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**The groundnuts Fairtrade arrangement and its spillover effects on agricultural
commercialization and household welfare outcomes:
*Empirical evidence from central Malawi***

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Abstract

We use a unique panel dataset of smallholder farmers that were collected in central rural Malawi in 2006/07 and 2017/18 agricultural seasons to test whether there are spillover effects of groundnut Fairtrade arrangement on small-scale agricultural commercialization and household welfare for smallholder farmers that did not participate in the arrangement. Our findings reveal that implementation of groundnuts the Fairtrade arrangement in Mchinji district has 29% spillover effect on commercialisation intensity for smallholder farmers that did not participate in the arrangement. However, the arrangement did not contribute to the improvement of agricultural income and asset value of non-participants. Based on our results, we recommend government's support to smallholder farmers to allow them continue commercialising farming, and improve their welfare.

1. Introduction

Smallholder agricultural commercialization is widely recognized as a key feature of achieving agricultural growth and poverty reduction in developing countries (Pingali, 2007; Jayne *et al.*, 2011; Muriithi and Matz, 2015; Sibande *et al.*, 2017). According to Jayne *et al.* (2011), smallholder agriculture commercialization occurs when farmers produce more output per unit of land and labour by using improved technologies, such as improved seed and inorganic fertiliser; produce greater surpluses; and, increase their market participation, which results in higher incomes and living standards. However, most smallholder farmers do not participate in the output markets as sellers because they do not produce surpluses due to lack or inadequate use of productivity-enhancing technologies. Most governments in Sub-Saharan Africa (SSA) use input support programs to increase the use of improved inputs by smallholder farmers to allow them produce surpluses, targeting the production of staple crops such as maize. Conversely,

development partners target high valued crops such as root tubers, legumes, and horticultural crops to enhance incomes for farmers by linking them to export markets. For example, access to subsidized inputs increases quantity of maize produced (Ricker-Gilbert and Jayne, 2011) and sold (Sibande *et al.*, 2017) in Malawi while participation in horticultural export markets increases farmers incomes in Senegal (Maertens and Swinnen, 2009), and Kenya (Muriithi and Matz, 2015).

In Malawi, groundnut is one of the legumes that is being promoted as an export crop grown by smallholder farmers (Government of Malawi, 2012). Although all the districts grow groundnut, production is concentrated in central region mostly in Kasungu, Mchinji, Nkhosakota, and Ntchisi. Sangole *et al.* (2010) find that a groundnut farmer allocates 0.4ha of land to groundnuts production, on average. Usually, farmers cultivate groundnuts in a pure stand or intercrop with maize with little or no use of chemical fertilisers and pesticides. The nuts are hand-shelled and hand-sorted to remove debris and spoiled nuts. Traditionally, most farmers soak their groundnuts before shelling to soften the shells. However, this affects the colour and taste of nuts and leads to development of the aspergillus fungus that produces aflatoxin (Pound *et al.*, 2011). Derlagen and Phiri (2012) indicate that 60 percent of hand shelled nuts meet export quality standards while local processors use the rest to make flour, cake and peanut butter. About 40 percent of the groundnuts produced by smallholder farmers is commercialized through formal markets with exports representing between 10-15 percent of the total production (Derlagen and Phiri, 2012; Diaz Rios *et al.*, 2013). In a liberalised market environment, smallholder farmers have several market options to sell their groundnuts such as National Association of Smallholder

Farmers of Malawi (NASFAM)¹, small-scale traders², and processors or enter into contract farming arrangements with seed growers.

During the 1970s and 1980s, groundnuts production was stable around 150,000 tonnes with exports averaging 19,000 tonnes per year. However, production declined below 50,000 tonnes in the 1990s due to collapse of state marketing agency, produce price liberalisation, problems of aflatoxin, poor quality of seeds and poor prices (Fitzgerald, 2015; Diaz Rios *et al.*, 2013). Efforts by NASFAM, International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), and government in the 2000s led to revival of groundnuts production in Malawi. In 1990, ICRISAT introduced an improved *Chalimbana* variety, called CG7, which is tolerant to drought and has a higher yield potential (60 percent) than *Chalimbana*³, traditional groundnut variety. NASFAM organized smallholder farmers into groups and introduced them to the business approach to farming, improved seed varieties (CG7), cheaper ways of detecting and controlling the problem of aflatoxin, and invested in processing facilities⁴ in Kasungu, Mchinji, and Ntchisi districts (Fitzgerald, 2015; Diaz Rios *et al.*, 2013). Further, NASFAM linked one of the associations in Mchinji district, Mchinji Area Small Farmers Association (MASFA), to the premium export market through Fairtrade and Liberation Foods certification in 2004. In this arrangement, NASFAM as the main buyer, exported MASFA's groundnuts to United Kingdom (UK) from 2007 to 2011 (Derlagen and Phiri, 2012; Pound *et al.*, 2011). Conversely, the government introduced groundnuts to its Farm Input Subsidy Programme (FISP) in 2008 to increase production of

¹ NASFAM is a key buyer of groundnuts for export.

² Small-scale traders penetrate remote rural areas and buy nuts of any quality, and supply the nuts to local processors such as Rab Processors, Transglobe, Mulli Brothers and Equator Nuts.

³ This is a Virginia-type larger groundnut variety with relatively high levels of protein.

⁴ Processing is limited to sorting, grading, and packaging.

legumes (Chirwa and Dorward, 2013). These initiatives led to increased production of groundnuts from 130,000 tonnes in 2000 to 286,080 tonnes in 2015 (Government of Malawi, 2000; 2015) and resumption of exports in 2005 (Derlagen and Phiri, 2012).

The objective of this study is to test whether there are spillover effects from the Fairtrade arrangement on agricultural commercialization and household welfare outcomes for smallholder that did not participate in Mchinji district. Understanding the direction and magnitude of spillover effects from the Fairtrade arrangement is important given that the effects may lead to transfer of technology, affect level and intensity of input use, increase yield, and encourage market participation for non-participants (Adewumi et al., 2013; Ali et al., 2015). Conversely, the spillover effects may lead to competition for productive land and casual labour, which may discourage non-participants from expanding their production (Key et al., 2000; Hall, 2011; Ali et al., 2015). The closest studies to ours are by von Braun et al. (1989), Neven et al. (2008), and Maertens and Swinnen (2009). The authors find increased use of hired labour on the farms (i.e. positive spillover effects) for the production of high-value horticultural products for the export market in Guatemala, Kenya, and Senegal. Ours is the first study to estimate the spillover effects from farmers' participation in the high-value production for the export market on commercialisation intensity, and household welfare outcome for non-participating smallholder farmers in SSA. This study contributes to the policy debate regarding the direction of spillover effects from Fairtrade arrangement in the region.

In this study, we hypothesis that the groundnut Fairtrade arrangement in Mchinji district might have influenced farmers that did not participate but were in the district to increase their level of commercialisation intensity. If this hypothesis holds, we further hypothesise that

increased commercialisation intensity of smallholder farmers that did not participate in the groundnuts fairtrade arrangement led to an improvement in the farmers' living standards. We use two waves of panel data from smallholder farmers that were not part of the NASFAM's Fairtrade arrangement in Mchinji district and smallholder farmers that did not have access to NASFAM's processing facilities in Ntchisi district collected in 2006/07 and 2017/18 agricultural seasons. The 2006/07⁵ data represent the year before NASFAM started exporting MASFA's groundnuts to UK while the 2017/18 data represent the year after NASFAM stopped exporting MASFA's groundnuts to UK, which allows us to measure spillover effects from the groundnut Fairtrade arrangement in Mchinji district. Firstly, we use our data to test whether farmers that did not participate in the groundnut Fairtrade arrangement in Mchinji district are more likely to commercialise their farming and have a higher commercialisation intensity than those in Ntchisi district using a double hurdle (DH) model. Then, we apply a difference-in-differences (DD) estimator to test whether there are spillover effects on commercialisation intensity, agricultural income, and value of assets for farmers that did not participate in the arrangement but were in Mchinji district.

Our findings reveal that households in Mchinji district are less likely to commercialise their farming than those in Ntchisi district by 36%. The volume of fertilizer used increase the likelihood of household's decision to commercialise farming and its intensity. Our coefficient for measuring the effect from the Fairtrade arrangement on agricultural commercialisation intensity for households that did not participate in the arrangement but were in Mchinji district (i.e.: indirect

⁵ 2006/07 is also the year in which groundnuts production was on the increase following the 2005 drought (Derlagen and Phiri, 2012; Diaz Rios et al., 2013)

impact or spillover effect) is positive and statistically significant at 1%. The treatment variable =1 if the household was in Mchinji district. This finding suggests that implementation of the groundnut Fairtrade arrangement in Mchinji district has 29% spillover effect on household agricultural commercialisation intensity for non-participants. However, we find no spillover effects from the arrangement on agricultural incomes and value of assets for farmers that did not participate but were in Mchinji district.

The remainder of this article is organized as follows. The next section provides the history of the Fairtrade arrangements in Malawi. A discussion of the methods and data used in the analysis follows. The article then presents the empirical results, and concludes with policy implications.

2. History of the Fairtrade Arrangements in Malawi

According to the Fairtrade International (2018), Fairtrade is an alternative approach to conventional trade and depends on a partnership between producers and consumers. This partnership hinges on dialogue, transparency and respect that seeks greater equity in international trade. When farmers sell on Fairtrade terms, they have a better deal and improved terms of trade, which allows them to improve their lives and plan for their future. Fairtrade has sets of standards for different types of producers and workers. For smallholder farmers, Fairtrade standards accept farmers who are working together in either a cooperative or any other form of organisation with a democratic structure. The standards cover terms of trade where consumers

pay a minimum set price⁶ and an additional sum of money, the Fairtrade premium⁷. The Fairtrade International certifies farmer organisations to sell their products under Fairtrade arrangement to make sure that they are compliant with economic, social and environmental standards for Fairtrade. Certified products carry the International Fairtrade Certification Mark as a guarantee that producers and traders have met Fairtrade standards. As such, consumers know that they are supporting a worthy cause rather than taking advantage of an exploitative supply chain. Further, traceability of products along the supply chain is the basis of Fairtrade to make sure that farmers sell their certified products.

International Fairtrade introduced Fairtrade arrangements in tea, sugar cane and groundnuts production in 2004 in Malawi. According to Pound *et al.* (2011), International Fairtrade certified five farmer organisations: Satemwa Tea Estates Limited, Sukambizi Association Trust, Eastern Outgrowers Trust (tea); Kasinthula Cane Growers Association (sugar cane); and MASFA (groundnuts). As the name suggest, MASFA is in Mchinji District, Central part of Malawi, bordering eastern Zambia. NASFAM facilitated the establishment of MASFA in 2001 (Fairtrade Foundation, 2019) and was certified as groundnut Fairtrade producers in 2004. Initially, it had a small membership of about 200 local farmers who wanted to improve their market access and prices paid for groundnuts. Over the years, membership has grown (e.g. 2,275 farmers were recorded in 2012) and members have been sub-divided into farmer clubs, each comprising 20 members. MASFA has six individual associations from across the district, namely; Kalulu,

⁶ This price ensures that producers cover their average costs of sustainable production. It acts as a safety net to farmers at times when world markets fall below a sustainable level.

⁷ Producers within the farmers' organization decide democratically the use of this additional income for community projects such as investment in education and healthcare, and processing facilities to increase income.

Mikundu, Chiosya, Mkanda, Mlonyeni, and Msitu. MASFA has employed six Field Officers who provide extension services to its members from groundnuts production to post-harvest handling. In addition, MASFA provides its members with improved seeds to improve nut quality⁸ and, with NASFAM, runs capacity building programmes such as trainings in crop production, business skills and management of the farmer clubs. MASFA has warehousing facility, which member farmers can access.

MASFA became a shareholder of Liberation Foods⁹, a UK based Fairtrade Nut Company that organisations including NASFAM and Twin, UK Fair Trade pioneer, established in 2007. In this groundnut Fairtrade arrangement, NASFAM was the main buyer of MASFA's groundnuts, Twin was the importing organisation, while Liberation Foods was providing MASFA members with control over supply and retail of their groundnuts in the UK (Fairtrade Foundation, 2019). Initially, NASFAM was buying groundnuts from MASFA without a contract (Pound et al., 2011). NASFAM introduced informal contracts in 2010; however, they were loose, like Memorandum of Understanding. If the quality was poor, NASFAM could reject the groundnuts. Pound *et al.* (2011) indicate that NASFAM preferred to buy not early in the season because the nuts could have high moisture content, making them susceptible to aflatoxin contamination. This late opening of the market led to side selling of some of the groundnuts by some MASFA members to private traders who opened their markets early in the season.

⁸ Members grow groundnuts on 500 hectares of land and produce an average of 630 tonnes per year (Fairtrade Foundation, 2019).

⁹ Liberation is partly owned by the producers of the groundnuts, cashews and Brazil nuts that it markets – over 22,000 smallholder nut producers from co-operatives in Asia, Africa and Latin America, including MASFA, set up the International Nut Producer Co-operative which holds a 42% stake in Liberation.

Twin had a contractual arrangement with NASFAM on Fairtrade terms. Twin limited the volume of groundnuts from MASFA to 72 metric tonnes per year because of low quality nuts. NASFAM started exporting MASFA's groundnuts in 2007 to UK. However, Pound *et al.* (2011) note that the volume of groundnuts that NASFAM exported to Fairtrade markets steadily decreased from 2007 – 08, despite an increase in production. This fall was due to the quality of nuts, which was poor and unfit for export, especially to the European market. In order to resolve this quality issue, NASFAM procured a shelling equipment for MASFA from South Africa. However, the equipment was not suited to the type of groundnuts in Malawi in that it had a high unacceptable percentage (14%) of split nuts, which did not stop farmers from shelling their groundnuts by hand. NASFAM in collaboration with Twin established a Joint venture known as Afri-Nut Limited, a processing plant for nuts to export to the UK and production of groundnut paste in 2011. Afri-Nut Limited procured a processing plant for MASFA, which had the potential to maintain the quality of the product offered by farmers at levels acceptable for export to Fairtrade and other markets, and to add value to the raw material through blanching, roasting and pasting. However, this processing plant could not improve the quality of the nuts it received. It could only sort the good from the bad nut and maintain its quality¹⁰. Further, Afri-Nut Limited procured and installed a small laboratory with aflatoxin testing equipment, and employed trained staff to check the levels of aflatoxin in groundnuts at the farm level.

According to the Fairtrade Foundation (2019), MASFA received a premium of US\$110/tonne to spend on business improvements or community projects agreed by its

¹⁰ It was up to farmers to improve their product quality if they were to take advantage of the processing facility and increase sales to fairtrade.

members. The International Fairtrade channeled the premium funds through NASFAM, which MASFA could access upon request against specific project activities. The reduction in Fairtrade sales negatively affected MASFA's premium income. Pound et al. (2011) indicate that NASFAM shipped eighteen containers (each carrying 18 metric tonnes of groundnuts) in 2007/08 season, four containers in both 2008/09 and 2009/10, and a container in 2010/11 to Fairtrade outlets in Europe. One of the four containers in 2008/09 and the 2010/11 shipment was found on arrival to have some contamination with aflatoxin¹¹. NASFAM stopped exporting groundnuts under Fairtrade arrangement in 2012.

The MASFA membership decided the use of premiums at each annual General Assembly. The first major premium-funded project was construction of a guardian shelter at Mchinji District hospital, which provides basic accommodation and a place to cook for people accompanying sick relatives and expectant mothers. MASFA used the subsequent premiums to construct two warehouses at Mkanda and Matutu trading centres where farmers come to trade their groundnuts and store their crops in a dry, secured environment. The community also use the centres for under-fives clinics, nursery schools, community meetings and storage of farm inputs. MASFA also used part of the premium money to pay the Fairtrade certification costs (US\$3,713).

3. Methods

3.1 Conceptual Framework

Smallholder farmers that participate in Fairtrade arrangements are considered to have access to better prices and stable markets, which in turn strengthen farmer organizations and

¹¹ According to one of the key informant, aflatoxin was dictated upon arrival in the export market because Malawi did not have an accredited facility to test for aflatoxin.

improve the living standards of its members (Ronchi, 2002; Milford, 2004; Calo and Wise, 2005; Bacon et al., 2008; Jaffee, 2007; Ruben and Fort, 2012; Meemken et al., 2017). Usually, smallholder farmers that operate in isolation produce smaller surpluses, which are geographically dispersed and attract operation of small-scale traders that penetrate the rural remote areas (Burke et al., 2019). These small-scale traders purchase smaller quantities from farmers, aggregate and re-sell them to large traders who usually operate in well-established markets such as the district capital market (locally known as *boma* market), where farmers with relatively large surpluses sell.

In this study, we hypothesise that the groundnuts fairtrade arrangement might have indirectly affected agricultural commercialization of smallholder farmers that did not participate in the arrangement but were in Mchinji district through two pathways. Firstly, farmers that did not participate in the arrangement but were in Mchinji district through their geographic or social interactions observed the benefits that accrued to Fairtrade participants such as access to stable market, improved incomes through better output prices and asset accumulation. Secondly, farmers in Mchinji district benefit from the development projects that MASFA implemented with Fairtrade premiums. Therefore, we anticipate that the implementation of the groundnuts Fairtrade arrangement might have increased amount of land cultivated, labour and input use, yield, and the level of market participation for farmers that were in Mchinji district but did not participate in the arrangement.

If this hypothesis holds, we further hypothesise that increased commercialisation intensity of smallholder farmers that did not participate in the groundnuts Fairtrade arrangement might have improved the living standards of farmers. Non-participating smallholder farmers may

enjoy increased incomes from relatively higher market surpluses. Usually, formal saving and banking institutions are rare or not available in the rural areas, therefore most smallholder farmers use crop income to build their household assets such as kitchenware, furniture, livestock, ploughs, solar panels and simple electronics (Kiiru, 2007). In this study, we considered crop income and value of assets as measures of household welfare outcomes.

It is very likely that farmers that participated in the groundnuts Fairtrade arrangement focused on groundnuts production for cash income and maize production as a source of food. Given that farmers may not predict the prices that small-scale traders purchase during the growing season, we anticipate that farmers may choose to cultivate a particular crop or more than one crop based on their access to inputs, agronomic technical expertise, and expected output price during the harvest period. Thus, we expect the spillover effects from the groundnuts fairtrade arrangement to promote groundnuts production or other crops that farmers find feasible to produce.

3.2 Empirical Strategy

We use Goetz (1992) household model of market participation to derive underlying factors that influence farmers decision to commercialise their farming and intensity of commercialisation. Farmer i at time t in district d will commercialise farming if:

$$\begin{aligned}
 1) \quad & \begin{cases} U_{Cit} - U_{Nit} \geq 0 \\ U_{Cit} = X_{it}\gamma + \epsilon_{it} \geq 0 \end{cases} \\
 2) \quad & C_{it} = \begin{cases} 1 \text{ if } U_{Cit} - \epsilon_{it} \geq X_{it}\gamma \\ 0 \text{ if } U_{Cit} - \epsilon_{it} \leq X_{it}\gamma \end{cases}
 \end{aligned}$$

where U_{Cit} is the utility farmer i derives from choosing to commercialise farming at time, t and U_{Nit} is the utility from not commercialising. X_{it} is the vector of explanatory variables that

determine agricultural commercialisation and γ the vector of corresponding parameters to estimate. We do not observe utility directly, but we do observe C_{it} which takes on a value of zero if the farmer decides not to commercialise and a one if he does. ϵ_{it} represents the composite error ($\rho_i + \mu_{it}$), where ρ_i represents the time constant unobservable factors that affect the decision to commercialise farming such as entrepreneurial skills, managerial ability, and degree of risk aversion while μ_{it} represents the unobservable time varying shocks that affect the decision to commercialise. When $C_{it} = 1$ the farmer must decide the proportion of the output to sell. In this study, we use household commercialisation index (HCI) as a measure of commercialisation intensity, given that farmers produce and sell more than one crop (Strasberg et al., 1999; Leavy and Poulton, 2007). HCI gives the degree of commercialisation as the percentage of crop production marketed¹². We specify the sale equation as follows:

$$3) \quad CI_{it} = C_{it}(CI_{it}^*)$$

$$4) \quad CI_{it}^* = Z_{it}\beta + \varepsilon_{it}$$

where CI_{it} represents commercialisation index, i . CI_{it}^* represents a latent variable for the level of commercialisation the farmer would like to achieve regardless of the decision to commercialise. We only observe CI_{it} if $C_{it} = 1$. Z_{it} represents a vector of variables that influence commercialisation intensity. β is corresponding parameters to estimate. The variables that influence the decision to commercialise farming (X_{it}) are the same as those that affect intensity of commercialisation (Z_{it}). Similarly, ε_{it} represents the composite error and is different from ϵ_{it} in the decision to commercialise equation. The model assumes the error terms, ε_{it} and ϵ_{it} to be

¹² $HCI = (\text{gross value of all crop sales} / \text{gross value of all crop production}) * 100$. A value of zero signifies total subsistence, and an index approaching 100 indicates higher degrees of commercialisation i.e. a greater percentage of crop production marketed.

uncorrelated (Wodjao, 2007; Engel and Moffat, 2012; Humphreys, 2013). Therefore, they are assumed to be independently and normally distributed with zero covariance (i.e. $\text{cov}(\epsilon_{it}, \epsilon_{it}) = 0$) (Wooldridge, 2009; Ricker-Gilbert et al., 2011).

Then, we estimate the spillover effect of the groundnuts Fairtrade arrangement on smallholder agricultural commercialisation and welfare outcomes. Recall, Fairtrade International implemented the groundnuts Fairtrade arrangement in Mchinji district with MASFA from 2004 to 2011, where 2007 is the year in which exports to UK started and 2018 is 7 years after the exports stopped, allows us to measure the spillover effects from this intervention on smallholder agricultural commercialisation intensity and welfare outcomes in Mchinji district. In this paper, Mchinji district is our treatment district whereas Ntchisi district is control district. However, we do not have observations for households that participated in the Fairtrade arrangement in Mchinji. As a result, we are unable to estimate the direct impacts from this arrangement on agricultural commercialisation and welfare outcomes for the participants. We use our data to estimate a DD estimator to measure the indirect effects from the Fairtrade arrangement on commercialisation intensity and welfare outcomes for the farmer i at time t in district d as follows:

$$6) \quad y_{idt} = \delta_0 + \delta_1 D_d + \delta_2 y_t + \delta_3 (D_d * y_t) + \delta_4 \Lambda_{idt} + \mu_{idt}$$

where y is household commercialisation index or household welfare outcomes (i.e. agricultural income or value of assets) for each farmer. The constant is represented by δ_0 , and $\delta_1 - \delta_4$ are all unknown parameters to estimate while μ_{idt} is a random error term. D denotes farmers that are in Mchinji district but did not participate in the groundnuts Fairtrade

arrangement. The year dummy t varies by year but is the same for the treated and control districts. It takes on a value of 1 for the 2018 year and zero for the earlier year, 2007. The parameter δ_3 represents the average treatment effect on the treated (ATT) district, in the DD estimation framework. It is the interaction of D and y , making the corresponding coefficient estimate of $\hat{\delta}_3$ of principal interest in the study because it captures the indirect effect from the groundnuts Fairtrade arrangement on our variables of interest. A positive coefficient estimate on $\hat{\delta}_3$ indicates that the arrangements led to increase in intensity of commercialisation, agricultural income or value of assets in other specifications (i.e. positive effects), while a negative coefficient indicates that the arrangement led to a reduction in commercialisation intensity, agricultural income or value of assets in other specifications (i.e. negative spillover effects). A range of control variables is denoted by Λ and are the same as those in equation [4] and [2] affecting decision to commercialise farming and its intensity. These variables include years of schooling of household head, household size, age of household head, landholding size, and volume of fertiliser used (see table A.1 in the appendix for the detailed description of variables used in the analysis).

3.3 *Identification strategy*

3.3.1 *Double hurdle model for the decision to commercialise farming and intensity*

Our data has a significant proportion of farmers that do not commercialise their farming, thus intensity of agricultural commercialisation is zero and the rest with a positive level of agricultural commercialisation. We treat the zero values in our data as genuine zeros and not as missing values, which is modeled using Heckman selection model (Yu and Abler, 2007; Ricker-Gilbert et al., 2011; Humphreys, 2013; Mather et al., 2013). Therefore, a corner solution model

fits our data than a selection model because most farmers are aware of selling agricultural produce as a source of income. A corner solution model is estimated via a tobit or DH model. Where the farmer makes the decision to commercialise farming and intensity of commercialisation simultaneously, decision to commercialise and intensity of commercialisation is estimated via tobit estimator. Thus, factors affecting commercialisation decision and intensity of commercialisation are the same (Wooldridge, 2009; Ricker-Gilbert et al., 2011; Mather et al., 2013). Conversely, where the farmer makes the decision to commercialise and intensity of commercialisation sequentially, the DH model to address corner solutions is appropriate. In the DH model, factors influencing commercialisation decision and intensity of commercialisation may be different (Yu and Abler, 2007; Ricker-Gilbert et al., 2011; Mather et al., 2013). Thus, the same factors can potentially affect commercialisation and intensity decisions differently.

Recall that one of our research objectives is to estimate factors that influence farmers' decision to commercialise farming and its intensity of commercialisation. We estimate a DH model of farmers' agricultural commercialisation decisions in two stages. The first stage is a Probit model of the decision to commercialise farming or not, equation [2], and the second is a truncated normal regression model of intensity of commercialisation, equation [4].

Estimation issues

Household-level unobserved heterogeneity

Our coefficient estimates would be biased if unobservable time-invariant household-level characteristics such as farm management ability and risk preferences are correlated with observable predictors of agricultural commercialisation intensity, CI , such as head's education level, landholding size and input use. The fixed effect (FE) estimator is known to control for

unobserved time-constant household characteristics, as it assumes no correlation between observable predictors and unobservable heterogeneity. However, the use of FE estimator has been shown to be inconsistent when the data take on the properties of nonlinear corner solution variables (Wooldridge, 2002; Ricker-Gilbert et al., 2011; Mather et al., 2013). We use Correlated Random Effects (CRE) to account for heterogeneity and its correlation with observable household characteristics in our DH model (Mundlak, 1978; Chamberlain, 1984). CRE approach involves adding the household's time-average of each time-varying explanatory variable as additional explanatory variables to each stage of the DH model. This allows for correlation between household-level unobserved heterogeneity and the vector of explanatory variables across all periods. This implies that household-level time-constant unobserved factors are correlated with time-average CRE terms, thus enabling our explanatory variables to remain uncorrelated with unobserved time-constant factors in the error term (Wooldridge, 2000).

Controlling for Endogeneity

Recall, the government has been implementing the large-scale farm input subsidy program, which provides farmers with subsidized fertilizer in Malawi. We use Control Function (CF) approach to test for the potential endogeneity of volume of fertilizer used. We estimate a reduced form Tobit regression of the volume of fertilizer used as a function of all the variables in our structural regression plus the instruments for fertilizer use. Then, we include the residual from the Tobit regression of fertilizer use as a regressor in the structural equations of the DH model, along with the endogenous variable, volume of fertilizer used. The volume of fertilizer used is endogenous if the partial effect of the Tobit reduced form residual is significant in either of the stages of the DH model. We use a variable =1 if a resident of the community is Member

of Parliament (MP) and the distance to fertilizer seller as instruments in Tobit regression (Ricker-Gilbert et al., 2011; Mason and Ricker-Gilbert, 2013; Mather et al. 2013; Sibande et al., 2017). Our results indicate that distance to fertilizer seller has a marginal significant effect on the volume of fertilizer used ($p=0.068$) whereas the variable =1 if a resident of the community is the MP is not significant (see table A.2 in the appendix). Following the CF approach, we include both the potentially endogenous variable – the volume of fertilizer used – and the reduced form residual (from the Tobit regression) in all stages of DH model. We find that the coefficient on the reduced form residual is insignificant in the first stage ($p = 0.592$, see table A.3 in the appendix) and significant in the second stage ($p = 0.004$) of the DH model. Therefore, we conclude that the volume of fertilizer used is exogenous in the first stage and endogenous in the second stage of the DH model. We estimate the first stage without the reduced form Tobit residual, but include them in the second stage of DH model.

3.3.2 DD estimator for the spillover effects from Fairtrade arrangement

It is important to note that selection of Mchinji district by NASFAM was non-random, and was likely based on the volume of groundnuts the district produces. Therefore, a potential source of endogeneity bias in this context comes from conditions that we cannot observe which likely determine selection of Mchinji district as well as influence intensity of commercialisation (Jalan and Ravallion, 1998; Khandker et al., 2010, Kaiyatsa et al., 2019). In this regard, the DD estimator allows us to control for possible endogeneity of the district that was selected for the groundnuts Fairtrade arrangement. This form of endogeneity caused by time-constant unobserved heterogeneity (i.e. the unobserved difference in mean counterfactual outcomes between the treated and control districts) cancels out through differencing, and the growth in agricultural

commercialisation intensity, agricultural income or asset value for the farmers in control district serves as the counterfactual indicator (Khandker et al., 2010; Kaiyatsa et al., 2019).

Parallel-Trend Assumption Test

While the DD estimator controls for time-constant unobserved heterogeneity, the coefficient estimates are consistent with the parallel trends assumption. It stipulates that the average change in intensity of commercialisation for farmers in treated district if they were untreated would be equal to the observable average change among comparable farmers in control district (Mora and Reggio, 2012; Kaiyatsa et al., 2019). Thus, the outcome in treatment and control district must follow the same time trend in the absence of the treatment. However, if the results are not consistent with parallel trend assumption, it means that time-varying unobservable factors are correlated with farmers who are in the Fairtrade district and their commercialisation intensity, agricultural income or value of assets, and thus the coefficient estimates are biased.

To deal with this problem and provide evidence in support of the parallel trend assumption in our context, we test for the change in time trend in each group during the pre-treatment and post-treatment years (i.e. the slope of D_d versus y_t) using *-margins command-* in Stata after estimation of equation [6] (Williams, 2012). If the two groups are parallel before treatment, then their pre-treatment slopes will be approximately the same and δ_3 will be approximately 0. If they diverge after the start of treatment, then δ_3 will be large, and the two post-treatment slopes will differ significantly, and the estimate will be consistent with the parallel trend assumption.

3.3 Data

The study uses two waves of panel data from Malawi's central districts of Mchinji and Ntchisi where groundnut production is concentrated. Data were collected as part of longitudinal tracker study for the Agricultural Policy Research in Africa (APRA)¹³ research project that explores pathways to agricultural commercialisation and livelihood trajectories (Matita et al., 2018). The tracker is based on a randomly representative survey that was conducted by the School of Oriental and African Studies and the National Statistical Office to evaluate the 2006/07 Farm Input Subsidy Programme (FISP). Chirwa and Dorward (2013) provide detailed description of the data including selection of respondents. We use the sub sample of 240 households selected in Mchinji and Ntchisi districts, which were interviewed in 2006/07. Respondents answered various questions on agricultural activities and FISP for the reference farming season of 2006/07 and welfare outcomes. We tracked the 240 household heads in September and October 2018 as part of APRA study. Successfully, we re-interviewed 217 out of the 240 households, representing 10 percent attrition rate. This attrition rate is low compared with similar surveys in developing countries (Alderman et al., 2001; Burke and Jayne, 2008; Chapoto and Jayne, 2008).

Attrition Bias

We use a balanced panel sample of 410 households to control for unobserved heterogeneity given that the CRE framework includes household time averages as additional regressors, which requires a balanced sample in nonlinear models with two waves (Ricker-Gilbert et al., 2011; Mather et al., 2013).

¹³ See www.futureagricultures.org/APRA for detailed description of the APRA research program.

4. Results and Discussion

4.1 Descriptive Results

The descriptive statistics in table 1 indicate that about 49% of households in Mchinji district and 59% of the households in Ntchisi district commercialise their farming. This might suggest that fewer households have commercialised their farming in Mchinji district than in Ntchisi district. Further, table 1 indicates that commercialisation intensity for households in Mchinji district is 31.96% while for Ntchisi district is 37.28%. The difference is marginally significant at 10% level. This means that commercialisation intensity is lower for households in Mchinji district than those in Ntchisi district. About 85% and 75% are male-headed households in Mchinji and Ntchisi districts, respectively. This suggests that most households in Mchinji district are male-headed households than those in Ntchisi district. The results show that households in Mchinji district own 2.82ha of land while those in Ntchisi district own 1.71ha, on average. This means that landholding size is higher in Mchinji district than in Ntchisi district.

Table 1: Comparison of variables by district

Variables	Full sample (N=410)		Households in Mchinji district (N=200)		Households in Ntchisi district (N=210)		t-test Statistic
			Mean	Std. Dev.	Mean	Std. Dev.	
=1 if commercialise farming	55.85		48.65		59.03		4.869**
Commercialisation Index (%)	34.68	39.17	31.96	39.17	37.28	39.09	1.376*
School years of head	3.81	3.92	3.87	4.15	3.76	3.70	-0.278
Household size	7.85	2.91	7.82	2.93	7.89	2.90	0.246
=1 if head is male	80.98		85		77.14		4.11**
Age of head	52.19	16.35	52.37	17.08	52.01	15.58	0.224
Landholding size in ha	2.25	3.51	2.82	4.65	1.71	1.71	-3.23***
=1 if rents in land	16.83		18.5		15.24		0.779
Volume of fertiliser used in kg	116.43	266.7	122.39	265.36	110.75	268.56	-0.44

Notes: The average difference in mean between households in Mchinji and Ntchisi districts; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Empirical Results

4.2.1 Determinants of household commercialisation and its intensity

Table 2 presents probit results of household decision to commercialise farming. The results indicate that households in Mchinji district are less likely to commercialise their farming than those in Ntchisi district by 36%. This finding may suggest that most households in Mchinji district are subsistence farmers than those in Ntchisi district. The time effect shows that the probability of households' decision to commercialise farming has increased by 94% from the 2007 level. As we would expect, the volume of fertilizer used increase the likelihood of household's decision to commercialise farming by 0.3%. The use of fertilizer has a greater potential to enable households to produce more output per unit of land.

Table 2: Factors affecting household decision to commercialise farming

Dependent variable: =1 if commercialise farming	CRE Probit Estimator (N=410)	
	APE	Std. Error
<i>Covariates:</i>		
=1 if district is Mchinji	-0.357**	(0.151)
School years of head	0.005	(0.023)
=1 if year 2018	0.944***	(0.302)
Household size	0.100	(0.069)
=1 if head is male	0.061	(0.189)
Age of head	-0.012	(0.015)
Landholding size in ha	0.006	(0.055)
=1 if rents in land	0.334	(0.217)
Volume of fertiliser used in kg	0.003*	(0.001)
Constant	-0.150	(0.454)

Notes: The variable quantity of fertiliser used is treated as exogenous; standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; model includes time averages of all time-varying explanatory variables; coefficients and p-values obtained by *margins* command in Stata; APE represents average partial effect.

Table 3 presents the determinants of commercialisation intensity. The results indicate that commercialisation intensity has increased by 29% from the 2007 levels. This suggests that the proportion of marketed output has increased over time. Landholding size has a marginal negative association of 4.5% with commercialisation intensity. This is surprising, as we would expect agricultural output to increase as landholding size increases, which may enable households to produce a greater surplus. Nevertheless, this might mean that land is not a limiting factor to prevent households from commercialising their farming.

Table 3: Determinants of commercialisation intensity

Dependent variable: Household commercialisation index (HCI)	CRE Truncated Normal Regression (N=229)	
	APE	Std. Error
<i>Covariates:</i>		
=1 if district is Mchinji	1.657	(4.446)
residual	-0.095**	(0.044)
=1 if year 2018	29.114***	(8.043)
Household size	-0.930	(2.006)
=1 if head is male	-2.168	(6.060)
Age of head	-0.043	(0.353)
Landholding size in ha	-4.666*	(2.444)
=1 if rents in land	-12.351	(8.534)
Volume of fertiliser used in kg	-0.003	(0.008)

Notes: The variable quantity of fertiliser used is treated as endogenous; standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; model includes time averages of all time-varying explanatory variables; coefficients and p-values obtained by *margins* command in Stata; APE represents average partial effect.

Table 4 shows that the coefficient for measuring the effect from the Fairtrade arrangement on agricultural commercialisation intensity for households that did not participate in the Fairtrade arrangement but were in Mchinji district (i.e.: indirect impact or spillover effect) is positive and statistically significant at 1%. The treatment variable =1 if the household was in Mchinji district. This finding suggests that implementation of the Fairtrade arrangement in Mchinji district has 29% spillover effect on household commercialisation intensity. This means that implementation of the Fairtrade arrangement in Mchinji district positively influenced households that were not involved to produce more output and increase their engagement with output markets; hence have a higher score on commercialisation intensity than those in Ntchisi district.

Table 4: Spillover impact of Fairtrade arrangement on agricultural commercialisation intensity using Pooled OLS Estimator

Dependent variable: Household commercialisation index (HCI)	DID Estimator (N=229)	
	Coefficients	Std. Error
Covariates:		
residual	-0.091**	(0.044)
=1 if year 2018	11.328	(6.960)
=1 if district is Mchinji	-18.735**	(7.675)
Fairtrade indirect impact (ATT):		
<i>=1 if in Mchinji district*=1 if year 2018</i>	29.398***	(8.857)
Household size	0.188	(0.693)
=1 if head is male	-1.587	(5.674)
Age of head	0.101	(0.144)
Landholding size in ha	-3.729**	(1.855)
=1 if rents in land	-11.719	(9.359)
Volume of fertiliser used in kg	0.010**	(0.005)
Constant	51.222***	(8.831)

Notes: The variable quantity of fertiliser used is treated as endogenous; standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Although the Fairtrade arrangement has a positive effect on commercialisation intensity for households in Mchinji district, our results indicate, further, that households in Mchinji district are less commercialised by 19% than in Ntchisi district. Similarly, landholding size is negatively associated with commercialisation intensity while the volume of fertiliser used increase commercialisation intensity of households.

To check for robustness of our parameter DD estimates, we implement parallel trend assumption test. Table 5 shows that the coefficient for measuring the effect from the Fairtrade arrangement on agricultural commercialisation intensity for households that did not participate in the Fairtrade arrangement but were in Mchinji district is positive in both years. The coefficient is statistically significant in 2018 but not significant in 2007. This shows that Parallel Trend Assumption is valid in our DD model.

Table 5: Average Marginal Effects after Pooled OLS regression

	Marginal Effects after OLS Estimator	
	Coefficients	Std. Error
<i>=1 if in Mchinji district*=1 if year 2018</i>		
<i>=1 if year is 2007</i>	11.328	(6.960)
<i>=1 if year is 2018</i>	40.726***	(6.461)

Notes: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; coefficients and p-values obtained by *margins* command in Stata.

Table 6 shows that the Fairtrade arrangement has no significant spillover effect on agricultural income for households that did not participate in the arrangement but were in Mchinji district. This finding indicates that household agricultural income has not improved because of the Fairtrade implementation in Mchinji district. This makes sense given that implementation of the Fairtrade did not influence private traders' decision to purchase agricultural produce at higher prices for households that did not participate in the arrangement. Usually, private traders purchase farmers' produce at very low farm gate prices than those set by government and use unstandardized equipment (Baulch, 2017; 2018). As a result, traders easily exploit farmers who do not belong to any farmer organisation because they lack bargain power. This finding is consistent with Muriithi and Matz (2015) who find that vegetables commercialization through the domestic market participation did not improve household's income per adult equivalent in Kenya. Further, the results indicate that agricultural income has increased by 54% for male-headed households, 12% for every hectare of land owned, and 0.5% for every 1% increase in the use of fertilizer. Overall, the year effect suggests that household agricultural income has increased over time.

Table 6: Spillover impact of Fairtrade arrangement on agricultural income in Mchinji District using Pooled OLS Estimator

Dependent variable: log of agricultural income	DID Estimator (N=146)	
	Coefficient	Std. Error
<i>Covariates:</i>		
=1 if year 2018	4.152***	(0.408)
=1 if district is Mchinji	0.422	(0.451)
Fairtrade indirect impact (ATT):		
=1 if in Mchinji district*=1 if year 2018	-0.571	(0.500)
Household size	-0.004	(0.042)
=1 if head is male	0.544**	(0.256)
Age of head	-0.004	(0.007)
Landholding size in ha	0.122***	(0.023)
=1 if rents in land	-0.161	(0.258)
Log of fertiliser used	0.515***	(0.152)
Constant	4.452***	(0.841)

Notes: The variable quantity of fertiliser used is treated as exogenous; standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Similarly, table 7 shows that the Fairtrade arrangement has no significant spillover effect on value of assets for households that did not participate in the arrangement but were in Mchinji district. This finding indicates that value of assets has not improved for households that did not participate in the arrangement because of the Fairtrade implementation in Mchinji district. . This finding is also not consistent with Muriithi and Matz (2015) who find that vegetables commercialization through the domestic market participation improved asset holdings in Kenya. The results indicate that value of assets has increased for male-headed households and those that use of fertilizer. Overall, the year effect suggests that household value of assets has declined over time.

Table 7: Spillover impact of Fairtrade arrangement on asset value in Mchinji District using Pooled OLS Estimator

Dependent variable: log of asset value	DID Estimator (N=177)	
	Coefficient	Std. Error
<i>Covariates:</i>		
=1 if year 2018	-4.986***	(0.310)
=1 if district is Mchinji	0.258	(0.363)
Fairtrade indirect impact (ATT):		
=1 if in Mchinji district*=1 if year 2018	0.240	(0.418)
Household size	0.013	(0.041)
=1 if head is male	1.030***	(0.315)
Age of head	-0.010	(0.007)
=1 if rents in land	0.211	(0.227)
Log of fertiliser used	1.038***	(0.122)
Constant	3.265***	(0.649)

Notes: The variable quantity of fertiliser used is treated as endogenous; standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5. Conclusions and Policy Implications

In this study, we test whether there are spillover effects from the groundnuts Fairtrade arrangement on smallholder agricultural commercialization in Mchinji district and their welfare outcomes by using two waves of panel data from Mchinji and Ntchisi districts that were collected in 2006/07 and 2017/18 agricultural seasons. The 2006/07 data is our baseline year before NASFAM started exporting MASFA's groundnuts to UK while the 2017/18 data represents the year after NASFAM stopped exporting MASFA's groundnuts to UK, which allows us to measure spillover effects from the Fairtrade arrangement in Mchinji district. Firstly, we use our data to test whether farmers that did not participate in the Fairtrade arrangement in Mchinji district are more likely to commercialise their farming and have a higher commercialisation intensity than those in Ntchisi district using a double hurdle model. Then, we apply a difference-in-differences estimator to test whether there are spillover effects on commercialisation intensity, agricultural

income, and value of assets for farmers that did not participate in the Fairtrade arrangement but were in Mchinji district.

Our findings reveal that households in Mchinji district are less likely to commercialise their farming than those in Ntchisi district by 36%. The volume of fertilizer used increase the likelihood of household's decision to commercialise farming and intensity of commercialization. Our coefficient for measuring the spillover effect from the Fairtrade arrangement on agricultural commercialisation intensity for households that did not participate in the Fairtrade arrangement but were in Mchinji reveals that implementation of the Fairtrade arrangement in Mchinji district has 29% spillover effect on household agricultural commercialisation intensity. However, we find that there are no spillover effects from the Fairtrade implementation on agricultural incomes and value of assets for farmers that did not participate in the arrangement in the district.

Given that, not all farmers can participate in programs that enhance their access to international markets; this study has demonstrated that the Fairtrade arrangement indirectly influences farmers to produce the market surplus for the domestic market. However, our findings indicate that such investment does not improve the welfare of farmers that are not involved in terms of agricultural incomes and the level of household assets. This would be due to poor output prices in the domestic market. Therefore, we recommend that smallholder farmers need support for them to continue commercialising their farming, increase their intensity and improve their welfare. Such support includes, but not limited to, enforcement and monitoring private traders' compliance to government set minimum farm gate prices to protect farmers from exploitation, linking farmers to financial and credit institutions to increase their access to productivity

enhancing technologies, and improving the rural road network to enable them easily transport their inputs and produce, and allow penetration of traders to remote rural areas.

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Appendix

Table A.1: Measurements of variables used in the empirical analysis

Variable	Type	Measurements
<i>Dependent Variables</i>		
=1 if Household commercialise farming	Binary	1=if household commercialise farming; 0 otherwise
Household Commercialisation Index (HCI)	Continuous	Household degree of commercialisation as the percentage of crop production marketed
<i>Independent Variables</i>		
=1 if head is male	Binary	Gender of household head: =1 if head is male; 0 otherwise.
Age of head	Continuous	Age of head in years
Number of school years of head	Continuous	Number of years head spent in school
Household size	Continuous	Number of household members
Landholding size in ha	Continuous	Amount of land that household owns in ha
=1 if rents in land	Binary	=1 if head rents in land; 0 otherwise
Volume of fertiliser used in kg	Continuous	The volume of fertiliser used on the farm in kgs

Table A.2: Determinants of fertilizer use using a reduced form Tobit model

Dependent variable: total fertilizer used in kg	CRE Reduced form Tobit Estimator (N=410)	
	APE	Std. Error
Covariates:		
Distance to fertilizer seller	0.93*	(0.51)
=1 if a resident of the community is Member of Parliament	17.27	(29.47)
=1 if district is Mchinji	-17.34	(27.92)
=1 if year 2018	-6.38	(16.84)
Household size	-2.78	(4.14)
=1 if head is male	34.68***	(13.55)
Age of head	0.49	(0.73)
Landholding size in ha	19.70***	(6.59)
=1 if rents in land	64.28***	(24.43)

Notes: standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; model includes time averages of all time-varying explanatory variables; coefficients and p-values obtained by *margins* command in Stata; APE represents average partial effect.

Table A.3: Factors influencing household decision to commercialise farming

Dependent variable: =1 if commercialise farming	CRE Probit Estimator (N=410)	
	APE	Std. Error
=1 if district is Mchinji	-0.228	(0.242)
residual	-0.004	(0.007)
School years of head	0.005	(0.023)
=1 if year 2018	1.035***	(0.404)
Household size	0.125	(0.121)
=1 if head is male	-0.289	(0.663)
Age of head	-0.018	(0.021)
Landholding size in ha	-0.178	(0.242)
=1 if rents in land	-0.257	(0.666)
Volume of fertiliser used in kg	0.003**	(0.001)
Constant	-0.090	(0.655)

Notes: The variable quantity of fertiliser used is treated as endogenous; standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; model includes time averages of all time-varying explanatory variables; coefficients and p-values obtained by *margins* command in Stata; APE represents average partial effect.