CHAPTER 7

Diversification of Income and Employment: How Does Microfinance Affect Agriculture?

Introduction

The previous chapters have considered the effects of microfinance on household consumption, assets, employment, schooling, and poverty, as well as its total income effect. The next key issue is to examine its effect on income and employment diversification among alternative farm and nonfarm sources. As already shown, microfinance in rural Bangladesh mainly supports nonfarm activities in order to promote nonfarm self-employment and income for the rural unemployed. Agriculture still provides the bulk of rural employment and income-earning opportunities, accounting for about 25 percent of the country's gross domestic product (GDP) and 45 percent of its overall employment. But increasing population pressure on the land, along with seasonality of agriculture, means that many poor people who are willing to work in agriculture cannot be fully or even partially absorbed into the sector. At the same time, growth of the population and potential labor force is outpacing industrialization and urbanization.

Thus, one can hypothesize that the surplus labor force willing to work productively will likely borrow from microfinance institutions (MFIs) in order to gain nonagriculture self-employment. This would explain why the MFIs in rural Bangladesh finance mainly nonfarm activities. Even so, microfinance lending may still benefit agriculture directly, given that many marginal farmers are willing to participate in MFI programs to support both farm and nonfarm activities, as well as indirectly since funds are fungible.

How has MFI credit expansion in Bangladesh benefited the country's small farmers and poor rural people engaged in agriculture? At a time when the formal sector, including commercial banks, has been asked increasingly to support agriculture, what role has microfinance played? Over the past decade, the Government of Bangladesh has steadily increased the share of public funds allocated to agricultural lending to help ensure food security in the country.

Between fiscal years 2008/09 and 2009/10 alone, it raised the disbursement target for agricultural credit by 23 percent to Tk. 115 billion (Bangladesh Bank 2010).[1] MFI loan disbursement has also increased steadily in recent years, reaching a total of Tk. 372 billion by 2010, about Tk. 340 billion more than in 1997. Traditionally, commercial and agricultural banks have financed nonagricultural activities for households with sufficient collateral, while MFIs typically have supported nonfarm activities for rural households that are unemployed or engaged as agricultural wage laborers. Unemployment or under-employment in the agricultural wage market is a major concern for the rural poor; thus, providing this segment of the population credit for initiating nonfarm income-generating activities can be a major boost.

From the outset, microfinance has targeted landless or near-landless households in an effort to address the needs of the extreme poor (e.g., Faruqee 2010; Khandker 1998). While large-scale farmers have been more likely to gain access to institutional finance through commercial and agricultural development banks, albeit on a limited scale, small- and medium-scale farmers, whose landholdings rank in the lower end of the distribution, have been left out for the most part. This segment of the population, which constitutes a large share of Bangladesh's farming community, is termed the "missing middle" in the literature (e.g., Khandker 1998). Based on the large number of microfinance borrowers in Bangladesh, currently estimated at about 30 million, it is obvious that the MFIs have been working to meet the credit demand of landless and near-landless households. The past two decades have witnessed the gradual entry of the MFIs into the credit markets and more relaxed enforcement of traditional eligibility conditions (e.g., households having to own less than half an acre of land), making it possible for marginal and small and medium landholding farmers to have received better access to microfinance.[2] If this indeed has occurred, what impact has it had on smallholder farmers' productivity and income growth?

This chapter investigates the impacts of rural credit channels—commercial and agricultural banks and the MFIs—on rural households, taking into account the nature and extent of credit constraints faced by agricultural and nonagricultural households.[3] It examines whether rural credit expansion by Bangladesh's banks and MFIs has helped poor farmers directly by stimulating agricultural productivity and income and/or indirectly by strengthening linkages between farm and nonfarm production and employment. Specifically, the chapter addresses several dynamic policy questions: (a) whether rural credit expansion has been able to handle agricultural loans; (b) how the borrowing needs of agricultural households have changed across landholding distribution; and (c) how easier access to credit has affected agricultural productivity, incomes, and income diversification.

Traditional Role of Institutional Finance in Agriculture

Historically, institutional credit to poor farmers has been limited in most developing countries; when available, it has usually supported nonfarm activities. The presence of credit constraints can significantly impact agricultural outcomes.

For example, using panel data from northern Peru, Guirkinger and Boucher (2008) found that credit constraints lower the value of agricultural output substantially for poor households; however, for those households without credit constraints, productivity is independent of such endowments as land and liquidity. Indeed, several studies across developing countries confirm that credit constraints among agricultural households significantly affect farm output (Feder and others 1990; Sial and Carter 1996), farm profit (Carter 1989; Foltz 2004), and farm investment (Carter and Olinto 2003). Recent efforts by many developing country governments to improve smallholder farmers' access to credit raise an interesting policy question regarding the role of the banks and MFIs as part of this process.[4]

Farmers face many risks to their livelihoods, including unpredictable weather and crop price variation, which may affect how they choose to borrow and invest to improve their businesses. For example, Pitt and Khandker (2002) found that consumption-poor households and those with higher than average seasonal fluctuations in consumption and labor supply are more likely to participate in microfinance programs. Smoothing consumption across seasons is thus an important motivation for participating in these credit programs. The enhanced ability to smooth consumption arising from microfinance may also permit households to choose riskier but higher-yielding contracts from among those offered in the agricultural markets (Pitt 2000), which can potentially increase household consumption across the seasons. Wadud (2013) examined the impact of the recent expansion of microfinance into agricultural loans on farm performance, output, and food security in northern Bangladesh, finding small and marginal farmers used inputs more efficiently as a result.

In terms of the supply-led approach to agricultural credit historically pursued in many developing countries, most studies have found that access to commercial and agricultural banks has created viable alternatives to moneylenders for those households with somewhat greater assets and sources of collateral. For example, Binswanger and Khandker (1995) found that better access to banks spurred fertilizer use and investment in agriculture; however, it was less successful in generating viable institutions to generate agricultural employment.

Credit can also be fungible, and even perfect monitoring does not necessarily mean that credit for nonfarm activities cannot substitute somewhat for consumption credit or prohibited agricultural credit. If a household wishes to devote resources obtained from savings, inter-household transfers, or borrowing from moneylenders or other sources to a production activity in the absence of institutional credit, it may, in the presence of group-based lending programs, substitute group-based credit for those resources, and funds from other sources can be used elsewhere. In this way, simply by relaxing the household's constraints on borrowing and transfers, monitored production credit may help households to alter their mix of income-generating activities, including the mix of agricultural contracts, as well as smooth consumption. Access to group-based microfinance may enhance the household's ability to borrow from other sources or obtain transfers, allowing it to expand self-employment and own-cultivation in field crop agriculture and reduce dependence on the agricultural wage labor market.

Pitt (2000), which examined the effects of group-based credit on the poor in Bangladesh, confirms the hypothesis that nonagricultural self-employment projects financed by microfinance induce households to choose higher-risk agricultural contracts. The study analyzed the effects of group-based credit by gender of participant, participating households' mix of agricultural contracts (quantities of land sharecropped and rented), and supply of agricultural labor (own-cultivation as opposed to agricultural wage labor). As predicted, it found that credit effects were larger for women than for men in increasing sharecropping and reducing male wage labor, as well as increasing agricultural self-employment. These findings are consistent with the presumed effects of diversifying income and smoothing consumption.

The linkages across farm and nonfarm sectors on which agricultural growth depends suggest a major role for finance. In rural Bangladesh, microfinance has traditionally been targeted toward the nonfarm sector. However, as a result of microfinance expansion, greater linkages have developed between the nonfarm and farm sectors over time. Thus, microfinance can indirectly benefit the farm sector.

Recent Credit Initiatives in Agriculture

In recent years, MFIs in developing regions have made some headway in reaching poor farmers with supply credit constraints;[5] however, they have enjoyed little capacity to expand because they typically have lacked required licenses and a wide array of financial products. As a result, they have tended to operate on a small scale, offering local, demand-driven options, such as group-liability lending, to better reach clients and improve lender profitability.

A variety of bilateral and nongovernmental organization–funded programs have recently evolved to provide these options (Kloeppinger-Todd and Sharma 2010). To address limited collateral among smaller farmers, techniques have been developed to tailor lending strategies to the agricultural supply chain. For example, farmers can borrow against output stored in licensed warehouses, or producers and processors can make binding contracts for output after which processors repay the producer's loan to the bank. Other alternatives being used include direct product-distribution channels (e.g., mobile banking), electronic point-of-sale devices (e.g., those run by the Uganda Microfinance Union in rural areas), and partnerships with market-facilitating institutions. Also, agricultural insurance is an emerging policy area for helping farmers to manage production risks (Cai 2012; Giné and Yang 2009; Karlan and others 2013). In the absence of the large-scale government subsidies of the past, policy makers are being challenged to explore new ways of expanding rural financial access effectively and sustainably.

Few randomized studies have evaluated the impacts of rural farmers' improved access to microfinance, particularly on an aggregate or regional scale.[6] Among those that have recently emerged is the Tenant Farmers Development Project (BCUP) Sharecropper Development Programme, introduced by Bangladesh Rural Advancement Committee (BRAC) in 2010. This program is a customized credit service that aims to help sharecroppers without large land

holdings to access cultivable land through the tenancy market. Traditionally, this sharecropper group has depended largely on credit borrowed from informal lenders at high interest rates to cover the costs of farming. Currently, the program is being expanded to include new branches introduced in a randomized fashion in order to estimate the effects of borrowing on outcomes for sharecroppers.

In Morocco, Crepón and others (2011) evaluated the expansion of that country's largest MFI into rural areas (by about 60 branches) during 2006/07. The study, which included a survey sample of about 5,500 households (about 4,500 treatment and 1,000 control households) before and after expansion, found no significant effect of program expansion on average consumption among the treatment households. However, the effects depended on activities that households were initially involved in, particularly in self-employed agriculture; a large increase in sales and profits led to substantial increases in expenditure and employment in this sector.

In Bangladesh, agricultural banks and nationalized commercial banks (NCBs) have been lending increasingly in rural areas,[7] but most of this lending has not been targeted to the poor (CDF 2006). Lending to smaller farmers is a relatively recent phenomenon, handled by microfinance agencies through Grameen Bank, Association for Social Advancement (ASA), and BRAC. In cooperation with Palli Karma-Sahayak Foundation (PKSF), Bangladesh's wholesale microfinance lending facility, the World Bank financed the Financial Services for the Poorest Project, a five-year effort initiated in June 2002; this project, which targeted the extreme poor in rural areas, included greater extension of microfinance programs and their linkages with other safety nets. Also, PKSF recently started a Seasonal Loans and Agricultural Lending program, nearly doubling the funds it directs toward crop agriculture during 2007/08 (Faruqee 2010). In addition, the Bangladesh Bank recently expanded its efforts to target marginal farmers, as well as small- and medium-scale landholder farmers, including a new Tk. 5 billion refinancing scheme with BRAC whereby sharecroppers receive collateral-free loans for the first time.[8]

Descriptive Data Analysis

Over the past two decades, microfinance has accounted for more than 90 percent of the improvement in access to institutional finance, increasing from 23 percent in 1991/92 to 38 percent in 1998/99 to 56 percent in 2010/11. Over that 20-year period, access to informal finance also increased (from 15 percent in 1991/92 to 23 percent in 1998/99 to 57 percent in 2010/11). The bulk of informal finance was directed to meeting the needs of non-microfinance participant households (table 7.1).

Interestingly, among microfinance participant households, the demand for informal finance increased, along with the demand for institutional finance (from more than 5 percent in 1991/92 to over 17 percent in 1998/99 to nearly 63 percent in 2010/11). However, microfinance represented a much larger share of lending volume, accounting for 65 percent of total borrowing

Table 7.1 Distribution of Surveyed Households' Borrowing Sources and Share in Total Loans

Borrowing source	*Microfinance households*	*Non-microfinance households*	*All households*
1991/92 (N = 1,509)			
Microfinance	100.0 (97.8)	0 (0)	23.3 (49.8)
Formal finance	1.2 (0.5)	11.2 (69.0)	8.9 (34.1)
Informal source	5.1 (1.7)	17.8 (31.0)	14.8 (16.1)
Any sources	100.0	27.6	44.5
1998/99 (N = 1,758)			
Microfinance	100.0 (91.4)	0 (0)	38.0 (67.2)
Formal finance	5.6 (1.9)	8.3 (26.1)	7.3 (8.3)
Informal source	17.5 (6.7)	27.0 (73.9)	23.3 (24.5)
Any sources	100.0	32.1	57.9
2010/11 (N = 2,322)			
Microfinance	100.0 (65.2)	0 (0)	56.2 (47.6)
Formal finance	7.1 (5.9)	8.8 (26.1)	7.8 (7.8)
Informal source	62.6 (28.9)	50.1 (73.9)	57.1 (44.6)
Any sources	100.0	53.7	79.7

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Figures in parentheses show loan volume from a borrowing source as a percentage share of total loan volume from all sources.

in 2010/11 (versus 29 percent for informal finance). That said, informal finance has played an increasing role among microfinance participant households; their percentage share of borrowing from informal finance increased from 1.7 percent in 1998/99 to 6.7 percent in 1998/99 to 28.9 percent in 2010/11 (table 7.1).

Several interesting loan-distribution patterns have emerged over the years. First, an increasing percentage of loans has supported consumption—from 18 percent in 1991/92 to 28 percent in 1998/99 and 27 percent in 2010/11. Second, over time, the farm sector has received a higher share of loans from all sources—from less than 22 percent in 1991/92 to more than 28 percent in 1998/99, reaching 33 percent by 2010/11. Formal financial services accounted for the bulk of the higher percentage of farm loans. The percentage of farm-sector loans from commercial and other banks increased from about 60 percent in 1991/92 to nearly 69 percent in 2010/11. Finally, although an overwhelming share of microfinance loans were for nonfarm-sector activities, a higher percentage went to support farm-sector activities over time. That is, in 1991/92, only about 8 percent of microfinance loans went to farming, compared to about 28 percent in 1998/99 and nearly 40 percent in 2010/11 (table 7.2).

Another important observation about the productive role of microfinance is that, although microfinance organizers have managed to enforce a high share of loans going to productive activities, enforcement of this rule has declined over

Table 7.2 Distribution of Loans by Major Purpose for Each Source of Borrowing

Borrowing source	*Farm-sector activities*	*Nonfarm-sector activities*	*Personal expenditure*
1991/92 (N = 1,509)			
Microfinance	8.2	82.7	9.1
Formal finance	59.5	28.9	11.6
Informal source	36.1	20.2	43.7
Any sources	21.5	60.5	18.0
1998/99 (N = 1,758)			
Microfinance	27.5	51.8	20.7
Formal finance	46.7	22.9	30.4
Informal source	26.8	22.8	50.4
Any sources	28.2	43.4	27.8
2010/11 (N = 2,322)			
Microfinance	39.8	56.5	3.7
Formal finance	68.7	26.6	4.7
Informal source	15.6	10.2	74.1
Any sources	33.0	39.9	27.1

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.

time. In 1991/92, some 91 percent of microfinance loans went to productive activities (some 83 percent for nonfarm and 8 percent for farm activities), which fell to 79 percent in 1998/99 (52 percent for nonfarm and 28 percent for farm activities). But this share rose to 96 percent in 2010/11 (56 percent for nonfarm and 40 percent for farm activities) (table 7.2).

Institutional finance has increasingly supported farm-sector activities, especially noncrop farming, over time. In 1991/92, about half of microfinance loans for farming activities supported the purchase of equipment, with 28 percent for other agricultural expenditure. By 1998/99, other agricultural expenditure accounted for 47 percent of microfinance farm-sector borrowing and 74 percent by 2010/11. Formal finance has become the dominant source of support for other agricultural expenses. For example, in 1991/92, nearly 30 percent of formal finance for farming went to other agricultural expenditure; this share doubled by 1998/99, reaching nearly 81 percent in 2010/11. Over time, an overwhelming share of loans from all sources has supported noncrop-related farming activities, increasing from just 36 percent in 1991/92 to 48 percent in 1998/99 and nearly 70 percent by 2010/11 (table 7.3).

Marginal farmers, the original target group of microfinance organizations, have agricultural landholdings of less than 0.5 acres (50 decimals); these include landless households involved in agricultural activities outside the home (e.g., sharecropping). Small and medium landholding farmers are defined as having 0.5–2.5 acres (50–250 decimals) of agricultural land; as mentioned earlier, these farmers have often been termed the "missing middle" since they typically have been left out of institutional finance. Finally, large landholding farmers are defined as

Table 7.3 Distribution of Farm-Sector Activities by Borrowing Source

Borrowing source	*Purchase of agricultural inputs*	*Purchase of equipment*	*Purchase/lease of agricultural land*	*Other agricultural expenditure*[a]
1991/92 (N = 282)				
Microfinance	9.3	50.2	12.4	28.1
Formal finance	53.5	13.9	3.1	29.5
Informal source	31.5	7.5	14.5	46.5
All sources	33.7	20.0	10.1	36.2
1998/99 (N = 1,218)				
Microfinance	35.9	1.3	15.7	47.0
Formal finance	24.5	0.0	15.4	60.1
Informal source	36.0	3.9	13.3	47.8
All sources	35.0	1.8	15.2	48.0
2010/11 (N = 3,253)				
Microfinance	15.4	0.2	10.9	73.5
Formal finance	11.9	0.0	7.6	80.5
Informal source	13.9	3.2	34.1	48.8
All sources	15.0	0.7	14.4	69.9

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
a. Other agricultural expenditure includes expenses for livestock and poultry raising, fisheries, sericulture, nurseries, and forestry.

Table 7.4 Distribution of Borrowing from Alternative Sources by Farm Size
percent

Farm size	*Microfinance*	*Formal finance*	*Informal source*	*Any source*
1991/92 (N = 703)				
Marginal (< 0.5 acres)	30.4	5.7	11.3	44.7
Small and medium (0.5–2.5 acres)	17.6	10.9	20.5	45.5
Large (> 2.5 acres)	6.2	18.3	17.1	41.3
1998/99 (N = 831)				
Marginal (< 0.5 acres)	44.9	2.9	22.9	61.1
Small and medium (0.5–2.5 acres)	34.4	9.5	25.0	56.1
Large (> 2.5 acres)	12.8	24.2	23.7	47.2
2010/11 (N = 1,439)				
Marginal (< 0.5 acres)	61.2	3.9	55.8	80.0
Small and medium (0.5–2.5 acres)	47.8	15.6	60.2	80.9
Large (> 2.5 acres)	30.5	21.9	62.2	73.2

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.

owning more than 2.5 acres (250 decimals) of agricultural land; this group often obtains credit from formal financial institutions, including agricultural development banks (table 7.4).

Table 7.4 shows that, over time, borrowing from any source (microfinance, formal finance, or informal source) increased at a similar pace for all three

farm-size categories. Between 1991/92 and 2010/11, it rose from 45 percent to 80 percent for both marginal and small and medium farmers and from 41 percent to 73 percent for large farmers. Over the 20-year period, microfinance borrowing among marginal agricultural households more than doubled (from about 30 to 61 percent), with higher participation rates also realized among small- and medium-scale, as well as large, farmers. Over the same period, borrowing from banks has remained essentially flat for marginal and small- and medium-scale farmers, at 10 percent each, and has even declined for large landholding farmers.

Table 7.5 shows that, for all three survey years, marginal farmers received the highest share of loans, followed by small- and medium-scale farmers and large farmers. In 1991/92, marginal farmers received some 74 percent of loans, with just 23 percent received by small and medium farmers and less than 4 percent by large farmers. By 2010/11, the respective shares were 76 percent for marginal farmers, 21 percent for small and medium farmers, and only 3 percent for large farmers. For the three survey years, the average loan size has remained at similar level for all three farm-size categories.

Table 7.6 shows that, for each of the three farm-size groups, the largest share of loans from any source went to support noncrop farming in all three survey years. In 2010/11, for example, 70 percent of loans to marginal farmers supported noncrop farming, compared to 71 percent for small- and medium-scale farmers and 59 percent for large landholding farmers.

Effects of Borrowing on Agricultural Household Income and Productivity

Since it is already known that microfinance matters for promoting nonfarm income and employment, the issue is whether household-level borrowing from

Table 7.5 Loan Volume for Borrowing Sources by Farm Size

Farm size	*Share among borrowers (%)*	*Cumulative loans by household males (Tk.)*	*Cumulative loans by household females (Tk.)*
1991/92 (N = 703)			
Marginal (< 0.5 acres)	73.8	3,007.2	7,059.6
Small and medium (0.5–2.5 acres)	22.6	4,729.7	6,906.6
Large (> 2.5 acres)	3.6	5,657.2	4,403.9
1998/99 (N = 831)			
Marginal (< 0.5 acres)	69.3	1,765.3	14,271.5
Small and medium (0.5–2.5 acres)	26.8	4,191.2	15,068.5
Large (> 2.5 acres)	3.9	10,076.9	7,052.1
2010/11 (N = 1,439)			
Marginal (< 0.5 acres)	76.2	4,362.7	15,407.0
Small and medium (0.5–2.5 acres)	20.6	8,547.8	13,644.1
Large (> 2.5 acres)	3.2	21,085.8	14,865.6

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.

Table 7.6 Distribution of Farm-Sector Activities by Farm Size

Farm size	*Purchase of agricultural inputs*	*Purchase of equipment*	*Purchase/lease of agricultural land*	*Other agricultural expenditure*
1991/92 (N = 282)				
Marginal (< 0.5 acres)	23.8	28.3	7.1	40.8
Small and medium (0.5–2.5 acres)	39.3	18.5	8.5	33.7
Large (> 2.5 acres)	38.2	9.3	18.8	33.7
1998/99 (N = 1,218)				
Marginal (< 0.5 acres)	30.1	1.9	18.0	50.0
Small and medium (0.5–2.5 acres)	42.3	1.1	14.1	42.5
Large (> 2.5 acres)	30.8	3.4	8.6	57.2
2010/11 (N = 3,253)				
Marginal (< 0.5 acres)	13.2	0.5	16.2	70.3
Small and medium (0.5–2.5 acres)	18.1	1.0	9.6	71.3
Large (> 2.5 acres)	18.3	1.2	21.8	58.7

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.

the MFIs matters also for farm income and employment. This subsection considers the microfinance effect on farm income from crops, livestock and poultry raising, and agricultural wages.[9]

Following the general method outlined in appendix B, we consider the following outcome equation for farm income with time-varying heterogeneity:

$$Y_{it} = X_{it}\beta_c + C_{ift}\delta_f + C_{imt}\delta_m + \eta_{it} + \mu_i + \varepsilon_{it}, \tag{7.1}$$

where Y_{it} equals the outcome (e.g., total farm, crop, noncrop, and agricultural wage income) of household i in survey year t, conditional on the level of credit demand by males (C_{imt}) and females (C_{ift}); X_{it} is a vector of characteristics at the household level (e.g., sex, age and education of household head, and landholding assets) and village level (e.g., extent of electrification and irrigation, availability of other infrastructure, and price of consumer goods), β_c is a vector of unknown parameters of X variables to be estimated, δ_m and δ_f measure the effects of borrowing, η_{it} is an unobserved household- or community-level determinant of the outcome that is time-varying, μ_i is an unobserved household- or community-level determinant of the outcome that is time-invariant, and ε_{it} is a nonsystematic error. The household fixed-effects (FE) estimation technique can eliminate the time-invariant parameter (μ_i) by transforming equation (7.1) as follows:

$$\begin{aligned} Y_{it} - \bar{Y}_i &= \left(X_{it} - \bar{X}_i\right)\beta + \left(C_{ift} - \bar{C}_{if}\right)\delta_f + \left(C_{imt} - \bar{C}_{im}\right)\delta_m + \left(\eta_{it} - \bar{\eta}_i\right) + \left(\mu_i - \bar{\mu}\right) + \left(\varepsilon_{it} - \bar{\varepsilon}_i\right) \\ \text{or } \Delta Y_{it} &= \beta\Delta X_{it} + \delta_f \Delta C_{ift} + \delta_m \Delta C_{imt} + \Delta\eta_{it} + \Delta\varepsilon_{it}, \end{aligned} \tag{7.2}$$

where the bar variables (e.g., $\bar{Y}_i, \bar{X}_i, \bar{C}_{if}$) are average values for each household. Since μ is constant, $\bar{\mu}_i = \bar{\mu}$ and thus its effect is eliminated. However, since $\bar{\eta}_i \neq \bar{\eta}$, the problem of unobserved effects cannot be disregarded completely, and thus ordinary least squares (OLS) estimation of equation (7.2) will be biased.

Our empirical strategy uses household-level FE estimation with weights determined by propensity-score (p-score) matching, based on the participation equation to account for unobserved time-varying heterogeneity, as outlined in the methodology (appendix B). This strategy is referred to as the p-score weighted FE method. To account for bias in the lagged dependent variable (LDV), which cannot be resolved using FE, the strategy also follows an alternative LDV method. Two alternative models are also considered: one that assumes the credit effects of men and women do not vary by time of borrowing (i.e., they are time invariant) and the other that assumes they do (i.e., they are time varying).

Table 7.7 presents the estimates of credit effects of male and female borrowers using both p-score weighted FE and LDV methods. The effects are considered for all types of farm income, as well as total farm income. Using both model estimation techniques, there is no significant effect (either positive or negative) of male credit on any type of farm income or total farm income, suggesting that male credit has no role in farm income. However, female credit matters for both crop and noncrop income using both model estimation techniques. Also, female credit has a significant positive effect on total farm income, using the p-score

Table 7.7 Alternate Panel Estimates of the Impacts of Microfinance Borrowing on Household Farm Income
N = 1,509

Microfinance loan variables	*Income from crop production*	*Income from livestock, poultry, and fishery*	*Wage income*	*Total farm income*
p-score weighted household FE model				
Log loans of household males (Tk.)	−0.051	−0.007	−0.042	−0.010
	(−1.45)	(−0.28)	(−1.49)	(−0.54)
Log loans of household females (Tk.)	0.035*	0.028**	0.001	0.007*
	(2.01)	(2.01)	(0.08)	(1.96)
R^2	0.238	0.139	0.087	0.085
Dynamic panel LDV model				
Log loans of household males (Tk.)	−0.007	−0.007	−0.007	−0.003
	(−0.36)	(−0.33)	(−0.36)	(−0.25)
Log loans of household females (Tk.)	0.030*	0.006**	−0.010	0.014
	(1.75)	(2.27)	(−0.66)	(1.28)
F statistics of the model	$F(26, 86) = 13.81$, $p > F = 0.00$	$F(26, 86) = 5.99$, $p > F = 0.00$	$F(26, 86) = 27.02$, $p > F = 0.00$	$F(26, 86) = 10.56$, $p > F = 0.00$

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log per capita Tk. per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; male and female wages; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effect; LDV = lagged dependent variable.
Significance level: * = 10 percent, ** = 5 percent or less.

weighted FE method. Results show that a 10 percent increase in female credit increases crop income by 3.5 percent, noncrop income by 2.8 percent, and total farm income by 0.07 percent.

Table 7.8 presents the alternative estimates of current and past credit effects of male and female borrowers. Using the FE model, the results show that current male credit has a negative effect on wage income, meaning that households with access to microfinance tend to opt out of wage labor in favor of farm self-employment and nonfarm activities. For female borrowers, current borrowing is found to increase noncrop income while past borrowing has a lingering effect on crop, as well as total farm, income.

Table 7.9 presents the credit-effect estimates for men and women by MFI source, using the p-score weighted FE model, having established that the FE model is the appropriate one for estimating farm income and its various components.

Table 7.8 Alternate Panel Estimates of the Impacts of Current and Past Microfinance Borrowing on Household Farm Income
N = 1,509

Microfinance loan variables	*Income from crop production*	*Income from livestock, poultry, and fishery*	*Wage income*	*Total farm income*
p-score weighted household FE model				
Log male current loans (Tk.)	−0.025	−0.039	−0.089**	−0.019
	(−0.71)	(−1.46)	(−3.13)	(−1.00)
Log male past loans (Tk.)	−0.112	0.031	0.014	−0.001
	(−1.54)	(0.48)	(0.30)	(−0.02)
Log female current loans (Tk.)	0.027	0.033*	0.012	0.013
	(1.45)	(1.81)	(0.59)	(1.27)
Log female past loans (Tk.)	0.056**	0.018	−0.029	0.034**
	(2.00)	(0.81)	(−1.22)	(2.54)
R^2	0.333	0.174	0.064	0.114
Dynamic panel LDV model				
Log male current loans (Tk.)	−0.040	−0.022	−0.097	−0.033
	(−1.22)	(−0.61)	(−0.83)	(−1.45)
Log male past loans (Tk.)	0.044	0.017	0.119**	0.039
	(1.18)	(0.41)	(3.28)	(1.59)
Log female current loans (Tk.)	−0.028	0.044*	0.007	0.024**
	(−1.31)	(1.77)	(0.35)	(2.08)
Log female past loans (Tk.)	−0.001	−0.046	−0.018	−0.011
	(−0.05)	(−1.51)	(−0.82)	(−0.96)
F statistics of the model	$F(26, 86) = 13.02$, $p > F = 0.00$	$F(26, 86) = 5.75$, $p > F = 0.00$	$F(26, 86) = 27.21$, $p > F = 0.00$	$F(26, 86) = 9.95$, $p > F = 0.00$

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log per capita Tk. per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; male and female wages; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effects; LDV = lagged dependent variable.
Significance level: * = 10 percent, ** = 5 percent or less.

Table 7.9 Impacts of Microfinance Borrowing on Household Farm Income by Lenders: Propensity-Score Weighted Household FE Estimates
N = 1,509

Microfinance loan variables by source	*Income from crop production*	*Income from livestock, poultry, and fishery*	*Wage income*	*Total farm income*
Grameen Bank				
Log loans of household males (Tk.)	0.042	−0.069	−0.095*	0.016
	(0.74)	(−1.48)	(−1.66)	(0.58)
Log loans of household females (Tk.)	0.014*	0.039*	−0.017	0.016*
	(1.78)	(1.77)	(−0.97)	(1.96)
BRAC				
Log loans of household males (Tk.)	−0.114	0.023	0.032	−0.040
	(−1.24)	(0.30)	(0.96)	(−0.85)
Log loans of household females (Tk.)	0.094**	−0.040	−0.053**	−0.008
	(4.27)	(−1.26)	(−2.60)	(−0.68)
Other sources[a]				
Log loans of household males (Tk.)	−0.056	0.013	−0.024	−0.002
	(−1.49)	(0.46)	(−0.69)	(−0.12)
Log loans of household females (Tk.)	0.010	0.008	0.018	0.005
	(0.55)	(0.54)	(1.21)	(0.64)
R^2	0.242	0.141	0.089	0.086

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log per capita Tk. per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effects; BRAC = Bangladesh Rural Advancement Committee.
Significance level: * = 10 percent, ** = 5 percent or less.
a. Other sources include BRDB, ASA, and other smaller MFIs.

While male borrowing from Grameen Bank reduces wage income, female borrowing from Grameen Bank increases crop, noncrop, and total farm income. Borrowing from other MFIs does not have a statistically significant effect on any type of farm income, with the exception of BRAC loans, especially for women borrowers, which increase crop income and reduce wage income. Thus, Grameen Bank appears to increase overall farm income significantly by raising both crop and noncrop income; however, BRAC loans help to increase crop income at a higher pace. For example, a 10 percent increase in female borrowing increases crop income by 9.4 percent for a BRAC loan, compared to 1.4 percent for a Grameen Bank loan. But 10 percent female borrowing from Grameen Bank increases noncrop income by 3.9 percent and total farm income by 1.6 percent. This means that Grameen Bank helps to increase noncrop income more than crop income, which is not surprising since the bulk of Grameen Bank lending supports rural income through diversification from nonfarm sources, as well as from noncrop activities (e.g., livestock and poultry raising and fisheries).

Who benefits the most from male and female microfinance borrowing for farming? Table 7.10 shows that male loans do not matter for any type of farming. But female borrowing increases crop and noncrop income for all three farm-size

Table 7.10 Impacts of Microfinance Borrowing on Household Farm Income by Farm Size: Propensity-Score Weighted Household FE Estimates
N = 1,509

Microfinance loan variables	*Income from crop production*	*Income from livestock, poultry, and fishery*	*Wage income*	*Total farm income*
Marginal (< 0.5 acres)				
Log loans of household males (Tk.)	−0.032	−0.011	−0.034	−0.004
	(−0.92)	(−0.44)	(−1.17)	(−0.13)
Log loans of household females (Tk.)	0.047**	0.031**	0.001	0.008**
	(2.61)	(2.07)	(0.04)	(2.02)
Small and medium (0.5–2.5 acres)				
Log loans of household males (Tk.)	−0.045	−0.013	−0.041	−0.011
	(−1.30)	(−0.61)	(−1.47)	(−0.61)
Log loans of household females (Tk.)	0.031*	0.025*	0.002	0.005
	(1.80)	(1.80)	(0.09)	(1.39)
Large (> 2.5 acres)				
Log loans of household males (Tk.)	−0.044	−0.002	−0.035	−0.004
	(−1.29)	(−0.06)	(−1.23)	(−0.20)
Log loans of household females (Tk.)	0.045**	0.033**	−0.001	0.010
	(2.43)	(2.19)	(−0.03)	(1.57)
R^2	0.242	0.141	0.087	0.087

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log per capita Tk. per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effects.
Significance level: * = 10 percent, ** = 5 percent or less.

categories (marginal, small and medium, and large), as well as total farm income for marginal farms. Interestingly, the female credit effects on crop and noncrop income do not differ statistically by farm size. Thus, a 10 percent borrowing by a woman increases crop income by 4.7 percent for marginal farmers, 3.1 percent for small- and medium-scale farmers, and 4.5 percent for large landholding farmers. On the other hand, a 10 percent increase in female borrowing increases noncrop income by 3.1 percent for marginal farmers, 2.5 percent for small and medium farmers, and 3.3 percent for large farmers; it also increases total farm income by 0.08 percent for marginal farmers. These findings suggest that microfinance helps marginal farmers more than the other two farm-size groups.

Do Credit Constraints Affect Microfinance Borrowers' Income and Productivity?

The effects of household-level credit, estimated above, may be affected by the extent of supply-side constraints, determined primarily by the MFIs declining to provide the amount of credit that borrowers request. More specifically, following Boucher, Guirkinger, and Trivelli (2009), borrowers were considered supply-side constrained if they reported not being able to borrow as much as they would have wanted. The possible negative effect of borrowing constraints

Table 7.11 Share of Credit-Constrained Household Borrowers by Farm Size for Selected Finance Sources over Time
percent

Farm size	*Microfinance*	*Formal finance*	*Both sources*
1991/92 (N = 784)			
Marginal (< 0.5 acres)	79.8	71.8	78.4
Small and medium (0.5–2.5 acres)	82.4	64.2	75.3
Large (> 2.5 acres)	70.3	68.2	68.7
All holdings	80.0	68.0	76.5
1998/99 (N = 903)			
Marginal (< 0.5 acres)	48.1	53.7	48.4
Small and medium (0.5–2.5 acres)	57.8	74.9	59.2
Large (> 2.5 acres)	76.2	74.1	72.8
All holdings	51.8	69.7	53.6
2010/11 (N = 1,501)			
Marginal (< 0.5 acres)	7.0	13.8	7.1
Small and medium (0.5–2.5 acres)	10.6	14.9	11.3
Large (> 2.5 acres)	14.7	12.9	10.6
All holdings	8.0	14.2	8.2

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Households were considered credit constrained if they received less than what they requested.

may prevent farmers from allocating resources efficiently and thus cause them to suffer from efficiency losses. Therefore, it is worth considering how supply-side factors causing demand for microfinance may affect farm-household income and productivity.

Before turning to this issue, we would like to compare the pattern of such constraints among farmers who borrowed from various MFIs and formal finance sources. Table 7.11 shows that supply constraints from both types of finance declined substantially overall, from more than 76 percent in 1991/92 to only about 8 percent in 2010/11. However, microfinance borrowers saw a significantly larger percentage decline over the period. For example, in 1991/92, 80 percent of microfinance borrowers faced supply-side constraints, compared to only 8 percent by 2010/11. Among borrowers of formal finance sources, by contrast, 68 percent were supply constrained in 1991/92, and more than 14 percent remained so in 2010/11.

In examining the role of supply constraints on farm income and productivity among microfinance borrowers beyond the estimated effects of borrowing, we may postulate that the outcome equation (7.2) differs across constrained and nonconstrained households. We can use the reported status of microfinance borrowers in terms of whether they were credit constrained as an additional variable in equation (7.2). We can also interact this constraint status with the amount of borrowing households received from MFI sources to determine whether the borrowing effect varied by the extent of constraint status.

Thus, by interacting credit constraints with the amount of borrowing, the differential impacts of credit constraints have been addressed both directly and indirectly. Table 7.12 shows that the total effect of credit constraint has a particularly strong negative effect on total farm income, but a positive effect on livestock income; that is, microfinance borrowers constrained on the supply side will have a lower income from crop production, which will induce them to seek livestock and poultry activities.

However, by interacting the supply-constraint status with the amount of borrowing alone, the direction of change is unclear. Therefore, we calculate the marginal effect of borrowing on credit-constrained households as opposed to nonconstrained households. We estimate the outcome equation of (7.2) after suppressing gender-specific effects, as well as the effects of other variables, for both types of borrowers, expressed as follows:

$$\Delta Y_{it} = \beta \Delta B_{it} + \gamma \Delta C_{it} + \Delta \eta_{it} + \Delta \varepsilon_{it}, \tag{7.3}$$

where C indicates the borrowing-constraint status. For those households that are not credit constrained (i.e., C = 0), we obtain the estimate of credit effect, β. For those that are constrained, we obtain the marginal credit effect, $(\beta + \gamma)$. Depending on the sign of both coefficients (β and γ), the effect of microfinance will be higher or lower for constrained borrowers.

Table 7.12 Impacts of Microfinance Borrowing and Credit Constraint on Household Farm Income: Propensity-Score Weighted Household FE Estimates
N = 1,509

Microfinance loan variable	*Income from crop production*	*Income from livestock, poultry, and fishery*	*Wage income*	*Total farm income*
Log loans of household males (Tk.)	−0.063	−0.004	−0.039	−0.012
	(−1.44)	(−0.18)	(−1.37)	(−0.67)
Log loans of household females (Tk.)	0.032*	0.033**	0.003	0.010*
	(1.77)	(2.37)	(0.16)	(1.83)
Household is credit constrained	−0.546	0.616**	−0.152	−0.354*
	(−1.59)	(2.03)	(−0.43)	(−1.90)
Log loans of household males x household is credit constrained	0.063*	−0.028	−0.004	0.024
	(1.96)	(−0.89)	(−0.13)	(1.50)
Log loans of household females x household is credit constrained	0.049	−0.063**	0.010	0.023
	(1.56)	(−2.00)	(0.31)	(1.39)
R^2	0.239	0.140	0.087	0.086
Calculated effects of borrowing on credit-constrained households				
Log loans of household males (Tk.)	−0.055	−0.008	−0.040	−0.009
	(−1.53)	(−0.34)	(−1.40)	(−0.50)
Log loans of household females (Tk.)	0.038**	0.025*	0.004	0.012*
	(2.20)	(1.79)	(0.24)	(1.70)

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log per capita Tk. per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effects.
Significance level: * = 10 percent, ** = 5 percent or less.

Table 7.12 also shows the calculated marginal credit effect for constrained households by gender of borrowers. Comparing these estimates (in elasticity form) for credit-constrained and nonconstrained households, we find that the marginal credit effect is positive for women only. For example, a 10 percent increase in women's borrowing increases total farm income by 0.10 percent for nonconstrained households, compared to 0.12 percent for those that are constrained. The effects of microfinance appear to matter by the extent of the credit constraint faced by the borrower.

However, being supply constrained may not be exogenous, as assumed in equation (7.3). Therefore, we estimate the outcome equation (7.3) using a switching regression (annex 7A). We allow an endogenous switching of who is likely to be credit constrained and how the effects of borrowing vary by whether a household is constrained. Here we implement the approach of Guirkinger and Boucher (2008), which estimates a dynamic switching model on a two-round panel by differencing the data to remove fixed unobserved heterogeneity and running a switching regression on the differenced model. More specifically, we estimate a switching regression model for equation (7.2) for credit-constrained and nonconstrained households separately with endogenous switching.

Table 7.13 presents the switching regression results of the effect of borrowing on income for credit-constrained and nonconstrained households. As expected, the selection equation reported shows that credit availability (represented by the number of MFIs in a village) lowers the extent of credit constraint for most outcomes (3 out of 4). For example, an additional MFI in a village lowers the credit constraint for microfinance household borrowing by 3.3 percentage points when the outcome is crop-production income. The effect of borrowing on farm income from all sources (except wage income in the case of male borrowing) is insignificant for credit-constrained households, regardless of the borrower's gender, while the credit effects for female borrowing in nonconstrained households are positive and statistically significant for most outcomes. That is, unlike the results reported in table 7.12, where we find positive credit effects for both constrained and nonconstrained borrowers, we find no significant effect of microfinance for credit constrained borrowers after correcting for the endogeneity of being credit constrained. These results suggest that credit constraint is a deterring factor for promoting income and productivity.

Table 7.13 also shows that the correlation coefficient ρ_2 is negative and statistically significant for the regressions for total farm income and wage income, indicating a negative correlation between the error terms of the selection equation and the outcome equations in the nonconstrained zone; that is, nonconstrained households have a higher total farm and wage income than a random household from the sample. But the correlation coefficient ρ_1 is positive and significant for all types of farm income except wage income, suggesting that credit-constrained households have higher crop, livestock, and total farm income, compared to a random household. The likelihood-ratio test for joint independence of the three equations, reported at the bottom of table 7.13, shows that

Table 7.13 Impacts of Microfinance Borrowing on Household Farm Income by Credit Constraint: Switching Regression
N = 1,509

Microfinance loan variable	*Income from crop production*	*Income from livestock, poultry, and fishery*	*Wage income*	*Total farm income*
Selection equation				
Household is credit constrained (excluded instrument is number of MFIs in the village)	−0.033** (−2.71)	−0.019* (−1.85)	−0.004 (−0.23)	−0.041** (−1.99)
Non-credit-constrained households				
Log loans of household males (Tk.)	−0.045 (−1.27)	0.006 (0.17)	−0.065 (−1.60)	−0.017 (−0.86)
Log loans of household females (Tk.)	0.036* (1.94)	0.040** (2.79)	0.002 (0.11)	0.013* (1.63)
Credit-constrained households				
Log loans of household males (Tk.)	−0.033 (−0.24)	−0.056 (−0.54)	0.118* (1.80)	0.021 (0.40)
Log loans of household females (Tk.)	−0.008 (−0.15)	−0.079 (−0.95)	0.079 (1.37)	0.017 (0.48)
Correlation coefficient between selection equation and nonconstrained regime equation (ρ_1)	0.678** (6.23)	0.719** (5.78)	−0.034 (−0.05)	0.635** (5.16)
Correlation coefficient between selection equation and constrained regime equation (ρ_2)	−0.193 (−0.25)	0.171 (0.29)	−0.862** (−3.11)	−0.685** (−5.14)
Wald test of independence equations	$\chi^2(2) = 3.17$, $p > \chi^2 = 0.205$	$\chi^2(2) = 1.65$, $p > \chi^2 = 0.438$	$\chi^2(2) = 19.15$, $p > \chi^2 = 0.000$	$\chi^2(2) = 4.60$, $p > \chi^2 = 0.1000$

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log per capita Tk. per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). MFI = microfinance institution.
Significance level: * = 10 percent, ** = 5 percent or less.

the equations are not typically independent of one another. Unobserved heterogeneity may still be an unresolved issue with these regressions; however, the results indicate that households with supply-side credit constraints are benefiting little from microfinance.

Effects of Microfinance on Borrowers' Farm Employment

Given that microfinance borrowing increases farm income and productivity, especially crop and noncrop income, the next question is whether it also increases farm employment. Growth in farm income and productivity may be accompanied by higher farm employment unless capital-intensive farm technology is in place that reduces demand for farm labor. However, as shown in chapter 4, microfinance increases nonfarm employment. Therefore, unless a major shift in labor from farm to nonfarm production occurs, it is possible that microfinance can also increase farm employment.

We consider an employment equation where days employed in farm activities by rural households is a function of the amount of borrowing by male and female borrowers, plus a host of household and community characteristics. Following the model specification in equation (7.2), we use the p-score weighted FE method to estimate the employment equation for the farm sector overall, as well as employment in crop activity, noncrop activity, and wage employment.

Table 7.14 reveals two major trends in farm-sector household employment for the three survey years. First, household employment hours declined consistently over time. While average monthly farm-sector employment was 163 hours in 1991/92, it dropped to 109 hours in 1998/99 and 74 hours by 2010/11. Second, it rose with increasing landholding size, and this trend was consistent for all three survey years. The findings also show that small-, medium- and large-scale farmers have devoted most of their labor to crop cultivation, except in 2010/11, when the largest share went to livestock and poultry raising. By contrast, marginal farmers have devoted most of their labor to wage employment, which is not unexpected. However, in 2010/11, like the other farm-size groups, marginal farmers devoted the largest share of their labor to livestock and poultry raising.

Although men's borrowing has no significant effect on any type of farm employment, women's borrowing increases employment for both crop and non-crop activities, as well as total farm employment. Table 7.15 shows that a 10 percent increase in female borrowing increases employment by 0.33 percent for crop production, 0.58 percent for noncrop production, and 0.46 percent for farming overall.

Table 7.14 Farm-Sector Household Employment by Landholding Size

Farm size	*Crop production (hours/month)*	*Livestock, poultry, and fishery (hours/month)*	*Wage labor (hours/month)*	*Total farm-sector employment (hours/month)*
1991/92 (N = 1,509)				
Marginal (< 0.5 acres)	25.2	24.5	78.4	128.2
Small and medium (0.5–2.5 acres)	112.2	48.7	43.9	204.7
Large (> 2.5 acres)	152.6	55.0	10.2	217.8
All households	68.3	35.9	58.9	163.1
1998/99 (N = 1,509)				
Marginal (< 0.5 acres)	24.3	10.9	65.5	100.7
Small and medium (0.5–2.5 acres)	70.1	10.0	28.9	109.0
Large (> 2.5 acres)	128.3	9.9	8.4	146.6
All households	50.0	10.5	48.0	108.5
2010/11 (N = 1,509)				
Marginal (< 0.5 acres)	7.7	37.3	23.0	68.0
Small and medium (0.5–2.5 acres)	21.9	58.0	7.5	87.5
Large (> 2.5 acres)	21.7	71.9	0.0	93.6
All households	12.0	44.4	14.9	74.3

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.

Table 7.15 Impacts of Microfinance Borrowing on Household Farm Employment: Propensity-Score Weighted Household FE Estimates
N = 1,509

Microfinance loan variable	*Employment in crop production*	*Employment in livestock, poultry, and fishery*	*Employment in wage labor*	*Total farm-sector employment*
Log loans of household males (Tk.)	0.022	0.012	–0.021	0.026
	(1.51)	(0.78)	(–1.18)	(1.34)
Log loans of household females (Tk.)	0.033**	0.058**	0.0001	0.046**
	(3.30)	(5.82)	(0.01)	(4.13)
R^2	0.179	0.351	0.107	0.147

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log hours per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the household level (e.g., age, sex, and education of household head, and log of land assets) and village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effects.
Significance level: * = 10 percent, ** = 5 percent or less.

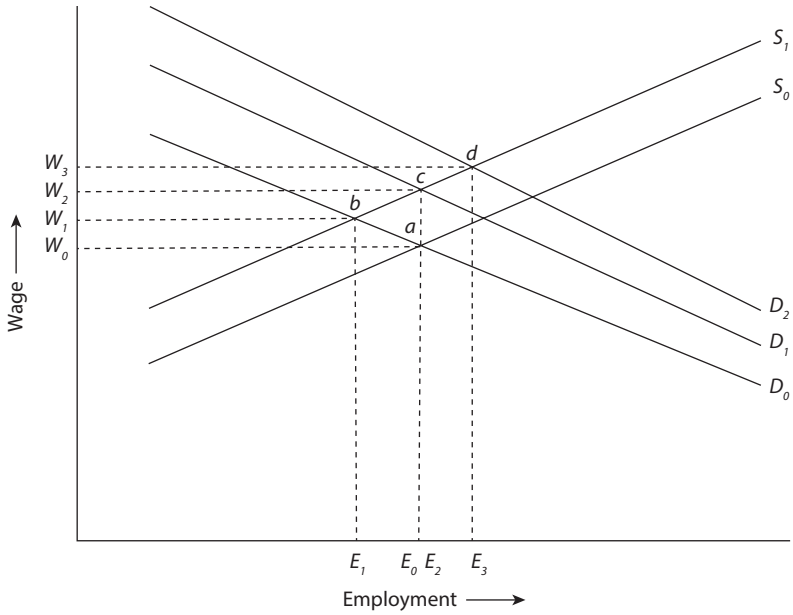
Village-Level Effect of Microfinance on Employment and Wage Rates

Thus far, we have only considered the credit effect on household borrowers' income, employment, and other welfare indicators. An even more important consideration is the aggregate effect of microfinance operations on the rural labor market in terms of farm and nonfarm employment and market wage rates since the spillover effect is likely to affect nonparticipants. For example, even if microfinance borrowers are withdrawing from the wage market, there may be a higher supply of labor from nonparticipating households, in which case, the wage rate determined by both demand and supply of labor may not increase as postulated under an increase in reservation price of own labor. The spillover effects of microfinance—especially when it has been in operation for a long time—can either benefit or harm a local economy. Over a 20-year period, nonparticipants will likely gain or lose from microfinance's induced effects, which means it is important to consider its aggregate effect, including the induced spillover effects.

What then is the expected effect of microfinance on agricultural wage and aggregate farm and nonfarm employment? To answer this question, we examine the aggregate effects of microfinance at the village level on various rural welfare outcomes, including farm and nonfarm employment and agricultural wage rates.

First, we consider the wage effect of microfinance intensity in a village. If there is no discernible microfinance-induced demand for wage labor, we can expect that agricultural wages will not be affected by microfinance interventions in a casual labor market (say, for example, E_0 and W_0 positions in figure 7.1). However, because of microfinance participation, it is possible that households that were previously wage employed may not prefer to demand wage work in an agricultural labor market. In figure 7.1, this shift in labor supply is represented

Figure 7.1 Wage Determination with Microfinance Participation



by the leftward shift from S_0 to S_1 (an indication of reservation wage), meaning a higher wage rate (from W_0 to W_1), given the aggregate demand for wage labor in agriculture (D_0). This also means an overall decline in wage employment in agriculture (from S_0 to S_1).

Since microfinance expansion results in higher self-employment in crop and noncrop activities (table 7.15), one can expect that the interactions between farm and nonfarm labor markets will increase agricultural wage rates. Despite the shift in both labor demand and supply curves for the agricultural wage market, an increase in wage rates is only possible if the demand for agricultural labor outweighs the reduction in labor supply. Alternatively, a reduction in labor supply for agricultural wage employment can outweigh the demand for wage employment, which, in turn, may push the wage rate up, given the unchanged demand for wage labor in agriculture. In figure 7.1, the position of *c* represents an unchanged employment despite a higher wage as a higher demand for wage labor compensates the reduced demand for wage labor by microcredit borrowers. The position of *d* is likely to occur when an induced demand for hired labor results due to an induced higher income level because of microfinance, characterized by higher levels of employment and wages.

We estimate a real wage function at the village level as a function of microfinance intensity in the village. For this purpose, microfinance intensity is measured in two ways: (a) by the number of MFIs operating in the village and (b) by MFI participation rates by men and women in the village. We thus have two specifications for which we also control for other exogenous factors

observed at the village level (e.g., prices of consumer goods and available infrastructure).

Table 7.16 presents the net effect of microfinance intensity on real agricultural wages observed at the village level using the long-panel, village-level data spanning the 20-year period. No matter how the village intensity of microfinance is measured, the results show that microfinance helped to increase agricultural wages.

For example, one additional MFI in the village increased men's wages by 1.5 percent and women's wages by 4.9 percent. A 10 percentage increase in men's participation at the village level increased male wages by 2.0 percent and female wages by 3.1 percent. By contrast, a 10 percentage point increase in women's participation increased male wages by 1.4 percent and female wages by 5.0 percent (table 7.16). Thus, the effect of microfinance—which increases female labor supply more than male labor supply, as shown in chapter 4—is unambiguously a higher demand for female labor in the rural labor market; as a result, we observe a higher effect on women's wages.

Using the same models, we next consider the effects of village-level program intensity on village-level employment, calculated as the village-level average of household employment hours per month. As table 7.17 shows, the placement of MFIs in a village does not affect village-level employment in the farm sector; however, it increases nonfarm and overall employment.

For example, an additional MFI in the village increases village-level employment in the nonfarm sector by 6.3 percent and overall employment by 4.2 percent. Farm-sector employment, however, increases as a result of increased female participation in the village. A 10 percentage point increase in female participation in the village increased village-level employment in the farm sector by 2.4 percent. Both male and female participation in the

Table 7.16 Impacts of Microfinance Program Placement and Participation Intensity on Village-Level Wage: Upazila FE Estimates
N = 87

	Model 1		*Model 2*	
Microfinance program variable	*Village male wage*	*Village female wage*	*Village male wage*	*Village female wage*
Number of MFIs in village	0.015** (2.01)	0.049** (2.24)	n.a.	n.a.
Microfinance participation rate by males in village	n.a.	n.a.	0.202** (2.16)	0.312** (2.66)
Microfinance participation rate by females in village	n.a.	n.a.	0.141** (2.00)	0.501** (2.35)
R^2	0.248	0.428	0.155	0.443

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log Tk. per day. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). n.a. = not applicable; FE = fixed effects; MFI = microfinance institution.
Significance level: * = 10 percent, ** = 5 percent or less.

Table 7.17 Impacts of Microfinance Program Placement and Participation Intensity on Village-Level Employment: Upazila FE Estimates
N = 87

	Village household employment (average)		
Microfinance program variable	*Farm*	*Nonfarm*	*Total*
Model 1			
Number of MFIs in village	–0.002	0.063**	0.042**
	(–0.11)	(2.82)	(4.69)
R^2	0.464	0.210	0.444
Model 2			
Microfinance participation rate by males in village	0.249	0.541*	0.230**
	(0.89)	(1.95)	(1.99)
Microfinance participation rate by females in village	0.237**	0.967**	0.357**
	(2.13)	(4.63)	(4.10)
R^2	0.471	0.257	0.433

Sources: World Bank/BIDS survey 1991/92 and 1998/99; World Bank/InM survey 2010/11.
Note: Outcomes are in log hours per month. Figures in parentheses are *t*-statistics based on standard errors clustered at the village level. Regressions include more control variables at the village level (e.g., price of consumer goods; infrastructure, including schools and electricity availability; and proportion of irrigated land). FE = fixed effects; MFI = microfinance institution.
Significance level: * = 10 percent, ** = 5 percent or less.

village boosted nonfarm-sector and overall employment, and the effects were higher for women. For example, a 10 percentage point increase in the rate of women's participation increased total village employment by 3.6, compared to 2.3 percent for men.

Summary

Raising agricultural productivity, especially food production, has received greater attention in recent years, particularly amid concerns about rising food insecurity, population pressure, and climate change. Many believe that better institutional access to credit and other financial services from both formal sources of finance (e.g., agricultural and commercial banks) and semiformal sources like microfinance can help rural households to smooth risks and access inputs and other technology to modernize agriculture and improve farm/nonfarm linkages.

Using household panel data from Bangladesh spanning the 1991–2011 period, we find that MFI participation has a significant positive effect for women borrowers in raising crop, noncrop (i.e., livestock/poultry raising and fisheries), and total household farm income. Although men's borrowing is found to reduce wage income in the short term, it has no lingering effect on wage income. Women's borrowing appears to have a long-term effect on both crop and total income. More interestingly, the effects of microfinance differ by program. For example, BRAC has a larger effect on increasing crop income for women borrowers than does Grameen Bank, while Grameen Bank has a larger effect on increasing men's wage income, compared to women's borrowing from BRAC.

That is, while microfinance increases nonfarm income and employment by reducing wage income, it also increases farm income, especially crop and livestock income. Overall, marginal farmers benefit more from microfinance borrowing than any other farm-size group.

The presence of credit constraints matters in raising crop and other sources of farm income. Borrowing from MFIs does not raise incomes if the borrowers are credit constrained, meaning that supply-side constraints act negatively for borrowers. Thus, the effect of borrowing on farm income is higher for credit-constrained, versus nonconstrained, households. Borrowing from agricultural or commercial banks has no significant effect on household outcomes from farm sources. By contrast, microfinance has benefited nonparticipants, as well as participants. Our findings show that microfinance increases aggregate (both farm and nonfarm) employment—nonfarm more than farm—as well as agricultural wages. The evidence confirms that agricultural households are benefiting from improved farm/nonfarm linkages resulting from better access to microfinance. Thus, microfinance programs have potentially direct and indirect effects on agricultural income and productivity as they continue to evolve and expand.

Annex 7A: Switching Regression Method

In the main chapter, we implemented endogenous switching regression to estimate the differential effects of microfinance by credit constraint. In this annex, we implemented the approach of Guirkinger and Boucher (2008), which estimates a dynamic switching model on a two-round panel by differencing the data to remove fixed unobserved heterogeneity and running a switching regression on the differenced model. More specifically, we estimated a switching regression model for equation (B.5a) for credit-constrained and nonconstrained households separately with endogenous switching (appendix B); thus, we could rewrite the outcome equation (B.5b) for credit-constrained and nonconstrained households as follows:

$$\Delta Y_{it}^{1} = \beta^{1}\Delta X_{it} + \delta_{ift}^{1}\Delta C_{ift} + \delta_{imt}^{1}\Delta C_{imt} + \Delta\eta_{it}^{1} + \Delta\varepsilon_{t}^{1} \text{ if } \tilde{b}_{it} = 1 \text{ and} \tag{7A.1}$$

$$\Delta Y_{it}^{0} = \beta^{0}\Delta X_{it} + \delta_{ift}^{0}\Delta C_{ift} + \delta_{imt}^{0}\Delta C_{imt} + \Delta\eta_{it}^{0} + \Delta\varepsilon_{t}^{0} \text{ if } \tilde{b}_{it} = 0, \tag{7A.2}$$

where $\tilde{b}_{it} = 1$ when a household is credit constrained, and $\tilde{b}_{it} = 0$ when it is not; b_{it} is determined by the critical value of a latent variable $\tilde{b}_{it}^{*}$, expressed as follows:

$$\tilde{b}_{it}^{*} = \alpha\Delta Z_{it} + \Delta\tilde{\varepsilon}_{it} \text{ and} \tag{7A.3}$$

$$\tilde{b}_{it} = \begin{cases} 1 \text{ if } \tilde{b}_{it}^{*} > 0 \\ 0 \text{ if } \tilde{b}_{it}^{*} \leq 0 \end{cases}. \tag{7A.4}$$

In equation (7A.3), Z_{it} represents a vector of instruments for $\tilde{b}_{it}^{*}$.

Notes

1. Credit disbursement has been made primarily through formal lending institutions (i.e., state-owned commercial banks and specialized banks simultaneously with private and foreign commercial banks). A portion of targeted agricultural/rural credit disbursement of Bangladesh Krishi Bank (BKB) and Rajshahi Krishi Unnayan Bank (RAKUB), who receive refinancing from the Bangladesh Bank, has been brought under a nongovernmental organization (NGO) linkage program.
2. In Bangladesh, some MFIs have increasingly developed products that cater to the needs of marginal and small- and medium-scale farmers.
3. Because this chapter focuses primarily on the role of institutional finance, the effects resulting from informal borrowing (e.g., through personal contacts or local moneylenders) are not examined.
4. Credit access includes extending agricultural lines of credit directly to local banks, which then provide loans to farmers and rural entrepreneurs. Prior to the 1990s, the World Bank and other multilateral institutions managed the disbursement of agricultural finance directly through project implementation units (World Bank 2003). Examples of recent World Bank–supported credit access programs include the Rural Finance Project in Vietnam, the SAGARPA Program in Mexico, the Financial Services for the Poorest Project in Bangladesh, and programs to provide local financial institutions technology upgrades and training (e.g., Strengthening India's Rural Credit Cooperatives Project and Ghana Rural Financial Services Project).
5. An analysis for Africa is provided in van Empel (2010).
6. For expanding urban households' bank credit and microfinance access, a series of small-scale randomized interventions have been conducted; for example, Karlan and Zinman (2010a) provide an analysis for South Africa (Capetown, Port Elizabeth, and Durban), Karlan and Zinman (2010b) examine the Philippines (Manila), and Banerjee and others (2013) evaluate the slums of India (Hyderabad).
7. Bangladesh's banking sector is dominated by four state-owned NCBs, which control approximately one-half of assets in the banking system.
8. Under this program arrangement, BRAC borrows money at 5 percent interest from the Bangladesh Bank and disburses it at 10 percent interest to sharecropper groups across 150 upazilas in 35 districts throughout the country (Bangladesh Bank 2010).
9. The microfinance effect on farm employment and its various categories are considered later in this chapter. One should note that the authors attempted to estimate the effect of borrowing from commercial banks on farm income and productivity. Commercial finance constituted no more than 10 percent of total household borrowing in any given year, and its effect was not significant; thus, the results are not reported here.

Bibliography

Banerjee, Abhijit, Esther Duflo, Rachel Glennersgter, and Cynthia Kinnan. 2013. "The Miracle of Microfinance? Evidence from a Randomized Evaluation." MIT Department of Economics Working Paper 1309, Massachusetts Institute of Technology, Cambridge, MA.

Bangladesh Bank. 2010. *Annual Agricultural/Rural Credit Policy and Program for Fiscal Year (2009–2010)*. Dhaka: Bangladesh Bank.

Binswanger, Hans, and Shahidur R. Khandker. 1995. "The Impact of Formal Finance on the Rural Economy of India." *Journal of Development Studies* 32: 234–62.

Boucher, Stephen, Catherine Guirkinger, and Carolina Trivelli. 2009. "Direct Elicitation of Credit Constraints: Conceptual and Practical Issues with an Application to Peruvian Agriculture." *Economic Development and Cultural Change* 57 (4): 609–40.

Cai, Jing. 2012. "Social Networks and the Decision to Insure: Evidence from Randomized Experiments in China." Working Paper, University of California-Berkeley, Berkeley, CA.

Carter, M. R. 1989. "The Impact of Credit on Peasant Productivity and Differentiation in Nicaragua." *Journal of Development Economics* 103: 13–36.

Carter, M., and P. Olinto. 2003. "Getting Institutions Right for Whom? Credit Constraints and the Impact of Property Rights on the Quantity and Composition of Investment." *American Journal of Agricultural Economics* 85 (1): 173–86.

CDF (Credit and Development Forum). 2006. *Bangladesh Microfinance Country Profile*. Dhaka: CDF.

Crepón, Bruno, Florencia Devoto, Esther Duflo, and William Pariente. 2011. "Impact of Microfinance in Rural Areas of Morocco: Evidence from a Randomized Evaluation." MIT Working Paper, Massachusetts Institute of Technology, Cambridge, MA.

Faruqee, Rashid. 2010. "Microfinance for Agriculture in Bangladesh: Current Status and Future Potential." InM Working Paper 8, Institute of Microfinance, Dhaka.

Feder, G., L. J. Lau, J. Y. Lin, and X. Luo. 1990. "The Relation between Credit and Productivity in Chinese Agriculture: A Model of Disequilibrium." *American Journal of Agricultural Economics* 72 (5): 1151–57.

Foltz, J. 2004. "Credit Market Access and Profitability in Tunisian Agriculture." *Agricultural Economics* 30: 229–40.

Giné, Xavier, and Dean Yang. 2009. "Insurance, Credit, and Technology Adoption: Field Experimental Evidence from Malawi." *Journal of Development Economics* 89: 1–11.

Guirkinger, Catherine, and Stephen Boucher. 2008. "Credit Constraints and Productivity in Peruvian Agriculture." *Agricultural Economics* 39: 295–308.

Karlan, Dean, Robert Osei, Isaac Osei-Akoto, and Christopher Udry. 2013. "Agricultural Decisions after Relaxing Credit and Risk Constraints." Yale University Economic Growth Center Discussion Paper 1019; Yale Economics Department Working Paper 110, Yale University, New Haven, CT.

Karlan, Dean, and Jonathan Zinman. 2010a. "Expanding Credit Access: Using Randomized Supply Decisions to Estimate the Impacts." *Review of Financial Studies* 23 (1): 433–64.

———. 2010b. "Expanding Microenterprise Credit Access: Using Randomized Supply Decisions to Estimate the Impacts in Manila." Working Paper, Abdul Latif Jameel Poverty Action Lab, Massachusetts Institute of Technology (MIT), Cambridge, MA.

Khandker, Shahidur R. 1998. *Fighting Poverty with Microfinance: Experience in Bangladesh*. New York: Oxford University Press.

Kloeppinger-Todd, Renate, and Manohar Sharma. 2010. *Innovations in Rural and Agricultural Finance*. Washington, DC: International Food Policy Research Institute and World Bank.

Pitt, Mark M. 2000. "The Effect of Nonagricultural Self-Employment Credit on Contractual Relations and Employment in Agriculture: The Case of Microfinance Programs in Bangladesh." Bangladesh Development Studies, June–September, 15–48.

Pitt, M., and S. Khandker. 2002. "Credit Programs for the Poor and Seasonality in Rural Bangladesh." *Journal of Development Studies* 39 (2): 1–24.

Sial, M. H., and M. R. Carter. 1996. "Financial Market Efficiency in an Agrarian Economy: Microeconometric Analysis of the Pakistani Punjab." *Journal of Development Studies* 32 (5): 771–98.

van Empel, Gerard. 2010. "Rural Banking in Africa: The Rabobank Approach." In *Innovations in Rural and Agricultural Finance*, edited by Renate Kloeppinger-Todd and Manohar Sharma. Washington, DC: International Food Policy Research Institute and World Bank.

Wadud, Mohammed Abdul. 2013. "Impact of Microfinance on Agricultural Farm Performance and Food Security in Bangladesh." InM Working Paper 14, Institute of Microfinance, Dhaka.

World Bank. 2003. "Review of the Bank's Rural Finance Experience." Working Paper, Operations Evaluation Department World Bank, Washington, DC.