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Agricultural Policy Research in Africa

# HIRED LABOUR USE, PRODUCTIVITY, AND COMMERCIALISATION: THE CASE OF RICE IN FOGERA PLAIN OF ETHIOPIA

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# ACRONYMS

| | |
|---|---|
| **APRA** | Agricultural Policy Research in Africa |
| **ATT** | average effect on treated household |
| **ATU** | average effect on untreated household |
| **ESR** | endogenous switching regression |
| **TH** | transitional heterogeneity |
| **PSM** | propensity score matching |
| **RCI** | rice commercialisation index |
| **TLU** | tropical livestock unit |

# EXECUTIVE SUMMARY

This paper presents the role of hired labour use on smallholders' rice productivity and commercialisation using cross-sectional data collected from 723 randomly selected smallholder rice farmers in the Fogera Plain.

The results indicated that the introduction of rice in the Fogera Plain has contributed to the development of rural labour, mainly to the casual labour market, where the area (previously known for the outflow of migrant labour) has started to absorb labour from other parts of the country. It is estimated that about 52 per cent of smallholder rice farmers in the Fogera Plain use hired labour to complete their agronomic practices. In terms of the estimated impact of hired labour on smallholder farmers' rice productivity, the key results are:

- On average the rice yield was higher by 0.4t/ha for users of hired labour, compared to their counterfactuals if they were non-users.
- Rice productivity would have been increased on average by 0.331t/ha for non-users of hired labour if they had applied hired labour in their production processes.
- Timely accomplishment of farm operations, starting from land preparation through to threshing, are crucial for improving productivity and the quality of production. Hired labour use was also highly associated with the use of productivity enhancing inputs like fertiliser.

In terms of estimated impact of hired labour use on rice commercialisation, the results indicate:

- On average, the rice commercialisation index (RCI) was higher by 0.02 units for users of hired labour, compared to their counterfactuals if they were non-users of hired labour.
- The RCI would have been increased on average by 0.06 units for non-users of hired labour if they apply hired labour in their production processes.

The implications of this empirical evidence indicates that: hired labour contributes significantly to the enhancement of productivity and commercialisation of rice; and that the labour market contributes to the creation of opportunity of employment for rural youth through the development of the rural labour market. However, there is a need to further enhance the development of the labour market so that the mismatch between supply and demand is reduced, which can be done through the introduction of a labour market information system, formalisation of market relations, and the creation of localised dispute settlement mechanisms.

# 1 INTRODUCTION

Agriculture in Ethiopia is still the main economic sector, absorbing a considerable portion of the national workforce. An increase in other economic sectors, namely services and industry, however, is leading to a reduction in the contribution of the workforce to the agriculture sector. Available data indicates that the contribution has declined from about 80 per cent in 2007 to about 68 per cent in 2017 (NBE, 2017). With a gradual increase in agricultural commercialisation, however, the engagement of smallholder farmers in the agricultural input and output markets, including labour markets, has increased considerably (Jaleta, Gebremedhin and Hoekstra, 2009; Cazzuffi, McKay and Perge, 2018). The growth of some agricultural commodities in Ethiopia – like sesame and coffee, among other high value export crops, and commercial crops such as rice, teff and common beans – has been highly dependent on the use of hired labour, especially for selected agronomic practices like weeding, harvesting and threshing. Hired labour use has also been found to be dependent on trends in farm labour productivity and mechanisation, and by farm and household characteristics, such as farm size, wages, input prices, farm household's education and the number of children in the household (Bhati, 1980; Blanc et al., 2008).

The development of the rural labour market is often seen as an effect of agricultural growth. It shows that a significant proportion of poor people, endowed mostly with labour but few other productive assets (e.g. landless), can generate a wage income by participating in the rural labour market. For smallholder farmers, this allows them to access hired labour when needed for agronomic operations that demand additional labour that family labour cannot meet, while also contributing to increased productivity and commercialisation (Foster and Rosenzweig, 2004; Shahe and Shilpi, 2014). In general, the extent of labour absorption is the joint outcome of demand and supply factors in the labour market, where aggregate demand for labour will equal aggregate supply, minus the number of openly unemployed (Mazumdar, 1989).

The Fogera Plain is a typical agricultural area that has demonstrated a progressive change, due to the introduction of rice, from a food insecure to a food surplus area, with dynamism in livelihood pathways and agrarian change (Alemu et al., 2018; Alemu et al., 2019). Rice in the Fogera Plain is produced under two main agro-ecosystems, namely under rain-fed lowland and rain-fed upland rice eco-systems. It is in recent years that upland rice production has become more important following the release of upland rice varieties, along with associated varietal demonstration and popularisation (EIAR, 2016). With increased commercialisation of rice in Fogera Plain, a rural labour market has also been developing, allowing smallholder rice farmers to access hired labour, particularly for agronomic practices that require timely implementation. This paper looks at the trends in hired labour use, and its impact on rice productivity and commercialisation.

# 2 METHODS

## 2.1 The study area

The study was conducted in Fogera Plain, which is one of the major rice-producing areas, accounting for 74 per cent of total area covered by rice in the country (CSA, 2018). It covered all three rice-producing districts, namely Fogera, Libo Kemkem and Dera districts.

## 2.2 Sample and sampling

The sampling followed a stratified procedure to make sure that all of the three rice-producing districts *(woredas)* in Fogera Plain were considered. The total sample of 723 was allocated to each district, depending on the proportion of land allocated to rice. About 64 per cent of the rice land in the Fogera Plain was found in Fogera District, 28 per cent in Libo Kemkem District and the rest (8 per cent) in Dera District. Accordingly, 470 respondents from Fogera, 199 respondents from Libo Kemkem, and 53 from Dera were selected.

The number of villages selected was further determined by considering the proportion of land allocated. Accordingly, using the total list of *kebeles* (villages) engaged in rice production for each of the districts, 13 *kebeles* from Fogera, six *kebeles* from Libo Kemkem, and two *kebeles* from Dera District were selected using systematic random sampling (Table 2.1). Recognising the more or less similar population of farmers at *kebele* level (around 1,000 farmers/*kebele*), a 35 sample farmers were allocated for each *kebele*. The last stage then used systematic random sampling to select respondent farmers using a list of farmers at *kebele* level. Expecting unavailability and some rejection to participate in the survey, the sample size was increased to 37 for each *kebele*.

## 2.3 Types and sources of data

The study employed primary data as the main source for this study. This was collected through a questionnaire-based survey of smallholder rice farmer and through focus group discussions and key informant interviews using checklists prepared to guide the discussions.

The semi-structured questionnaire was administered to randomly-selected farmers targeting the generation of data on issues related to socio-demographics, resource ownership, access to services, production, marketing, and social capital.

The selection of farmers was made by Agricultural Policy Research in Africa (APRA) Ethiopia research team members with the assistance of field guides. The guides, who were development agents working in each of the *kebele* as extension agents, assisted the survey by providing a list of farmers in each kebele, fixing appointments with the selected farmers, and guiding the contact place and time. The questionnaire was administered by trained enumerators with a research background through face-to-face interviews with farmers, under the supervision of the APRA research team.

## 2.4 Analytical framework and estimation procedure

Examining the impacts of hired labour use on rice productivity, and the extent of rice commercialisation, using the cross-sectional data requires determining proper counterfactuals to correct for any self-selection bias and control for non-observable farm and household characteristics. With cross sectional survey data, where the counterfactual situation is not known,

**Table 2.1 Sample size by district, Fogera Plain**

| District | Number of *kebeles* | Sample size |
|---|---|---|
| Fogera | 13 | 470 |
| Libo Kemkem | 6 | 200 |
| Dera | 2 | 53 |
| Total | 21 | 723 |

Source: Authors' own, using data from APRA Farmers' Survey, 2018

the causal inference becomes a challenge, demanding the application of estimation models that address this (Abdulai and Huffman, 2014; Jaleta et al., 2016; Bidzakin et al., 2019).

We present below the analytical framework and estimation procedure employed in this paper, and also the justification of the application of the endogenous switching regression (ESR) approach by comparing it with other possible models (propensity score matching (PSM) approach and Heckman's selection correction model).

We conceptualise that a rice farmer fulfils their labour demand using hired labour or other sources of labour (mainly family labour). In this regard, use of hired labour is observed if the expected utility from use of hired labour ($U_h$) is better than the corresponding utility from non-use of hired labour ($U_{Nh}$), i.e., $U_h - U_{Nh} > 0$. Let $A_i^*$ is the latent variable that captures the benefit from using hired labour by the $i^{th}$ farmer, and given as:

$$A_i^* = Z_i\alpha + \varepsilon_i \quad \text{Where } A_i = \begin{cases} 1 \; if \; Z_i\alpha + \varepsilon_i > 0 \\ 0 \quad \text{otherwise} \end{cases} \quad \text{(Eq. 1)}$$

$A_i^*$ is a binary variable, and equals to 1 if a farmer 'i' use hired labour and 0 if they do not use hired labour in rice production.

Z is a vector of variables related with household level demographic, resource ownership, production characteristics, access to services, and social capital that affects the decision to use or not to use hired labour in rice production.

$\varepsilon_i$ is an error term normally and independently distributed with mean zero and variance $\sigma^2$

$$Y_i = X_i\beta + \gamma A_i + u_i \quad \text{(Eq. 2)}$$

X is a vector of variables related with household level demographic, resource ownership, production characteristics, access to services, and social capital that affect the extent of rice commercialisation and productivity (yield). $\gamma$ represents the effect of hired labour use on rice commercialisation and yield.

The PSM approach and Heckman's selection correction model that have been widely employed to examine the impacts of technology adoption on farm outcomes and household welfare can be considered for the stated framework. However, PSM estimation tries to balance the observed distribution of covariates across the groups of users and non-users of hired labour. This implies that the probit, or logit estimates obtained in the estimation cannot be considered as determinants of hired labour use. Similarly, Heckman's selection approach can be employed but it assumes that the yield and commercialisation functions would differ only by a constant term, between users and non-users of hired labour. However, the difference between the two is more systematic due to the potential interaction between the hired labour use decision and determinants of yield and commercialisation.

The ESR approach, in a counterfactual framework, relaxes the assumptions imposed by PSM and Heckman's selection approach as it accounts for selection bias by treating selectivity as an omitted variable problem (Abdulai and Huffman, 2014; Jaleta et al., 2016). The ESR model therefore allows for the estimation of the selection equation along with endogeneity. In the ESR approach, farmers are partitioned according to their classification as users and non-users of hired labour in order to capture the differential responses of the two groups. It specifically treats use of hired labour as a regime shifter and the outcome equation (rice commercialisation status or yield), corrected for endogenous hired use, is given as follows:

$$Regime\ 1\text{: } Y_{1i} = X_{1i}\beta_1 + \sigma_{1\varepsilon}\hat{\lambda}_{1i} + \eta_{1i} \quad if\ A_i = 1\ (hired\ labour\ use) \quad \text{(Eq. 3a)}$$

$$Regime\ 0\text{: } Y_{2i} = X_{2i}\beta_2 + \sigma_{2\varepsilon}\hat{\lambda}_{2i} + \eta_{1i} \quad if\ A_i = 0\ (non\text{-}hired\ labour\ user) \quad \text{(Eq. 3b)}$$

Where $\hat{\lambda}_{1i} = \frac{\phi(Z_i\widehat{\alpha})}{\Phi(Z_i\widehat{\alpha})}$ and $\hat{\lambda}_{2i} = \frac{\phi(Z_i\widehat{\alpha})}{1-\Phi(Z_i\widehat{\alpha})}$ are the inverse Mill's ratios computed from the selection equation (Eq. 1) to correct for selection bias in the second-stage estimation (outcome equations, i.e. for rice commercialisation and yield). β and σ are parameters to be estimated, and η is an independently and identically distributed error term with mean zero and constant variance. The standard errors in equations 3a and 3b are bootstrapped to account for the heteroscedasticity arising from the generated regressors $(\phi)$.

Following equations 3a and 3b, the actual and counterfactual expected rice commercialisation/yield are below considering conditional expectations and treatment effects.

**Conditional expectations**

$$(a)\quad E[Y_{1i}|X,\ A_i=1] = X_{1i}\beta_1 + \sigma_{1\varepsilon}\hat{\lambda}_{1i} \quad \text{(Eq 4a)}$$
$$(hired\ labour\ users)$$

$$(b)\quad E[Y_{2i}|X,\ A_i=0] = X_{2i}\beta_2 + \sigma_{2\varepsilon}\hat{\lambda}_{2i} \quad \text{(Eq. 4b)}$$
$$(non\text{-}hired\ labour\ user)$$

$$(c)\quad E[Y_{2i}|X,\ A_i=1] = X_{1i}\beta_2 + \sigma_{2\varepsilon}\hat{\lambda}_{1i} \quad \text{(Eq. 4c)}$$
$$(hired\ labor\ users\ had\ they\ decided\ not\ to\ use)$$

$$(d)\quad E[Y_{1i}|X,\ A_i=0] = X_{2i}\beta_1 + \sigma_{1\varepsilon}\lambda_{2i} \quad \text{(Eq. 4d)}$$
$$(non\text{-}hired\ labour\ user\ had\ they\ decided\ to\ use\ hired\ labour)$$

Equations 4a and 4b are observed from the rice household survey data and equations 4c and 4d are the counterfactual outcomes. The counterfactual outcome is defined as the expected level of rice commercialisation or rice yield of hired labour users if their characteristics ($X_{1i}$) had the same return as non-hired labour users' characteristics ($\beta_2$), and *vice versa*.

**Treatment effects**

Accordingly, the expected change in the level of rice commercialisation/yield for rice households using hired labour i.e., the average effect on the treated households (ATT), is presented in equation 5a. The expected change in the level of rice commercialisation for households not using hired labour, i.e., the average effect on untreated households (ATU), is presented in equation 5b.

$$ATT = (a) - (c) = E[Y_{1i}|X,\ A_i=1] - E[Y_{2i}|X,\ A_i=1] = X_{1i}(\beta_1 - \beta_2) + \hat{\lambda}_1(\sigma_{1\varepsilon} - \sigma_{2\varepsilon}) \quad \text{(Eq. 5a)}$$

$$ATU = (d) - (b) = E[Y_{1i}|X,\ A_i=0] - E[Y_{2i}|X,\ A_i=0] = X_{2i}(\beta_1 - \beta_2) + \lambda_2(\sigma_{1\varepsilon} - \sigma_{2\varepsilon}) \quad \text{(Eq. 5b)}$$

**Table 2.2 Expected conditional, average treatment effects and heterogeneity effects**

| Outcome variable | Category | Decision stage | | |
|---|---|---|---|---|
| RCI yield | | To use hired labour | Not to use hired labour | Effect hired labour use |
| | ATT | (a) $E[Y_{1i}\|X, A_i=1]$ | (c) $E[Y_{2i}\|X, A_i=1]$ | $a$-$c$ |
| | ATU | (d) $E[Y_{1i}\|X, A\_i=0]$ | (b) $E[Y_{2i}\|X, A_i=0]$ | $d$-$b$ |
| | TH | $BH_1$=$a$-$d$ | $BH_2$=$c$-$b$ | $BH_1$-$BH_2$ |

Note: (a) and (b) represent observed outcomes for rice commercialisation and yield; (c) and (d) represent counterfactual outcomes for rice commercialisation and yield

$A_i$ =1 if the household i used hired labour;

$A_i$ =0 if the household i did not use hired labour;

$Y_{1i}$ = rice commercialisation/yield if a household used hired labour;

$Y_{2i}$ = rice commercialisation/yield if a household did not use hired labour;

$ATT$ = average treatment effect on treated;

$ATU$ = average treatment effect on untreated;

$BH_1$ = the effect of base heterogeneity for hired labour users (a–d);

$BH_2$ = the effect of base heterogeneity for non-hired labour users (c–b);

$TH$ = transitional heterogeneity (*ATT-ATU*)

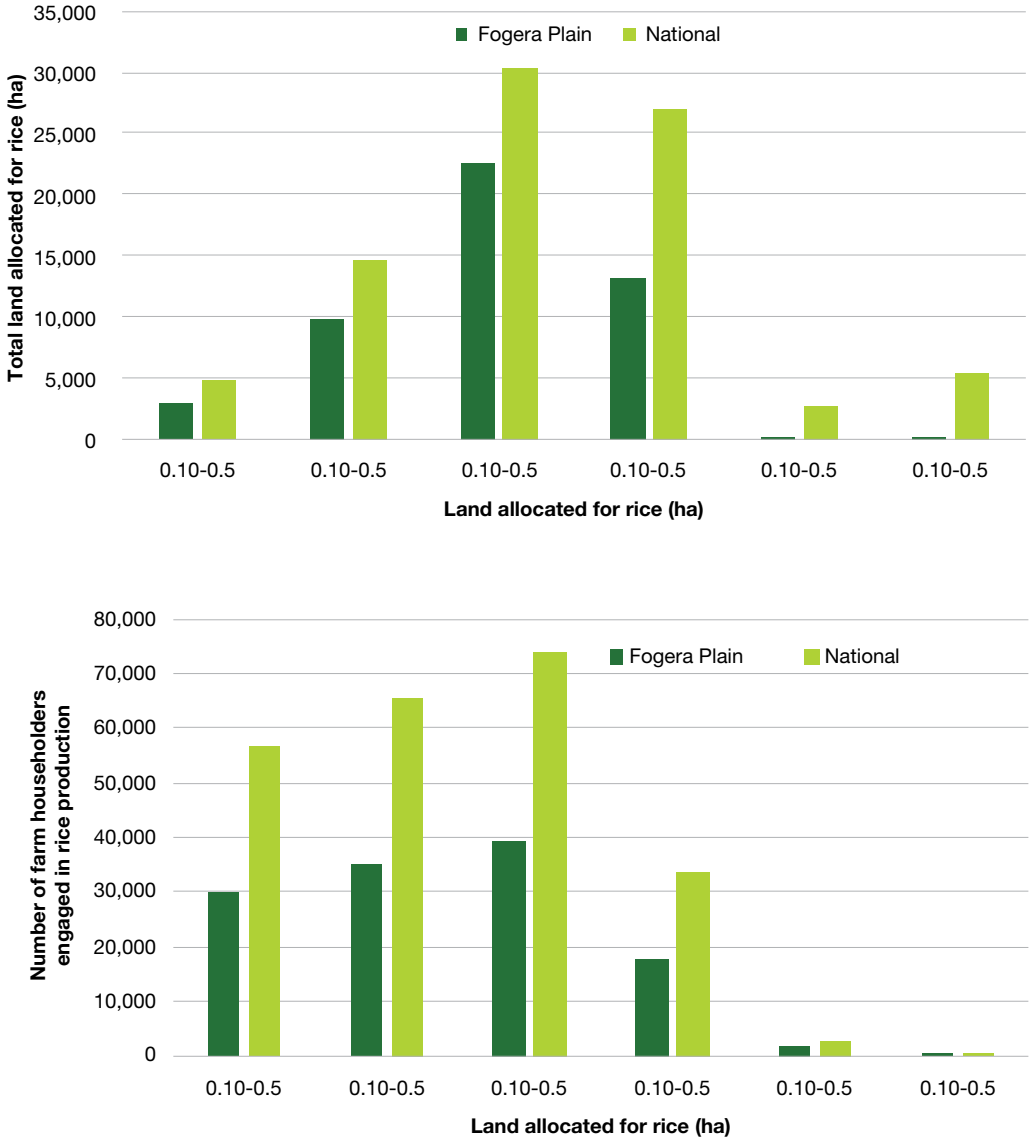
Source: Authors' own

# 3 RESULTS AND DISCUSSIONS

## *3.1 Rural labour market in the Fogera Plain*

With the expansion of rice production in the Fogera Plain, the rural labour market, highly characterised by the casual unskilled labour supply, has flourished. This is mainly associated with the nature of rice production, where certain agronomic practices demand timely accomplishment and family labour may not be sufficient. This has created an opportunity for rice farmers to hire labour when they need for extra labour, and also for unskilled labourers to gain casual employment.

**Figure 3.1 Distribution of rice farm households by land size allocated for rice (Fogera Plain and national level)**




Source: Authors' own, using data from CSA (2021)

The size of the rural labour market in the Fogera Plain is associated with the total number of rice producers in the Fogera Plain and the distribution of the amount of land allocated for rice. Though there is a debate about the limitation of available data on the size of land allocated for rice in the country and in Fogera Plain, it is estimated that there are close to 124,000 farm households, allocating about 50,000ha of land annually for rice in the three districts of Fogera, Libo Kemkem and Dera (Figure 3.1).

Labourers are employed on a casual basis from nearly towns and kebeles within the district. The wage rates range from 80 to 120 Ethiopian Birr per day depending the type of work and distance from Wereta town, which isa hub for rice processing and has an emerging hospitality service industry (Tadesse et al., 2020). The labourers are mainly from South Gondar (97 per cent) and the rest from North Gondar in Ethiopia's Amhara Region.

The operation of the labour market is fully informal: the market is highly seasonal, being linked with the production cycle of rice; there are no formal relationships between farmers and labours; and hiring arrangements are conducted through negotiations (daily wages, time of payment, and other terms). Due to this, the following key challenges were identified during discussions with farmers and labourers:

- Hiring required labour when needed is not always easy as labour availability is not stable. Labourers also find this to be a challenge as work isn't always available. This implies a mismatch in supply and demand for labour;
- Daily wages are not stable, making it difficult for smallholder rice farmers to plan their expenses;
- Some farm operations require specific skill sets, like fertiliser and herbicide applications, and finding skilled labour is sometimes very difficult; and
- No mechanism to settle labour disputes between farmers and labourers.

## 3.2 Hired labour use and characteristics of rice farmers

Our results indicate that in Fogera Plain, 52.4 per cent of the smallholder rice farmers use hired labour in the course of rice production. Considering CSA (2021), about 65,000 farm householders have demand for hired labour in the Fogera Plain. Table 3.1 presents the mean value of key variables that characterise rice farmers covering socio-demographics, resource ownership, production characteristics, social capital and access to services. In terms of demographic characteristics, rice farmers show statistically significant differences between users and non-users of hired labour for sex, age, formal education, and experiences in rice production. The proportion of male-headed households was also higher for users of hired labour (93 per cent) compared to non-users (85 per cent). Users of hired labour were, on average younger (about 43 years) compared to non-users (about 45 years). Though there is a low level of formal schooling among rice farmers, users of hired labour had a higher level of formal schooling compared to non-users. Rice farming experience was also slightly higher for users of hired labour compared to non-users.

Among the different production related variables, a statistically significant difference between users and non-users of hired labour was found for access to irrigation, use of fertiliser (DAP and urea) and pesticides (insecticide and herbicide), the number of rice plots and number of crops grown. A higher proportion of users of hired labour (54 per cent) had access to irrigation compared to non-users (44 per cent). Similarly, a higher proportion of users of hired labour applied chemical fertilisers and pesticides compared to non-users. On average, the number of plots allocated for rice was higher (2.79) for users of hired labour compared to non-users (2.44), whereas, the number of crops grown was higher, on average, for non-users of hired labour (3.03) compared to users (2.77).

In terms of resource ownership, there was a statically significant difference between users and non-users of hired labour for land owned, area covered by rice and livestock ownership. On average, users of hired labour had owned more land, allocated a larger area for rice, and owned more livestock (measured in tropical livestock units, TLUs) compared to non-users of hired labour. Similarly, a higher proportion of hired labour users had better social capital compared to non-users.

The descriptive analysis further indicates that access to extension services, land market participation, cooperative membership and use of credit showed a statistically significant difference between users and non-users of hired labour. Except for the use of credit, the proportion of users of hired labour was higher with regard to access to extension services, land market participation, and coop membership compared to non-users, whereas a higher proportion of non-users of hired labour used credit.

## 3.3 Rice productivity and commercialisation

The rice farmers' survey indicates that 52.4 per cent of farmers use hired labour in rice production. The mean difference test indicates that, on average, users

**Table 3.1 Descriptive statistics of hypothesised variables by hired labour use**

| Category | Variable | Total (N=723) | Hired labour users (N=379) | Hired labour non users (N=344) |
|---|---|---|---|---|
| Demographic characteristics | Sex of household head (1=male) | 0.89 (0.31) | 0.93*** (0.26) | 0.85 (0.35) |
| | Age of household head (years) | 44.19 (12.16) | 43.38 (12.32) | 45.08** (11.92) |
| | Education of household head (years of schooling) | 1.62 (2.46) | 2.05*** (2.63) | 1.16 (2.16) |
| | Rice farming experience (years) | 12.28 (6.35) | 12.66** (6.30) | 11.85 (6.39) |
| | Household size (number) | 5.52 (2.04) | 5.54 (1.97) | 5.49 (2.12) |
| Production practices | Access to irrigation (1=yes) | 0.49 (0.50) | 0.54 (0.50) | 0.44*** (0.50) |
| | Compost use (1=yes) | 0.19 (0.39) | 0.19 (0.39) | 0.19 (0.39) |
| | DAP use (1=applied recommended rate) | 0.41 (0.49) | 0.45** (0.50) | 0.37 (0.48) |
| | Herbicide use (1=yes) | 0.36 (0.48) | 0.43*** (0.49) | 0.29 (0.45) |
| | Insecticide use (1=yes) | 0.08 (0.28) | 0.10** (0.30) | 0.06 (0.24) |
| | UREA use (1=applied recommended rate) | 0.59 (0.49) | 0.61* (0.48) | 0.57 (0.50) |
| | Planting method (1=row planting) | 0.22 (0.42) | 0.28 (0.45) | 0.17 (0.37) |
| | Soil and water conservation practice (1=yes) | 0.91 (0.29) | 0.91 (0.29) | 0.91 (0.29) |
| | Rice plots (number) | 2.62 (1.36) | 2.79*** (1.37) | 2.44 (1.32) |
| | Crops grown (number) | 2.89 (1.60) | 2.77 (1.50) | 3.03** (1.69) |
| | Weeding frequency (number) | 2.88 (0.88) | 2.91(0.89) | 2.86 (0.88) |
| | Improved seed (1=yes) | 0.77 (0.42) | 0.77(0.42) | 0.77(0.42) |
| Resource ownership | Off or non-farm income (1=yes) | 0.22 (0.42) | 0.24 (0 .43) | 0.20 (0.40) |
| | Own land (ha) | 1.06 (0.65) | 1.13*** (0.69) | 1.00 (0.60) |
| | Area covered by rice (ha) | 0.72 (0.40) | 0.83***(0.43) | 0.61 (0.32) |
| | Rice farming experience (years) | 12.28 (6.35) | 12.66** (6.30) | 11.85 (6.39) |
| Social capital | Position in Kebele Administration (1=yes) | 0.21 (0.41) | 0.27***(0.44) | 0.14 (0.35) |
| | One to five group leaders (1=yes) | 0.60 (0.49) | 0.63** (0.48) | 0.56 (0.50) |
| Social capital | Distance to main market (minute) | 112.61(70.07) | 111.47 (69.87) | 113.86 (70.36) |
| | Extension service (1=yes) | 0.74 (0.44) | 0.78** (0.42) | 0.70 (0.46) |
| | Land market participation (1=yes) | 0.44 (0.50) | 0.56*** (0.50) | 0.37 (0.48) |
| | Cooperative membership (1=yes) | 0.47 (0.50) | 0.50*** (0.50) | 0.38 (0.49) |
| | Credit (1=received) | 0.28 (0.45) | 0.24 (0.43) | 0.31** (0.46) |

Source: Author's own, using data from an APRA Rice farmers' survey (2018)

of hired labour achieved a better yield compared to those who do not use hired labour, where the average rice yield achieved by users of hired labour was 11 per cent higher than for non-users (Table 3.2). However, both users (4.05t/ha) and non-users (3.61t/ha) of hired labour achieved higher yields compared to the national average, which is estimated at 2.84t/ha (CSA, 2018).

Similarly, users of hired labour were on average more commercial compared to non-users, with an RCI 3 per cent higher compared to non-users (Table 3.2). The overall RCI is estimated at 32 per cent, implying that on average rice farmers in the Fogera Plain sell 32 per cent of their total production.

We estimated RCI as the proportion of rice sold over total production in the production season considered (2018). The distribution of the rice farmers by the level of rice commercialisation indicates that there are more farmers in the category of 'highly commercial' and 'commercial' for users of hired labour compared to non-users (Table 3.3). The proportion of farmers who do not participate in the rice market (RCI=0) is higher (5.3 per cent) for non-users compared to users (2.5 per

cent) of hired labour. These trends indicate that hired labour use has a positive relationship with the level of commercialisation, where commercially-oriented rice farmers tend to use hired labour.

## 3.4 Determinants of hired labour use and its impact on rice productivity and commercialisation: estimates of ESR

### 3.4.1 Determinants of hired labour in rice production

The first stage probit model estimates of the determinants of hired labour are presented in Table 3.4. The results indicate that age, education status of the householder head and family size significantly affected use of hired labour. In line with our expectations, education of the household head affected use of labour positively, while family size and age of the household head affected it negatively; where a one-year formal education increased the probability of use of hired labour by 2.7 per cent on average, a one-person increase in the family size decreased the probability of hired labour use by 4.7 per cent, and a one-year increase in age of the household head decreased the probability of hired labour use by 0.34 per cent.

Among production-related factors, application of DAP fertiliser and herbicides, application of row planting, and weeding frequency were found to significantly and positively affect the use of hired labour, whereas total number of crops grown and number of plots allocated for rice per household affected it negatively. Application of fertiliser and row planting, as expected, demanded more labour. Accordingly, the probability of using hired labour increased by 9.5 per cent if the household applied the recommended rate of DAP fertiliser, and by 3.7 per cent if a household increased the frequency of weeding one time. The increase in the number of rice plots by one implies a reduction of the probability of use of hired labour by 7.05 per cent. This is associated with the fact that as the number of plots increases, the plots tend to be located in different rice agro-ecology zones, spreading the one-time labour demand for the same agronomic practices. As the number of crops grown increases by one type, the probability of using hired labour in rice also decreases by 3.64 per cent, which is linked with the limited specialisation in rice production.

Among factors related with resources owned, the availability of income from off-farm or non-farm activities, size of land allocated for rice, and livestock

**Table 3.2 Mean difference in rice yield and RCI by use of hired labour**

| Outcome | Indicators | Use of hired labour | | Total | Mean difference |
|---|---|---|---|---|---|
| | | Non-users | Users | | F-Value |
| Yield (kg/ha) | Mean | 3,606.56 | 4,045.55 | 3,836.68 | 15.63*** |
| | Std | 1,454.45 | 1,523.43 | 1,506.04 | |
| | n | 344 | 379 | 723 | |
| RCI | Mean | 0.30 | 0.33 | 0.32 | 5.08** |
| | Std | 0.19 | 0.18 | 0.19 | |
| | n | 344 | 379 | 723 | |

Source: Authors' own, using data from APRA Farmers' Survey, 2018

**Table 3.3 Distribution of rice farmers by level of commercialisation and labour use**

| Commercialisation levels | Hired labour use | | | | Total | |
|---|---|---|---|---|---|---|
| | Non-users | | Users | | | |
| | N | % | N | % | N | % |
| Non-commercial (RCI=0) | 38 | 5.3 | 18 | 2.5 | 56 | 7.7 |
| Moderately commercial (RCI ≤ 0.25) | 111 | 15.4 | 118 | 16.3 | 229 | 31.7 |
| Commercial (0.25 RCI ≤ 0.5) | 164 | 22.7 | 184 | 25.4 | 348 | 48.1 |
| Highly commercial (RCI>0.5) | 31 | 4.3 | 59 | 8.2 | 90 | 12.4 |
| Total | 344 | 47.6 | 379 | 52.4 | 723 | 100.0 |
| Distribution difference (Chi-square) | 15.56*** | | | | | |

Source: Authors' own, using data from APRA Farmers' Survey, 2018

Note: *** indicates a significance at 1 per cent and N represents the number of respondents; RCI is calculated by dividing the total rice sold by the total produced

ownership in terms of TLUs, were found to positively affect the probability of hired labour use in rice production. Availability of income from off-farm and non-farm activities also increased the probability of using hired labour by 9.25 per cent. This is linked with the additional income that can be mobilised to finance hired labour use. As expected, increasing the area allocated for rice by 1ha, led to the probability of using hired labour increasing by 50.13 per cent, which indicates that land allocated for rice is the most important factor for use of hired labour. A unit increase in livestock ownership in terms of TLU increases the

**Table 3.4 Determinants of hired labour use decision: Probit estimation**

| Category | Explanatory variables | Coef. | Std. err. | Marginal effect |
|---|---|---|---|---|
| Demographic characteristics | Age of household head (years) | -0.0085* | 0.0050 | -0.0034 |
| | Education of household head | 0.0689*** | 0.0241 | 0.0273 |
| | Rice farming experience (years) | 0.0154 | 0.0099 | 0.0061 |
| | Household size (number) | -0.1186*** | 0.0301 | -0.0471 |
| | Sex of household head | -0.1493 | 0.1860 | -0.0592 |
| Production characteristics | Access to irrigation (1=yes) | 0.0892 | 0.1073 | 0.0354 |
| | DAP use (1=applied recommended rate) | 0.2394** | 0.1171 | 0.0945 |
| | UREA use (1=applied recommended rate) | 0.1677 | 0.1095 | 0.0665 |
| | Herbicide use (1=yes) | 0.2717*** | 0.1110 | 0.1070 |
| | Insecticide use (1=yes) | 0.0805 | 0.1933 | 0.0318 |
| | Rice plots (number) | -0.1777*** | 0.0558 | -0.0705 |
| | Crops grown (number) | -0.0917** | 0.0404 | -0.0364 |
| | Planting method (1=row planting) | 0.2885** | 0.1268 | 0.1128 |
| | Weeding frequency (number) | 0.0923* | 0.0568 | 0.0366 |
| | Improved variety use (1=yes) | -0.1367 | 0.1332 | -0.0542 |
| Resource ownership | Own land (ha) | 0.0559 | 0.1220 | 0.0222 |
| | Off or non-farm income (1=yes) | 0.2359* | 0.1292 | 0.0925 |
| | Area covered by rice (ha) | 1.2637*** | 0.2082 | 0.5013 |
| | Livestock ownership (TLU) | 0.1090*** | 0.0296 | 0.0432 |
| Social capital | One to five group leaders (1=yes) | -0.0858 | 0.1208 | -0.0340 |
| | Number of relatives with regular contact | 0.0156* | 0.0088 | 0.0062 |
| | Number of non-relatives with regular contact | -0.0194*** | 0.0077 | -0.0077 |
| | Number of processors with regular contact | 0.0068 | 0.0080 | 0.0027 |
| | Number of regular clients for selling rice | -0.0022 | 0.0378 | -0.0009 |
| | Number of traders in all market a farmer knows | -0.0096 | 0.0111 | -0.0038 |
| Access to services and infrastructure | Distance to main market (minutes) | -0.0004 | 0.0008 | -0.0002 |
| | Extension service access (1=yes) | 0.0385 | 0.1294 | 0.0153 |
| | Land market participation (1=yes) | 0.1495 | 0.1157 | 0.0592 |
| | Cooperative membership (1=yes) | 0.2790** | 0.1143 | 0.1102 |
| | Credit (1=received) | -0.0622 | 0.1176 | -0.0247 |
| | Constant | -0.3347 | 0.5011 | |
| Module diagnosis | Number of observations | 723 | | |
| | Wald chi2(30) | 153.78*** | | |
| | Pseudo R2 | 0.1837 | | |
| | Log likelihood | -408.39 | | |

Note: ***, ** and * are significant at 1 per cent, 5 per cent and 10 per cent respectively
Source: Authors' own, using data from APRA Farmers' Survey, 2018

probability of hired labour use by 4.32 per cent, which is associated with the additional income a household can generate from livestock for financing hired labour.

Among social capital factors, the number of relatives and non-relatives that a farmer has regular social contact with was found to be statistically significant; an increase by one in the number of relatives that a farmer has regular contact with saw an increase in the probability of using hired labour by 0.62 per cent. This is associated with the assistance that relative can offer in accessing labour for hire. On the other hand, the probability of using hired labour decreases by 0.77 per cent if the number of non-relatives that a farmer has regular contact with increases by one. This has to do with the possibility of mobilising labour through traditional approaches like *Debo*[1] to fulfil labour demand rather than hiring labour.

Membership in cooperatives was also found to positively affect the use of hired labour, where membership increased the probability of using hired labour by 11.02 per cent. Agricultural cooperatives in the area are the major service providers, including information about input and output marketing.

### *3.4.2 Impact of use of hired labour on rice productivity and RCI*

The impact of the use of hired labour on rice productivity and the extent of rice commercialisation is summarised in Table 3.5. As the estimates indicate, hired labour use has a positive impact on rice productivity and commercialisation. Results from the ESR treatment effect model show that rice productivity is higher by 0.4t/ha for users of hired labour compared to their counterfactuals if they were non-users of hired labour. Similarly, rice productivity increased, on average, by 0.331t/ha for non-users of hired labour if they applied hired labour in the production process. This can be associated with the timely accomplishment of farm operations. For instance, an estimation about grain losses at different harvesting times based on rice crop maturity indicated that a one-week delay of harvesting after maturity results in a 5.63 per cent grain loss, and a two-week delay results in a 8.64 per cent (Lantin, 1999). The transitional heterogeneity effect is positive, which implies that the productivity effect is greater for users compared to non-users of hired labour.

Further, the results from the ESR treatment effect model show that rice commercialisation (RCI) is higher by 0.02 units for users of hired labour compared to their counterfactuals if they were non-users of hired labour. Similarly, the RCI would have been increased on average by 0.06 units for non-users of hired labour if they apply hired labour in the production process. The transitional heterogeneity effect is negative, which implies that the commercialisation effect is greater for non-users compared to users of hired labour.

These results clearly indicate that the use of hired labour contributes in enhancing rice productivity and commercialisation in the Fogera Plain. The emergence of a rural labour market in the area, mainly for casual labour, has enabled rice farmers to better access labour when needed.

**Table 3.5 Expected conditional and average treatment effects of hired labour use on productivity and commercialisation: ESR estimates**

| Outcome variable | Category | Decision stage | | |
|---|---|---|---|---|
| | | To use hired labour | Not to use hired labour | Effect of hired labour use |
| Rice productivity | ATT | (a) 4045.55(679.11) | (c) 3642.35 (593.19) | 403.19*** |
| | ATU | (d) 3937.37 (776.21) | (b) 3606.56 (609.91) | 330.81*** |
| | TH | BH1=108.18 | BH2=35.79 | TH=72.38 |
| Rice commercialisation | ATT | (a) 0.3316 (0.047) | (c) 0.3117 (0.049) | 0.02*** |
| | ATU | (d) 0.3549 (0.051) | (b) 0.3003 (0.045) | 0.055*** |
| | TH | BH1=-0.013 | BH2=0.011 | TH=-0.035 |

Note: *** is significant at 1 per cent
Source: Authors' own, using data from APRA Farmers' Survey, 2018

1 Debo is a traditional, mutual and voluntary labour sharing mechanism where farmers within a community help each other, especially during period of peak labour demand.

# 4 CONCLUSION AND RECOMMENDATIONS

The introduction of rice in the Fogera Plain has contributed to the development of a rural labour (mainly casual labour) market with about 52 per cent of the smallholder rice farmers using hired labour to accomplish their required agronomic practices. In this paper, we assessed the role of hired labour use on rice productivity and its commercialisation based on data collected from 723 randomly selected smallholder rice farmers in the Fogera Plain.

The estimated impact of hired labour use on rice productivity shows that, on average, rice yield was higher by 0.4t/ha for users of hired labour compared to their counterfactuals if they were non-users of hired labour. Similarly, rice productivity would have been increased on average by 0.331t/ha for non-users of hired labour if they applied hired labour in the production process. Timely accomplishment of farm operations starting from land preparation to threshing are very crucial for improved productivity and quality of production. This is also in line with the fact that hired labour use was highly associated with the use of productivity enhancing inputs like fertiliser.

The estimated impact of hired labour use on rice commercialisation shows that, on average, RCI was higher by 0.02 units for users of hired labour compared to their counterfactuals if they were non-users of hired labour. Similarly, the RCI would have increased on average by 0.06 units for non-users of hired labour if they applied hired labour in the production process.

These results imply that in addition to creating employment opportunities for rural youth, through the development of the rural labour market, hired labour contributes significantly to the enhancement of productivity and commercialisation of rice in the study area. Thus, it will be important to further enhance the development of a labour market that reduces the mismatch between supply and demand through labour market information systems, formalisation of market relations, and setting up of localised dispute settlement mechanisms. In addition, it will be important to promote labour saving technologies for rice production. All these recommendations require further research, piloting of innovations and policy engagement.

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