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THE GROUNDNUTS FAIRTRADE ARRANGEMENT AND ITS SPILLOVER EFFECTS ON AGRICULTURAL COMMERCIALISATION AND HOUSEHOLD WELFARE OUTCOMES: EMPIRICAL EVIDENCE FROM CENTRAL MALAWI

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ACRONYMS

AAMP	African Agricultural Markets Programme
APRA	Agricultural Policy Research in Africa
APE	average partial effect
ATT	average treatment effect on the treated
CF	control function
CRE	correlated random effects
DD	difference-in-differences
DH	double hurdle
FAO	Food and Agriculture Organization of the United Nations
FE	fixed effects
FISP	Farm Input Subsidy Programme
HCI	household commercialisation index
IAAE	International Association of Agricultural Economists
IDB	Inter-American Development Bank
IPW	inverse probability weight
LDC	least developed countries
MAFAP	Monitoring African Food and Agricultural Policies
MAPAC	Malawi Programme for Aflatoxin Control
MASFA	Mchinji Area Small Farmers Association
MASSP	Malawi Strategy Support Programme
MP	Member of Parliament
MSU	Michigan State University
NASFAM	National Association of Smallholder Farmers of Malawi
NBER	National Bureau of Economic Research
NGO	non-governmental organisation
NSO	National Statistical Office
OLS	ordinary least squares
PRUS	Poverty Research Unit at Sussex
PTA	parallel trends assumption

SOAS	School of Oriental and African Studies
STDF	Standards and Trade Development Facility

ABSTRACT AND KEYWORDS

In 2004, Fairtrade International certified one of the farmers' associations in Mchinji District, the Mchinji Area Small Farmers Association (MASFA), as a Fairtrade groundnuts producer to sell its groundnuts to the premium export market in the UK and Europe. MASFA sold its groundnuts through the National Association of Smallholder Farmers of Malawi (NASFAM) from 2007 to 2011 under the Fairtrade arrangement. In this study, we test whether there are spillover effects of this groundnut Fairtrade arrangement on small-scale agricultural commercialisation and its effect on household welfare for smallholder farmers that were not part of the arrangement in Mchinji District.

We use a unique panel data set of smallholder farmers that were collected in central rural Malawi in the 2006/07 and 2017/18 agricultural seasons. Our difference-in-differences (DD) estimator reveals that the implementation of the groundnuts Fairtrade arrangement in Mchinji District has a 30 per cent spillover effect on commercialisation intensity for smallholder farmers that were not part of the arrangement. Further, a fixed effect (FE) regression model reveals that crop income marginally improved by MK11 917 (US$16.41) for smallholder farmers that were not part of the arrangement in Mchinji District, on average. However, we find no improvement in the value of assets for smallholder farmers in Mchinji District. Our results suggest that smallholder farmers need support to allow them to continue to commercialise farming and improve their welfare.

Keywords: Groundnuts Fairtrade, agriculture commercialisation, spillover effects, welfare outcomes, panel data analysis, Malawi.

INTRODUCTION

Promoting smallholder agricultural commercialisation in the least developed countries (LDCs) is well known as a means to reduce rural poverty (Pingali 2007; Jayne *et al*. 2011; Muriithi and Matz 2015; Sibande, Bailey and Davidova 2017). Smallholder agriculture commercialisation happens when farmers use modern inputs (e.g. hybrid seed and chemical fertilisers) to produce market surpluses, which increase their engagements with output markets and result in better incomes and improved standards of living (Jayne *et al.* 2011; Kirsten *et al*. 2012). However, most rural farmers are unable to sell their output because of low yields due to limited use of modern inputs.

Recently, input support programmes have become popular in most LDCs to increase farmers' access to modern inputs and permit them to produce surpluses. Government-led input support programmes target the production of staple crops such as maize and rice while development partner-led programmes target the production of high-value crops such as root tubers, legumes, and horticultural crops. Some of the programmes that development partners support link farmers to export markets. For instance, recent studies have established that access to subsidised inputs increases the quantity of maize that farmers produce (Ricker-Gilbert and Jayne 2012) and sell (Sibande *et al*. 2017) in Malawi, whereas linking farmers to export markets increases their incomes in Senegal (Maertens and Swinnen 2009) and Kenya (Muriithi and Matz 2015).

In Malawi, the government has identified groundnuts, which smallholder farmers grow as one of the legumes to promote for export markets (Government of Malawi 2012). Although nearly all the districts grow groundnuts, production is concentrated in the central region, mostly in Kasungu, Mchinji, Nkhotakota, and Ntchisi. Sangole, Magombo and Kalima (2010) find that a groundnut farmer allocates 0.4ha of land to groundnuts production, on average. Traditionally, farmers cultivate groundnuts in a pure stand or intercrop with maize with limited input use. Farmers use their hands to shell the groundnuts. Because the shells are hard, most farmers soak their groundnuts to soften the shells, which builds up aspergillus fungus that causes aflatoxin (Pound *et al*. 2011).

In a liberalised market environment, smallholder farmers have several market options to sell their groundnuts. Farmers may sell their groundnuts to the National Association of Smallholder Farmers of Malawi (NASFAM),[1] small-scale traders,[2] large-scale traders,[3] and processors, or enter into contract farming arrangements with seed growers. NASFAM has also invested in processing facilities, which are limited to sorting, grading, and packaging in the Kasungu and Ntchisi districts (Fitzgerald 2015; Diaz Rios *et al*. 2013). According to Derlagen and Phiri (2012) and Diaz Rios *et al.* (2013), about 60 per cent of hand-shelled nuts have the potential to reach the export markets but exports are as low as 10–15 per cent.

In 2004, the Fairtrade Labelling Organisation International (now Fairtrade International) certified one of the NASFAM's farmer associations, the Mchinji Area Small Farmers Association (MASFA) in Mchinji District, as a Fairtrade groundnuts producer to sell its groundnuts to the premium export market. This arrangement involved three key partner organisations: namely, NASFAM (a Fairtrade International certified exporter), Twin Trading (a Fairtrade International certified buyer), and Liberation Foods Community Interest Company (an owned producer organisation). MASFA would sell its groundnuts through NASFAM, which would export the groundnuts to Twin Trading in the UK, and then Liberation Foods would coordinate the retail of groundnuts in the UK and European markets (Pound and Phiri 2011).

During implementation of the Fairtrade arrangement, MASFA received support which included, but was not limited to, capacity building, improved seed varieties (CG7), and extension services, and were introduced to cheaper ways of detecting and controlling the problem of aflatoxin (Pound and Phiri 2011). Farmer organisations access relatively higher prices when they sell their products on Fairtrade terms, which improves their incomes and welfare (Oya *et al.* 2017; Fairtrade International n.d.).[4] Fairtrade has sets of standards, which allow consumers to pay a premium price, which is over and above the usual product price. The farmer organisations decide democratically on how to utilise the premiums for community projects. Traceability of products along the supply chain ensures that

producers are compliant with economic, social, and environmental standards for Fairtrade.[5] MASFA sold its groundnuts through the Fairtrade arrangement to the UK from 2007 to 2011 (Derlagen and Phiri 2012; Pound *et al.* 2011).

The objectives of the present study are threefold. Firstly, to test whether smallholder farmers in a district in which Fairtrade International implemented the groundnut Fairtrade arrangement are more likely to commercialise their farming and have a higher commercialisation intensity than those in a district in which NASFAM invested in processing facilities. Secondly, to explicitly test whether the groundnuts Fairtrade arrangement has spillover effects on commercialisation intensity for smallholder farmers that were not part of the arrangement in Mchinji District.[6] Thirdly, to test whether agricultural commercialisation intensity improved household welfare for smallholder farmers that were not part of the arrangement 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 the level and intensity of input use, increase yield, and encourage market participation for programme non-participants (Adewumi, Jimoh and Omotesho 2013; Ali, Deininger and Harris 2015).

Conversely, Key, Sadoulet and de Janvry (2000), Hall (2011), and Ali *et al.* (2015) indicate that the spillover effects may lead to competition for productive land and casual labour, which may discourage non-participants from expanding their production. Von Braun, Hotchkiss and Immink (1989), Neven *et al.* (2009), and Maertens and Swinnen (2009) find positive spillover effects from farmers' participation in the export market on demand for wage labour in the production of horticultural crops in Guatemala, Kenya, and Senegal, respectively. Ours is the first study to estimate the spillover effects from the Fairtrade certification scheme on commercialisation intensity for smallholder farmers that are not involved in the programme in sub-Saharan Africa.

In this study, we hypothesise that smallholder farmers in a district in which Fairtrade International implemented the groundnut Fairtrade arrangement are more likely to commercialise their farming and have a higher commercialisation intensity than those in a district in which NASFAM invested in processing facilities. Further, we hypothesise that the groundnuts Fairtrade arrangement has spillover effects on commercialisation intensity for smallholder farmers that were not part of the arrangement in Mchinji District. If this hypothesis holds, we further hypothesise that an increased level of commercialisation intensity improved the living standards of smallholder farmers that were not part of the arrangement in Mchinji District.

We use unique panel data collected over a span of ten years (between the 2006/07 and 2017/18 agricultural seasons) from smallholder farmers which the School of Oriental and African Studies and the National Statistical Office surveyed in the evaluation of the 2006/07 Farm Input Subsidy Programme (FISP) in the Mchinji and Ntchisi districts. Thus, our data comprise smallholder farmers that were not part of the groundnuts Fairtrade arrangement in Mchinji District and those that do not have access to NASFAM's processing facilities in Ntchisi District.

The 2006/07[7] data represent the year before MASFA started selling its groundnuts through NASFAM to the UK while the 2017/18 data represent the year after Twin Trading stopped importing MASFA's groundnuts into the UK, which allows us to measure spillover effects from the groundnut Fairtrade arrangement for farmers that were not part of the arrangement in Mchinji District.

Firstly, we estimate a double hurdle (DH) model to test whether smallholder farmers in Mchinji District are more likely to commercialise their farming and have a higher commercialisation intensity than those in Ntchisi District. Then, we estimate a difference-in-differences (DD) model to explicitly test whether the groundnuts Fairtrade arrangement has spillover effects on commercialisation intensity and household welfare outcomes for smallholder farmers that were not part of the programme in Mchinji District. Finally, we estimate a fixed effects (FE) regression model to test whether agricultural commercialisation intensity improved household welfare for smallholder farmers that were not part of the arrangement in Mchinji District.

Our findings reveal that the likelihood of commercialising farming is lower for households in Mchinji District than for those in Ntchisi District by -38 per cent. The volume of fertiliser used increases the likelihood of a household's decision to commercialise farming. Commercialisation intensity between 2007 and 2018 has increased by 29 per cent, on average. We find that the groundnut Fairtrade arrangement has a spillover effect of 30 per cent for smallholder farmers that were not part of the arrangement in Mchinji District. Further, we find that while increased intensity of commercialisation did not improve the value of assets, it marginally improved crop income for smallholder farmers that were not part of the arrangement in Mchinji District – by MK11 917 (US$16.41), on average.

The rest of the paper is organised as follows. The history of the Fairtrade arrangements in Malawi is detailed in Section 2. A discussion of the methods and data used in the analysis is given in Section 3, and empirical findings follow in Section 4. The paper concludes with implications in Section 5.

2 HISTORY OF THE FAIRTRADE ARRANGEMENTS IN MALAWI

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 the Kasinthula Cane Growers Association as a farmer organisation that produces sugar cane, the Eastern Outgrowers Trust, Sukambizi Association Trust, and Satemwa Tea Estates Limited as producers of tea, and MASFA as producers of groundnuts. As the name suggests, MASFA is located in the district of Mchinji in the Central region of Malawi. NASFAM facilitated the establishment of MASFA in 2001 (Fairtrade Foundation n.d.) and they were 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 selling prices 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 about 20 members. MASFA has six individual associations from across the district, namely: Kalulu, 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 high-yielding seed varieties,[8] extension services, and warehousing facilities.

In 2007, Twin, NASFAM, and other organisations with an interest in groundnuts Fairtrade, established Liberation Foods as the company to coordinate operations of Fairtrade arrangements in the UK. In this groundnut Fairtrade arrangement, NASFAM was the main buyer of MASFA's groundnuts in Malawi, Twin was the importing organisation in the UK, while Liberation Foods was providing MASFA members with control over the supply and retail of their groundnuts in the UK and Europe (Fairtrade Foundation n.d.). Initially, NASFAM was buying groundnuts from MASFA without a contract (Pound *et al.* 2011). NASFAM introduced informal contracts in 2010; however, they were a loose arrangement, like a Memorandum of Understanding. If the quality was poor, NASFAM could reject the groundnuts. Pound *et al.* (2011) indicate that NASFAM delayed in opening its markets to allow the groundnuts to dry on the farm, which slows down aflatoxin from building up. This late opening of the market led to the side-selling of some of the groundnuts by some MASFA members to private traders who opened their markets early in the season.

Twin had a contractual arrangement with NASFAM on Fairtrade terms. Given that the quality of groundnuts produced was poor, Twin limited the volume of groundnuts to import from MASFA to 72,000kg every season. NASFAM started exporting MASFA's groundnuts in 2007 to the UK. Although the production of groundnuts started to increase in the 2007/08 season, the volume that NASFAM exported to Fairtrade markets afterwards steadily decreased (Pound *et al.* 2011). Twin gradually reduced the volume it was importing from MASFA due to poor quality groundnuts, which was unacceptable in Europe. In order to resolve this quality issue, NASFAM procured 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 per cent) 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 in 2011. Afri-Nut Limited procured a processing plant for MASFA. This plant could only sort and preserve the quality of groundnuts that farmers produced or process the groundnuts into paste. This meant that if farmers produced poor quality groundnuts that were unacceptable in the export markets, the plant could not modify its quality to acceptable levels. Thus, the responsibility to produce good quality groundnuts required for Fairtrade remained with the farmers. 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.

The reduction in the volume of groundnuts that MASFA could sell through Fairtrade negatively affected its premium income. For example, Pound *et al.* (2011) indicate that Twin imported 18 containers (each carrying 18,000kg of groundnuts) in the 2007/08 season, four containers in both 2008/09 and 2009/10, and a container in 2010/11 from MASFA. One of the four containers in 2008/09 and the 2010/11 shipment was found on arrival to have some contamination with

aflatoxin. According to one of the key informants, Twin could dictate aflatoxin contamination upon arrival in Europe because Malawi did not have an accredited facility to test for aflatoxin. The 2010/11 shipment was returned to Malawi and later Twin completely stopped importing MASFA groundnuts in 2012.

Apart from proceeds accruing to individual farmers through improved selling prices for achieving certain groundnuts attributes, Fairtrade International also provided social or community premiums to producer organisations like MASFA for investment in assets and infrastructure with wider community benefits (Oya *et al.* 2017; Fairtrade Foundation n.d.). The MASFA membership decided the use of such social premiums at each annual General Assembly. In one of the years, MASFA used the funds to construct a guardian shelter at Mchinji District Hospital where people that accompany sick people sleep and cook, in an effort to improve access to health services. Further, MASFA constructed two warehouses at Mkanda and Matutu trading centres to provide storage facilities to its members. MASFA also used the money to meet the costs associated with the process of Fairtrade certification, which includes auditing on developed standards and strategising on improvements to ensure adherence. Thus, whilst engagement with premium markets accrued benefits to NASFAM participating members in Mchinji District as individuals, non-members and the community at large also benefited because of the social premiums and implemented community projects.

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 organisations and improve the living standards of its members (von Braun, Bouis and Kennedy 1994; Ronchi 2002; Milford 2004; Calo and Wise 2005; Jaffee 2007; Bacon 2005; Asfaw *et al.* 2012; Arslan *et al.* 2014; Meemken, Spielman and Qaim 2017; Carletto, Corral and Guelfi 2017; Ogutu and Qaim 2019). Usually, smallholder farmers that operate in isolation produce smaller surpluses, which are geographically dispersed and attract the operation of small-scale traders who penetrate rural remote areas (Burke, Jayne and Sitko 2020). These small-scale traders purchase smaller quantities from farmers, and aggregate and re-sell them to large traders who usually operate in well-established markets such as the district capital market (locally known as the *boma* market), where farmers with relatively large surpluses sell.

It has previously been noted that the groundnuts Fairtrade arrangement came with extension services and improved seed varieties, which improved farm productivity for smallholder farmers that participated in the arrangement. Extension messages and technology may potentially spread and reach other smallholder farmers that were not part of the arrangement in Mchinji District, thereby motivating them to change their farming practices. Previous studies have established that social networks lead to transfers of technology among programme non-participants (Rogers 1963; Carter, Laajaj and Yang 2014; Aramburu *et al.* 2019; Varshney, Joshi and Dubey 2019). In this study, we hypothesise that geographic or social interactions might have facilitated the spread of extension messages and improved seed varieties from farmers that participated in the groundnuts Fairtrade arrangement (i.e. MASFA members) to farmers that were not part of the arrangement in Mchinji District. As a result, farmers that were not part of the arrangement might have improved their farming practices in a way that enabled them to produce market surpluses.

It is very likely that farmers that participated in the arrangement focused on groundnuts production as a cash crop and maize production as a food crop. Given that the market channel for farmers that were not part of the arrangement is small-scale traders and that farmers do not know the prices that traders will buy before cultivating, we anticipate a farmer cultivating a particular crop or more than one crop, based on their access to inputs, agronomic technical expertise, and expected output prices. Thus, we expect the spillover benefits from the groundnuts Fairtrade arrangement to improve the human capital of smallholder farmers that were not part of the arrangement, which allows them to increase market surplus for groundnuts as well as other food crops such as maize and soybeans that farmers find feasible to produce (Govereh and Jayne 1999).

If this hypothesis holds, we further hypothesise that increased commercialisation intensity might have improved the living standards of smallholder farmers that were not part of the groundnuts Fairtrade arrangement in Mchinji District. Thus, these smallholder farmers may enjoy increased crop income from relatively higher market surpluses. Usually, formal saving and banking institutions are rare or not available in rural areas; therefore, most smallholder farmers use crop income to build their household assets such as kitchenware, furniture, livestock, ploughs, solar panels, and simple electronic equipment (Kiiru 2007).

3.2 Empirical strategy

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

$$\begin{cases} U_{Cit} - U_{Nit} \geq 0 \\ U_{Cit} = X_{it}\gamma + \epsilon_{it} \geq 0 \end{cases} \quad (1)$$

$$C_{it} = \begin{cases} 1 \; if \; U_{Cit} - \epsilon_{it} \geq X_{it}\gamma \\ 0 \; if \; U_{Cit} - \epsilon_{it} \leq X_{it}\gamma \end{cases} \quad (2)$$

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} represents a list of covariates 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 captures unobservable time-invariant factors affecting the decision to commercialise farming such as entrepreneurial skills, agronomic technical expertise, and ability to avert risk, while μ_{it} represents the unobservable time-variant factors affecting the decision to commercialise farming. When $C_{it}=1$, the farmer must decide the proportion of the output to sell.

Govereh and Jayne (1999) measure household commercialisation as the proportion of the output from the crop marketed over its total production, while Strasberg *et al.* (1999) measure household commercialisation as the proportion of the value of total produce from all the crops marketed over the value of total production. In this study, we use the household commercialisation index (HCI) that Strasberg *et al.* (1999) developed as a measure of household commercialisation intensity, given that our data set has farmers that produce and sell more than one crop such as groundnuts, beans, maize, soya beans, and tobacco.[9] We specify the commercialisation intensity equation as follows:

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

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

where CI_{it} represents the household commercialisation index and CI_{it}^{*} is an unobserved variable for the level of commercialisation intensity. We only observe CI_{it} if C_{it}=1. Z_{it} represents a vector of variables that influences commercialisation intensity. β represents the corresponding parameters to estimate. The variables that influence the decision to commercialise farming (X_{it}) are the same as those that affect the 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 that the error terms ε_{it} and ϵ_{it} have zero covariance (i.e. cov $(\varepsilon_{it},\epsilon_{it})=0$) (Wooldridge 2001).

We then estimate the spillover effect from the groundnuts Fairtrade arrangement on smallholder agricultural commercialisation. It has previously been noted that 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 the UK started and 2018 represents seven years after the exports stopped. This therefore allows us to measure the spillover effects from this intervention on agricultural commercialisation intensity for smallholder farmers that were not part of the arrangement in Mchinji District. In this paper, Mchinji District is our treatment district whereas Ntchisi District is the control district.[10] We do not have observations for households that participated in the Fairtrade arrangement in Mchinji District to estimate the direct impacts from this arrangement. We use our data to estimate a DD estimator to measure the indirect effects from the Fairtrade arrangement on commercialisation intensity for the farmer i at t time in district d as follows:

$$CI_{idt} = \delta_0 + \delta_1 D_d + \delta_2 y_t + \delta_3 (D_d * y_t) + \delta_4 \Lambda_{idt} + \mu_{idt} \qquad (5)$$

where CI is the household commercialisation index for each farmer. The constant is represented by δ_0, and δ_1- δ_4 are all unknown parameters to estimate, while μ_{idt} is a random error term. D denotes farmers that were not part of the groundnuts Fairtrade arrangement in Mchinji District. t is a year variable equal to 1 for 2018 and zero for the base year, 2007. The parameter δ_3 represents the average treatment effect on the treated (ATT) district, which measures the indirect effect from the groundnuts Fairtrade arrangement on commercialisation intensity. A positive coefficient estimate on δ_3 indicates that the Fairtrade arrangement increased commercialisation intensity for smallholder farmers that were not part of the arrangement, while a negative coefficient indicates that the arrangement reduced their commercialisation intensity. Λ is a list of explanatory variables and are the same as those in equation [4] and [2], affecting the decision to commercialise farming and its intensity.

Finally, we test whether an increased level of agricultural commercialisation improved household welfare for smallholder farmers that were not part of the groundnut Fairtrade arrangement in Mchinji District. We use crop income and the value of assets as measures of household welfare outcomes (Muriithi and Matz 2015). We apply a FE regression model to estimate the effect of commercialisation intensity on crop income and the value of assets for the farmer i at time t in district d as follows:

$$Y_{idt} = \varphi_0 + \varphi_1(D_d * CI_{idt}) + \varphi_2 H_{idt} + \theta_i + \tau_{idt} \quad (6)$$

where Y is household crop income or value of assets in another specification for each farmer. [11] The constant is represented by φ_0, and φ_2 represents all unknown parameters to estimate, while τ_{idt} is a random error term. θ_i controls for unobserved heterogeneity, which enables us to measure changes in crop income and value of assets within households between the two periods. Similarly, D denotes farmers that were not part of the groundnuts Fairtrade arrangement in Mchinji District. φ_1 is a parameter of interest because it measures the effect of commercialisation intensity on crop income or value of assets in another specification for smallholder farmers that were not part of the groundnuts Fairtrade arrangement in Mchinji District. A positive coefficient estimate on φ_1 indicates that commercialisation intensity improves crop income or value of assets in another specification, while a negative coefficient indicates that commercialisation intensity reduces crop income or value of assets in another specification for smallholder farmers that were not part of the groundnuts Fairtrade arrangement in Mchinji District. H is a list of explanatory variables and are the same as those in equation [5], [4], and [2]. These variables include school years of household head, age of household head, landholding size, distance to the *boma* market, and volume of fertiliser used (a list and description of variables used in the analysis is in Table A.1 in the Appendix).

3.3 Identification strategy

3.3.1 Commercialisation decision and its intensity

Our data include a significant proportion of farmers who did not commercialise their farming; thus, the intensity of agricultural commercialisation is zero and the rest have a positive level of agricultural commercialisation. We treat the zero values in our data as genuine zeros and not as missing values, which is modelled using the Heckman selection model (Yu and Abler 2008; Ricker-Gilbert, Jayne and Chirwa 2011; Humphreys 2013; Mather, Boughton and Jayne 2013). Given that selling agricultural produce is the main source of livelihood in the rural areas, we use a corner solution model to account for the genuine zeros in our data. This is estimated via a Tobit or DH model. A Tobit model is estimated when the farmer makes the decision to commercialise farming and increase the intensity of commercialisation simultaneously. This means that the same factors affect the decision to commercialise and the intensity of commercialisation (Wooldridge 2009; Ricker-Gilbert *et al.* 2011; Mather *et al.* 2013). Conversely, the DH model is used where the farmer makes the decision to commercialise and to increase the intensity of commercialisation sequentially. Thus, the two decisions may be influenced by different, or the same factors may have different effects on the two decisions (Yu and Abler 2008; Ricker-Gilbert *et al.* 2011; Mather *et al.* 2013). The DH model has two components, a probit model and a truncated normal regression model.

It has previously been noted that one of our study objectives is to test whether smallholder farmers in a district in which Fairtrade International implemented the groundnut Fairtrade arrangement are more likely to commercialise their farming and have a higher commercialisation intensity than those in a district in which NASFAM invested in processing facilities. We apply a probit model to estimate the likelihood of the farmer commercialising farming or not, (equation [2]), and a truncated normal regression model to estimate the intensity of commercialisation once the decision to commercialise is made (equation [4]).

Unobserved heterogeneity

Our coefficient estimates would be biased when unobservable factors that do not vary with time, for instance, entrepreneurial skills and agronomic technical expertise in the error term, correlate with observable predictors of commercialisation intensity, CI, such as the household head's education level, landholding, and input use. The FE estimator is well known to deal with heterogeneity when unobservable and observable predictors correlate. However, in our case, the FE estimator would be inconsistent given that CI is nonlinear with a corner solution at zero (Wooldridge 2001; Ricker-Gilbert et al. 2011; Mather et al. 2013). To deal with heterogeneity and its correlation with observable characteristics, we use correlated random effects (CRE) in our DH model (Mundlak 1978; Chamberlain 1984). According to Wooldridge (2001), the CRE approach involves computing the average for each predictor that varies with time and adding them to the DH model as additional predictors. This enables the unobserved heterogeneity to correlate with the time averages while keeping the predictors uncorrelated in the DH model in each period.

Controlling for endogeneity

To recap, smallholder farmers have been receiving subsidised fertiliser through the government's Farm Input Subsidy Programme since the 2004/05 agricultural season. Therefore, the volume of fertiliser

that farmers applied to their plots would likely be a source of endogeneity. To test for the possible endogeneity problem in our DH model, we use the control function (CF) approach (Ricker-Gilbert *et al* 2011; Mason and Ricker-Gilbert 2013; Mather *et al.* 2013; Sibande *et al.* 2017). Our endogenous variable, the volume of fertiliser applied on the plots, is nonlinear with a corner solution at zero since some of the farmers do not apply fertiliser at all. Therefore, we regress the endogenous variable on instruments for fertiliser use and the predictors of agricultural commercialisation using a reduced form Tobit estimator and obtain the residual. A variable =1 if a resident of the community is a Member of Parliament (MP) and the distance to the fertiliser market are our instruments for fertiliser use (Ricker-Gilbert *et al.* 2011; Mason and Ricker-Gilbert 2013; Mather *et al.* 2013; Sibande *et al.* 2017).

We then estimate a DH model with a Tobit regression residual, the predictors of agricultural commercialisation, while maintaining the possible endogenous variable, the volume of fertiliser applied on the plots. A significant partial effect of the residual in the DH model indicates that the volume of fertiliser applied on the plots is endogenous. We find that distance to the fertiliser market is significant (=0.068), whereas the variable =1 if a resident of the community is the MP is not significant in the Tobit regression (see Table A.4 in the Appendix). Further, the partial effect of the Tobit regression residual in the DH model is not significant in the probit model (see Table A.5 in the Appendix) but significant in the truncated normal regression model. Therefore, we conclude that the volume of fertiliser applied on the plots is exogenous in the probit model and endogenous in the truncated normal regression model in the DH model. Therefore, we estimate the probit model without the reduced form Tobit residual, but include them in the truncated normal regression model.

3.3.2 DID estimator for the spillover effects from the Fairtrade arrangement

It is likely that the selection of MASFA in Mchinji District was based on the volume of groundnuts that its members produced; hence, it was non-random. In this regard, conditions that we cannot observe (i.e. time-invariant unobserved heterogeneity) which likely determine the selection of MASFA as well as influencing the intensity of commercialisation for smallholder farmers that were not part of the arrangement is a possible source of endogeneity (Jalan and Ravallion 1998; Khandker, Koolwal and Samad 2010, Kaiyatsa, Ricker-Gilbert and Jumbe 2019). The DD estimator allows us to control for the possible endogeneity of the producer organisation that was selected for the groundnuts Fairtrade arrangement in Mchinji District. According to Khandker *et al.* (2010) and Kaiyatsa *et al.* (2019), differencing in the DD estimator allows the unobserved difference in mean counterfactual outcomes between smallholder farmers that were not part of the Fairtrade arrangement in the Mchinji and Ntchisi districts to cancel out. The increase in agricultural commercialisation intensity for the smallholder farmers in Ntchisi District acts as a counterfactual indicator.

Test for parallel trend assumption

Our coefficient estimates need to be consistent with the parallel trends assumption (PTA). The PTA stipulates that the average change in outcome for the smallholder farmers that were not part of the Fairtrade arrangement in Mchinji District if the district was untreated would be the same as the observable average change among comparable farmers in Ntchisi District (Mora and Reggio 2012; Kaiyatsa *et al.* 2019). Thus, in the absence of the groundnuts Fairtrade arrangement, the time trend for commercialisation intensity for smallholder farmers that were not part of the arrangement in both districts should be the same. Our coefficient estimates would be biased if the results were inconsistent with the PTA, which would mean that smallholder farmers that were not part of the Fairtrade arrangement in both districts have the same average change in commercialisation intensity regardless of the groundnuts Fairtrade implementation in Mchinji District.

To deal with this problem and provide evidence in support of the PTA 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 the 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 PTA.

For robustness, we also estimate the spillover effect from the Fairtrade arrangement on smallholder agricultural commercialisation intensity for smallholder farmers that were not part of the arrangement in Mchinji District via FE (Kaiyatsa *et al.* 2019). The results are shown in tables A.6–A.7 in the Appendix, which are consistent with δ_3 from equation [5].

3.4 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 a longitudinal tracker study for the Agricultural Policy Research in Africa (APRA)[12] research project that explores pathways to agricultural commercialisation and livelihood trajectories (Matita *et al.* 2018). The first wave of the data comes from the study that the School of Oriental and African Studies (SOAS) in collaboration with the National Statistical Office (NSO) conducted to evaluate the 2006/07 FISP in Malawi.[13] 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 the APRA study.

We successfully re-interviewed 217 out of the 240 households, representing a 10 per cent attrition rate, which is not significant to affect our results (Alderman *et al.* 2001; Burke and Jayne 2008; Chapoto and Jayne 2008). We added new questions in the 2018 survey and kept all the questions in the data collection tools that SOAS and the NSO used in the 2007 survey. This study is based on data that were collected in both years from the same households in both districts.

Testing for attrition

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 (Ricker-Gilbert *et al.* 2011; Mather *et al.* 2013). To check for potential attrition bias due to removing these households, we compare our key results with those from the unbalanced sample. To deal with the attrition problem in the unbalanced sample, we use an inverse probability weight (IPW) approach (Wooldridge 2001). We find that our overall results from the balanced sample are not different in magnitude from the unbalanced sample (see tables A.8–A.15 in the Appendix).

4 RESULTS

4.1 Descriptive results

Table 4.1 presents a descriptive summary of variables used in this study. The results indicate that about 49 per cent of households in Mchinji District and 59 per cent of the households in Ntchisi District commercialise their farming.[14,15] This might suggest that fewer households have commercialised their farming in Mchinji District than in Ntchisi District. Further, Table 4.1 indicates that the commercialisation intensity for households in Mchinji District is 31.96 per cent while for Ntchisi District, it is 37.28 per cent. The difference is marginally significant at the 10 per cent level. This means that commercialisation intensity is lower for households in Mchinji District than those in Ntchisi District. About 85 per cent and 75 per cent are male-headed households in the Mchinji and Ntchisi districts, respectively. This suggests that most households in Mchinji District are male-headed households compared to those in Ntchisi District.

The results show that households in Mchnji 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. Distance to the *boma* market as a proxy for market access is 32.34km with 13.94km standard deviation in Mchinji District while in Ntchisi District, it is 21.29km with 8.27km standard deviation. This finding suggests that the transaction costs for small-scale traders who penetrate the rural markets are higher in Mchinji District than in Ntchisi District.

4.2 Empirical results

4.2.1 Determinants of household commercialisation decision and its intensity

Table 4.2 presents the probit results of the household decision to commercialise farming. The results indicate that the likelihood to commercialise farming is lower for households in Mchinji District than for those in Ntchisi District by -38 per cent. This finding may suggest that most households in Mchinji District are subsistence farmers compared to those in Ntchisi District. The time effect shows that the probability of households' decision to commercialise farming has increased by 94

Table 4.1 Comparison of variables by district

Variables	Full sample (N=410) Mean or proportion		Households in Mchinji District (N=200)		Households in Ntchisi District (N=210)		Chi-square/t-test statistic
			Std. dev.	Mean or proportion	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
Distance to *boma* market in km	26.68	12.66	32.34	13.94	21.29	8.27	-9.818***

Notes: The average difference in mean or proportion between households in Mchinji and Ntchisi districts; *, **, *** indicates the mean or proportion difference is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table 4.2 Factors affecting household decision to commercialise farming

Dependent variable: =1 if commercialise farming	CRE probit estimator (N=410)	
	APE	Std. error
Covariates:		
=1 if district is Mchinji	-0.378**	0.173
School years of head	0.007	0.023
Distance to *boma* market in km	0.002	0.006
=1 if year 2018	0.944***	0.302
Household size	0.100	0.069
=1 if head is male	0.055	0.189
Age of head	-0.012	0.015
Landholding size in ha	0.008	0.057
=1 if rents in land	0.333	0.217
Volume of fertiliser used in kg	0.003*	0.001
Constant	-0.223	0.497

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the average partial effect (APE) is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

per cent from the 2007 level. As we would expect, the volume of fertiliser used increases the likelihood of a household's decision to commercialise farming by 0.3 per cent. The use of fertiliser has a greater potential to enable households to produce more output per unit of land.

Table 4.3 presents the factors that influence commercialisation intensity using a truncated normal regression model. The results indicate that commercialisation intensity has increased by 29 per cent 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 per cent 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 in preventing households from commercialising their farming.

4.2.2 Spillover effect of Fairtrade arrangement on agricultural commercialisation

Table 4.4 shows that the coefficient for measuring the effect from the Fairtrade arrangement on agricultural commercialisation intensity for households that were not part of the Fairtrade arrangement in Mchinji District (i.e. indirect impact or spillover effect) is positive at the 1 per cent level of significance. The treatment variable takes on a value of one if the household is in Mchinji District and zero if it is in Ntchisi District. This finding suggests that implementation of the

Table 4.3 Determinants of commercialisation intensity using CRE truncated regression

Dependent variable: HCI	CRE truncated normal regression (N=229)	
	APE	Std. error
Covariates:		
=1 if district is Mchinji	3.168	4.416
residual	-0.090**	0.041
=1 if year 2018	29.253***	8.037
Distance to boma market in km	-0.158	0.166
Household size	-1.182	2.015
=1 if head is male	-1.362	5.977
Age of head	-0.045	0.358
Landholding size in ha	-4.417*	2.398
=1 if rents in land	-10.714	8.164
Volume of fertiliser used in kg	-0.004	0.008

Notes: The variable volume quantity of fertiliser used is treated as endogenous; *, **, *** indicates that the average partial effect (APE) is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table 4.4 Spillover impact of Fairtrade arrangement on commercialisation intensity using pooled ordinary least squares (OLS) estimator

Dependent variable: HCI	DD estimator (N=229)	
	Coefficients	Std. error
Covariates:		
residual	-0.085**	0.041
=1 if year 2018	11.413	6.980
=1 if district is Mchinji	-17.453**	7.730
Spillover effect from Fairtrade: *=1 if district is Mchinji*=1 if year 2018*	29.556***	8.923
Distance to *boma* market in km	-0.149	0.175
Household size	-0.043	0.712
=1 if head is male	-0.820	5.622
Age of head	0.099	0.145
Landholding size in ha	-3.418*	1.752
=1 if rents in land	-10.085	8.928
Volume of fertiliser used in kg	0.009*	0.005
Constant	55.432***	9.622

Notes: The variable quantity of fertiliser used is treated as endogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Fairtrade arrangement in Mchinji District has a 30 per cent 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, those households have a higher score for commercialisation intensity than those in Ntchisi District.

Although the groundnuts Fairtrade arrangement increased commercialisation intensity for households in Mchinji District, our results indicate, further, that commercialisation intensity for smallholder farmers that were not part of the arrangement is -17.5 per cent less than for those in Ntchisi District, on average. This means that smallholder farmers in Ntchisi District have a higher commercialisation intensity than those in Mchinji District, on average. Similarly, landholding size has a marginal negative association with commercialisation intensity while the volume of fertiliser used marginally increases the commercialisation intensity of households.

To check for the robustness of our parameter DD estimates, we implement a parallel trend assumption test. Table 4.5 shows that the coefficient for measuring the effect from the Fairtrade arrangement on agricultural commercialisation intensity for households that were not part of the groundnut Fairtrade arrangement in Mchinji District is positive in both years. The coefficient is statistically significant in 2018 but not significant in 2007. This shows that our coefficient estimates in the DD model are consistent with parallel trend assumption.

4.2.3 Welfare effects (crop income and asset holding) of commercialisation intensity

Table 4.6 shows the effect of commercialisation intensity on crop income. The results indicate that commercialisation intensity in Mchinji District has a marginal effect of MK11 917 (US$16.41) on crop income for smallholder farmers that were not part of the Fairtrade arrangement compared to those in Ntchisi District. Further, the results indicate a positive and significant relationship between crop income and age of household head. This finding means that crop

Table 4.5 Average marginal effects after pooled OLS regression

	Marginal effects after OLS estimator	
	Coefficients	Std. Error
=1 if in Mchinji District=1 if year 2018*		
=1 if year is 2007	11.41	6.98
=1 if year is 2018	40.97***	6.45

Notes: *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table 4.6 Effect of agricultural commercialisation on crop income using FE estimator

Dependent variable: Crop income in Malawi Kwacha	FE estimator (N=146)	
	Coefficient	Std. error
Covariates:		
=1 if year 2018	311 655	282 142
Commercialisation index	-8 223	6 444
Effect of commercialisation on crop income		
*=1 if Mchinji*commercialisation index*	11 917*	6 663
Household size	-66 641	104 712
=1 if head is male	89 208	773 211
Age of head	47 535**	21 333
Landholding size in ha	-22 410	32 718
=1 if rents in land	-447 354	881 901
Log of fertiliser used	212 341	146 279
Constant	-2 514 400	1 625 249

Notes: The variable quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table 4.7 Effect of agricultural commercialisation on asset value using FE estimator

Dependent variable: log of asset value	FE estimator (N=177)	
	Coefficient	Std. error
Covariates:		
=1 if year 2018	-5.845***	0.750
Commercialisation index	0.015**	0.006
Effect of commercialisation on asset value		
*=1 if Mchinji*commercialisation index*	-0.0092	0.0089
Household size	0.083	0.118
=1 if head is male	-0.619	0.776
Age of head	0.057	0.042
Landholding size in ha	0.055	0.045
=1 if rents in land	-0.043	0.502
Log of fertiliser used	0.408**	0.164
Constant	3.485	2.330

Notes: The variable quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

income increases by MK47 535 (US$65.48) above the average age of household heads.

Contrary to our expectation, Table 4.7 shows that commercialisation intensity did not improve the value of assets for smallholder farmers that were not part of the Fairtrade arrangement in Mchinji District. However, commercialisation intensity has a positive and significant effect on the value of assets, on average. This finding is consistent with Muriithi and Matz (2015) who find that vegetable commercialisation through domestic market participation improved asset holdings in Kenya. Further, the value of assets has increased by 41 per cent for households that use fertiliser, on average. Overall, the year effect suggests that the household value of assets has declined between 2007 and 2018.

5 CONCLUSIONS AND IMPLICATIONS

In this study, we test whether smallholder farmers in a district in which Fairtrade International implemented the groundnut Fairtrade arrangement are more likely to commercialise their farming and have a higher commercialisation intensity than those in a district in which NASFAM invested in processing facilities. We then explicitly test whether the groundnuts Fairtrade arrangement has spillover effects on commercialisation intensity for smallholder farmers that were not part of the arrangement in Mchinji District. Finally, we test whether agricultural commercialisation intensity improves household welfare for smallholder farmers that were not part of the arrangement in Mchinji District.

We use two waves of panel data from the Mchinji and Ntchisi districts collected in 2018 from households that SOAS and NSO surveyed in 2007 using the same data collection tools. Firstly, we use our data to test whether farmers that were not part of 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 the difference-in-differences estimator to test whether there are spillover effects from the Fairtrade arrangement on commercialisation intensity for smallholder farmers that were not part of the arrangement in Mchinji District. We use the 2006/07 data as our baseline year before MASFA started selling its groundnuts through NASFAM to the UK and the 2017/18 data as the year after MASFA stopped selling its groundnuts through NASFAM to the UK, which allows us to measure spillover effects from the Fairtrade arrangement in Mchinji District.

Our findings reveal that the likelihood of commercialising farming is lower for households in Mchinji District than for those in Ntchisi District by -38 per cent. The volume of fertiliser used increases the likelihood of a household's decision to commercialise farming. Commercialisation intensity between 2007 and 2018 has increased by 29 per cent, on average. We find that the groundnut Fairtrade arrangement has a spillover effect of 30 per cent for smallholder farmers that were not part of the arrangement in Mchinji District. Further, we find that the increased intensity of commercialisation marginally improved crop income for smallholder farmers that were not part of the arrangement in Mchinji District by MK11 917 (US$16.41), on average. However, the increased intensity of commercialisation did not improve the value of assets for smallholder farmers that were not part of the Fairtrade arrangement in Mchinji District.

This study has not controlled for other interventions other than the groundnuts Fairtrade arrangement that operated in Mchinji District to promote commercialisation of smallholder farming over the years under consideration. Despite this limitation, this study provides useful information to non-governmental organisations (NGOs) who enhance the participation of smallholder farmers in the output market. Given that not all smallholder farmers can participate in programmes that enhance their access to international markets, this study has demonstrated that such programmes have spillover benefits to other smallholder farmers that are not targeted.

Usually, these smallholder farmers change their farming practices to produce market surpluses for the domestic market. Our findings indicate that such investment marginally improves crop income and not the value of assets as hypothesised in this study. This would be due to poor output prices in the domestic market. It can be noted that the market channel for smallholder farmers is small-scale traders who purchase farmers' produce at very low farm gate prices, rather than large-scale traders who purchase at or above government-set prices for produce, and use standard equipment (Baulch 2017; Baulch *et al.* 2018). As a result, there are marginal benefits for producing market surpluses for smallholder farmers in rural areas without access to premium export markets, which constrains asset accumulation.

Therefore, we recommend that smallholder farmers need support for them to continue commercialising their farming, increasing their intensity, and improving their welfare. Such support includes, but is not limited to: promoting collective marketing among smallholder farmers to improve their bargaining power; attracting large-scale traders to rural areas, who buy in large quantities and offer better prices; and linking farmers to financial and credit institutions to enhance their access to and use of improved farm inputs, which will allow them to produce greater market surpluses.

APPENDIX

Table A.1 Description of variables used in the study

Variable	Category	Description
Dependent variables		
=1 if household commercialise farming	Binary	1=if household commercialise farming; 0 otherwise
HCI	Continuous	Household degree of commercialisation as the percentage of crop production marketed
Independent variables		
=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
Distance to *boma* market in km	Continuous	This variable is used as a proxy for market access. It is measured in km.

Source: Authors' own computation.

Table A.2 Comparison of households that commercialise farming and those that do not

Variables	Commercialised households (N=229)		Non-commercialised households (N=181)		Chi-square/ t-test Statistic
	Mean or proportion	Std. dev.	Mean or proportion	Std. dev.	
=1 if district is Mchinji	44.98		53.59		3.002*
School years of head	4.18	3.69	3.35	4.17	-2.15**
Household size	8.40	2.76	7.16	2.96	-4.37***
=1 if head is male	82.53		79.01		0.817
Age of head	52.83	16.10	51.38	16.68	-0.897
Landholding size in ha	2.51	4.01	1.92	2.72	-1.71**
=1 if rents in land	23.14		8.84		14.78***
Volume of fertiliser used in kg	153.05	345	70.10	84.34	-3.16***
Distance to *boma* market in km	26.66	12.40	26.71	13.00	0.0414

Notes: The average difference in mean or proportion between households in Mchinji and Ntchisi districts; *, **, *** indicates the mean or proportion difference is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.3 Changes in variables across the years

Variables	Full sample (N=410)				Households in Mchinji District (N=200)				Households in Ntchisi District (N=210)			
	2007		2018		2007		2018		2007		2018	
	Mean or proportion	Std. dev.	Mean or proportion	Std. dev.	Mean or proportion	Std. dev.	Mean or proportion	Std. dev.	Mean or proportion	Std. dev.	Mean or proportion	Std. dev.
=1 if commercialise farming	36.1		75.6		29		74		42.9		77.1	
Commercialisation index (%)	16.5	30.2	52.8	38.7	9.42	21.2	54.5	40.1	23.3	35.7	51.2	
School years of head	3.81	3.93	3.81	3.93	3.87	4.16	3.87	4.16	3.76	3.71	3.76	3.71
Household size	6.54	2.47	9.17	2.72	6.51	2.63	9.12	2.61	6.56	2.32	9.21	2.83
=1 if head is male	82		80		86		84		78.1		76.2	
Age of head	46.8	15.7	57.6	15.2	46.4	15.1	57.6	14	47.1	16.3	57.6	16.3
Landholding size in ha	2.12	2.5	2.4	4.3	2.69	3.34	3.0	5.7	1.58	1.02	1.85	2.19
=1 if rents in land	9.27		24.4		10		27		8.57		21.9	
Volume of fertiliser used in kg	91.6	88.8	141.2	365.4	108.1	108.4	136.7	359.7	76.0	61.3	145.5	372.5
Distance to *boma* market in km	26.7	12.7	26.7	12.7	32.3	14.0	32.3	14.0	21.3	8.3	21.3	8.3

Source: Authors' own computation.

Table A.4 A reduced form Tobit model of factors that influence fertiliser use

Dependent variable: total fertiliser used in kg	CRE reduced form Tobit estimator (N=410)	
	APE	Std. error
Covariates:		
Distance to fertiliser market in km	1.115**	0.540
Distance to *boma* market in km	-0.884	0.674
=1 if a resident of the community is Member of Parliament	-3.609	30.931
=1 if district is Mchinji	12.064	31.153
=1 if year 2018	-6.703	16.985
Household size	-2.867	4.167
=1 if head is male	37.356***	14.124
Age of head	0.499	0.732
Landholding size in ha	20.316***	6.378
=1 if rents in land	65.311***	24.807

Notes: *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.5 Factors influencing household decision to commercialise farming using CRE probit estimator

Dependent variable: =1 if commercialise farming	CRE probit estimator (N=410)	
	APE	Std. error
=1 if district is Mchinji	-0.324	0.212
residual	-0.002	0.005
Distance to *boma* market in km	0.004	0.010
School years of head	0.006	0.024
=1 if year 2018	0.995***	0.363
Household size	0.115	0.106
=1 if head is male	-0.157	0.440
Age of head	-0.015	0.020
Landholding size in ha	-0.103	0.239
=1 if rents in land	-0.015	0.554
Volume of fertiliser used in kg	0.003*	0.001
Constant	-0.241	0.626

Notes: The variable volume quantity of fertiliser used is treated as endogenous; *, **, *** indicates that APE is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.6 Spillover impact of Fairtrade arrangement on agricultural commercialisation intensity in Mchinji District using FE estimator

Dependent variable: HCI	FE estimator (N=229)	
	Coefficients	Std. error
Covariates:		
=1 if year 2018	19.460	17.74
Spillover effect from Fairtrade:		
=1 if district is Mchinji=1 if year 2018*	37.735***	11.66
Household size	-0.203	3.291
=1 if head is male	-7.356	32.51
Age of head	-0.496	0.619
Landholding size in ha	-0.423	1.632
=1 if rents in land	0.854	12.95
Volume of fertiliser used in kg	0.002	0.010
Constant	71.276	48.182

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.7 Average marginal effects after FE estimator

	Marginal effects after FE estimator	
	Coefficients	Std. error
=1 if in Mchinji District=1 if year 2018*		
=1 if year is 2007	19.46	17.74
=1 if year is 2018	57.20***	13.50

Notes: *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.8 A reduced form Tobit model of factors that influence fertiliser use using full sample

Dependent variable: total fertiliser used in kg	CRE reduced form Tobit estimator (N=449)	
	APE	Std. error
Covariates:		
Distance to fertiliser seller	1.007**	0.495
=1 if a resident of the community is Member of Parliament	-0.063	29.962
=1 if district is Mchinji	10.081	29.979
=1 if year 2018	-12.702	15.065
Distance to *boma* market in km	-0.904	0.622
Household size	-1.755	3.837
=1 if head is male	30.875**	12.769
Age of head	0.716	0.690
Landholding size in ha	20.114***	6.405
=1 if rents in land	61.766***	23.797

Notes: *, **, *** indicates that APE is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.9 Factors influencing household decision to commercialise farming using full sample

Dependent variable: =1 if commercialise farming	CRE probit estimator (N=450)	
	APE	Std. error
Covariates:		
=1 if district is Mchinji	-0.383**	0.181
residual	-0.004	0.005
School years of head	0.008	0.024
=1 if year 2018	1.269***	0.344
Distance to *boma* market in km	0.009	0.010
Household size	0.093	0.074
=1 if head is male	-0.241	0.391
Age of head	-0.027	0.024
Landholding size in ha	-0.168	0.241
=1 if rents in land	-0.189	0.571
Volume of fertiliser used in kg	0.003**	0.001
Constant	-0.663	0.581

Notes: The variable volume quantity of fertiliser used is treated as endogenous; *, **, *** indicates that APE is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.10 Factors influencing household decision to commercialise farming using full sample

Dependent variable: =1 if commercialise farming	CRE probit estimator (N=450)	
	APE	Std. error
Covariates:		
=1 if district is Mchinji	-0.445***	0.160
School years of head	0.009	0.024
=1 if year 2018	1.114***	0.252
Distance to *boma* market in km	0.005	0.007
Household size	0.080	0.059
=1 if head is male	0.038	0.189
Age of head	-0.019	0.016
Landholding size in ha	0.006	0.051
=1 if rents in land	0.342	0.218
Volume of fertiliser used in kg	0.003**	0.001
Constant	-0.523	0.421

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that APE is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.11 Determinants of commercialisation intensity using full sample

Dependent variable: HCI	CRE truncated normal regression (N=242)	
	APE	Std. error
Covariates:		
=1 if district is Mchinji	-0.092	4.356
residual	-0.083*	0.043
=1 if year 2018	33.396***	7.191
Distance to *boma* market in km	-0.059	0.164
Household size	-1.954	1.871
=1 if head is male	-0.476	5.524
Age of head	-0.190	0.340
Landholding size in ha	-3.948	2.440
=1 if rents in land	-8.923	8.153
Volume of fertiliser used in kg	-0.004	0.008

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that APE is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.12 Spillover impact of Fairtrade arrangement on agricultural commercialisation in Mchinji District using full sample

Dependent variable: HCI	DD estimator (N=242)	
	Coefficients	Std. error
Covariates:		
=1 if year 2018	11.631*	6.649
=1 if district is Mchinji	-25.343***	7.350
Spillover effect from Fairtrade:		
=1 if district is Mchinji=1 if year 2018*	33.699***	8.584
Distance to *boma* market in km	-0.142	0.169
Household size	-0.589	0.709
=1 if head is male	6.080	4.575
Age of head	0.009	0.135
Landholding size in ha	-0.098	0.522
=1 if rents in land	3.431	4.757
Volume of fertiliser used in kg	0.012***	0.004
Constant	55.421***	10.054

Notes: The variable volume quantity of fertiliser used is treated as endogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.13 Spillover impact of Fairtrade arrangement on agricultural commercialisation in Mchinji District using full sample

Dependent variable: HCI	FE estimator (N=242)	
	Coefficients	Std. error
Covariates:		
=1 if year 2018	19.460	17.72
Spillover effect from Fairtrade:		
=1 if district is Mchinji=1 if year 2018*	37.735***	11.64
Household size	-0.203	3.288
=1 if head is male	-7.356	32.47
Age of head	-0.496	0.618
Landholding size in ha	-0.423	1.630
=1 if rents in land	0.854	12.94
Volume of fertiliser used in kg	0.002	0.010
Constant	71.299	48.05

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.14 The effect of agricultural commercialisation on crop income using full sample

Dependent variable: crop income in Malawi Kwacha	FE estimator (N=186)	
	Coefficient	Std. error
Covariates:		
=1 if year 2018	311 655	281 761
Commercialisation index	-8 223	6 436
Effect of commercialisation on crop income		
*=1 if Mchinji*commercialisation index*	11 917*	6 654
Household size	-66 641	104 570
=1 if head is male	89 208	772 167
Age of head	47 535**	21 304
Landholding size in ha	-22 410	32 674
=1 if rents in land	-447 354	880 710
Log of fertiliser used	212 341	146 081
Constant	-2 520 231	1 613 405

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

Table A.15 The effect of agricultural commercialisation on value of assets using full sample

Dependent variable: log of value of assets	FE estimator (N=185)	
	Coefficient	Std. error
Covariates:		
=1 if year 2018	-5.8451***	0.7494
Commercialisation index	0.0145**	0.0058
Effect of commercialisation on asset value		
*=1 if Mchinji*commercialisation index*	-0.0092	0.0089
Household size	0.0826	0.1179
=1 if head is male	-0.6195	0.7752
Age of head	0.0574	0.0416
Landholding size in ha	0.0546	0.0448
=1 if rents in land	-0.0432	0.5015
Log of fertiliser used	0.4080**	0.1641
Constant	3.5127	2.3262

Notes: The variable volume quantity of fertiliser used is treated as exogenous; *, **, *** indicates that the coefficient is significant at the 0.10, 0.05, and 0.01 level, respectively.
Source: Authors' own computation.

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ENDNOTES

1 NASFAM is a farmer-owned membership organisation in which the smallest unit of operation is a club comprising about 10–15 individual farmers. The clubs form NASFAM associations, which are legally registered, and managed by farmer boards (Chirwa and Matita 2012). NASFAM buys most of its groundnuts from its farmer organisation and penetrates the export markets.

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

3 Large-scale traders mostly operate at the main district capital market, locally known as boma market and get their supplies from small-scale traders.

4 Certified products carry the International Fairtrade Certification Mark as a guarantee that producers and traders have met Fairtrade standards. As such, the Certification Mark signals to the consumer that the product is certified and the premium they can pay would reach the intended farmer organisations.

5 Products are returned if farmer organisations do not comply with economic, social, and environmental standards for Fairtrade.

6 Our data do not have observations for smallholder farmers that participated in the groundnuts Fairtrade arrangement in Mchinji District. Therefore, we are unable to estimate the direct impact of the arrangement on commercialisation intensity and welfare outcomes for the smallholder farmers that participated in the arrangement.

7 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).

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

9 $HCI_{it} = \sum_{\sigma=1}^{n}(gross\ value\ of\ agricultural\ sales_{it}\ /gross\ value\ of\ all\ agricultural\ production_{it}) * 100.$ We compute commercialisation intensity for farmer i in year t in three steps. Firstly, we estimate the value of each individual crop that a farmer produced and sold using its prevailing market price at the time of the survey in each year. Secondly, we add the values of each crop item produced to get the value of total production, and add the values of each crop item sold to get the value of crops marketed in each year. Thirdly, we compute a proportion of the value of total produce marketed over the value of total production. Our index ranges from zero to 100. An index of zero indicates subsistence production while the index closer to 100 signifies a greater commercialisation intensity.

10 Mchinji and Ntchisi districts have the same agro-ecological characteristics (i.e. similar agroclimatic conditions, types of the soil, and agricultural practices) under Kasungu-Lilongwe plain, which is considered to be relatively more efficient in crop production than other parts of the country (Asfaw and Maggio 2017).

11 Crop income is based on a farmer's self-reported income earned from crop sales. Conversely, the value of assets is based on a farmer's self-reported value of each asset that they indicated they had at the time of the survey.

12 See www.futureagricultures.org/APRA for a detailed description of the APRA research programme.

13 See Chirwa and Dorward (2013) for the details on how the survey was conducted, including the selection of respondents.

14 See Table A.2 in the Appendix for a comparison of households that commercialise farming and those that do not.

15 Table A.3 in the Appendix presents the changes in the variables across the years.

16 We obtain the average partial effect (APE) using the *–margins–* command in Stata.

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