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The influence of socio-economic characteristics on crop choice: Evidence from rural Ethiopia*

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This paper examines the influence of socio-economic characteristics on major crop choice, using original data collected in 2014 and 2015 in Tigray, Ethiopia. The proxy variables representing social capital in the study area show some significant relationships. The key finding is that household head age, non-farm income, and plot size are negatively associated with crop change decision whereas the period of living in a village and agricultural assets are positively associated with the crop change decision. Also, farm income from changing the major crop in the Millennium Village Project areas is larger than that in the non-project villages, suggesting that appropriate interventions matter. Hence, targeting assistance to aggressively investing households in the form of microfinance or other support may encourage greater smallholder innovation and reduce poverty.

[Key Words: Crop choice, Adoption, Tigray, Social Capital, Ethiopia, Risk, Smallholder, Agriculture]

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Ⅰ. Introduction

The adoption of improved agricultural technology can lead to increased productivity and income among farmers in developing countries (Becerril & Abdulai, 2010; de Janvry & Sadoulet, 2002; Irz, Lin, Thirtle, & Wiggins, 2001).[1] However, income risk is a significant consideration for smaller holder farmers, particularly those with few assets, leading to strategies that can limit the adoption of new technologies (Harrison, Humphrey, & Verschoor, 2010; Yesuf & Bluffstone, 2009). The lack of developed credit and insurance markets can compound this risk adverse attitude (Dercon, 1996; Eswaran & Kotwal, 1990).[2]

In some circumstances at least, access to social capital can provide a substitute for real capital (Narayan & Pritchett, 1999). Social capital represents the social proximity of a household to the community. For example, if a household contributes significantly to a place of worship that is located in the area in which most villagers share the same religion, that household can be regarded as being close to the village and therefore having high social capital. Or if a household has more financial transactions with others in the village than the average, we can assume that the household is again socially closer to the village. In that case, a farmer who has a close relationship with other villagers can borrow a small amount of seed privately with a low interest rate or share labor when necessary. A farmer can also hedge against variation in crop price by buying seeds in advance from a fellow villager. In this way, the overall level of social capital in a village is expected to influence various farming decisions by way of risk attitude. However, few studies have investigated this relationship, and it is unclear the extent to which such social capital will determine attitudes toward the adoption of new agricultural technology.

This paper employs a logit model to examine the influence of social capital on

1) It is worth noting that major crop change between 2004 and 2012 is significantly associated with an increase in income in our data, as shown in the table A.1. in the appendix.

2) Stress resulting from poverty can be another reason for being risk averse (Haushofer & Fehr, 2014).

smallholder farmers' decisions to change or not change their major crop between 2004 and 2012. It utilizes survey data collected by the Institute for Poverty Alleviation and International Development (IPAID) in 2014 and 2015 in the Tigray region of Ethiopia. The proxy variables representing social capital in the study area show some significant relationships; however, the influences of social capital and the risk channel on major crop change decisions are limited. The key finding is that relatively young, poor households that have resided for a long period in their communities, and that are limited to farming activities as a source of income, are more innovative in the sense of being more willing to try a new major crop. This result appears to capture the desperate need of such a household to find an alternative way to increase income. In terms of policy, targeting assistance to such households in the form of technical assistance and microfinance or other support may encourage greater smallholder innovation, promote the accumulation of capital stock and reduce poverty.

Ⅱ. Description of Survey Area and Data

Ethiopia as a developing country is a suitable context for investigating the relationship between social capital in the village and the adoption of new agricultural technology for several reasons.[3] First, Koraro in Ethiopia is one of the first ten areas where the Millennium Village Project (MVP) was conducted. Second, a sufficient amount of research has been published on Ethiopia to enable the present study to proceed. .Namely, severe poverty in Ethiopia influences risk averse preferences (Harrison et al., 2010; Yesuf & Bluffstone, 2009), which eventually influences the adoption decision and performance (Rosenzweig & Binswanger, 1993; Tanaka, Camerer, & Nguyen, 2010). In addition, this risk preference is

3) We would like to thank an anonymous reviewer for pointing the reason of selecting Ethiopia. A village in a developing country is well applicable to the analysis of various village assets and its application. (Duflo, 2006)

modulated by rich indigenous social institutions. Gebre-Egziabher (2010) reports that based on a poverty line of 1,075 birr (USD 51.39)[4], 38.7 percent of the total population was below the poverty line in 2005. Also, according to the 2010 World Bank estimate, 33.5 percent of the population lives under the poverty line of USD 1.9 (PPP).[5] The Tigray district specifically has been widely studied because of its severe poverty (Gebre-Egziabher, 2010), with around 48.5 percent of the population below the poverty line of 2005—the highest ratio in Ethiopia. The low agricultural potential in Tigray discourages exits from poverty (Lee et al., 2013). In addition, regarding informal social capital, various informal and traditional social institutions exist. For instance, Iddir provides informal insurance and emotional support related to funeral expenses (Aredo, 1993). Another example is Ekub. This is a pseudo banking system based on social networks. Each member belonging to an Ekub deposits a certain amount of money, and then each member receives the pooled sum according to a scheduled rotation. There is also Debo, which is a labor sharing institution in which members provide labor rotationally to each member's agricultural activity.[6]

IPAID collected survey data from four regions in Tigray in 2014: Selam, Koraro, Hiwot, and Simret in Hawzen. It then carried out another survey in 2015 in two of these regions: Selam and Simret. The former survey mainly collected agriculture-related information, such as farm activities, home, agricultural, and livestock assets, household composition, and general life satisfaction. The latter survey focused on what was not collected in the former survey, such as social capital. This paper draws mainly on data from the former survey and the latter survey is used for supplemental purposes.

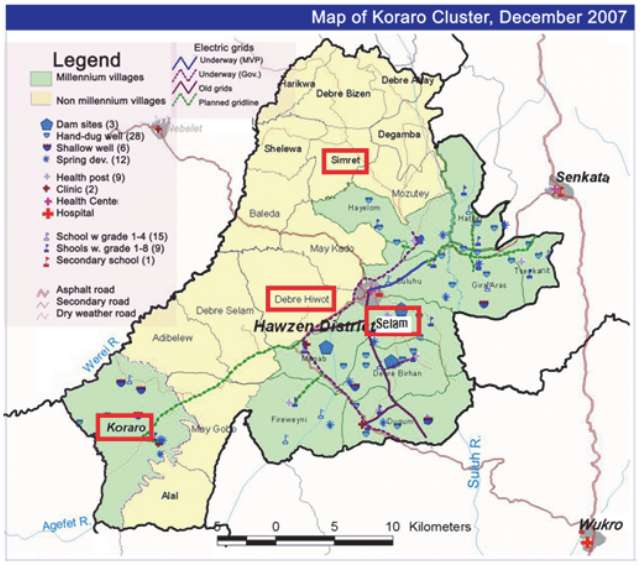
The location of the four villages is displayed in Figure 1. Fifty three percent of

4) The food poverty line for an adult per year just for a surviving is 647.8 birr (USD 30.91).

5) The CIA factbook estimates as 39 percentage point (2012 est.).

6) As shown in table A.1 in the appendix, 41.3 percent of the respondent households participate in an Iddir based on the survey conducted in August, 2015. The reason for participating in an Iddir is to prepare a funeral or a wedding ceremony (43 percent) or to help others (32 percent). Also, 48 percent of respondent households participate in a Debo.

the area has an altitude of between 1,500 m and 2,300 m. Most precipitation occurs during the monsoon season from June to September, known as Meher. Koraro and Selam have been included in the Millennium Village Project (MVP) since February 2005 and June 2006 respectively. Hiwot and Simret are not Millennium Villages (Lee et al., 2013).



Source : Annual Report of Clusters of Koraro, Ethiopia Millennium Village Project (2006)

For the survey in 2014, households were randomly selected based on the village roaster with assistance from the village head and village manager. Enumerators were hired at Mekelle University, and typically spent fifty minutes at each household completing the questionnaire. The survey aimed to interview 100 households for each village. However, 325 households were able to be surveyed.[7] The sample reflects the regional population ratio reasonably since the sample takes up 6.34 percent of four regions' population respectively.

7) Details are available in Abafita and Kim (2015) which uses the same survey questionnaire.

Table 1. Census of Surveyed Areas

Region	Total	Men	Women	Household	Sample Household	Ratio
Simret	7,999	3,993	4,006	1,668	85	5.1
Hiwot	7,121	3,433	3,688	1,417	81	5.72
Selam	3,449	1,704	1,745	781	81	10.37
Koraro	5,682	2,856	2,826	1,261	78	6.19
	24,251	11,986	12,265	5,127	325	6.34

Note : 2007 Census Data of Central Statistical Agency in Ethiopia

The independent variables in the model are categorized as wealth variables, family structure variables, and financial status variables. Agricultural asset (AASSET) is the number of agricultural assets (tools) such as shovels or ploughs. Livestock asset (LASSET) converts the number of livestock to tropical livestock units (TLU).[8] For example, an ox can be converted to 1.26 TLU and cow can be converted to 1.29 TLU as shown in the table below (Hassen, Ebro, Kurtu, & Treydte, 2010).

Table 2. The TLU of livestock in Ethiopia

	Ox	Cow	Goat	Sheep	Donkey	Chicken
TLU	1.26	1.29	0.24	0.52	0.64	0.01

Note 1 : Hassen, Ebro, Kurtu & Treydte (2010). Table 2
Note 2 : TLU is the tropical livestock unit.

8) The TLU provides "a method for qualifying different livestock types and sizes in a standardized manner considering the metabolic weight of each animal". See http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/Mixed1/TLU.htm.Thesurvey questionalsoaskedthenumberofotheranimalswhicharenotlistedinthetable3.Sincethereisnocommonconversionratefortheseothertypesofanimals, a variable for these animals (LASSET_OTHERS) is not employed in the model. In addition, this LASSET_OTHERS is highly correlated with LASSET, so that an inclusion of LASSET_OTHERS can result in a multi-collinearity problem.

When it comes to the family structure, HH_NUM is the family size. H_AGE and H_EDU represent the age and education period of each household head. The PSIZE represents the size of cultivated plots measured in hectares (ha). PNUM is the number of plots cultivated by each household. For financial information, SAV, BOR, and LED[9] represent the saving, borrowing and lending at the household level respectively. For BOR, one observation is deleted because it is too extreme. It is 400,000 birr (19,159.40 USD) whereas the average is 3,702 birr (177.32 USD) and the second highest loan amount is 13,000 birr (622.68 USD). The home asset value of this observation is also 585 birr when the average is 9,620 birr. The responder appears to have been confused about the unit of the question because English written questions were translated into Tigrinya by an enumerator. After the elimination of that observation, the mean decreases to 2,166 birr from 3,702 birr.

The total income variable is divided into farm based income and non-farm based income. The non-farm based income is regarded as being associated with an accumulation of wealth rather than subsistence (Weldegebriel et al., 2015). Non-farm based income can provide farmers with a buffer against a failed harvest of a new crop, which could increase the extent to which farmers are willing to adopt new technology. Farm income (F_INCOME) typically consists of the revenue from crop and livestock sales and associated by-products. Non-farm income (NF_INCOME) consists of the wages earned outside the farm, a profit from running an own business, and financial profit such as interest.

To capture social capital or social proximity to the village, three main variables, VYEAR, SOCIAL_DIST, CONTB, are employed. VYEAR is the period that a household has lived in the village. The household which has lived for a long period has a higher chance to get accustomed to a village environment. CONTB is the amount of money contributed to a church. As 95.6 percent of residents in Tigray

9) Income and financial transaction variables are not converted into log variables. The values of financial variables for some households are zero, so their log conversion would result in a considerable number of missing values. It might also be capturing the degree of enthusiasm toward a church.

are Orthodox Christians, presumably a contribution to a church would capture how a household is related to village society.[10] Like BOR, one observation of CONTB is also deleted. One extreme value is 94,000 birr (4,502.46 USD) when the average is 354.5 birr and the second highest value is 1,000 birr. After elimination, the mean decreases to 38.08 birr from 354.50 birr. SOCIAL_DIST is the variable which is created from four different dummy variables, D1, D2, D3, and D4. D1 (D2) represents whether a household lent money to a relative (a friend) in the village. D3 (D4) represents whether a household borrowed money from a relative (a friend) in the village. To measure the degree of financial transaction within the village, these four variables are averaged. In addition, as noted above a dummy variable for inclusion in the MVP is added.

Here is the descriptive statistics for variables.

Table 3. Descriptive statics of main variables

Variable	Min	Mean	Max	Missing Values	Standard Deviation
Farm Income(birr)	0	2,104.22	14,600.00	25	2,791.85
Nonfarm Income(birr)	0	2,305.45	21,000.00	39	2,489.65
Pooled Income	0	4,447.61	21,320.00	39	4,256.76
Household Asset(birr)	0	9,620.00	250,100.00	7	27,869.08
Agriculture Asset(#)	0	6.86	85.00	4	5.97
Livestock Asset(TLU)	0	4.10	52.02	4	4.22
Family Size(#)	1	5.77	11.00	0	2.25
HH. Head Age(Year)	24	52.36	87	0	13.70
HH. Head Education a	1	1.94	12	0	2.20
Plot Size(Ha)	0	0.63	2.5	29	0.35
Plot Number (#)	1	2.28	7	17	1.24
Saving(birr)	0	270.90	28,000.00	116	2,049.74
Borrowing(birr)	0	3,702.00	400,000.00	66	24,861.61
Lending(birr)	0	135.90	5,000.00	124	618.24

10) It might also be capturing the degree of enthusiasm toward a church.

Variable	Min	Mean	Max	Missing Values	Standard Deviation
Village Year(Year)	1	38.90	78.00	40	16.90
Contribution(birr)	0	354.50	94,000	29	5,462.23
Social Distance	0	0.05	1	58	0.14

Note 1 : The number of observations is 325.
Note 2 : '#' represents the unit of the variable is the number of elements
Note 3 : a: The value of 1 represents zero education. Then, the education year is to get by subtracting 1 year from the Household Average Education.

It is worth noting that the mean household income is 4,447 birr or 213 USD. Since the 2014 GDP per capita in Ethiopia was 568 USD,[11] and considering that the average number of household members is 5.79, this income is just 6.5 percent of GDP per capita. Responders in this area are said to tend to under-report their income level to private institutions like NGOs but over-report to government officials. This is said to be because farmers may expect a higher level of aid from an NGO when they under report their current income status. For a comparison, the plot size and the crop production on average are 0.64 ha and 965.4 kg/ha per household, which is 70.8 and 47.9 percent of the national average, 0.89 ha and 2,016.6 kg/ha.[12] Even though these government figures may be over-estimates, it would be reasonable that the household income takes up around 50 - 60 percent of the national average, so a very rough figure for average household income is around 30,000 birr. However, in the regression model, the income variable is used without a revision because we focus more on the differences of incomes. Also, it is not clear that responders clearly recognized that self-consumption should be included in income. Rather, the income variable consists of wages and revenue from selling crops, so that this compound variable needs to be narrowly understood. In spite of this limitation, people in this region are poorer compared to the Ethiopian average. It is also clear that people in this region are clearly surviving on less than USD 1.25 a day regardless of any measurement error.[13]

11) World Bank (2014).
12) Author estimates based on the table 4.2 in the report of the central statistical agency.

In addition, the sum of saving and lending on average take up only 15.0 percent of the amount of borrowing. The total saving and lending of the whole household is 83,934 birr (4,020.31 USD) while total borrowing is 560,994 birr (26,870.77 USD). The net debt is 477,060 birr, that is, 37.4 percent of the 1,271,730 birr total income. Based on a report from the National Bank of Ethiopia (The national bank of Ethiopia, 2014), the total debt to GDP ratio is 27.4 percent. Although it is possible to over-report their debt as the same expectation as the income or due to the under-estimated income, people are in deficit so that their investment decisions (or adoption decisions) would relate more to their borrowing than lending and saving.

Ⅲ. Model Specification

1. Dependent Variable Specification

Since the crop change decision is dichotomous, a discrete choice model is widely applied to study the adoption decision (Amsalu & de Graaff, 2007). The adoption decision, Y_1, represents whether farmers changed their major crops between 2004 and 2012 in their plots. In the survey, 85 percent of respondents were educated to choose crop variation. Also, 70 percent of respondents learned of a new crop from a relative, the central government, an NGO, or a MVP organization. Therefore, when a household changed the major crop, it is reasonable to assume that they adopt a new technology or more advanced seed to improve their production.

Conceptually, the dependent variable Y_1 might have an endogeneity problem since such a change in years would affect other variables. For example, an increased

13) Because of the same reason, it is doubtful that wealth is correctly estimated. However, again we focus on differences in wealth rather than absolute values. The poverty line of a household is 55,159 birr (USD 2,642), which comes from multiplying USD 1.25 times 365 days times 5.79 family members.

crop change might result in an increased income, so that overall assets increase. Otherwise, an increased crop change might result in decreased household assets because the household budget supported improved crop production. However, it is also true that each household faces the decision of whether to change their major crop before planting begins. Moreover, a crop change decision occurring after 2004 but reversed before 2012 will not be registered. However, in the new survey conducted in August 2015, 68 out of 101 households changed their major crop from the previous year (2014). Also, 94 percent of the households (68 of 74 households) used an improved seed when changing. Based on this result, it is assumed that a farmer chooses to maximize its expected utility at the moment of choice or every year.[14] Then, Y_1 just provides the decision as to whether a household's crop variation decision is different from that of 2004.

Note that crop rotation might also influence the change in the major crop. Unfortunately, the question asking for the reason for the crop change in the survey questionnaire was rarely answered. However, according to Corbeels and Haile (2000), farmers in Tigray rotate crops from the plot far away from their household due to a deficit of manuring in these more distant plots. It means farmers are less likely to change the crop variation in the primary plot unless the usage of fertilizer is enough. The survey shows that 285 households over 325 households (87.7%) use a fertilizer in the primary plot while 158 households over 325 households (48.6%) use a fertilizer in the non-primary plot. Therefore, the primary plot is likely to not be rotated. Although a decision based on crop rotation is not clearly isolated from a decision that is not, in a general sense crop rotation can be regarded as one way of improving crop production. To check whether crop rotation is associated with an adoption decision, a variable of whether a fertilizer is used at their plots (FERTILIZER) is included.

14) Since most of the questions in the same survey seem to be related with a crop change decision, it is difficult to find appropriate instrumental variables. Also, a non-linear probability model, such as a probit or logit model, can introduce bias when employing instrumental variables.

2. Independent Variable Specification

Based on Y_1, the characteristics of adopters and non-adopters are reported in Table 4 below. Over seventy percent (73.5 percent) of households made a decision to change their major crop. The period that the household has lived in the village and plot size of households that changed the major crop are significantly lower than those of non-changing households. The non-farm income and agriculture assets of non-adopters are greater than those of adopters in the one tail t-test with a 10% significance level. However, the two tail t-test does not show any significant difference. On the other hand, the changed crop does not show any difference in household head age and education. To sum up, a household that changed major crop is more likely to be relatively poor, but to have lived for a long period in the village.

Table 4. Short summary of the major independent variables depending on Y_1 (themajorcropchange)

	Pooled	Non-crop Changers	Crop Changers	t-test
#Sample Household	325	86	239	-
Farm Income (birr)	2,104.22	2,115.67	2,100.20	0.04 (0.97)
Non-Farm Income (birr) [a]	2,305.45	2,862.67	2,178.54	1.30 (0.19)
Pooled Income (birr)	4,446.61	4,860.82	4307.25	0.95 (0.34)
Household				
Family Size	5.77	5.63	5.82	-0.68 (0.50)
Head Age	52.36	52.54	52.29	0.15 (0.88)
Head Education	1.94	1.93	1.95	-0.07 (0.94)
Livestock (TLU)	4.10	4.15	4.08	0.12 (0.90)
Agriculture Tools (#) [b]	6.86	6.08	7.14	-1.41 (0.16)
Plot Size (ha)	0.63	0.69	0.60	2.01 (0.05)

	Pooled	Non-crop Changers	Crop Changers	t-test
Plot Number (#)	2.28	2.28	2.27	0.07 (0.95)
Village Year (years)	38.90	34.39	40.45	-2.67 (0.01)
Millennium Village (1=Yes, 0=No)	-	0.62 (53/86)	0.44 (106/239)	-

Note : a: One way test (Pr(Non-adopters>Adopters)) shows a difference with the 10% significant level.
b: One way test (Pr(Non-adopters<Adopters)) shows a difference with the 10% significant level.

In Table 5, the farm and non-farm income (F_INCOME, NF_INCOME), plot size (PSIZE), and the period living in the MV (VYEAR) on average depending on whether to adopt and whether to live in the MV are summarized for a detailed analysis. The farm income of non-adopters, 2,577 birr, is significantly greater in the non-Millennium Villages than those of adopters, 1,648 birr. However, in the MV, that of the non-adopters, 1,810 birr, is less than those of adopters, 2,671 birr. It appears that the crop change decision is risky and it is easy to fail. However, the major crop change seems to succeed with aid from the MVP. Additionally, in spite of no significant association of non-farm income with MV or adoption, the non-farm income of non-adoption is overall greater than those of adoption. Possibly, there is a trade-off between adoption and gaining additional off-farm income because changing the major crop may greater input. Regarding the plot size, that in non-MV (0.53 ha) is smaller than that in MV (0.72 ha). Also, that of non-adopters in MV is greater with 1.4 t-stats than that of adopters in non-MV. This pattern also appears for the period living in the village. The adopting households in non-MV have lived in the village significantly longer, w 44.22 years, than the non-adopters in non-MV, 36.18 years. Presumably, this leads to the difference of residence period between non-MV and MV. Hence, the household residing longer in the non-MV seems to have more chances to adopt.

Table 5. Short Summary of Major independent variables depending on Y1 and MVP

	Pooled	obs	Non-Adopter	obs	Adopter	obs	t-stat
	F_INCOME						
Non-MV	1834.41	155	2577.77	31	1648.57	124	1.93*
MV	2392.64	145	1810.83	47	2671.65	98	-1.56
t-stats	-1.74						
	NF_INCOME						
Non-MV	2271.98	150	2500.37	30	2214.88	120	0.54
MV	2342.37	136	2812.88	42	2132.14	94	1.17
t-stats	-0.21						
	PLOT_SIZE						
Non-MV	0.53	147	0.59	29	0.52	118	1.4
MV	0.72	149	0.76	49	0.7	100	0.77
t-stats	-4.77***						
	VYEAR						
Non-MV	42.66	144	36.18	28	44.22	116	-2.39**
MV	35.05	141	33.28	45	35.89	96	-0.86
t-stats	3.89***						

Ⅳ. Results and Discussion

The estimated coefficients based on the maximum likelihood function are reported in table 5. The baseline model is to regress the major crop change (Y_1) on the wealth variables, the family characteristic variables, the income variables, borrowing, and the social asset variables. The baseline model does not include social distance, fertilizer, saving and lending variables. This is because the social distance variable is a compounded variable that measures the degree of financial transactions with other villagers as well as savings and lending variables. These have a considerable number of missing values that would introduce bias. In the expanded model, social distance, fertilizer, saving and lending are added to the model as a comparison. The missing values of the saving and lending variables are replaced with zero. Presumably, a non-response to these items in the survey represents zero as the level of poverty of farmers in the area is such that they do

not have a considerable amount of savings and lending.

Table 6. The result of the estimated model

	Baseline (Model 1)		Expanded Model	
Household Asset (birr)	8.50e-07	(1.02e-5)	-1.31e-6	(9.86e-6)
Agriculture Asset (#)	.151	(0.086)*	.152	(0.086)*
Livestock Asset (TLU)	.015	(0.076)	.008	(0.076)
Family Size (#)	-.133	(0.104)	.134	(0.106)
HH. Head Age (years)	-.026	(0.017)	-.029	(0.018)
HH. Head Education	-.050	(0.098)	-.084	(0.105)
Plot Size (ha)	-1.44	(0.740)*	-1.508	(0.766)**
Plot Number (#)	-.037	(0.186)	-.013	(0.186)
Contribution to a church (birr)	-.001	(0.002)	-.001	(0.002)
Village Year (year)	.032	(0.002)***	.035	(0.013)***
Millennium Village	-.345	(0.452)	-.356	(0.457)
Farm Income (birr)	-6.91e-5	(7.00e-5)	-7.90e-5	(7.05e-5)
Non-farm Income (birr)	-1.22e-4	(6.85e-5)*	-1.23e-4	(7.15e-5)*
Borrowing (birr)	2.13e-5	(8.57e-5)	1.92e-5	(8.73e-5)
Saving (birr)	-		2.62e-4	(5.16e-4)
Lending (birr)	-		6.74e-5	(3.22e-4)
Fertilizer	-		-.959	(0.728)
Social Distance	-		-.033	(1.298)
Observation	165		164	
LR	26.50		28.96	
Pseudo R2	0.14		0.16	

Note 1 : * it is significant with 10% credit interval.
** It is significant with 5% credit interval.
*** It is significant with 1% credit interval
Note 2 : The number in the parenthesis is the standard error

As shown in the base model results in table 6, the likelihood ratio test shows that the model is significant with a LR of 26.25. First, agriculture asset (AASSET) is positively associated with an increase in the crop change probability. Since the AASSET represents the number of agricultural tools, it means that a higher amount

of agricultural tools encourages the household to change the major crop. Regarding incomes, farm income does not show any significant relationship with major crop change. This seems to be partly because farm income is strongly and oppositely associated with the major crop change between MV and non-MV in spite of controlling for MVP. On the other hand, the nonfarm income variable is negatively associated with an increase in the adoption probability. Since nonfarm income is generally understood as a way of building wealth, this negative relationship suggests that the household does not have any alternative way of earning income other than through farming.[15)]

Regarding family characteristics, household head age (H_AGE) is negatively related to an increase in adoption probability. Note that its significant level in terms of p-value is around 11 percentage point. One study on adopting an improved technique to reduced soil degradation in western Ethiopia suggests that younger household heads might consider a longer planning horizon for the adoption of a new technique (Anley, Bogale, & Haile-Gabriel, 2007). Another explanation is that a new household which is isolated from its parent household is more likely to be aggressive in its investment decisions.[16)] Additionally, the plot size is negatively associated. Kebede et al. (1990) report that an increase in farm size requires more traction power to complete a critical field operation on time. Therefore, it implies a decrease in the probability of adoption.

Regarding social proximity variables, the contribution to a church (CONTB) is not significant. On the contrary, the period living in the village (VYEAR) is highly associated with an increase in the change probability in terms of the highest t-stats. Note that the period of residence in the village is not constrained by MVP status. Because only 14 of 325 households had lived in their village for a period of less than 8 years between 2004 and 2012, most households were resident before the onset of the MVP. In addition, in regards to living in a Millennium Village (MVP),

15) Although we know that these income variables would be under-estimated, the difference of non-farm income clearly provides an interesting result.

16) This suggestion was made by Chang-Soo Kim.

the variable MVP does not provide any significant relationship with the crop change decision. Recall that the dependent variable represents the difference of cultivating primary crops between 2004 and 2012. The year of 2004 is the time when the MVP started. Aid in the form of necessary agricultural resources seems to have decreased after the onset of the MVP, so that in 2012 such an additional influence had disappeared and did not influence the major crop decision.

Generating a firm overall interpretation is problematic without further information on causality. Nevertheless, the following conjecture is consistent with the results.[17] A household of with a younger head and that has resided longer is likely to change the major crop because younger households are less risk averse (Yesuf & Bluffstone, 2009) and the longer period of residence provides more opportunities to try new agricultural methods in a close-knit village. However, this change requires farmers to use more resources for farming (low non-farm income and higher agricultural assets) and is risky. Hence, it is easy to fail to improve production without the sufficient aid (for instance, MVP). On the other hand, plot size can be interpreted in two opposite ways. First, the overall difficulty and failure of adoption might result in negative influence on the accumulation of land in non-MV whereas the success of adoption in MV might be beneficial to accumulate land. This is consistent with that the land size in MV is bigger than that in non-MV. In contrast, as the plot size decreases, because of household poverty or the increased ease of cultivating a new major crop on a smaller plot, the household has more chance to change the major crop (Kebede et al., 1990). To sum up, though the survey data has limitations in terms of generalizing, some meaningful results are provided. A young household is likely to change its major crop. If the household has resided longer in the village, it is also likely to change. However, this change seems to be risky and consume more resources such as agricultural tools and opportunity cost of earning non-farm income, and can achieve better production only with appropriate aid.

For a robustness check, in the expanded model, fertilizer, social distance, and

17) We would like to thank an anonymous to suggest this interpretation.

saving and lending are additionally employed. The variables that are significant in the baseline model are also significant in the expanded model. Admittedly, FERTILIZER is insignificant. Therefore, the adoption decision is less likely to be associated with major crop rotation. All other financial transaction variables and social distance are insignificant. Recall that the social distance represents an average of whether a household has borrowing or lending with relatives or friends in the village. This means that the model says a financial transaction in the village is not associated with the adoption decision. This result seems to be inconsistent with the argument that a non-adoption is highly associated with financial constraint and a high cost of improved seed (Bekele & Shiberu, 2014). However, social distance and financial variables provide information on current financial status rather than financial constraint. This is even though households for which the amount of financial transactions is low are likely to have limited access to formal financial institutions. Moreover, since the degree of poverty of households in the village is very similar, such financial status might not be identified.

Ⅴ. Conclusion

According to our results, the influences of social capital and the risk channel on major crop change decisions are limited. However, due to certain limitations in the data, further investigation is required. Although the period of residence in the village relates to the crop change decision, it needs to be calibrated to clearly capture the degree of social closeness in the village. For example, an additional in-depth survey of interpersonal village institutions, such as Iddir and Debo, can possibly capture the degree of village network connections more clearly.[18] In

18) This incursion of the participation variables does not necessarily imply the higher rate of adoption. Its participation can encourage the households to be less risk-averse because such an indigenous institution replaces a formal insurance company or provides an emotional relief. On the other hand, households might participate in an institution because of a reciprocal

addition, time series data would allow comparisons of the differences of the variables.

The study yields one policy implication for reducing poverty in terms of a general approach. We found that households that are relatively young and have lived for a long period in the village have a higher possibility of trying a new crop. If such a household also has a small plot size, it will tend to try to find an alternative way of cultivating crops to earn additional income. However, because changing the major crop is risky, it can fail to achieve better performance without assistance, resulting in persistent poverty. Hence, if crop productivity and commercialization assistance are targeted to households which can be more aggressive in investing, it may prove to be more effective. In addition to direct assistance such as technical information, providing access to microfinance may be beneficial. Access to credit will enable farmers that are more adventurous to make more productive investments. Success of such farmers would presumably then have a spillover effect, as others follow their example.

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APPENDIX

Table A.1. Pearson's correlation between Y1 and ΔIncome

Correlation	t-value	p-value	Degree of Freedom
0.155	2.7473	0.006 **	306

- Y_1 iswhetherthemajorcropproductionisdifferentbetween2004and2012.
- ΔIncome is whether the income is increased in 2012 than in 2004.

Table A.2. The participation of social institution

Do you currently participate in an Iddir?		
Yes	No	Total
38 (41.3%)	54 (48%)	92 (100%)
What is the main purpose of this Iddir?		
Answers	Frequency	
To prepare a funeral or a wedding ceremony	16 (43%)	
To help others	12 (32%)	
To purchase equipment	4 (11%)	
Etc.	5 (14%)	
Total	37 (100%)	
Do you currently participate in a Debo?		
Yes	No	Total
44 (48.4%)	47 (51.6%)	91 (100%)

■□□□□□□□ 국문초록

사회·경제적 특성이 주요 작물선택에 주는 영향에 관한 연구: 에티오피아 농촌 지역을 중심으로

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이 연구는 연세대학교 빈곤문제연구원이 에티오피아의 티그레이 지역에서 2014년과 2015년에 수집된 설문을 중심으로 그 지역의 사회적 자산이 주요 작물선택에 주는 영향을 분석한 것이다. 사회적 자산 관련 변수들은 주요 작물선택과 제한적이지만 유의한 결과를 보여주었다. 주요 결론으로는 가구주의 나이가 어리고 마을에서의 거주기간이 길수록 새로운 작물을 선택을 가능성이 높았다. 그러나 이러한 새로운 농업투자는 위험하고 더 많은 농업자원 및 노동력 등의 소비가 요구되어, UN의 밀레니엄 마을 계획과 같은 적절한 관련 지원이 있을 때 상대적으로 높은 농업 소득이 가능하였다. 따라서 하나의 정책 제안으로서 빈곤감축을 위한 빈곤국 농촌을 지원할 경우, 젊고 마을의 거주기간이 긴 농가 등 농업투자의 가능성이 높은 소작농을 선별하여 이를 중심으로 지원을 집중할 필요가 있다.

[주제어: 작물 선택, 적응, 티그레이, 사회적 자본, 에티오피아, 위험, 소작농, 농업]

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