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Do Public Transfers Discourage Farmer Participation in Subsistence Crop Production? Empirical Evidence from Botswana

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Abstract

We analyze the impact of public food and cash transfers on farmer participation in Botswana's subsistence arable agriculture. The results indicate that publicly provided social pensions and food packages (rations) reduce the probability of participation in subsistence crop farming. Engagement in paid off-farm employment, which is sometimes facilitated through a public works programme (PWP), also discourages farmer participation in the subsistence economy. Therefore, public food and cash transfers and the PWP yield work disincentive effects in Botswana's subsistence agriculture. This is because transfers are usually consistent and regular in Botswana, impacting on household behaviour. The design of social protection policies should therefore consider such potential disincentive effects on the agricultural sector.

JEL Classification: Q12, Q18

Keywords - Subsistence agriculture, Public and private transfers, Work disincentive, Dependency, Botswana, Social safety nets, Poverty

1. INTRODUCTION AND BACKGROUND

Agriculture was the leading sector at Botswana's independence in 1966, contributing about 40 percent of the country's Gross Domestic Product (GDP). Since then, the sector's relative contribution to the economy has declined due to, among other things, recurrent and prolonged droughts and the rapid growth of other sectors (CSO, 2008a; Seleka, 2004). By 2009, agriculture contributed only 3 percent to GDP (CSO, 2010). However, due to limited economic opportunities in rural Botswana, where 46 percent of the population resides, the sector remains the only hope for rural employment creation and poverty reduction.

Botswana's rainfed arable agriculture is dominated by subsistence crop farming, which accounts for over 85 percent of total cultivated area, with commercial farming accounting for the remaining 15 percent (Seleka, 2005). According to the 2004 Agricultural Census, about 46 percent of traditional agricultural households engage in subsistence crop production, implying that the subsistence economy supports a significant proportion of rural dwellers (see Table 2).¹

Farmer participation in subsistence crop farming has fluctuated over time, with lower estimates seen in the early 1980s and the early 2000s (Figure 1). Generally, the number of crop holdings rose from 1983 to 1996, mainly because of the implementation of the Accelerated Rainfed Arable Programme (ARAP) during this period, which provided input subsidies to farmers to incentivize them to engage in farming activities (TRANSTEC and BIDPA, 2010). However, following the termination of ARAP after the 1995/6 cropping season, crop holdings began to decline, until the end of the period of analysis in 2004, representing a two-fold fall.

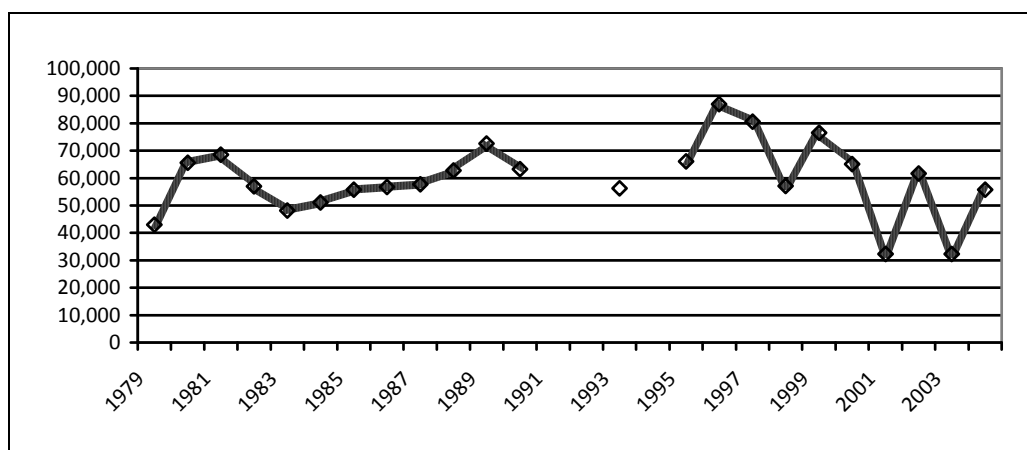


Figure 1: Number of Crop Holdings: 1979-2004

Source: TRANSTEC & BIDPA (2010)

¹ Traditional households are those that practise subsistence crop production and/or communal livestock (sheep, goats and cattle) farming.

As measured in terms of total cultivated area, farmer participation in the subsistence economy shows a similar trend (Figure 2). Thus, an increase in cultivated area occurred during ARAP implementation, but a decline was evidenced after the programme was terminated. These trends raise the question of whether Botswana’s subsistence crop farming has lost competitiveness, and whether it can be sustained in the absence of government subsidies through programmes such as ARAP.

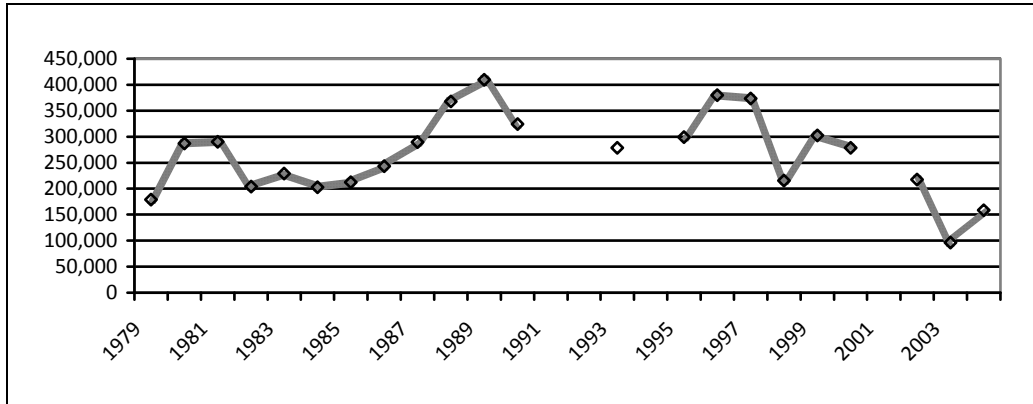


Figure 2: Total Area Planted (Ha): 1979-2004
Source: CSO (various)

In our view, the decline in farmer participation in the subsistence economy is a reflection of the loss of relative competitiveness of the sub-sector over time. Crop yields in this production system are excessively low and have generally exhibited a stagnant to declining trend over time; as depicted in Figure 3.² Due to stagnant to declining productivity and declining cultivated area, cereal crop output has also declined, particularly following the termination of ARAP after the 1995/96 cropping season (Figure 4). Thus, in sum, out-migration from the subsistence economy has caused a decline in both cultivated area and output, and has itself been caused by the loss of relative competitiveness of the subsector, as reflected by stagnant to declining crop yields.

Declining farmer participation in the subsistence economy could also be due to the provision of cash and food packages through publicly provided social safety nets (SSNs), a phenomenon often termed dependency in the development literature. In Botswana, such programmes deliver benefits to disadvantaged and vulnerable groups, and they can be broadly classified into cash transfers, food based safety nets and public works programmes. Cash transfer programmes include the Old Age Pension (OAP) scheme (which offers monetary support and financial security to the elderly aged 65 and above) and the World War II (WWII) Veterans Programme. OAP

² The major determining factor of the observed year-to-year variations in yields is rainfall variability (Seleka, 1999).

and WWII Veterans Programme are still in operation today since their introduction in 1996 and 1998, respectively.

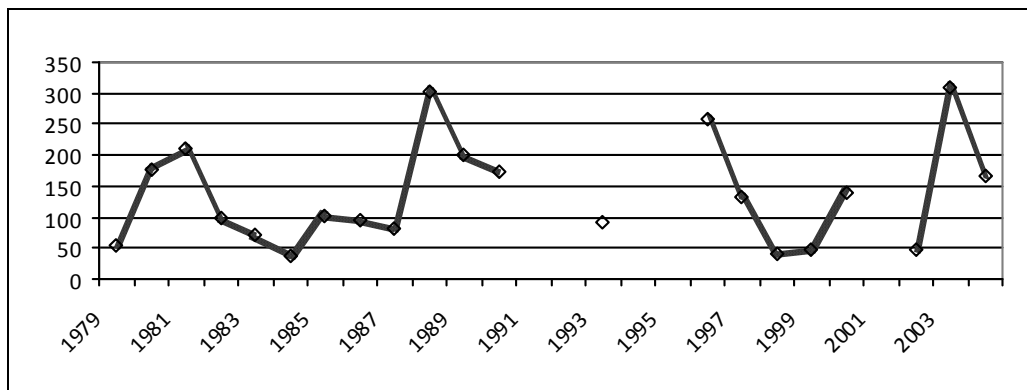


Figure 3: Cereal Crop Yields (KG/Ha): 1979-2004
Source: CSO (various)

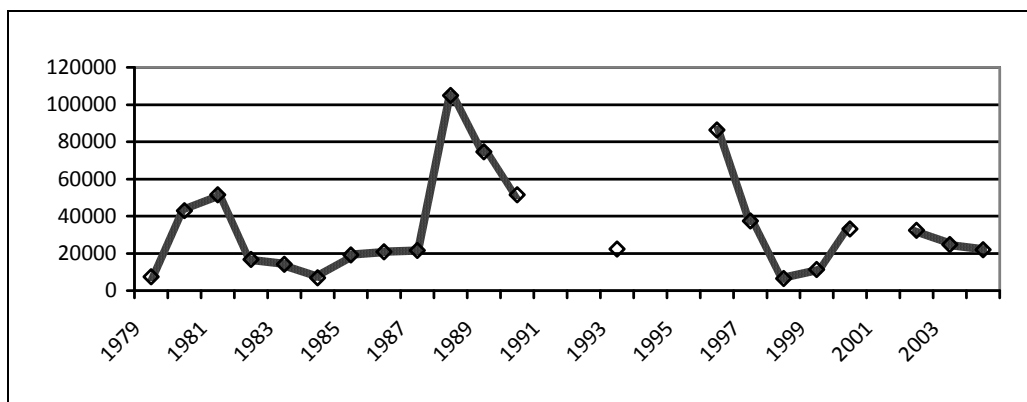


Figure 4: Cereal Crop Output (Metric tonnes): 1979-2004
Source: CSO (various)

Many SSNs in Botswana use food as a vehicle to transfer benefits to poor and vulnerable groups. The Destitute Persons Programme (introduced in 1980) provides food packages to destitute persons earning incomes below a specified threshold (Seleka et al., 2007; BIDPA, 2010). The Orphans Care Programme (introduced in 1999) provides monthly food packages to all orphans under the age of 18. The Vulnerable Group Feeding Programme was introduced in 1966 to provide food packages to children under the age of five, pregnant and lactating mothers, and TB and leprosy patients (Ministry of Health, 2005). The Community Home Based Care Programme (introduced in 1995) was initially geared at giving HIV positive persons with fully-blown AIDS the opportunity for enhanced nutrition and care in their homes. Currently, the programme also covers patients with other chronic illnesses such as diabetes, who require special diets and are unable to provide for themselves (BIDPA, 2010).

The current public works programme in Botswana, Ipelegeng, was introduced in 2009 to provide short-term wage employment to the unemployed. Its predecessor, Labour Based Drought Relief Programme (LBDRP), operated from 1982 to 2009 to provide short-term employment opportunities in construction or maintenance of public facilities during drought years. Unlike LBDRP which was only implemented during droughts periods, Ipelegeng runs on a permanent basis, with employees engaged rotationally to broaden the participation and coverage of unemployed able-bodied individuals (BIDPA, 2010).

The majority of SSNs beneficiaries come from rural areas where agriculture plays an important role as an economic activity (BIDPA, 2010; TRANSTEC & BIDPA, 2010). Therefore, the question of whether such publicly provided cash and food transfers could discourage farmer participation in agriculture is relevant. Existing data reveal that crop sale is not a frequent source of income for agricultural households, and is surpassed by public and private transfers. In 2004, for example, only 7 percent of the agricultural households derived cash income from crop sale (TRANSTEC and BIDPA, 2010). More frequent cash income sources were paid employment (38 percent)³, remittances (32 percent), pension (32 percent), livestock sale (26 percent) and non-farm business (16 percent).

Crop sale is also not the main (major) source of cash income for most of the agricultural households. Only 2 percent of the agricultural households indicated that crop sale was their main source of cash income in 2004 (TRANSTEC & BIDPA, 2010). More important sources were paid employment, remittances, non-farm business and livestock sale, which were respectively identified by 33, 17, 10 and 9 percent of the agricultural households as the main sources of cash income.

Publicly provided SSNs are also an important source of food for agricultural households. In 2004, about 11 percent of the agricultural households indicated that government rations were one of their sources of food (TRANSTEC and BIDPA, 2010). This was less significant than own produce (33 percent) and purchased food (95 percent). In the same year, 7 percent of the agricultural households identified government rations as their main source of food, compared to 13 percent for own farm produce and 80 percent for purchased food. Thus, while they are not that frequent and are not the main source of food for many agricultural households, government rations are an important source of food for some of the agricultural households.

In sum, publicly provided SSNs are important sources of both cash and food income for some agricultural households, implying that their provision could affect

³ Paid employment covered employment in a drought relief public works programme, which is also a publicly provided social safety net programme.

household behaviour. This paper, therefore, examines the influence of SSNs on farmer participation in subsistence crop farming. We also examine other plausible determinants of farmer participation in the subsistence economy, such as private transfers and household characteristics. The paper contributes to the current debate on the disincentive effects of public transfers on agricultural production (Abdulai et al., 2005; Barret, 2006; Gebreselassie, 2006; Gillian et al., 2010; Little, 2008; Maluccio and Flores, 2004).

The rest of the paper is organized as follows. Section 2 briefly reviews the literature on the work disincentive effects of public (cash and food) transfers. In section 3, we specify the model for examining the determinants of participation in subsistence crop farming in Botswana. We then discuss data and descriptive statistics in section 4. The results are presented in section 5, and conclusions made in section 6.

2. REVIEW OF RELATED LITERATURE

Existing empirical evidence on the work disincentive effects of publicly provided SSNs is scanty and has yielded mixed results as to whether cash and food transfers create dependency.⁴ Dependency in this paper refers to a situation where beneficiaries modify their economic behaviour as a result of the provision of public SSNs (Little, 2008).

Public transfers have been criticized for creating disincentive effects. Kanbur et al. (1994) pointed out that introducing any transfer, including food aid, into a community causes recipients to work less; transfers may discourage work effort by increasing time devoted to leisure. As Seleka et al. (2007) put it, “to some extent, the SSNs may create an attitude of dependency on government support, leading to reluctance to look for jobs or to engage in agricultural activities” (p.14).

Lentz and Barret (2005) found sketchy evidence linking food aid with decreased labour supply and reduced yields. In Ethiopia, for example, food aid has been dispensed for decades and the argument has been that it (food aid) negatively affected food production, agricultural marketing and economic growth, creating dependency and undermining incentives for product trade in higher potential areas (Gebreselassie, 2006). On the contrary, Little (2008) argued that food aid did not encourage dependency-like behaviour, since the amount of food aid received was too small and irregular, discouraging Ethiopians from relying on it. Thus, Little found no significant difference in social and economic behaviour between households receiving food relief and those who did not.

⁴ A related review of existing literature on the subject was made by Grosh et al. (2008).

Similarly, Lentz and Barrett (2005) argued that the quantity of food aid is usually too small to encourage households to rely on it. Gillian et al. (2010) also argued that there is little evidence of Ethiopia's productive safety net programme having disincentive effects. Abdulai, Barrett and Hoddinott (2005) also concluded that food aid does not appear to have created disincentive effects to local agricultural production, labour supply or investment in Ethiopia. Similarly, del Ninno et al. (2005) found no strong evidence of the disincentive effects of food aid in South Asia and Sub-Saharan Africa.

With regard to cash transfers, Martinez (2004) argued that they (cash transfers) can boost production and income generation potential by encouraging household investment in farming and non-farm enterprises. Abdulai, Barrett and Hoddinott (2005) also argued that such transfers provide households with working capital, which might compliment certain activities such as farming. Gertler et al. (2005) ascertained that, in addition to spending the cash on direct consumption, participants in a cash transfer programme in Mexico, *Oportunidades* (formerly *progres*a), invested part of their income on land and livestock. Thus, the programme appeared to have had substantial influence on investment in productive activities of the beneficiaries.

Similarly, Winters and Davies (2007) noted that most beneficiaries of *Oportunidades* in Mexico increased their ownership of draft and production animals, while large farmers increased cultivated area. However, in Nicaragua's *Red de Proteccion Social*, there was limited evidence of investment of transfers on productive activities, including agriculture. This is despite the fact that agriculture played a more important role in rural livelihoods in Nicaragua than in Mexico.

Harnett and Cromwell (2000) found that in Malawi's social transfer programme, participants invested their cash transfers in crop production rather than relying on casual employment for their immediate survival. In Lesotho, old age pension recipients invested some of their cash receipts on income generating activities like rearing chicken (Devereux et al., 2005). Participants in a cash transfer programme in Kalomo District in Zambia invested about 30 percent of their cash receipts on purchase of livestock, purchase of farming inputs, or investment in informal enterprise (MCDSS/GTZ, 2007).

With regard to programme impact on labour supply, Maluccio and Flores (2004) found no evidence that participation in the *Red de Proteccion Social* programme in Nicaragua reduced labour force participation. Evidence from other studies suggested insignificant labour disincentives for adults participating in *Progres*a (Grosh et al., 2008; Parker and Skoufias, 2000). However, Nguyen and Van den Berg (und) found that transfer recipients in Vietnam decreased labour supply and work, resulting in an increase in leisure. According to Moffit (2002), single mothers benefiting from the *Aid to Families with Dependent Children* (AFDC) programme in the United

States reduced their work effort by 10 to 50 percent. In Sri Lanka, a rice subsidy programme induced labour disincentives, resulting in a labour reduction of about 10 percent (Sahn and Alderman, 1996).

Even though PWPs have potential synergies with agriculture, since many assets created through these programmes can support agriculture directly or indirectly, they may also be associated with disincentive effects. A PWP may impact negatively on agricultural production as it may compete directly with labour requirements; farmers may neglect their fields and opt to work for this programme, resulting in under-production. Thus, participation in a PWP may force smallholders to divert their labour away from vital own farm activities such as weeding, especially if employment is offered during the cropping season. This creates a trade-off between social protection and immediate consumption needs and longer term returns to agriculture (McCord, 2005). Again, PWP wages offered above the prevailing market rates can cause dependency by diverting labour from other productive activities (Barrett, 2006).

3. EMPIRICAL MODEL SPECIFICATION

We specify two econometric models to analyze farmer participation. For the first model, let Y_i represent the i th household's participation in subsistence crop production ($Y_i = 1$ if the household participates and $Y_i = 0$ otherwise). If we let $P_i = \text{Prob}(Y_i = 1)$ be the probability that the household participates in subsistence crop production and $1 - P_i = \text{Prob}(Y_i = 0)$ the probability that the household does not participate, the logistic regression equation is stated as follows:

$$\ln \left[\frac{P_i}{(1 - P_i)} \right] = \beta_0 + \sum_{j=1}^n \beta_j Z_{ji} + \varepsilon_i \quad (1)$$

where β_0 is the intercept term, β_j is the coefficient associated with the explanatory variable Z_j and ε is the error term, which is normally distributed with zero mean and constant variance (Gujarati, 1995). Z_j s include household characteristics, sources of income dummies, sources of food dummies, household assets, and district dummies (Table 1).

Current opinion regarding the selection of a link function in binary response is that Probit and Logit links give essentially similar results and that they provide identical substantive conclusions (Maddala, 1983; Davidson and McKinnon, 1993; Gujarati, 1995; Greene, 1997; Long, 1997; Gill, 2001; Quinn and Keough, 2002). A Logit regression is therefore used to estimate equation 1.

The second specification is a Tobit model on the rate of household participation to test the robustness of the results. Thus, given that not all households surveyed participated in crop production, we employ a censored regression model to correct for this censoring of the dependent variable. Participation rate is defined as the share of cultivated area to total land area, which by definition is truncated at 0 and 1. A censored regression model is such that:

$$A_i^* = \alpha_0 + \sum_{j=1}^n \alpha_j Z_{ij} + v_i \quad (2)$$

$$A_i = \begin{cases} A_i^* & \text{if } A_i^* > 0 \\ 0 & \text{if } A_i^* \leq 0 \end{cases}$$

$$\Rightarrow A_i = \max(0, \alpha_0 + \alpha_j Z_{ij} + v_i) \quad (3)$$

where A_i^* is only observed when household i decided to participate in crop production, A_i is the observed share of cultivated area (to total arable land) for the i th household, α_0 is the intercept, α_j is the parameter associated with the j th explanatory variable Z_j , and v_i is the error term (Alem et al., 2010). If we assume the error to be independently, identically and normally distributed with zero mean and constant variance, this leads to a Tobit model, originally developed by Tobin (1958).

4. DATA SOURCES AND DESCRIPTIVE STATISTICS

The 2004 Agricultural Census data is used for the analysis in this paper. The dataset contains a total sample of 21,743 agricultural households. From this sample, we used data for 19,847 households, the reduction being due to data cleaning and missing observations. Table 1 provides the descriptions of the variables used in the analysis whilst Table 2 provides summary statistics.

The variables are both continuous and categorical. The average age of the head of household is 52 years. About 66 percent of the household heads are males, and 50 percent are married. Majority of the household heads have low educational attainments, with average schooling estimated at 3 years. Household size averaged 4 members, and is consistent with other studies (CSO, 2008b). About 75 percent of household heads were fulltime farmers.

For public and private transfer variables, we included sources of food dummies (government food rations and food from relatives/friends) and sources of cash income

dummies (pensions, remittances, non-farm business and paid employment). About 38 and 31 percent of the households respectively identified paid-employment and remittances as sources of cash income, and another 31 percent received pensions. Only 15 percent of the households sourced income from non-farm businesses. On average, household cash income sources are not that diversified with an average of about 2 income sources per household. Only 10 percent of the households received government food rations, and 4 percent received food from relatives/friends. Average livestock units were estimated at 49 cattle, indicating the predominance of smallholder cattle herders.

Table 1: Description of Variables used in the model

Variable	Description
Dependent Variable	Participation in rainfed arable agriculture (1=Yes, 0=No)
Household Characteristics	
Prop0-7n	Proportion of children aged between 0 and 7 years
Prop8-12n	Proportion of children aged between 8 and 12 years
Prop13-18n	Proportion of children aged between 13 and 18 years
Prop19-45n	Proportion of individuals aged between 19 and 45 years
Prop46plus	Proportion of individuals aged 46 and above
Household size	Number of members in the household
Age of HH	Holder's age (years)
Gender of HH	Value 1 if the holder is male, 0 otherwise
Marital status of HH	Value 1 if the holder is married, 0 otherwise
Farming status of HH	Value 1 if fulltime, 0 otherwise
Years schooling of HH	Number of years schooling of the HH
Sources of Cash Income	
Paid Employment	Value 1 if the holder gets paid income, 0 otherwise
Non-farm Business	Value 1 if the holder has other businesses, 0 otherwise
Remittance	Value 1 if the holder received remittance, 0 otherwise
Pension	Value 1 if the holder received pension, 0 otherwise
Diversity of Income sources	Number of income sources
Food Sources	
Government ration	Value 1 if the holder received government ration, 0 otherwise.
Supply from relatives	Value 1 if the holder received supplies from friends/relatives, 0 otherwise.
Household Assets	
Livestock Units	Number of livestock units

HH: Household Head

Table 2: Descriptive Statistics

Variable	Mean	Standard Deviation	Min.	Max
Dependent Variable	0.459964	0.498407	0	1
Household Characteristics				
Prop0-7n	0.143344	0.187452	0	1
Prop8-12n	0.078493	0.137368	0	1
Prop13-18n	0.098528	0.172094	0	1
Prop19-45n	0.361219	0.327921	0	1
Prop46plus	0.318416	0.348574	0	1
Household size	4.224002	3.059847	1	30
Age of HH	52.04329	18.12591	12	99
Gender of HH	0.660294	0.473621	0	1
Marital status of HH	0.504254	0.499994	0	1
Farming status of HH	0.747373	0.43453	0	1
Years schooling of HH	3.091861	3.830167	0	13
Sources of Cash Income				
Paid Employment	0.384292	0.48644	0	1
Non-farm Business	0.157789	0.364553	0	1
Remittance	0.314483	0.464321	0	1
Pension	0.309378	0.462249	0	1
Diversity of Income sources	1.599279	0.709444	0	8
Food Sources				
Government ration	0.096241	0.294929	0	1
Supply from relatives	0.036435	0.187374	0	1
Household Assets				
Livestock Units	48.6627	96.13911	0	2074

HH: Household Head.

5. RESULTS AND DISCUSSIONS

Table 3 presents the results of the Logit model. The log likelihood ratio (LR) test shows that participation in subsistence arable agriculture, the estimated model, and the set of explanatory variables fit the data better compared to the model containing the constant only. In other words, there is a significant relationship between the log of odds and, hence, odds and the probability of participation in the subsistence arable agriculture and the explanatory variables included in the model. This suggests that the variables contribute significantly, as a set, to the explanation of participation of the sample farmers. The table also shows the coefficients, their standard errors (SE), associated p-values and odds ratios (Exp (B)). Most of the explanatory variables had expected signs and are statistically significant. The model explains about 16 percent of the variation in the dependent variable.

Table 3: Determinants of participation in subsistence crop farming-logit analysis

Variable	B-Coefficient	Std. Error	z	P-value	Exp(B)	Prob.
Household Characteristics						
Prop0-7n	1.056134	0.103501	10.20	0.000***	2.875235	0.7420
Prop8-12n	0.604775	0.130717	4.63	0.000***	1.830840	0.6467
Prop13-18n	0.358331	0.101372	3.53	0.000***	1.430939	0.5886
Prop46plus	0.746719	0.070696	10.56	0.000***	2.110066	0.6785
Household size	0.034290	0.007334	4.68	0.000***	1.034885	0.5086
Age of HH	0.003608	0.001420	2.54	0.0011***	1.003614	0.5009
Gender of HH	-0.219280	0.043053	-5.09	0.000***	0.803095	0.4454
Marital status of HH	0.339324	0.040803	8.32	0.000***	1.403998	0.5840
Farming status of HH	0.574058	0.044918	12.78	0.000***	1.775457	0.6397
Years schooling of HH	-0.009815	0.004942	-1.99	0.047**	0.990233	0.4975
Sources of Cash Income						
Paid Employment	-0.076064	0.046024	-10.54	0.000***	0.615530	0.3810
Non-farm Business	-0.176740	0.052031	-3.40	0.001***	0.837999	0.4559
Remittance	-0.076060	0.045183	-1.68	0.092*	0.926757	0.4810
Pension	-0.156930	0.047913	-3.28	0.001***	0.854761	0.4608
Diversity of Income sources	0.164152	0.032623	5.03	0.000***	1.178393	0.5409
Food Sources						
Government ration	-0.336320	0.056102	-5.99	0.000***	0.714393	0.4167
Supply from relatives	-0.706410	0.088378	-7.99	0.000***	0.493410	0.3304
Household Assets						
Livestock Units	-0.002098	0.000254	-8.26	0.000***	0.997903	0.4995
Constant	-5.231526	0.422559	-12.38	0.000***		
Pseudo R ²	0.1599					
LR test ^a	4378.74			0.000***		
Log likelihood	-11503.039					
Number of observations	19847					

HH: Household Head . ***Significant at 1 percent: **Significant at 5 percent: *Significant at 10 percent. Results for districts dummies are not reported. The reference district is Tsabong and all district dummies are significant and with positive coefficients, an indication that Tsabong is the least district in terms of participation in subsistence crop farming. This is expected because arable activity is lower in Tsabong due to lower rainfall than other areas.

Age category omitted is for 19 – 45 year olds.

^a Likelihood ratio (LR) test is used to test the null hypothesis that there is no relationship between the log of odds of farmer participation in subsistence crop farming and the set of independent variables included in the model (i.e. $H_0 : \beta_j = 0$).

5.1 Household characteristics

Each variable (Prop0-7n, Prop8-12n, etc) represents the proportion of household members in that age bracket. The omitted category in the regression is the proportion of family members between the ages of 19 and 45. Households with higher proportions of young children aged 0-7 are more likely to participate in subsistence arable farming compared to households with higher proportions of members aged 19-45. This may suggest that households with higher proportions of young children are more compelled to engage in the subsistence economy to provide for their children in terms of food security. Similarly, households with relatively more members aged 46 and above are more likely to engage in subsistence arable agriculture compared to those with relatively more members aged 19-45. Coefficients for other age categories (8-12 and 13-18) may be interpreted along similar lines.

An increase in household size by one member would increase the probability of participation in subsistence crop farming by 3.4 percent. This may be driven by food security concerns for households with many dependents. Another reason may be that a household with many members has more (excess) labour to allocate to farming activities.

Age is highly significant and positively relates with participation in subsistence arable agriculture. A unit increase in the age of the household head would increase the probability of participating in subsistence crop farming by only 0.3 percent. Families headed by older members may have limited opportunities outside the subsistence economy, leading to increased likelihood of reliance on subsistence agricultural production.

Male-headed households are 45 percent less likely to participate in subsistence crop farming than their female-headed counterparts. This may suggest that, in Botswana, males are more likely to engage in livestock rearing than subsistence arable agriculture, with the latter being relegated to female-headed households. The results are consistent with the finding that women, especially from large households, engaged in agricultural activities like crop production for survival (Shingi et al., 1980).

A married head of household is 58 percent more likely to participate in subsistence crop production than an unmarried household head. This could be attributed to increased concern for household welfare and food security due to marital responsibilities. The results concur with the finding of Nnadi and Akwivu (2005) that married people were more disposed to farming and adoption of new technologies.

Full-time farmers are 64 percent more likely to participate in subsistence arable farming than part-time farmers. This is expected since fulltime farmers have more time to devote to farming than part-time farmers; part-time farmers may also be

involved in off-farm activities, such as paid employment or non-farm business that may impact negatively on their participation in subsistence crop farming. A unit increase in years of schooling would reduce the probability of participation by about 1 percent. One of the reasons for this is that farmers with higher education may opt for other more productive economic activities than subsistence crop production.

5.2 Sources of cash income

Sources of cash income include paid employment, non-farm business, remittance and pension. Households engaged in paid employment are 38 percent less likely to participate in subsistence crop production than households without paid employment. Households engaged in a non-farm business are 46 percent less likely to participate in subsistence arable agriculture than those without such businesses. Those households receiving remittances are 48 percent less likely to participate in subsistence crop farming than non-recipient households.

Households receiving pension are 46 percent less likely to participate in subsistence crop farming than non-recipients of pension. Thus, the recipients would rather spend a large amount of their pension income on food, which contributes to containment of child malnutrition and the avoidance of starvation (Morgan, 1991), than engage in an unproductive and risky subsistence sector. The evaluation of Malawi's Food and Cash Transfer (FACT) programme yielded similar results with 75.5 percent of the transfers typically spent on groceries (Devereux et al, 2006), indicating that the majority of the pensioners did not invest their money on productive activities.

Farmers with more diversified cash income sources are more likely to invest in subsistence crop farming than those with only one income source. A unit increase in the number of income sources would increase the probability of participation by 16.5 percent. This may be because a more diversified income portfolio allows households to invest in a risky crop production activity.

In sum, the results indicate that lump-sum transfers such as remittances and social pensions have a disincentive effect on participation in subsistence crop farming. Such transfers induce recipient households to allocate more of their time to leisure and less to productive activities, such as farming⁵. Similarly, the existence of non-farm wage or business income serves as a disincentive to participation in the subsistence economy. The results are consistent with the economic theory of the farm household, where production and consumption decisions are non-separable (Nakajima, 1986).

⁵ It is also possible that SSNs may lead to an early exit of households contemplating retirement for reasons such as ill health, and would have continued if there were no guarantees of this form.

5.3 Sources of food

Despite some arguments in the literature that food aid does not cause work disincentive effects and dependency among beneficiaries, government food rations in Botswana discourage farmer participation in subsistence crop farming. Households receiving government food rations are 42 percent less likely to participate in subsistence crop farming than their non-recipient counterparts. This is expected since the provision of public food rations in Botswana is consistent and regular.

Similarly, food supply from friends and relatives negatively relates to participation in subsistence crop farming. Households receiving food from friends and relatives are 33 percent less likely to participate in subsistence crop farming than non-recipient households. Thus, private food transfers also do discourage participation in the subsistence economy.

In sum, unlike food aid in Ethiopia, the provision of food rations through public programmes in Botswana is consistent and regular, with predetermined packages supplied on a monthly basis. This implies that the disincentive effect is possible as there is perfect certainty on the delivery of food packages. Similar results are obtained for private food transfers, implying that they may also be regular and consistent for most of the recipients. These results are consistent with the economic theory of the farm household where an increase in lump-sum transfers, fixed income or property income leads to an increase in leisure and thereby a reduction in time allocated to farm production (Nakajima, 1986). This finding applies where production and consumption decisions are non-separable.

5.4 Household assets

Farmers with larger livestock units are less likely to participate in subsistence crop farming than those with smaller herd-sizes. Increasing livestock units by one animal would increase the probability of household participation in subsistence crop farming by about 0.2 percent. This may be because farmers with larger livestock inventories would rather exchange some of their animals for cash to meet household needs, rather than engage in an unproductive subsistence economy.

5.5 Testing for robustness of the results

In this section, we test for the robustness of the results, using a Tobit regression model (Tobin, 1958; Matuschke & Qaim, 2009). Table 4 presents the results. The log likelihood shows that the model is statistically significant in predicting participation in subsistence crop farming. The table also shows the coefficients, robust standard errors, t-statistics and the associated p-values. Sigma represents the estimated standard error of the regression.

Table 4: Determinants of participation in subsistence crop farming-Tobit model

Variable	α -Coefficient	Robust Std. error	t	P-value
Household Characteristics				
Prop0-7n	0.3487616	0.0751655	4.64	0.000***
Prop8-12n	0.2086123	0.0538792	3.87	0.000***
Prop13-18n	0.1180561	0.0450869	2.62	0.009***
Prop46plus	0.2673050	0.0643178	4.16	0.000***
Household size	0.0141235	0.0059243	2.38	0.017**
Age of HH	0.0010340	0.0005567	1.86	0.063*
Gender of HH	-0.0951483	0.0385643	-2.47	0.014**
Marital status of HH	0.1328622	0.0442216	3.00	0.003***
Farming status of HH	0.2169210	0.0507472	4.27	0.000***
Years schooling of HH	-0.0049050	0.0026237	-1.87	0.062*
Sources of Cash Income				
Paid Employment	-0.1752665	0.0336714	-5.21	0.000***
Non-farm Business	-0.0798551	0.0310212	-2.57	0.010***
Remittance	-0.0495376	0.0249830	-1.98	0.047**
Pension	-0.0690256	0.0289813	-2.38	0.017**
Diversity of Income sources	0.0657337	0.0251857	2.61	0.009***
Food Sources				
Government ration	-0.0673394	0.0255728	-2.63	0.008***
Supply from relatives	-0.2531160	0.0672706	-3.76	0.000***
Household Assets				
Livestock Units	-0.0005981	0.0001811	-3.3	0.001***
Constant	-2.0610340	0.5154100	-4.00	0.000***
Pseudo R ²	.0874			
LR test ^a	3222.00			0.000***
Log likelihood	-16796.291			
Number of observations	19847			
Sigma	.8133079	.1930164		

HH: Household Head. ***Significant at 1 percent; **Significant at 5 percent; *Significant at 10 percent. Results for districts dummies are not reported. The reference district is Tsabong and all district dummies are significant and with positive coefficients, an indication that Tsabong is the least district in terms of participation in subsistence crop farming. This is expected because arable activity is lower in Tsabong due to lower rainfall than other areas.

Age category omitted is for 19 – 45 year olds.

^a Likelihood ratio (LR) test is used to test the null hypothesis that there is no relationship between the log of odds of farmer participation in subsistence crop farming and the set of independent variables included in

the model (i.e. $H_0 : \alpha_j = 0$)

10723 left-censored observations at participation rate ≤ 0 and 9124 uncensored observations.

The results generally confirm our previous findings. All the age groups (0-7, 8-12, 13-18 and 45plus) positively affect household decisions to participate in subsistence arable agriculture compared to the 19-45 year age group. Household size, age, marital status and farming status (being full-time) positively relate with participation. Females are more likely to participate in subsistence arable agriculture than males. Education negatively relates to participation in subsistence arable agriculture. Households with large livestock units are less likely to participate in subsistence crop production than those with smaller herd-sizes.

Both public and private transfers (food and cash) negatively affect household participation in the subsistence economy. Similar results are obtained for other off-farm income variables (paid employment and non-farm business). These results are consistent with the previous findings that food and cash transfers (private and public) have served as a disincentive to farmer participation in the subsistence economy.

6. CONCLUSION

The main objective of this paper was to examine whether public transfers discourage farmer participation in subsistence arable agriculture in Botswana. The paper also examined other factors underlying farmer participation in the subsistence economy. The results indicate that households with higher proportions of young children aged 0-7 are more likely to participate in the subsistence economy than those with higher proportions of members aged 19-45. This may suggest that households with higher proportions of young children are more compelled to participate in the subsistence economy for food security. Similar results are obtained for other age cohorts, as compared against the 19-45 year age group.

Household size positively relates to participation in subsistence arable agriculture. This may be because of the availability of excess labour to allocate to crop production and the need to produce food to feed many dependents. Married household heads are more likely to participate in subsistence arable agriculture, implying increased concern for household welfare and food security due to marital responsibilities.

The results further show that households engaged in non-farming businesses are less likely to participate in the subsistence economy. Similarly, off-farm (paid) employment reduces the probability of participation in the subsistence economy. Off-farm employment in this case includes participation in a publicly provided PWP, implying that such a programme has a disincentive effect on participation in subsistence arable agriculture. This is expected since a PWP competes directly for household time with crop production activities.

The most important finding for this study is that both public and private transfers (food and cash) do significantly impact on participation in the subsistence economy. Households receiving either public or private transfers (food and cash) are less likely to participate in subsistence arable agriculture. However, farmers with more diversified income sources are more likely to participate in subsistence arable agriculture than those with a few income sources. A more diversified income portfolio is likely to

boost investment in a risky activity such as crop farming; it may cause farmers to be more risk averse.

The findings are consistent with the economic theory of the farm household where production and consumption decisions are non-separable. In such a model, off-farm wage work directly reduces the time allocated to farming activities. Engagement in non-farm businesses also competes for household time directly, and may yield a level of property income that causes households to consume more leisure and, hence, reduce participation in arable farming. Both private and public lump-sum transfers (food and cash) also serve as a disincentive to participation in arable farming as they cause households to devote more time on leisure and conversely reduce time allocated to farm work. Thus, lump-sum transfers such as social pension, remittances and private and public food rations have a disincentive effect on arable farming in Botswana.

The policy implication of these results is that, as both agriculture and SSNs are important for rural poverty reduction, it is fundamental for the design of publicly provided SSNs to ensure positive synergies of SSNs and agricultural policies. It is also important that the timing and targeting of SSN programmes avoids potential conflict between SSNs and agricultural activities. Moreover, wages paid through a PWP, such as Ipelegeng, should not exceed the prevailing market wage rates to avoid direct competition with cropping and other economic activities.

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