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Rural media, agricultural technology adoption and productivity: evidences from small rice farmers in Burkina Faso

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240- Rural media, agricultural technology adoption and productivity: evidences from small rice farmers in Burkina Faso

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Abstract

In this paper we examine empirically the effect of Information and Communication Technologies on the adoption of improved rice varieties and its indirect effect on productivity with focus of the rural radio in Burkina Faso. The econometrics framework adopted is the Rubin Causal Model that has emerged as the standard approach for evaluating policy/program effect using an observational data. We found that adoption of modern varieties is significantly higher for the farmer that have listened radio program on rice before 2008 than those who have not. Also the use of rural radio appears to significantly increase the propensity of adopting modern varieties by 6%. We also estimate that the local average treatment effect of adoption of improved varieties induced by listening rice program radio on rice yield significantly positive. Ours results suggest that using rural radio could be an effective strategy to speed up the adoption of improved agricultural technologies and increase rice farmer productivity.

Key words: Rural radio, improved rice varieties, adoption, productivity.

1 Introduction

Agriculture remains a major sector in most African countries where it accounts up to 40% to the total GPD and up to 60% to export revenue and remains a major source of income to a significant share of rural households. Despite this importance, the agricultural sector in Africa has consistently faced a crucial problem of low productivity. As consequence, increase in agricultural crop production relies mainly on area expansion. This is true for most crops. AfricaRice (2011) reported that for several years, most of the increase in rice production in Africa was mainly attributed to area expansion, rather that productivity increase. However, area expansion is getting difficult because of the demographic pressure due to population and urbanization. This threat to agriculture production is worsen with the negative effect of climate change. Thus, raising productivity could be the most sustainable option. Also, agricultural productivity increase is widely accepted as strategic approach to contribute to poverty alleviation in developing countries.

To address the low agricultural productivity issue and consequently poverty and food insecurity, national and international agricultural research centers developed wide range of technologies. These technologies comprised high-yielding cultivars, best farm management practices, fertilizer, crop protection and harvest technologies as well as agricultural equipment, etc. The adoption of improved varieties along with best crop management practices and mechanization has been identified and one the major engine of the Green Revolution in Asia. However, the diffusion and the adoption of most of these technologies are still incomplete and even low in Africa (Abdulai and Huffman, 2007). For instance, improved rice varieties adoption in Africa is still low compared to other part of the world (AfricaRice, 2011). Thus, a greater and wide diffusion of the improved agricultural constitute, undoubtedly, an important strategy for agricultural intensification, productivity increase and then poverty reduction and food security in Africa.

To achieve this goal it is important to identified constraints to diffusion and adoption of improved technologies in Africa. The first step of adoption of new technology is the “exposure”. “Exposure” is simply the knowledge of the existence of the technology. Diagne and Demont (2007) argued that if a farmer have not been exposed to the modern variety, it is unlikely that he adopts it.. Thus, simple exposure is not a determinant of adoption. Possibly, knowledge of the some important characteristics of the technology is critical in farmer decision to adopt (Diagne and Demont, 2007). This knowledge could be just a subjective perception on the performance of the new technology compared to the traditional one (Nowak, 1992; Adesina and Baidu-Forsons, 1995, Diagne et al., 2012). These subjunctives perceptions could be formed formally or informally and are likely to increase propensity to adopt a given technology.

The literature usually distinguishes three principal, but overlapped, channels through which learning and knowledge accumulation on agricultural technologies could occur (Lam, 1998). First, farmer could acquire knowledge or learn through formal agricultural education and training. This is the channel through which research outputs are formally diffused to first adopters. It is also the channel that delivers the “most perfect” information about the technology. The second channel is the social network. Through this channel, the agricultural information is conveyed to the farmer within its community by its peers who also probably acquire the information through the first channel or from other peers. The third channel is the individual self-learning. This occurs when the farmer itself discovers some best features of the technology or update its beliefs about the characteristics (“learning by doing or by using”, Cameron et al., 1999). This last channel is important to strengthen the ability and the skills of the adopting farmers (Conley and Udry, 2003).

The first two channels use various tools and methods to spread the information to potential adopters. Direct contact between an extension agents or a field researcher constituted the most widely used methods of knowledge transmission in rural area. The method has the advantage that the audience could interact with the trainers and clarify any questions or doubts about the information received. However it presents the inconvenient that that only a small audience can be reached at the same time. The relatively low adoption rate of improved varieties questions the effectiveness of such methods.

Since the late 1990s and early 2000s, with the development of information and communication technologies such radio, television, CDs, mobile phone and internet, an important avenue was opened for a massive outreach and delivery of agricultural knowledge at an incredibly low marginal cost. In most countries, a high proportion of household owns at least one radio receptor. Among the ICTs, radio is one the fastest for communicating agricultural information. It has been used as extension tool since several years (Bereh, 2002). Wele (1991) argued that radio have been quite successful in spreading agricultural information in several countries such as Brazil and Cote d’Ivoire. For instance in Nigeria radio listening groups and clubs have been a popular extension strategy (Dimelu and Anyawu, 2004). Also, radio is very effective in terms of audience reached and cost than most other ICT tools. In most countries radio coverage is usually greater that television coverage and there more radio stations that TV channels. In addition, it less costly to own a small ration transistor than owing a television receptor.

This paper proposes to contribute this growing literature and empirically examines the effect of ICT use on the adoption of improved rice varieties and productivity. It focuses on the use of rural radio and the learning of agricultural information on rice technologies from rural radio in Burkina Faso. The paper takes advantage on recent advances in the econometric of program evaluation to identify the causal effect of the use of rural radio by estimating various treatment effect parameters such as the marginal treatment effect, the local treatment effect and the average surplus of the adoption of improved varieties resulted from the use of rural radio. The rest of the paper is organized as follow. In the second section we examined specifically the link between rural radio used, adoption of improved varieties and the different outcomes and present the econometric methodology used in the analysis. The third section describes the data and presents some descriptive findings. The fourth section reports the econometrics results and discusses their implications.

2 Theoretical framework and methods

2.1 Rural media and the Rubin Causal Model

The Rubin Causal Model developed by Rubin (1974) and surveyed in Imbens and Wooldridge (2009), Heckman (2010) has emerged as the standard method for impact evaluation using observational data when the randomization condition are not satisfied (Imbens and Wooldridge, 2009). In this analysis, we consider a typical farmer making a decision to adopt or not a modern rice variety by cultivating it during a particular growing season. Let denote by decision variable by D and by $D=1$ if the farmer adopt and $D=0$ if he do not adopt. It should be understood that within a population, each farmer will be indexed i; for ease of exposition we leave implicit the index. For any outcome variable Y, the farmer also faces two hypothetical or potential outcomes $Y_1 = \mu_1(X) + U_1$ and $Y_0 = \mu_0(X) + U_0$ with $\mu_1(X) \equiv E(Y_1 \mid X = x)$, $\mu_0(X) \equiv E(Y_0 \mid X = x)$; X comprises all the observed factors that explain the variable in the potential outcomes; U_1 and U_0 are unobserved factors with the classical assumption of additively separable unobserved factors (Heckman, 2010). Ingredient for X are usually specified by the theory or the empirical literature. In our analysis, the outcome of interest is the productivity of the farmer measured as the rice yield.

Modern varieties passed various tests in experimental laboratories as well in experimental fields before they get released and disseminated. Thus, they appeared to have some desired characteristics such high yield, resistance to local conditions and biophysical stress, etc. For instance, the Nerica developed in the early 1990s by the AfricaRice center and disseminated in more than 21 African countries is proved to have high yield and resistance for various production stress such as drought, weed, etc. (. However, there is a cost in adopting modern varieties. These cost include seed cost and cost resulting from complex input requirements Also, the adopter encounters various other monetary and non-monetary costs that may result from adjustment to the new technology. Following Heckman (2010), we model the adoption decision as $D = 1(\mathrm{E}[Y_1 - Y_0 - C \mid \mathrm{I}] > 0)$ with C representing the cost associated to the adoption and $C = \mu_c(Z) + U_c$, I the information set. The equation states that a rational farmer will adopt the improve varieties if the expected net gain is positive. The adoption decision could be rewritten as $D = 1(\mu_D(Z) > V)$ with $\mu_D(Z) = \mathrm{E}[\mu_D(Z) - \mu_D(Z) - \mu_D(Z) \mid \mathrm{I}]$ and $V = -\mathrm{E}[U_1 - U_0 - U_c \mid \mathrm{I}]$. $I_S = \mu_D(W) - V$ can be interpreted as the net benefit for adopting the improved variety which depends on observed factors Z, $\mu_D(.)$ a real valued function representing the net indirect utility function, V a scalar random variable continuously distributed with cumulative distribution function F_V.

The framework describes the mechanism explaining how rural radio affects D and also explain with of the potential outcomes could arise. First rural media affects adoption and the outcomes by modifying the information set of the decision maker. It could modify anon adopting farmer’s beliefs about a new rice variety. An extreme case is that the farmer wasn’t aware of the existence of the improved variety and gets informed through the radio. In most cases the information received will complements some prior information that the farmers had and then will likely increase the probability that he decides to adopt the variety. For instance a farmer exposed several times to emissions about the success of Nerica rice varieties in his village or nearby communities is more like likely to adopt these varieties than a farmer have not been exposed to such emissions. Second, it could also increase the knowledge of an adopting or even a non-adopting farmer about how to correctly use an existing improved rice variety which has a complex input use requirement. In both cases there is potential positive effect of the rural radio on the propensity to adopt improves rice varieties.

2.2 Econometrics of program evaluation and application to rural medial impact

Having described the framework, we now turn into the description of the parameters of interest and the estimation methods. The impossibility to observe for the same farmer both Y_1 and Y_0 , termed as "*evaluation problem*", makes impossible to estimates individual level effect of adoption $Y_1 - Y_0 = \beta = \mu_1(X) - \mu_0(X) + U_1 - U_0$. For this reason, only population level summary effect will be of interest. Also, farmers may self-select themselves into the adoption stature and the then the adoption is not randomly distributed in the population. This is known as the "selection problem".

The most widely estimated parameter is the so called Average Treatment Effect (ATE). It is expressed as follow: $ATE(x) = \overline{\beta}(X) = E(Y_1 - Y_0 \mid X = x) = \mu_1(X) - \mu_0(X)$. Other parameters of interest include the Average Treatment effect on the treated $ATT(x) = E(Y_1 - Y_0 \mid D = 1, X = x)$ and the average treatment effect of the untreated $ATU(x) = E(Y_1 - Y_0 \mid D = 0, X = x)$. Despite the appeal of these parameters they are can be identified only when there an assumption of selection on observable or unconfoundedness, that is $Y_1, Y_0 \perp D \mid X$. This assumption implies that the adoption status and the potential outcomes are independent conditional on some observed covariates X . In our case of adoption of improved rice varieties this assumption is too strong. In fact farmer adoption of decision is likely to be endogenous (Diagne et al., 2012) and the values of the potential outcome are not necessarily random induce hidden bias in the ATE.

To address the failure of the conditional independence assumption and consequently remove any hidden bias due to the endogeneity of the adoption in estimating ATE, Imbens and Angrist (1994) proposed the Local Average treatment Effect $LATE$. Considering an "instrument" W element of the vector W but not in X satisfying the condition $Y_1, Y_0, D(w) \perp W \mid X$, the $LATE$ corresponds to the effect of D of Y through change in W conditional to X . In our application the instrument is the use of rural radio and the $LATE$ will correspond to the indirect effect of the adoption of improved varieties on yield through the use of rural radio.

Heckman (2010) provide and economic content to the $LATE$ by defining the Marginal Treatment Effect. To define the different parameters, let $P(w) = F_V\left(\mu_D(w)\right) \geq F_V(v) = u_D$ be probability that a giving farmer adopt the improved variety. This is usually termed as the propensity score. For ease of presentation, we leave implicit the other variable in Z different from W that affect the adoption decision. Following Heckman (2010), Heckman and Vytlacil

(2007), the parameters are expressed as follow: $MTE(u) = E\left(Y_1 - Y_0 \mid U_D = u\right)$, $LATE(u,u') = E\left(Y_1 - Y_0 \mid u \le U_D \le u'\right)$ for any $u, u', p \in [0,1]$Conditioning the parameters on the observed vector $X = x$ give the $MTE(u,x)$, $LATE(u,u',x)$ and $AS(u,x)$. In particular one can obtain the relevant parameters for the treated (adopters) and the untreated (non adopters).

Heckman and Vytlacil (2007), and Heckman (2010) suggested a local instrumental variables (LIV) method for the estimation of the different parameter. First we estimate the propensity score $P(W) = P(D=1 \mid W, Z)$ using a probit procedure and get the predicted propensity score. Next, we can estimate the conditional expectation $E\left(Y \mid X = x, \hat{P}(W) = p\right) = E(Y_0 \mid X = x) + \int_0^p MTE(u,x)du$ using parametric regression methods with the propensity score entering in polynomial form into the regression function. Then the MTE is obtained as $MTE(p) = \partial E\left(Y \mid X = x, P(W) = p\right) / \partial p$. It represents the return to adoption of improved varieties for a farmer with characteristics $X = x$ propensity score $P\left(W\right) = p$ indifferent between the traditional varieties and the improved one (Carneiro et al., 2011). We can recover the changes in the average surplus and the LATE induced by a change in the propensity score from due to the use of rural radio as follow: $AS(p_1, x) - AS(p_0, x) = \int_{p_0}^{p_1} MTE(u,x)du$ and $LATE(p_0, p_1, x) = \int_{p_0}^{p_1} MTE(u,x)du / (p_1 - p_0)$ where p_1 is the average propensity score of adoption for farmer who used rural radio and p_0 the average propensity score for those who did not.

4 Data and descriptive statistics

4.1 Data

The data set for this analysis is extracted from the rice statistics[1] survey for Burkina Faso collected in 2009-2010 by AfricaRice center and the National Agricultural Research Systems in collaboration with the National Agricultural Statistics Systems of the different countries[2]. The survey used a structured questionnaire administered through interview to a nationally representative sample of rice farmers. The sampling method stratum used stratification at region/province level with villages randomly selected in each stratum proportionally to the importance of the stratum and a fixed number of rice farming households selected in each village. The size of sample drawn was originally 760 . The number of households effectively surveyed was 650 in Burkina Faso. Many households did not report data of adoption, production and income. Since the number of missing data is relatively important, we do not attempt to correct them. Instead we opt to focus the analysis only on the households with available data. Thus the final data used have 284 households. The survey

[1] This survey was a large nationally representative survey conducted in 21 countries and funded by the Government of Japan to build a rice data system for sub-Saharan African countries and is a contribution to the Japan-AfricaRice Emergency Rice Project response.

[2] In Burkina Faso the centers involved are the Institut de l'Environnement et de la Recherche Agricole (INERA) and the Direction General de la Promotion de l'Economie Rurale (DGPER).

collected a wide range of information on the farmers' socio-demographics, production practices, income, rural ICT use, biophysical constrains as well as community level information.

A list of the village varieties was collected and categorized into traditional, Nerica, Improved AfricaRice, Improved NARS and Improved other. The last four groups are the modern varieties. For each varieties of the village, the farmer, head of household of the designated respondent, where asked if he/she known the varieties. If yes, he/she was asked whether he/she have access to its seed within or outside the village. If he/she did have access to the seed, he/she was asked whether he/she grew the variety each subsequent year from 2005 to 2009. If grown, what was the area allocated, the quantity of seed used, the quantity of paddy produced, etc? We use these variables to compute the modern varieties adoption decision[3] variable as follow:

$$D = \begin{cases} 1 \;\; if \;\; the\ farmer\ grew\ at\ lease\ one\ modern\ variety\ in\ 2008 \\ 0 \;\; if \;\; the\ farmer\ did\ not\ grow\ any\ \ modern\ varieties\ in\ 2008 \end{cases}$$

The survey was not primarily designed to assess ICT use or a particular radio program. However various data of ICT use were also collected using direct and retrospective interview. First, the farmer or the respondent was asked if he/she or anyone in the household listen often to radio. Also the number of receptors owned by the household and the different radio stations listened are collected. Then it was asked to the farmer if he/she ever listened to radio programs on rice. If affirmative response to this question, then he/she provided the main contain of the program and also stated if he/she acquired some knowledge from listening these programs and applied them. Similar question were also asked for other ICT devices such as mobile phone and TV. A dummy variable were constructed for the use of rural radio as follow:

$$W = \begin{cases} 1 \;\; if \;\; the\ farmer\ have\ ever\ listened\ to\ radio\ programs\ on\ rice\ before\ 2008 \\ 0 \;\; if \;\; the\ farmer\ have\ never\ listened\ to\ radio\ programs\ on\ rice\ before\ 2008 \end{cases}$$

Following Diagne et al. (2012), we use household's rice yield as measure of productivity. The yield is computed as the total paddy rice production for all varieties cultivated by the farmers over the total harvested area under rice in 2008. The outcome variable is taken in logarithm form. The other variables are socio-demographics and economics characteristics such gender, age, agriculture as main activity, secondary activity and education level. We also control for the experience of biophysical constraints such as weed, drought in 2007 for the adoption model and 2008 for the outcome equations.

4.2 Descriptive results

Table 1 presents some basic descriptive statistics. It also contains some explanatory results from mean and proportion comparison test over adoption status (D) and rice program on rural radio listening (W). The mean of yield is significantly higher for farmer who have

[3] We focus in adoption decision instead of adoption intensity which could be measure as the areas devoted to improved varieties or the quantity of improve rice produced.

adopted improved rice varieties than for those who have not. On average the logarithm yield is 0.19 higher for adopters. That is about 417 Kg/Ha. The table also shows that the percentage of household that have listened rice program on radio is significantly higher in the group of improved varieties adopters (42% against 10 for those who have not). We also found more farmer have adopted improved varieties in the group if farmer that have listened rice program on radio than in those who have not. This might suggest a positive association between having listened rice program on radio and improved varieties adoption. The probit regression of adoption decision will help to investigate in detail this relationship after partialling out the effect of other selected factors affecting adoption. Another result from the descriptive statistics concerns the effect of rural radio on yield. In fact there is no significant difference between the yield of farmer that have listened rice program on radio and the farmers that have. Our hypothesis is that the effect, if any, will be through the increase in the adoption of improved variety that the exposition to radio may induce.

Table 1: Descriptive statistics, mean comparison and proportion comparison test

	Have Adopted improved varieties				Have Listened rice program on radio			
	No	Yes	Diff	tstat[a]	No	Yes	Diff	tstat[a]
Quantitative variables								
Rice yield in 2008 (Kg/Ha)	0.69 (0.39)	0.88 (0.50)	-0.19	-2.4**	0.83 (0.47)	0.88 (0.51)	-0.05	-0.9
Household size	9.40 (4.84	9.13 (5.40)	0.28	0.3	9.45 (5.54)	8.70 (4.92)	0.75	1.2
Number of radio receptors	1.88 (0.91)	1.52 (1.02)	0.36	2.0**	1.46 (1.09)	1.72 (0.88)	-0.26	-2.1**
Categorical variables								
Have listened rice programs on radio	10%	42%	-33%	-4.0***				
Have acquired some knowledge	2%	40%	-37%	-4.7**	1%	91%	-90%	-15.5***
Have applied knowledge acquired	2%	36%	-34%	-4.3***	1%	82%	-82%	-14.4***
Gender of Head of household	76%	80%	-4%	-0.5	77%	83%	-6%	-1.2
Has secondary activity	13%	6%	6%	1.4	7%	8%	-1%	-0.3
Has agriculture as main activity	93%	95%	-2%	-0.5	95%	93%	2%	0.5
Has at least some primary education	33%	42%	-9%	-1.0	34%	51%	-16%	-2.7***
Sample size	242	42			106	178		

[a:] For quantitative tstat is the t- statistics for two groups mean comparison; for categorical it correspond to the z-statistics of two groups proportions comparison. Standard deviations for quantitative variables are presented in parenthesis. The significance levels are *** p<0.01, ** p<0.05, * p<0.1

5 Results and discussion

5.1 Impact of media use on improved variety adoption

To estimate the effect of rural radio on the adoption of improved varieties, we estimate the regression $P(W) = P(D = 1 | W, Z)$ where D is the dummy adoption variable, W the dummy variable capturing the listening of rice program on radio and Z represent the control variables that affect adoptions. The model was estimates using probit regressions and the results are presented in the table 2 below.

Table 2: Probit regression of the determinant of improved varieties adoption

Variables	Coef (se)
Have Listened rice program on radio	0.0588*
	(0.029)
Household Head has secondary activity	0.102
	(0.355)
Household Head gender	(0.237)
	(0.205)
Household size	0.0173
	(0.0157)
Household Head age	-0.00296
	(0.00602)
Household Head has agriculture as main activity	0,0266
	(0.399)
Has at least some primary education	-0.0185
	(0.172)
Number of radio receptors	-0.200**
	(0.0785)
Have acquired some knowledge	4.422
	(152.1)
Have applied knowledge acquired	-2.984
	(152.1)
Number of Observations	284

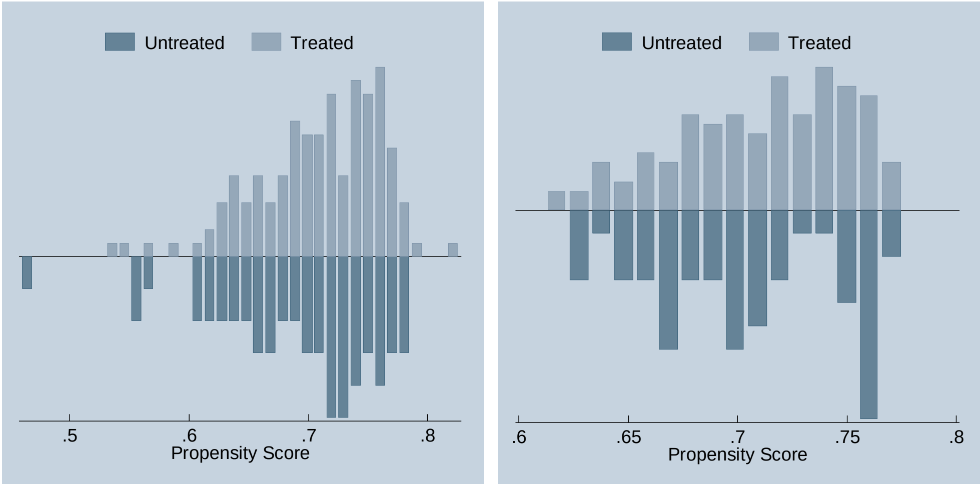
Robust standard errors in parentheses ; *** p<0.01, ** p<0.05, * p<0.1

We found that having listened rice program on radio is positively associated with the probability of adopting improved varieties. Everything else being equal, the propensity to adopt improved varieties is 6% higher for a farmer that have listen rice program on radio than for a farmer that have never. We do not have enough information of the exact contents of the program being listened and these contents certainly vary largely over time and across radio stations. However, this result is in line with the empirical literature. Most of the other control variables have the expected sign but were found to be not significant.

We also plot the distribution of the propensity score of adoption of improved varieties in the figure 1 below. The propensity score associated with some non-adopters is as high as those for the actual adopters. This could suggest that all farmer are potential adopter of improved varieties despite some of them didn't actually adopt.

Figure 1: Propensity score for improved varieties adopters and non-adopters

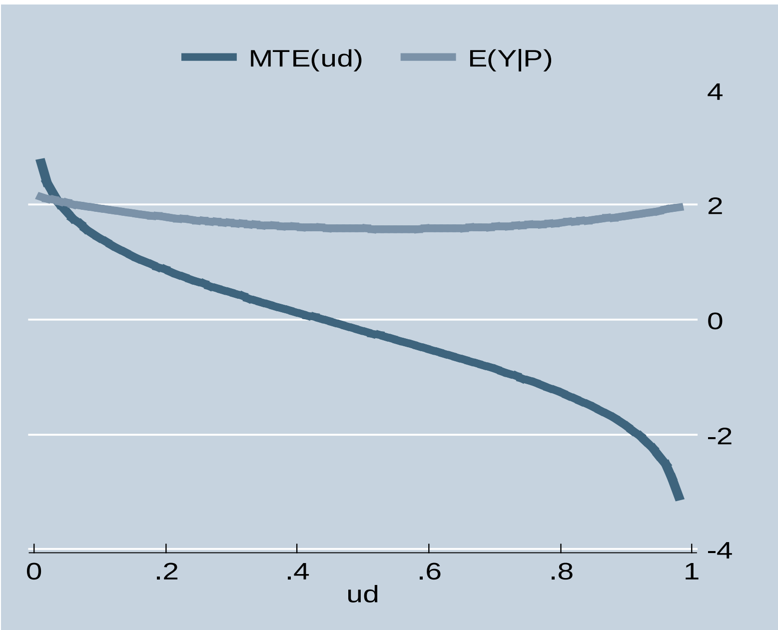
a) All observations b) Observations in the common support



5.2 Impact of media use on rice productivity

The impact of adopting improved varieties on productivity through the use of rural radio is captured through two parameters: the marginal Treatment Effect (MTE) and the Local Average Treatment Effect (LATE). The MTE measure the marginal return to adoption of improved varieties induced by listening rice program on radio term of yield gain. The graph below presents the MTE for different levels of the unobserved utility and propensity score. We also plot the total gross return each level of propensity score.

Figure 1: Marginal Treatment Effect of the adoption of improved varieties induced by rural radio



The graph shows that the MTE is decreasing in the unobserved utility u_d and consequently in the propensity score. This is an evidence of diminishing marginal return. FO farmer that have a low propensity to adopt improved varieties, exposition to rice program on radio have a greater effect on the adoption on their yield if this exposition makes them adopted improved varieties. For farmers that already have a very high propensity, the effect is much smaller.

The total gross return of adoption is positive and relatively high for all potential adoption farmers. However this gain does not capture the gain induced by the listening of rice program of radio. The results of the LATE estimation that captures the return to adoption induced by the listening of rice programs are presented in the table 3 below.

Table 3: Estimation of the regression of the Local Average Treatment Effect

Parameters	Estimates
Local Average Treatment Effect	0.392**
	(0.200)
Local Average Treatment Effect for adopters	0.193
	(0.196)
Local Average Treatment Effect for non- adopters	1.749*
	(1.062)
Population Selection Bias	-0.199
	(0.489)
Difference in mean	0.194***
	(0.0673)
Mean yield of adopters	0.879***
	(0.0319)
Mean yield of non-adopters	0.685***
	(0.0592)
Observations	284

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The LATE estimated is about 0.392 and is statistically significant. This implies that the indirect effect of rural radio rice programs through adoption of modern varieties on rice farmer yield in Burkina Faso is about 0.392 (approximately 1.4 Kg/Ha). This is relatively higher than the simple difference in mean. Also the LATE of the actual adopter and the actual non-adopters are both positive. However, only the LATE for the actual non-adopters is significantly positive. This suggests that if the actual non adopter were all exposed to rice programs on radio and come to adopter improved varieties, their yield is gain will be positive and much higher than the average yield gain across for all adopting farmers.

6 Conclusion

In this paper, we use the econometrics of program evaluation framework to empirically examine the effect of rural radio on the adoption of improved varieties and yield of rice farmer in Burkina Faso. We found that farmers who have listened rice program on radio before 2008 are more likely to adoption improved varieties than those who have not. Most importantly we found the indirect effect of listening rice program on radio is significantly positive. Ours results are in line with the empirical literature on the effect of ICT.

This suggests that rural radio could be an effective tool to speed up diffusion and adoption of improved agricultural technologies and increase rice farmer's productivity in sub-Sahara Africa and consequently contribute to poverty alleviation and food security.

6 References

Abdulai, A. & Huffman, W. (2007). "The Diffusion of New Agricultural Technologies: The Case of Crossbreeding Technology in Tanzania," Staff General Research Papers 12785, Iowa State University, Department of Economics.

Adesina, A. and Baidu-Forson, J. (1995). "Farmers' perceptions and adoption of new agricultural technology: evidence from analysis in Burkina Faso and Guinea, West Africa," Agricultural Economics, Blackwell, vol. 13(1), pages 1-9, October.

Africa Rice Center (AfricaRice). 2011. Boosting Africa's Rice Sector: A research for development strategy 2011–2020. Cotonou, Benin: ii+78 pp.

Bereh, H. (2002). Connecting Farmers Worldwide through Radio. Low External Input and Sustainable Agriculture (LEISA) July. Vol 1 No. 2

Carneiro, P. , Heckman, J. and Vytlacil, E. (2011). Estimating Marginal Returns to Education. American Economic Review, American Economic Association, vol. 101(6), pages 2754-81, October.

Conley, T., and C. Udry."Learning about a New Technology: Pineapple in Ghana."Economic Growth Center Working Paper, Yale Univer-sity, New Haven, CT, 2003.

Cameron, L.A. "The Importance of Learning in the Adoption of High-Yielding Variety Seeds." American Journal of Agricultural Economics 81(1999):83-94.

Diagne, A. and Demont, M. (2007). "Taking a New look at Empirical Models of Adoption: Average Treatment Effect estimation of Adoption rate and its Determinants". Agricultural Economics, Vol 37 (2007). 30p

Diagne, A.; Dontsop, P.; Kinkingninhoun-Medagbe, F., **Alia, D.**, Adegbola, P.; Coulibaly, M.; Diawara, S.; Dibba, L.; Mahamood, N.; Mendy, M; Ojehomon, V.; and Wiredu, A. (2012). "The impact of adoption of NERICA rice varieties in West Africa". Presented at the International Conference of Agricultural Economists, Brazil 2012

Dimelu M. U. and Nwonu. A. (2004). Paradigm shift in the agro-technology transfer system: Case study of Agricultural Development Programme in Enugu State, Nigeria (2001 to 2009). Journal of Agricultural Extension and Rural Development Vol. 4(19), pp.495-503, November 2012.

Heckman, J., and Vytlacil, E.J., (2007). Econometric Evaluation of Social Programs, Part II: Using the Marginal Treatment Effect to Organize Alternative Economic Estimators to Evaluate Social Programs and to Forecast Their Effect in New Environments. In Handbook of Econometrics. vol. 6B, ed. J.J. Heckman and E. Leamer, 4875-5144. Amsterdam: Elsevier.

Heckman , J. 2010. Building bridges between structural and program evaluation approaches to evaluating policy. Journal of Economic Literature 48 (2): 356–398.

Imbens, G. and J. M. Wooldridge. 2009. "Recent Developments in the Econometrics of Program Evaluation," Journal of Economic Literature, 47:1, 5–86.

Imbens, G. and Angrist, J. D. ((1994). Identification and Estimation of Local Average Treatment Effects. Econometrica, Econometric Society, vol. 62(2), pages 467-75, March.

Lam, A. (1998). Tacit Knowledge, Organisational Learning and Innovation A Societal Perspective DRUID Working Papers 98-22, DRUID, Copenhagen Business School, Department of Industrial Economics and Strategy/Aalborg University, Department of Business Studies.

Nowak, P. (1992). Why farmers adopt production technology. J. Soil Water Conserv., 47: 14-16

Rubin, Donald (1974) Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies, Journal of Educational Psychology, 66 (5), pp. 688–701.

Wele, P. W., (1991). New Technology for transferring Agricultural Extension in Rivers W. M. and D. J. Gutafson (eds) Agriculture Extension and Forces for change. London Elsevier pp. 163 – 174.