6	1	1	3	2	100

Table 6: Value of output of major crops (Rs per ha)

Landholding Categories	Bihar	Gujarat	MP	Punjab	Overall
Overall crops					
Marginal	59865	68421	48850	85879	65609
Small	60203	63111	46878	89405	63161
Medium	58971	82373	53106	102465	71992
Large	58023	90807	56373	109688	80324
Very Large	60175	62276	55929	116916	68445
Total	59243	76061	185661	104643	122580
Paddy					
Marginal	54477	70611	57665	129690	77713
Small	54411	84934	60355	128085	88343
Medium	54512	87143	58755	123157	92845
Large	54537	186856	57346	128126	130413
Very Large	56815	59845	61250	131990	111040
Total	54723	107750	58916	127886	104647
Wheat					
Marginal	69716	46023	64147	79074	64762
Small	69952	47840	57705	82667	68137
Medium	68843	44888	62829	85310	69938
Large	68856	41042	73195	87209	74916
Very Large	69892	46857	68882	89801	73919
Total	69328	44720	67457	85860	71746
Maize					
Marginal	52051	22345		40805	36063
Small	52093	32394		36009	35741
Medium	52583	13597		45120	36280
Large	51209	17014		87217	79793
Very Large	51316			111195	112500
Total	51881	21200		46658	42627
Masur					
Marginal	56868				56868
Small	57249		38400		56336
Medium	56690		27000		55446
Large	57339		24426		53230
Very Large	62319		33745		46805
Total	57461		30934		53887
Gram					
Marginal	55498	31050	39696		43933
Small	52285		41493		42878
Medium	55735	396086	38799		47414
Large	53493	25662	40895		41492
Very Large	53363		46137		46394
Total	53127	232777	41336		44719
Potato					
Marginal	105685				105685
Small	111970			122314	103858
Medium	99340			111344	113717
Large	122307			148502	143747
Very Large	132819			169628	172226
Total	113007			146337	138461
Cotton					
Marginal		107394		112134	107620
Small		69155		112734	70569
Medium		93692		115793	94447
Large		66108		142412	67071
Very Large		52540			52540

Total		75127		117549	76085
Onion					
Marginal	188966				188966
Small	191517	38664	1470185		85218
Medium	197721	52950	509183		350894
Large	192406	36571	517586		172829
Very Large		71094	614263		574028
Total	192498	56688	587715		269296
Soyabean					
Marginal			32579		
Small			32708		
Medium			35329		
Large			33720		
Very Large			34779		
Total			343808		
Groundnut					
Marginal		71383			
Small		63419			
Medium		48098			
Large		67000			
Very Large		63251			
Total		60522			

Table 7: Input usage (Rs/ha) - total expenditure on all inputs

Landholding Categories	Bihar	Gujarat	MP	Punjab	Overall
Marginal	80966	71538	57505	54113	61229
Small	78808	63320	47375	62978	52112
Medium	76152	55955	45706	64628	46303
Large	80607	47877	45000	107579	40832
Very Large	80144	44551	43750	108950	38832
Total	79109	55600	45550	69379	45625

Table 8: Value added1 (VA1) per ha and per person

VA1 per ha (Rs per ha)				
Landholding Categories	Bihar	Gujarat	MP	Punjab
Marginal	22819	27046	48156	106211
Small	24631	25795	50790	108784
Medium	25069	45018	67566	132891
Large	26483	60886	74640	117102
Very Large	23055	28768	75167	122893
Total	24807	40980	69237	119677
VA1 per person (Rs per capita)				
Marginal	2551	4192	7202	20733
Small	6872	8308	14348	36874
Medium	12099	24659	36272	82258
Large	27331	76083	82566	136817
Very Large	46549	73165	205156	266767
Total	8251	18976	46658	74152

Please note VA1 is value of output minus paid-out costs; VA1 per person is computed by dividing VA1 by number of adults in a family.Two children are considered to be equivalent to one adult in a family. Children are considered as those below 18 years of age (National Policy for Children, 2013).

Table 9: Value added (VA2) per ha and per person

VA2 per ha (Rs per ha)				
Landholding Categories	Bihar	Gujarat	MP	Punjab
Marginal	-36339	-44604	13250	-115939
Small	511	-11763	26604	-18266
Medium	11360	20398	47945	58700
Large	19930	48458	45643	84393
Very Large	20150	22967	60883	103626
Total	4822	14027	48148	50493
VA2 per person (Rs per capita)				
Marginal	-4063	-6913	1982	-22632
Small	142	-3788	7516	-6192
Medium	5483	11173	25739	36335
Large	20569	60552	50490	98602
Very Large	40682	58410	166170	224945
Total	1604	6495	32446	31286

Please note that VA2 is VA1 minus imputed value of family labour at market wage rate.

Table 10: Reasons for dissatisfaction regarding sale of first major disposal of crops (% of households)

Landholding Categories	Bihar									Gujarat																		
	Paddy			Maize			Wheat			Paddy				Wheat						Groundnut				Cotton			
	satisfactory	lower than market price & faulty weighing and grading	Total	satisfactory	lower than market price & faulty weighing and grading	Total	satisfactory	lower than market price & faulty weighing and grading	Total	satisfactory	lower than market price	delayed payments	Total	satisfactory	lower than market price	delayed payments	deductions for loans borrowed	faulty weighing and grading	Total	satisfactory	lower than market price	deduction for loan borrowed	Total	satisfactory	lower than market price	deductions for loans borrowed	Total
Marginal	0	130	130	0	130	130	97	33	130	24	90	4	121	8	42	0	1	2	53	3	16	0	19	5	36	0	42
%	0	100	100	0	100	100	75	25	100	20	74	3	100	15	79	0	2	4	100	16	84	0	100	12	86	0	100
Small	9	78	87	9	78	87	74	13	87	12	56	4	73	7	29	0	1	0	37	12	45	1	58	12	57	0	71
%	10	90	100	10	90	100	85	15	100	16	77	5	100	19	78	0	3	0	100	21	78	2	100	17	80	0	100
Medium	7	44	51	7	44	51	47	4	51	2	38	6	46	1	19	1	0	1	22	9	38	1	48	8	63	5	77
%	14	86	100	14	86	100	92	8	100	4	83	13	100	5	86	5	0	5	100	19	79	2	100	10	82	6	100
Large	4	23	27	4	23	27	24	3	27	5	21	4	30	3	12	1	0	0	16	2	21	0	23	5	25	0	30
%	15	85	100	15	85	100	89	11	100	17	70	13	100	19	75	6	0	0	100	9	91	0	100	17	83	0	100
Very Large	0	5	5	0	5	5	4	1	5	1	5	0	6	0	1	0	0	0	1	1	6	0	7	2	7	0	9
%	0	100	100	0	100	100	80	20	100	17	83	0	100	0	100	0	0	0	100	14	86	0	100	22	78	0	100
Total	20	280	300	20	280	300	246	54	300	44	210	18	276	19	103	2	2	3	129	27	126	2	155	32	188	5	229
%	7	93	100	7	93	100	82	18	100	16	76	7	100	15	80	2	2	2	100	17	81	1	100	14	82	2	100

Table 10contd…

landholding categories	MP																Punjab	
	Soyabean				Paddy				Wheat			Gram					Paddy	Wheat
	satisfactory	lower than market price	faulty weighing & grading	Total	satisfactory	lower than market price	delayed payments	Total	satisfactory	lower than market price	Total	satisfactory	lower than market price	delayed payments	deductions for loans borrowed	Total	satisfactory	satisfactory
marginal	7	45	0	52	20	3	3	26	48	8	56	10	20	5	0	35	46	80
%	13	87	0	100	77	12	12	100	86	14	100	29	57	14	0	100	100	100
small	15	52	1	68	35	1	4	40	59	11	70	23	48	2	1	74	61	94
%	22	76	1	100	88	3	10	100	84	16	100	31	65	3	1	100	100	100
medium	26	66	0	92	28	0	2	30	76	14	90	16	59	4	7	86	65	70
%	28	72	0	100	93	0	7	100	84	16	100	19	69	5	8	100	100	100
large	10	40	0	50	6	0	2	8	50	2	52	12	28	0	0	40	43	44
%	20	80	0	100	75	0	25	100	96	4	100	30	70	0	0	100	100	100
very large	1	24	0	25	1	0	0	1	26	0	26	5	17	0	0	22	12	12
%	4	96	0	100	100	0	0	100	100	0	100	23	77	0	0	100	100	100
Total	59	227	1	287	90	4	11	105	259	35	294	66	172	11	8	257	227	300
%	21	79	0	100	86	4	10	100	88	12	100	26	67	4	3	100	100	100

Table 11: Reasons for receiving lower price for crops (% of households)

Land holding Categories	Bihar Paddy — no government purchase & private buyers collude	Gujarat Paddy — very few buyers	very few buyers & private buyers collude	no government purchase	no government purchase & no minimum price fixed	private buyers collude	no minimum price fixed	all of the reasons	Total	Wheat — very few buyers	very few buyers & private buyers collude	no government purchase	private buyers collude	no minimum price fixed	all of the reasons	Total	Groundnut — very few buyers	no government purchase & no minimum price fixed	no minimum price fixed	all of the reasons	Total	cotton — very few buyers	very few buyers & private buyers collude	no government purchase	private buyers collude	no minimum price fixed	all of the above	Total for cotton
Marginal	130	1	1	13	10	8	62	2	97	1	0	9	7	31	1	49	1	0	2	10	13	0	1	4	0	13	18	36
%	100	1	1	13	10	8	64	2	100	2	0	18	14	63	2	100	8	0	15	77	100	0	3	11	0	36	50	100
Small	87	1	0	2	11	16	22	0	52	0	0	0	13	18	0	31	1	1	7	31	40	1	1	0	0	14	44	60
%	100	2	0	4	21	31	42	0	100	0	0	0	42	58	0	100	3	3	18	78	100	2	2	0	0	23	73	100
Medium	51	1	3	1	8	4	21	0	38	0	1	1	2	13	0	17	0	1	11	29	41	0	3	1	1	27	38	70
%	100	3	8	3	21	11	55	0	100	0	6	6	12	76	0	100	0	2	27	71	100	0	4	1	1	39	54	100
Large	27	1	3	1	0	0	14	0	19	1	0	1	0	8	0	10	0	0	3	16	19	0	0	0	0	3	22	25
%	100	5	16	5	0	0	74	0	100	10	0	10	0	80	0	100	0	0	16	84	100	0	0	0	0	12	88	100
Very Large	5	0	0	0	0	0	1	0	1								0	0	1	3	4	0	0	0	0	1	4	5
%	100	0	0	0	0	0	100	0	100								0	0	25	75	100	0	0	0	0	20	80	100
Total	300	4	7	17	29	28	120	2	207	2	1	11	22	70	1	107	2	2	24	89	117	1	5	5	1	58	126	196
%	100	2	3	8	14	14	58	1	100	2	1	10	21	65	1	100	2	2	21	76	100	1	3	3	1	30	64	100

Table 11contd…

landholding categories	MP Soyabean			MP Paddy				MP Wheat				MP Gram			Punjab Paddy	Punjab Wheat	Overall								Total
	no government purchase	private buyers collude	Total	no government purchase	private buyers collude	others	Total	very few buyers	private buyers collude	others	Total	no government purchase	private buyers collude	Total	others for paddy	others for wheat	no government purchase & no minimum price fixed	no government purchase & private buyers collude	no government purchase	no minimum price fixed	private buyers collude	very few buyers and private buyers collude	others	all of the reasons	
marginal	13	10	23	4	0	4	8	2	0	3	5	23	11	34	5	5	6	130	82	180	51	23	13	41	538
%	57	43	100	50	0	50	100	40	0	60	100	68	32	100	100	100	1	24	15	33	9	4	2	8	100
small	11	4	15	2	5	4	11	2	1	6	9	48	20	68	17	17	9	87	77	125	72	36	33	115	569
%	73	27	100	18	45	36	100	22	11	67	100	71	29	100	100	100	2	15	14	22	13	6	6	20	100
medium	16	10	26	5	2	2	9	0	0	9	9	45	28	73	18	18	17	51	81	127	50	24	34	90	493
%	62	38	100	56	22	22	100	0	0	100	100	62	38	100	100	100	3	10	16	26	10	5	7	18	100
large	5	5	10	1	1	1	3					21	10	31	16	16	6	27	42	44	19	8	27	62	246
%	50	50	100	33	33	33	100					68	32	100	100	100	2	11	17	18	8	3	11	25	100
very large	3	5	8									14	6	20	5	5	0	5	18	8	13	0	10	13	70
%	38	63	100									70	30	100	100	100	0	7	26	11	19	0	14	19	100
Total	48	34	82	12	8	11	31	4	1	18	23	151	75	226	61	61	38	300	299	484	205	91	117	321	1916
%	59	41	100	39	26	35	100	17	4	78	100	67	33	100	100	100	2	16	16	25	11	5	6	17	100

Please note that there are no responses reported for other crops such as maize, wheat, masur, gram, potato, onion in case of Bihar.

All of the reasons includes very few buyers, no govt purchase, private buyers collude, no minimum price fixed. The figures for overall sample are for all the crops taken together and not just the ones given in the table.

Table 12: Average person days per hectare

Landholding Categories	Bihar	Gujarat	MP	Punjab
Overall labour				
Marginal	103	239	219	223
Small	150	130	152	542
Medium	89	116	204	325
Large	92	87	207	137
Very Large	57	49	133	68
Total	100	107	276	279
Family labour & farm servants				
Marginal	69	178	81	76
Small	72	86	56	78
Medium	39	75	45	59
Large	30	41	34	26
Very Large	15	29	26	10
Total	48	65	121	40
Family labour				
Marginal	69	147	81	76
Small	24	64	56	33
Medium	12	65	45	31
Large	8	34	34	18
Very Large	4	16	10	6
Total	16	49	31	18
Hired labour				
Marginal	52	72	537	13
Small	59	62	307	29
Medium	62	55	481	12
Large	81	57	409	7
Very Large	83	41	250	7
Total	61	53	387	15

Table 13: Households engaged as wage labour in various forms (% of households)

landholding categories	Bihar others' farm	MNREGS	Total	Gujarat others' farm	MNREGS	Total	MP others' farm	MNREGS	Total	Punjab	Overall others' farm	MNREGS	Total
marginal	70	13	83	130	3	133	23	10	33		223	26	249
small	1		87	55	1	56	13	5	18		69	6	75
medium	0		51	28	0	28	4	1	5		32	1	33
large	0		27	7	0	7	4	0	4		11	0	11
very large	0		5	3	0	3	1	0	1		4	0	4
Total	71	13	300	223	4	227	45	16	61		339	33	372

Please note that none of the households were engaged as wage labour (others' farm and MNREGS).

Table 14: Constraints related to wage labour (% of households)

landholding categories	Bihar work available for a very limited period	wage is very low	total	Gujarat	MP work available for a very limited period of time	wage is very low	Total	Punjab	Overall work available for a very limited period of time	wage is very low	Total
marginal	31	31	62		3	7	10		34	38	72
%	50	50	100		30	70	100		47	53	100
small					2	3	5		2	3	5
%					40	60	100		40	60	100
medium					0	1	1		0	1	1
%					0	100	100		0	100	100
large									0	0	0
%									0	0	0
very large									0	0	0
%									0	0	0
Total	31	31	62		5	11	16		36	42	78
%	50	50	100		31	69	100		46	54	100

Note: In case of Gujarat, there are 33 different combinations of responses, hence it was not possible to put it in tabular format. Please note that none of the households were engaged as wage labour (others' farm and MNREGS) in Punjab, hence the question on constraints related to wage labour is also not applicable to them.

Table 15: Percentage of households borrowing from different sources (wrt to total no of borrowings)

categories	Bihar						Gujarat							MP							
	government bank	cooperative society	micro finance/community group/NGOs	SHG	relatives	Total no of borrowings	government bank	cooperative society	SHG	input dealers/commission agent	money lenders	employer	Total no of borrowings	govt bank	cooperative society	micro finance	Self-help	fellow farmers	money lenders	others	Total no of borrowings
marginal	3	1	1	2	1	8	80	53	1	0	1	1	136	12	28	0	1	1	1	0	43
%	38	13	13	25	13	100	59	39	1	0	1	1	100	28	65	0	2	2	2	0	100
small	6					6	147	59	0	0	0	2	208	33	49	1	0	3	0	1	87
%	100					100	71	28	0	0	0	1	100	38	56	1	0	3	0	1	100
medium	2					2	115	57	0	1	0	6	179	61	39	0	0	0	0	0	100
%	100					100	64	32	0	1	0	3	100	61	39	0	0	0	0	0	100
large	3					3	65	28	0	0	0	3	96	40	7	0	0	0	2	1	50
%	100					100	68	29	0	0	0	3	100	80	14	0	0	0	4	2	100
very large							19	5	0	0	0	0	24	21	2	0	0	1	2	0	26
%							79	21	0	0	0	0	100	81	8	0	0	4	8	0	100
Total	14	1	1	2	1	19	426	202	1	1	1	12	643	167	125	1	1	5	5	2	306
%	74	5	5	11	5	100	66	31	0	0	0	2	100	55	41	0	0	2	2	1	100

Table 15contd…

Landhlding categories	Punjab				Overall										
	govt bank	cooperative society	input dealers/commission agents	Total number of borrowings	Government bank	Cooperative society	Micro finance/community group/NGOs	SHGs	Relatives	Input dealers/commission agent	Money lenders	employer	fellow farmers	others	total no of borrowings
Marginal	50	154	54	258	145	236	1	4	1	54	2	1	1	0	445
%	19	60	21	100	33	53	0.2	1	0	12	0	0	0	0	100
Small	54	182	66	302	240	290	1	0		66	0	2	3	1	603
%	18	60	22	100	40	48	0	0	0	11	0	0	0	0	100
Medium	52	134	73	259	230	230	0	0		74	0	6	0	0	540
%	20	52	28	100	43	43	0	0	0	14	0	1	0	0	100
Large	36	82	80	198	144	117	0	0		80	2	3	0	1	347
%	18	41	40	100	41	34	0	0	0	23	1	1	0	0	100
Very large	6	24	22	52	46	31	0	0		22	2	0	1	0	102
%	12	46	42	100	45	30	0	0	0	22	2	0	1	0	100
Total	198	576	295	1069	805	904	2	4	1	296	6	12	5	2	2037
%	19	54	28	100	40	44	0	0	0	15	0	1	0	0	100

Table 16: Interest rate charged by non-institutional sources (%)

landholding categories	Bihar	Gujarat	MP	Punjab
Input dealers/commission agents				
marginal				18
small				18
medium		7		18
large				18
very large				18
total		7		18
Money lenders				
marginal		24	24	
small				
medium				
large			21	
very large			24	
total		24	22.8	
Employer				
marginal		7		
small		7		
medium		9.8		
large		10.2		
very large				
total		9.2		
Fellow farmers/neighbours				
marginal			24	
small			24	
medium				
large				
very large			18	
total			22.8	

Table 17: Reasons for non-repayment of the borrowed money (% of households)

landholding categories	Bihar money borrowed from govt bank			Gujarat money borrowed from govt bank					money borrowed from cooperative bank			money borrowed from employer		MP money borrowed from govt bank			money borrowed from cooperative bank			
	debt repayment has been postponed	payment will be made after harvesting	Total	expecting debt waiver	debt repayment has been postponed	payment will be made after harvesting	Major medical or other expenses	Total	income is always less than expenditure	others	Total	payment will be made after harvesting	Total	income is always less than expenditure	expecting debt waiver	Total	income is always less than expenditure	expecting debt waiver	payment will be made after harvesting	Total
marginal	0	1	1	0	1	1	1	3	0	1	1			8	3	11	13	7	1	21
%	0	100	100	0	33	33	33	100	0	100	100			73	27	100	62	33	5	100
small	1	0	1	1	1	0	1	3	1	0	1			20	8	28	23	16	0	39
%	100	0	100	33	33	0	33	100	100	0	100			71	29	100	59	41	0	100
medium				0	1	1	0	2				1	1	20	32	52	19	14	0	33
%				0	50	50	0	100				100	100	38	62	100	58	42	0	100
large				0	0	1	1	2				1	1	4	36	40	0	7	0	7
%				0	0	50	50	100				100	100	10	90	100	0	100	0	100
very large														0	21	21	0	1	0	1
%														0	100	100	0	100	0	100
Total	1	1	2	1	3	3	3	10	1	1	2	2	2	52	100	152	55	45	1	101
%	50	50	100	10	30	30	30	100	50	50	100	100	100	34	66	100	54	45	1	100

Table 18: Percentage of insured, non-insured and loanee insured households

landholding categories	Bihar Paddy insured only when received loan	not insured	Total	Bihar Wheat insured only when received loan	not insured	Total	Gujarat Paddy insured only when received loan	not insured	Total	Gujarat Wheat insured only when received loan	not insured	Total	Gujarat Groundnut insured only when received loan	not insured	Total	Gujarat Cotton insured only when received loan	not insured	Total	MP Paddy insured only when received loan	not insured	Total	MP Wheat insured only when received loan	not insured	Total	MP Soyabean insured only when received loan	not insured	Total	MP Gram insured only when received loan	not insured	Total	Punjab not insured in case of paddy	not insured in case of wheat
marginal	3	127	130	3	107	110	13	149	162	14	73	87	14	7	21	20	23	43	13	13	26	25	34	59	5	49	54	25	10	35	46	80
%	2	98	100	3	97	100	8	92	100	16	84	100	67	33	100	47	53	100	50	50	100	42	58	100	9	91	100	71	29	100	100	100
small	6	81	87	6	73	79	14	76	90	11	42	53	42	16	58	42	29	71	30	10	40	59	21	80	7	62	69	56	19	75	61	94
%	7	93	100	8	92	100	16	84	100	21	79	100	72	28	100	59	41	100	75	25	100	74	26	100	10	90	100	75	25	100	100	100
medium	2	49	51	2	49	51	5	47	52	5	26	31	33	15	48	46	31	77	21	8	29	79	21	100	18	70	88	74	12	86	65	70
%	4	96	100	4	96	100	10	90	100	16	84	100	69	31	100	60	40	100	72	28	100	79	21	100	20	80	100	86	14	100	100	100
large	3	24	27	3	24	27	5	27	32	3	19	22	17	6	23	21	9	30	7	2	9	46	9	55	9	42	51	31	9	40	43	44
%	11	89	100	11	89	100	16	84	100	14	86	100	74	26	100	70	30	100	78	22	100	84	16	100	18	82	100	78	23	100	100	100
very large	0	5	5	0	5	5	3	4	7	0	2	2	7	0	7	6	3	9	1	0	1	23	5	28	2	26	28	17	5	22	12	12
%	0	100	100	0	100	100	43	57	100	0	100	100	100	0	100	67	33	100	100	0	100	82	18	100	7	93	100	77	23	100	100	100
Total	14	286	300	14	258	272	40	303	343	33	162	195	113	44	157	135	95	230	72	33	105	232	90	322	41	249	290	203	55	258	227	300
%	5	95	100	5	95	100	12	88	100	17	83	100	72	28	100	59	41	100	69	31	100	72	28	100	14	86	100	79	21	100	100	100

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Table 19: Reasons for not insuring crops (% of the total number of responses)

landholding categories	Bihar Paddy: not aware	not aware about availability of facility	not interested	not satisfied with terms & conditions	Total	Wheat: not aware	not aware about availability of facility	not interested	not satisfied with terms & conditions	Total	Gujarat Paddy: not aware	delay in claim payment	others	not aware about availability of facility	not interested	no need	insurance facility not available	nearest bank at a long distance	Total	Wheat: not aware	not aware about availability of facility	not interested	no need	insurance facility not available	nearest bank at a long distance	delay in claim payment	others	not aware & not aware about availability of facility	Total
marginal	101	18	1	7	127	101	18	1	7	127	62	8	14	26	24	4	10	1	149	35	21	6	2	0	1	1	6	1	73
%	80	14	1	6	100	80	14	1	6	100	42	5	9	17	16	3	7	1	100	48	29	8	3	0	1	1	8	1	100
small	67	7	5	2	81	67	7	5	2	81	31	2	3	24	12	4	0	0	76	19	13	3	1	0	0	0	6	0	42
%	83	9	6	2	100	83	9	6	2	100	41	3	4	32	16	5	0	0	100	45	31	7	2	0	0	0	14	0	100
medium	38	8	2	1	49	38	8	2	1	49	17	1	2	14	10	1	2	0	47	9	12	2	1	0	0	1	1	0	26
%	78	16	4	2	100	78	16	4	2	100	36	2	4	30	21	2	4	0	100	35	46	8	4	0	0	4	4	0	100
large	19	4	1	0	24	19	4	1	0	24	11	1	1	10	3	1	0	0	27	6	8	3	1	1	0	0	0	0	19
%	79	17	4	0	100	79	17	4	0	100	41	4	4	37	11	4	0	0	100	32	42	16	5	5	0	0	0	0	100
very large	3	1	0	1	5	3	1	0	1	5	2	0	0	1	0	1	0	0	4	1	0	1	0	0	0	0	0	0	2
%	60	20	0	20	100	60	20	0	20	100	50	0	0	25	0	25	0	0	100	50	0	50	0	0	0	0	0	0	100
Total	228	38	9	11	286	228	38	9	11	286	123	12	20	75	49	11	12	1	303	70	54	15	5	1	1	2	13	1	162
%	80	13	3	4	100	80	13	3	4	100	41	4	7	25	16	4	4	0	100	43	33	9	3	1	1	1	8	1	100

Table 19contd...

landholding categories	Gujarat groundnut: not aware	not aware about availability of facility	not interested	insurance facility not available	delay in claim payment	others	Total	cotton: not aware	not aware about availability of facility	not interested	no need	insurance facility not available	delay in claim payment	others	Total
Marginal	3	3	0	1	0	0	7	15	2	1	0	3	2	0	23
%	43	43	0	14	0	0	100	65	9	4	0	13	9	0	100
Small	2	11	0	3	0	0	16	8	10	0	0	5	6	0	29
%	13	69	0	19	0	0	100	28	34	0	0	17	21	0	100
Medium	1	6	1	4	2	1	15	14	4	0	1	9	1	2	31
%	7	40	7	27	13	7	100	45	13	0	3	29	3	6	100
Large	0	5	0	1	0	0	6	2	2	0	1	4	0	0	9
%	0	83	0	17	0	0	100	22	22	0	11	44	0	0	100
Very Large								0	0	1	0	2	0	0	3
%								0	0	33	0	67	0	0	100
Total	6	25	1	9	2	1	44	39	18	2	2	23	9	2	95
%	14	57	2	20	5	2	100	41	19	2	2	24	9	2	100

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Table 19 contd..

landholding categories	MP												Punjab							
	soyabean	paddy			wheat			gram					paddy				wheat			
	others	not aware	others	Total	not aware	others	Total	not aware	not satisfied	complex procedures	others	Total	not interested	no need	not satisfied with terms and conditions	Total	not interested	no need	not satisfied with terms &conditions	Total
Marginal	49	1	12	13	6	28	34	3	2	4	1	10	12	32	2	46	23	55	2	80
%	100	8	92	100	18	82	100	30	20	40	10	100	26	70	4	100	29	69	3	100
Small	62	2	8	10	2	19	21	3	1	8	7	19	21	40	0	61	26	68	0	94
%	100	20	80	100	10	90	100	16	5	42	37	100	34	66	0	100	28	72	0	100
Medium	70	1	7	8	0	21	21	5	1	3	3	12	19	45	1	65	20	49	1	70
%	100	13	88	100	0	100	100	42	8	25	25	100	29	69	2	100	29	70	1	100
Large	42	1	1	2	1	8	9	2	1	1	5	9	16	27	0	43	16	28	0	44
%	100	50	50	100	11	89	100	22	11	11	56	100	37	63	0	100	36	64	0	100
Very Large	26				0	5	5	0	1	1	3	5	3	9	0	12	2	10	0	12
%	100				0	100	100	0	20	20	60	100	25	75	0	100	17	83	0	100
Total	249	5	28	33	9	81	90	13	6	17	19	55	71	153	3	227	87	210	3	300
%	100	15	85	100	10	90	100	24	11	31	35	100	31	67	1	100	29	70	1	100

Table 20: Whether income from farming is adequate

	Bihar			Gujarat			MP			Punjab			overall sample		
categories	yes	no	Total	yes	no	Total	yes	no	Total	yes	no	Total	yes	no	Total
marginal	0	130	130	0	315	315	22	59	81	3	77	80	25	581	606
%	0	100	100	0	100	100	27	73	100	4	96	100	4	96	100
small	0	87	87	3	236	239	17	96	113	3	91	94	23	510	533
%	0	100	100	1	99	100	15	85	100	3	97	100	4	96	100
medium	4	47	51	2	154	156	10	111	121	3	67	70	19	379	398
%	8	92	100	1	99	100	8	92	100	4	96	100	5	95	100
large	3	24	27	3	73	76	2	55	57	0	44	44	8	196	204
%	11	89	100	4	96	100	4	96	100	0	100	100	4	96	100
very large	0	5	5	0	14	14	0	28	28	0	12	12	0	59	59
%	0	100	100	0	100	100	0	100	100	0	100	100	0	100	100
Total	7	293	300	8	792	800	51	349	400	9	291	300	75	1725	1800
%	2	98	100	1	99	100	13	87	100	3	97	100	4	96	100

Table 21: Coping strategies undertaken by the households with respect to the economic risks faced- Bihar

Landholding categories	stored crops for better price	carried out primary processing	Reduced household consumption expenditure	mortgaged/ leased out land	Borrowed money from bank	Borrowed money from moneylenders	Borrowed from friends and relatives	Worked for wage labour in the village	Total
marginal	27	103	38	0	3	0	1	16	188
%	14	55	20	0	2	0	1	9	100
small	18	69	16	7	6	1	0	0	117
%	15	59	14	6	5	1	0	0	100
medium	10	41	12	3	2	0	0	0	68
%	15	60	18	4	3	0	0	0	100
large	5	22	5	5	3	0	0	0	40
%	13	55	13	13	8	0	0	0	100
very large	0	5	1	0	0	0	0	0	6
%	0	83	17	0	0	0	0	0	100
Total	60	240	72	15	14	1	1	16	419
%	14	57	17	4	3	0	0	4	100

Table 22: Coping strategies undertaken by the households with respect to the economic risks faced- Gujarat

Landholding categories	stored crops for better price	carried out primary processing	reduced hh consumption	reduced health exp	took children out of school	deferred social and family functions	sold land	sold livestock	mortgaged/leased out land	borrowed money from bank	borrowed money from money lender	borrowed money from friends/relatives	worked for wage lab in the village	started petty business	others	Total
marginal	48	3	92	5	27	72	28	34	63	194	176	275	221	69	4	1311
%	4	0	7	0	2	5	2	3	5	15	13	21	17	5	0	100
small	40	7	62	16	20	57	29	31	47	135	132	194	172	48	6	996
%	4	1	6	2	2	6	3	3	5	14	13	19	17	5	1	100
medium	34	4	33	5	14	42	19	23	19	101	83	123	91	31	1	623
%	5	1	5	1	2	7	3	4	3	16	13	20	15	5	0	100
large	25	1	14	0	7	10	11	7	11	52	38	66	43	24	0	309
%	8	0	5	0	2	3	4	2	4	17	12	21	14	8	0	100
very large	5	1	0	1	0	1	4	1	2	9	6	9	5	8	0	52
%	10	2	0	2	0	2	8	2	4	17	12	17	10	15	0	100
Total	152	16	201	27	68	182	91	96	142	491	435	667	532	180	11	3291
%	5	0	6	1	2	6	3	3	4	15	13	20	16	5	0	100

Table 23: Coping strategies undertaken by the households with respect to the economic risks faced- MP

Landholding categories	stored crops for better price	carried out primary processing	reduced hh consumption	reduced health exp	took children out of school	deferred social and family functions	sold land	sold livestock	mortgaged/leased out land	borrowed money from bank	borrowed money from money lenders	borrowed money from friends/relatives	worked for wage lab in the village	started petty business	total
marginal	0	13	31	29	34	51	0	3	7	40	4	1	25	10	248
%	0	5	13	12	14	21	0	1	3	16	2	0	10	4	100
small	0	27	32	31	51	63	1	5	9	83	8	4	35	8	357
%	0	8	9	9	14	18	0	1	3	23	2	1	10	2	100
medium	17	28	42	38	44	65	1	7	5	100	12	0	21	6	386
%	4	7	11	10	11	17	0	2	1	26	3	0	5	2	100
large	31	14	16	7	25	33	2	5	1	48	10	1	0	11	204
%	15	7	8	3	12	16	1	2	0	24	5	0	0	5	100
very large	24	4	7	9	11	20	0	5	0	23	4	1	0	4	112
%	21	4	6	8	10	18	0	4	0	21	4	1	0	4	100
Total	72	86	128	114	165	232	4	25	22	294	38	7	81	39	1307
%	6	7	10	9	13	18	0	2	2	22	3	1	6	3	100

Table 24: Coping strategies undertaken by the households with respect to the economic risks faced- Punjab

Landholding categories	stored crops for better price	Reduced household consumption expenditure	deferred social & family functions	Borrowed money from bank	Borrowed money from input dealer/commission agents	Borrowed from friends and relatives	started petty business /shops	total
marginal	0	12	9	0	1	1	2	25
%	0	48	36	0	4	4	8	100
small	0	9	4	0	2	0	1	16
%	0	56	25	0	13	0	6	100
medium	2	10	9	3	1	0	2	27
%	7	37	33	11	4	0	7	100
large	5	10	7	3	3	1	0	29
%	17	34	24	10	10	3	0	100
very large	2	2	1	0	0	0	0	5
%	40	40	20	0	0	0	0	100
Total	9	43	30	6	7	2	5	102
%	9	42	29	6	7	2	5	100

Table 25: Whether aware of MSP related to paddy

	Bihar			Gujarat			MP			Punjab			Overall sample		
categories	yes	no	Total	yes	no	total	yes	no	total	yes	no	total	yes	no	total
marginal	0	130	130	57	105	162	26	0	26	46	0	46	129	235	364
%	0	100	100	35	65	100	100		100	100		100	35	65	100
small	3	84	87	43	47	90	40	0	40	61	0	61	147	131	278
%	3	97	100	48	52	100	100		100	100		100	53	47	100
medium	2	49	51	34	18	52	29	0	29	65	0	65	130	67	197
%	4	96	100	65	35	100	100		100	100		100	66	34	100
large	0	27	27	31	1	32	9	0	9	43	0	43	83	28	111
%	0	100	100	97	3	100	100		100	100		100	75	25	100
very large	0	5	5	7	0	7	1	0	1	12	0	12	20	5	25
%	0	100	100	100		100	100		100	100		100	80	20	100
Total	5	295	300	172	171	343	105	0	105	227	0	227	509	466	975
%	2	98	100	50	50	100	100		100	100		100	52	48	100

Table 26: Average payment received under PM-KISAN and time taken

	Bihar			Gujarat			MP			Punjab		
Landholding categories	payment received (Rs)	no of households who received the payment	time taken (in months)	payment received (Rs)	no of households who received the payment	time taken (in months)	payment received (Rs)	no of households who received the payment	time taken (in months)	payment received (Rs)	no of households who received the payment	time taken (in months)
marginal	4708	130(100)	9	4746	260 (83)	7	2350	40 (49)	1	3433	60 (75)	2
small	4667	87 (100)	9	4471	191 (80)	6	2385	52 (46)	1	2982	55 (59)	2
medium	5000	4 (8)	9	4404	109 (70)	6	2308	52 (43)	1	3636	22 (31)	2
large		0		4847	59 (78)	6	2111	18 (32)	1	4000	8 (18)	2
very large	6000	1 (20)	9	4250	8 (57)	5	2444	9 (32)	1		0	
total	4703	222 (78)	9	4606	627 (74)	6	2327	171 (43)	1	3324	145 (48)	2

Please note figures in parentheses are percentages of households who received the payment out of the total sample households.

Table 27: Value Added (per ha)

EQUATION NAME	VALUE ADDED (per ha)					
Dependent variable:	L_VA1PERHA					
Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
C	6.30***	6.32***	6.34***	7.55***	7.62***	7.71***
L_OPAREA	-0.26***	-0.33***	-0.26***	-0.32***	-0.53***	-0.35***
L_OWN_LAND	0.41***	0.42***	0.40***	0.47***	0.48***	0.32***
PER_IRR_OP	0.005**	0.005**	0.005**	0.003	0.002	0.002
PER_AR_PDWHSUG	0.007***	0.007***	0.007***	0.003**	0.004**	0.004**
L_EXP_FERT_HA	0.31***	0.30***	0.30***	0.21***	0.22***	0.21***
State dummies	Yes	Yes	Yes			
State interaction dummies	No	Yes	Yes			
State interacted with		Operated Area	Own Land			
Village dummies				Yes	Yes	Yes
Village interaction dummies				No	Yes	Yes
Village interacted with					Operated Area	Own Land
Adjusted R sq	0.36	0.36	0.36	0.48	0.5	0.5
Log-likelihood	-1785.85	-1784.17	-1784.42	-1613.7	-1560.25	-1562.74
No. of included observations	1503	1503	1503	1503	1503	1503

Note: Level of significance - *,**,*** denote significance at 10%, 5% and 1% respectively

Table 28: Value added (per person or per capita)

EQUATION NAME	VALUE ADDED (per person or per capita)					
Dependent variable:	L_VA1PERPRN					
Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
C	7.22***	4.64***	4.66***	6.03***	6.02***	6.10***
L_OPAREA	0.60***	0.68***	0.62***	0.53***	0.46***	0.52***
L_OWN_LAND	0.47***	0.43***	0.53***	0.53***	0.50***	0.44***
PER_IRR_OP	0.01***	0.01***	0.01***	0.002	0.002	0.002
PER_AR_PDWHSUG	0.01***	0.01***	0.01***	0.004***	0.005***	0.005***
L_EXP_FERT_HA		0.28***	0.28***	0.20***	0.21***	0.20***
State dummies	Yes	Yes	Yes			
State interaction dummies	No	Yes	Yes			
State interacted with		Operated Area	Own Land			
Village dummies				Yes	Yes	Yes
Village interaction dummies				No	Yes	Yes
Village interacted with					Operated Area	Own Land
Adjusted R sq	0.64	0.65	0.65	0.71	0.72	0.72
Log-likelihood	-1953.41	-1932.61	-1931.32	-1779.15	-1724.97	-1724.92
No. of included observations	1504	1503	1503	1503	1503	1503

Note: Level of significance - *,**,*** denote significance at 10%, 5% and 1% respectively

Table 29: Intensity of family labour use

EQUATION NAME	Labour			
Dependent variable:	RATIO_FL_HL_DAYS			
Explanatory variables	Model 1	Model 2	Model 3	Model 4
C	1.51***	1.69***	1.09**	0.97*
L_OPAREA	-0.90***	-0.98***	-1.24***	-0.71***
CI_CROP_INTEN	-0.002	-0.003	0.002	0.001
State dummies	Yes	Yes		
State interaction dummies	No	Yes		
State interacted with		Operated Area		
Village dummies			Yes	Yes
Village interaction dummies			No	Yes
Village interacted with				Operated Area
Adjusted R sq	0.22	0.22	0.35	0.38
Log-likelihood	-4085.89	-4080.4	-3935.72	-3889.41
No. of included observations	1420	1420	1420	1420

Note: Level of significance - *,**,*** denote significance at 10%, 5% and 1% respectively.

Table 30: Fertilizer consumption expenditure

EQUATION NAME	Fertilizer			
Dependent variable:	L_EXP_FERT_HA			
Explanatory variables	Model 1	Model 2	Model 3	Model 4
C	8.91***	8.89***	8.86***	8.83***
L_OPAREA	-0.004	0.06***	-0.03**	0.03
PER_IRR_OP	0.005***	0.005***	0.004***	0.003***
PER_AR_PDWHSUG	0.001**	0.001	0.004***	0.005***
State dummies	Yes	Yes		
State interaction dummies	No	Yes		
State interacted with		Operated Area		
Village dummies			Yes	Yes
Village interaction dummies			No	Yes
Village interacted with				Operated Area
Adjusted R sq	0.24	0.24	0.41	0.44
Log-likelihood	-1461.27	-1452.21	-1218.2	-1150.14
No. of included observations	1797	1797	1797	1797

Note: Level of significance - *,**,*** denote significance at 10%, 5% and 1% respectively.

Table 31: Cropping intensity

EQUATION NAME	Cropping Intensity			
Dependent variable:	CI_CROP_INTEN			
Explanatory variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
C	92.66***	90.91***	110.93***	110.91***
L_OPAREA	-6.13***	3.94**	-2.38**	-1.76
PER_IRR_OP	0.29***	0.28***	0.10**	0.09**
RATIO_FL_HL_DAYS	-0.16	-0.27	0.14	0.06
State dummies	Yes	Yes		
State interaction dummies	No	Yes		
State interacted with		Operated Area		
Village dummies			Yes	Yes
Village interaction dummies			No	Yes
Village interacted with				Operated Area
Adjusted R sq	0.45	0.47	0.66	0.7
Log-likelihood	-7173.92	-7145.24	-6805.01	-6709.88
No. of included observations	1420	1420	1420	1420

Note: Level of significance - *,**,*** denote significance at 10%, 5% and 1% respectively.

Table32: Access to Bank Credit

EQUATION NAME	Credit
Dependent variable:	AMT_GOVBNK
Explanatory variables	**Model 1**
C	-3596922***
L_OWN_LAND	114182.4***
State dummies	Yes
State interaction dummies	No
State interacted with	-
Adjusted R sq	
Log-likelihood	-7411.506
No. of included observations	556

Note: Level of significance - *,**,*** denote significance at 10%, 5% and 1% respectively

Table 33: State and village effects: Value added per hectare

State/village No.	State / Village name	Operated Area		Owned land	
		Intercept effect	Interaction (slope) effect	Intercept effect	Interaction (slope) effect
1	Gujarat	***		***	
2	MP	***	**	***	
3	Punjab	***		***	
	Villages				
2	Korai				**
3	Kurpat		**		***
4	Rangra				
5	Nabaganj		*		**
6	Narayanpur				*
7	Sahij	***	**	***	*
8	Vanch	***		***	
9	Moti Pavad				
10	Vasana	***	***	***	***
11	Vasana-Vatam				
12	Umalla	***		***	
13	Otha	***		***	
14	Shirvaniya				
15	Haripar				
16	Theba	***		***	
17	Heranj	***	***	***	**
18	Savali	***	***	***	***
19	Janod	***	**	***	*
20	Limbadiya				
21	Vad		***		***
22	Kumbhari	***		***	
23	Kikakui				
24	Butte Hajari	***	***	***	***
25	Merigaon	***		***	
26	Gadariya	***		***	
27	Rampura	***		***	
28	Badgama	***	***	***	***
29	Palduna	***	*	***	
30	Badkhera Gambheer	**		**	
31	Badkhera Kachwa		***		***
32	Ghuman Kalan	***		***	
33	Kararwala	***		***	
34	Asalpur	***	***	***	***
35	Khun Khun Khurd	***	***	***	***
36	Khusrpur	***	***	***	***
37	Lachowal	***	***	***	***
38	Madiala	***	***	***	***
39	Nainowal Vaid	***	***	***	***
40	Pathial	***	***	***	***
41	Rampur	***	***	***	***
42	Sherpur	***	***	***	***
43	Sikri	***	***	***	***
44	Bhinder Khurd	***		***	*
45	Chuhar Chak	***		***	

Villages showing significant interaction effect– 3, 5, 7, 10, 17-19, 21, 24, 28, 31, 34-43 – Total 21 villages

Table 34: State and village effects: Value added per capita

State/village No.	State / Village name	Operated Area		Owned land	
		Intercept effect	Interaction (slope) effect	Intercept effect	Interaction (slope) effect
1	Gujarat	***		***	**
2	MP	***		***	
3	Punjab	***	*	***	**
	Villages				
2	Korai				**
3	Kurpat	*	***		***
4	Rangra				*
5	Nabaganj		*		**
6	Narayanpur				*
7	Sahij	***		***	
8	Vanch	***		***	
9	Moti Pavad				
10	Vasana	***	***	***	***
11	Vasana-Vatam				
12	Umalla	***		***	
13	Otha	***		***	
14	Shirvaniya				
15	Haripar			**	
16	Theba	***		***	
17	Heranj	***		***	
18	Savali	***	***	***	***
19	Janod	***	**	***	*
20	Limbadiya	***		***	
21	Vad	**	***	**	***
22	Kumbhari	***		***	
23	Kikakui				
24	Butte Hajari	***	*	***	
25	Merigaon	***		***	
26	Gadariya	***		***	
27	Rampura	***		***	
28	Badgama	***	**	***	*
29	Palduna	***		***	
30	Badkhera Gambheer	***		***	
31	Badkhera Kachwa	**	**	**	**
32	Ghuman Kalan	***		***	
33	Kararwala	***		***	
34	Asalpur	***	***	***	***
35	Khun Khun Khurd	***	***	***	***
36	Khusrpur	***	***	***	***
37	Lachowal	***	***	***	***
38	Madiala	***	***	***	***
39	Nainowal Vaid	***	***	***	***
40	Pathial	***	***	***	***
41	Rampur	***	***	***	***
42	Sherpur	***	***	***	***
43	Sikri	***	***	***	***
44	Bhinder Khurd	***		***	
45	Chuhar Chak	***		***	

Villages showing significant interaction effect – 3, 5, 10, 18-19, 21, 28, 31, 34-43 – Total 18 villages

Table 35: State and village effects: Ratio of family labour to hired labour

State/village No.	State / Village name	Operated Area	
		Intercept effect	Interaction (slope) effect
1	Gujarat	***	
2	MP	**	***
3	Punjab	***	
	Villages		
2	Korai		
3	Kurpat		
4	Rangra		
5	Nabaganj		**
6	Narayanpur		
7	Sahij	***	***
8	Vanch	**	
9	Moti Pavad	**	**
10	Vasana		***
11	Vasana-Vatam	**	
12	Umalla	***	
13	Otha	**	
14	Shirvaniya	***	
15	Haripar	***	
16	Theba	**	
17	Heranj	***	
18	Savali	***	***
19	Janod	***	***
20	Limbadiya	***	***
21	Vad	*	
22	Kumbhari		
23	Kikakui		**
24	Butte Hajari	***	***
25	Merigaon	***	***
26	Gadariya	***	***
27	Rampura	***	***
28	Badgama	**	***
29	Palduna	***	***
30	Badkhera Gambheer	***	***
31	Badkhera Kachwa	***	***
32	Ghuman Kalan	***	
33	Kararwala	***	***
34	Asalpur	***	***
35	Khun Khun Khurd	***	***
36	Khusrpur	***	***
37	Lachowal	***	***
38	Madiala	***	***
39	Nainowal Vaid	***	***
40	Pathial	***	***
41	Rampur	***	***
42	Sherpur	***	***
43	Sikri	***	***
44	Bhinder Khurd		
45	Chuhar Chak	***	*

Villages showing significant interaction effect – 2, 5, 7, 9, 10, 18-20, 24-31, 33-43, 45 – Total 28 villages

Table 36: State and village effects: Fertilizer consumption expenditure

State/village No.	State / Village name	Operated Area	
		Intercept effect	Interaction (slope) effect
1	Gujarat	***	***
2	MP	***	
3	Punjab	***	
	Villages		
2	Korai		
3	Kurpat		
4	Rangra		
5	Nabaganj		
6	Narayanpur		
7	Sahij	***	
8	Vanch	***	***
9	Moti Pavad		*
10	Vasana		
11	Vasana-Vatam	**	**
12	Umalla	***	**
13	Otha		
14	Shirvaniya	***	
15	Haripar	***	**
16	Theba	***	
17	Heranj	***	
18	Savali	***	***
19	Janod	***	
20	Limbadiya	***	***
21	Vad	***	
22	Kumbhari	***	
23	Kikakui	***	
24	Butte Hajari	***	
25	Merigaon	***	**
26	Gadariya	***	
27	Rampura	***	
28	Badgama	***	
29	Palduna		
30	Badkhera Gambheer	***	
31	Badkhera Kachwa	***	
32	Ghuman Kalan	***	
33	Kararwala	***	***
34	Asalpur	***	**
35	Khun Khun Khurd	***	**
36	Khusrpur	***	**
37	Lachowal	***	**
38	Madiala	***	**
39	Nainowal Vaid	***	**
40	Pathial	***	**
41	Rampur	***	**
42	Sherpur	***	**
43	Sikri	***	**
44	Bhinder Khurd	***	
45	Chuhar Chak	***	**

Villages showing significant interaction effect – 8, 11, 12, 18, 20, 25, 33-43, 45 – Total 18 villages

Table 37: State and village effects: Cropping Intensity

State/village No.	State / Village name	Operated Area	
		Intercept effect	Interaction (slope) effect
1	Gujarat	***	***
2	MP	***	
3	Punjab	***	
	Villages		
2	Korai		
3	Kurpat		*
4	Rangra		
5	Nabaganj		
6	Narayanpur		
7	Sahij	***	**
8	Vanch	***	**
9	Moti Pavad	***	***
10	Vasana		
11	Vasana-Vatam	***	
12	Umalla	***	
13	Otha		
14	Shirvaniya	***	
15	Haripar	***	
16	Theba	***	
17	Heranj		
18	Savali	***	***
19	Janod		
20	Limbadiya	***	*
21	Vad	***	
22	Kumbhari	***	
23	Kikakui		
24	Butte Hajari	***	
25	Merigaon	***	
26	Gadariya	***	
27	Rampura	***	
28	Badgama	***	
29	Palduna	***	
30	Badkhera Gambheer	***	
31	Badkhera Kachwa	***	
32	Ghuman Kalan	***	
33	Kararwala	***	***
34	Asalpur	***	**
35	Khun Khun Khurd	***	**
36	Khusrpur	***	**
37	Lachowal	***	**
38	Madiala	***	**
39	Nainowal Vaid	***	**
40	Pathial	***	**
41	Rampur	***	**
42	Sherpur	***	**
43	Sikri	***	**
44	Bhinder Khurd	*	**
45	Chuhar Chak	***	

Villages showing significant interaction effect – 7-9, 18, 20, 33-44, 45 – Total 18 villages

Table 38: State effects: Credit

State/village No.	State / Village name	Intercept effect
1	Gujarat	*
2	MP	*
3	Punjab	**

Appendix A.1: List of Villages in the study

	State	District	Village	Number of sample households
	Bihar	Begusarai	Kesabe	50
			Korai	50
		Bhagalpur	Kurpat	50
			Rangra	50
		Katihar	Nabaganj	50
			Narayanpur	50
	Gujarat	Ahmedabad	Sahij	50
			Vanch	50
		Banas Kantha	Moti Pavad	50
			Vasana	25
			Vasana-Vatam	25
		Bharuch	Umalla	50
		Bhavnagar	Otha	50
		Botad	Shirvaniya	50
		Jamnagar	Haripar	50
			Theba	50
		Kheda	Heranj	50
			Savali	50
		Mahisagar	Janod	50
			Limbadiya	50
		Navsari	Vad	50
		Surat	Kumbhari	50
		Tapi	Kikakui	50
	MP	Balaghat	Butte Hajari	50
			Merigaon	50
		Hoshangabad	Gadariya	50
			Rampura	50
		Ujjain	Badgama	50
			Palduna	50
		Vidisha	Badkhera Gambheer	53
			Badkhera Kachwa	47
	Punjab	Bathinda	Ghuman Kalan	50
			Kararwala	50
		Hoshiarpur	Asalpur	2
			Khun Khun Khurd	7
			Khusrpur	2
			Lachowal	16
			Madiala	3
			Nainowal Vaid	36
			Pathial	7
			Rampur	10
			Sherpur	13
			Sikri	4
		Moga	Bhinder Khurd	50
			Chuhar Chak	50
Total	**4**	**21**	**45**	1800

References

Assunção Juliano J. and Luis H. B. Braido (2007), "Testing Household-Specific Explanations for the Inverse Productivity Relationship", *American Journal of Agricultural Economics*, Nov., 2007, Vol. 89, No. 4 (Nov., 2007), pp. 980-990

Bardhan, P. K. (1973) "Size, Productivity and Returns to Scale: An Analysis of Farm Level Data in Indian Agriculture," *Journal of Political Economy* (November-December, 1973): 1370-86 1973a.

Bardhan, P. (Ed.). (1989b): *The Economic Theory of Agrarian Institutions* (Oxford: Clarendon Press).

Bardhan, P. K. (1977). Variations in forms of tenancy in a peasant economy. *Journal of Development Economics*, *4*(2), 105-118.

Barrett, C. B., &Mutambatsere, E. (2008). *Agricultural markets in developing countries*.

Barrett, Christopher B., Marc F. Bellemare, and Janet Y. Hou. 2010. "Reconsidering Conventional Explanations of the Inverse Productivity-Size Relationship." *World Development* 38 (1): 88–97.

Basu, K. (1983). The emergence of isolation and interlinkage in rural markets. *Oxford Economic Papers*, *35*(2), 262-280.

Bhaduri, A. (1977). On the Formation of Usurious Interest Rates in Backward Agriculture. *Cambridge Journal of Economics*, vol. 1.

Berry, R. A (1973). "Land Distribution, Income Distribution, and the Productive Efficiency of Colombian Agriculture," *Food Research Institute Studies* 12 (3), 1973.

Berry, A. R. and Cline, William R. (1979), *Agrarian Structure and Productivity in Developing Countries*, Johns Hopkins University Press, Baltimore, 1979.

Bhagwati, J. N. and Chakravarty, S. "Contributions to Indian Economic Analysis: A Survey," *American Economic Review* (supplement) September 1969.

Bhalla, Surjit S. (1986), "*Size Determination of Farms-Theory and Evidence*", World Bank, Aug. 1986.

Bhalla, Surjit S. and Prannoy Roy (1988), "Mis-Specification in Farm Productivity Analysis: The Role of Land Quality", *Oxford Economic Papers* , Mar., 1988, New Series, Vol. 40, No. 1 (Mar., 1988), pp. 55-73.

Binswanger, H. P. and Deininger, K. (1997), Explaining agricultural and agrarian policies in developing countries. *Journal of Economic Literature 35, 1958-2005.*

Binswanger, H. P., & McIntire, J. (1987). Behavioral and material determinants of production relations in land-abundant tropical agriculture. *Economic Development and Cultural Change*, *36*(1), 73-99.

Binswanger-Mkhize, Hans P. and Alwind'Souza (2012) "Structural Transformation of the Indian Economy and its Agriculture" in *Productivity Growth in Agriculture:An International Perspective* (eds) K Fuglie, S L Wang, and E Ball

Brandt, L. (1987). Farm household behavior, factor markets, and the distributive consequences of commercialization in early twentieth-century China. *The Journal of Economic History*, *47*(3), 711-737.

Braverman, Avishay and Stiglitz, Joseph E. (1982). "Sharecropping and the Interlinking of Agrarian Markets", *American Economic Review*, September.

Braverman, Avishay and J. Luis Guasch (1986) "Rural Credit Markets and Institutions in Developing Countries: Lessons for Policy Analysis from Practice and Modern Theory", *World Development*, Vol. 14, No 10/11, pp. 1253-1267, 1986

Chatterjee S., Krishnamurthy, M., Kapur, D. and Bouton, M (2020) "A Study of the Agricultural Markets of Bihar, Odisha and Punjab", Final Report, *Center for the Advanced Study of India, University of Pennsylvania: Philadelphia.*

Chavas, Jean-Paul and Mathew T Holt (1990): "Acreage Decisions under Risk: The Case of Corn and Soybeans," *American Journal of Agricultural Economics*, Vol 72, No 3, pp 529–38.

Chayanov, A. V. (1966), *The Theory of Peasant Economy*, ed. Daniel Thorner, B. Kerblay, R. E. F. Smith (Homewood: R. D. Irwin) 1966.

Cheung, *S* .(1969). *The Theory* of *Share Tenancy.* Chicago: The University of Chicago Press.

Carter, M. R.(1984), "Identification of the Inverse Relationship between Farm Size and Productivity: An Empirical Analysis of Peasant Agricultural Production", *Oxford Economic Papers*, 36, 1984.

Cramer, H.,(1930), "On the Mathematical Theory of Risk", Stockholm, *Skandia Jubilee Volume*, 1930.

Datta-Chaudhuri, M. (1990). Market failure and government failure. *Journal of Economic Perspectives*, *4*(3), 25-39.

Deininger S Klaus, SongqingJin, Yanyan Liu and Sudhir K. Sing (2018), "Can Labor-Market Imperfections Explain Changes in the Inverse Farm Size–Productivity Relationship? Longitudinal Evidence from Rural India", *Land Economics*, May 2018, 94 (2): 239–258

De Janvry, A., &Sadoulet, E. (2006). Progress in the modeling of rural households' behavior under market failures. In *Poverty, inequality and development* (pp. 155-181). Springer, Boston, MA.

De Janvry, A., Fafchamps, M., &Sadoulet, E. (1991). Peasant household behaviour with missing markets: some paradoxes explained. *The Economic Journal*, *101*(409), 1400-1417.

Dreze, Jean and Amartya Sen (1995): *India: Economic Development and Social Opportunity*, Oxford University Press, Walton Street, Oxford.

Eswaran, M., &Kotwal, A. (1986). Access to capital and agrarian production organisation. *The Economic Journal*, *96*(382), 482-498.

Foltz, J. D. (2004). Credit market access and profitability in Tunisian agriculture. *Agricultural Economics*, *30*(3), 229-240.

Foster, A., &Rosenzweig, M. R. (2010, September). Barriers to farm profitability in India: mechanization, scale and credit markets. In *Conference Agriculture for Development-Revisited, University of California at Berkeley. October* (Vol. 24, pp. 1-2).

Fulginiti, Lilyan E. and Richard K. Perrin. (1993). Prices and Productivity in Agriculture. *The Review of Economics and Statistics*, Aug., 1993, Vol. 75, No. 3 (Aug., 1993), pp. 471-482

GoI (2016), *Report of the Expert Committee on Land Leasing*, NITI Aayog, Government of India, New Delhi, March 31, 2016

Harriss-White, B. (Ed.). (1999). *Agricultural markets from theory to practice: Field experience in developing countries*. Springer.

Hayami, Yujiro, and Vernon W. Ruttan .(1970). Agricultural Productivity Differences among Countries. *American Economic Review* (Dec. 1970), 895-911.

Heltberg, R. (1998). Rural market imperfections and the farm size—productivity relationship: Evidence from Pakistan. *World Development*, *26*(10), 1807-1826.

Holden, S. T., & Binswanger, H. P. (1998). Small-farmer decisionmaking, market imperfections, and natural resource management in developing countries. *Agriculture and the environment: perspectives on sustainable rural development*, 50-71.

Holden, S., Shiferaw, B., & Pender, J. (2001). Market imperfections and land productivity in the Ethiopian highlands. *Journal of Agricultural economics*, *52*(3), 53-70.

Jan, M. A., &Harriss-White, B. (2012). The three roles of agricultural markets: a review of ideas about agricultural commodity markets in India. *Economic and Political Weekly*, 39-52.

Johnson, D. G. (1950). Resource allocation under share contracts. *Journal of Political economy*, *58*(2), 111-123.

Khusro, A. M (1964), "Returns to Scale in Indian Agriculture", *Indian Journal of Agricultural Economics*, July-December 1964.

Knight, F. H. (1957). Risk, uncertainty and profit,[Boston and New York, 1921. *Auflage Chicago*.

Lundeberg, Filip (1903), "Approximerad [ramstdllningavsannolikhets]unktioneD, AterfOrs~kringavkollektivrisker, Akad. Afhandl., Uppsala, 1903

Nabi, I. (1985). Rural factor market imperfections and the incidence of tenancy in agriculture. *Oxford Economic Papers*, *37*(2), 319-329.

NitiAayog(2020)*, Understanding the Farm Acts,* Working Paper 1/2020, NitiAyog, November 2020

Rada, N. E., &Fuglie, K. O. (2019). New perspectives on farm size and productivity. *Food Policy*, *84*, 147-152.

Rao, C.H.H. (1971). Uncertainty, entrepreneurship, and sharecropping in India. *Journal of Political Economy*, *79*(3), 578-595.

Roth, H. D. (1979). Moneylenders' management of loan agreements: report on a case study in Dhanbad. *Economic and Political Weekly*, 1166-1170.

Rudra, Ashok (1968), "More on Returns to Scale in Indian Agriculture", *Economic and Political Weekly*, Oct. 26, 1968.

Sekhar, C.S.C. (2005), 'Economic Growth, Social Development and Interest Groups', *Economic and Political Weekly*, Vol 40, No 50. Dec 10-16. 2005, pp. 5338-5346

Sen, A. K. (1962), "An aspect of Indian agriculture", *Economic Weekly* 14.

Sen, A. K. (1966). "Peasants and dualism with or without surplus labor", *Journal of Political Economy* 74, 425-450.

Singh, I., Squire, L. and Strauss, J. (eds.). (I986). Agricultural Household Models. Baltimore: The Johns Hopkins University Press.

Skoufias, E. (1995) Household resources, transaction costs, and adjustment through land tenancy. *LandEconomics 71,42-56.*

Srinivasan, T. N. (1972), "Farm Size and Productivity-Implications of Choice under Uncertainty", *Indian Journal of Statistics*, Series B, Vol. 34, part 4, 1972.

Stiglitz, J. (1974). Incentives and Risk Sharing in Sharecropping. *Review* of *Economic Studies,* 41,219-55.

Tey, Y. S., &Brindal, M. (2015). Factors Influencing Farm Profitability. In *Sustainable Agriculture Reviews* (pp. 235-255). Springer, Cham.

Udry, C. (1996). *Efficiency and market structure: testing for profit maximization in African agriculture.* Department of Economics, Northwestern University.

Ünal, F. G. (2012). Sharecropping or Fixed-Rent Tenancy? In *Land Ownership Inequality and Rural Factor Markets in Turkey* (pp. 63-94). Palgrave Macmillan, New York.

Williamson, O. E. (1993). Transaction cost economics and organization theory. *Industrial and Corporate Change*, *2*(2), 107-156.

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