Improving Smallholder Farmers' Income through Farmer Training Centers: an Impact Evaluation in Haramaya District, Ethiopia

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Paper prepared for presentation at the 3rd AIEAA Conference
"Feeding the Planet and Greening Agriculture: Challenges and opportunities for the bio-economy"

25-27 June, 2014
Alghero, Italy

CONTENTS

INTRODUCTION

- Agricultural sector as an engine for (rural/local) development (World Bank, 2007; Mogues et al., 2009a)

- Some constraints facing the sector

- AASs to deal with the challenges (Birner et al., 2009)
  - AASs defined (Birner et al., 2006; Swanson, 2008)

- AASs in Ethiopia
  - historical evolution (e.g., Belay, 2003; Gebremedhin et al., 2006)
  - smallholder productivity remains low
  - FTC-based provision of AASs (Gebremedhin et al., 2006; Mogues et al., 2009b; IFPRI, 2010)

INTRODUCTION…(2)

❑ Effectiveness/impact of AASs

- on knowledge, skills, technology diffusion and adoption, productivity, etc (Birkhaeuser et al., 1991; Anderson, 2008; Swanson, 2008; Dercon et al., 2009; IFPRI, 2010; Benin et al., 2012)

- shortage of rigorous impact evaluations (Waddington et al., 2010)
- in Ethiopian context, there is little systematic and careful empirical investigation on final outcomes (Dercon et al., 2009)

- available studies in the country focus on intermediate outcomes, such as knowledge (Efa et al., 2005), agricultural productivity (Ayele et al., 2005 cited in Davis, 2008), and productive and technical efficiency (Alene & Hassan, 2003; Ayele et al., 2006; Thangata & Mequaninte, 2011; Elias et al., 2014).

- The only rigorous impact evaluation of AASs on final outcomes (i.e., poverty and consumption growth) in the country is that of Dercon et al. (2009)

- there is not any careful empirical study conducted to systematically document the effectiveness of the recent FTC-based approach to AAS provision.
  - Lemma et al. (2011) – IPMS supported FTCs in PLWs

INTRODUCTION…(3)

- **The present study**

  - *investigates the causal effect of modular training organized at FTCs on farm income of participating farmers in Haramaya district of eastern Ethiopia*

  - household survey (May-Oct.2013)

  - data quality assurance

  - construction of the outcome variable (i.e., farm income)
    - policy aim of establishing FTCs (MOARD, 2009)
    - the literature dealing with agriculture and allied activities in developing countries (e.g., Cunguara and Darnhofer, 2011; Davis et al., 2012; Benin et al., 2012b)
    - dominant crops versus less dominant ones
    - crop residues/by-products

DATA AND METHODS

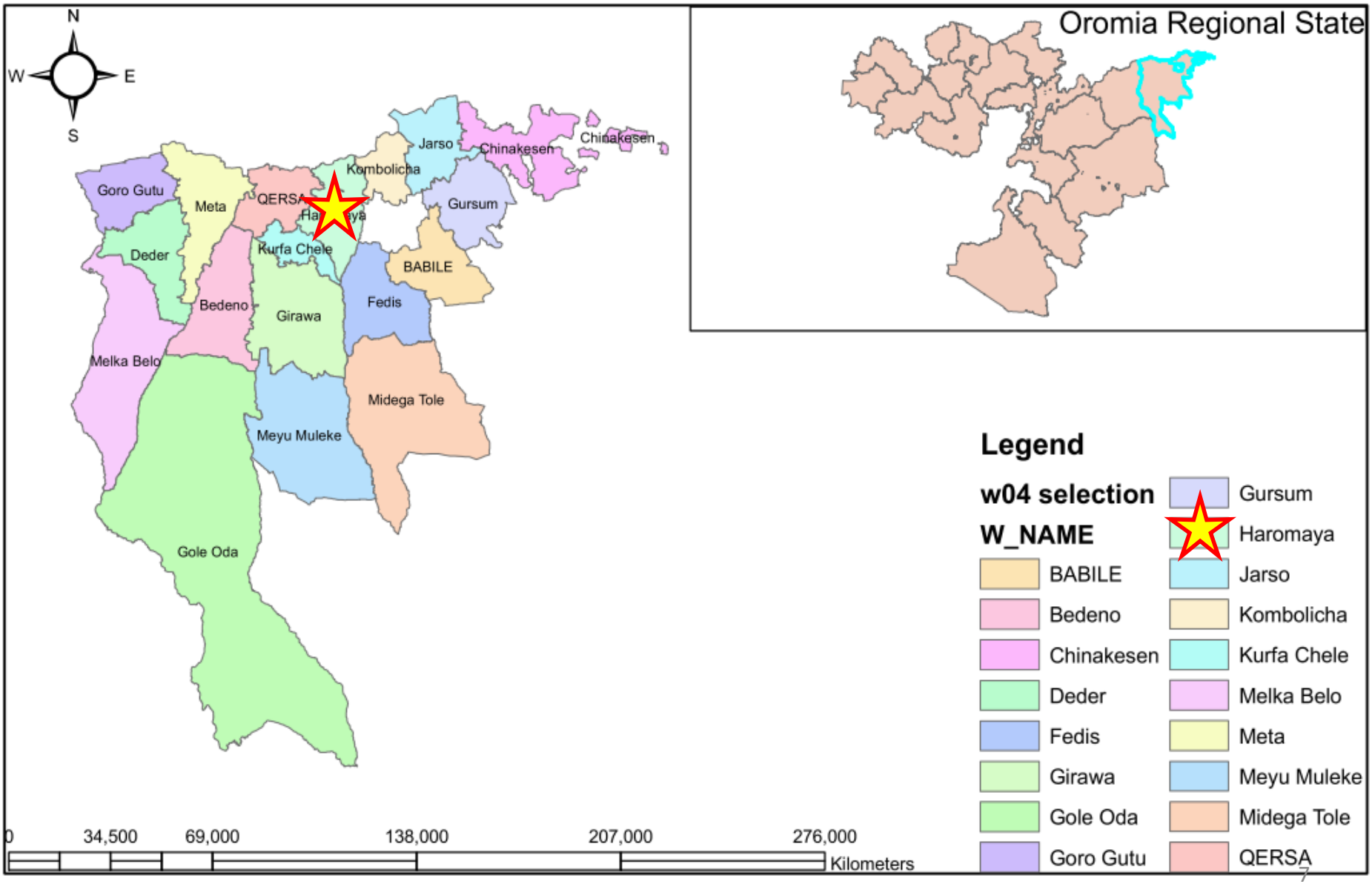
❑ Study area, *kebele*/PA, and household selection

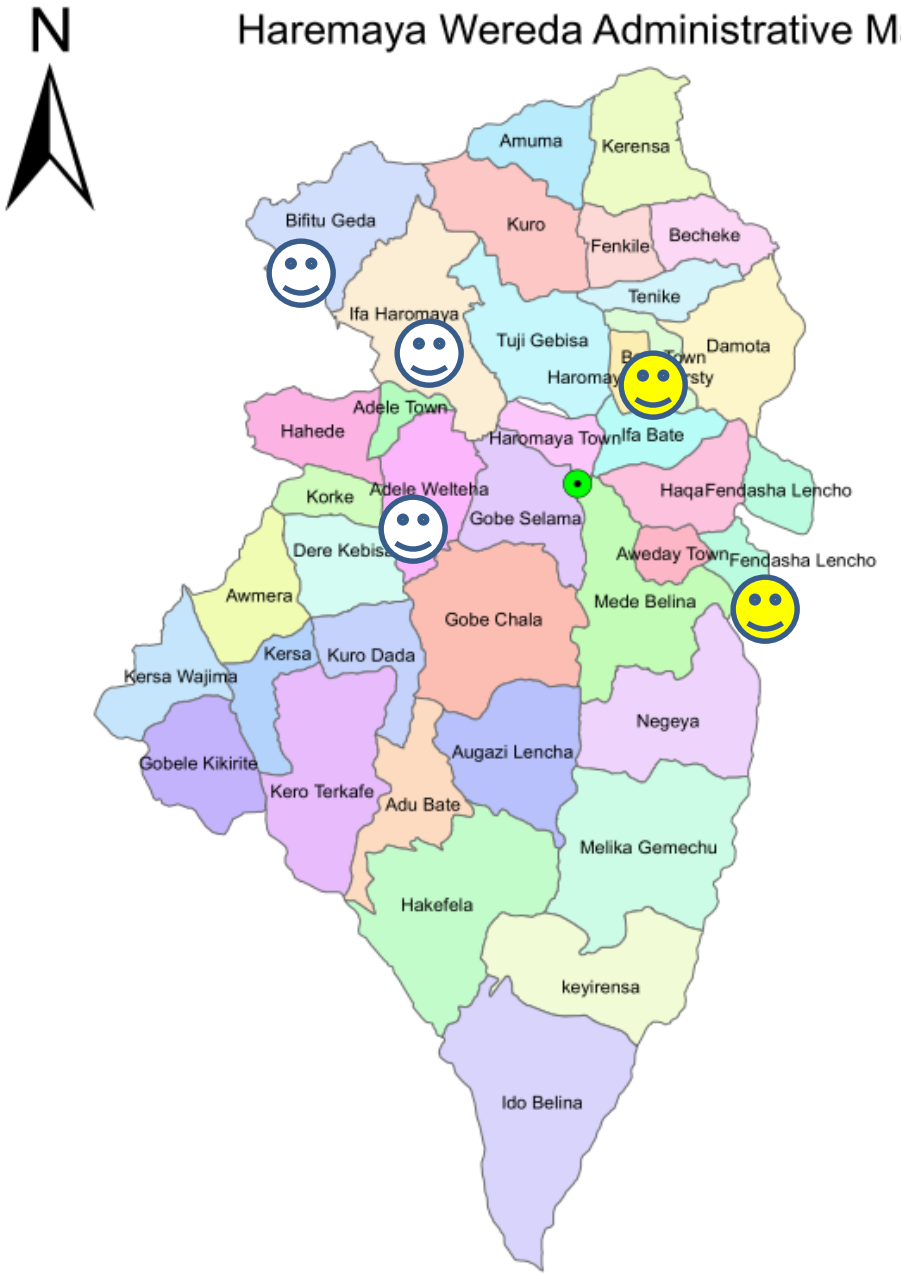
- ➢ 18 districts in east Hararghe, Haramaya district selected purposively
  - representativeness to the major farming systems and agro-ecological zones,
  - proximity to the collaborating institutions,
  - availability of established and functional FTCs, and personal experience in the area.
- ➢ 33 PAs in Haramaya: 31 (established FTCs), from which 14 are operational. From the 14, only ten are fully functional
- ➢ Three FTCs selected (Ifa Oromia, Adele Waltaha, and Biftu Geda)
- ➢ Two non-FTC PAs also selected (Ifa Bate and Fendisha Lencha)

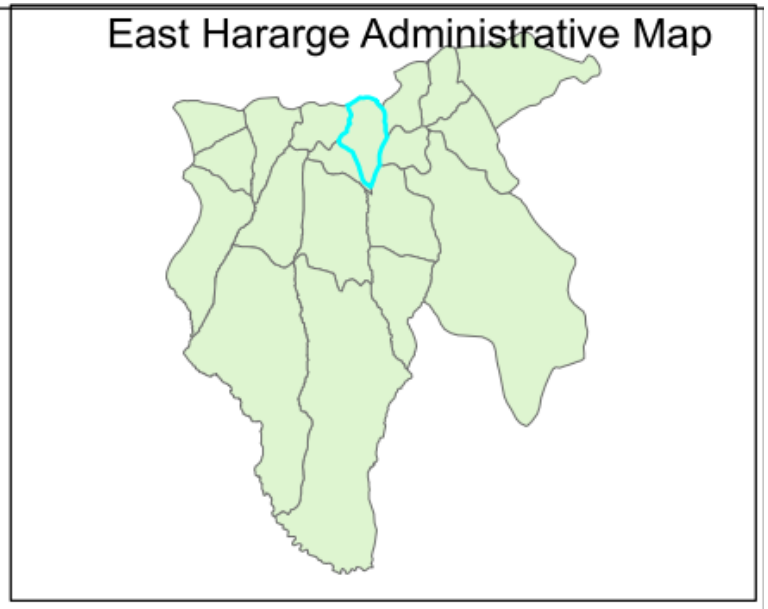
❑ 250 household heads (90 treatment and 160 comparison)

❑ PSM and matching quality analysis

EAST HARARGE ZONE ADMINISTRATIVE MAP




N
Haremaya Wereda Administrative Map
Amuma
Kerensa
Bifitu Geda
Kuro
Fenkile
Becheke
Tenike
Ifa Haromaya
Tuji Gebisa
Damota
Adele Town
Hahede
Haromaya Town
Ifa Bate
Korke
Adele Welteha
HaqaFendasha Lencho
Gobe Selama
Dere Kebisa
Aweday Town
Fendasha Lencho
Awmera
Gobe Chala
Mede Belina
Kersa
Kuro Dada
Kersa Wajima
Negeya
Augazi Lencha
Gobele Kikirite
Kero Terkafe
Adu Bate
Melika Gemechu
Hakefela
keyirensa
Ido Belina


East Hararge Administrative Map

RESULTS

Descriptive statistics of covariates measured at baseline

	Treatment	Comparison	T-test
Age of the household head (=1 if >18 years)	.99	.99	-0.41
Gender (=1 if male)	.98	.96	0.66
Education (=1 if attended some formal school)	.30	.68	-6.10 ***
Household size (number of people in the house)	3.30	3.99	-2.47 **
Assets (number of productive assets)	3.01	2.61	3.22 ***
Farming experience (number of years)	18.29	18.62	-0.36
Experience in AASs (number of years)	15.24	13.63	1.69 *
Land holding (=1 if >=1 ha)	.32	.36	-0.54
Organization (=1 if a member of at least one organization/association)	.99	.86	3.38 ***
Educated members (=1 if number of educated members of the household is >=1)	.89	.95	-1.80 *
Number of observations	90	160	
Significant at 10% (*), 5% (**), 1% (***)			

RESULTS…(2)

Propensity score estimation

Dependent variable: Participation in modular training (=1 if trained in 2009)	Coef.	Z
Age of the household head (=1 if >18 years)	-.53 (1.47)	-0.36
Gender (=1 if male)	1.24 (0.92)	1.36
Education (=1 if attended some formal school)	-1.93 (0.35)	-5.48 ***
Household size (number of people in the house)	-.16 (0.08)	-1.95 **
Assets (number of productive assets)	.42 (0.18)	2.38 **
Farming experience (number of years)	-.08 (0.04)	-2.19 **
Experience in AASs (number of years)	.05 (0.03)	1.38
Land holding (=1 if >=1 ha)	-.15 (0.36)	-0.42
Organization (=1 if a member of an organization)	2.47 (1.06)	2.32 **
Educated members of the household (=1 if >=1)	.53 (0.60)	0.90
_cons	-2.93 (2.17)	-1.35
Number of observations	250	
Pseudo R^2	0.21	
LR $chi^2(10)$	67.95 ***	
Significant at 5% (**), and 1% (***) level; Standard errors in parenthesis		

RESULTS…(3)

Construction of the outcome variable

	Treatment	Comparison	t-test
a. Total value of crop sold, consumed and stored (Birr)	30216 (11545)	59341 (78748)	3.48 ***
Value of crop sold (Birr)	19842 (9398)	39380 (37802)	4.82 ***
Value of crop consumed/stored (Birr)	10374 (5195)	19961 (58865)	1.54
b. Total value of crop residue produced (Birr)	1645 (1834)	1205 (1732)	1.89 *
Value of crop residue sold (Birr)	143 (188)	83 (771)	0.72
Value of crop residue paid as rent (Birr)	2.22 (21.08)	0	1.34
Value of crop residues consumed (Birr)	1499 (1909)	1121 (1377)	1.81 *
c. Total value of crop production (a + b) (Birr)	31861 (12437)	60546 (78811)	3.43 ***
d. Crop production expenses (Birr)	2440 (978)	4858 (6276)	3.63 ***
e. Crop income (c – d) (Birr)	29421 (12458)	55688 (77442)	3.19 ***
f. Farm income (crop + livestock)	31499 (12276)	58421 (78025)	3.25 ***
Number of observations	90	160	

Significant at 10% (*), at 1% (***) level; Standard deviations in parenthesis.

RESULTS…(4)

Construction of …(2)

	Treatment	Comparison	t-test
a. Total value of livestock products sold and oxen rented out (Birr)	2876 (1639)	4422 (6444)	2.23 **
Value of livestock products sold (Birr)	2876 (1639)	4403 (6411)	2.22 **
Value of rented out oxen (Birr)	0	19 (237)	0.75
b. Livestock production expenses (Birr)	798 (791)	1689 (2207)	3.69 ***
c. Livestock income (a – b) (Birr)	2078 (1849)	2733 (6692)	0.91
Number of observations	90	160	

** significant at 5%, and *** at 1%; Standard deviation in parenthesis

RESULTS…(5)

Contribution of different crops to gross crop income (percentage share)

	Gross crop income		
	Treatment	Comparison	Total
Cereals	41.23	23.41	29.83
Vegetables	0.88	0.11	0.39
Root crops	11.78	7.22	8.86
Chat	39.97	63.64	55.12
Crop residues	4.76	4.33	4.48
Others	1.38	1.29	1.32
Total	100.00	100.00	100.00

RESULTS…(6)

Distribution of the average values (Birr) of outcome variables

Outcome variable	Treatment	Comparison	t-test
1. farm income	31498.63	58420.96	3.25 ***
	(1293.96)	(6168.42)	
2. farm income (excluding *chat*)	20135.42	11653.44	-4.98 ***
	(1219.91)	(1077.61)	
3. crop income	29420.65	55687.50	3.19 ***
	(1313.19)	(6122.31)	
4. crop income (excluding *chat*)	18057.44	8919.99	-6.30 ***
	(1248.76)	(831.15)	
5. livestock income	2077.98	2733.46	0.91
	(194.86)	(529.04)	
Number of observations	90	160	

Significant at 1% (***) level; Standard errors in parenthesis

RESULTS…(7)

Estimation of the average effect of training on farm income

Outcome variable	(1)	(2)		(3)
		(2a)	(2b)	
1. Farm income per household (Birr)	-24854.46 (9105.19) ***	-27344.03 (7597.10) ***	-28262.78 (8554.61) ***	-27536.20 (8205.94) ***
2. Farm income per household (Birr) excluding *chat*	9557.47 (2561.70) ***	10387.53 (2129.27) ***	9846.20 (2685.35) ***	10233.93 (2509.94) ***
3. Crop income per household (Birr)	-24511.34 (8932.87) ***	-27045.93 (7404.51) ***	-28003.22 (8353.19) ***	-27316.92 (7994.48) ***
4. Crop income per household (Birr) excluding *chat*	9900.59 (2487.14) ***	10685.63 (2165.25) ***	10105.76 (2713.51) ***	10453.21 (2571.27) ***
5. Livestock income per household (Birr)	-343.12 (837.34)	-298.10 (565.04)	-259.56 (666.38)	-219.28 (647.25)

Significance test based on z statistics: significant at 1% (***) level; bootstrap standard errors in parenthesis (50 replications)

Note: 73 treated and 160 untreated individuals on common support. (1) Nearest Neighbors matching; (2) Kernel matching; (2a) Normal (Gaussian) Kernel; (2b) Epanechnikov Kernel; (3) Radius matching

RESULTS…(8)

Matching quality analysis: t-test before/after

	Unmatched (mean and t-test)			Matched (t-test between treated and control groups)			
	Treated	Control	t-test	(1)	(2a)	(2b)	(3)
Age of the household head (=1 if >18 years)	.99	.99	-0.41	0.13	-0.41	-0.36	-0.39
Gender (=1 if male)	.98	.96	0.66	-0.21	-0.03	0.04	-0.00
Education (=1 if attended some formal school)	.30	.68	-6.10 ***	-0.07	-0.39	-0.22	-0.27
Household size (number of people in the house)	3.30	3.99	-2.47 **	0.20	0.36	0.23	0.37
Assets (number)	3.01	2.61	3.22 ***	0.23	0.17	-0.10	0.05
Farming experience (in years)	18.29	18.62	-0.36	-0.25	-0.20	-0.24	-0.10
Experience in AASs (in years)	15.24	13.63	1.69 *	-0.31	-0.13	-0.35	-0.16
Land holding (=1 if >=1 ha)	.32	.36	-0.54	-0.07	0.04	-0.09	-0.03
Organization (=1 if a member of at least one organization)	.99	.86	3.38 ***	-0.00	0.34	-0.12	-0.06
Educated members (=1 if >=1)	.89	.95	-1.80 *	-0.35	-0.20	-0.30	-0.32

Significant at 10% (*), 5% (**), and 1% (***) level

RESULTS…(9)

Matching quality analysis: standardized percentage bias and measures of overall covariate imbalance

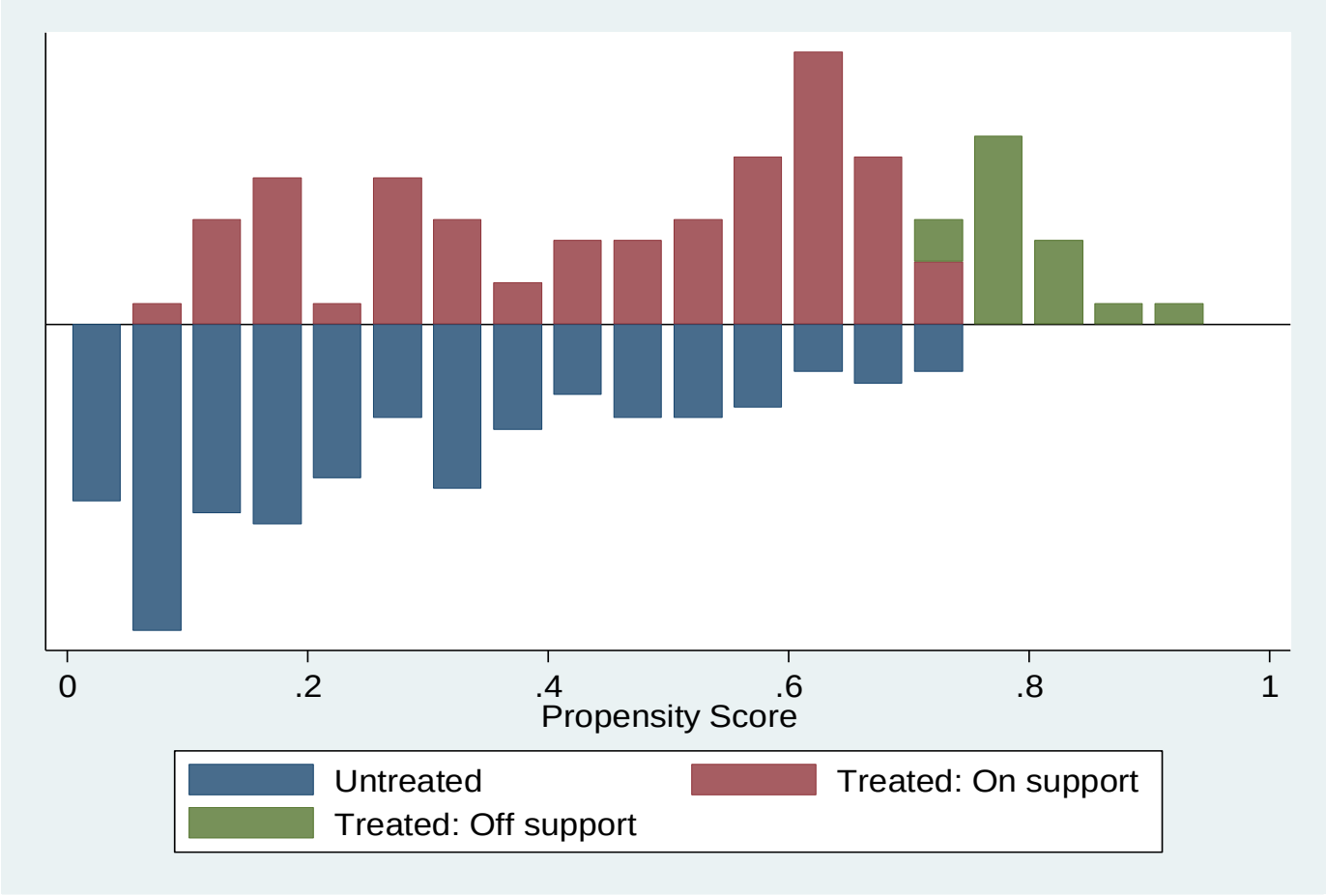
	Unmatched	Matched			
	(1) to (3)	(1)	(2a)	(2b)	(3)
Age of the household age (=1 if >18 years)	-5.2	2.9	-6.2	-6.6	-7.0
Gender (=1 if male)	8.9	-3.2	-0.5	0.7	-0.1
Education (=1 if attended some formal school)	-80.6	-1.2	-6.7	-3.8	-4.7
Household size (number of people in the house)	-34.1	3.1	5.8	3.6	5.9
Assets (number of productive assets)	43.9	3.6	2.6	-1.5	0.8
Farming experience (number of years)	-5.1	-4.1	-3.4	-4.0	-1.7
Experience in AASs (number of years)	22.4	-5.0	-2.1	-5.8	-2.6
Land holding (=1 if >=1 ha)	-7.2	-1.2	0.8	-1.5	-0.6
Organization (=1 if a member of an organization)	49.5	0.0	2.9	-0.9	-0.4
Educated members (=1 if >=1)	-22.5	-6.0	-3.4	-5.3	-5.6
Mean	27.9	3.0	3.4	3.4	3.0
	(24.5)	(1.9)	(2.2)	(2.1)	(2.6)
Median	22.4	3.2	3.2	3.7	2.2
Variance	602.1	3.4	4.7	4.5	7.0
Pseudo R2	0.21	0.003	0.003	0.003	0.003
LR chi2	68.4 ***	0.53	0.70	0.63	0.60

Standard deviation in parenthesis

Likelihood-ratio (LR) test of the joint insignificance of all the covariates: significant at 1% (***) level

RESULTS…(10)

Common support condition



DISCUSSION and CONCLUSION

- adding an impact evaluation component to IFPRI (2010) and Tefera et al. (2011)

- reasonable robust results: a positive and statistically highly significant gain of farm income (excluding *chat*), which is between Birr 9,557.47 and Birr 10,387.53 per household, on average

- broadly consistent with previous research conducted on the roles of farmer field schools (FFSs) on agricultural income in the country (Todo and Takahashi, 2011) ... PFM project

DISCUSSION and…(2)

- also related to
  - FFSs in East Africa (Kenya, Uganda and Tanzania) (Davis et al., 2012) and
  - National Agricultural Advisory Services (NAADS) of Uganda (Benin et al., 2011)

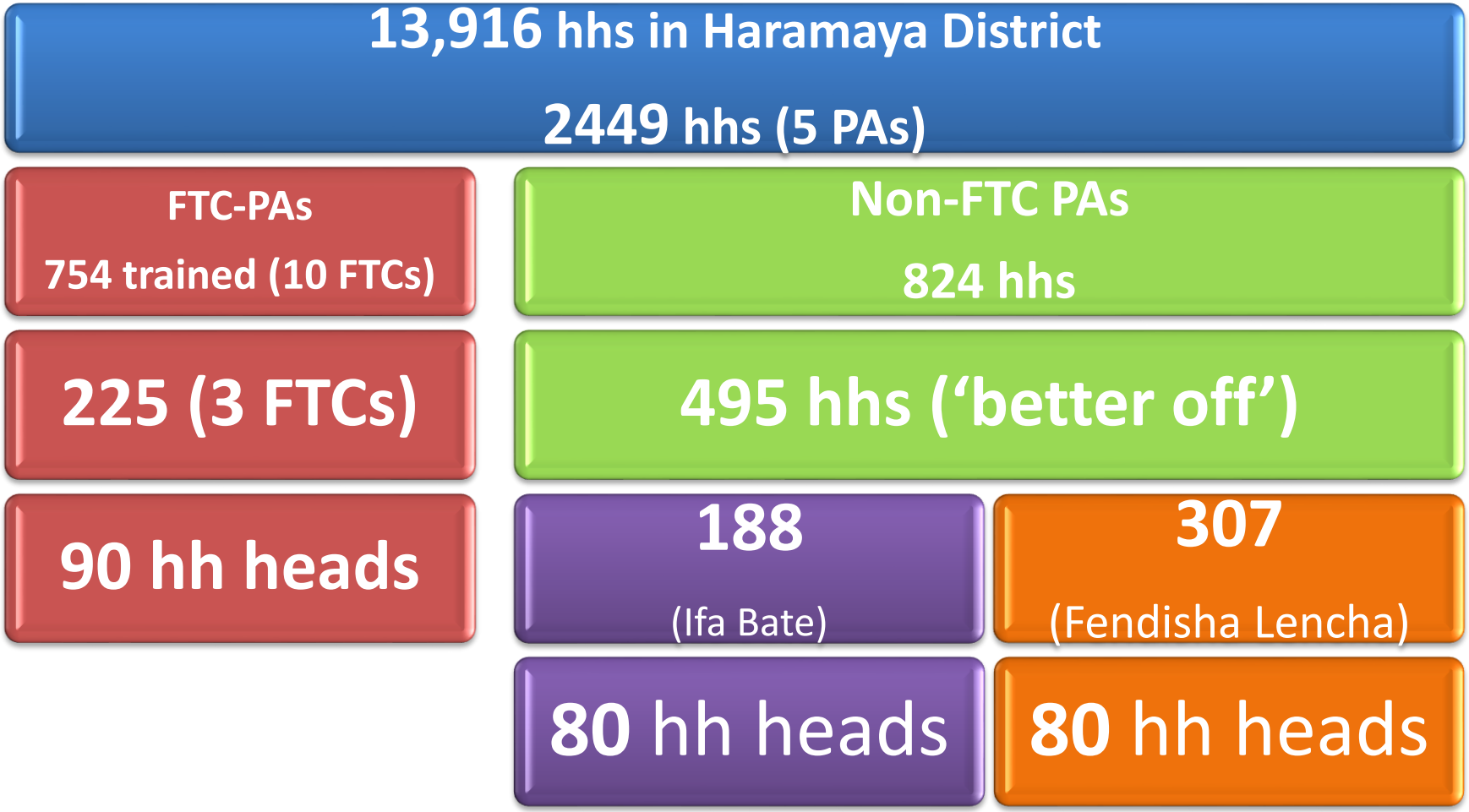
SOME RECOMMENDATIONS

- a general shift of focus from household heads to members of the household
- a minimum experience in farming and in general AASs should be sufficient
- future study...inclusion of more FTCs + spillovers
- a move away from individual level evaluations to aggregate levels (such as village/peasant association, district, etc) or a combination
- baseline data on important covariates, including outcome variables, which can be amenable to the use of various evaluation techniques (e.g., PSM+DID, etc)

Additional materials

DATA AND … (2)

Household head selection



DATA AND …(2)

Empirical strategy for data analysis

- '*the fundamental problem of causal inference*' (Holland, 1986) or '*fundamental evaluation problem*' (Heckman, Lalonde and Smith, 1999)
- RCTs- *potential outcome approach* or *Roy–Rubin model* (Roy, 1951; Rubin, 1974)
- quasi-experimental approaches (PSM, DID, RDD)

Propensity score matching (PSM)

- *unconfoundedness* (Rosenbaum and Rubin, 1983), *selection on observables* (Heckman & Robb, 1985), or *conditional independence assumption (CIA)* (Lechner, 1999) assumption
- assumption of *common support* or *overlap* (Heckman et al., 1999)
- Nearest Neighbor Matching, Kernel Matching (both Gaussian and Epanechnikov), and Radius Matching

Matching quality analysis

- checking if there remains any difference between the two groups after conditioning on the propensity score (Caliendo and Kopeinig, 2008)
- mean comparisons and standardized bias (Rosenbaum and Rubin, 1985)
- measures of overall covariate imbalance (Sianesi, 2004)

Livelihood activities … CHAT!