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Smallholder Farming in Asia and the Pacific: Challenges and Opportunities

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Smallholder Farming in Asia and the Pacific: Challenges, and Opportunities[3]

SUMMARY

This paper assesses the challenges and opportunities faced by small or family farming in Asia and the Pacific Region in sustainable agricultural production and productivity enhancements, and in diversifying into high value commodities.

It is estimated that about 87 per cent of the world's 500 million small farms (less than 2 ha) are in Asia and the Pacific region. China and India alone account for 193 million and 93 million farms, respectively.

Small farms continue to contribute significantly to agricultural production, food security, rural poverty reduction, and biodiversity conservation despite the challenges they face in the access to productive resources and service delivery. They confront new challenges on integration into high value chains, adaptation to climate change, and market volatility and other risks and vulnerability.

They have integrated successfully into high value chains contingent upon support through intermediation (e.g. public –private cooperation in ensuring food safety standards) and internalisation (e.g. through producers' association in meeting quality standards).

Attractive investment opportunities have opened up in agriculture, leading to large-scale investments and competition for land. While new economies of scale (e.g. in external financing) have emerged, elimination of biases against smallholders (e.g. in credit) would enhance their competitiveness.

In complementing incentives to the private sector to innovate, governments must play an active role in coordinating the delivery of inputs, technical and output marketing services to small farms. Support is also needed to enable them to adapt to climate change and market volatility.

[3] An earlier version of the paper (Thapa 2010) was presented at the Roundtable on the role of smallholder agriculture and family farming in Asia and Latin America and options for South-South cooperation organized by the International Fund for Agricultural Development (IFAD) on 18 February 2010 in Rome.

I. Introduction

Small farms, also known as family farms, have been defined in a variety of ways. The most common measure is farm size: many sources define small farms as those with less than 2 hectares of crop land. Others describe small farms as those depending on household members for most of the labour or those with a subsistence orientation, where the primary aim of the farm is to produce the bulk of the household's consumption of staple foods (Hazell et al., 2007). Yet others define small farms as those with limited resources including land, capital, skills and labour. The World Bank's Rural Development Strategy defines smallholders as those with a low asset base, operating less than 2 hectares of cropland (World Bank, 2003). An FAO study defines smallholders as farmers with limited resource endowments, relative to other farmers in the sector (Dixon et al 2003). In this paper, small farms have been defined as those with less than 2 hectares of land area and those depending on household members for most of the labour[4].

It is estimated that about 87 per cent of the world's 500 million small farms (less than 2 ha) are in Asia and the Pacific region (IFPRI, 2007). China and India alone account for 193 million and 93 million small farms, respectively. Three other Asian countries with a large number of small farms are Indonesia (17 million), Bangladesh (17 million) and Viet Nam (10 million).

Agriculture in Asia is characterized by smallholders cultivating small plots of land. The average size of operational holdings (actual area cultivated) is only 0.5 hectares in Bangladesh, 0.8 hectares in Nepal and Sri Lanka, 1.4 hectares in India and 3.0 hectares in Pakistan. About 81 per cent of farms in India have land holdings of less than 2 hectares, whereas their share in total cultivated area is about 44 per cent (NCEUS, 2008). In China 95 per cent of farms are smaller than 2 hectares. In Nepal 93 per cent of operational holdings are operated by small farmers (<2 hectares) covering 69 per cent of the cultivated area. In Bangladesh, small farms account for 96 per cent of operational holdings with a share of 69 per cent of cultivated area. Pakistan is an exception, with a relatively high concentration of large landholdings. Fifty eight per cent of farms in Pakistan are of less than 2 hectares but they operate only 16 per cent of the farm area. In contrast, farms of more than 10 hectares occupy 37 per cent of total farm area.

The overall trend in Asia has been that of declining farm size over time. For example, in China farm size decreased from 0.56 hectares in 1980 to 0.4 hectares in 1999 (Fan and Chan-Kang, 2003); in Pakistan it declined from 5.3 hectares in 1971-73 to 3.1 hectares in 2000; in the Philippines the average farm size fell from 3.6 hectares in 1971 to 2 hectares in 1991; and in India it declined from 2.2 hectares in 1950 to 1.8 hectares in 1980, to 1.4 hectares in 1995-96 and to 1.33 hectares in 2000-01 (Nagayets, 2005; Government of India, 2008). In Bangladesh, the average farm size declined from 1.4 ha in 1977 to 0.6 ha in 1996 whereas in Thailand, it declined from 3.8 to 3.4 ha between 1978 and 1993 (Table 1).

In Asia, the Gini coefficient in land distribution is declining in India whereas it is increasing in other countries like Bangladesh, Pakistan and Thailand. In many countries of Asia and the Pacific, unequal land access is perpetuated through social mechanisms, which leave many households belonging to indigenous peoples or ethnic minorities without access to land or with land plots too small to meet their needs.

The number of small farms and their share in total cultivated area has been increasing over time in some Asian countries. For example, in India, small farms accounted for almost 81 per cent of operational holdings in 2002-03 compared to about 62 per cent in 1960-61 (Table 2).

[4] With the exception of the analysis of size, marketed surplus and price in India, where land is measured in terms of acres instead of hectares.

Correspondingly, the area operated by small farms increased from about 19 per cent to 44 per cent during this period (NCEUS, 2008). The distribution of landownership in India has become less skewed. The share of land area owned by small farms increased from 20% in 1961-62 to 43.5% in 2003. Also, the trend toward landlessness also appears to have been arrested, with the percentage of landless between 1971-72 and 2003 remaining approximately at 10%. In India the distribution of operational holdings (actual area cultivated) closely mirrors the distribution of land owned.

Smallholders' contribution to the total value of agricultural output is also significant in many countries of Asia. For example, in India their contribution to total farm output exceeds 50 per cent although they cultivate only 44 per cent of land. Many studies have also confirmed the inverse relationship between farm size and productivity per hectare. Small farmers are characterized by smaller applications of capital but higher use of labour and other family-owned inputs, and a generally higher index of cropping intensity and diversification. The inverse relationship between farms size and productivity is a powerful rationale for land reform policies, including land redistribution for both efficiency and equity gains. Small farms tend to grow a wide variety of cultivars, many of which are landraces. These landraces are genetically more heterogeneous than modern varieties, offer greater resilience against vulnerability and enhance harvest security in the midst of diseases, pests, droughts and other stresses (Clawson 1985).

More recent evidence from India confirming but elaborating the inverse size-productivity relation in agriculture is given in Section III.

Experience has shown that Asian countries such as India that promoted small farms were able to launch the Green Revolution. Countries like China started supporting smallholder farming after collective farms could not provide adequate incentives to increase production and productivity.

This paper assesses the challenges and opportunities faced by small or family farming in Asia and the Pacific region in sustainable agricultural production and productivity enhancement, and in diversifying into high-value commodities. It first gives a brief account of the transformation of the agriculture sector in the region from the mid-1960s to the mid-1990s, which was characterized by a dramatic increase in agricultural production and productivity through major breakthroughs in technological innovations, and the more recent transformation, which is characterized by significant changes in diets brought about by increases in incomes, urbanization and globalization, and the resulting changes in production of high-value commodities and major transformation in the agrifood industry. The paper then discusses the challenges faced by smallholders in addressing the problems related to sustainability of food production as well as agricultural diversification. Of particular importance in this context is responsiveness of marketed surplus of food commodities to prices. Based on a recent household survey in India, new light is thrown on whether smallholders are constrained in marketing their outputs of these commodities. Also, two inter-related issues are examined: (i) whether large scale investments in agriculture –especially in some of the poorest countries in Asia and the Pacific-are justified on efficiency grounds; and (ii) whether complementarities between large investors and smallholders could be better exploited. Following this, the paper highlights some of the technological and institutional innovations that have been tested to address such challenges. It then discusses the policy and programme support provided by selected countries in the region to small or family farms in enhancing productivity and in benefiting from emerging markets in high-value commodities. Finally, it identifies some measures that the governments, the private sector and international development partners can take to support small farmers in dealing with emerging challenges and in sharing experiences and learning from one another.

II. Transformation of agriculture

This section briefly discusses two important transformations in the agriculture sector, which have profound impact on the small or family farms of the two regions. In the first one, small farms played an important role particularly in Asia in raising food production and incomes based on biological, chemical and mechanical innovations. The second transformation is more recent and presents considerable challenge as well as opportunity for these farmers to benefit from new agriculture.

The Green Revolution

The Green Revolution in Asia, which mainly comprised a dramatic increase in the production of three important cereal crops – rice, maize and wheat – between 1965 and 1990, was driven by rapid advances in the sciences and substantial public investments in and policy support for agriculture (Hazell, 2009). This represented the first major transformation of the agriculture sector in Asia in its modern history. Cereal production more than doubled in Asia between 1970 and 1995, from 313 to 650 million tons per year (Table 3). As a result, per capita calorie availability increased by about 30 per cent and real prices of wheat and rice decreased. Higher production of all three major cereal crops was realized mainly through yield growth. Between 1965 and 1982, average rice, maize and wheat yields increased by 2.54 per cent, 3.48 per cent and 4.07 per cent per year, respectively. During the same period, cultivated area expanded by only 0.7 per cent, 1.09 per cent and 1.3 per cent, respectively.

The success of the Green Revolution in raising food production and productivity, broadening economic growth and reducing poverty has been impressive. Nevertheless, in recent years agricultural production has experienced a number of challenges that have cast doubts on the sustainability of past gains.

Recent transformations in agriculture

Growth in consumption and production of high-value commodities

Rapid economic and income growth, urbanization and globalization are leading to a significant shift in diet in Asia and the Pacific region, away from staples and increasingly towards livestock and dairy products, fruits and vegetables, and fats and oils. Rapid income growth is a key factor in the rising demand for high-value agricultural products. In most Asian countries urbanization is increasing rapidly and studies have shown that urban households spend more on meat, fish and sugar and less on rice than rural households, even after taking into account income and household characteristics (Minot et al., 2003).

Urbanisation, rapid growth in per capita incomes, and the increase in the opportunity cost of women's time as a result of their entry into the workforce led to greater demand for non-staples, particularly perishables and processed foods in Latin American countries (Reardon et al 2002). On the supply side, trade liberalisation since the early 1980s made it easier and cheaper to import food and non-food products.

Trade liberalization has also contributed to the growth of high-value agriculture. The reduction in import barriers in industrialized countries has favoured the growth of high-value exports such as fish and seafood products. Likewise, foreign direct investment has also facilitated the transformation of agricultural production in developing countries. It has facilitated the expansion of food processing, animal feed production, exports and food retailing. The entry of foreign companies into the agriculture sector has put competitive pressure on domestic agribusiness companies (Gulati et al., 2005).

A recent study by the International Food Policy Research Institute (IFPRI) analysed the growth of high-value agriculture in Asia and its implications on the restructuring of the agricultural supply

chain, and on the role of small farmers (Gulati et al., 2006). These countries include the largest and most important transforming countries of Asia – Bangladesh, India and Pakistan in South Asia; Indonesia, the Philippines, Thailand and Viet Nam in Southeast Asia; and China in East Asia.

The study documented a clear shift in food consumption from grains and other starchy staple crops such as cassava and sweet potatoes to meat, milk, eggs, fish, fruits and vegetables mainly due to income increases (Table 4). In these countries, per capita grain consumption either increased very slowly or even decreased between 1990 and 2000. In contrast, per capita demand for vegetables, fruits, and animal products increased substantially in all countries.

In addition to rising domestic demand, these high-value commodities have also experienced high export demand. High-value products such as fruits, vegetables, livestock products and fish constitute a rapidly growing share of international trade in agricultural products. In these countries as a group, the share of high-value exports in total agricultural exports increased from 47 per cent to 53 per cent.

Due mainly to the high growth in domestic demand and, to some extent, an increase in exports, the production of high-value commodities in many Asian countries has grown more rapidly than that of food grains. The production of food grains in the eight countries under study increased by 1.3 per cent per year during the 1990s, slightly below the population growth rate of 1.5 per cent. In contrast, the production of high-value commodities grew much more rapidly during this period (Table 5). For example, fruit and vegetable production increased by 7.7 per cent in these eight countries. China, in particular, achieved a very high growth rate in the production of fruits and vegetables. Between 1980 and 2004, 58 per cent of the increase in global horticulture production came from China, 38 per cent from all other developing countries and the remaining 4 per cent from developed countries (Ali, 2006). India, Indonesia, Pakistan and Viet Nam also recorded an annual growth rate of more than 3 per cent in the production of fruits and vegetables in the 1990s.

The production of livestock products also increased impressively in many Asian countries during the 1990s. Milk production grew by 4.6 per cent per year in these eight countries during this period. Most countries also achieved high growth rates in the production of eggs, meat and fish.

Transformation of agrifood industry

The growth in domestic consumption and production of high-value agricultural commodities in Asia and the Pacific was accompanied by a transformation of the agrifood industry, which includes processing, wholesale and retail. Governments contributed to this mainly through investment in municipal wholesale markets, parastatal processing firms and state-run retail chains. However, the main new developments are private-sector investment in and consolidation of processing and retail (Reardon et al., 2009).

An important element of this transformation is the restructuring of the wholesale sector, which started with the public investment phase in the 1970s-1980s in many parts of Asia and in the 1990s in China. This phase was characterized by public investment in the expansion and upgrading of wholesale markets, and investment in market information systems to reduce transaction costs for small farmers to gain access to growing urban markets. In the 1990s and 2000s, more attention was paid to deregulation of wholesale markets to allow greater entry and competition.

The second element of this transformation is the restructuring of the processing sector. In the 1990s, private small and medium-sized processing companies grew due to liberalization in the processing sector. This growth was facilitated by a rapid increase in the consumption of processed foods spurred by rising incomes and urbanization, and a concomitant increase in the number of women working outside their homes.

The third element is the restructuring of the retail sector, which is mainly characterized by the supermarket revolution and a rapid spread of fast-food chains in many countries of the region. The

growth in supermarkets, which started in the early to mid-1990s, was driven by a massive flow of foreign direct investment and competitive domestic private investment, privatization of retail parastatals, rising incomes and urbanization, and procurement system change (Reardon et al., 2009). The spread of modern retail took place in three waves, first in East Asia outside China, then in Southeast Asia and, finally, in China, India and Viet Nam. Within a given country, supermarkets first sold processed products, then semi-processed and recently fresh produce.

III. Challenges faced by small/family farms

Farmers are facing a number of challenges in producing food in a sustainable manner as well as in diversifying from their dependence on cereal production to the production of high-value commodities. Although some of these challenges affect both large and small farms, there is evidence that they apply more strongly to small farms. For example, small farmers cannot take advantage of higher food prices by expanding production if they have difficulty in accessing services and credit. Similarly, when new technologies require higher capital inputs or mechanization, small farmers may be at a disadvantage unless they are helped in reducing their transaction costs to access inputs, credit and marketing facilities.

In recent years, productivity growth of major food crops has declined quite significantly. However, funding has shifted from public to private research, particularly in biotechnology. This change is reportedly disadvantageous to small farmers because private research companies lack incentives to address small farmers' concerns (Pingali and Traxler, 2002). Also, the impacts of both environmental degradation and climate change are usually more severe for small farmers than for large farmers because small farmers have less access to human, social and financial capital and information than large farmers (Hazell et al., 2007).

Attractive investment opportunities have opened up in agriculture, leading to large-scale investments and competition for land (e.g. rubber plantations in Cambodia, palm oil production in Indonesia, cereals in Kazakhstan)[5]. New sources of economies of scale have emerged, as a result of technical change (zero tillage and GMOs), new markets (contracts with supermarket chains for large continuous and uniform deliveries) and institutional changes (e.g. access to international finance)[6]. However, frequently the large farm advantage is due to market failures (e.g. credit), institutional gaps (e.g. weak extension services) and policy distortions (e.g. minimum support prices). Elimination of such biases against smallholders would enhance their competitiveness. State interventions and collective action by producers' organisations would make a significant difference.

A feasible option is to explore mutually beneficial complementarities between large and small farms. In cooperatives, for example, large farmers could be cast in an entrepreneurial role that enables small farmers to access technology and markets.

In what follows, we throw new light on how constrained smallholders are in marketing their produce, based on a recent nationwide household survey in India in 2006.

Size, Marketed Surplus and Price

To serve as a backdrop to our analysis, a distillation of available evidence on market arrivals and size of holdings in India is given below. Many of the important contributions were based on farm management studies and cost of cultivation surveys carried out by Krishna (1995a, 1995b, 1995c), Bardhan (2003), Bardhan and Bardhan (2003), among others. A notable recent addition is Kanwar

[5] For details, see Deininger and Byerlee (2010).

[6] Many land concessions in Lao PDR and Cambodia-two of the poorest countries in Asia and the Pacific-were withdrawn either because there was lack of transparency in granting them and/or because no investment was made. For details, see Gaiha and Annim (2010), and Gaiha and Azam (2011, forthcoming).

(2006). The insights from these studies are highly relevant in the context of rising food and oil prices, and their implications for the rural poor.

One important finding relates to the price response of marketed surplus of foodgrains. Bardhan and Bardhan (2003) first specify a theoretical model of farmers' foodgrain marketing decision, positing that in the production decision the relevant prices are those of foodgrains relative to competing crops and agricultural inputs whereas in the consumption decision the relevant prices are those of foodgrains relative to competing consumption good(s) – including manufactured consumables. They conclude that the marketed surplus of grains is higher when the relative cereal price is higher, and it is lower when the relative price of commercial crops is higher. The intuition underlying these results is that, when the relative cereal price is high, more is marketed as less is consumed; and when the relative price of commercial crops is high, marketed surplus of grains is lower because of switching of acreage.

The analysis given here builds on this literature by using a recent all-India survey (Rural Economic and Demographic Survey (REDS)) conducted by the National Council for Applied Economic Research in 17 states of India in 2006[7]. As the household and village data are being subjected to consistency checks, our results are not to be treated as definitive. The sample consists of 5695 households in the 17 states. We have worked with smaller samples as outliers had to be eliminated.

Our focus is on marketed surplus by size of landowned/operated. As the entire land data are in acres, for analytical convenience we have grouped households into cultivating < 2 acres (small), between 2 -5 acres (medium) and > 5 acres (large)[8]. As such groupings vary with soil conditions and whether irrigation is used, our grouping is essentially a first order of approximation. Although recent cross-country evidence confirms robustly a positive supply response of food commodities to prices, the present analysis seeks to extend it by analyzing the responsiveness of market surplus of various commodities to their own prices by size of landowned/operated[9].

Another contribution of this analysis is that food commodities are disaggregated into four groups: cereals, pulses, oil seeds and vegetables. As the consumption basket has changed in recent years-as illustrated earlier -it is worthwhile to examine whether smallholders are responding to the high value chains (e.g. by producing and marketing more of high value commodities such as oil seeds and vegetables in response to market prices)[10].

In a broad brush treatment, let us consider distribution of farming households into small, medium and large, shares of land irrigated, proportions using fertilizers, and access of sample villages to rural infrastructure[11].

About three fourths of the sample households are small landholders, about 15 per cent are medium and just under 10 per cent are large. About 57 per cent of land of smallholders is irrigated, but slightly lower shares of land of medium and large landholders are. However, out of the total land irrigated, more than half belongs to large landholders and less than one-fifth to smallholders.

Given the cost of fertilizer, it is not surprising that the fraction of farmers not using fertilizers is highest among smallholders – in fact, it is nearly three times higher among smallholders than large landholders. Two striking features with respect to the educational attainment of household heads are: (i) the proportion of illiterate heads is highest among smallholders and lowest among large landholders; and (ii) the proportion with more than 10 years of schooling is lowest among

[7] The states include Tamil Nadu, Kerala, Karnataka, Maharashtra, Gujarat, Rajasthan, Punjab, Haryana, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Orissa, Chhattisgarh, Madhya Pradesh, Himachal Pradesh and Andhra Pradesh.
[8] 1 hectare=2.47 acres.
[9] For details of the cross-country evidence, see Imai et al. (2011).
[10] In fact, evidence has accumulated pointing to a dietary transition in India. For details, see Kulkarni and Gaiha (2010), and Gaiha et al. (2010).
[11] All cross-tabulations are given in Annex 1.

smallholders and highest among large landholders. As access to new technology and markets with more remunerative prices are positively linked to educational attainments- admittedly, these links have weakened somewhat with advances in ICT-smallholders are at a disadvantage[12].

Table A.1 describes access to different forms of rural infrastructure. Unfortunately, access to these is in relation to a village and not a household. Hence we are unable to capture inequity in access by size of holding. Subject to this caveat, we note that village access varies enormously depending on the type of infrastructure. For example, about 72 per cent of the villages had a *pacca* road, and about 70 per cent had a telephone facility; by contrast, more than half the villages had access to a wholesale agricultural product market at a distance of more than 10 km; about 48 per cent of the villages had access to an input store at a distance exceeding 5 km while about 35 per cent of the villages had access within <5 km; about 41 per cent of the villages had access to banks within the narrow range <5 km while about 33 per cent had access within 5-10 km; as access to the nearest town makes a difference to marketing of output and purchase of input options, it is of some concern that the nearest town for over 43 per cent of the villages was at a distance >10 km.

Investment in rural transportation and other facilities (e.g. banking, communication, storage) is likely to make agricultural markets more efficient as well as benefit the poor more. Evidence for other Asia and Pacific countries points in the same direction (Gaiha et al. 2009).

Crop Yields by Size

As a descriptive technique, we approximate distributions of crop yields by size using kernel density functions.[13]

Figure A.1.1 shows that kernel densities of cereal yields among smallholders are unimodal, with a cluster around moderately high values; the densities among medium land holders are unimodal too, with the cluster at slightly lower yields than among small holders; and the densities among large landholders are bimodal with clusters at low and moderately high yields.

Figure A.1.2 illustrates that kernel densities of pulses are bimodal among both large and smallholders with very different clusters of yields; among the latter yields cluster around very low and large values while among the former the clusters are around very low and slightly larger values; in striking contrast are the unimodal densities among medium landholders, with a cluster around low yields, but skewed to the right, implying that many obtain low yields while others obtain moderate to high yields.

Figure A.1.3 illustrates that vegetable kernel densities are bimodal among all three size groups. Among small holders clusters of yields occur at moderate or high values, with a few obtaining very high yields; among medium landholders clusters of yields occur at moderate or high values; in striking contrast are the yield densities among large landholders, with a cluster at low values and another at moderately high values.

Figure A.1.4 depicts yet another striking contrast in oilseeds' yields by size. The densities are unimodal among large landholders, with a cluster of yields at low values. The densities among medium landholders, by contrast, are bimodal, with clusters at low and moderately high yields; and, while the kernel densities are bimodal among smallholders too, the clusters occur at low and very high values.

In sum, while the generalisation that has dominated the size-productivity debate, with rich and fascinating explanations of why smallholders are more productive, is confirmed, our descriptive analysis suggests that this relation varies with food commodity group (not- so -strong, for example, in cereals). Another point that emerges is that, while much lower fractions of smallholders are

[12] See, for example, Byerlee et al. (2010).

[13] The underlying distribution is Gaussian. For a lucid exposition of why kernel densities are to be preferred to histograms, see Deaton (1997).

concentrated in lower ranges of yields compared with medium and large landholders, segments of smallholders also obtain very low yields (for example, in oilseeds).

Determinants of Marketed Supply

The specification used and the results are given in Annex 2.

(a) *Cereals*[14]

The tobit results on the marketed surplus of cereals are given in Table A.2.1. The main findings are[15]:

1. The higher the household head's schooling, the higher was the marketed surplus of cereals.
2. Lower caste households (the Scheduled Castes (SCs), and Other Backward Castes (OBCs)) marketed lower fractions relative to Others (the omitted group), presumably because of discriminatory practices in output and credit markets.
3. Controlling for these and other effects, small landholders marked significantly lower proportions than large landholders (the omitted group), and these proportions were substantially lower.
4. The higher the price of cereals, the larger was the marketed surplus. The elasticity of marketed surplus of cereals to its own village price is about 0.41, implying that a 1 per cent higher price is likely to induce a 0.40 per cent larger marketed surplus.

Figure: A.2.1 points to a quadratic relation between predicted marketed surplus and land size.

(b) *Pulses*[16]

The regression results for pulses are given in Table A.2.2.The main findings are:

1. The head's schooling does not have a significant positive effect on marketed surplus of pulses.
2. However, the caste affiliations matter, as both SCs and STs market lower proportions of pulses produced.
3. Smallholders market significantly lower proportions, as also Medium landholders, than large landholders.
4. Controlling for these effects, the price of pulses and marketed surplus are positively related and the elasticity is 0.31. This implies that if cereal price rises by 1 per cent, the marketed surplus rises by 0.31 per cent. This elasticity is slightly lower than that of cereals.

Figure A.2.2 points to a quadratic relation between predicted market surplus and land size.

(c) Vegetables

The sample of households that grew vegetables was small (283). The main findings from Table A.2.3 are:

1. Head's schooling and marketed surplus of vegetables are positively related.
2. ST households marketed significantly lower fractions than Others.
3. Smallholders marketed a significantly lower proportion of vegetables than large landholders.
4. The longer the distance to a wholesale market, the lower was the marketed surplus. This is highly plausible as, given lack of cold storage facilities, vegetables cannot be marketed over

[14] Out of 5694 observations in the sample, the uncensored were 2791.

[15] As the log of a variable has a monotonic relation to the values of the variable, we avoid use of log for expositional convenience.

[16] The uncensored observations were 634.

long distances. The elasticity is 0.09, implying one per cent increase in distance to the nearest market resulted in a 0.09 per cent lower marketed surplus.

5. Controlling for these effects, the price has a robust effect on marketed surplus. The elasticity is 0.13, implying that a one per cent higher price induces a 0.13 higher marketed surplus.

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Figure A.2.3 suggests an almost flat linear relation between predicted marketed surplus of vegetables and landowned/operated.

(d) Oilseeds

The tobit results for oilseeds (the sample of households that grew oilseeds was also small (601)) are given in Table A.2.4. The main findings are:

1. Somewhat surprisingly, the head's education is not linked to marketed surplus of oilseeds.
2. While SCs market lower fractions, STs market higher fractions (relative to Others).
3. Both small and medium landholders market lower fractions of their output than large landholders-especially the former.
4. Controlling for these effects, there is a significant positive price effect on marketed surplus of oilseeds. The elasticity is 0.27, implying that a 1 per cent higher price induces a 0.27 per cent higher marketed surplus.

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Figure A.2.4 suggests that the quadratic does not fit the relation between marketed surplus and landowned/operated well.

In sum, our analysis confirms the important effect of price on marketed surplus of each of the four food commodity groups: cereals, pulses, vegetables and oilseeds. However, elasticities with respect to own price vary, with the highest for cereals, followed by pulses and then for oilseeds. For vegetables, easier access to markets matters a great deal, given lack of cold storage facilities. Education of household head matters too in two commodity groups. To the extent that education enables access to new technology and market prices, it is also positively related to marketed surplus. In all four cases, smallholders are associated with lower marketed surplus. Our analysis, however, could not throw light on whether smallholders marketed lower fractions because they received lower farm gate prices and/or because their access to markets was more constrained.

Declining productivity growth

A number of studies have confirmed a slowdown in productivity growth in cereal crops such as rice and wheat in major irrigated areas of Asia such as the Indo-Gangetic plain and East Asia (Bhandari et al., 2003; Pingali et al., 1997). For example, rice yield growth in irrigated areas of Asia declined from 2.31 per cent per annum in 1970-90 to 0.79 per cent in 1990-2000 (Hossain, 2006). The major reasons for this decline in yield growth include: the displacement of cereals on better lands by more profitable crops; diminishing returns to modern varieties when irrigation and fertilizer use are already at high levels; and the recent low price of cereals relative to input costs, making additional intensification less profitable (Hazell, 2009). In intensive monocrop systems such as the rice-wheat system of the Indo-Gangetic plains, deteriorating soil and water quality is an important problem; degradation of soils and build up of toxins have been reported in intensive paddy systems in several Asian countries (Pingali et al., 1997; Ali and Byerlee, 2002).

Researchers have documented stagnating or even declining levels of total factor productivity in some of these production conditions (Janaiah et al., 2005). An analysis of data from long-term yield trials in several countries of South Asia found stagnating or declining yield trends in rice and wheat when input use was held constant (Ladha et al., 2003). One of the reasons for slow yield growth has been reported to be pest and disease resistance of modern varieties to chemical pesticides.

Environmental problems

Poor water management in many countries of Asia has resulted in land degradation in irrigated areas through salinization and waterlogging. It is estimated that almost 40 per cent of irrigated land in dry areas of Asia are affected by salinization (Millennium Ecosystem Assessment, 2005).

Inappropriate use of fertilizers and pesticides has led to water pollution and damage to larger ecosystems, where excess nitrates from agriculture enter water systems. Fertilizer nutrient runoff from agriculture has become a major problem in intensive systems of Asia, causing algal bloom and destroying wetlands and wildlife habitats.

Serious soil and water degradation has taken place in the rice-wheat system of India and Pakistan due to intensive and continuous monoculture of rice in summer and wheat in winter (Ali and Byerlee, 2002). The effects of soil nutrient mining, salinization and declining organic matter have been exacerbated by depletion of groundwater aquifers and build-up of pest and weed populations and resistance to pesticides.

Land and tenure security

In many countries of the region, marginalization is linked to the lack of access to land and land-use rights. Improving poor people's access to land is important to improve equity as well as production, as small farms tend to be more productive than large farms (Lipton, 1993). The political prospects for redistributive land reform are not bright for many developing countries. Also, land scarcity has become acute, and rapid urbanization is reducing the area available for agriculture (Cassman et al., 2003). Crop land per capita of agricultural population is only 0.23 hectares in East Asia and the Pacific and 0.27 hectares in South Asia, compared to 0.48 hectares in Sub-Saharan Africa, 0.74 hectares in Middle East and North Africa, 1.55 hectares in Latin America and the Caribbean, and 3.53 hectares in Europe and Central Asia.

Some aspects of land reform, such as the extension of tenurial security, may be less difficult to implement than other aspects, such as land ceilings. IFAD-supported tribal development projects in India provide examples illustrating the importance of security of tenure. For example, the Orissa Tribal Development Project in India provided titles to land above 10 degrees in slope to tribal groups. Land occupied by tribals became transferable to women in the form of inheritable land titles in perpetuity. Such land titling led to major improvements in natural resource management, with the incentives derived from clear property rights.

In socialist countries like China and Viet Nam, land tenure reform has led to significant increases in agricultural production and rural poverty reduction. In Viet Nam under the Doi Moi reform process, in 1988 agricultural collectives were converted to contract land to households for 15 years for annual crops and 40 years for perennial crops (Kirk and Nguyen, 2009). This reform together with the relaxation of price controls and the opening up of domestic and international trade promoted entrepreneurship and productivity. Viet Nam passed a Land Law in 1993 that extended land tenure to 20 years for annual crops and 50 years for perennial crops. These reforms generated strong incentives to invest in agriculture, which led to greater food security and better nutrition. Land transactions increased greatly as a result of tenure reforms. There is an active land market in the country, with the percentage of households participating in land transactions increasing from 3.8 per cent in 1993 to 15.5 per cent in 1998. Although land sales are not allowed, with more secure land rights many farmers have diversified their production into aquaculture, livestock and perennial crops such as coffee and cashew. Land titles in Cambodia raised rice productivity and reduced rural poverty[17]. In China land rentals have contributed to rural diversification and income growth.

[17] For details, see Gaiha and Azam (2011, in preparation).

An analysis of land reforms in India by Deininger et al. using a 20 year panel (1981-99) of household data for rural India yields useful insights into their effects. First, by allowing households to increase investment, land reforms had a positive impact on accumulation of assets-both human and physical capital. Partly through this channel, land reforms promoted growth[18]. Second, the benefits to the poor were disproportionately large, implying a positive impact on equity. Third, the impact of reforms declined with time-land transfers have come to a virtual standstill in recent years- emphasising the need for more imaginative approaches that take note of existing opportunities to access land, the obstacles preventing such access, and the potential economic returns from land compared to the alternatives.

Water shortages

In much of Asia, the demand for water for both agricultural and non-agricultural uses is rising and water scarcity is becoming acute, thus limiting the future expansion of irrigation. Irrigated food production in large areas of China and South Asia is being maintained through unsustainable extraction of water from rivers or the ground (UNDP, 2006). The expansion of tubewell irrigation in South Asia has resulted in serious overdrawing of groundwater and falling water tables. In the agriculturally advanced states of India – Haryana, Punjab, Rajasthan and Tamil Nadu – more than one fifth of groundwater aquifers are overexploited (World Bank, 2007). As a result, water pumping has become difficult and too costly. The most affected are small farmers, who have little access to expensive pumps and often have insecure water rights.

In Asia in general, and South Asia in particular, the area of land irrigated by large-scale surface schemes has been declining since the early 1990s. For example, between 1994 and 2001, India and Pakistan together lost more than 5.5 million ha of canal-irrigated areas, despite very large investments in rehabilitation and new projects (Mukherji et al 2009). Some of these areas were lost due to irrigation-induced soil salinity and waterlogging.

Diversification

Small farmers have the potential to raise their incomes by switching from grain-based production systems to high-value agriculture. Although the production of high-value agriculture is labour-intensive and thus more suitable for smallholders, they face a number of constraints. Since high-value agricultural commodities are perishable and their markets are fragmented, there is high volatility in their prices, and thus high market risk. In addition, small farmers have low volumes of marketable surplus and the land they cultivate is mostly located in remote areas with poorly developed infrastructure. As a result, smallholders face high transaction costs and risks in production and marketing of such commodities. They also face poor access to credit, and stringent food safety and quality standards[19].

While growth of urbanisation and rising incomes fuelled the growth of a diversified agricultural sector and integration into high value chains linked to supermarkets in some parts of Asia and the Pacific Region, following the food crisis, there is evidence of erosion of trust in markets allocating food supplies in countries worst affected, and heightened concerns for self-sufficiency in food staples. Manifestation of such concerns (reflected in protectionist policies towards rice in particular) runs the risk of slowing down diversification of agriculture.

[18] Tenancy reforms and ceilings have significant and positive (reduced form) effects on income, consumption and assets, with the former yielding stronger effects. (Deininger et al. 2009).

[19] As noted in Section III, although yields of food crops are higher among smallholders, the fact that they market substantially lower fractions of their outputs suggests that lack of easy access to credit and markets are major impediments.

Impact of climate change

Researchers have predicted that climate change will have serious consequences for agriculture, particularly for smallholders in poor developing countries. In tropical countries even moderate warming (1 degree C for wheat and maize, 2 degrees C for rice) can reduce yields significantly because many crops are already at the limit of their heat tolerance (World Bank, 2007). In parts of Asia and Central America wheat and maize yields could decrease by 20 to 40 per cent as the temperature rises by 3 to 4 degrees, even if farm-level adjustments are made to accommodate higher average temperatures, such as changing the date of seeding or planting drought-resistant varieties (Long et al, 2007)[20]. Rice yields would also decline, although less than wheat and maize yields.

In low-lying areas agriculture will be adversely affected by flooding and salinization due to sea level rise and salt water intrusion in groundwater aquifers. Water scarcity will increase in areas such as Nepal, and parts of China and India due to decreasing snow cover over time, where glacial melt is an important source of irrigation water.

Both mitigation and adaptation measures are necessary, with greater emphasis on the latter. As the 'world's appetite for emissions reduction has been revealed to be chronically weak", it is imperative "to find ways of adapting to many possible future climates" (*The Economist*, 25th November, 2010).

Adaptation calls for not just expanded research into improved crop yields and tolerance of temperature and water scarcity, but also research into management of pests, soil conservation, and cropping patterns that enhance their resilience[21]. There is also a case for weather insurance which will pay not when crops fail but when specific climatic events occur (e.g. rainfall below a set level).[22]

Strategies of adaptation by smallholders raise specific concerns. They are likely to suffer impacts of climate change that are locally specific and hard to predict. The variety of crop and livestock species produced by them, and the importance of non-market relations will increase the complexity both of the impacts and the subsequent adaptations, relative to commercial farms with more restricted ranges of crops. While small farm sizes, low technology, low capitalisation and diverse non-climate stressors (e.g. population driven land fragmentation, limited access to markets) add to their vulnerability, their existing patterns of diversification away from agriculture and store of indigenous knowledge impart greater resilience (Morton, 2007).

Risk and vulnerability

Smallholders face a number of individual risks such as disease, injury and death of animals, as well as common or aggregate risks such as drought, epidemic and economy-wide shocks, affecting everyone in the locality. The consequences of these risks can be extremely severe, potentially leading to malnutrition, disease, starvation or even death. As a result, managing and coping with risks are an integral part of the daily lives of poor rural people.

In addition, there has been a concern that the recent successes of market-oriented policy reforms (e.g. in India and China) or the advance of globalization may have further increased the degree of potential income fluctuations, thereby exacerbating the already precarious position of poor rural people, comprising principally landless and small farmers (Dercon, 2005). Evidence points to high vulnerability of small farmers in the semi-arid region of south India to crop shocks. What is worse, occasionally they are subject to a series of such shocks, making it harder for them to escape persistent poverty (Gaiha and Imai, 2004). Other evidence comes from the Philippines, Bangladesh and Cambodia confirming significant effects of natural hazards (e.g. El Nino in the Philippines, floods in Bangladesh, and droughts, floods and windstorms in Cambodia) on various indices of poverty and

[20] Some researchers point to the fact that the projections of crop yield losses made by different climate change models may be overestimated, as they tend to be based on cereal mono-crops with high rates of chemical fertilizer use.
[21] For details, see Gaiha and Mathur (2010).
[22] For a review of weather-based insurance, see Gaiha and Thapa (2006).

anthropometric measures of under-nutrition[23]. Disasters often disrupt food production, resulting in loss of livelihoods and higher food prices. Finally, not only do poor rural people lose assets, but they also lack access to risk-sharing mechanisms such as insurance. It is therefore not surprising that disasters substantially increase poverty levels (e.g. 50 per cent of the increase in the incidence of poverty in the Philippines during the 1998 crisis was due to El Nino). Although the devastation is seldom confined to the poorer segments – including small farmers – in the absence of easy access to credit and insurance they find it harder to recover their previous standard of living (Jalan and Ravallion, 2001).

Although there is overlap between poverty and vulnerability to poverty, with a diverse pattern both *within* and *between* countries for which evidence exists, a useful insight is that poverty and vulnerability are *distinct*. Thus interventions designed to target the latter must differ from those designed for the former. Specifically, more careful attention must be given to risk mitigation and coping in dealing with vulnerability to poverty-especially in rural areas.

IV. Opportunities for higher productivity, higher incomes and sustainability

This section discusses technological as well as institutional innovations that can enable small or family farms to sustainably raise agricultural productivity and to increase incomes by accessing emerging markets for high-value commodities.

Technological innovations to address environmental problems and yield growth

To address the concerns about the sustainability of Green Revolution technologies and their ability to benefit poor farmers, particularly in less favoured areas, many are advocating new technological approaches (e.g. Pender, 2008). These include low external input and sustainable agriculture approaches based on ecological principles of farming; organic agriculture based on a similar set of agro-ecological principles but without the use of artificial chemical fertilizers, pesticides or genetically modified organisms; and biotechnology. Although biotechnology and agro-ecological approaches seem to be in opposition to one another, both approaches focus on biologically based rather than chemically based technologies, and there may be potential for realizing complementarities between these approaches. In fact, it has been argued that a combination of ecological and biotechnology approaches is needed to bring about a "Doubly Green Revolution" (Conway, 1997). Others have argued that integrated agricultural and natural resource management innovations are needed that combine improved germ plasm (using both conventional methods and biotechnology) and improved and integrated management of soils, water, biodiversity and other natural resources (CGIAR, 2005).

Conservation agriculture/zero tillage

To address the declining productivity growth of the rice-wheat system in the Indo-Gangetic plain, zero tillage has been promoted by the Rice-Wheat Consortium, a partnership of the Consultative Group on International Agricultural Research centres and national agricultural research and extension system and with the support of IFAD and other development partners. This technology involves planting wheat immediately after rice, without tillage, so that wheat seedlings germinate using the residual soil moisture from the previous rice crop. Zero tillage has been reported to have many advantages over conventional tillage in the rice-wheat system. It saves labour, fertilizer and energy, minimizes planting delays between crops, conserves soil, reduces irrigation water needs, increases tolerance to drought, and reduces greenhouse gas emissions (Erenstein et al., 2007).

[23] See, for example, Gaiha and Azam (2011, forthcoming) for a robust confirmation of how natural hazards aggravate rural poverty in Cambodia.

Organic agriculture

Organic agriculture is a specific type of low external input whose requirements are more restrictive – no use of chemicals or genetically modified organisms. Based on certification, price premiums of 10 to 50 per cent are common for developing country exports of organic products (IFAD, 2005). Organic farming has increased rapidly in many Asian countries in the last few years. In 2000-02, there were about 60,000 farms producing certified organic products on about 600,000 hectares. This increased to more than 90,000 farms on more than 3.8 million hectares in 2005-06 (Pender, 2008). China, India and Indonesia are the major organic producers in Asia.

Several studies have shown favourable impacts of organic agriculture on the costs of production and yields (IFAD, 2005; Reunglertpanyakul, 2001). However, there are several constraints to the adoption of organic farming. Profit margins usually diminish due to increased competition, and organic producers may face greater market risks as the sector grows. Perhaps the most important concern among smallholder farmers relates to the costs of certification and assuring compliance with organic standards. These problems can be addressed by developing farmer organizations at the local level and through efforts by outside agencies to develop local capacities and facilitate linkages to markets.

Biotechnology

Broadly defined, biotechnology includes a wide variety of techniques, from traditional methods such as conventional plant and animal breeding to more modern techniques such as tissue culture, embryo transfer, cloning, breeding using marker-assisted selection, genetic engineering of plants or animals, and genomics (ADB, 2001). In current literature, the term biotechnology is used to refer to modern agricultural biotechnology and it is also used synonymously with genetic engineering. Biotechnology is reported to have the potential of incorporating many traits in crop varieties that can address problems faced by smallholders, such as drought resistance, disease and pest resistance, yield improvement and quality improvement.

Since 1996, there has been a rapid adoption of a few genetically modified (GM) crops globally. Among Asian countries, an estimated 6.4 million small farmers in China (on an average area of 0.5 hectares) and 1 million small farmers in India (on an average area of 1.3 hectares) were growing Bt cotton by 2005, while more than 50,000 farmers in the Philippines (on an average area of 2 hectares) were growing Bt maize (Pender, 2008). Studies have shown that Bt cotton has contributed to increasing yields, reducing costs of production, increasing farmer incomes and reducing negative health and environmental effects of high pesticide use, particularly in China (Smale et al., 2006; Huang et al., 2002). Other studies conducted in India have also reported reduced pesticide use and increased yields (Bennett et al., 2006; Qaim et al., 2006).

Genetically modified cotton has been adopted by large numbers of smallholders in China and India, indicating that the technology can be adopted equally by large and small farmers. It further confirms the ability of smallholders to adopt new technologies, although there may be lags in adoption due to considerations of costs and risks. The dissemination of biotechnology to developing countries is inhibited by intellectual property rights issues, the lack of interest of multinational corporations in investing in the development of genetically modified crops in poor countries and less-favoured areas, difficulties in establishing public-private partnerships and the lack of investment and leadership in biotechnology by international agricultural research centres (Pender, 2008).

Institutional innovations for productivity enhancement and diversification

Although smallholders face formidable challenges, a number of innovative institutional models are emerging that can help small farmers benefit from the 'new agriculture' dominated by value chains. These include: the development of farmer/producer organizations for marketing; the promotion of contract farming; the development of supply chains for high-value exports through an appropriate mix

of private- and public-sector initiatives; facilitating private-sector provision of market information through telecommunication; and directing fiscal stimulus to rural areas.

Farmer/producer organizations

To overcome challenges related to high transaction costs, small farmers in many countries have formed producer organizations. These organizations are of various kinds, including cooperatives, associations and societies. They support smallholders in gaining access to markets and public services, and for advocacy. One of the most well-known producer organizations in Asia is the Indian dairy cooperative, which in 2005 had a network of more than 100,000 village-level dairy cooperatives with 12.3 million members and which accounts for 22 per cent of milk produced in the country (National Dairy Development Board, 2006). Sixty per cent of members are landless or smallholders; women make up 25 per cent of the membership. This cooperative model was replicated with the brand name "Safal" for fruits and vegetables to meet the growing demand in the Indian capital Delhi.

Cooperative model for vegetable and fruit marketing, India

To meet the growing demand for fresh fruits and vegetables in the Indian capital city Delhi, the Mother Dairy Fruit and Vegetables Limited (MDFVL) was established in 1988 as a subsidiary of the National Dairy Development Board, which has brought about a milk revolution in India through farmer cooperatives. MDFVL sells 250 metric tons of fresh vegetables and fruits to about 75,000 customers every day. It sources fruits and vegetables from over 150 producer associations comprising 18,000 farmers. These associations are informal cooperatives or self-help groups and are not governed by the State Cooperative Act. MDFVL helps producer associations procure improved seed varieties, fertilizer and chemicals and also provides extension services. It links producers with input dealers for the supply of production inputs at wholesale rates. It also organizes training programmes for farmers on good agronomic practices to increase production and minimise the use of chemicals. MDFVL has established quality standards for fruits and vegetables and the produce are graded and priced as per agreed norms. Farmers are paid every two weeks through their associations.

Source: Joshi, Gulati and Cummings Jr., 2007

Contract farming

Contract farming has been promoted in many Asian countries as a potential means to incorporate small farmers into growing markets for high-value commodities. Since contracts often include the provision of seed, fertilizer and technical assistance for accessing credit and a guaranteed price at harvest, this form of 'vertical coordination' has the potential to address many constraints to small-farm productivity. In this sense, it has been viewed as an institutional solution to the problems of market failure for credit, insurance and information.

Several studies have assessed to what degree smallholder farmers have participated in contract farming in Asia, and the evidence has been mixed. A recent study of contract and non-contract growers of apples and green onions in Shandong province of China found no bias toward large farmers in contract farming schemes (Miyata et al., 2009). In contrast, another study found that small farmers were less likely to participate in contract farming than larger farmers (Guo et al., 2005). Singh (2002) identifies several problems associated with contract vegetable production in Punjab state of India – imbalanced power between farmers and companies, violation of the terms of the agreements, social differentiation, and environmental unsustainability.

Most studies indicate positive impacts of contract farming on incomes. For example, Birthal et al (2005) found that the gross margins for contract dairy farmers in India were almost double those of independent dairy farmers, largely because contract farmers had lower production and marketing

costs. Miyata et al (2009) also found that contract farmers earned more than non-contract farmers even after controlling for household labour availability, education, farm size, share of land irrigated, and proximity to the village leader. Major factors for this difference included higher yields obtained by contract growers due to the technical assistance and specialized inputs provided by the packers, and higher prices received.

Two challenges are: (i) achieve discipline in collective action for the producer organisation to meet the terms of the contract and at the same time ensure that members resist the temptation of side-sales, particularly when prices are rising and local markets exist for the contracted product; and (ii) ensure that the commercial partner, often with monopsony power, does not renege on the contractual arrangement when the crop is ready, by offering lower prices or imposing higher quality standard (Byerlee et al. 2010).

Supply chains and supermarkets

Several researchers have argued that smallholders enjoy several advantages over large commercial farmers in supplying to supermarkets. The first advantage is linked to production technologies and the associated labour requirements. Thai Fresh United, for example, has a portfolio of 140 herbs, spices, vegetables and fruits, each of which has stringent quality requirements (Gaiha and Thapa, 2007). Smallholders, especially women, are able to give the careful attention that such crops require. Small producers supplying Hortico, for example, had lower rejection rates for certain non-traditional vegetables relative to large farmers. Second, the traditional agro-economic and production practices of smallholders are more amenable to the requirements of supermarkets. For example, in Thailand, Tops has found that smallholders adapt more easily to organic production through crop rotation and selection among resistant varieties.

However, smallholders need support for intermediation and internalization to be able to integrate into the supply chains (Gaiha and Thapa, 2007; Lipton, 2006; Swinnen 2006). Intermediation can take different forms involving the cooperation of public and private agencies. For example, food safety standards might be laid down by national governments, and private agencies might help smallholders implement them; rural infrastructure might be strengthened by the public sector through private financing; suppliers might help finance the provision of inputs and provide extension. Internalization involves organizations of producers, especially small producers, who negotiate production and marketing arrangements with supermarkets or their suppliers.

A study sponsored by IFAD found the prospects for the expansion of supermarkets to be promising in most Asian countries (Gaiha and Thapa, 2007). It also saw good potential for the integration of smallholders in a rapidly transforming food and agricultural sector provided they receive adequate support from the public and private sectors.

Information and communication technology

Information and communication technologies can reduce information asymmetries by providing information to smallholders on weather, input and output prices and production technologies. Many successful examples of smallholders benefiting from ICT are emerging.

Marketing support to smallholders through information and communication technology: the case of e-Choupal in India

The e-Choupal initiative of the Indian Tobacco Company (ITC) is changing the lives of thousands of farmers in India. Between 2000 and 2007, the agribusiness division of ITC set up 6,400 Internet kiosks called e-Choupals in nine Indian states, reaching about 38,000 villages and 4 million farmers. ITC establishes an Internet facility in a village and appoints and trains an operator (*sanchalak*) from among the farmers in the village. The *sanchalak* operates the computer to enable farmers to get free information on local and global market prices, weather, and farming practices. The e-Choupal also allows farmers to buy a range of consumer goods and agricultural inputs and services (sourced from other companies).

The e-Choupal serves as a purchase centre for ITC for 13 agricultural commodities, with the *sanchalak* acting as the commission agent in purchasing the produce and organizing its delivery to ITC. In 2006/07 ITC purchased about 2 million tons of wheat, soybeans, coffee, shrimp, and pulses valued at $400 million through the e-Choupal network. This direct purchasing cuts marketing costs for both farmers and ITC. It improves price transparency and allows better grading of produce. It also allows farmers to realize a bigger share of the final price.

Source: World Bank. 2007. World Development Report 2008: Agriculture for Development.

Fiscal stimulus

Although the contagion of the financial crisis did not dampen growth in the Asia and the Pacific region as much as initially feared, the projected reductions in growth rates are 2 per cent or more in 2009. This is largely due to the resilience of China and to a lesser extent India (ADB, 2009a). In anticipation of such losses, and to minimize them, fiscal stimulus was undertaken by many countries in the region, ranging from 0.5 per cent of gross domestic product to more than 5 per cent (ADB, 2009b). A study undertaken by IFAD's Asia and the Pacific Division (Gaiha et al., 2009) demonstrates the potential of fiscal stimulus in accelerating overall growth through agricultural growth. If mechanisms are put in place to direct the fiscal stimulus to rural areas where both physical and social infrastructure are inadequate to sustain the growth impulse, substantial increases in yields and revenues from agriculture are likely. Various studies have confirmed the vital role of rural roads, transportation and market access in enabling small farmers and others to reap greater benefits from higher prices (Fan and Rao, 2008; Gaiha et al., 2009). Of particular significance are the findings of a study by Shilpi and Deininger (2008), focusing not only on distance to a market in the Indian state of Tamil Nadu, but also on the facilities available in that market. Their analysis shows that additional investments in market facilities are indeed pro-poor, since the sales by poorer farmers increase more than those by wealthy farmers. In other words, while the wealthier farmers capture the benefits of existing facilities better than the poorer farmers, the marginal benefit from an improvement of market facilities is substantially greater for small (poorer) farmers.

Sustainability of the fiscal stimulus, however, seems doubtful amidst fears of inflation in emerging Asian countries (notably China and India).

V. Enabling policy and programme support to small or family farms—Selected Examples from Asia and the Pacific

There are powerful efficiency and equity reasons to support small farms in Asia and the Pacific. They are economically more efficient relative to large farms, can create large amounts of productive employment, reduce rural poverty and food insecurity, support a more vibrant rural nonfarm economy, and help to contain rural-urban migration (Hazell 2003). The Green Revolution experience showed strong commitment of both Asian governments to agriculture, which led to significant investments in technologies and rural infrastructure as well as major policy and institutional reforms in support of agriculture. However, there was one major difference between the two regions. In Asian countries such as China and India, public interventions such as land policies, agricultural marketing and support services and agricultural research and extension benefited commercially oriented small farms. In China, small farms were supported after collective farms could not provide adequate incentives to increase production and productivity. Box 1 provides the highlights of the current programme of the Chinese government in support of small farmers.

Box 1. Policy support to small farmers in China

The reform of the rural economic system in 1978 laid an institutional foundation for rural development and poverty reduction in China. The main element of the reform was to change the agricultural production model from centralized planning to household contract farming. This reform significantly boosted farmers' incentives to produce more and promoted agricultural development.

In recent years the government has implemented a series of policies to strengthen agriculture sector and to benefit small farmers. First, the government has significantly improved resource allocation to agriculture to benefit small farmers in rural areas: from RMB 432 billion in 2007 to RMB 596 billion in 2008 and to RMB 716 billion in 2009. Second, since 2006 the government has abolished agricultural tax and other taxes and fees, which has changed the age-old distribution relationship between the state and farmers. Third, the government has implemented the policy of minimum procurement price for grains to protect farmers' interest and national food security. Fourth, more resources have been allocated to build rural infrastructure and to improve rural production and living conditions. Fifth, since 2007 China has exempted tuition and fees for students in rural elementary and secondary schools, which has benefited over 148 million rural children. The government has also established a new rural cooperative medical system covering 815 million farmers.

Although smallholder farming has contributed significantly to enhance agricultural production and to reduce rural poverty during the past thirty years, it is experiencing new challenges due to globalization and trade liberalization. These include the inability to achieve economies of scale, ineffectiveness in the dissemination of new technologies, and difficulties in risk prevention and control. The government has taken a number of steps to deal with the challenge of declining farm size. Although farmers had land-use contracts for 15 years, administrative reallocation was regularly practiced in response to population growth or to make land available for non-agricultural purposes. With the rapid rise in rural-urban migration, decentralized land rentals have complemented and eventually replaced administrative reallocations. Such land rentals have been reported to have had favourable impacts on land productivity, occupational structures, and welfare (World Bank 2007). Net revenue on rented land increased by about 60 percent, as land was transferred from those with low ability or interest in agriculture to better farmers. Net income increased both for renters and landlords by 25 percent and 45 percent, respectively. Land rentals also transformed the occupational structure in rural areas. Almost 60 percent of farmers, who rented out their land, depended on agriculture as their main source of income before entering land rental markets. Their number declined to 17 percent following land rentals, with 55 percent migrating and 29 percent engaging in local nonfarm activity. This shows that, in a context of strong non-farm growth and migration, a well functioning land rental market can contribute to productivity growth as well as welfare. However, there is a need to continue efforts to strengthen farmers' property rights and to reduce the discretionary powers of officials.

VI. Concluding remarks

Small farms have proved resilient over time and they continue to contribute significantly to agricultural production, food security, rural poverty reduction, and biodiversity conservation in Asia and the Pacific Region despite the challenges they continue to face with respect to the access to productive resources and service delivery. They are now facing new challenges on integration into new agriculture dominated by value chains, adaptation to climate change, and management of market volatility and other risks and vulnerability.

However, they have also shown their ability to integrate into the emerging value chains, if they are provided support through intermediation and internalization. Intermediation may take a variety of forms whereby public and private agencies cooperate (e.g. food safety standards might be laid down by governments, and private agencies might help smallholders implement them; rural infrastructure might be strengthened by the public sector through private financing; suppliers might help finance the provision of inputs and provide extension). Internalization involves organizations of producers, especially small producers that negotiate production and marketing arrangements with supermarkets or their suppliers.

In the wake of the food price crisis, attractive investment opportunities have opened up in agriculture, leading to large-scale investments and competition for land. However, frequently the large farm advantage is due to market failures (e.g. credit), institutional gaps (e.g. weak extension services) and policy distortions (e.g. minimum support prices). Elimination of such biases against smallholders would enhance their competitiveness.

Institutional innovations can play an important role in the provision of inputs and services to small or family farmers when there are market failures. In some cases, the private sector has adequate incentives to innovate (as discussed above in the sections on contract farming and supermarkets). However, in many cases the government should play an active role in coordinating the delivery of input, financial, technical and output marketing services to small farms. Support will also be needed to enable small farmers to face emerging challenges related to climate change impacts and market volatility.

Table 1. Changes in farm size and land distribution in selected Asian and Latin American countries

Country	Period	Land distribution (Gini)		Average farm size (hectares)		Change in total number of farms (%)	Change in total area (%)
		Start	End	Start	End		
Smaller farm size, more inequality							
Bangladesh	1977-96	43.1	48.3	1.4	0.6	103	-13
Pakistan	1990-00	53.5	54.0	3.8	3.1	31	6
Thailand	1978-93	43.5	46.7	3.8	3.4	42	27
Smaller farm size, less inequality							
India	1990-95	46.6	44.8	1.6	1.4	8	-5

Sources: World Bank 2007, Anriquez and Bonomi 2007.

Table 2. Changes in Percentage Distribution of Operated Area by Size of Operational Holdings in India, 1960-61 to 2002-03

Land class	% distribution of operational holdings				% distribution of operated area			
	60-61	81-82	91-92	02-03	60-61	81-82	91-92	02-03
Small	61.7	68.2	75.3	80.6	19.2	28.1	34.3	43.5
Medium	33.8	28.8	24.8	18.1	51.9	53.7	50.5	44.7
Large	4.5	3.1	1.9	1.3	29.0	18.2	15.2	11.8

Small: < 2 ha; medium: 2-10 ha; large: >10 ha
Computed from: NCEUS 2008.

Table 3. Changes in cereal yield and production in Asia, 1970 and 1995

	India	Other S. Asia	China	SE Asia	Developing Asia
Cereal yield (mt/ha)					
1970	0.93	1.20	1.77	1.35	1.32
1995	1.74	1.85	4.01	2.24	2.63
% change	88.4	54.2	126.5	65.6	99.5
Cereal production (million mt)					
1970	92.8	25.4	161.1	33.8	313.2
1995	174.6	48.1	353.3	73.6	649.6
% change	88.1	89.3	119.3	117.8	107.4

Source: Hazell 2009.

Table 4. Average annual percentage growth in per capita consumption of selected foods in selected Asian countries, 1990-2000

	B'desh	India	Pak	Indo	Phil	Thai	Viet	China
Cereals	0.2	-0.4	0.0	0.9	0.1	0.2	1.2	-1.3
Veg	0.2	2.1	2.2	3.3	0.0	0.5	4.9	8.5
Fruits	-1.5	2.9	0.5	1.9	0.2	0.3	1.7	10.0
Milk	0.2	1.9	3.0	5.9	1.5	5.0	13.5	5.0
Meat	1.0	0.9	0.2	0.4	4.7	1.5	4.3	6.8
Eggs	4.6	1.9	1.9	3.7	1.6	-0.4	5.8	9.7
Fish	4.7	2.0	1.6	3.2	-1.4	3.9	3.7	8.4

Source: Gulati et al 2006 (based on FAO Food Balance Database).

Table 5. Average annual percentage growth in production of food grains and high value commodities in selected Asian countries, 1990-2000

	B'desh	India	Pak	Indo	Phil	Thai	Viet	China
Grains	3.6	1.9	3.8	1.7	1.4	3.7	5.7	0.1
Fruits & Veg	1.7	4.3	3.8	4.1	2.1	2.1	4.7	10.2
Milk	3.0	4.2	5.7	2.8	-6.5	14.8	3.5	5.8
Eggs	6.4	4.2	4.6	4.9	3.4	1.1	6.7	10.8
Meat	3.4	3.0	2.8	1.6	5.6	3.6	6.3	7.6
Fish	7.0	4.0	2.7	5.0	0.4	3.0	7.6	11.3

Source: Gulati et al 2006 (based on FAO Agricultural and Fisheries Production Databases).

Annex 1

(a) Cross-Tabulations

Table A.1. Distribution (%) of Villages by Access to Infrastructure and Markets

Distance ranges	Nearest Wholesale Agriculture Product Market	Nearest *Pacca* Road	Nearest Agricultural Input Store	Nearest Bank	Nearest District headquarters	Nearest Town	Nearest Telephone facility
0 kms	3.42	72.27	16.17	14.49	0.00	2.54	69.66
0-5 kms	18.8	22.27	34.89	41.12	0.84	21.61	22.65
5-10 kms	27.35	2.52	25.11	32.71	5.88	32.63	5.13
above 10 kms	50.43	2.94	23.83	11.68	93.28	43.22	2.56
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

(b) **Kernel Density Functions of Yields**

Figure A.1.1: Kernel Density Function for Log of Cereals Quantity (in Quintal) Produced Per Acre of Land for Small, Medium and Large Land Holders.

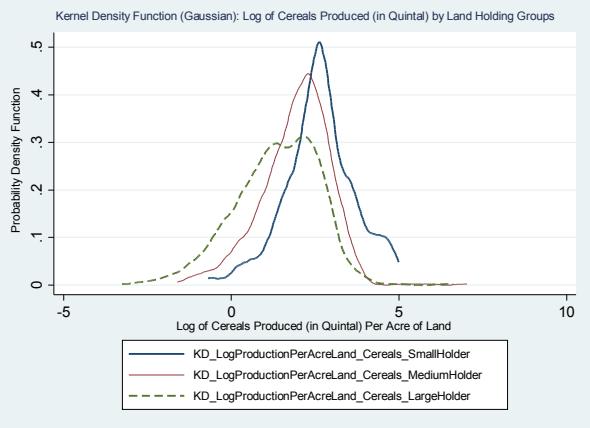


Figure A.1.2: Kernel Density Function for Log of Pulses Quantity (in Quintal) Produced Per Acre of Land for Small, Medium and Large Land Holders.

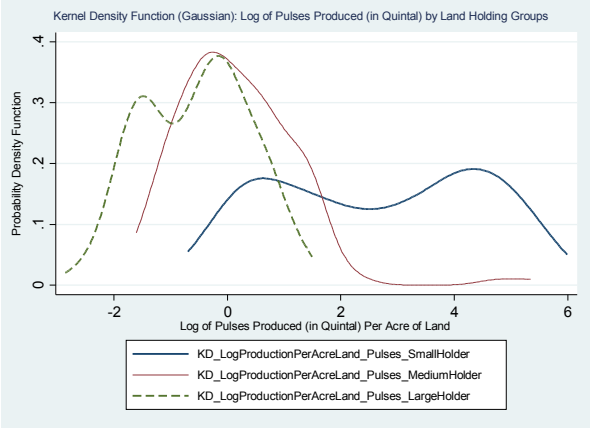


Figure A.1.3: Kernel Density Function for Log of Vegetables Quantity (in Quintal) Produced Per Acre of Land for Small, Medium and Large Land Holders.

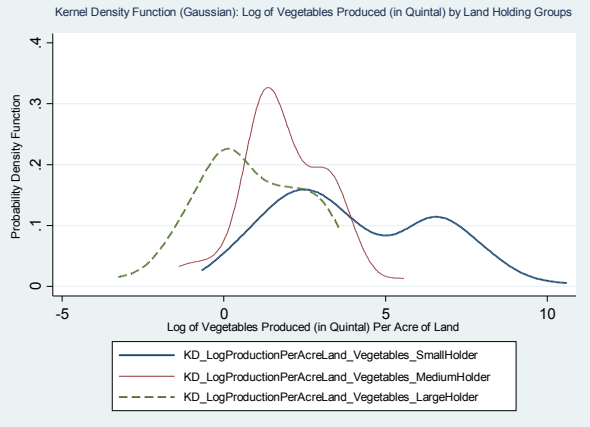
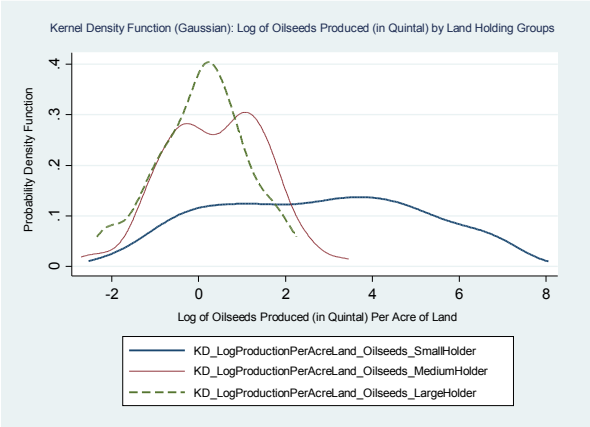


Figure A.1.4: Kernel Density Function for Log of Oilseeds Quantity (in Quintal) Produced Per Acre of Land for Small, Medium and Large Land Holders.



Annex 2

(a) The Tobit Model

We have used a tobit specification in which (positive) values of marketed surplus of a food commodity are transformed logarithmically and zeros are treated as 1 (so that the natural log is 0). The tobit specification is appropriate when there is a large number of zeros for a variable of interest and it is continuously distributed over positive values.

The censored normal regression model, or tobit model, is one with censoring from below at 0 where the latent variable is linear in regressors. Thus

$y^* = \beta_0 + \mathbf{x}\boldsymbol{\beta} + \mu,\ \mu|\mathbf{x} \sim \text{Normal}(0, \sigma^2)$ (1)
$y = \max(0, y^*)$ (2)

The latent variable y^* satisfies the classical linear model assumptions: in particular, it has a normal, homoscedastic distribution with a linear conditional mean. Equation (2) implies that the observed variable, y, equals y^* when $y^* \geq 0$, but $y = 0$ when $y^* < 0$. Since y^* is normally distributed, y has a continuous distribution over strictly positive values.

In the estimating equation, the dependent variable, y, represents marketed surplus of food, **x** is a vector of independent variables, **β** is a vector of unknown coefficients, and μ is an independently distributed error term assumed to be normally distributed with 0 mean and variance σ^2.

In the tobit, two expectations are of particular interest: $E(y|y>0,\mathbf{x})$, which is sometimes called the "conditional expectation" because it is conditional on y>0, and $E(y|\mathbf{x})$, which is unfortunately called the "unconditional expectation". (Both expectations are conditional on the explanatory variables)[24]. We have used the former.

[24] For further details, see Wooldridge (2006).

(b) Tobit Results

Table A.2.1. Factors Affecting Marketed Surplus of Cereals: Tobit Estimates

Explanatory Variables	Coefficient (t-statistic)	Elasticity (z-statistics)
Log of household head's years of schooling	0.1880(3.44)***	0.0309(3.44)***
Caste dummy: SC	-2.1535(-11.75)***	-0.0408(-11.79)***
Caste dummy: ST	0.2250(1.04)	0.0021(1.04)
Caste dummy: OBC	-0.4138(-3.36)***	-0.0249(-3.36)***
Land owned dummy: Small	-2.0455(-11.57)***	-0.1983(-11.57)***
Land owned dummy: Medium	-0.0522(-0.25)	-0.0010(-0.25)
Log of village level traders' price for cereals	0.5085(13.95)***	0.4078(14.08)***
Constant	-0.8318(-2.59)***	
/sigma	3.6360	
Number of observations	5694	
Left-censored observations at dep. variable=0	2903	
Uncensored observations	2791	
LR chi-square(7)	713.64***	
Pseudo R-square	0.0359	
Log likelihood	-9594.4877	

Note: Log of market surplus of cereals is the dependent variable. *** refer to significance at the 1 % level of significance. The elasticities are based on the uncensored observations.

Table A.2.2. Factors Affecting Marketed Surplus of Pulses: Tobit Estimates

Explanatory Variables	Coefficient (t-statistic)	Elasticity (z-statistics)
Log of household head's years of schooling	0.0043(0.03)	0.0003(0.03)
Caste dummy: SC	-2.0434(-3.51)***	-0.0156(-3.54)***
Caste dummy: ST	-1.6488(-2.07)**	-0.0062(-2.08)**
Caste dummy: OBC	0.5397(1.51)	0.0130(1.51)
Land owned dummy: Small	-2.6876(-5.90)***	-0.1048(-5.98)***
Land owned dummy: Medium	-1.5170(-2.79)***	-0.0115(-2.80)***
Log of village level traders' price for pulses	1.7053(15.08)***	0.3199(21.72)***
Constant	-15.2291(-14.32)***	
/sigma	6.1329	
Number of observations	5694	
Left-censored observations at dep. variable=0	5060	
Uncensored observations	634	
LR chi-square(7)	1109.80***	
Pseudo R-square	0.1587	
Log likelihood	-2941.5805	

Note: Log of market surplus of pulses is the dependent variable. *** and ** refer to significance at the 1% and 5% level of significance, respectively. The elasticities are based on the uncensored observations.

Table A.2.3. Factors Affecting Market Surplus of Vegetables: Tobit Estimates

Explanatory Variables	Coefficient (t-statistic)	Elasticity (z-statistics)
Log of household head's years of schooling	0.8226(3.25)***	0.0430(3.30)***
Caste dummy: SC	-0.3457(-0.45)	-0.0022(-0.45)
Caste dummy: ST	-5.8672(-2.79)***	-0.0185(-2.84)***
Caste dummy: OBC	-0.4484(-0.81)	-0.0089(-0.81)
Land owned dummy: Small	-2.3713(-3.30)***	-0.0729(-3.34)***
Land owned dummy: Medium	-0.7835(-0.92)	-0.0050(-0.92)
Log of village level traders' price for vegetables	1.4638(14.15)***	0.1340(22.35)***
Log of distance of whole sale agricultural market from the village	-0.8809(-3.42)***	-0.0906(-3.47)***
Constant	-14.6484(-10.24)***	
/sigma	7.3142	
Number of observations	5284	
Left-censored observations at dep. variable=0	5001	
Uncensored observations	283	
LR chi-square(8)	593.72***	
Pseudo R-square	0.1661	
Log likelihood	-1490.3393	

Note: Log of market surplus of Vegetables is the dependent variable. *** refer to significance at the 1 % level of significance. The elasticites are based on the uncensored observations.

Table A.2.4. Factors Affecting Market Surplus of Oilseeds: Tobit Estimates

Explanatory Variables	Coefficient (t-statistic)	Elasticity (z-statistics)
Log of household head's years of schooling	0.0271(0.17)	0.0018(0.17)
Caste dummy: SC	-1.4245(-2.57)**	-0.0108(-2.58)***
Caste dummy: ST	1.4928(2.20)**	0.0056(2.20)**
Caste dummy: OBC	0.1617(0.45)	0.0039(0.45)
Land owned dummy: Small	-5.0931(-11.15)***	-0.1979(-11.88)***
Land owned dummy: Medium	-2.3262(-4.49)***	-0.0176(-4.53)***
Log of village level traders' price for oilseeds	1.4414(17.08)***	0.2754(24.18)***
Constant	-12.1763(-14.27)***	
/sigma	6.3191	
Number of observations	5694	
Left-censored observations at dep. variable=0	5093	
Uncensored observations	601	
LR chi-square(7)	1028.34***	
Pseudo R-square	0.1531	
Log likelihood	-2844.7652	

Note: Log of market surplus of oilseeds is the dependent variable. *** and ** refer to significance at the 1 % and 5 % level of significance, respectively.

Figure A.2.1: Log of Predicted Market Surplus for Cereals by Land Holdings*

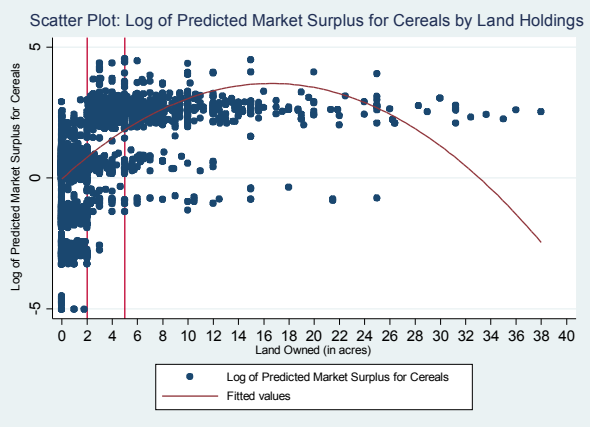


Figure A.2.2: Log of Predicted Market Surplus for Pulses by Land Holdings*

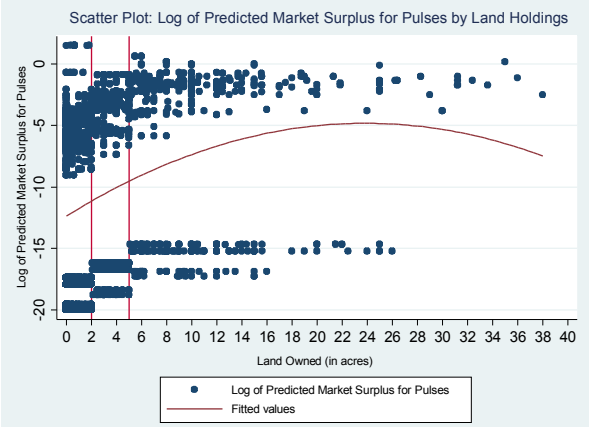


Figure A.2.3: Log of Predicted Market Surplus for Vegetables by Land Holdings*

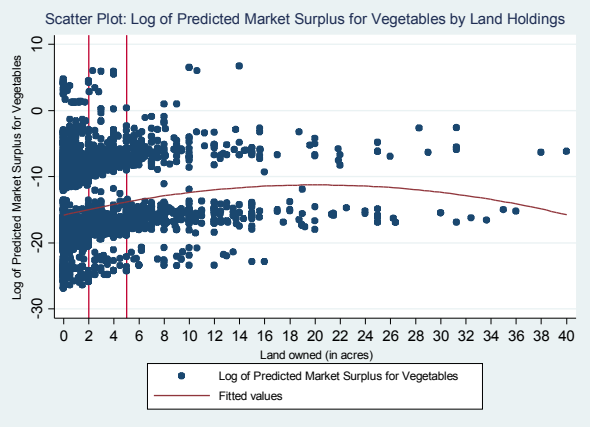
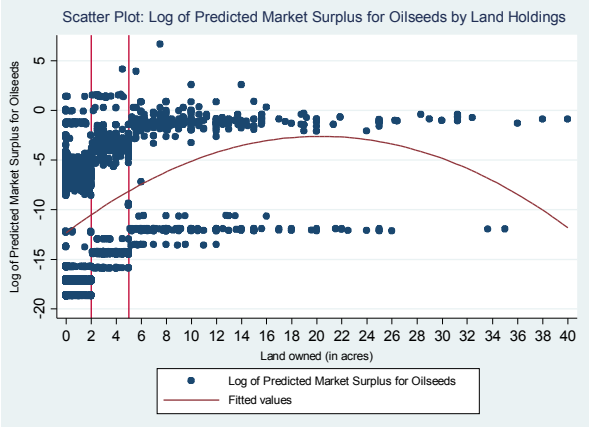


Figure A.2.4: Log of Predicted Market Surplus for Oilseeds by Land Holdings*



* Note: Vertical lines are drawn at 2 acres and 5 acres, respectively. The lines separate small, medium and large land holders

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