Farmer Training and Household Labour Use

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Abstract

The question has always been asked as to whether training leads to a change in farmer behaviour in terms of labour for farm production. This question forms the main thesis of this paper. The paper investigates this question, among others, using panel data obtained from about 3,000 farmers and collected over the period February 2010 to January 2011. The paper employs a difference-in-difference estimator to test whether training provided to beneficiary farmers under the Millennium Challenge Account (MCA) Ghana programme did change labour use on the farms of these farmers. The main findings of the study are that the training seems to have impacted positively on households' decision to allocate labour hours to harvesting related activities for both the major and minor seasons. The study concludes by noting that there are significant differential impacts with respect to the type of labour, and/or zone for which the estimates were generated. In general, the impact is positive for all the cases where evidence of impact is found. It is therefore suggested that farmers increased their labour use because of their expectations of positive returns due to the Millennium Development Authority (MiDA) intervention.

Introduction

Agriculture continues to be the world's single largest industry, employing nearly 1.3 billion smallholders and landless workers. It provids livelihood for close to 86% of the global rural population (World Development Report, 2008). There are an estimated 5.5 billion people living in the developing countries with 3 billion of those people living in rural areas. About 2.5 billion live in households that are engaged in agriculture, while 1.5 billion live in smallholder households (Ravallion and Chen 2007, World Bank 2007c). In Ghana, Agriculture employs about 60% of labour force (Alemna and Osei 2007) and contributes an average of 40% to Ghana`s gross domestic product (GDP) and 55% of the nations' foreign exchange earnings (Wolter Denise 2008).

Ghana's agriculture is the smallholder type and relies heavily on the use of labour. Labour therefore remains an essential component in agricultural production – and is used at the different stages of production (Ruben et al 2006).

Farm households' decisions to reallocate labour to other activities will be influenced by the difference in the perceived returns of the off-farm work and that of the farm activity (Huffman, 1980). However, it is also true that labour reallocation from agricultural activities is low due to the inadequate skills set of rural households (Sikei et al; 2009). The labour supply theory, which explains the use of labour for leisure and work suggest that labour-time in hours and days may not be entirely devoted to farm activities even with an improvement in the skill set due to training. The farm household's behaviour with respect to the use of labour include the decision to allocate labour time to farm and off-farm activities on one hand and to the different types of farm activity on the other (Huffman, 1980). Indeed, given the low levels of skills of agricultural labour plus the fact that agricultural productivity is generally low among Ghanaian farmers, agricultural policies that seek to enhance farm productivity should attract increased labour hours to farm activities. *Ex ante* labour use decisions with respect to farm activities gives an indication of farmer's perception on expected returns.

This study seeks to investigate whether the MiDA intervention with respect to the training and 'starter pack' received by farmers leads to increases in the use of labour on household farms. This paper researches a critical policy question as it will give an indication of farmers' perception about the intervention through changes in the use of labour. Some studies have argued that training, which encourages farmers to adopt farm mechanization, may displace labour, however the use of fertilizer and other pesticides will require more labour. As Oberaj and Ahmed (1981) argued, the use of fertilizer and high yield seeds will require more labour. This is because the increased use of fertilizer will result in increased weeds which, if not dealt with will compromise the yields of the high yielding varieties. The study therefore uses data obtained as part of the impact evaluation of the MiDA programme to assess how farmers' behaviour with respect to farm labour use changed. Section II presents a brief background to the MiDA programme. In Section III, the methodology and Data are discussed. We then present the results in Section IV. Conclusions are presented in Section V.

Background of MiDA Program

In August 2006, the government of Ghana signed a compact with the United States of America under the Millennium Challenge worth about US$547 million. The main objective of the compact was to transform Ghanaian agriculture and through that increase economic growth and consequently reduce poverty. The two main objectives through which this was to be achieved was to increase production and productivity of high value cash and food crops, and also create a competitive local, national and international market for these high value cash crops and food crops.

As part of the agriculture commercialization, MiDA trained farmers in technical knowledge/skills in farm management and crop production process. The MiDA technical training of beneficiary FBOs included farm management, production, harvesting, temporary storage, and long-term storage. Training in farm management includes better and more effective ways of employing farm inputs and resources for crop production processes among the selected MiDA farmer-based organizations (FBOs) in the intervention zones.

With the help of Ministry of Food and Agriculture (MOFA), MiDA selected 23

districts and clustered them into three zones namely the Northern Agricultural Zone, Afram Basin and the Southern Horticultural Belt in Ghana. These districts were selected because they are predominantly involved in agriculture and also had a high level prevalence of poverty. The Northern agricultural zone includes the following districts: Savelugu-Nanton, Tolon-Kumbugu, Tamale, Gushegu-Karaga and West Mamprusi. The districts in the Afram Basin are EjuraSekyeredumasi, Kwahu South, Fanteakwa, Afram plains, Sekyere East, and Sekyere West. The Southern Horticultural Belt districts include Gomoa, Awutu Efutu Senya, Akwapim South, Manya Krobo, Dangme West, Yilo Krobo, North Dayi, Hohoe, Ketu, Keta, South Tongu, and Akatsi.

Research Methodology

Farmers are managers in the sense that they take decisions and make choices in the entire production operations to ensure effective administration and execution of the farming activities (Oshy, 2010). The allocation of labour within the household and for the different farm and non-farm activities is one of such decisions that the household must make. A farming household's decision to allocate labour time to farm and off-farm is influenced by the level of skills acquired through training (Huffman, 1980). Bratberg and others (2008) found that receiving agricultural training has the greater tendency to increase off-farm work participation by farming households.

The conceptual framework that forms the basis of this study is based on two key hypotheses on the effects of training on labour. The first relates to the fact that if training leads to an increase in the relative efficiency of labour use on farms vis-a-vis off-farm work, then it could result in an increase in labour use on the farm. The second hypothesis relates to the case where training leads to an increase in nominal efficiency which has negative effects on labour use on the farm, and results in allocating labour hours to other non-farm activities. Sentumbwe et al; (2005) found the higher probability of household labour engaging in off-farm enterprises when they are more educated. Thus, if training equips farmers with skills and knowledge about the effective use of farm inputs then farmers can reduce labour man-hours required for farm activities and allocate some of the labour hours to other non-farm activities.

Data used for the study

The data used for this study is based on the Batch II Panel Data collected by ISSER as part of the evaluation of the MiDA FBO training programme. The sampling frame was the list of farmers of Batch II FBOs who were considered eligible to benefit from the compact intervention. The FBOs were randomized into treatment and control groups where the former were given the intervention initially whilst the latter benefited a year later (randomised phasing in design). Random samples of 5 farmers were selected from each of the 600 FBOs. There was a baseline collection of data in 2010. The follow-up data was collected about a year after the baseline and on the same set of farmers for which data was collected in the baseline. In-depth data collection was undertaken using two sets of questionnaires: a household questionnaire and a community questionnaire. The questionnaires included modules on the household demographic characteristics, educational characteristics of households, household health, and activity status of household members, migration and transfers in and out of households. The rest were information seeking behaviour of households, household assets including information on borrowing, savings and

lending behaviour, housing characteristics, household agricultural activities involving issues of land ownership, transactions and agricultural processing and non-farm enterprises of households. Other information contained in the questionnaire included location of households, community facilities and farm sizes which were captured through the use of global positioning system units (GPS) while information on market price survey was captured in the community questionnaire.

Within the agriculture modules, information collected included labour use on land preparation, field management, harvesting, and post-harvest activities during the last major and minor crop farming seasons and over the last twelve months preceding the survey. Land preparation was defined to include activities such as clearing or weeding before planting, seeding and nursery, planting and transplanting stage of production. Field management activities included clearing weeds after planting, fertilizer and pesticides applications and irrigation until harvesting. Harvesting was the period when farmers harvested outputs from their farms and either took them to the market or the places of storage. The post-harvest activities included those relating to the preservation and storage of outputs. We therefore obtain the households' labour use as man-hours used per hectare of plot for the different farm production activities described above. The household is the unit of analysis for the study.

Empirical Model

The empirical model used in the estimation of the impact in this study is difference-in-difference (DiD) estimator. The DiD essentially estimates the impact as the difference between the mean value of the outcome variable observed in the treatment and control group as well as the difference in mean value over time (Tembo et al; 2007).

We therefore determined the impact of the intervention (training *(T)*) on agricultural labour use *(L)* as:

$$\alpha = (L|T = 1) - (L|T = 0)$$

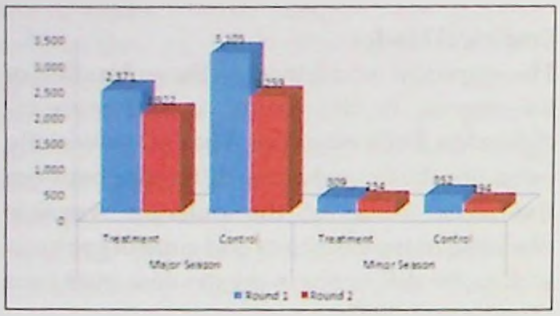
Where, the causal impact (α) of the training program *(T)* on the outcome *(L)* is the difference observed between the outcome *(L)* of the participants (which is when $T = 1$) in addition to the same outcome of non-participant (that is when $T = 0$) which is otherwise referred to as 'counterfactual' (Gertler et al 2011). The final outcome is observed by calculating the difference between the two mean differences. This is same as estimating a regression model of the form:

$$Y_{it} = \alpha_{\circ} + \beta_1 T + \beta_2 TD + \beta_3 T * TD + \delta \quad (1)$$

Where, Y_{it} denotes the dependent variable.
Timedum (T) is a binary variable = 0 if Round = 1, and = 1if Round = 2
Treatdum *(TD)* is a binary variable = 1 if treated, otherwise = 0
TreatTime (T * TD) = (Timedum X Treatdum) is an interaction term denoting the product of the two binary variables 2 = only in period *T* if a household receives training.
β_3 is the actual impact of the program intervention.
α, δ and □ are regression parameters to be estimated.

Data Analysis and Findings

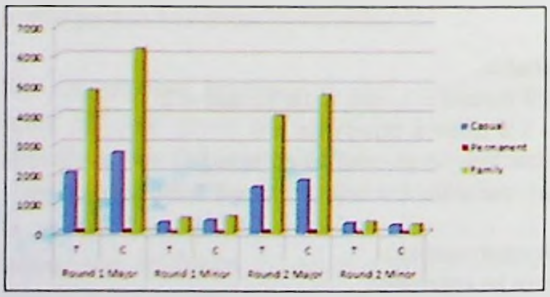
Figure 1 Overall Average Total Man-hours by Treatment, Round and Season



Source: Authors Construct from MiDA FBO Survey 2010/11

Figure 1 shows the average total labour hours used on a representative farm in a given year. Generally, one observes that labour use on farms decreased over the two years. This is true for both sets of households – treatment and control. For the Round 1 and during the major season, labour use in the typical treatment households was about 2,371 man-hours whilst that of the control was about 3,105 man-hours in the year. In the follow-up period (Round 2) and for the major season, labour use in the treatment households averaged about 1,922 man-hours compared to about 2,259 man-hours for the control. The minor season averages follow very similar pattern except that they are much lower.

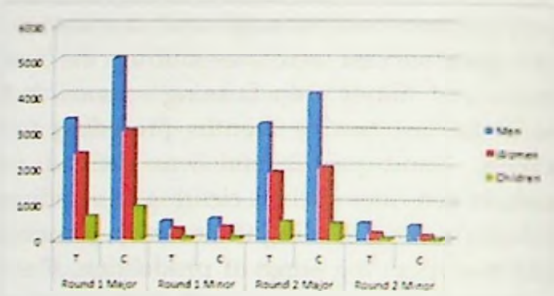
Figure 2. Overall Mean Man-Hours by Labour Type, Round & Season



Source: Authors construct from MiDA FBO Survey 2010/11

Majority of treated and control households used family labour for farm activities in all seasons. Casual labour use by these households is higher than permanent labour. The low use of permanent labour could be attributed to the fact that farm activities among the households in the MiDA project zones are predominantly smallholder and subsistence in nature (see Figure 2).

Figure 3 Overall Mean Man-hours by Gender and Youth labour, Round and Season.



Source: Authors construct from MiDA FBO Survey 2010/11

We note from Figure 3 that the average labour hours of men are generally higher than that of women and also of children. As expected, the mean labour hour is higher in the major season than it is in the minor season. This is not too surprising as by default the returns to labour will be lower in the minor season. What we also do observe from the data is the fact that the mean labour hours did decrease for all these classes of labour over the two periods.

IMPACT ESTIMATES OF TRAINING ON LABOUR USE

We discuss in this section a summary of the main results of the regressions which estimate the impact of the MiDA training intervention

on the total labour hours committed by the household to farming. We subsequently also discuss the

impact results for disaggregated labour hours. These results help to throw light on whether the extent to which labour investment by the household is affected by the intervention and also whether there is reallocation of household labour as a result.

Table 1 Summary of difference-in-difference regression results for total man-hours, by season and stage of production

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)			
Major Season			
Land Preparation	*Field Management*	*Harvesting*	*Post-Harvest*
151.3	63.09	132.55***	26.23
Minor Season			
Land Prep	*Field Mgt*	*Harvesting*	*Post-Harvest*
15.96	25.23	30.05***	13.75***

Notes: the asterisks shows that the coefficient is significant at 1%, 5% or 10%. i.e.***p<0.01 **p<0.05 *p<0.1

Our results shows that training had a positive impact on labour use for harvesting in both the major and minor seasons (Table 1, Column 3). We however do not find any impact of the intervention on land preparation and field management. For post-harvest activities, we do find that labour hours committed to this activity did increase in the minor season but not for the major season.

The results also show differential impacts at the zonal level (See Appendix). In the southern horticulture belt for instance, we find evidence of an impact in land preparation in the major season. However in the minor season the impact is rather found for the field management, harvesting and post harvesting (Appendix Table 1). In the Afram Basin, evidence of impact is found for harvesting in the major season only (Appendix Table 2). We do not find any impact of the MiDA intervention on man hours in the northern agriculture zone, at the 5 per cent significance level (Appendix Table 3).

The general result that the impact of the training on labour use by farmers is positive and significant could be explained by two reasons. First, training could have increased farmers' expectations about their returns to agriculture activities and therefore encouraged them to invest more man hours. A second reason could have been that the training required increased time use on farms and consequently increased labour hours. In other words, the training imposed some technology which required additional time.

Table 2 Summary of difference-in-difference regression results for the different labour types, by farming season

	Magnitude of Programme Impact Coefficient (β_3 in Equation 1)			
	Major Season			
Dependent Variables	*Land Prep.*	*Field Mgt.*	*Harvesting*	*Post-Harvest*
Family Labour	74.21*	34.87	111.80**	14.76
Casual Labour	74.81	31.4	21.83	12.93
Permanent Labour	2.29	-3.18	-1.09	-1.45
Men labour	151.3	63.9	132.55**	26.23
Women labour	57.25	36.05	59.95*	12.81
Youth labour	42.98*	42.58***	18.36*	3.72
Minor Season				
Dependent Variables	*Land Prep*	*Field Mgt*	*Harvesting*	*Post-Harvest*
Family Labour	2.01	2.01	18.7***	10.34***
Casual Labour	14.06	14.06	11.79	3.73
Permanent Labour	-0.1126	-0.1126	0.1998	-0.324
Men labour	15.96	15.96	30.05***	13.75***
Women labour	2.48	2.48	14.58*	7.51
Youth labour	-0.963	-0.963	5.91***	1.67

Notes: the asterisks show that the coefficient is significant at 1%, 5% or 10%. i.e.
***p<0.01 **p<0.05 *p<0.1

In Table 2 we show the impact estimates by type of labour used for the different stages of production. We observe from this table that the impact of training on labour use in harvesting is significant for family labour but not for permanent or casual labour. We also found that it impacts positively on the labour use for men as opposed to women or the youth. For field management and in the major season, the intervention impacted on youth labour. Similarly, in the minor season, we found that training impacted on family labour in terms of the types. We also found that men worked more hours on farms for harvesting and post-harvest activities.

Here also, we estimated these impact regressions at the zonal level and found some zonal effects on the results. For instance in the Southern Horticulture Belt, the impact of the intervention on labour use is more probable in land management whereas for the Afram Basin and the Northern Agriculture Zone, it is more likely to be in respect of Harvesting (Appendix Table 4 - Appendix Table 6). These zonal differences may reflect the varying degrees of capital intensity of farming for southern part of Ghana relative to the north.

Conclusions

This study provides an analysis of the impact of the MiDA intervention of providing farmers with technical training on labour use during different stages of production. In particular, we examined the impact of the training on man-hours used for land preparation, field management, harvesting, and post-harvesting activities. We also examined the impact of the different types of labour used for the different activities.

The main findings of the study is summarised as follows.

First, we found that overall the impact of the training on farm households' decision to allocate labour hours to harvesting related activities is positive for both major and minor seasons. In addition, we did find impact for post-harvest activities in the minor season.

Second, we found some evidence of differential impacts at the zonal level. The only impact in the major season and for the Southern Horticulture Belt is with the use of labour for land preparation. In the minor season however, the impact is found for harvesting and post harvesting activities. We also found evidence of impact on labour use for harvesting in the Afram Basin but no impact for the Northern Agriculture Belt.

Third, with respect to the different categories of labour we found that the impact evidence for harvesting related activities is driven by family labour use in the major season. We also found for the zones that increase in labour use for land preparation is again driven by family labour for the Southern Horticulture Belt. We further noted that labour use for field management was driven by casual labour in this zone. In the Northern Agriculture Zone, the positive impact on field management result is driven by use of youth labour. In terms of the results for harvesting in the Southern Horticulture Belt, we found evidence of impact on these categories of labour use - casual labour, both men and women labour use. For harvesting in the Afram Basin and Northern Agriculture Zone, we found impact on youth labour, and additionally family labour for the Afram Basin.

Finally, for post-harvest activities, we found the impact of the MiDA intervention on family labour and men labour in the Southern Horticulture Belt. No impact on labour use for post-harvest activities was found for the other zones.

We conclude by noting that although overall, we do not find impact on the total labour use as a result of the MiDA intervention, there are significant differences when one considers the type of labour and or zone for which the estimates were generated. In general and for all the cases where evidence of impact was found, it was positive. If we married this outcome with some of the comments from the farmers, we could argue that farmers expected positive outcomes as a result of the MiDA intervention and consequently increased their labour use.

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APPENDICES

Appendix 1:
Difference-in-difference regression results on total man-hours in Southern Horticultural Belt

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)			
Major Season			
Land Prep	Field Management	Harvesting	Post-Harvest
129.72**	86.53	8.43	0.10
Minor Season			
Land Prep	Field Mgt	Harvesting	Post-Harvest
50.01	55.88*	69.62***	29.62***

Notes: the asterisks show that the coefficient is significant at 1%, 5% or 10%. i.e.***p<0.01 **p<0.05 *p<0.1

Appendix 2:
Difference-in-difference regression results on total man-hours in Afram Basin

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)			
Major Season			
Land Prep	Field Management	Harvesting	Post-Harvest
44.88	-2.13	144.58**	30.49
Minor Season			
Land Prep	Field Mgt	Harvesting	Post-Harvest
8.62	3.03	17.30	11.33

Notes: the asterisks show that the coefficient is significant at 1%, 5% or 10%. i.e.***p<0.01 **p<0.05 *p<0.1

Appendix 3:
Difference-in-difference regression results on total man-hours in Northern Agricultural Zone

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)			
Major Season			
Land Prep	Field Management	Harvesting	Post-Harvest
276.49	104.07	208.57	36.63
Minor Season			
Land Prep	Field Mgt	Harvesting	Post-Harvest
-2.87	24.82*	10.83	3.17

Notes: the asterisk show that the coefficient is significant at 1%, 5% or 10%. i.e. ***p<0.01 **p<0.05 *p<0.1

Appendix 4:
Difference-in-difference Regression Results of the effects of training by labour type and gender in the Southern Horticultural Belt

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)				
Major Season				
	Land Prep.	Field Management	Harvesting	Post-Harvest
FamilyLabour	81.63***	22.19	-0.71	-6.24
Casual Labour	50.51	47.14*	11.33	8.65
Permanent Labour	-2.42	17.20	-2.18	-2.31
Menlabour	129.72**	86.53	8.43	0.10
Womenlabour	18.23	20.65	47.04	15.23
Youth labour	10.75	17.33	-9.65	-20.45
Minor Season				
	Land Prep.	Field Management	Harvesting	Post-Harvest
FamilyLabour	16.84**	6.51	23.45	20.12***
Casual Labour	34.96	47.43**	47.10***	9.31
Permanent Labour	-1.80	1.94	-0.93	0.18
Menlabour	50.01	55.88*	69.62***	29.62***
Womenlabour	9.23	13.37	32.47**	12.62*
Youth labour	-5.10	4.48	8.02	5.84*

Notes: the asterisks show that the coefficient is significant at 1%, 5% or 10%. i.e.***p<0.01 **p<0.05 *p<0.1

Appendix 5:
Difference-in-difference regression results of the effects of training by labour type and gender in the Afram Basin

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)				
Major Season				
	Land Prep.	Field Management	Harvesting	Post-Harvest
FamilyLabour	-6.20	-19.83	101.63***	22.65
Casual Labour	43.17	22.36	43.79	8.52
Permanent Labour	7.92	-4.66	-0.84	-0.68
Menlabour	44.88	-2.13	144.58*	30.49
Womenlabour	4.74	12.20	52.91	-3.13
Youth labour	11.75	-8.50	26.44**	12.94
Minor Season				
	Land Prep	Field Mgt	Harvesting	Post-Harvest
FamilyLabour	-4.06	11.87	14.91	11.85
Casual Labour	11.07	-10.83	1.21	0.48
Permanent Labour	1.62	2.00*	1.19	-0.99
Menlabour	8.62	3.03	17.30	11.33
Womenlabour	-1.88	9.37	11.11	7.62
Youth labour	0.75	3.52	7.94*	0.65

Notes: the asterisk show that the coefficient is significant at 1%, 5% or 10%. i.e.***p<0.01 **p<0.05 *p<0.

Appendix 6:
Difference-in-difference Regression Results of the effects of training by labour type and gender in the Northern Agricultural Zone.

Magnitude of Programme Impact Coefficient (β_3 in Equation 1)				
Major Season				
	Land Prep	Field Mgt	Harvesting	Post-Harvest
FamilyLabour	149.74	95.16	202.24*	17.01
Casual Labour	127.05	26.45	6.99	21.31
Permanent Labour	-0.30	-17.54	-0.67	-1.69
Menlabour	-2.87	24.82*	10.83	3.17
Womenlabour	143.63	69.92	72.25	25.53
Youth labour	101.84	117.49***	31.13	11.95
Minor Season				
	Land Prep	Field Mgt	Harvesting	Post-Harvest
FamilyLabour	-3.33	25.39*	15.70*	0.35
Casual Labour	1.10	0.15	-4.87	2.82
Permanent Labour	-0.64	-0.72	0.00	0.00
Menlabour	-2.87	24.82	10.83	3.17
Womenlabour	1.88	5.70	3.15	2.87
Youth labour	0.39	7.73	1.85	-0.56

Notes: the asterisks show that the coefficient is significant at 1%, 5% or 10%. i.e.***p<0.01 **p<0.05 *p<0.1