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Assets and poverty traps in rural Bangladesh

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What is Chronic Poverty?

The distinguishing feature of chronic poverty is extended duration in absolute poverty.

Therefore, chronically poor people always, or usually, live below a poverty line, which is normally defined in terms of a money indicator (e.g. consumption, income, etc.), but could also be defined in terms of wider or subjective aspects of deprivation.

This is different from the transitorily poor, who move in and out of poverty, or only occasionally fall below the poverty line.

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Abstract

This paper applies Carter and Barrett's theory of assets poverty traps to a unique longitudinal survey from rural Bangladesh. Non-parametric and parametric methods are used to examine the shape of the dynamic asset frontier, the number of equilibria, and whether land and non-land assets stock converge to such equilibria. We find evidence for concavity of the dynamic asset frontier but no evidence for multiple equilibria in the case of both land and non-land assets. It is hypothesised that the existence of well-functioning markets for labour and capital and the absence of discrete differences in livelihood strategies in rural Bangladesh, and Asia more generally, help to explain the contrast between our results and those for several African countries

Keywords: Asset dynamics, poverty traps, Bangladesh

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1 Introduction

In recent years, a literature on assets and poverty traps in developing countries has emerged with two distinct strands. The first of these strands takes a micro-economic perspective and uses household-level panel data on asset holdings to distinguish between structurally and stochastically poor households and to identify whether a 'bifurcation point' exists at which asset holdings (usually defined in terms of an index of physical productive assets) tend toward high or low level equilibria (Carter and May, 2001; Lybbert *et al.,* 2004; Carter and Barrett, 2006; Adato *et al.,* 2006; Barrett *et al.,* 2006; Carter *et al.,* 2007; among others). The second strand takes a more macro-economic and system dynamics perspective and examines whether low-level equilibria are consistent with the divergence of living standards between regions and countries and to what extent this is associated with 'adverse geography' (Bloom *et al.*, 2003; Bowles *et al.*, 2006, Kanbur and Venables, 2005; Kraay and Raddatz, 2005; Sachs *et al.*, 2004).

This paper is firmly within the micro-economic strand of the poverty traps literature, and seeks to apply and extend Carter and Barrett's dynamic assets framework to rural Bangladesh. In particular, using a unique longitudinal survey covering 1,787 households located in three case-control intervention study sites in rural Bangladesh, it will investigate the following questions:

(1) is there evidence of multiple equilibria in land and physical capital asset holdings in rural Bangladesh?;

(2) if so, does a 'bifurcation point' (at which assets holdings or livelihood trajectories diverge) or 'break point' in the dynamic asset frontier best characterise asset dynamics in rural Bangladesh;

(3) what household and community characteristics are associated with asset growth over time? In particular, what is the role of access to credit, labour markets, and nongovernmental organisations (NGOs) in asset accumulation?; and,

(4) what are the negative events and processes (such as health shocks, natural disasters, payments of marriage dowries, property division, etc.) that prevent households from accumulating assets? To what extent are these mitigated by positive events?

We attempt to answer these question using both non-parametric and parametric (regression-based) methods, which are outlined in the next section of the paper. Section 3 describes the unique longitudinal survey of rural Bangladesh to which we apply this methodology, together with baseline household characteristics, baseline livelihoods strategies, the incidence of shocks, and the trends in asset stocks observed over the three periods spanned by the survey. Section 4 moves on to discuss our empirical specification and the variables we use

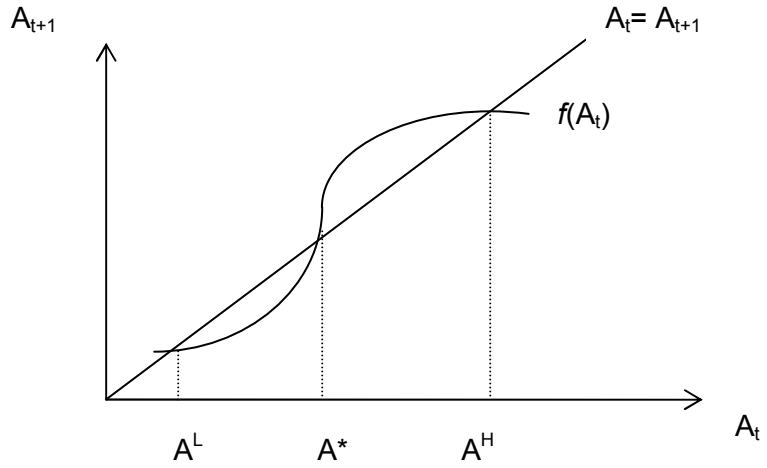
to measure labour and capital market access, which are viewed as mediating factors. Section 5 presents our non-parametric results using Lowess plots and joint density functions for both land and non-land assets. Section 6 then examines the impact of household characteristics, shocks, and the mediating role played by labour and capital markets on land and asset growth, and tests for the convergence of three classes of assets using parametric methods. Section 7 concludes with a summary of the results and a discussion of why our and other Asian studies typically find very limited evidence of multiple dynamic asset poverty traps.

2 Methodology

In a series of recent papers, Carter, Barrett and others have developed a theory of (dynamic) poverty traps and tested it empirically using data from sub-Saharan Africa.[1] Their elegant conceptualisation of poverty traps starts with the observation that it is usually much easier to measure assets than either consumption expenditures or incomes, and goes on to develop a theory of asset dynamics and dynamic poverty traps which can be applied to longitudinal data on assets stocks. Parametric and non-parametric methods are used to derive a dynamic asset path, which shows the typical relationship between asset holdings in two periods, usually a number of years apart. Typically, as shown in Figure 1, the dynamic asset path has an elongated S-shape with three equilibria at the points where the dynamic asset path intersects the diagonal: a stable low level equilibrium (A^L), an unstable mid-level equilibrium (A^*), and a stable high level equilibrium (A^H). This leads to a prediction that households' asset trajectories will bifurcate, with those households which start off with asset levels above A^* accumulating assets over time and tending toward the stable high level equilibrium. Meanwhile households with assets below the unstable equilibrium disaccumulate their initial assets and tend toward the stable low level equilibrium. This implies that some households will tend toward a persistently (or chronically) poor state, while other households will tend towards relative affluence.

[1] See, *inter alia*, Carter and Barrett (2006), Barrett.*et al.* (2006), Lybbert *et al.* (2004) and Barrett and Carter (2001).

Figure 1: Carter and Barrett's Theory of asset dynamics and poverty traps



Source: Carter and Barrett (2006)

Technically, the dynamic asset path represents the central tendency of the asset recursion function (Naschold, 2006). Dynamic asset paths can be estimated using a variety of non-parametric and parametric methods although, given the inherent non-linearity hypothesised by the theory, non-parametric methods usually provide the best fit. For our non-parametric estimation, we use locally weighted scatterplot smoothing, or Lowess, as proposed by Cleveland (1979). Despite its computational intensity, Lowess is attractive compared to other non-parametric methods such as kernel regression as it uses a variable bandwidth, which is robust against outliers, and uses a local line or polynomial estimator to minimise boundary problems (Cameron and Trivedi, 2005). However, such methods do impose continuity on the dynamic asset path.[2]

In a recent paper, Naschold's (2008: 5–7) reviews the parametric specifications used in other growth and convergence studies. Most of these studies include not only a linear term in lagged assets or income, but also higher order polynomial terms. For example, Lokshin and Ravallion (2004) estimate a third degree polynomial in income levels, while Jalan and Ravallion (2004) used a fixed effects model in differences for rural China. [3] Neither of these studies, which use income growth as the dependent variable, finds evidence for multiple dynamic equilibria, concluding that current income is a slightly concave function of lagged income. Barrett *et al.* (2006) and Naschold (2006, 2008) use a fourth degree polynomial function of past assets controlling for household and time-specific effects, to test asset dynamics in Northern Kenya, Ethiopia, India and Pakistan. The Barrett *et al.* (2006) study,

[2] This is not the innocuous assumption it may first appear, as it rules out the sort of discontinuities (jumps) in the asset frontier, which might characterise poverty traps. However, testing for such discontinuities is a complex estimation problem (Hansen, 1999) and we find no evidence for such discontinuities in our graphical analysis for Bangladesh.

[3] Jalan and Ravallion (2004) note that a cubic function is the lowest order polynomial that can detect multiple stable dynamic equilibria since it allows the curvature of the function to switch. However, as Naschold (2008) points out, a cubic function has a tendency to force the stable equilibria into the tails of the distribution.

which examines livestock assets only, finds one unstable threshold point and two stable equilibria suggesting the existence of multiple dynamic poverty traps consistent with the Carter and Barrett theory. In contrast, the Naschold study finds evidence of a weakly concave dynamic asset frontier in Ethiopia, India and Pakistan. This implies that rural households in these settings tend to move slowly towards a single long-run equilibrium, which may be a poverty trap, if it lies below the poverty line.

We estimate the following non-parametrically:

$$A_T = ß\ (A_B) + \varepsilon_t \quad (1)$$

where A_B and A_T are assets at the baseline (B) and the most recent survey period (T). The analogous parametric regression is:

$$A_T = (1 + \alpha)A_B + \theta_t \quad (2)$$

which is estimated in differenced form as

$$AT - AB = \alpha AB + \theta t \quad (3)$$

A dynamic equilibrium implies that, at least in expectation, asset stocks do not change over time, that is,

$$E[A_T - A_B] = 0 \quad (4)$$

Suppose there is a level of assets A* that represents a dynamic equilibrium. For A* to be a stable equilbirum, the following condition must be met:

$$-2 < \frac{\partial E[A_T - A_t]}{\partial A_{B|A^*}} \leq 0 \quad (5)$$

For our parametric specification, we use a 4th order polynomial regression as follows:

$$A_{iT} - A_{iB} = \beta_0 + \beta_1 A_{iB} + \beta_2 A_{iB}^2 + \beta_3 A_{iB}^3 + \beta_4 A_{iB}^4 + Z_i \Gamma_i + C_i \Lambda_i + \varepsilon_{it} \quad (6)$$

where A_{iT} -A_{it} is asset growth for household *i* from the baseline survey period (B) to the most recent survey (T), A_{iB} is assets at the baseline, and Z_i and C_i are time invariant household and community characteristics and ε_{it} is the error term. This specification, which resembles that used by Barrett *et al.* (2006) and Naschold (2006), allows for convergence to be tested in a two ways. First, a strong test of convergence would be to reject $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ in favour of $-2 < \beta_1 \leq 0$ and $\beta_2 = \beta_3 = \beta_4 = 0$. That would imply a unique, stable dynamic equilibrium in which less wealthy households' asset stocks grow faster until they reach the equilibrium, while the asset growth of wealthier households slows down. This is similar to the

basic test for cross-country convergence in the macro-economic literature. Second, a weaker test of convergence is if the expected value of change in log assets is non-negative and the first derivative of the expected change in log assets with respect to lagged assets is negative at the point where E[.] = 0 and the first derivative is greater than minus one, otherwise the equilibrium would not be stable.[4] This weaker test implies local convergence but not necessarily a stable or unique equilibrium, since the function could diverge before reaching the global maximum. However, this can checked by repeating the test at different percentiles of the lagged asset distribution. In our application of this test in Section 5, we conduct this test at the 10th, 25th, 50th, 75th and 90th percentiles of the lagged asset distribution.

3 Data and descriptives

3.1 Survey design

The longitudinal study on which this study is based builds on three surveys conducted by IFPRI in Bangladesh to evaluate the impacts of microfinance, new vegetable and polyculture fish technologies, and the introduction of educational transfers. These are described in Zeller *et al.* (2001), Bouis *et al.* (1998), Quisumbing and Maluccio (2003) and Ahmed and Arends-Kuenning (2006), respectively. The original evaluations surveyed 1787 households and 102 villages located in 14 of Bangladesh's 64 districts, and were set up with intervention and comparison groups. These districts and villages were selected to span the range of agro-ecological conditions found in rural Bangladesh and, while the sample cannot be described as representative in a statistical sense, it does broadly characterise the variability of livelihoods found in rural Bangladesh.

Sample sizes and geographic distribution vary across sites. The microfinance study consisted of 350 households in seven villages across four districts; the agricultural technology study included 990 households in 47 villages in three districts; while the educational transfers study comprised 480 households in 47 villages in eight districts. Since these evaluation surveys were conducted, the sample households have been re-surveyed on one or more occasions. The most recent follow-up was conducted in 2006/2007 as part of a major project by the International Food Policy Institute (IFPRI), Data and Analysis and Technical Assistance Ltd. (DATA) and the Chronic Poverty Research Centre (CPRC) to resurvey all the households surveyed in each of the three evaluations. While the focus of this study was on understanding of the drivers and maintainers of chronic poverty in rural Bangladesh, the intervention-comparison groups were maintained from the previous study. In

[4] Note that because of the higher order polynomial terms, the derivative has to be evaluated throughout the conditioning domain.

addition, adult sons who had left their parents' households and set-up their own households were tracked, as long as they had not migrated from their home districts.

The IFPRI-CRPC-DATA resurvey in 2006/2007 involved both qualitative fieldwork and a follow-up longitudinal survey of households included in the IFPRI studies, and consists of three sequenced and integrated phases: (1) a qualitative phase based on focus group discussions designed to examine perceptions of changes (and why these have come about) from women and men in a subsample of our survey communities; (2) a quantitative resurvey of the original households and household 'splits' that have formed new households in the same district; and (3) a qualitative phase based on life histories of 160 selected households, with households first stratified by intervention, and then selected based on the four cells of the poverty transition matrix (poor in both waves, moving into poverty, moving out of poverty, and not poor in both waves). The analysis in this paper uses the data collected in the second (quantitative) phase of the study; further details on the study are found in Quisumbing (2007), Davis (2007), and Baulch and Davis (2008).

The household survey took place from November 2006 to March 2007, coinciding roughly with the same agricultural season, as one of the original survey rounds, and covered 2,152 households, of which 1,787 were core households that took part in the original survey, and 365 are 'splits' from the original household. The household survey questionnaire was designed to be comparable across sites and also to facilitate comparability with the original questionnaire from the evaluation studies. Key variables collected were food and non-food expenditures, transfers and social assistance received, assets, educational attainment of children, shocks, perceptions of well-being, and anthropometry of all household members. At this stage, a community level questionnaire was also administered to key informants to obtain basic information on each village and changes in the community and important institutions within the community since the last survey round. GPS coordinates for all sample households and village facilities were also collected.

Since this paper focuses on asset growth between the baseline and most recent survey rounds, the analysis sample consists of a subsample of those households that were re-interviewed, consisting of core households (originally interviewed households) for whom we have valid data on assets in both the baseline and 2006/2007 rounds. An attrition analysis for the survey is found in Quisumbing (2007) and will not be repeated here, but what is noteworthy is the relatively low level of attrition across sites. About 93.7 percent of original households were re-interviewed, implying an overall attrition rate of 6.3 percent between the baseline and the 2007 survey round. Attrition rates across survey sites differ, with a low attrition rate of four percent in the improved vegetables site to 11.1 percent in the individual fishponds site. Nevertheless, attrition per year is relatively low, ranging from 0.4 percent per

year in the agricultural technology site to a maximum of two percent per year in the educational transfers site — an average of 0.8 percent per year across all sites.[5]

3.2 Household characteristics and asset trends

Bangladesh has experienced impressive rates of poverty reduction from the mid-1990s up to the onset of the food price crisis in 2007. While our data are not nationally representative, comparisons of per capita consumption and poverty in the baseline survey and in 2006/2007 show definite increases in per capita consumption, and impressive reductions in poverty.[6] Table 1 presents per capita consumption expenditures, poverty transition categories, and baseline household characteristics of core households in the assets analysis. All monetary values are in 2007 taka, converted using the Consumer Price Index.[7] In the microfinance site, the earliest site to be surveyed, the percentage of the population in poverty declined from 60 percent in 1994 to 21 percent in 2006/2007, a reduction of 3.25 percentage points per year. In the agricultural technology sites, poverty incidence declined from 70 percent in 1996 to 18 percent in 2006/2007 (a yearly reduction of 5.2 percentage points), and in the educational transfers sites, from 67 percent in 2000 to 22 percent in 2006/2007 (a yearly reduction of 7.5 percentage points).

Movements of previously poor households across the poverty threshold have been substantial—across study sites, the percentage of households that moved out of poverty were 44 percent of households in the microfinance sites, 54 percent of households in the agricultural technology sites, and 49 percent of households in the educational transfers sites. Despite these substantially and statistically significant reductions in poverty, 18 percent of core households in the educational transfers sites, 16 percent of core households in the microfinance sites, and 16 percent of households in the agricultural technology sites had per capita consumption expenditures below the poverty line in both periods—they are what we call chronically poor. Even if their conditions may have improved, they have not improved sufficiently to raise their per capita consumption above the poverty line.

[5] Our attrition rates compare quite favourably to the longitudinal data sets reviewed in Alderman *et al*. (2001), where attrition rates range from six to 50 percent between two survey rounds and 1.5 to 23.2 percent per year between survey rounds. While we did not have the resources to track all splits that had migrated to other districts, we obtained names and addresses of migrants from their parents or neighbours. All in all, we were able to track and interview 75 percent of household splits. Future work will investigate more systematically whether attrition bias affects our estimates of asset growth.

[6] See Quisumbing (2007) for a definition of the consumption variable used in this paper.

[7] Note that since the number of valid observations on assets differs slightly from those with valid observations on consumption expenditures, there may be slight differences between the numbers here and those reported in Quisumbing (2007).

Table 1: Per capita expenditures, poverty incidence, and poverty transition categories of surveyed households, by site

	Microfinance site		Agricultural technology site		Educational transfers site	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Number of panel households in asset growth analysis[a]	349		879		424	
Per capita expenditures (in 2006 taka)						
Per capita expenditure in baseline survey	936.40	512.43	960.48	549.61	869.17	785.81
Per capita expenditures in 2006/2007	1377.23	828.86	1485.69	754.75	1439.03	972.46
Poverty incidence at baseline and 2006/2007						
Whether poor in baseline survey	0.60	0.49	0.70	0.46	0.67	0.47
Whether poor in 2007	0.21	0.41	0.18	0.39	0.22	0.41
Poverty transition category						
Chronic poor	0.16	0.37	0.16	0.37	0.18	0.39
Falling into poverty	0.05	0.22	0.02	0.15	0.04	0.19
Moving out of poverty	0.44	0.50	0.54	0.50	0.49	0.50
Nonpoor	0.35	0.48	0.28	0.45	0.29	0.46

Source: CPRC-DATA-IFPRI long-term impact study

Notes: [a]These households had valid observations on land and assets in both survey rounds. Regression analysis was conducted on a subsample after trimming the top 5 percent of nonland asset observations.

Heads of the core households in our survey were around 43 years old during the baseline (Table 2), with a very low percentage of female-headed households (five percent). Because the baseline occurred at different years, at present, household heads are not the same age—heads of core households in the microfinance sites and the agricultural technology sites would now be close to 55 years of age, while those in the educational transfers sites would be six years younger, at 49 years of age. The difference in the current ages of household heads is worth noting, because it implies that the relatively younger educational transfers core households are at a different life cycle stage compared to the older households in the microfinance and agricultural technology sites.[8] Moreover, households included in the educational transfers sites were also required to have at least one child of primary school age (between 6–12 years), which explains the relatively larger proportions of household members age 5–14 as compared to the other sites.

[8] This is reflected in the survival rates of the heads of households across sites, based on those household that were successfully tracked and reinterviewed. In the microfinance sites, 302 out of 350 household heads (out of households that were successfully tracked and reinterviewed) are still alive (86.3 percent), in the agricultural technology sites, 844 out of 957 household heads are still alive (88.2 percent), and in the educational transfers sites, 466 out of 480 household heads are still alive (97.1 percent).

Table 2. Characteristics of households in microfinance, agricultural technology, and educational transfers sites

	Microfinance site		Agricultural technology site		Educational transfers site	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Number of panel households in asset growth analysis[a]	349		879		424	
Characteristics in baseline survey						
Age of household head	42.67	13.17	44.80	12.75	42.98	9.83
Whether female headed household	0.05	0.23	0.04	0.20	0.05	0.23
Education of HH head (years of schooling)	2.79	3.96	3.09	4.00	1.97	3.23
HH head has at least 4 years of schooling	0.34	0.47	0.38	0.49	0.27	0.44
Area of land owned at baseline (in decimals)	111.98	188.43	148.49	207.95	128.99	258.47
Whether functionally landless (<50 decimals)	0.58	0.49	0.38	0.49	0.62	0.49
Household size	5.17	2.36	5.69	2.77	5.22	1.74
Percent males 0-4 years	5.88	10.67	4.86	9.73	5.84	9.77
Percent females 0-4 years	6.03	10.45	4.74	9.33	4.50	8.82
Percent males 5-14	12.71	14.86	13.53	14.50	16.56	13.85
Percent females 5-14	13.39	15.29	11.50	13.62	21.24	16.06
Percent males 55 and over	4.98	10.25	4.81	8.97	3.06	7.35
Percent females 55 and over	4.32	11.78	4.15	9.04	2.85	7.81

Source: CPRC-DATA-IFPRI Long-term impact study

Notes: [a] These households had valid observations on land and assets in both survey rounds. Regression analysis was conducted on a subsample after trimming the top five percent of nonland asset observations.

As of the baseline, household sizes ranged from 5.17 persons in the microfinance sites to 5.69 persons in the agricultural technology sites. Most household heads had very little schooling, with only about third of household heads having completed four or more years of schooling.[9] Average schooling attainment also varies across sites, with household heads in the agricultural technology sites being better schooled, at 3.09 years, compared to those in the microfinance (2.79 years) and educational transfers sites (1.97 years). Reflecting the sample design of the original surveys, the area of land owned by households (including homesteads and cultivated land) ranged from 128.99 decimals in the educational transfers sites to 148.49 decimals in the agricultural technology sites (the latter is skewed by Mymensingh, which has relatively large landholding sizes).[10]

[9] All household characteristics are evaluated as of the baseline, but monetary values are expressed in 2007 taka for comparability, since the baseline surveys for each study site took place in different years.

[10] 100 decimals = 1 acre (or 0.4047 of a hectare).

Households' livelihood strategies were centered around agriculture at baseline (Table 3), albeit with marked gender differences. Forty-five to 58 percent of male household members 15 years of age and older said that their primary occupation was in agriculture, whether as self-employed or as agricultural wage workers. Non-agricultural self-employment, wage work, or salary work accounted for the primary occupation of between 29 to 35 percent of adult male household members. Between 12 to 19 percent of adult males were in neither sector, since they were students, unemployed, retired, beggars, or invalids. In contrast, women's livelihoods revolve around the home: 80 to 85 percent of adult females were engaged in domestic work within the home.

Consistent with the large long-term reduction in poverty, sample households built up and diversified their asset stocks over time (Table 3). Our measure of assets includes livestock, productive assets (agricultural equipment and non-agricultural business assets), consumer durables, vehicles, and jewellery, but excludes monetary savings, loans given to others, the value of food stocks, owner-occupied housing and trees. We do not include land in our asset aggregate because we do not have land values in the baseline survey of the educational transfers site, however, we control for the size of land owned in our regression analysis.[11] We conduct the non-parametric and parametric analysis of poverty traps in Sections 3 and 4 using three separate categories of assets: land, total non-land assets and agricultural durable assets (which accounted for about 15 percent of the value of total non-land assets at baseline, but only about four percent in 2006/2007).

Although land is an important asset for agricultural households, and is a strong predictor of movements out of poverty or for never being poor (Quisumbing, 2007), we see reductions in the size of owned land across all study sites. This reflects both a movement out of agriculture into non-agricultural income earning opportunities, as well as life-cycle processes, in which parents retire from active farming and subdivide their land among their children (usually sons). Such decreases in the size of landholdings, particularly of owned land, are typically due to institutional factors such as partible inheritance (in which, on his death, a father's land is divided between surviving sons) rather than market forces (Foster and Rosenzweig, 2002). Owned cultivated area declined by almost 18 percent in the microfinance sites, 12 percent in the agricultural technology sites, and 2.7 percent in the educational transfers sites. Leased-in area declined even more markedly, with reductions of 51.1 percent in the microfinance sites and 35.3 percent in the agricultural technology sites.[12]This means that even landless or functionally landless households, who would have relied on land rental markets to obtain land to cultivate, reduced their participation in these markets.

[11] We do have the size of land owned in all sites. Because we do not have the land value in the baseline educational transfers data, we cannot compute an asset aggregate based on summing the values of land and assets.

[12] We cannot examine changes in leased-in area in the educational transfers sites because this information was not collected at baseline.

Agricultural technology households had higher non-land asset holdings at baseline valued at 27.04 thousand taka (in 2007 prices), compared to 20.73 thousand taka and 17.84 thousand taka (both in 2007 prices) in the microfinance and educational transfers sites, respectively. This may be due to the selection of households that had enough assets (land and assets) to adopt the new technologies in the agricultural technology sites. In 2006/2007, households in the agricultural technology sites continued to have the highest mean asset levels, at 49.73 taka, nearly doubling their non-land asset holdings. Households in the microfinance and educational transfers sites also dramatically increased their mean asset holdings, with increases of close to 60 percent in the microfinance sites (up to a level of 33.15 thousand taka) and 33.2 percent (up to 23.76 thousand taka) in the educational transfers sites. These increases translated to annual asset growth rates of about eight percent in the agricultural technology sites and five percent in both the microfinance and educational transfers sites.

Changes in the composition of the asset portfolio accompanied increases in asset holdings. The top three categories of non-land assets in the microfinance and agricultural sites were livestock, consumer durables, and agricultural equipment at baseline. By 2006/2007, this had shifted to consumer durables as the most important asset, followed by livestock and jewellery. In the educational transfers sites, most non-land assets were held as livestock, consumer durables, and jewellery at baseline; at the time of the most recent survey, the relative ranking of the three categories remained the same, although the value of livestock holdings increased dramatically, by close to 60 percent. Quite remarkably, the percentage change (and annual growth rate) of jewellery was the highest in the microfinance and agricultural technology sites, suggesting that women within these households, many of whom were members of women's NGOs, were increasing holdings of these assets, which are traditionally considered women's assets in Bangladesh (White, 1992). It is possible that having more income under their control as a result of NGO programs stimulated investment in jewellery. This is consistent with patterns observed in India, Pakistan, and the Philippines, where women hold more jewellery assets than men (Antonopolous and Floro, 2005). In Thailand, Antonopolous and Floro (2005) find that women tend to keep more of their individual assets in real (tangible) forms rather than financial, because keeping assets in real form, such as jewellery, gives them more control over asset use. Other studies, such as Frankenberg *et al*. (2003) for Indonesia, also show that jewellery traditionally serves as a buffer asset for consumption smoothing since it can be easily pawned or sold, even if women consider distress sales of jewellery shameful in the Bangladeshi context (White, 1992: 133).

Investment in non-agricultural durables also grew at average annual rates of 25.8 percent and 16.1 percent in the agricultural technology and educational transfers sites, respectively, indicating diversification to nonfarm income-generating activities. However, holdings of non-agricultural durables fell by 23.7 percent in the microfinance sites. In all sites, households reduced their holdings of agricultural durable equipment, possibly because of diversification out of agriculture.

Households experienced a variety of negative shocks and positive events over the past ten years. Our data on shocks come from both the community questionnaire and the household questionnaire. Household-level positive and negative 'shocks' modules similar to that developed in Hoddinott and Quisumbing (2003), but modified for the Bangladesh context, ask households to consider a list of adverse events and indicate whether the household was adversely affected by them. Conversely, households are also asked to recall positive events that occurred in the same intervening period. Because there may be biases in the household reporting of covariate shocks, we prefer to use data on covariate shocks (floods) from the community survey.

Floods are the most important covariate shock in Bangladesh. During the past 10 years, Bangladesh experienced two significant flood events, the 1998 floods, which were widespread in scale (del Ninno *et al.* 2001) and the 2004 floods, which were less severe for the country as a whole (even if some individual communities may have been severely affected). Figure 2 shows the proportions of households affected by floods from both the community and household surveys. As previously discussed, there are striking differences between community and individual reports of flood severity. Based on the community survey, 31 percent of households in the agricultural survey sites were affected by the 1998 flood, compared to only 8.5 percent in 2004. Similarly, 28 percent of households in the microfinance were affected by the earlier flood, compared to 17 percent for the later occurrence. However, a larger percentage (38 percent) of households in the educational transfers sites, were affected by the later floods compared to the earlier floods (35 percent), based on the community survey. In all sites, household self-reports of flood occurrences for the 1998 floods suggest a lower incidence of flood losses compared to the community reports, but for the later flood, household reports indicate a higher incidence of flood losses and are quite close to the community reports. This could indicate a recall problem, especially for the earlier floods, which households are less likely to remember compared to the more recent floods, but could also reflect measurement error in community surveys. While these differences are interesting and sizeable, we do not know the magnitude of the bias between community and household self-reports.

Figure 2. Proportion of households affected by floods, 1997–2001 and 2002–2006

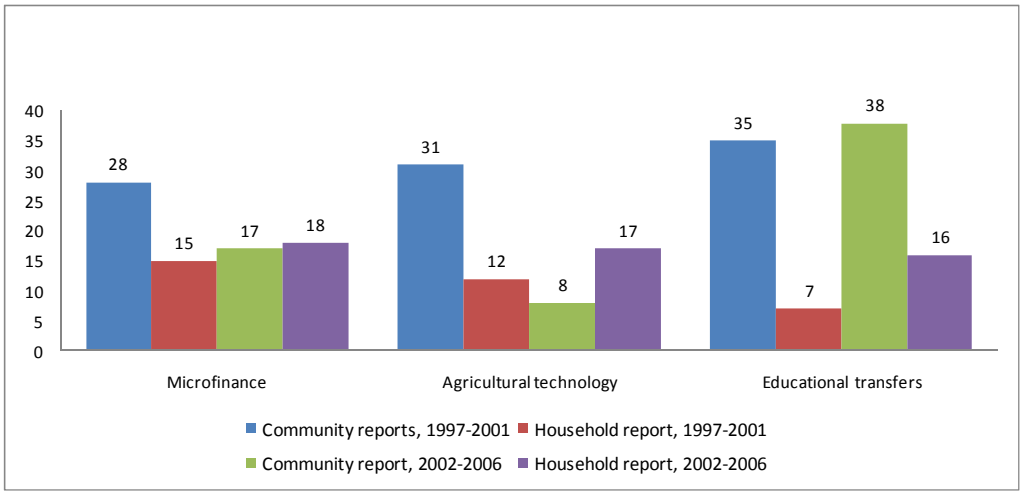
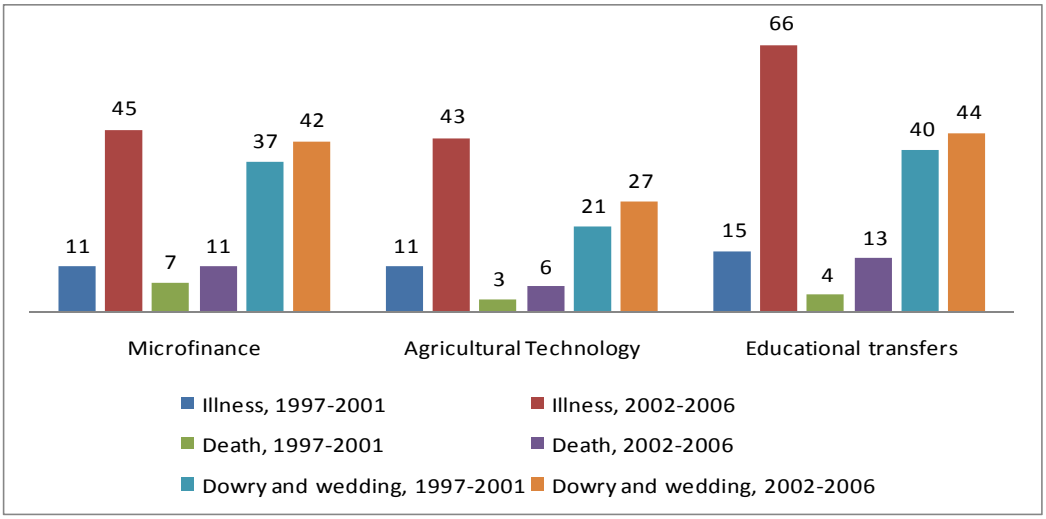


Figure 3 presents the proportions of households affected by negative shocks, broken down into two five-year periods, 1997-2001, and 2002-2006. For parsimony, we focus on the most important idiosyncratic shocks reported by households: dowry and wedding expenses, plus illness and/or death of household members. These are discussed in greater detail in Quisumbing (2007).[13]

Figure 3. Proportion of households reporting negative shocks, 1997–2001 and 2002–2006



[13] The relative frequencies of shock reporting is consistent with the reporting of factors responsible for household decline or remaining in poverty obtained from the focus group discussions conducted in a subsample of these sites during Phase I of the current study (Davis, 2007).

Although the prevalence of shocks varies slightly across sites, illness (combining expenses related to illness and foregone income) is the most common idiosyncratic shock affecting households, followed by dowry and wedding expenses, and then by death. While the prevalence of illness shocks across sites does not vary widely in the earlier period, the educational transfers sites have a much higher proportion of households reporting illness shocks in the second five-year period.[14] In both five year periods, the proportion of households reporting dowry and wedding expenses is much lower in the agricultural technology sites, followed by the microfinance and the educational transfers sites. It is possible that the presence of NGOs in the agricultural technology and microfinance sites, most with programs targeted to women, served to discourage the practice of dowries and excessive wedding expenses (Naved, 2000). Reflecting the aging of the sample, the prevalence of illness and death shocks varies across five-year periods, with much higher incidences reported in the last five years. Indeed, illness shocks affect between 45 to 66 percent of households across sites. Dowry and wedding expenses are also more frequently reported in the later period, as daughters reach marriageable ages.

Figure 4 shows the proportions of households reporting positive events, namely receipt of remittances, inheritance receipts, and dowry receipts. The prevalence of positive events is much lower than that of negative events, although proportions increase over the two five-year periods. One would expect that as children grow up and start working, the proportion of households receiving remittances would increase. Similarly, as sons grow up and get married, their parents also start receiving dowries. However, because dowries tend to accrue to the newlywed groom rather than his parents, one expects reports of dowry receipts by core households (parents) to be lower than reports of dowry and wedding expenses. While inheritance reports are higher in the second five-year period, the proportion of households reporting inheritance received is low, consistent with the low incidence of death in the sample as a whole.

[14] The increase in self-reported illness shocks is also consistent with the empirical regularity of higher self-reported illness among better-off households. Given the high income growth rates experienced by the sample, it is likely that the higher self-reported rates of illness could be due to reporting bias.

Figure 4. Proportion of households reporting positive events, 1997–2001 and 2002–2006

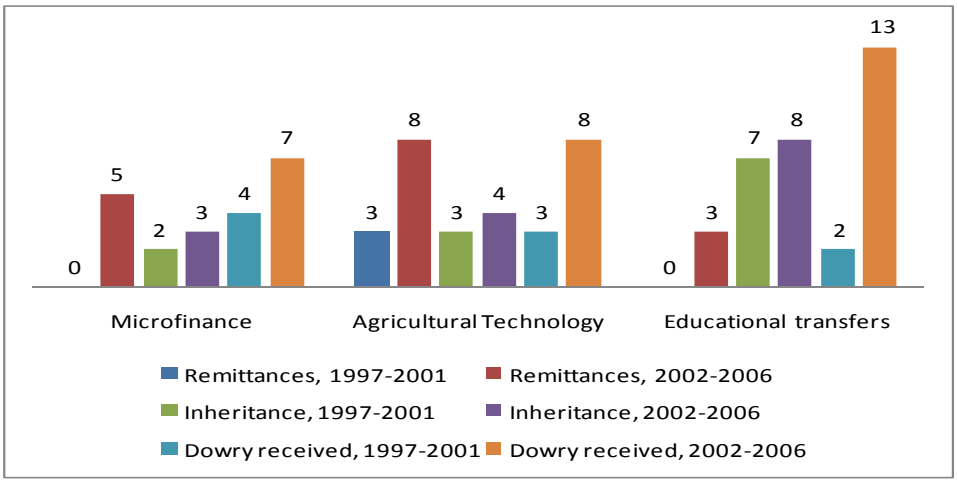


Table 3 presents information on community-level factors that might affect asset accumulation. One possible factor that might affect asset accumulation is access to capital markets, from formal and informal sources. Nongovernment organisations that provide credit, typically targeted to the poor, are an important feature of the capital markets in Bangladesh. In most countries, NGOs are community-based or membership-based organisations focusing on social assistance and welfare programmes. In Bangladesh, however, NGOs have an important role in asset accumulation, since many microfinance activities, particularly those targeted to the poor, are undertaken by NGOs. Other credit sources also exist, such as banks, moneylenders (*mahajan*), and input or output traders engaged in interlinked credit transactions.

Table 3. Primary occupations of household members 15 years of age and older, by site, percent distribution

	Microfinance		Agricultural technology		Educational transfers	
Sector	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
Agriculture						
Agriculture, self-employed	27.42	0.50	35.48	1.13	34.05	0.28
Agricultural wage labor	18.44	1.00	9.85	0.28	24.73	0.00
Non-agriculture						
Non-agriculture, self-employed	20.33	1.50	16.53	3.02	17.56	1.99
Nonagricultural wage labor	7.09	0.75	8.10	1.04	7.53	0.28
Salaried or skilled workers	7.09	1.00	10.85	2.83	3.94	0.57
Domestic work, including servants	0.71	85.75	0.50	79.72	0.00	85.75
Not employed						
Students	11.35	3.25	13.69	8.40	10.04	5.41
Unemployed	0.71	0.00	1.25	0.09	0.36	0.00
Retired	0.24	0.00	0.50	0.00	0.00	0.00
Beggars and invalids	3.55	5.00	1.84	2.83	1.79	5.70
Others	3.07	1.25	1.42	0.66	0.00	0.00

Source: CPRC-DATA-IFPRI Long-term impact study

Although they are important institutions that facilitate asset accumulation by the poor, we do not use NGO membership in our regressions because the baseline samples in the microfinance and agricultural technology sites were originally designed to evaluate the impacts of NGO programs. So NGO membership in our sample is likely to be much higher than typical. Moreover, one could argue that NGO membership at baseline is clearly endogenous to household characteristics, given the sampling design of the original surveys.

We therefore used data from the community survey to construct indicators of credit availability at five year intervals, with one of those intervals corresponding to the baseline round. Key informants were asked about the number of credit sources within the village, including moneylenders (*mahajan*) and NGOs lending outside program activities, plus agricultural input dealers, large farmers, shopkeepers and other traders offering loans in cash or kind. Our preferred indicator of credit availability excludes NGOs, since NGO placement is arguably endogenous to community characteristics, and because the samples were purposively designed to include NGO members. Not counting NGOs, credit sources at baseline ranged from about 11 in the microfinance sites to around 31 in the educational transfers sites.[15]

Another factor affecting capital accumulation would be access to labour markets, both agricultural and non-agricultural. The main agricultural labour market that is found in all areas in Bangladesh occurs during the *aman* (wet season) rice harvesting period; though yields are often higher in the *boro* (dry season) crop.[16] Households also have access to other off-farm labour opportunities, both on others' farms and in non-agricultural occupations. We examined two alternative indicators of labour markets: the village average *aman* male wage in 2006–2007 and village average yearly off-farm earnings in 2006–2007. While we would have wanted to have these data at baseline, data definitions would not have been comparable so we use the information from the most recent round instead. The educational transfers sites have the highest *aman* male wages, followed by the microfinance and agricultural technology sites. However, off-farm earnings (defined as earnings off one's own farm, including agricultural wage labour on others' farms as well as self-employment in nonagriculture) are highest in the microfinance site, followed by the agricultural technology site, and lastly by the educational transfers sites. This descriptive information on the villages suggests that the microfinance and agricultural technology sites are more likely to be more economically diversified (out of agriculture into nonfarm activity) than are the educational transfers sites. This is consistent with information in Table 3 showing the larger proportion of adult males engaged in agriculture in the educational transfers sites.

[15] The higher number of credit sources in the educational transfers sites seem to be driven by the number of shopkeepers offering credit in a few of the larger (more commercialised) villages.

[16] Note *boro* rice can only be grown in irrigated areas and is therefore not found in all parts of Bangladesh.

4 Empirical specification and definition of variables

In what follows we will examine how initial asset positions, shocks experienced by households, baseline household characteristics, and characteristics of the community that may affect asset growth between the baseline and 2006/2007 rounds. We conduct the analysis separately for each site, because the length of time between the baseline and the present survey is not the same across sites, using three categories of assets (land, total non-land assets, and agricultural durables). We control for baseline household characteristics and unobserved community characteristics because current household characteristics could be affected by the same processes that bring about current asset levels. By using past values of household characteristics we should eliminate endogeneity bias. We use *thana*-level dummies to control for unobserved community characteristics, and also include community characteristics related to the availability of credit and off-farm employment in our regressions.

The empirical specification of this paper draws from the work of Carter *et al.* (2007), Barrett *et al.* (2006), and Naschold (2008), with adaptations for the specific characteristics of the Bangladesh datasets. The data available include measures of baseline asset stocks (in 1994, 1996, and 2000), and endline asset stocks (in 2006/2007), measures of negative and positive shocks, household characteristics, and indicators of credit and labour market access. Because we want to compare growth of assets within the same household, we confine the analysis to 'core' households that were interviewed in both the baseline and recent rounds.

Our empirical specification, which includes polynomial terms in lagged assets up to the fourth degree, is similar to Barrett *et al.* (2006) in including higher order (up to quartic) terms in lagged assets. Our empirical specification modifies Equation (6) and is similar to Carter *et al.* (2007) by including shocks and positive events experienced by households. We estimate two versions, a linear version in lagged assets (7a), and a version with polynomial terms in lagged assets up to the fourth degree (7b):

$$\ln A_{iT} - \ln A_{iB} = \beta_0 + \beta_1 A_{iB} + \Theta(A_{iB}, L_i, K_i) + \Omega_i(A_{iB}, L_i, K_i) + Z_i\Gamma_i + C_i\Lambda_i + \varepsilon_{it} \quad (7a)$$

$$\ln A_{iT} - \ln A_{iB} = \beta_0 + \beta_1 A_{iB} + \beta_2 A_{iB}^2 + \beta_3 A_{iB}^3 + \beta_4 A_{iB}^4 + \Theta(A_{iB}, L_i, K_i) + \Omega_i(A_{iB}, L_i, K_i) + Z_i\Gamma_i + C_i\Lambda_i + \varepsilon_{it} \quad (7b)$$

where $ln\ A_{iT}$ -$ln\ A_{iB}$ is asset growth for household *i* from the baseline survey period (B) to the most recent survey (T), A_{iB} is assets at the baseline, Θ_i and Ω_i are vectors of negative and positive shocks obtained from the retrospective shocks modules, and Z_i and C_i are time invariant household and community characteristics and ε_{it} is the error term. The only

difference between equations (7a) and (7b) are the higher order terms in lagged assets in the latter equation. We estimate these separately for land non-land assets (including livestock), and agricultural durables.[17]

Because the impacts of shocks may differ depending on initial asset levels and labour and capital market conditions, the responses to these shocks β_Θ and β_ε, are written as functions of initial asset stocks A_{bi}, labour market conditions L_i, and capital market conditions K_i. We also include an indicator of functional landlessness, defined in the Bangladesh context as having less than 50 decimals (about 0.2 hectare) of owned land (Hossain 2007)[18] Using a sub-set of this longitudinal data set, Davis and Baulch (2009) find that functional landlessness at baseline is an important explanation for the differences in households' quantitative and qualitative classifications of poverty dynamics.

Unlike Carter *et al.* (2007), we do not distinguish between asset and income shocks, but we differentiate between negative shocks and positive events since the respondents were asked about these events in separate modules in our Bangladesh survey. For parsimony, we include only the most important negative and positive shocks reported by the respondents: floods, illness, and death, and remittance receipts, receipt of an inheritance, and dowry receipts. Partly to control for reporting bias in the case of covariate shocks, we use the village-level proportion of households reporting the flood shock in a given year from the community questionnaire. To examine whether shocks have persistent impacts, we divide the shocks into two recall periods, 1997–2001, and 2002–2006. The first recall period includes the 1998 floods, and the second the 2004 floods.

We use two measures of capital and labour market access. The measure of capital market access is the number of non-NGO credit sources in the village as of the baseline, and the measure of labour market access is the scaled village-off farm wage as of 2006/2007. This was constructed by constructing the village average earnings from off-farm sources (including work on others' farms) and scaling the village average earnings by dividing them by the village with the highest value (so the highest value is 1.0).[19] We use 2006-2007 data because labour market indicators constructed using the baseline data would not have been comparable across sites. We include control variables for household characteristics as of baseline (location, age and age squared of the household head, completed years of

[17] We estimate these separately for agricultural durables in an attempt to focus on assets that have a purely productive purpose, because consumer durables (which account for the bulk of non-land assets) and livestock have consumption and investment aspects. Households derive a stream of consumption benefits from consumer durables, and livestock can obviously be used for food as well as used as draft animals or stores of value.

[18] We had included interactions with initial asset tercile in previous specifications, but these were not jointly significant and are not included in the current paper.

[19] Although the male *aman* wage rate is also an indicator of labour market access, there was less variation in this variable across sites; moreover, it would not adequately capture all potential labour market opportunities (including non-agriculture and non-agricultural self-employment).

schooling of the household head, household size, proportion in various household demographic categories, and value of baseline assets in the land regressions and size of land owned as of the baseline in the non-land assets regressions). Finally, *thana* dummies capture unobserved community-level effects. The top 5 percent of the observations were trimmed to remove outliers.

5 Non-parametric results

Our Bangladesh data contains data on both initial households' assets (in 1994, 1996 or 2000) and final assets (in 2006/07) and allows the dynamic asset path to be estimated for both land and non-land assets. Figures 5 and 6 show the paths for land (in decimals) and non-land assets (in constant 2007 Bangladeshi Taka) in each of the three intervention sites.[20] The land graphs are for all households and include the sum of cultivated homestead and other land measured in decimals. For non-land assets, which include the values of agricultural and non-agricultural durables, consumer durables, jewelry, and livestock, values have been restricted to the first 95 percentiles of the total nonland asset distribution in all the figures that follow. This trimming of the top five percentiles of the data was adopted because of the presence of a number of implausibly high outliers at the extreme upper end of the distribution (especially in the initial years, and in the microfinance sites). Inclusion of these observations makes the overall shapes of the dynamic asset paths difficult to see.

Two features of the asset plots are apparent. First, while all of the dynamic asset paths are non-linear, none have the elongated S-shape hypothesised by Carter and Barrett. Indeed, all have just one point at which they cross the diagonal (from above, implying the equilibrium is stable.[21] This suggests that multiple equilibrium and asset-based poverty traps (or, at least, dynamic asset poverty traps of the Carter-Barrett type) do not exist in rural Bangladesh. Second, while the observations (represented by crosses) in these diagrams are widely distributed, they do not appear to divide into two groups (towards the bottom left-hand corner and top right-hand corners of the asset plots), as Carter and Barrett's theory of bifurcation would lead one to expect. Instead, there is a clustering of observations close to the origin, which suggest the persistence of minimal asset holdings among a large numbers of households.

The shape of the land and non-land assets plots are, however, quite different. The Lowess curves for land in all three sites cross the diagonal line close to the origin, and lie almost entirely below the diagonal from there on (Figure 5). This is consistent with the declining

[20] These figures were produced using a Lowess estimator with optimal bandwidth in Stata 10.

[21] Note that there is one outlier in the land plots for the microfinance sites, which causes the frontier in the upper plot in Figure 5 to recross the diagonal.

annual growth rates for total and cultivated land observed in Table 2, and the type of partible land inheritance practiced in rural Bangladesh.[22] However, the density of points close to the origin in the land plots also indicates the presence of a large number of functionally landless households with no land other than their homesteads. While this might be regarded as evidence of an underclass of chronically poor households, the scatter plots in the bottom left-hand corner of Figure 5 are broadly balanced and do not suggest any bifurcation of land values.

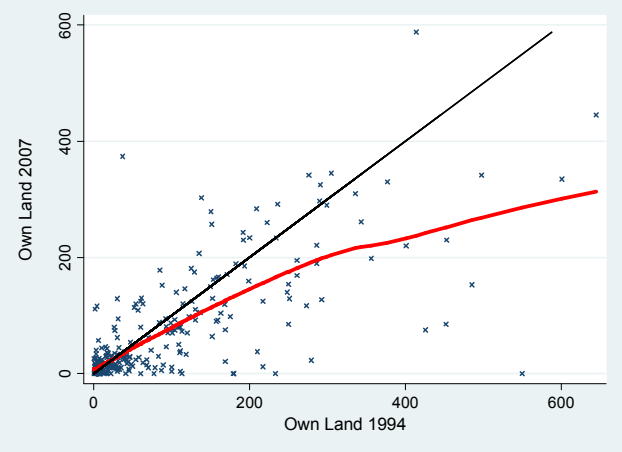
In contrast, the shapes of the non-land assets plots in Figure 6 have clear curvature and cross the diagonal at somewhat higher values. The Lowess curve for the agricultural technology households is the least convex and also crosses the diagonal at a slightly higher point than the Lowess curves for microfinance and education transfer sites. This is consistent with the generally higher levels of welfare in the agricultural technology sites. [23]This apparent convexity in the non-land asset frontier is confirmed by the joint density (surface) plots in Figure 7. In these plots, the x and y axes show the value of non-land assets in 2007 and the baseline year, while the z axes shows the relative frequency of observations. The joint density surfaces for the microfinance and education transfer sites can be seem to be more asymmetric than the surface for the agricultural technology sites. While the surface plots for the agricultural sites clearly has a single global maximum at around Taka 1000 worth of total non-land assets in both years, a local maximum can be seen the foreground of the surface plots for both the microfinance and education transfers sites around Taka 1400 in 2007.

[22] Note that in recent years, the practice of partible inheritance has been modified so that the division of land among surviving sons, takes place both informally, when sons marry and set up their own households, and formally, upon the father's death. (Davis, 2007) .As Foster and Rosenzweig (2002) have pointed out in the Indian context, whether or not households divide is not strictly exogenous.

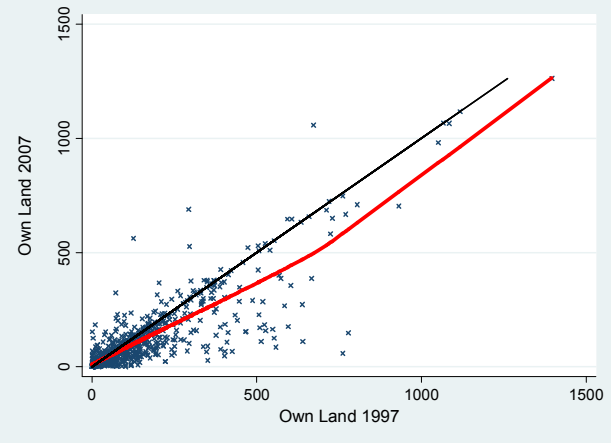
[23] The very small number of households with total asset values above 5000 Taka at baseline in the microfinance sites is probably attributable to the initial sampling design. Respondents consisted of NGO members (either ASA, BRAC, or GTZ/RDRS), controls with less than one acre of land, and controls with more than one acre of land. Respondents with less than one acre of land (controls and NGO members) comprised about 70 percent of the initial sample, so it is not surprising that these relatively land-poor respondents would also have lower baseline asset values.

Figure 5: Lowess plots for land

Microfinance Sites



Agricultural Technology Sites



Education Transfer Sites

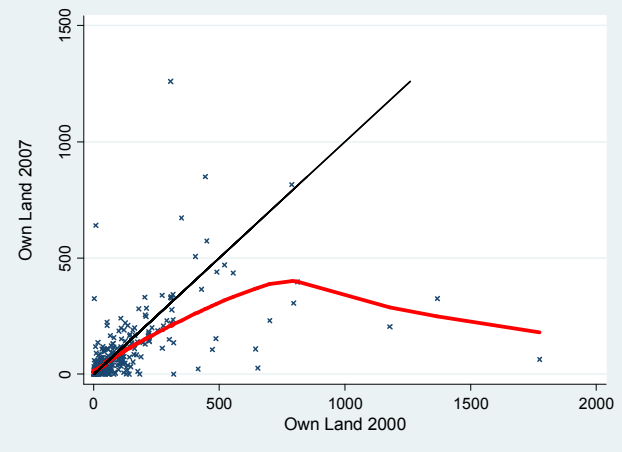
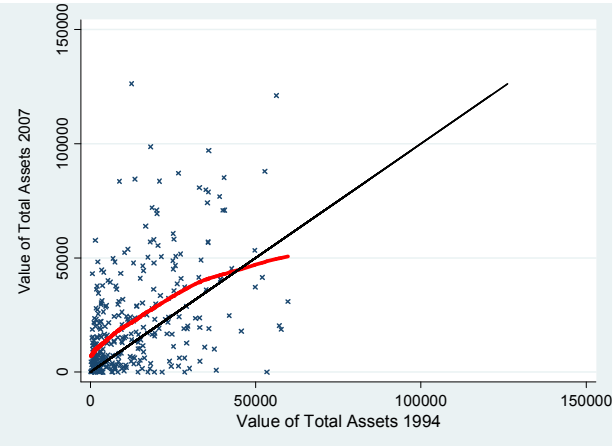
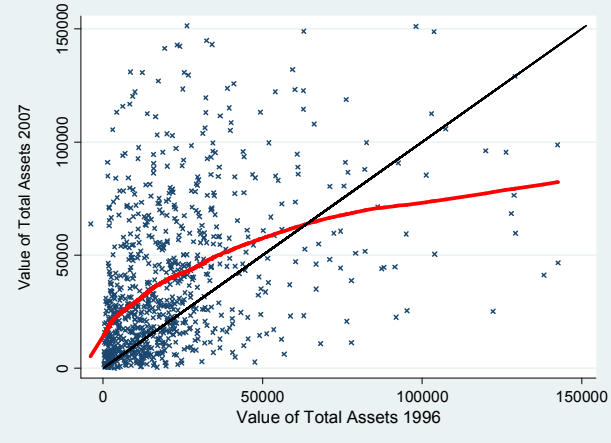


Figure 6: Lowess plots yotal non-land assets

Microfinance Sites



Agricultural Technology Sites



Education Transfer Sites

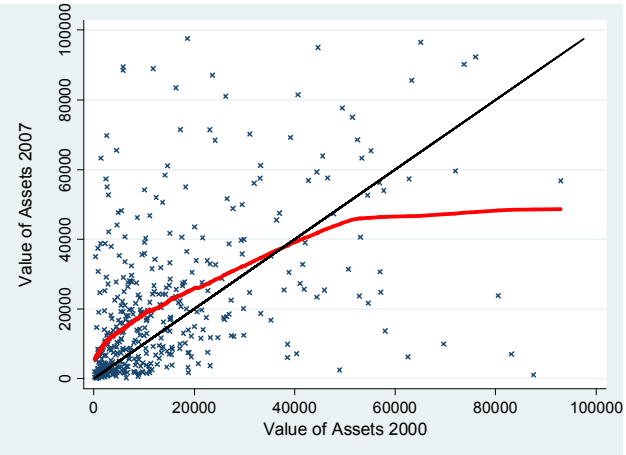
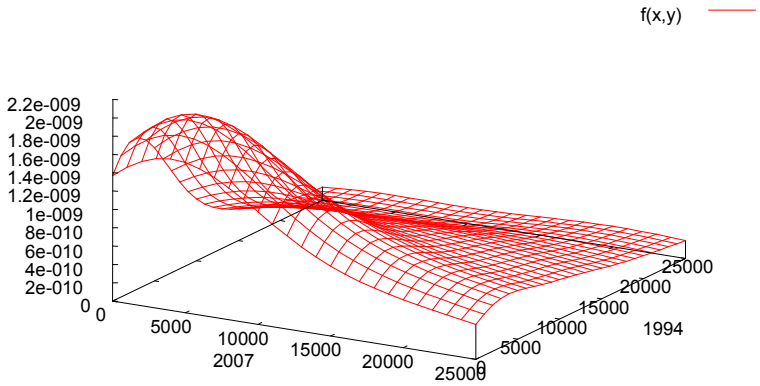
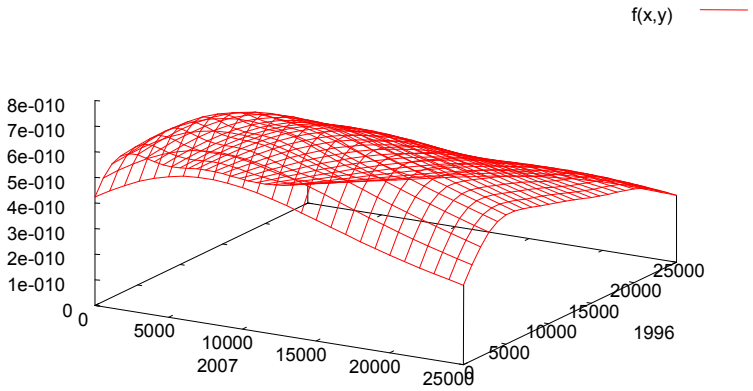


Figure 7. Joint density plots for total non-land assets

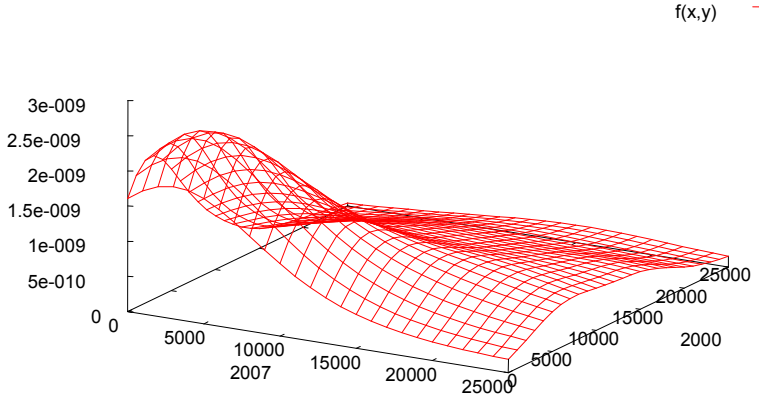
Microfinance Sites



Agricultural Technology Sites



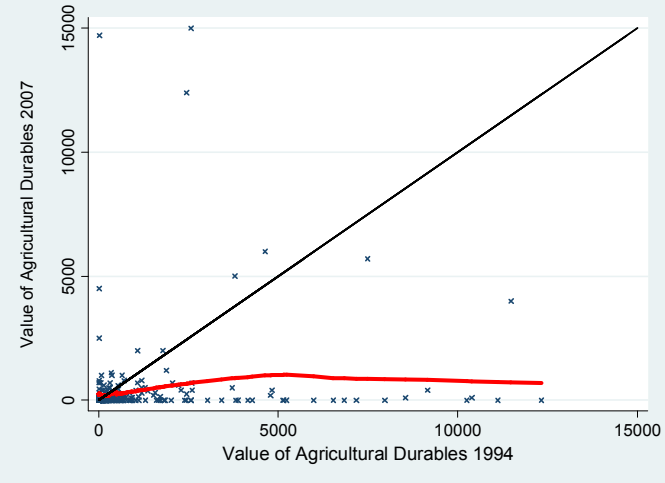
Education Transfer



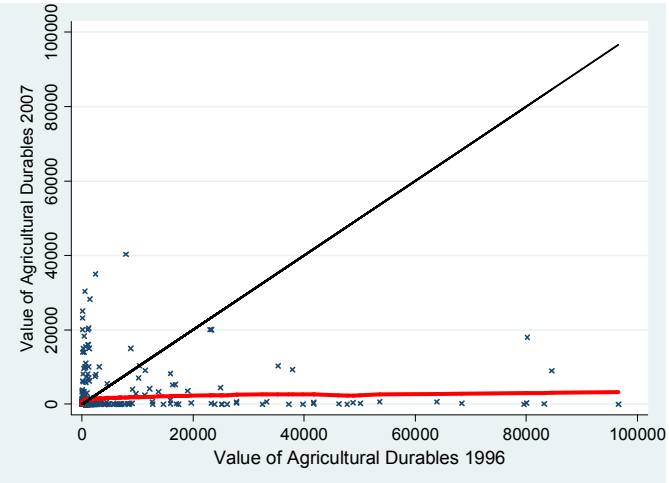
Finally, we examine asset plots for agricultural durables, which are the most important category of total non-land productive assets (Figure 8). As can be seen from the scaling of the axes in Figure 8, the value of agricultural durables owned in the three sites is quite different, being highest in the richer agricultural technology sites near to Dhaka and lower in the educational transfer and microfinance sites. There are also more households who hold no agricultural durables at all. However, again in all three cases, the Lowess curves show no evidence of multiple equilibria and the S-shape hypothesised by Carter and Barrett. The Lowess curves for agricultural durables all cross the diagonal close to the origin, and only the one for the educational transfer sites shows any sign of curvature. We do not show the joint density surfaces for agricultural durables, as like the ones for land assets, they do not reveal much.

Figure 8: Lowess plots for agricultural durables

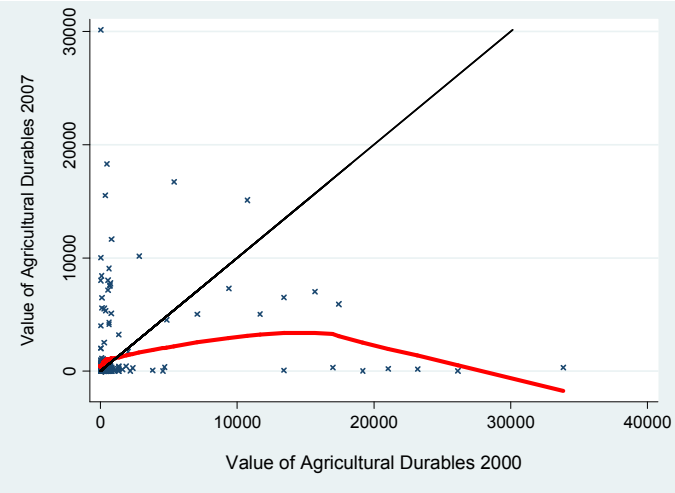
Microfinance Sites



Agricultural Technology Sites



Education Transfer Sites



It should be noted that these non-parametric results are similar to those of Naschold (2006), for rural Pakistan and rural Ethiopia. Naschold found 'no evidence for non-convexities in asset dynamics, which would be necessary for multiple stable asset equilibria' in these two countries (Naschold, 2006: 24). Naschold also found ‘a (slightly) concave pattern of asset accumulation', which he interprets as evidence in favour of (eventual) unconditional convergence toward a common long-run equilibrium. Such concavities, in turn, suggest that: (i) the speed of asset accumulation is a function of initial asset levels; and, (ii) poor households recover from asset shocks more slowly. We test for concavity more systematically in the parametric regression reported below.

6 Results from parametric methods

6.1 Land accumulation regressions

Estimates from alternative specifications of equation (7) for each site, separately, are presented in the succeeding tables. Because there is only weak support for the joint significance of the higher order terms, we present the results from the linear specification (7a) in the main body of the paper and results from the specification with higher order terms (7b) in Appendix 1.[24] Table 6 presents regression results for the land accumulation

[24] We fail to reject the null hypothesis that higher order terms are jointly equal to zero in the land accumulation regression only in the microfinance site; we reject the null hypothesis in both agricultural technology and educational transfers sites. For total non-land assets, we fail to reject the null hypothesis that higher order terms are jointly equal to zero in the land accumulation regressions in the agricultural technology and educational transfers sites, and only weakly reject the null hypotheses in the microfinance sites (p=0.09). Finally, for agricultural durables, we reject the null hypotheses that the higher order terms are jointly equal to zero in all sites, though only at p-value=0.08 in the microfinance site.

regressions across sites. The dependent variable is the difference between the areas of current and baseline owned land.[25]

Table 6: OLS estimates of land accumulation, linear specification, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Core growth and convergence						
Initial land owned, A(t-1)	-0.483	**-4.89**	-0.271	**-4.18**	-0.770	**-6.68**
Whether functionally landless[a]	-20.549	**-2.45**	8.297	1.09	-65.408	**-4.32**
Covariate shocks (floods)						
Prop. households affected, 1997-2001	-0.4540651	-1.63	-0.028	-0.22	0.217	**1.99**
Prop. households affected, 2002-2006	0.670	**2.39**	0.401	**2.63**	0.004	0.03
Idiosyncratic shocks, 1997-2001						
Any illness in household	-10.881	**-0.83**	4.067	0.52	10.977	0.74
Any death in household	-3.659919	-0.37	-1.270	-0.07	25.655	0.80
Dowry or wedding expenses	0.568	0.05	-0.999	-0.08	1.503	0.11
Idiosyncratic shocks, 2002-2006						
Any illness in household	4.019	0.56	2.933	0.45	11.325	0.89
Any death in household	-8.423	-0.75	-14.058	-1.12	53.037	1.53
Dowry or wedding expenses	3.734247	0.29	10.694	0.90	-13.695	-0.89
Positive events, 1997-2001						
Whether received remittances	(dropped)		25.991	1.34	18.487	0.33
Whether received inheritance	0.752	0.05	-6.651	-0.34	65.633	**2.20**
Whether received dowries	14.720	0.90	-4.608	-0.21	12.769	0.59
Positive events, 2002-2006						
Whether received remittances	22.41511	1.14	26.698	**2.28**	-11.160	-0.85
Whether received inheritance	(dropped)		6.331	0.38	-38.938	**-2.13**
Whether received dowries	15.203	0.78	5.541	0.61	25.990	1.37
Household characteristics at baseline						
Age of household head	5.532	**3.18**	5.950	**3.23**	5.916	**1.70**
Age of head, squared	-0.0622983	**-2.51**	-0.065	**-3.09**	-0.058	-1.49
Education of household head	-0.419	-0.32	0.769	1.04	1.794	1.03
Household size	-2.801	-0.76	-5.476	**-2.71**	-0.982	-0.28
Proportion males 0-4	-0.082	-0.31	0.275	1.04	-0.289	-0.59
Proportion females 0-4	0.03029	0.06	0.460	1.31	0.560	0.99
Proportion males 5-14	0.034	0.10	0.158	0.67	-0.233	-0.71
Proportion females 5-14	-0.453	**-2.57**	0.008	0.04	-0.086	-0.27
Proportion males 55+	-0.198	-0.29	-0.160	-0.34	0.619	0.51
Proportion females 55+	-0.274	-0.60	-0.097	-0.41	-0.958	**-2.00**
Value of assets at baseline	0.001	**2.65**	0.000	0.68	0.001	1.25

[25] We use area of owned land, area, and landholding sizes interchangeably in the discussion of the regression results.

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	**t**	**Coeff**	**t**	**Coeff**	**t**
Thana dummies for microfinance households (Ulipur excluded)						
Rajarhat, Kurigram	3.164	1.19				
Saturia, Manikganj	13.532	**1.80**				
Trishal, Mymensingh	(dropped)					
Bahubal, Habiganj	13.470	1.52				
Thana dummies for agricultural technology households (Saturia excluded)						
Mymensingh			14.769	1.32		
Kishoreganj			21.574	**1.83**		
Jessore			-4.937	-0.57		
Thana dummies for educational transfers sites (Nilphamari excluded)						
Mohadepur, Naogaon					1.806	0.10
Sherpur Sadar, Sherpur					-7.778	-0.53
Madhupur, Tangail					-15.556	-0.92
Nayagati (Kalia), Narail					16.121	0.76
Agolijhara, Barisal					-25.406	-1.23
Hazigonj, Chandpur					-8.415	-0.35
Chakaria, Cox's Bazaar					-0.639	-0.04
Constant	-76.681	**-2.43**	-119.320	**-3.01**	-79.645	-0.91
Tests of coefficients						
-2 - ß = 0 (t, p-value)	-15.35	**0.00**	-26.68	**0.00**	-10.66	**0.00**
ß < 0 (t, p-value)	-4.89	**0.00**	-4.18	**0.00**	-6.68	**0.00**
Number of obs	325		900		425.00	
F-value	.		18.68		8.69	
Prob > F	.		0.00		0.00	
R-squared	0.47		0.33		0.56	

Source: CPRC-DATA-IFPRI long-term impact study

Notes: t-values in bold are significant at 10 percent or better. Standard errors are corrected for clustering within villages

[a]*Functionally landless households are those with owned land less than 50 decimals*

Initial landholding sizes are important determinants of asset growth in all study sites, with asset growth occurring more slowly for households with more land, which is consistent with convergence. Consistent with the nonparametric analysis for land, the linear term in lagged area of owned land is significant. In the microfinance and educational transfers sites, however, households that are functionally landless experience more difficulty in accumulating land. (This coefficient is not significantly different from zero in the agricultural technology sites). Very few negative shocks affect changes in the area of land owned over time; where significant, negative shocks have unexpected positive effects. In contrast, remittances have a positive impact on the growth of land area in the agricultural technology sites in the later

period. Inheritance received in the earlier period increases landholdings, but more recent inheritance reduces it, possibly because it may imply the final division of the estate.[26]

Household characteristics emerge as important determinants of land area expansion in the microfinance sites and agricultural technology sites, with strong life-cycle effects in age and age squared. Reflecting both the gender division of labour in agriculture and the cost of providing dowries, the proportion of females between five and 14 reduces land accumulation. The number of females older than 55 reduces growth in landholding sizes in the educational transfers site. As expected, the value of initial assets is associated with increases in landholdings in the microfinance sites, owing to the complementarity between (mostly agricultural) assets and land.

We explore whether landholdings converge to a single long-run equilibrium by performing tests of convergence. We find strong evidence for convergence using both the strong test on coefficients (reported at the bottom of the regression equations) as well as by evaluating the first derivative across a range of A* (results available from authors upon request).[27]

6.2 Asset growth regressions

An analogous basic specification for asset growth is found in Table 7, which presents a basic linear specification for asset growth regressions across sites; the corresponding specification with higher order terms is in Appendix 2. The dependent variable is the difference between the values of baseline and current non-land assets (defined as consumer durables, agricultural and non-agricultural durables, jewelry, and livestock).

[26] While some property may initially be distributed upon the child's marriage, the property is finally divided only when the parent dies.

[27] Note that, because of the higher order polynomial terms, the derivative has to be evaluated throughout the conditioning domain.

Table 7: OLS estimates of total nonland asset growth, linear specification, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Core growth and convergence						
Initial assets, A(t-1)	-0.367	**-2.14**	-0.666	**-11.25**	-0.442	**-4.21**
Whether functionally landless[a]	-6005.523	-1.12	-10188.350	**-4.05**	-5725.123	**-2.26**
Covariate shocks (floods)						
Prop. households affected, 1997-2001	198.661	1.31	5.638	0.10	21.961	0.89
Prop. households affected, 2002-2006	-277.831	-1.63	159.249	**2.60**	11.964	0.46
Idiosyncratic shocks, 1997-2001						
Any illness in household	147.846	0.04	3398.214	1.11	-1782.343	-0.79
Any death in household	4245.406	0.94	-1147.310	-0.21	7793.634	1.51
Dowry or wedding expenses	-3301.987	-0.62	-4606.359	-1.06	-2891.113	-0.80
Idiosyncratic shocks, 2002-2006						
Any illness in household	3854.026	1.48	-1410.921	-0.98	491.524	0.32
Any death in household	-264.084	-0.07	-9303.869	-3.08	-1946.102	-0.66
Dowry or wedding expenses	2057.500	0.62	6390.554	1.72	2933.274	0.80
Positive events, 1997-2001						
Whether received remittances	(dropped)		9091.789	1.43	16472.550	**2.93**
Whether received inheritance	-1062.168	-0.53	13518.170	1.01	4530.047	0.70
Whether received dowries	8870.024	1.45	-3483.715	-0.53	587.751	0.12
Positive events, 2002-2006						
Whether received remittances	4817.977	0.66	8618.319	**1.86**	2573.258	0.77
Whether received inheritance	(dropped)		-12948.170	-1.08	-3229.095	-0.65
Whether received dowries	12177.170	1.64	5789.948	1.54	3169.025	0.95
Household characteristics at baseline						
Age of household head	-470.163	**-1.71**	319.628	0.79	128.961	0.18
Age of head, squared	4.482	1.17	-3.729	-0.85	-0.989	-0.13
Education of household head	33.970	0.11	1212.147	**4.56**	170.386	0.59
Household size	-534.753	-0.58	-716.965	-1.22	1307.036	1.56
Proportion males 0-4	81.144	0.67	12.051	0.13	-191.567	-1.58
Proportion females 0-4	61.594	0.61	-32.472	-0.29	-94.912	-0.72
Proportion males 5-14	213.402	**1.78**	24.573	0.33	-38.396	-0.44
Proportion females 5-14	-8.948	-0.20	-81.986	-1.16	-118.926	-1.58
Proportion males 55+	-19.947	-0.19	-192.246	-1.46	-158.683	-0.83
Proportion females 55+	-173.383	-1.25	-149.989	**-1.70**	-97.001	-0.92
Size of owned land at baseline	16.827	0.46	30.953	**3.27**	-17.762	**-1.67**
Thana dummies for microfinance households (Ulipur excluded)						
Rajarhat, Kurigram	-2078.886	**-4.00**				
Saturia, Manikganj	2421.201	0.57				
Trishal, Mymensingh	(dropped)					
Bahubal, Habiganj	840.516	0.34				

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Thana dummies for agricultural technology households (Saturia excluded)						
Mymensingh			-20883.450	-4.82		
Kishoreganj			-17434.090	-4.84		
Jessore			-8835.696	-1.83		
Thana dummies for educational transfers sites (Nilphamari excluded)						
Mohadepur, Naogaon					6546.271	1.87
Sherpur Sadar, Sherpur					5523.762	**2.08**
Madhupur, Tangail					8387.422	**2.68**
Nayagati (Kalia), Narail					5191.175	**1.79**
Agolijhara, Barisal					-4317.387	**-1.70**
Hazigonj, Chandpur					6786.032	**1.93**
Chakaria, Cox's Bazaar					5718.412	1.22
Constant	22138.430	**3.39**	31878.480	**3.00**	4395.504	0.24
Tests of coefficients						
-2 - ß = 0 (t, p-value)	-9.50	**0.00**	-22.55	**0.00**	-14.81	**0.00**
ß < 0 (t, p-value)	-2.14	**0.05**	-11.25	**0.00**	-4.21	**0.00**
Number of obs	328		900		425	
F-value	.		35.70		7.06	
Prob > F	.		0.00		0.00	
R-squared	0.18		0.24		0.23	

Source: CPRC-DATA-IFPRI long-term impact study

Notes: values in bold are significant at 10 percent or better. Standard errors are corrected for clustering within villages

[a]*Functionally landless households are those with owned land less than 50 decimals*

The coefficients on initial assets in Table 7 are significantly different from zero in all sites; however, we cannot reject the null hypothesis that the higher order terms are jointly equal to zero in the agricultural technology and educational transfers sites. Being functionally landless is again a detriment to asset accumulation; this dummy variable is negative and significant in the agricultural technology and educational transfers sites (it is negative but not significant in the microfinance sites). The occurrence of floods does not seem to have much impact on asset accumulation (indeed the impact of the more recent floods in the agricultural technology sites is positive, possibly because of the impact of large emergency transfers). Recent deaths in the household, however, reduce asset accumulation in the agricultural technology sites. Dowry and wedding expenses are weakly associated with higher asset growth in the agricultural technology site, but not the other two sites. The receipt of remittances (both domestic and international) are positively associated with asset growth in the agricultural technology and educational transfers sites; remittances are probably

clustered within a few villages in the microfinance sites, so this variable drops out of the regression.

Table 7 shows that some household baseline characteristics are important determinants of asset growth, although these effects tend to be strongest in the agricultural technology sites (partly because the larger sample size for these sites allows effects to be measured with greater precision). As expected, higher levels of schooling of the household head are associated with higher asset growth in the agricultural technology sites. Households who own larger areas of land at baseline in the agricultural technology sites also experience faster growth in non-land assets, possibly because of complementarities between land and other assets and also because land can be used as collateral. Household demographics are also important, but appear to play different roles across sites. In the agricultural technology sites, households with higher proportions of females older than 55 experience slower asset growth. In the microfinance sites, the proportion of males five to 14 is weakly associated with positive asset growth. In the educational transfers sites, none of the household demographic categories affect asset growth. Finally, the significant of *thana* dummies indicates the importance of unobserved *thana*-level effects.

We again test for whether assets converge to a single long-run equilibrium. Similar to the case of land, convergence tests on the linear specification, as well as the specification with higher order terms, indicate convergence. In the microfinance site, while we only weakly reject ($p=0.09$) the null hypotheses that the higher order terms are equal to zero, evaluating the derivative of asset change with respect to past assets across the distribution supports convergence.

Table 8: OLS estimates of agricultural durables growth, linear specification, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Core growth and convergence						
Initial assets, A(t-1)	-0.992	**-7.26**	-0.964	**-58.42**	-0.919	**-13.91**
Whether functionally landless[a]	378.399	0.58	-941.871	**-2.87**	-222.267	-0.75
Covariate shocks (floods)						
Prop. households affected, 1997-2001	-50.800	**-2.48**	-1.997	-0.29	-1.320	-0.36
Prop. households affected, 2002-2006	64.452	**2.61**	14.244	**1.82**	3.730	0.91
Idiosyncratic shocks, 1997-2001						
Any illness in household	19.173	0.05	-86.781	-0.27	291.157	0.88
Any death in household	-510.699	-0.96	-477.978	**-1.73**	252.143	0.40
Dowry or wedding expenses	-651.813	-1.39	-126.616	-0.36	-777.128	-0.85
Idiosyncratic shocks, 2002-2006						
Any illness in household	-169.520	-0.87	-206.341	-1.49	-339.117	-1.04
Any death in household	209.681	0.38	-876.761	**-3.53**	-74.802	-0.13
Dowry or wedding expenses	130.566	0.18	222.915	1.04	627.763	0.61
Positive events, 1997-2001						
Whether received remittances	(dropped)		-627.764	**-2.21**	879.204	0.55
Whether received inheritance	-651.275	**-1.73**	-72.570	-0.13	687.549	0.84
Whether received dowries	281.950	0.39	-84.417	-0.11	815.343	1.05
Positive events, 2002-2006						
Whether received remittances	86.291	0.10	-291.924	-0.63	-289.069	-1.22
Whether received inheritance	(dropped)		-536.887	-1.09	-259.293	-0.62
Whether received dowries	-395.853	-0.79	-1196.156	**-3.23**	41.000	0.09
Household characteristics at baseline						
Age of household head	87.418	1.37	4.507	0.14	233.776	**2.53**
Age of head, squared	-1.065	-1.46	0.078	0.20	-2.791	**-2.88**
Education of household head	99.675	1.20	5.539	0.15	2.927	0.06
Household size	-98.497	-0.71	-23.101	-0.32	119.034	1.62
Proportion males 0-4	-2.952	-0.16	11.824	0.51	-26.922	-1.37
Proportion females 0-4	0.953	0.12	8.918	0.60	-3.357	-0.31
Proportion males 5-14	6.177	0.54	-7.399	-1.16	-16.491	-1.15
Proportion females 5-14	16.712	1.07	-13.037	-1.59	-13.846	-0.99
Proportion males 55+	-4.999	-0.15	-22.553	**-1.67**	44.452	1.33
Proportion females 55+	-15.262	-0.75	-21.557	-1.47	5.380	0.33
Size of owned land at baseline	6.347	0.89	0.520	0.51	1.768	1.34
Thana dummies for microfinance households (Ulipur excluded)						
Rajarhat, Kurigram	453.740	**2.16**				
Saturia, Manikganj	1743.594	**3.61**				
Trishal, Mymensingh	(dropped)					
Bahubal, Habiganj	932.228	**2.70**				

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Thana dummies for agricultural technology households (Saturia excluded)						
Mymensingh			-2033.645	**-4.08**		
Kishoreganj			-1825.378	**-3.55**		
Jessore			-1297.059	**-2.49**		
Thana dummies for educational transfers sites (Nilphamari excluded)						
Mohadepur, Naogaon					938.130	**1.95**
Sherpur Sadar, Sherpur					94.362	0.22
Madhupur, Tangail					450.035	0.83
Nayagati (Kalia), Narail					-116.051	-0.30
Agolijhara, Barisal					-629.779	-1.38
Hazigonj, Chandpur					-382.839	-0.79
Chakaria, Cox's Bazaar					635.223	0.80
Constant	-1934.094	-1.31	2603.447	**2.26**	-4000.050	-1.58
Tests of coefficients						
-2 - ß = 0 (t, p-value)	-7.39	**0.00**	-62.80	**0.00**	-16.36	**0.00**
ß < 0 (t, p-value)	-7.26	**0.00**	-58.42	**0.00**	-13.91	**0.00**
Number of obs	325.000		847		425	
F-value	.		595.63		53.98	
Prob > F	.		0.00		0.00	
R-squared	0.402		0.88		0.59	

Source: CPRC-DATA-IFPRI long-term impact study

Notes: t-values in bold are significant at 10 percent or better. Standard errors are corrected for clustering within villages

[a]*Functionally landless households are those with owned land less than 50 decimals*

Table 8 analyses agricultural durables growth using the linear regression specification (with results for the specification with higher order terms in the Appendix 3). The results are qualitatively similar to those for total assets, with negative and significant coefficients for lagged assets in the linear specification. Flood shocks in the earlier period reduce agricultural durables accumulation in the microfinance sites, but, unexpectedly, more recent flood shocks increase the accumulation of agricultural durables in the microfinance and agricultural technology sites. Although one could argue that flood shocks at the community level are a negative unexpected event, they could also create a reason for acquiring more assets, if asset stocks are destroyed and have to be replenished. Similar to the results for total non-land assets, death within the household reduces accumulation of agricultural durables. Remittances, inheritance, and dowries have unexpected negative effects on nondurables growth, but the results are not consistent across sites. Life cycle effects are important only in

the educational transfers sites, while the proportion of elderly males is associated with slower agricultural durables growth only in the agricultural technology sites.

However, in contrast to land and total assets, we can reject the null hypothesis that the coefficients on the higher order terms are jointly equal to zero (see Appendix 3). This implies that tests for convergence will involve evaluating the derivative throughout the range of the distribution of lagged assets. Because tests of global convergence are not conclusive for agricultural durables, we also conducted tests of local convergence by evaluating the derivative throughout the distribution of agricultural durables at baseline. In all cases, the condition for local convergence was met, so we conclude that agricultural durables, like land and total assets, converge to a single long-run equilibrium in all three sites.

Finally, we examine the impact of capital and labour market access on asset accumulation. We use two indicators of capital and labour market access, the number of non-NGO credit sources at baseline and the scaled village off-farm wage. We interact these variables with the dummy variable for functional landlessness to ascertain whether labour and capital markets discriminate against those with minimal owned land. Selected coefficients on the two market access variables and their interaction with the functionally landless dummy are presented in Table 9. A word of caution is in order: unlike the agricultural technology and educational transfers sites, which included 47 and 48 villages, respectively, there are only seven villages in the microfinance sites. Thus, results for the microfinance sites should be taken as indicative only (and possibly unreliable). [28]

The number of non-NGO credit suppliers in the village has a negative impact on land accumulation in the microfinance sites, but households in villages with higher scaled off-farm wage rates are better able to accumulate land. Evidence also suggests that non-NGO credit suppliers are biased against the landless in the microfinance sites (but not the educational transfers sites). However, the interaction of the functionally landless dummy with the capital and labour market access variables are only weakly significant (at 10 percent) in the microfinance sites.

[28] Because of the limited number of villages and *thanas* in the microfinance sites (only seven), we do not include *thana* dummies in the specification with labour and capital market indicators, as these are constructed at the village level.

Table 9: Effects of mediating factors on asset accumulation, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Land						
Number of non-NGO credit suppliers in village	-18.201	**-2.81**	-0.059	-0.54	-0.216	-1.60
Scaled off-farm wage rate	569.278	**3.17**	58.672	1.64	-46.821	-0.87
Non-NGO credit x functionally landless	-2.783	**-2.63**	-0.092	-0.77	0.288	**1.86**
Off-farm wage x functionally landless	-25.611	-1.57	-53.191	-1.52	33.228	0.64
Interactions with functionally landless=0	3.46	**0.10**	1.23	0.30	1.96	0.15
Total nonland assets						
Number of non-NGO credit suppliers in village	11581.010	**7.43**	166.894	**2.02**	-36.048	-1.09
Scaled off-farm wage rate	-278297.700	**-7.92**	14531.460	**1.80**	621.514	0.09
Non-NGO credit x functionally landless	-864.301	**-2.78**	-218.162	**-2.69**	43.621	1.05
Off-farm wage x functionally landless	-5239.209	-0.90	17269.120	1.22	-2296.797	-0.29
Interactions with functionally landless=0	4.05	**0.08**	5.20	**0.01**	0.55	0.58
Agricultural durables						
Number of non-NGO credit suppliers in village	131.950	0.47	-7.530	-0.81	4.008	0.54
Scaled off-farm wage rate	318.470	0.05	669.080	0.49	149.884	0.15
Non-NGO credit x functionally landless	-106.267	-0.78	10.941	1.02	-3.243	-0.39
Off-farm wage x functionally landless	-2308.562	-0.90	287.358	0.23	-661.164	-0.65
Interactions with functionally landless=0	0.44	0.66	0.52	0.60	0.49	0.61

Source: CPRC-DATA-IFPRI long-term impact study

Notes: Regression equations are identical to the nonlinear specification with the above additional variables. Standard errors are corrected for clustering within villages.

Stronger results can be seen in the regression for total non-land assets. The number of non-NGO credit suppliers in the village increases non-land asset growth in the microfinance and agricultural technology sites, but preferentially for those households that are not functionally landless. The scaled off-farm wage rate has different impacts in the microfinance and agricultural technology sites: decreasing non-land asset growth in the former and increasing it in the latter. We reject the null hypotheses that interactions with the functionally landless dummy are jointly equal to zero in both the microfinance and agricultural technology sites.

Finally, none of the market access variables, nor their interactions with the functionally landless dummy, are jointly significant in the regressions for agricultural durables.

7 Summary and conclusion

This paper has investigated whether dynamic asset poverty traps exist for rural Bangladesh by applying non-parametric and parametric methods to a unique longitudinal data set that has followed almost 1,800 households for periods of between six and twelve years. Our principal finding is that, while there is a (single) low-level equilibrium or poverty trap, there is limited evidence for the existence of multiple equilibria and the bifurcation of asset trajectories found in the previous literature. 0Non-parametric analysis based on non-parametric Lowess plots show that the asset frontier for non-land assets in all three sites is convex and has a single equilibrium. This convexity is also supported by surface plots of non-land assets. Dynamic asset plots for land owned also contain a single equilibrium point, although in two of the sites their shape is linear. A high density of points close to the origin suggests a large number of landless or functionally landless households. Beyond the point, however, land ownership in 2007 strongly resembles that at the baseline, suggesting that land markets in rural Bangladesh are relatively thin.

The insights from the non-parametric analysis are largely borne out by a parametric regression analysis in which changes in land and non-land assets are regressed on household characteristics, community characteristics, positive events and negative shocks along with interactions between these variables and mediating factors (such as the availability of credit and off-farm wage employment). While both idiosyncratic and covariate shocks have complicated and sometimes counter-intuitive effects on asset accumulation, the impacts of positive events (such as dowry receipts, inheritances, and remittances) generally increase asset accumulation. In the non-land asset regressions, the initial value of land is also an important determinant of subsequent asset growth. A fourth-order polynomial on lagged assets is also included to allow testing of the convergence of the accumulation functions for land and non-land assets. Global convergence is suggested for land and total non-land assets in all sites, but for agricultural durables, local rather global convergence is indicated. Nonetheless, local convergence in the agricultural durables is suggested for all of the selected percentiles.

These results resemble the only other studies of asset dynamics and traps in Asia that we know of (Naschold, 2006 and 2008; Jalan and Ravallion, 2004 ; Lokshin and Ravallion, 2004), which deal with Pakistan, India, and China, respectively and also find that asset accumulation is weakly convex. However, they stand in sharp contrast to the results on studies on asset poverty traps in Africa (Adato *et al.,* 2006; Barrett *et al.,* 2006; Lybbert *et al.,* 2004; Carter *et al.*, 2007) which mostly find evidence of multiple equilibria and a bifurcation of household's asset trajectories.

What features of their rural economies explain why multiple equilibrium asset poverty traps do not appear to be empirically supported in Bangladesh, while they are in most of the sub-Saharan African economies that Carter, Barrett and their associates have examined? One obvious explanation is the presence of well-functioning markets for land, labour, credit and other factors in South Asia; markets that are either 'thin' or non-existent in the rural areas of Africa (and especially in the semi-arid pastoral area, in which Carter and Barrett's Ethiopian and Kenyan studies were conducted). The presence of well-functioning factor markets clearly facilitates consumption smoothing and the informal insurance mechanisms that protect households against short-term shocks, though possibly at the cost of 'adverse incorporation' and longer term impoverishment (see Wood, 2003). The existence of factor markets, well-functioning or otherwise, is in turn likely to be related to the relative population densities of South Asia and the Sub-Saharan Africa (and especially the Sahel). As the theory of production relations developed by Rosenzweig, *et al*. (1988) suggests, factor markets and 'insurance substitutes' are more likely to develop in sub-tropical land-scarce rural economies with high population densities (such as in Bangladesh) than in the arid, land-abundant rural areas with low population densities that characterise much of sub-Saharan Africa.

While our empirical findings show little evidence of the type of multiple asset-based poverty traps hypothesised by Carter and Barrett, this does not imply that poverty traps do not exist. The persistence of large numbers of rural Bangladeshi households with minimal assets holdings is consistent with the existence of an underclass of chronically poor households, and the types of poverty traps embodied in the older theories of cumulative causation (Myrdal, 1968) and urban bias (Lipton, 1977). Indeed, we find some indications that capital markets may work against the landless, and the exclusion of women from labour markets and other market-oriented activities may create different livelihood strategies for men and women. In future work, we will explore whether differential access to credit and labour markets leads to different asset dynamics for men and women in rural Bangladesh, in a renewed attempt to answer the classic question of 'why poor people stay poor?'

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Appendix

Appendix 1: OLS estimates of land accumulation, nonlinear specification, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Core growth and convergence						
Initial land owned, A(t-1)	-0.611	**-1.61**	0.184	0.76	0.147	0.36
Initial land owned, squared	0.004	1.11	-0.003	**-2.74**	-0.001	-0.49
Initial land owned, cubed	0.000	-1.19	0.000	**3.64**	0.000	-0.16
Initial land owned, fourth	0.000	1.15	0.000	**-4.07**	0.000	0.37
Whether functionally landless[a]	2.073	0.18	18.346	1.50	18.389	0.90
Covariate shocks (floods)						
Prop. households affected, 1997-2001	-0.514	-1.46	-0.033	-0.25	0.122	1.11
Prop. households affected, 2002-2006	0.794	**2.11**	0.378	**2.58**	0.026	0.22
Idiosyncratic shocks, 1997-2001						
Any illness in household	-10.213	-0.76	7.170	0.95	11.490	0.96
Any death in household	-6.097	-0.46	-4.434	-0.25	26.828	1.01
Dowry or wedding expenses	-3.165	-0.29	0.313	0.03	-9.312	-0.96
Idiosyncratic shocks, 2002-2006						
Any illness in household	3.487	0.63	2.232	0.37	7.154	0.59
Any death in household	-4.210	-0.29	-13.782	-1.14	39.481	1.15
Dowry or wedding expenses	5.030	0.42	6.262	0.53	-10.810	-0.80
Positive events, 1997-2001						
Whether received remittances	(dropped)		32.856	1.57	24.057	0.36
Whether received inheritance	-6.648	-0.45	-7.490	-0.33	55.081	**1.70**
Whether received dowries	14.583	0.94	-6.685	-0.32	19.868	1.23
Positive events, 2002-2006						
Whether received remittances	15.297	0.71	28.832	**2.45**	-4.276	-0.38
Whether received inheritance	(dropped)		7.741	0.35	-39.164	**-1.91**
Whether received dowries	11.441	0.57	2.427	0.30	21.467	1.57
Household characteristics at baseline						
Age of household head	5.197	**3.62**	5.912	**3.54**	1.775	0.66
Age of head, squared	-0.057	**-2.72**	-0.063	**-3.26**	-0.008	-0.29
Education of household head	-0.391	-0.32	1.019	1.41	1.024	0.77
Household size	-4.291	-1.26	-5.054	**-2.70**	-3.458	-1.14
Proportion males 0-4	-0.013	-0.05	0.312	1.22	-0.443	-0.86
Proportion females 0-4	0.001	0.00	0.471	1.33	0.703	1.47
Proportion males 5-14	0.106	0.29	0.131	0.60	-0.002	-0.01
Proportion females 5-14	-0.298	**-1.78**	0.025	0.15	0.125	0.46
Proportion males 55+	-0.315	-0.45	-0.188	-0.43	0.295	0.28
Proportion females 55+	-0.332	-0.82	-0.073	-0.31	-0.739	**-2.32**
Value of assets at baseline	0.001	2.89	0.000	0.81	0.000	**0.16**

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Thana dummies for microfinance households (Ulipur excluded)						
Rajarhat, Kurigram	5.364	1.48				
Saturia, Manikganj	14.490	1.54				
Trishal, Mymensingh	(dropped)					
Bahubal, Habiganj	13.694	1.42				
Thana dummies for agricultural technology households (Saturia excluded)						
Mymensingh			12.291	1.08		
Kishoreganj			25.511	**2.30**		
Jessore			-4.935	-0.58		
Thana dummies for educational transfers sites (Nilphamari excluded)						
Mohadepur, Naogaon					11.464	0.70
Sherpur Sadar, Sherpur					-12.541	-0.87
Madhupur, Tangail					-15.007	-0.94
Nayagati (Kalia), Narail					20.636	1.14
Agolijhara, Barisal					-16.669	-0.81
Hazigonj, Chandpur					-2.008	-0.10
Chakaria, Cox's Bazaar					7.785	0.46
Constant	-90.056	**-4.33**	-138.670	**-3.75**	-76.841	-0.87
Tests of coefficients						
-2<ß<0 (t, p-value)	-3.66	**0.01**	-9.04	**0.00**	-5.25	**0.00**
ß2= ß3 = ß4 =0 (F, p-value)	2.10	0.20	11.20	**0.00**	7.28	**0.00**
Number of obs	325		900		425	
F-value	.		.		.	
Prob > F	.		.		.	
R-squared	0.49		0.38		0.65	

Source: CPRC-DATA-IFPRI long-term impact study

Notes: t-values in bold are significant at 10 percent or better. Standard errors are corrected for clustering within villages

[a] *Functionally landless households are those with owned land less than 50 decimals*

Appendix 2: OLS estimates of total nonland asset growth, nonlinear specification, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Core growth and convergence						
Initial assets, A(t-1)	-0.383	-0.93	0.078	0.19	-0.081	-0.14
Initial assets, squared	0.000	**2.01**	0.000	-1.19	0.000	-0.79
Initial assets, cubed	0.000	**-3.81**	0.000	0.83	0.000	1.02
Initial assets, fourth	0.000	**4.02**	0.000	-0.66	0.000	-1.31
Whether functionally landless[a]	-5877.958	-1.11	-7712.247	**-2.88**	-4809.020	**-1.88**
Covariate shocks (floods)						
Prop. households affected, 1997-2001	268.178	**2.18**	2.655	0.05	22.692	0.93
Prop. households affected, 2002-2006	-385.114	**-2.77**	150.615	**2.46**	9.517	0.36
Idiosyncratic shocks, 1997-2001						
Any illness in household	-305.635	-0.08	3053.470	1.02	-2321.716	-1.01
Any death in household	5170.628	1.10	-1209.480	-0.22	7803.367	1.56
Dowry or wedding expenses	-3121.950	-0.62	-4361.149	-1.04	-2801.175	-0.80
Idiosyncratic shocks, 2002-2006						
Any illness in household	3684.870	1.53	-1264.766	-0.86	870.271	0.54
Any death in household	514.199	0.17	-8879.442	**-3.00**	-1867.782	-0.69
Dowry or wedding expenses	918.847	0.26	6049.487	**1.70**	2783.057	0.78
Positive events, 1997-2001						
Whether received remittances	(dropped)		9013.902	1.47	21491.740	**4.19**
Whether received inheritance	-2019.904	-1.21	14732.950	1.07	5327.922	0.81
Whether received dowries	8659.714	1.36	-3002.984	-0.46	782.689	0.15
Positive events, 2002-2006						
Whether received remittances	5053.281	0.70	7621.551	**1.68**	2140.401	0.63
Whether received inheritance	(dropped)		-13917.140	-1.13	-4106.768	-0.81
Whether received dowries	11099.870	1.47	6138.560	1.60	2639.118	0.76
Household characteristics at baseline						
Age of household head	-486.367	**-1.70**	211.736	0.51	-173.806	-0.25
Age of head, squared	4.384	1.05	-2.761	-0.62	2.793	0.38
Education of household head	-41.452	-0.14	1201.673	**4.52**	38.481	0.14
Household size	-374.582	-0.36	-776.795	-1.42	1224.859	1.49
Proportion males 0-4	98.666	0.81	5.901	0.06	-195.522	-1.61
Proportion females 0-4	66.760	0.66	-29.580	-0.27	-103.312	-0.79
Proportion males 5-14	206.022	**1.72**	24.460	0.33	-34.627	-0.39
Proportion females 5-14	-11.845	-0.29	-74.606	-1.01	-128.054	-1.68
Proportion males 55+	17.485	0.16	-204.021	-1.50	-192.439	-1.00
Proportion females 55+	-164.177	-1.12	-127.158	-1.49	-131.608	-1.26
Size of owned land at baseline	12.451	0.36	32.249	**3.33**	-11.499	-1.10

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Thana dummies for microfinance households (Ulipur excluded)						
Rajarhat, Kurigram	-1824.602	**-5.63**				
Saturia, Manikganj	1840.893	0.56				
Trishal, Mymensingh	(dropped)					
Bahubal, Habiganj	1455.073	0.62				
Thana dummies for agricultural technology households (Saturia excluded)						
Mymensingh			-19870.930	**-4.46**		
Kishoreganj			-16713.320	**-4.52**		
Jessore			-8462.112	**-1.69**		
Thana dummies for educational transfers sites (Nilphamari excluded)						
Mohadepur, Naogaon					5786.247	**1.65**
Sherpur Sadar, Sherpur					4447.384	1.59
Madhupur, Tangail					8030.050	**2.61**
Nayagati (Kalia), Narail					4487.393	1.58
Agolijhara, Barisal					-4187.212	-1.59
Hazigonj, Chandpur					6986.155	**1.94**
Chakaria, Cox's Bazaar					4923.804	1.02
Constant	21231.440	**3.84**	27716.680	**2.61**	9297.724	0.55
Tests of coefficients						
-2<ß<0 (t, p-value)	-3.92	**0.01**	-5.16	**0.00**	-3.37	**0.00**
ß2= ß3 = ß4 =0 (F, p-value)	4.05	**0.09**	1.43	0.24	0.62	0.43
Number of obs	328		900		425	
F-value	.		.		.	
Prob > F	.		.		.	
R-squared	0.21		0.25		0.26	

Source: CPRC-DATA-IFPRI long-term impact study

Notes: t-values in bold are significant at 10 percent or better. Standard errors are corrected for clustering within villages

[a]*Functionally landless households are those with owned land less than 50 decimals*

Appendix 3: OLS estimates of agricultural durables growth, nonlinear specification, all sites

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	t	Coeff	t	Coeff	t
Core growth and convergence						
Initial assets, A(t-1)	-0.390	-1.32	-0.493	**-2.95**	0.234	0.41
Initial assets, squared	0.000	-1.61	0.000	**-2.24**	0.000	-0.49
Initial assets, cubed	0.000	1.17	0.000	**1.94**	0.000	-0.57
Initial assets, fourth	0.000	-0.91	0.000	**-1.78**	0.000	1.11
Whether functionally landless[a]	347.099	0.54	-774.791	**-2.45**	-453.020	-1.47
Covariate shocks (floods)						
Prop. households affected, 1997-2001	-49.300	**-2.70**	-4.298	-0.71	-1.332	-0.44
Prop. households affected, 2002-2006	59.288	**2.50**	12.591	**1.68**	3.163	0.89
Idiosyncratic shocks, 1997-2001						
Any illness in household	-34.694	-0.08	-53.724	-0.17	276.902	1.04
Any death in household	-424.866	-0.81	-492.724	**-1.69**	157.969	0.23
Dowry or wedding expenses	-640.667	-1.36	-106.942	-0.31	-1063.043	-1.15
Idiosyncratic shocks, 2002-2006						
Any illness in household	-207.256	-1.14	-181.724	-1.47	-318.534	-0.98
Any death in household	244.037	0.40	-676.147	**-2.99**	-82.221	-0.14
Dowry or wedding expenses	43.745	0.06	113.194	0.57	745.553	0.73
Positive events, 1997-2001						
Whether received remittances	(dropped)		-328.966	-1.37	600.913	0.62
Whether received inheritance	-675.283	**-1.83**	-285.173	-0.60	701.141	0.88
Whether received dowries	331.152	0.45	-90.954	-0.12	716.236	1.01
Positive events, 2002-2006						
Whether received remittances	109.468	0.12	-166.034	-0.42	-233.252	-1.05
Whether received inheritance	(dropped)		-358.878	-0.84	-69.264	-0.17
Whether received dowries	-262.453	-0.53	-1129.804	**-3.06**	210.360	0.49
Household characteristics at baseline						
Age of household head	91.847	1.63	20.267	0.65	225.061	**2.77**
Age of head, squared	-1.121	**-1.67**	-0.153	-0.44	-2.713	**-3.07**
Education of household head	95.292	1.21	-1.889	-0.05	-17.963	-0.51
Household size	-91.061	-0.70	-24.886	-0.38	53.978	0.57
Proportion males 0-4	-3.046	-0.17	10.435	0.49	-28.389	-1.51
Proportion females 0-4	0.457	0.07	7.269	0.48	3.056	0.33
Proportion males 5-14	6.037	0.52	-7.814	-1.31	-21.433	-1.56
Proportion females 5-14	15.713	1.04	-13.562	-1.51	-14.860	-1.13
Proportion males 55+	-3.541	-0.10	-23.424	**-1.79**	52.896	**1.65**
Proportion females 55+	-15.425	-0.69	-23.832	-1.85	-2.667	-0.16
Size of owned land at baseline	5.569	0.79	0.429	0.38	-1.115	-0.72

	Microfinance		Agricultural technology		Educational transfers	
	Coeff	**t**	**Coeff**	**t**	**Coeff**	**t**
Thana dummies for microfinance households (Ulipur excluded)						
Rajarhat, Kurigram	528.839	**2.35**				
Saturia, Manikganj	1770.443	**4.36**				
Trishal, Mymensingh	(dropped)					
Bahubal, Habiganj	955.250	**2.40**				
Thana dummies for agricultural technology households (Saturia excluded)						
Mymensingh			-2113.191	**-3.83**		
Kishoreganj			-1893.371	**-3.45**		
Jessore			-1398.642	**-2.59**		
Thana dummies for educational transfers sites (Nilphamari excluded)						
Mohadepur, Naogaon					751.700	**2.10**
Sherpur Sadar, Sherpur					337.886	0.86
Madhupur, Tangail					560.628	1.08
Nayagati (Kalia), Narail					68.602	0.20
Agolijhara, Barisal					-354.826	-0.95
Hazigonj, Chandpur					-80.218	-0.20
Chakaria, Cox's Bazaar					1002.703	1.30
Constant	-2040.710	-1.51	2272.750	2.03	-3360.616	-1.45
Tests of coefficients						
-2<ß<0 (t, p-value)	-5.44	**0.00**	-9.01	**0.00**	-3.94	**0.00**
ß2= ß3 = ß4 =0 (F, p-value)	3.95	**0.08**	5.02	**0.03**	7.08	**0.00**
Number of obs	325		847		425	
F-value	.		.		.	
Prob > F	.		.		.	
R-squared	0.41		0.88		0.63	

Source: CPRC-DATA-IFPRI long-term impact study

Notes: t-values in bold are significant at 10 percent or better. Standard errors are corrected for clustering within villages

[a]*Functionally landless households are those with owned land less than 50 decimals*

Chronic Poverty
Research Centre

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The **Chronic Poverty Research Centre** (CPRC) is an international partnership of universities, research institutes and NGOs, with the central aim of creating knowledge that contributes to both the speed and quality of poverty reduction, and a focus on assisting those who are trapped in poverty, particularly in sub-Saharan Africa and South Asia.

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