Journal of Rural and Community Development

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Citation:

Kassie, G. T., Kassa, H., Padoch, C., Abebaw, D., Limenih, M., & Teka, W. (2014). Resource entitlement and welfare among resettlers in the dry forest frontiers of northwestern Ethiopia. *The Journal of Rural and Community Development, 9*(2), 81-102.

Publisher: Rural Development Institute, Brandon University.

Editor: Dr. Doug Ramsey

Issue Dedication:
This issue of the JRCD is dedicated to Cheryl Williams who passed away suddenly in 2010. She was in the first semester of her PhD program in Nursing at the University of Saskatchewan at the time of her death. Her co-authored paper in this issue is based on her master's thesis research. Pammla Petrucka was Cheryl's advisor. It was Pammla's wish to publish this peer-reviewed article in honour of Cheryl's work and her family.

ISSN: 1712-8277 © Journal of Rural and Community Development
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Resource Entitlement and Welfare among Resettlers in the Dry Forest Frontiers of Northwestern Ethiopia

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Abstract

Ethiopia has been resettling poor rural households both voluntarily and involuntarily from degraded and drought prone highlands to sparsely populated areas in the lowlands since the late 1950s. This study investigated resource entitlement and factors that influence perceived level of food and income security among resettlers of different origins and different length of stay in a district where resettlement has been practiced for over twenty years. The results of the study indicated the need to revisit the country's rural development strategy that puts resettlement as one of the primary methods to ensure food security of vulnerable households given the heterogeneity among settlers in terms of origin, roles of women, and the overall need for minimizing the impact of resettlement on the environment. Selection of origin of settlers, ensuring women's access to resources particularly land, diversification of

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livelihood activities should be promoted to improve food security. Besides, development of rural infrastructure notably roads and markets should be given due emphasis to enhance the role of non-agricultural income generating activities and thereby reduce dependence on dry forests.

Keywords: food shortage, income shortage, resettlement, 3SLS, Sure

1.0 Introduction

Ethiopian agriculture is characterized as traditional, rainfed, low-input, low-productivity, predominantly subsistent, and yet as the most important sector in the national economy. Smallholder farming is the dominant livelihood activity for the majority of Ethiopians, but it is also the major source of vulnerability to poverty, food insecurity and their often fatal consequences – chronic malnutrition, premature mortality and recurrent famines (Devereux & Guenther, 2007). Particularly, low levels of input use, ancient farming and storage practices, inappropriate polices, tenure insecurity, as well as the degradation of the environment and its productive potential are the underlying reasons for poverty, food insecurity and increased vulnerability to drought in the Ethiopian highlands (Kassa, 2004; Stellmacher & Eguavoen, 2011).

The Ethiopian highlands (above 1500 m.a.s.l.) constitute about 46% of the total area of the country, support more than 80% of the population, and account for over 95% of the regularly cultivated land and about 75% of the livestock population (Shiferaw & Holden, 1998). In the Ethiopian highlands, agriculture is dominated by small scale mixed crop-livestock subsistence farms. National statistical reports indicate that 10% of the farming households grow only crops where 86% are engaged in crop and livestock farming (CSA, 2011). In these areas, the population growth rate is creating increasing pressure on land and other natural resources (Devereux et al., 2007). Thus average farm size is shrinking. During the 2009/10 crop season, more than a third of close to 15 million agricultural land holders in the highland areas cultivated less than half a hectare of land, and 60% of them live on a hectare or less of land. Only 16% cultivated more than 2 hectares of land (CSA, 2011). Environmental degradation is the other challenge in the Ethiopian highlands with severe land degradation and very little recycling of organic materials such as manure and crop residues, high deforestation rates and depletion of ground and surface water (Benin & Pender, 2002).

One of the coping strategies farming communities in the highlands developed to escape from the vagaries of fragile livelihoods and fatal shocks is migrating and resettling in higher potential and less populated areas within the country where one finds dry forests and woodlands[1]. Resettlement in this paper refers to forced or voluntary movement of people from their habitual residence—considered to be more socio-economically and environmentally stressful—to areas of better biophysical resources expected to offer them better livelihood opportunities (AU, 2009; Mulugeta & Woldesemait, 2011) even though the new areas could be less hospitable in terms of weather and disease such as malaria incidences and poor access to social services and infrastructure.

[1] Dry forest and woodlands in Ethiopia occupy close to half of the total land area (WBISPP, 2004).

Ethiopia has a long history of resettling people from highly vulnerable and degraded areas to sparsely populated and less exploited corners of the country. The first government-led resettlement in Ethiopia happened in the late 1950's by moving people from the Northeastern parts to Southern parts of the country (Cernea, 2000; Fosse, 2006; Gebre, 2004). More radical resettlement programs however happened during the military (1974-1991) and the current (EPRDF) regimes that is governing the country since mid-1991.

Most authors reported failure and delinquency on Ethiopia's five decades of sporadic and yet significant resettlement efforts (e.g., Berhanu, 2003; Desalegn, 1988; Getachew, 1989; Pankhurst, 2009; Pankhurst & Piguet, 2009). Irregularities and mishaps in the resettlement programs implemented under the imperial system (1930-1974), the military regime (1974-1991), and current ethno-centric government system (1991 to date) of Ethiopia can be categorized into three broad classes. The most important problem commonly shared by the programs of the three regimes is poor planning. The resettlement programs were all post-disaster endeavors that were planned hastily with settler and settling site selection done erratically without, inter alia, any due consideration of socioeconomic and biophysical dynamics both in the sources and destinations of settlers. In addition to poor destination site and settler selection, coercion of poor farming households, and the dehumanizing movement and settlement of people—in situations where there were not even temporary shelters—were typical characteristics of the resettlements undertaken in Ethiopia, particularly during the 1980s (Desalegn, 2003; Messay, 2009). Faulty implementation of the programs caused great hardship and loss of life, and most people who were forcibly resettled returned home as soon as they could (Devereux & Guenther, 2007). The widespread suffering and the high mortality that occurred in the 1980s en route to resettlement sites and upon arrival showed how poorly the resettlement programs were executed (Feleke, 2003; Tefera & Sterk, 2008).

The second category of weaknesses of the resettlement programs is the lack of discussions with host communities in the resettlement sites whose access and entitlement to land and forest resources were significantly affected (Desalegn, 2003; Pankhurst & Piguet, 2009; Stellmacher & Eguavoen, 2011). The discussions could have been useful in identifying and employing measures that facilitate smooth integration of settlers with the host communities. The fact that settlers had the right to settle and host communities had *de facto* rights on land and forests, in some cases created legal pluralism (Stellmacher & Eguavoen, 2011) and led to many conflicts that compromised the livelihoods of both settlers and host communities (Devereux & Guenther, 2007; Mulugeta & Woldesemait, 201).

The third class of drawbacks of the resettlement programs in Ethiopia is the lack of long-term objective and vision. Unless due consideration is given to sustainably managing the resource base, there will be a danger of falling into the vicious cycle of poverty: from the desperate use of natural resources, degradation of resources to poverty. There were no alternative and progressive plans that aimed at transforming the livelihoods of settlers and host communities to less nature-dependent economic activities, nor were there specific measures designed to ensure responsible use of natural resources. This was complicated by the heterogeneity of resettled communities that made collective action even more difficult (Paumgarten, Kassa, Zida, & Moeliono, 2012) as people from different regions, for example, opted for different forest management arrangements (Lemenih, Kassa, Kassie, Abebaw, & Teka, 2012). Since socio-economic and demographic characteristics influence

people's dependence on forest resources (Abebaw et al., 2012), they may have varying interests in managing it responsibly. For instance, farming communities that practiced very exploitative agriculture in a degraded environment moved to a less degraded area and resumed the same farming practices. As such, major negative impacts to the natural ecosystem in the destination areas are expected since these ecosystems are known to be sensitive to forest and land degradation (Lemenih & Kassa, 2011). A wealth of empirical research has shown that the programs engendered massive destruction of the country's forest resources and introduced intensive highland agricultural techniques in areas which had delicate soils and supported low population densities that practiced mainly shifting cultivation (Cohen and Isaksson, 1988; Desalegn, 2003; Gebre, 2003; Getachew, 1989; Woube, 1999). In a nut shell, the resettlements that aimed at tackling the problems of land scarcity, famine, and ecological degradation in the highlands have resulted in the spread of these problems to regions which were previously less affected (Desalegn, 1988; Devereux & Guenther, 2007; Pankhurst & Piguet, 2009).

The principal objective of the resettlement programs has essentially been to improve farmers' access to larger and more fertile plots and thereby to increase agricultural productivity and enhance food security. Before the mid-1970s, the Imperial Government intended to rationalize land use on government owned land and thus raise state revenue, and to provide additional resources for the hard pressed northern peasantry by relocating them to the southern regions & Woldesemait, 2011). An estimated 20,000 households were settled. The settlement undertakings by the military regime that settled some 100,000 households (CSA, 2011; Mundi Index, 2013) in the 1980s aimed at addressing food insecurity and averting famine caused by drought, land degradation, and farmland scarcity in central and northern parts of the country (Abbute, 2003).

After a decade of reluctance to consider resettlement as part of its rural development agenda, the current government incorporated resettlement into its food security strategy in 2002. Policies and strategies have since been highlighting the importance of resettlement to improving the livelihoods of not only settlers but also of their relatives in their home areas through trickle-down effects. The Climate Resilient Green Economy Strategy of the Government of Ethiopia issued in 2011 underscored the demerits of increasing agricultural production through area expansion though the specific role of resettlement was not discussed (FDRE, 2011).

It is important to see whether the livelihoods of settlers have improved before looking at the spillover effects that might occur. The Government's resettlement strategy aims at resettling even more people in the sparsely populated lowlands in response to the problems of farm size fragmentation and land degradation in moisture deficit highland areas (FDRE, 2003). The national resettlement strategy is envisioned to resettle about 2.2 million people over five years (FDRE, 2003; FDRE, 2004). According to Sisay (2007), the Amhara Regional State alone had a plan to resettle 200,000 households or 1 million people over five years (2003–2007). The resettlement program of the Amhara region has been implemented in North Gondar and Awi Administrative Zones of the region. Metema, Quara, Tach Armachiho and Tsegedie in North Gondar Zone and Jawi district in Awi Zone are the host districts. Until June 2005, a total of 109,909 people have been relocated from food insecure districts of the Amhara region to all five settlement districts. There were a total of about 43 settlement villages in these five districts. These settlement sites include

both new areas, which are developed by clearing the forest, as well as existing settlement sites in which newcomers are added.

Like other districts, the most recent resettlement in Metema district was started in 2003, and by the end of 2006 the district had received three consecutive batches of settlers. Taken together, the district had received about 18,586 households and distributed land for each household. Most of the resettlers in Metema came in 2005. The settlers are diverse in terms of their geographic origin. In particular, the resettlers came from Wag Hamira, North Welo, South Welo, North Shewa, West Gojjam Zones, and the neighboring districts within North Gondar Zone. In fact, most of the settlers originated from North Gonder Zone itself.

To what extent resettlement has helped relocated farmers to build assets and reduce their perceived food and income insecurity has not been adequately studied. It is assumed that asset building and the perception of feeling more food and income secure improves with the length of stay in the resettlement areas. If this does not happen or if settlers face challenges in doing so, they tend to go back to their original places. In this respect, a study pointed out that of the 109,909 relocated settlers in three years, close to 50% had actually returned to their original places (Sisay, 2007). The main reason for returning was indicated to be unmet promises. The settlers in Metema district were promised that each household would receive a package of assistance that included access rights for up to 2 hectares of fertile land, seed, oxen, hand tools, utensils, and food rations for the first eight months. The extent to which this promise was kept and farmers were able to use this package was crucial for determining the livelihoods of these new settlers. The recent thinking and empirical work on 'asset thresholds' reveals that households with inadequate access to key productive assets may be unable to accumulate assets and grow their way out of poverty (Devereux & Guenther, 2007).

This paper examines resource entitlements and the settlers' perceptions of food and income insecurity. It presents a detailed synthesis of the factors that influence access to resources, food and income security perceptions among resettlers of different origins and different lengths of stay in Metema. The study will contribute to the existing knowledge base on resettlement and livelihoods by presenting a rigorous analysis as to whether resource access promises were met and what actually determined vulnerability to food and monetary income shortages.

The paper is organized as follows. The next section briefly describes the study area, Metema district, followed by a description of the data collection and management procedures in Section 3. Section 4 presents the analytical framework employed for the inferential statistics used in the study. In Section 5, results and a discussion are presented. Finally, section six presents the major conclusions of the study.

2.0 Study Area

The study was conducted in Metema district of Amhara Regional State, northwestern Ethiopia. Metema is located between 35° 54' 22.8"E – 36° 47' 2.62"E longitude and 12° 17' 31.12" N – 13° 06' 35.03"N of latitude. It is one of the 18 districts in North Gondar Zone of the Amhara National Regional State (Figure 1). Metema district has 20 Kebeles[2] in total, 18 of which are rural. The capital of the district is located about 900 km northwest of Addis Ababa and about 180 km west

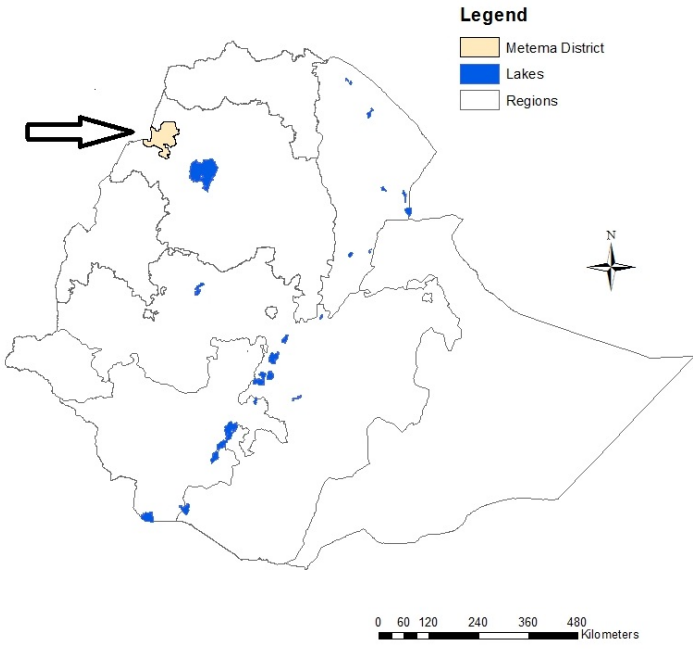
[2] The smallest political administration unit in Ethiopia (singular = Kebele).

of Gondar town. Metema is 6970 km^2 wide and is inhabited, in 2011, by about 123,200 people (CSA, 2011).

The District's altitude ranges from 550 to 1608 m.a.s.l while the minimum annual temperature ranges between 22^{o}C and 28^{o}C. Daily temperature becomes very high during the months of March to May, reaching as high as 43^{o}C. Metema has a uni-modal rainfall. Based on the decadal rainfall data, the highest monthly rainfall is observed in August. The average annual rainfall obtained from the Metema metrological station was 840.6 mm. The maximum annual rainfall observed was 1159.2 mm in 1987 and the minimum annual rainfall is recorded was 728.3 mm in 1990 (Sisay, 2007).

Agro-ecologically, Metema is characterized as lowland. The most important livelihood options of the inhabitants are agriculture and activities related to exploiting the natural vegetation. The soils in the district are predominantly black and some soils have vertic properties (Desalew, Tegegne, Nigatu, & Teka, 2011). Farmers consider the soils in the area as fertile and hence there is minimal use of soil fertility enhancing inputs (Desalew et al., 2011). The main crops grown in the district are sorghum, sesame, and cotton. Cattle, goats, donkeys, sheep, and camel are livestock species in the area. Thus, grazing and browsing is an integral part of the land use system.

Figure 1: Location of Metema District.



Source: Kindie Tesfaye, CIMMYT GIS Unit. Addis Ababa, Ethiopia.

3.0 Data Management

Both primary and secondary data were used in this research. The secondary data and records were collected from previous research reports and the archives of the District Office of Agriculture (DoA). The primary data were collected using both informal and formal surveys. During the informal survey, discussions were held with 40

people in three separate groups including new settlers (2-3 years), earlier settlers (14-25 years), native people, and experts of DoA. These 40 discussants were selected purposively from natives and resettlers. In selecting the resettlers, length of stay in the district was the criterion, while DoA experts were selected only if they have any official responsibility to work in areas where resettlements were implemented. We used group discussions in all cases, since the aim was essentially to explore the communal wisdom with regard to the impact of the resettlement schemes carried out over the years in the district. Effort was made not to mix the settlers of different length of years of settlement in the same group during the discussion. The discussion with experts of DoA were held at Metema town. Discussions were also held with staff of the Gondar Agricultural Research Centre in Gondar town and Environmental Protection Land Administration and Use Authority (EPLAUA) in Bahir Dar town, the regional capital. The discussions were used to make sense of the quantitative data generated using the formal survey.

For the formal survey, 10 Kebeles were randomly selected out of the 20 Kebeles in the district. The list of all households in each Kebele was acquired from the Kebele residents' registry and it served as a sampling framework. Then a lottery method was used to select 20 households randomly with a replacement from each Kebele. The sample survey covered nine of the ten Kebeles and one Kebele was left for security reasons. A valid sample of 180 households was interviewed during the survey using a structured questionnaire. Experts of DoA were trained and hired to administer the questionnaire under the supervision of two senior researchers.

4.0 Analytical Framework

The federal food security strategy emphasized that the resettlers will be made food secure after only one season of harvest through the provision of sufficient fertile land and a pair of oxen for traction, a crucially important asset for farming in Ethiopia. Assessing the perceived level of food security and experiences of income shortage will clearly show whether the strategic objectives were achieved. Respondents who settled in the area for a minimum of two years were asked whether they experienced food shortage or income shortage in the year preceding the survey. The assumption was that if the respondent experienced food shortage or income shortage, then he or she would still be food insecure and entitlement to food was hampered. Two binary logit models were estimated to identify and estimate the relative importance of the factors that influenced the food shortage or income shortage experiences of respondents in the district.

The binary logit model employed here is formulated as follows. The response variable (Y_i) was given the value 1 if the response was yes (Y_i=1) and 0 otherwise (Y_i =0). Computation of the probability that the respondent had faced food shortage (income shortage) (Y_i = 1) can be formulated as:

$$\Pr \boldsymbol{ob}(\boldsymbol{Y_i} = 1) = \boldsymbol{F}(\boldsymbol{X_i}\boldsymbol{\beta}) \quad (1)$$

where X_i is a vector of explanatory variables and β is a conformable vector of coefficients to be estimated. By choosing F to be a logistic distribution, the probability can be estimated using the logit formulation as:

$$\Pr ob(Y_i = 1) = \Lambda(X_i\beta) = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)} \quad (2)$$

An easier way of interpreting the estimated coefficients is to consider the partial derivatives of the probability that Y_i equals one with respect to a continuous variable or with respect to a change from the reference level to another of a discrete variable (X_k). The partial derivatives give the marginal effects and are formulated as:

$$\frac{\partial E(Y_i = 1)}{\partial X_k} = \frac{\exp(X_i\beta)}{(1+\exp(X_i\beta))^2}.\beta_k \qquad (3)$$

The estimation of the logit model is done with the maximum likelihood (ML) approach. The general log likelihood function is specified as:

$$\log \boldsymbol{L}(\boldsymbol{\beta}) = \sum_{i=1}^{N} \boldsymbol{Y_i} \log \boldsymbol{F}(\boldsymbol{X_i'\beta}) + \sum_{i=1}^{N} (1-\boldsymbol{Y_i}) \log(1-\boldsymbol{F}(\boldsymbol{X_i'\beta})) \qquad (4)$$

The first order condition of the ML function is generated by differentiating the above equation with respect to β, which gives:

$$\frac{\partial \log \boldsymbol{L}(\boldsymbol{\beta})}{\partial \boldsymbol{\beta}} = \sum_{i=1}^{N} \left[\frac{\boldsymbol{Y_i} - \boldsymbol{F}(\boldsymbol{X_i'\beta})}{\boldsymbol{F}(\boldsymbol{X_i'\beta})(1-\boldsymbol{F}(\boldsymbol{X_i'\beta}))} \boldsymbol{f}(\boldsymbol{X_i'\beta}) \right] \boldsymbol{X_i} = 0 \qquad (5)$$

where f is equal to F′, and denotes the density function. For the logistic function the above equation is simplified as:

$$\frac{\partial \log \boldsymbol{L}(\boldsymbol{\beta})}{\partial \boldsymbol{\beta}} = \sum_{i=1}^{N} \left[\boldsymbol{Y_i} - \frac{\exp(\boldsymbol{X_i'\beta})}{1+\exp(\boldsymbol{X_i'\beta})} \right] \boldsymbol{X_i} = 0 \qquad (6)$$

The solution for this equation is the maximum likelihood estimator $\hat{\boldsymbol{\beta}}$. This estimator can be used to estimate the probability that $Y_i = 1$ for a given X_i as:

$$\hat{\boldsymbol{P}}_i = \frac{\exp(\boldsymbol{X_i'}\hat{\boldsymbol{\beta}})}{1+\exp(\boldsymbol{X_i'}\hat{\boldsymbol{\beta}})} \qquad (7)$$

The third model focuses on analyzing the determinants of farmland size and livestock ownership by resettlers. In fact, ownership of these assets is crucial for the agrarian livelihoods in more ways than one. By implication, identifying the factors influencing the ownership of these crucially important assets for income security would suggest possible interventions to enhance the viability of livelihoods of settlers in Metema. In principle, the resettlement program states that land to the settlers would be distributed following an egalitarian approach. However, in actual practice, the results of our survey indicate that there was a high degree of land holding inequality (Gini Coefficient = 0.5) among resettled households

The models estimated are formulated as:

$$\boldsymbol{Farmsize}_i = \boldsymbol{\beta}_0 + \sum_j^m \boldsymbol{\beta}_i \boldsymbol{X}_{ij} + \boldsymbol{\varepsilon}_i \qquad (8)$$

$$\boldsymbol{TLU}_i = \boldsymbol{\gamma}_0 + \sum_j^m \boldsymbol{\gamma}_i \boldsymbol{X}_{ij} + \boldsymbol{\upsilon}_i \qquad (9)$$

where β and γ are the parameters to be estimated, ε and υ are disturbance terms, *i* denotes the sample individual, and *j* denotes the explanatory variable (*j*= 1,2,..,m).

The discussion above has shown that although there was an official promise made to resettlers about the provision of land based on family size, the size of land that

resettler owned is highly variable. This simply implies that there were many factors in play in determining the size of land owned by the resettled households. Either they were allocated differently or the settlers themselves went on clearing dry forests and woodlands and expanded their farm size. The size of farmland owned (y_1) is therefore hypothesized to be influenced by different respondent characteristics (e.g. gender, age, length of stay) and household characteristics such as wealth status and livestock holding (y_2) of the household head. Similarly, livestock wealth—used as proxy of estimating the access to plowing oxen and additional sources of income—is expected to be influenced by similar sets of factors including farm size (y_1) owned by the household. This clearly indicates the econometric problem of endogeneity and simultaneity. We have, therefore, simultaneously estimated equations 8 and 9 using the three stages least square estimator of seemingly unrelated regressions.

Three-stage least square (3SLS) estimation is one of the well-established methods for joint estimation of entire system of equations (Davidson & MacKinnon, 1993; Cameron & Trivedi, 2005). Following Cameron and Trivedi (2005), the linear simultaneous equations model specifies the g^{th} of G equations for the i^{th} of N individuals to be given by

$$y_{ig} = z_{ig}\gamma_g + \chi_{ig}^{'}\beta_g + u_{ig}, \quad g = 1,...,G \tag{10}$$

where z_g is a vector of exogenous regressors that are assumed to be uncorrelated with the error term u_g, and χ_g is a vector that contains a subset of the dependent variables $y_1,....,y_{g-1},y_{g+1},....,y_G$ of the other G-1 equations. χ_g is endogenous as it is correlated with model errors. The model for the i^{th} individual can equivalently be written as:

$$y_i^{'}B + z_i^{'}\Gamma = u_i \tag{11}$$

where $y_i = [y_{i1}...y_{iG}]'$ is a G×1 vector of endogenous variables, z_i is an r×1 vector of exogenous variables $z_{i1},....,z_{iG}$, $u_i = [u_{i1}....u_{iG}]'$ is a G×1 error vector, B is a G×G parameter matrix with diagonal entries unity , Γ is a r×G parameter matrix, and some of the entries in B and Γ are constrained to be unity. It is assumed that u_i is iid over *i* with mean 0 and variance matrix **Σ**.

The model (11) is the structural form with different restrictions on B and Γ corresponding to different structures (Greene, 2012). Solving for the endogenous variables as a function of the exogenous variables yields the reduced form

$$\begin{aligned} y_i &= -z_i^{'}\Gamma B^{-1} + u_i B^{-1} \\ &= z_i^{'}\Pi + v_i, \end{aligned} \tag{12}$$

where $\Pi = -\Gamma B^{-1}$ is the r×G matrix of reduced form parameters, and $v_i = u_i B^{-1}$ is the reduced form error vector with variance $\Omega = (B^{-1})'\Sigma B^{-1}$.

Given identification, the structural model parameters can be consistently estimated by the separate estimation of each equation by two-stage least squares given as

$$\hat{\beta}_{2SLS} = [X'Z(Z'Z)^{-1}Z'X]^{-1}[X'Z(Z'Z)^{-1}Z'y] \tag{13}$$

The same set of instrument z_i is used for each equation. In the g^{th} equation the subcomponent z_{ig} is used as instrument of itself and the remainder of z_i is used as instrument for χ_{ig} .

More efficient systems estimates are obtained using the three-stage least-squares (3SLS) estimator of Zellner and Theil (1962), which assumes errors are homoscedastic but are correlated across equations. First, the reduced form coefficients Π in (12) would be estimated by OLS regression of '*y*' on '*z*'. Secondly, the 2SLS estimates by OLS regression of (10) is obtained, where χ_g is replaced by the reduced form predictions $\hat{\chi}_g = z'\hat{\Pi}_G$. This is an OLS regression of y_g on $\hat{\chi}_g$ and z_g , or equivalently of y_g on $\hat{x}_g$, where $\hat{x}_g$ are the predictions of χ_g and z_g from OLS regression on z. Third, we obtain the 3SLS estimates by the systems OLS regression of y_g on $\hat{x}_g$, $g = 1,...,G$, through estimation of

$$\hat{\theta}_{3SLS} = [\hat{X}'(\hat{\Omega}^{-1} \otimes I_N)\hat{X}]^{-1}\hat{X}'(\hat{\Omega}^{-1} \otimes I_N)y \qquad (14)$$

where $\hat{X}$ is obtained by first forming a block-diagonal matrix $\hat{X}_i$ with diagonal blocks $\hat{x}_{i1},...,\hat{x}_{iG}$ and then stacking $\hat{X}_1,...,\hat{X}_N$, and $\hat{\Omega} = N-1\sum_i \hat{u}_i\hat{u}_i'$ with $\hat{u}_i$ the residual vectors calculated using the 2SLS estimates.

The 3SLS computation can be iterated but this procedure does not provide the maximum likelihood estimator, nor does it improve the asymptotic efficiency (Greene, 2012). We therefore used the estimation procedure that adjusts standard errors for small samples and seemingly unrelated regressions option without iteration (Cameron et al., 2005; Cameron & Trivedi, 2009).

5.0 Results and Discussion

5.1 The sample population

The sample was composed of 95% male and 5% female respondents. Nearly 89% of the respondents (household heads) were married and only 3% were single while the remaining 8% were divorced or widowed. In addition, 42.8% of the respondents were illiterate, 30.5% could read and write and 21.7% had attended elementary school. Only 5% of the sample respondents had attended secondary school. In terms of origin, most of the settlers (60.6%) came from North Gondar Zone (the Zone in which Metema is found) and 17.8% came from Welo. Only 5% came from Shewa, 4.4% from Gojjam and 9.4% refused to tell their actual origins. A higher proportion of settlers is expected to come from Gondar since Metema is in the North Gondar Zone and people have been coming to Metema from different districts of North Gondar and South Gondar Zones both temporarily and permanently. This sample included both self-driven settlers and government supported settlers.

The occupations of the respondents both before and after settlement were examined to see whether there was any shift in the combination and relative importance of different livelihood strategies. As expected, 68.3% of the settlers were primarily farmers in their original places, whereas a higher proportion (86.1%) of the settlers said farming was their occupation. In Metema, only 0.6% of the settlers were engaged in trading whereas 2.8% of the respondents were traders in their home areas. Interestingly, 10.6% of the settlers were farmer-traders (engaged in trading in their slack periods) whereas only 1.7% of them were so in their home areas. The

resettlement strategy of the government envisaged that all settlers would be farmers and this seems to be happening. However, livelihood improvement can hardly be anticipated with such resource constraints and remote and extensive crop-livestock mixed agriculture. Given the fragile environment in which farming is practiced, focusing on agriculture as the only livelihood option cannot be considered as a viable strategy to increasing productivity and enhance food and income security of settlers and in helping them to come out of poverty.

5.2 Determinants of the likelihood of facing income shortage

The odds ratio (of experiencing to not experiencing) income shortage was found to be significantly influenced by the number of female family members, the age and education level of the household head, origin of settlers, distance to market, sesame selling, and marketing of forest products (Table 1).

The age of the household head is significantly and quadratically related to the likelihood of facing income shortage by the resettling households. As the age of the household head increases, the likelihood that the household will face income shortage will increase but not indefinitely. This indicates that the younger generation of the settlers in Metema are more vulnerable to income shortages as compared to the older generation which is composed mainly of self-resettled households. This can also be associated with the fact that the older generation that came earlier than the recently settled youth might have more resources at their disposal.

The number of female family members is also negatively associated with the likelihood of a resettling household facing income shortage. Resettling households with higher number of female family members are less prone to income shortage. This cannot be entirely and necessarily because female members need or consume less of the family's financial income rather it shall be due to better management of the available goods and services and the diligence of females in anticipating and managing livelihood risks. Female family members are also culturally burdened with many responsibilities both in and out of the house. Apart from fully handling the household chores, they are as equally responsible as men for agricultural production and marketing thereby playing a crucial and positive role in generating monetary income.

Household heads who have attended secondary school have a significantly higher odds ratio of feeling experiences of income shortage compared to illiterate household heads. This association between reported income shortage and literacy level is probably due to the higher expectations that 'educated' individuals tend to have compared to 'illiterate' ones since the expectation is that higher education will result in better employment opportunities and hence higher income and thus the needs and wants of the former are generally more diverse than the latter. Studies have shown that higher level of literacy result in lower expenditure per unit of food and in higher demand for diversity (Drescher, Thiele, Roosen, & Mensink, 2009).These higher and diverse demands that awareness, due to education, create, associated with the apparent scarcity of the necessary financial means to satisfy those demands, result in a higher demand for financial income or stronger feelings of deprivation by the relatively better educated farmers.

Settlers from North Shewa Zone were found to be less likely to face income shortages in the year considered as compared to settlers from within Gondar. These settlers are involved in trading activities more often than other settlers and seem to be faring well under the hot and harsh environment since they are used to living in

a more or less similar agro-ecological zones where trade is also more common (with the Sudan) than with other zones. Discussions with settlers have also indicated that settlers from North Shewa came with some cash resources of their own, making them able to start off-farm business quite easily.

Table 1: *Determinants of the Likelihood of Reported Income Shortage by Settlers*

Reported income shortage (yes)	Coefficient	dy/dx	exp(beta)	Robust Std. Err.
Age	0.246‡	0.059	1.279	0.092
Age*age	-0.002+	-0.001	0.998	0.001
Male family	0.040	0.010	1.041	0.127
Female family	-0.330+	-0.079	0.719	0.169
HH head literacy (base = illiterate)				
HH head reads and writes	-0.625	-0.150	0.535	0.383
HH head elementary school	0.214	0.051	1.239	0.373
HH head secondary school	1.581+	0.379	4.859	0.695
Place of origin (base = Gondar)				
Welo settler	0.439	0.105	1.551	0.424
Shewa settler	-2.303+	-0.552	0.100	0.936
Gojjam settler	1.724+	0.413	5.608	0.814
Other settler	-0.225	-0.054	0.798	0.658
Length of stay (base = less than 6 years)				
Stayed more than 22 years	0.206	0.049	1.229	0.311
Stayed 6-22 years	0.113	0.027	1.120	0.299
Sold livestock (TLU)	-0.159	-0.038	0.853	0.146
Farm size	-0.004	-0.001	0.996	0.020
Distance to market (hours)	-0.337+	-0.081	0.714	0.165
Distance to forest (hours)	-0.110	-0.026	0.895	0.174
Distance to main road (hours)	0.541‡	0.130	1.717	0.196
Sells sorghum (yes)	-0.118	-0.028	0.889	0.380
Sells tef (yes)	0.068	0.016	1.070	1.195
Sells cotton (yes)	0.161	0.039	1.175	0.399
Sells sesame (yes)	-0.943+	-0.230	0.390	0.424
Sells forest product (yes)	2.702+	0.521	14.906	1.216
Sells livestock (yes)	0.054	0.013	1.056	0.467
Constant	-4.217+			1.921

‡, and + denote statistical significance at alpha equal to 0.01 and 0.05, respectively.

By comparison, resettlers from Gojjam were found to be more vulnerable to the feeling of income shortage as compared to those from Gondar. Being a settler from Gojjam increases the odds ratio of experiencing income shortage by a multiple of 1.72 as compared to being a settler from Gondar. Gojjam is an area where settlers were more recent since the province used to be one of the potential agricultural areas in the country. It is only in the last decade that people from Gojjam availed themselves of resettlement. These settlers used to live in a different agro-ecological system with different farming experiences and preferences and where agricultural production was high and diverse. In Metema, they have to adjust their way of life to a hot climate and their farming practices to the prevailing agro-ecological system. The vulnerability of these settlers for income shortage is therefore expected.

As the distance from the market increases, the likelihood of facing income shortage decreases for resettlers in Metema. This can be seen in two ways. First, people in communities that are more distant from markets or economic centers, tend to be more self-sufficient in their production decisions. By so doing, they minimize the burden of travelling to markets and buying diverse products. This may reduce the feeling of the lack of income that could happen if they have to frequently travel and buy. Therefore, they may report less financial income constraints than people from communities which are close to the market with a relatively higher dependence on the markets and the diversity of items they provide. Second, this could be due to lower exposure to what the market has to offer. The resettlers are in a predominantly subsistence livelihood system. Therefore, they go to the market mainly to buy the goods and services they critically need given their resources. Accordingly, the higher the exposure to the market, the higher the demand for the goods and services the family needs. This creates both an actual and emotional lack of monetary income.

On the other hand, households residing closer to the main all-season road have a lower likelihood of experiencing income shortage. This is essentially because resettlers tend to undertake their transactions along the main road more often than in the formal market. Hence, resettlers that live nearby the main road are more likely to generate cash income than those who live further away.

Households that sell sesame in the market were found to be less likely to report income shortages compared to those who do not sell. Although not fully engaged in cash crop production, many resettlers grow sesame as a side crop mainly for marketing and are thereby able to gain higher incomes. On the other hand, those who sell forest products – charcoal, firewood, gums and resins – were found to be more vulnerable to income shortage than those who do not. Given the depth of poverty of the resettling community, it is expected that the poor will rely more on the forest resources in the area.

5.3 Determinants of Likelihood of Facing Food Shortage

The motivation for resettlement in Ethiopia emanates essentially from food insecurity in the source areas. The Government of Ethiopia considers resettling households as an important means of helping them attain food security. Achieving food security is affected by various factors. In addition to farm size and fertility levels of cultivated plots, a combination of household, village and location characteristics may determine whether a household faces food insecurity at any place and time (Shiferaw, Freeman, & Swinton, 2005). Better understanding of the factors impacting on household food insecurity would provide an important insight into the design and implementation of food security programs. This understanding will also

be useful in setting up institutional arrangements that would support such programs in the resettlement areas. In Table 2 below we present empirical evidence from our study as to how these factors are influencing self-reported/perceived food shortage which we used as a proxy for food insecurity (Maxwell, 1999).

Table 2: *Determinants of the likelihood of reported food shortage by settlers*

Reported food shortage (Yes)	Coefficient	exp(beta)	dy/dx	P>z
Age	0.262[+]	1.299	0.006	0.048
Age*age	-0.002	0.998	0.000	0.182
Male family	0.114	1.121	0.003	0.639
Female family	-0.450*	0.637	-0.011	0.089
HH head literacy (base = illiterate)				
HH head reads and writes	-0.769	0.464	-0.018	0.159
HH head elementary school	0.526	1.693	0.012	0.369
HH head secondary school	1.202	3.326	0.029	0.181
Place of origin (base = Gondar)				
Welo settler	0.834	2.302	0.020	0.138
Shewa settler	-2.368	0.094	-0.056	0.179
Gojjam settler	1.761[+]	5.819	0.042	0.040
Other settler	-0.489	0.613	-0.012	0.667
Length of stay (base = less than 6 years)				
Stayed more than 22 years	-0.923	0.397	-0.022	0.151
Stayed 6-22 years	0.825*	2.282	0.020	0.072
Livestock wealth (TLU)	-0.138*	0.871	-0.003	0.081
Farm size	-0.244[+]	0.784	-0.006	0.018
Distance to main road (hours)	-0.067	0.936	-0.002	0.828
Distance to market (hours)	0.497	1.644	0.012	0.133
Distance to forest (hours)	0.003	1.003	0.000	0.994
Sells cereals (yes)	-1.160	0.314	-0.029	0.121
Sells cash crops (yes)	-0.779	0.459	-0.024	0.212
Sells forest product (yes)	0.906	2.474	0.033	0.386
Constant	-6.988[+]			0.015

[‡], [+] and * denote statistical significance at alpha equal to 0.01, 0.05, and 0.1, respectively.

The logit model results show that the age of household head, number of female family members, place of origin of the settlers, livestock wealth and farm size of the household and length of stay in the district are important determinants of likelihood of facing food shortage. Age of household head has a positive sign indicating that older households are more likely to face food shortage problems. This can be the case for two reasons. First, older farmers will have less labour capacity and are less likely to produce more and less so to make use of available income generating opportunities to earn additional income that they could use to buy food, or to use different sources of food. Second, they generally have more dependents to care for and more social responsibilities. As in the income shortage case, the number of female family members is negatively and significantly related to the likelihood of

resettlers facing food shortage. The same explanation applies since female household members are clearly the lead actors in managing the food resources in the study area in particular and in the whole of rural Ethiopia in general.

The households' place of origin has a strong impact on the likelihood of food shortage suggesting that differences in places of origin may be associated with other factors that may eventually affect food shortage at the household level. Settlers from Gojjam (a relatively more fertile area with more dependable rainfall than Gondar) are more likely to feel experiencing food shortage as compared to settlers from North Gondar Zone known to be among the most degraded. As explained above, settlers from Gojjam are entirely from the highland areas with different livelihood systems than those in Metema. Almost all of the resettlers from Gojjam were engaged in food crop farming which is less suited to the harsh and dry climate of their new environment.

Two other highly significant factors that influence the resettlers' likelihood of facing food shortage in the Metema district are farm size and livestock wealth owned. It is quite apparent that the endowment of these two crucially important agricultural resources significantly reduces the likelihood that households would experience food shortage. A unit increase in the livestock wealth of the settlers decreases the odds ratio of experiencing income shortage by a multiple of 0.138. This is an important finding as livestock keeping seems to be the plausible way to enhance the viability of settling households in a short period of time. The tendency of households to increase their livestock wealth as much as they can is therefore understandable and needs to be encouraged, but with due consideration to their management practices as free year round grazing is also a threat to the natural vegetation that is already being degraded due to agricultural expansion and wood collection.

Households that settled from 1974-2000[3] were found to be more vulnerable to food shortage compared to resettlers brought in through the new program. Similarly, those who resettled before the military regime seem to be rather similar to the recent settlers when it comes to the likelihood of facing food shortage. It might not be appropriate to compare the different eras of resettlement with such limited data, but it can still be argued that resettlers are hardly established despite the length of time they are in the district.

5.4 Determinants of Access to Essential Agricultural Resources

The third econometric model attempts to identify the factors that influence the ownership of the two most important assets of settlers in Metema (land and livestock holding) and to quantify the relative importance of these factors. The simultaneous equation estimation results show that age and literacy of household head, number of male family members, length of stay in the district, and distance to market are important factors determining the size of farmland owned by resettling households. Comparably, the results show that age and literacy of household head, number of male and female family members, distance to market, and marketing of cereals and livestock are important factors determining livestock wealth owned by resettling households (See Table 3).

[3] These are mainly households resettled by the military regime and those who came by their own. The current resettlement was started in 2003.

Table 3: *Determinants of farm size and livestock wealth of Metema settlers*

Variable	Farm size		Livestock	
	Coef.	Std. Err.	Coef.	Std. Err.
Age	0.197*	0.118	-0.209‡	0.078
Age*age	-0.003*	0.002	0.002+	0.001
Male family	0.955*	0.507	0.745+	0.302
Female family	0.483	0.547	1.147‡	0.319
HH head literacy (base = illiterate)				
HH head reads and writes	2.352*	1.309	1.981+	0.788
HH head elementary school	-0.357	1.320	0.678	0.817
HH head secondary school	-1.523	2.363	-1.861	1.416
Place of origin (base = Gondar)				
Welo settler	0.166	1.663	-0.763	1.019
Shewa settler	-1.512	2.675	-1.423	1.853
Gojjam settler	1.499	3.025	-0.765	1.624
Other settler	-1.816	2.123	0.612	1.299
Length of stay (base = less than 6 years)				
Stayed more than 22 years	2.251+	1.134	0.166	0.688
Stayed 6-22 years	1.202	1.022	0.784	0.615
Distance to market (hours)	-0.973*	0.500	1.131‡	0.326
Distance to forest (hours)	1.176	0.713	-0.349	0.431
Sells forest product (yes)	-0.093	3.905	-0.534	2.353
Market for forest products poor (yes)	-1.429	1.608	1.431	0.963
Livestock wealth (TLU)	-0.035	0.122		
Sells livestock **(**yes**)**	0.330	1.500	1.871+	0.895
Sells cash crops **(**yes**)**			1.157	0.997
Sells cereals **(**yes**)**			1.982+	0.800
Farm size			-0.039	0.047
Distance to nearest town (hours)			0.084	0.163

‡, + and * denote statistical significance at alpha equal to 0.01, 0.05, and 0.1, respectively.

Size of Farm Land Owned

Age of the household head has a significant quadratic relationship with farm size owned by the resettling households. Farm size owned increases with age up to the age of 66 years and then decreases as age increases. The resettlement program, at least in the initial stages, targeted households with limited or no land holdings, and households that can potentially adapt and survive in the resettlement areas. Accordingly, young men and women constitute most – along with children – of the resettling population. This therefore implies that old members of the resettling community are less endowed in terms of farmland in this resettlement site.

Households headed by those who can read and write own significantly bigger farm sizes compared to those headed by illiterates. This is an interesting observation since higher levels of education do not show any significant difference in terms of farm

size owned compared to illiterate household heads. Given the location and the issue at hand, education is not a crucial indicator of social status, and yet even those who are a bit more educated than illiterates can easily identify and make use of the different options they get to increase their access to land.

The length of stay in Metema was found to influence the size of farmland more strongly and positively than any other variable. Respondents who stayed more than 22 years in the district have significantly more farmland owned as compared to those who settled over the last five years. The higher coefficient associated with settlers who stayed more than 22 years shows that these group of people have larger farm sizes as compared to the other two groups.

The number of male family members significantly and positively influences the size of land owned by the household. This is expected since only male settlers are directly entitled to receive land as settlers. Males are the initial travelers to settlement areas, and it was only after the males made sure that the settlement location is good enough to live in that the female family members would follow. The land distribution was already over by the time the female family members arrived in Metema.

The proximity to market places shows a negative relationship to the farm size owned by the resettling households. This is expected since the village markets are established by early settlers who have enjoyed access to big stretches of land since the district has until very recently been very sparsely populated.

Livestock Wealth

The age of the household head shows a strong quadratic relationship with the livestock wealth of the resettlers but in a different direction. As age increases, the livestock wealth of resettlers decreases and then starts to increase. The general tendency is to produce as much crop as possible. Those who manage to produce more than the family consumption needs will generally sell surplus produce and buy livestock to build assets. This is somehow related to the importance of land to establish livelihood in the settlement areas and to the fact that the younger generation has always been underprivileged when it comes to owning farmland. Those who find it hard to acquire any or sufficient land may opt to raise livestock.

The number of both male and female family members was found to be positively and significantly influence the magnitude of livestock wealth owned by the household. This relates to the labour availability to look after livestock, and it may show the value attached to owning livestock by both male and female members of the resettling families. The livestock wealth owned by a resettling household was found to be positively and significantly associated with the distance from the markets. As distance increases from the markets/towns, the TLU owned by a settling household increases. This is expected since households close to the markets have limited grazing land to raise more livestock units, but have better opportunities to be engaged in off-farm income generating activities.

Related to this, households who sell cereal crops and livestock were found to own more livestock compared to those who do not. Farmers who sell their crops and livestock products tend to invest more on livestock as assets, since livestock production serves a lot of purposes—among which generating liquid capital when need arises as well as building capital through herd growth.

6.0 Conclusions and Recommendations

Resettlement may help to improve household welfare by providing settlers with access to large farm size and fertile land; however, it might not guarantee automatic success in achieving food security for all households. Years after resettlement many household heads still feel food and income insecurity. Thus, to minimize the risk of food shortage in the new area, policy makers need to also focus on other supply side and demand side factors of agricultural production and put in place the necessary institutional arrangement to support the needy population.

Settlers from Gojjam faced income shortage whereas settlers from North Shewa appeared to be better off as compared to people who came from different districts of North and South Gondar zones. Similarly, settlers from Gojjam as compared to those from North and South Gondar Zones were found to be feeling that they could not maintain their living standard nor improve it after moving to Metema. An important feature of Gojjam settlers is that most of them are originally from highland areas with no experience of growing dry lowland crops. They are trying to adapt themselves to the hot and dry climate of Metema and to learn producing mainly lowland crops. Given their meager resources to cope with the inherent risks of nature-based agriculture, it is not easy for them to make their lives better off in a short period. This implies that the viability of settling households under the new environment was not considered as a priority while moving people to new areas. Also, careful consideration of the place of origin and its similarity to the settlement areas is suggested.

Age and literacy of the household head, number of male family members, length of stay in the district, and distance to market were found to be important factors determining the size of farmland owned by resettling households. This is despite the officially reported land allocation of two hectares per household. No government authority is controlling the sizes of land that resettlers are cultivating by converting dry forest and woodlands to crop fields. The age and literacy of the household head, number of male and female family members, distance to market, and marketing of cereals and livestock were identified to be important factors determining livestock wealth owned by resettling households. This implies at least the need to invest on intensification and the market orientation of resettlers so as to reduce the burden on the land and move farmers from extensive crop farming to also more intensive livestock rearing—an enterprise which has co-existed with the dry-forest of the area for centuries.

This study also revealed that the higher the number of females in a household, the less the likelihood that the household will face food or income shortage. This is so despite the fact that the farmland distribution considered virtually solely male adults who moved earlier to the settlement area. Households who are engaged also in trading are better off than those engaged only on farming. People from entirely different agro-ecologies are also less likely to achieve food and income insecurity. And the size of farmland and livestock wealth a resettling household owns significantly reduces the likelihood that a household experiences food shortage.

We have also learnt that those who sell forest products – charcoal, firewood, and gums and resins – are more vulnerable to income shortage than those who do not. This clearly shows the extent to which the poorer section of the settler community depends on the forest to generate additional income. This dependence has an important implication for the sustainability of the livelihood systems of the most

vulnerable group of resettlers as well as on the environment. Unless alternative options are made available and/or the use of forest resources is made in a sustainable way, this continuous extraction will have negative impacts on the forest resources. The degradation will only worsen if the status of poor settlers does not improve and if the poorer segments are further pushed into poverty, resulting in the poverty-degradation-poverty cycle: the reason for their resettlement in the first place.

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