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The Effect of off Farm Employment on Agricultural Production and Productivity: Evidence from Gurage Zone of Southern Ethiopia

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Abstract
Theoretically there are two possible impacts of off-farm employment on agricultural production and productivity. On the one hand, they can enhance farm production by providing the finance needed for farm inputs and technologies and, on the other hand, off-farm activities may have a detrimental effect on farm output by competing farming for labor. The aim of this study is to explore the effect of off-farm employment participation of farm households on agricultural crop output yield and productivity. The data used for this study is collected from four rural kebeles of farm households with the total sample size of 221, and individual household head was selected by applying a multistage sampling technique. Sub districts were selected purposively based on their distance from the nearby town (Wolkite) as well as the type of crops produced, while households were selected randomly from a stratified sample frame. We used OLS and Tobit regressions to analyze the data. The results show that households' engagement in off-farm activities is inversely related to crop production and, to some extent, to land productivity implying that the rural non-farm economy competes with agriculture for labor and that marginal productivity of labor in agriculture is positive.
Keywords: Off farm employment, productivity; production; Ethiopia; Gurage zone

1. INTRODUCTION

Rural areas usually provide two categories of income sources to their dwellers: agriculture and the non-farm economy. In fact, agriculture is the source of livelihood for of the majority of people leaving in rural areas. A recent report indicates that out of 3 billion people living in rural areas in the world, 2.5 billion people derive their livelihood from agriculture (FAO 2013). However, the contribution of the rural non-farm economy to rural livelihoods is also not trivial in rural areas. For instance, the non-farm economy accounts for about 37 percent of rural incomes in Africa while it goes even beyond 50 percent in Asia (Haggblade, et al. 2007).

While agriculture and the rural non-farm economy coexist in rural areas, the way they interact with each other is important in policy. Where the two have complementary effects on each other rural policies may focus on how to maximize their synergies, and, on the other hand, where the two are competing, policies may focus on how to minimize the trade-offs between. However, the relationship between agriculture and rural non-farm economy is not uniform across geographical locations to provide a silver-bullet policy measure across nations. Some authors argue that the agriculture and the rural non-farm economy have complementary effects to each other (Reardon *et al.,* 1994, Pfeiffer *et al.* 2009). For instance, Reardon et al (1994) posit that income from the non-farm economy can be used as a source of liquidity to purchase farm inputs and technology which leads to more intensification, modernization, and commercialization of agriculture.

On the other hand, participation in non-farm activities requires reallocation of those limited resources and results in an inevitable withdrawal from the farm. For instance, Leones and Feldman (1998) argue that rural nonfarm activities compete with agriculture for labor which can lead to a reduction in agricultural output. Furthermore, a higher return from off-farm activities relative to farm production can impede investment in land conservation and technology, result in hamper productivity, modernization and commercialization (Barrette *et al.,* 2001).

Even though, nonfarm activities can affect agricultural production both labor and capital markets through competing linkage, however, withdrawal of labor out of agriculture into non-farm activities may or may not negatively affect agricultural output, depending on the presence of surplus labor and the extent of rural labor market perfection (Bardhan and Udry, 1999) cited in (Yewang et.al, 2011). If there is surplus labor in rural market and the labor market perfect, then the loss labor as a result the household engaged in off farm employment can be effectively substituted by hiring labor in the labor market, hence, off farm employment have no negative effect on output and productivity, then the theory of Arthur Lewis is successful in explaining rural transformation as well as rural labor market.

However, some empirical evidences show that the marginal productivity of labor engages in agriculture production is greater than zero (Woldehanna, 2000)). So, empirically identifying the linkage between off farm employment and agricultural production is very important for policy making in Ethiopia because if expansion of off farm activities in rural area undertaken at the expense of agricultural production, then strategies which are set to boost agricultural production via increasing productivity, intensification and sustainable land management through conservation may be fruitless task.

Furthermore, there is limitedness in empirical literature which link off farm employment and agricultural production while most literatures focus on the relationship between nonfarm employment and intensification, by relaxing credit constraint, for example, (Reardon, et.al, 1994; Woldehanna, 2000; Kedanemariam, 2012). Hence, the contribution of this paper is used as the sparse body of literature that empirically examines the effects of off-farm work on agriculture production and productivity.

Therefore, this study was proposed to address the following objectives: (1) to examine the relationship between off-farm employment and agricultural production, and productivity, particularly, land productivity and labor productivity, and (2) to test the applicability of the theory of Arthur Lewis "growth with unlimited labor supply. The rest of the paper is organized as follows. Farm production and off farm employment in the study area is described in section 2, followed by revision of theoretical and empirical literatures of farm production and off farm employment. In section 4 model specification and estimation are described, followed by estimation results and discussion. Finally, the paper ends with conclusion and policy recommendation.

2. THE FARM-RNFE LINKAGE

2.1. Theoretical background

The terms "off-farm", "non-farm", "nonagricultural", "nontraditional", etc. normally appear in seemingly synonymous ways. The basic distinctions among activities and incomes are to be made along sectoral and spatial lines (*Barrett et al*, 2001). According to Haggblade et al. (2007) off-farm income or employment mean off the owner's own farm that includes wage employment in agriculture earned on other people's farms along with nonfarm earnings from the owner's nonfarm enterprises or from nonfarm wage earnings. Thus, off-farm income is the sum of rural nonfarm income and wage earnings in agriculture.

On the other hand, nonfarm employment refers all income-generating activities except crop and livestock production and fishing and hunting, located in areas that are mainly servicing agricultural activities (*Barrett et al*, 2001, and Lanjouw and Lanjouw, 2001). In most literature off farm employment and nonfarm employment used interchangeably but, some others not, while the difference is that working in the other's farms considered as off farm employment but not nonfarm employment. This study used these terms interchangeably, hence, rural off farm employment including wage employment in agriculture, self-employment, wage employment, full-time, part-time, formal, informal, seasonal, and episodic nonfarm production. And the distinction between rural and urban employment is based on the place of residence of workers, so those who commute to a job in a nearby urban center are considered to be rural workers (Lanjouw and Lanjouw, 2001).

The linkage between farm and non farm sector goes from former to latter or may go the other way round. From pull factors perspective, the linkage between farm and off farm employment goes from farm to non farm sector while the push factors perspective does not tell any linkage direction. Nevertheless, the former was the traditional theory which surplus agriculture invested in nonfarm sector. Similarly linkages can also run from rural non-farm activities to agricultural production (Ranis and Stewart, 1987; Reardon, 1997) through demand, supply, motivational and liquidity related linkages.

Demand linkage through expansion of rural based manufacturing stimulates the development of markets for agricultural production, and as these markets expand, it allows agricultural producers to diversify into non-food agricultural production. Production of manufacturing goods in the traditional sector will provide the supply of inputs necessary to increase agricultural production through supply linkage. On the other hand, motivational linkage take place in areas where agriculture is risky, rural non-farm activities for farmers will reduce the risk associated with innovation. In a situation where insurance and credit markets are limited, off farm employment for farmers will help to finance agricultural production-liquidity linkage. Hence, the interaction of farm and non-farm activities, a virtuous circle of traditional sector development can arise. However this self-reinforcing between a farm and nonfarm activities only happen when the two sectors are not compete for labor and capital or there is unlimited supply of labor in the rural area.

In contrast to the above argument, the use of family labor off-farm reduces the availability of labor on the family farm that can lead to productivity loss and stagnating or declining agricultural incomes (Reardon, 1997). While, Lewis (1954) argued that in the rural area agricultural production does not decrease as a result of household member transferred to other employment, because the marginal productivity of labor in agriculture almost zero. According to Lewis (1954) unlimited supply of labor in a country said to be exist when the population of the country large enough relative to capital and natural resources- land, as a result, the land holding of each individual so small. In this case, if some members of the household find alternative employment

opportunity, then the remaining household members will effectively cultivate the land as before without output reduction. Finally, Lewis suggests that agricultural labor could be shifted to the industrial sector without any reduction in total agricultural output, implying that the shadow wage in agriculture is nil. In contrast the theory Lewis (1954), Harris and Todaro (1970) develop the model of migration (rural-urban) in the existence of unemployment in the urban area. One of the basic assumptions to develop the model is that marginal productivity of labor or the shadow wage of labor in agricultural sector is always positive. Hence, labor is not surplus in the agricultural sector of the economy. The contra argument Harris and Todaro(1970) with the theory of Lewis (1954) was supported by some empirical evidence from Asia and Latin America countries. On the other hand, the proposition of Lewis (1954) supported by some macro level empirical findings. For instance Ercolani and Wei (2010) find that labor reallocation from agriculture to non agriculture sector has a positive impact on China's economic growth, accounting for 1 to 2 percent per annum of GDP growth. Therefore, it is possible to remove labor from the agricultural sector without cost.

Lewis (1954) proposed that marginal productivity of labor(MPL) in the agriculture sector is negligible or zero, but Sen(1966) state MPL zero in agriculture sector is a necessary but not the sufficient condition for surplus labor, since surplus labor may exist even MPL greater than 0. But the question is where this unlimited labor supply comes from? If new employment opportunities created at the subsistence wage in rural area such as off farm employment, Lewis(1954) has convincing answer for the above question, accordingly, in rural area not only the farmers, the casuals, the petty traders and the retainers (domestic and commercial) available labor supply but also from other three classes.

Primarily, wives and daughters of the household, most of the time they are working in the home making household consumption because of lack of employment opportunity in the traditional sector. However, the employment of women outside the household depends upon number of factors, such as, religious and conventional (education, experience and skill). Lewis stated that, expanding employment opportunity for women outside their home is the best way for economic growth. Furthermore, he states that one of the features of economic development is the transfer of women work's from household to commercial based work. Secondly, population increases resulting from the excess of births over deaths, which common in developing countries after 20^{th} century. Economic development affects both birth and death rate, but very certain effect on the former one. However, population increase is not relevant for this particular study expect to show the source of labor.

Finally, the last source of labor is reserve army namely the unemployment generated by increasing efficiency. Capital intensive machinery displaced employee, self employment and petty capitalist. Based on the above three conditions he further argued that expansion of new industries or new employment opportunities possible without any shortage of labor (unskilled) in the labor market, and then the supply of labor is practically unlimited. Once again, the theory applies only for unskilled labor, which the characteristic of rural labor of Ethiopia. Therefore, the availability of surplus labor in rural area pressed to conclude that agriculture production does not decrease as consequence of household engaged in off farm and farming activities simultaneously.

2.2 Empirical literatures

A few studies have been undertaken to examine the interaction between farm and nonfarm sectors which are empirical in nature (Reardon *et al.,* 1994; Savadogo et al., 1994; Reardon *et al.,* 1998; woldenhanna and Oskam, 2001; Davis, 2003; Holden *et al,* 2004). These studies look at different aspects of farm investment, and have found mixed evidence for the direction of off-farm work effects on farm production.

Savadogo et al. (1994) conclude that non-farm earnings do positively influence animal traction adoption in Burkina Faso. Reardon *et al.* (1998) found that income from agro industrial activities influences farm households' capacity to invest in farm input, capital and appropriate technology, and the author suggested that non-farm activities are potentially important for long-term food security because it stimulates spending on farm inputs and thereby farm productivity.

Similarly, woldenhanna and Oskam(2001) found a positive relationship between off farm income and farm production or productivity in Tigray regional state of Ethiopia. The authors conclude that farm households with more diversified sources of income have a higher agricultural productivity, since expenditure on farm input is dependent not only on agricultural production, but also on off-farm income because of capital market imperfections. Farmers involved in better paying off-farm activities such as masonry, carpentry and trading are in a better position to hire farm labor, thus there is a complimentarily linkage between off farm employment and farm production.

In contrast to woldenhanna and Oskam(2001) finding, Holden *et al.* (2004) found that off farm employment reduces farm production through different channel in Ethiopia. The authors suggest that better access to non-farm income reduces incentives to do farming activities and this leads to lower agricultural production including production of own food. Therefore, household become net buyers of food, this shows that even though there may be surplus labor in agriculture, the marginal return to labor is not zero and withdrawal of labor from agriculture has a negative effect on agricultural production because the marginal return to labor

increases when it becomes scarcer.

By contrast, Savadogo,et.al (1994) find that nonfarm earnings are reinvested into expensive animal traction packages in southern Burkina Faso, where agro climatic conditions are good. Hence, the above studies tried to find the link between farm production and nonfarm income/employment using different approach and analytical methods, but they cannot reach similar conclusion. Vigorously, they do not answer the question what is the effect of off farm employment on agricultural production and productivity. Rather these studies indicate how nonfarm employment is affect agricultural production via different channels.

Moreover, recently similar studies have been undertaken which are mainly focus on link between off-farm employment and farm production (Mearttens, 2008; Mathenge and Tschirley, 2009; Yewang et.al, 2011; Kidanemariam, 2012). Kidanemariam (2012) studied the effect of nonfarm income on relaxing liquidity constraint in marginal farms in Tigray regional state of Ethiopia. The result indicates that off-farm income positively affects agricultural input expenditure but negatively affects livestock investment. The author suggests that off farm income will relax cash constraint and further investment in farm intensification leads more commercialization. Thus, there is complementarily between off farm employment and farm activities. Similarly, Yewang et.al (2011) studied the impact of nonfarm activities on productivity in Chinese villages', they found that nonfarm activities do withdraw labor out of agriculture and therefore dampen land productivity, and however, nonfarm revenue has a significant positive effect on agricultural land productivity. The negative effect is negligible in comparison with the land productivity improvement. Furthermore, access to unskilled employment in the export agro-industry of Senegal has contributed to alleviation farmers' liquidity constraints, resulting in increased smallholder agricultural production (Mearttens, 2008).

In contrast to the above, the study by Mathenge and Tschirley (2009) Off-Farm Work and Farm Production Decisions from Maize Producing Households in Rural Kenya. The result shows that engagement in off-farm work may allow some partial intensification; it may also compete with farming at higher levels with households shifting their resources to other uses perhaps with higher returns than agriculture. Generally, the above Studies on the linkage between off farm employment and agricultural production and productivity have pointed in contradictory directions. Nonfarm activity some case it reduces farm productions through withdrawal labor and capital, in other cases, increases farm production and productivity through investment linkage.

3. METHODOLOGY

3.1. The study area and sampling procedure

Abeshge woreda is found in the Gurage Zone, Southern Notions Nationalities and People Regional State of Ethiopia (Figure 1). It is situated between 80 19'- 80 45' North latitudes and 370 45'-380 7' East longitudes. Its administrative center town (Wolkite) is located at a distance of 155 km from Addis Ababa toward Southwest direction.

Figure 1: Location of the study area

The topography of Abshege district varies from 1000-2000 masl. The annual average temperature ranges from 15.50 - 250 c while the total annual rainfall varies between 801mm and 1400mm. These situations resulted in a diverse agro-ecology which is suitable for the production of various annual crops (such as maize and tef), perennial crops (such as coffee and k'hat), and livestock.

The study was conducted in four kebeles namely: Mamedie, Michile & Tereqo, Tawula & Gefersa and Gihbebare. They were selected based on their distance from the highway connecting Addis Ababa to the towns in southwestern part of Ethiopia (such as Jimma, Bedele, and Metu). Tawula & Gefersa and Gihbebare have access to this road whereas Mamedie and Michile & Tereqo are away from the road. The households were selected randomly and the sample size for each kebele was fixed based on the proportionate to size sampling procedure. A total of 221 households were selected based this procedure.

3.2. Data analysis

The relationship between agricultural production and productivity with off farm employment is analyzed using OLS and Tobit regressions. It is hypothesized that off farm employment participation will reduce agricultural production and productivity at farm level of household through competing linkage. Since labor is one of the inputs for farm production, the direct effect of off farm labor supply will reduce agricultural production and productivity.

The production function is specified as a Cobb-Douglas production function and final estimation is made per unit of land and labor. The Cobb-Douglas production function is used because it is linear, homogenous and it yields a reasonable estimate of the marginal productivity of farm inputs. It has an advantage of being easily interpreted in economic term. Despite its apparent complexity for estimation, the constant elasticity of substitution (CES) production function (which is a general case of Cobb-Douglas production function) is only perfectly adequate for two inputs. To use it for more than two inputs, unreasonable restrictions on the substitution possibilities of inputs must be made (McFadden, 1963 and Uzawa, 1962).The following regression model will be employed to examine the relationship between off farm employment and farm production and productivity at household level:

$$Qi = \beta 0 + \beta 1X1 + \beta 2X2 + ...\beta nXn + \mu i.....(3.1)$$

Where Qi ; the annual household agricultural output; $X1, X2, ... Xn$ are the explanatory variable; Bo - is the intercept; $B1, B2 ..... Bn$ -are the coefficient of the parameter (elasticity) and Ui -represents the error term

The models that is specified as in equation (4.1) regression model can be estimated using ordinary least square method. Except for dummies, all variables include in the model is in logarithm forms. Labor and land productivity was estimated in similar specification of the production model but labor and land productivity were generated from division of total output by the total amount of labor and land used for that production respectively**.** The final version of the empirical agricultural production model is specified as follows:

$$Qi = Bo + B1\,A + B2\,Lf + B3\,Lh + B4\,EEXIMS + B5\,EXLS + B6\,OFL + B7\,EXD + B8\,EXU + B9\,Age + B10\,DPEDUC + B11\,DSEDUC + B12\,DCOFE + B13\,DCHT + Ui \quad ....(3.2)$$ [1]

4. RESULTS AND DISCUSSION

4.1. Descriptive Results

In the selected four sub districts farm households participate in a variety of farm and off-farm activities. The farming activities comprise crop production and mixed farming. Crop production is the dominant type of farming system. The proportion of farm households engaged in crop production only and mixed farming are 63 percent and 19 percent respectively. The farming technology is traditional, simple hand tools and oxen driven implements. Most of the farm households use capital input such as fertilizer and improved seed. In the Table 1 below shows that on average, 64.9Kg of UREA and 90.8 Kg of Dap are applied in their farm land. Moreover, the average expenditure of farm household on improved seed, fertilizer, pesticide, farm machinery and local seed are (543.5), (2197.5), (25.7), (103.2) and (325.1) Ethiopian Birr, respectively. On the other hand, the average wage

[1] Qi represents the monetary value (in Birr) of annual total crop output of household, $\beta_1 \ldots \beta_8$ are the coefficients of parameter(elasticity) , A represents the total cultivated land holding of household in hectors, L_f represent total family labor used in farm in man-days, L_h is stand for total hired labor used in farm in man-days, EXU represent total expenditure on urea fertilizer (in Birr), EXD is the total value of expenditure on dap fertilizer (in Birr), EXIMS is the value of expenditure on improved seed (in Birr)EXLS represent total expenditure on local seed (in Birr), OFL is a total of household labor allocated to off farm employment (in man-days), DPEDUC is dummy for primary education (1= primary, 0= otherwise)DSEDUC is dummy for secondary education (1= secondary and above, 0= otherwise, Age is the age of household head (in year). DCHT stand for dummy of chat production (1= produced, 0= otherwise and
DCOFE represent for dummy for coffee production (1= produced, 0= otherwise

rate paid for hired labor is 31.9 Birr/day or 4 Birr/hours. The land holding size is not such fragment for each farm households, on average each households have (2) plots or parcel of land in different location, even though, the range is (7) plot of land.

Table 1 Description of farm inputs

Variables	Mean	Std. Dev.	Min	Max
UREA fertilizer	64.44	77.25	0	800
DAP fertilizer	90.38	100.01	0	800
Total expenditure on fertilizer	2197.47	2439.01	0	22320
Expenditure on pesticide	25.64	86.900	0	1000
Expenditure on improved seed	543.50	589.23	0	6000
Expenditure on Local seed	325.13	438.11	0	2862.5
Number of plot	2.26	1.13	1	8
Expenditure on Farm machinery	103.17	635.25	0	7500
Expenditure on hired labor	692.80	1492.6	0	9856
Average wage of hired labor	38.58	19.88	12	115

Source: own survey 2013

Note: Value of input and output measured in birr. One Ethiopian birr is equivalent with 0.055 US dollar during surveying time.

The labor demand for farming are meet by family labor, hired labor and labor sharing arrangements. The labor sharing arrangements is a social tie which is used as a farming business transaction and a form of family labor. This implies that sources of labor for farm are causal hired labor and family labor. Most farm labor comes from family labor. Family labor accounts for 89.6 percent of the farm labor, while the share of hired labor is 10.4 percent. The highest proportion of farm labor both hired and family labor used for planting and weeding season, it accounts 47.7 percent and 41.2 percent, respectively. The second highest use of hired labor and family labor is for harvesting. Close to 22 percent of the hired labor and 29 percent family labor is also used for land preparation, during the slack season. Hence, there is an obvious seasonal variation in the use of total farm labor, with planting and weeding takes the highest proportion of total labor.

In addition to adult family labor, the households are used child labor. On proportion 21.1 percent of family labor came from child (age lessthan14 years). Particularly, planting and weeding season take the highest proportion about 43 percent of total child labor. The reason is that weeding can be done using relatively lower skill level and is not as intensive as plowing and harvesting. For instance, harvesting is a difficult job and needs some level of skill and competence, which may not undertaken by the child labor.

Table2 below shows that on average, (83.3) days or (665.6) hours supply (selling) labor to the off farm employment, and the proportion family labor supply to off farm employment is 44.3 percent. Labor supply to off farm employment is elevated to highest figure 35 percent during slack season (plowing period) and relatively lowest level 32 percent occur during planting and weeding times. On the other hand, most of the hiring of labor is done during the planting and weeding season, and the percentage of labor-hiring is lowest during the slack seasons. Study shows that the share off farm income in the rural area ranging from 30 to 50 percent of farm household total income (Davies, 2002). However, the share of off farm income for the farm household is (16.2%) in survey area which is slightly lower than the national level of 20 percent cited in (Zarai et.al, 2010). The income obtained from off farm employment is spending on consumption.

The lion share which is close to 63.4 percent spread out to smooth consumption, farm inputs accounts for 14.6 percent and their marginal saving rate is 12.2 percent of off farm income. This may indicate that off farm employment is important to welfare improving rural farm households. Consequently, it has positive effect on poverty alleviation of rural poor households via labor market channel.

Table 2 Family off farm labor supply

Variables	Mean	Std. Dev.	Min	Max
off farm labor supply of households	83.27	128.53	0	540
Income generate from off farm employment	4224.3	12636.53	0	156000
Percent of off farm labor supply to family labor	44.3	-	0	-
Percent of off farm labor supply for planting	32.2	-	0	-
Percent of off farm labor supply during plowing	34.7	-	0	-
Percent of off farm labor supply during harvesting	33.2	-	0	-
Percent share of off farm income to total farm income	16.2	-	0	-

Source own survey, 2013

In the production and productivity farm household is given Table 3. The total value of agricultural output is estimated to 4,855,923 Birr and per head farm income is Birr 21972.5 excluding livestock rental and selling income. The incomes obtain from selling and rented livestock are not incorporated in this analysis. Firstly, animal husbandry type of farming does not exist in the studied area of farm households. Secondly, the data is collected from households are cross sectional (one time observation) which is not appropriate to include the selling value of livestock as output of that production year and considered as income of household for that year.

Land and labor are the most important factors in agricultural production, while the effect on average output produced is different. The total land cultivated and labor used in the farm is 359.4 hectors and 46317 mans day, respectively. The proportion of labor allocated for one hectors land to the production of agricultural output beginning from plowing to harvesting and trashing is (128.9) mans day. On average, labor productivity and land productivity of farm households is (141.2) Birr/ labor and (13882.2) Birr/hectors respectively. Labor is more productive than land, when we changed to the same denominator i.e. (The productivity of labor/ hector is 18200.7 Birr). Dynamically, the value of one raw labor greater by 31.1 percent than that of value one hectors land when considering the raw labor only.

Table 3 Description of output and productivity

Variables	Total	Mean	Std. Dev.	Min	Max
Output	4855923	21972.5	23579.7	0	217150
Total cultivated land size	359.4	1.63	1.3454	0	10
Land productivity	-	13882.16	9885.76	0	84460
Labor productivity	-	141.22	183.21	0	1880.56
Total labor used	46317	209.5792	173.01	0	979

Commonly, farm households involves in wage employment and self-employment (own business activities). Wage employment includes paid farm work, professional (Teacher, government worker and administration), skilled laborer (manual work in construction, masonry, and carpentry). Self-employment includes petty trading (brewing local alcohol and food, grain trading), fuel wood selling, charcoal making and unskilled nonfarm work (weaving, handicrafts and milling). Eighty one out of two hundred twenty one households head or about 36.7 percent of farm households head participate in off-farm activities. While, 38 percent or eighty four farm household participate in off farm employment at least one member. Most of the households participate in self employment activities, which do not require any professional qualification except masonry and carpentry. The proportion of households participate in off-farm self employment is 54.7 percent, and out of the total petty trading accounts for 58.7 percent, skilled laborer 24.1 percent, unskilled nonfarm work 13 percent and, selling fire wood and charcoal 4.3 percent. The proportion of households that participate in off-farm wage employment is 45.3 percent. Paid farm worker take the highest share of off farm wage employment participant 47.4 percent followed by professional 39.5 percent. In general, petty trading is the dominant type of off-farm employment 31.8 percent followed by paid farm worker 21.2 percent farm household participated.

Table 4 Farm household participation in off farm employment

Types of off farm activities	Participation rate (%)	Cumulative participation rate (%)
Farm worker	21.4	21.4
Professional	17.9	39.3
Driver	1.2	40.5
Guard	4.8	45.3
Off farm wage employment	45.3	-
Petty trading	32.1	77.4
Selling fire wood and charcoal	2.4	79.8
Unskilled nonfarm worker	7.1	86.9
Skilled laborer	13.1	100
Off farm self employment	54.7	-
Over all participation in off farm	38.0	-

4.2. Regression results and discussion

The estimation results of the effect of off farm employment in agricultural production and productivity are given in Table 5. In this analysis 208 sample households are considered, the remaining 13 observation is missed because of incomplete information as well as detection of outlier problem. The dependent variable in this case is agricultural output in monetary unit (Birr). After repeated estimation and transformation the problem of heteroscedacity was corrected by estimating the robust standard error of the coefficients and the existence of multicollinearity between explanatory variables were checked through Collin and variance of inflated factors (VIF) for tobit and OLS regression respectively. The Collin test results reveal the problem of multicollinearity is not serious and the VIF of each coefficient of parameter is less than 10 and the mean VIF of the coefficients is 2.11. Tobit estimation methods are non-linear estimation techniques, which makes it difficult to interpret the raw coefficients of the estimation results. To make interpretation easier, marginal effects are reported in addition to coefficient estimators.

Table 5 present the results of the production function estimation. The results reveal from both Tobit and multivariate regression are qualitatively similar results. The signs of the coefficients are the same for almost all coefficients in both estimations. There is no variation in significant levels across the two estimation techniques. While, the coefficient estimators of multivariate regression results are somehow lower than the respective Tobit model estimation, since OLS estimation is down ward biasness when there is zero value of dependent variable.

The result shows that educational status of household head (dummies) and expenditure on fertilize (Dap and Urea) do not significantly affect the output production of farm household, while the sign is positive. On the other hand the coefficient of age of household head is negative and statistically not significant. As expected Family labor, expenditure on improved and local seed, hired labor and chat dummy have a positive effect on agricultural production at 1 percent level of significance, while coffee crop dummy is significant at 5 percent in both models. Moreover, off farm labor supply of the household affect agricultural output production negatively at 5 percent level of significance for both regression models estimates.

The coefficients of primary and secondary education dummies are positive sign, but are not statistically significantly at commonly accepted level of significance for the farm household in both model estimations. Being the farm households primary or secondary and above educated do not have significant effect on farm output as compared to illiterate farm household. Even though, the coefficients are not statistically significant, the coefficient of estimator for secondary and above educational dummy of farm households is (0.4), which is higher than the primary education dummy (0.1). Being higher education category for farm household may have positive impact on agricultural output production. Since, education captures the managerial skill and efficiency of farm households in the process of production (Huffman and Lange 1989).

Table 5 Result from Tobit and multivariate regressions

Dependent variable is output		
Variable name	Tobit Coefficient	Multivariate Coefficient
Family labor	0.4817918***	0.4579991***
	(5.11)	(5.15)
Hired labor	0.1523402***	0.1451648***
	(2.80)	(2.75)
Improved seed	0.4380984***	0.4197248***
	(6.22)	(6.34)
Local seed	.2864668***	0.2718019***
	(5.63)	(5.73)
Off farm labor supply	-0.0890322**	-0.0838795**
	(-2.20)	(-2.14)
Dap fertilizer	0.0091197	0.0067678
	(0.12)	(0.09)
Urea fertilizer	0.0683101	0.0670771
	(0.86)	(0.87)
Age	-0.0000657	-0.0002054
	(-0.01)	(-0.02)
Primary education(D)	0.1013555	0.0984928
	(0.41)	(0.41)
Secondary education(D)	0.3970522	0.3819946
	(1.07)	(1.06)
Coffee (D)	1.09524**	1.060512**
	(2.28)	(2.24)
Chat (D)	0.6793259***	0.6442954
	(2.99)	(2.93)***
Pseudo R2	0.25	-
R- square	-	0.69
N	**208**	**208**

(D) Marginal for discrete change for dummy variable from 0 to 1, * p<0.10, ** p<0.05, *** p<0.01, values in parentheses are t-values

Family labor has the highest output elasticity of all factor inputs. When family labor input increase by 10%, farm output increases by (4.8%). The elasticity of output with respect to hired labor is low as compared to other, which is (0.15). These results imply that the marginal productivity of labor in agriculture is greater than zero, which disproof the theory of Arthur Lewis (1954) discussed in literature part.

Expenditure on Improved seed has almost twofold elasticity of local seed expenditure. When farm household expenditure on improved seed increases by 10%, farm output increases by 4.4% and in case of local seed, by 2.8 %. The elasticity of output with respect to total land cultivated is depends on the assumption of return to scale. If the return to scale is constant or decreasing, the elasticity of output with respect to land turns to be negative. On the other hand, if the return to scale increasing, unlikely to be happen in agricultural production, the elasticity became positive.

The perennials crops (chat and coffee) positively affect farm output production compared to those who are not produce perennials crops. The result indicates that agricultural output is higher for farm household engaged in perennials crop production, which is make sense.

The off farm labor supply of the household show a remarkable result. When off farm labor supply increases by 10%, farm production output decreases by 0.8%. This result confirm the hypothesis that farm and off farm employment (activities) competing for scarce labor resource when there is no credit constraint in the farm households (Reardon et.al 1994). Therefore, one can safely say that transfer of labor from agriculture to other sector of economy has negative effect on crop output production. This result is similar to the finding of Holden et.al (2004) in East Shewa, Ethiopia. Furthermore, this finding confirm that the theory of surplus labor is not valid in contemporary century, and also consistence with the theory of Sen(1966) state that the assumption of zero marginal productivity is neither a necessary nor the sufficient condition for the existence of surplus labor, rather any finite withdrawal of the peasant labor force will reduce the level of output.

Estimation results for the effect of off farm labor supply on land productivity are presented in Table 6. The results reveal that land productivity mainly influenced by family labor, improved and local seed, off farm labor supply, cultivated land size and perennial crops. The effects of hired labor, fertilizer expenditure, age and primary, and secondary and above education dummies are not significantly different from zero at any reasonable level of significance in both estimation techniques. While, off farm labor supply and cultivated land size negatively influence land productivity at 10 % and 1% level of significance respectively.

Table 6 Result from Tobit and multivariate regressions

Dependent variable is land productivity		
Variable name	Tobit Coefficient	Multivariate Coefficient
Cultivated land size	-1.412286***	-1.28762***
	(-3.57)	(-3.38)
Family labor	0.5125621***	0.4693917***
	(4.00)	(3.97)
Hired labor	0.0914192	0.0794202
	(0.76)	(0.67)
Local seed	0.2126755***	0.1902585***
	(3.00)	(2.80)
Improved seed	0.3582096***	0.3281217***
	(2.94)	(2.79)
Urea fertilizer	0.18453	0.1757218
	(1.27)	(1.26)
Dap fertilizer	-0.0368983	-0.0364257
	(-0.28)	(-0.28)
Off farm labor supply	-0.1011665*	-0.0907346*
	(-1.83)	(-1.72)
Age	-0.0082491	-0.0078322
	(-0.48)	(-0.48)
Primary education(D)	0.1766865	0.1665723
	(0.59)	(0.59)
Secondary education(D)	0.1870638	0.1739863
	(0.39)	(0.38)
Coffee (D)	1.170117**	1.105029**
	(2.40)	(2.38)
Chat (D)	0.8576581**	0.7930267**
	(2.14)	(2.07)
N	208	208
Pseudo R2	0.13	-
R- square	- -	0.46

(D) Marginal for discrete change for dummy variable from 0 to 1, * p<0.10, ** p<0.05, *** p<0.01, values in parentheses are t-values

Family labor, expenditure improved, and local seed affect land productivity positively at 1% of level of significance. When family labor increases by 10% land productivity is increase by 5.1%. Similarly, when expenditure on improved seed and local seed increases by 10% for each, land productivity is increases by 3.6% and 2.1% respectively. Enthusiastically, expenditure on improved seed, increases land productivity almost two times as compare to comparable expenditure on local seeds. Similar to effect on value of output, perennial crops dummies have positive influence on land productivity compared to farm household produce only cereal crops. This is clearly understandable particularly chat and coffee are land saving perennial crops compared to other cereal crops and the relative value of output to the land allocation for perennial crops are high as compared to cereal crops.

An important finding is that, off farm labor supply of household influence land productivity negatively. When off farm labor supply of farm households increases by 10% land productivity decline by 1.0%. As discussed earlier in output analysis there is competing linkage between farming and off farm activities. Withdrawal of labor from agriculture not only decrease output but also land productivity. This finding would appear to support the contentions Barrette *et al., (2001*) and Reardon et.al (1994) high returns from off farm activities relative to farming threaten investment land conservation and technology, leads to hinder to land productivity. Some empirics that support this findings are Mishra and Goodwin (2004) greater involvement in off-farm labor markets does indeed appear to decrease on farm efficiency, Yewang et.al (2011), non-farm activities do withdraw labor out of agriculture and dampen land productivity and Holden et.al, (2004) rural non-farm income reduces households‟ incentive to invest in conservation measures, increasing land degradation and soil erosion, ultimately land productivity. While, this result is contrary to the finding of Woldehana and oskam(2001) and Kidanemariam, (2012) that off farm income increase productivity through relieve credit constraint enhance expenditure on inputs.

The other important finding is cultivated land size has inversely correlated with land productivity. This finding is confirming the theory state that small farmers are efficient. Controlling for other factors, land productivity is highly influenced by land size of household. The effect is significantly different from zero at a one percent significance level. When land size increase by 10% land productivity is decreases by 14%.

Empirically, Humera Iqbal(1989) find that land size have inverse relationship in Pakistan peasant agriculture production.

Table 7 present the estimation results of the effect of off farm labor supply on labor productivity of farm households. In both estimation techniques the coefficients are comparable, but higher in Tobit and there is no variation in sign and level significance for coefficient except for cultivated land size, which is insignificant in multivariate model. Secondary and above education dummy, expenditure on fertilizers and off labor supply coefficient parameters are not statistically significant at commonly accepted significance level.

Family and hired labor, expenditure on improved and local seed, explain the variation in labor productivity at one percent significance level. Age of the household head has negative influence on labor productivity at 10 percent of significance. The possible reasons are; first farming activities need human physical power consequently, as age going up human being becoming weak this may have adverse effect on labor productivity visa-vice output production. Second as age of farm household increase the marginal propensity to consume or leisure is higher than saving or work for farm households (Huffman and Lange, 1989).

Primary educations have positive influence on labor productivity of farm household at 10 percent significance level. This finding is in line with Weir (1999) findings that reports primary education has positive effect on productivity of household, but the author does not differentiate the influence on weather land productivity or labor productivity. Being primary educated of farm household have more than one third higher effect on labor productivity as compared to illiterate farm households. Alternatively primary educated farmers are 1.36 times more productive than illiterate farmer (when considering labor productivity only).

The influence off farm labor supply on labor productivity is not significant, unlike the effect on farm output production and land productivity, the coefficient of off farm labor supply is positive. Technically, it seems that off farm labor supply has positive effect on labor productivity because less labor is allocated to the farming activities as compared to non participant in off farm employment and the return becomes high. But, to answer the question that off farm participant household allocate their labor in profit maximization ways? It is beyond the scope of the study and left for future investigation.

The result further assures that the theory of “unlimited surplus labor” does not work. Since, family labors highly influence labor productivity at one percent significance level. Labor productivity with respect to family labor is 0.35 and 0.28 in Tobit and multivariate regression respectively. When family labor supply increases by 10% labor productivity is increase about by 3.2% (average of the two models). This indicates that agricultural production is in stage one of classical production function. While the elasticity of labor productivity with respect to hired labor is 0.16 (which is lower than family labor).

Table 7 Estimation results of labor productivity

Dependent variable is labor productivity		
	Tobit	Multivariate
Variable name	Coefficient	Coefficient
Cultivated land size	-0.4118349*	-0.3068138
	(-1.94)	(-1.57)
Family labor	0.3456055***	0.2758228***
	(3.38)	(3.07)
Hired labor	0.1939569***	0.1691903***
	(3.30)	(3.12)
Local seed	0.1612784***	0.1441774***
	(3.00)	(3.14)
Improved seed	0.2054269***	0.1811459***
	(3.60)	(3.36)
Urea fertilizer	0.0425575	0.0453191
	(0.59)	(0.68)
Dap fertilizer	0.0132878	0.0075239
	(0.20)	(0.12)
Off farm labor supply	0.0223755	0.0244461*
	(0.54)	(0.62)
Age	-0.0197211*	-0.0188487*
	(-1.84)	(-1.86)
Primary education(D)	0.3618179*	0.3358854*
	(1.72)	(1.72)
Secondary education(D)	0.4724827	0.4233095
	(1.35)	(1.30)
Coffee (D)	0.7381517*	0.6890853*
	(1.72)	(1.90)
Chat (D)	0.1137917	0.0833285
	(0.50)	(0.39)
N	208	208
Pseudo R2	0.18	-
R- square	-	0.47

(D) Marginal for discrete change of dummy variable from 0 to 1, * p<0.10, ** p<0.05, *** p<0.01, values in parentheses are t-values

5. CONCLUSION AND POLICY IMPLICATION

5.1 Conclusion

This paper is designed to address to identify the effect of off farm labor supply of farm households on agricultural production particularly, crop output production, land productivity and labor productivity. The survey data collected from 221 farm households reveal the fact that farmers are overwhelmingly dependent on agricultural crop income that make up an average of 83.8 percent of total income, while the average share of off farm income is 16.2 percent, which is an indication of off farm activities are not the finest choice of farm households. Majority of farm labor input comes from family labor with substantial contribution of child labor, while the farm households used hired labor relatively small proportion of total farm labor. On the other hand, there is positive demand-supply gap for farm worker. This indicates that the rural labor market is not working smoothly, therefore, it need intervention to correct the labor market imperfection until the market support the process.

The results from Tobit and multivariate models showed that crop output production is mainly explained by inputs factors. However, the amount of fertilizer used by farmers does not have significant effect on crop output production. This may indicate that the application fertilizers without soil test have no effect on crop output production. The other possible reason is that fertilizers are complimentary with other farm input such as labor; therefore, it may be difficult to see the effect on agricultural yield clearly. On the other hand, demographic factors such as age and educational status of farm household do not explain significantly variation in crop output production of farm households.

As the first finding, the paper provides evidence that the effect of off farm participation on agricultural output production. The results indicate that off farm labor supply of farm households have negative and significant effect on crop output production, given the households supply labor to off farm employment during peak time of agricultural production, in this case, planting and weeding farming season. This indicates that farming and off farming activities is compete for limited labor in peak time of farming season. In sum, working of family member outside their own land has negative effect on crop output production of the household;

consequently, the theory of Lewis (1954) growth model based on assumption of unlimited supply of labor in agriculture sector is no more workable.

Similar to crop output production, land productivity is explained by farm households inputs used. In contrary to crop output production, hired labors do not have significant contribution on land productivity. This does not mean that hired labor have no effect on land productivity, since as farm input it has its own effect. The possible reasons are the proportion hired labor to total labor used for farming is small around 10 percent and the shirking behavior of hired labor and their super vision cost may undermine the influence of hired labor on land productivity.

The second finding, like crop output production, off farm labor supply of farm households negatively affect land productivity. Greater involvement farm households in off farm activities reduce time allocated to farming (on farm efficiency) and disincentive investing in land improving and conserving measures, consequently left large proportion of land fallow for a long period of time. Moreover, land size and land productivity have negative relation.

The third finding is that unlike crop output production and land productivity, labor productivity affect by demographic factor. Educational status of farm households has positive effect on labor productivity because education raises the efficiency and marginal skills of individual, which enhance to carry out tasks and activities in optimal way. On the other hand, off farm labor supply of farm households do not have significant effect on labor productivity. Whether the household participate or not participate in off farm activities, there is no significant variation between them in relation to labor productivity. This shade light on the linkage between farm and nonfarm sector is not complementary. Since, it indicates that off farm income that the household obtained may not allocate for purchase of farm inputs.

Generally, transformation of the economy from agriculture lead to industry can be achieved without loss, when smallholder farmers strengthen farming, and the urban areas expand the supply of goods and service and reciprocal demand. Therefore linkage between farm and nonfarm activities may not be achieved both together in rural area.

5.2. Policy Implication

Generally the above findings have important implication for rural transformation in Ethiopia. Firstly, the findings cast doubts on the success of the broad ADLI policy, because off farm activities are expanding at the cost of agricultural production. Secondly, the expected land productivity increment may be undermined by off farm participation of rural households. Finally, in the recent years the government of Ethiopia institutionally structure one department up to zonal level with respective agricultural office, which promote rural nonfarm activities, while the agricultural office work to boost output production and productivity. Therefore, integrated approach; promoting farming and nonfarm activities simultaneously need very serious caution.

Specifically, results from production function shows that elasticity of labor and seed with respect output and productivity is positive and satisfactory coefficient. Therefore, more labor-intensive farming practices for each crop activity should also be promoted, such as better land preparation, frequent weeding, line planting instead of random planting as well as the application of larger amount of improved seed and local seed. Moreover, planting perennial crops should be promoted through providing seedling, information and technical knowhow for the farmers. These crops are planted in lesser plot, but high value compared to cereal crops. Therefore, the government design effective strategy and plan for national wide mobilization that promote planting perennial crops considering the agro ecology and weather condition of the project implemented. Effectively implementing the strategy will enhance to achieve three birds in one stone (objective of environment sustainability, productivity and market orientation).

On the other hand, serious caution is needed, when the government implements labor intensive program in rural area such as land conservation and frequent meeting in peak agricultural production time. Meanwhile, it is better to link rural youth employment creation to agricultural production rather than nonfarm activities since, there is a room for land reform and land can be redistribute without yield and productivity loss. The issue of time is very critical in rural households. Therefore, the government should give priority for program and project that focus on time saving of rural households. For instance, institution that focused on conflict management, water supply, road accessibility, and other social infrastructure. However, when in structuring kebele level institution that provides and good and service to rural households, it should not justified as employment creation or as formality like other office located in center rather it should be based on optimality. Hence, the human resource requirement that structured for rural public service deliver should be narrowing as much as possible

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