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Complementary instruments for supporting agricultural transformation and increasing consumption and productive activities?

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Highlights

- The Government of Malawi is currently reviewing the Farm Input Subsidy Programme (FISP) with the aim of cutting costs.

- The debate focuses on whether the FISP should target commercial farmers and be better harmonized with social protection interventions, such as the Social Cash Transfer Programme (SCTP).

- This study shows that there are positive synergies between SCTP and FISP in terms of increasing expenditure and the value of agricultural production, crop production, livestock and, to a lesser extent, improving food security.

- The study provides empirical evidence – taken from survey data – on the interplay between an agricultural development and a social protection intervention in Malawi. This is likely to be of interest to other countries in the region that operate similar types of programmes.

1. Introduction

The Government of Malawi is currently reviewing its Farm Input Subsidy Programme (FISP), which was initiated in 2005/2006 to combat poverty and food insecurity. This paper is intended to inform the FISP review and, in particular, to suggest how it could be coordinated with the Social Cash Transfer Programme (SCTP) to more effectively fulfil Malawi's objectives of reducing poverty and food insecurity. The FISP and the SCTP have been implemented simultaneously since 2006 with limited strategic coordination, even though both programmes aim to reduce poverty and vulnerability to hunger in poor households that mostly rely on agriculture as their main source of income.

Recent policy declarations emphasize that, by working together, agriculture and social protection can play an important role in tackling poverty and hunger. For example, the 39th Session of the Committee on World Food Security urged member states – including Malawi – to strengthen the coordination between agriculture and social protection (CFS, 2012). Regional policy declarations, such as the 2014 Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, also recognize the role that the two domains can jointly play in achieving regional goals on poverty and hunger. Nevertheless, interventions that bring together agriculture and social protection are still unusual. Case studies in seven countries across Africa, Asia and Latin America show that there is limited coordination between agricultural and social protection programmes, even when they have similar aims and stakeholders (Slater *et al.*, 2016).

In Malawi, the FISP and the SCTP are expected to have an impact on outcomes related to poverty and hunger. The FISP should directly influence production decisions; its contribution to reducing hunger and poverty is mediated by factors such as access to land, water and labour for food production, responsiveness of yields to increased inputs, climatic factors and the relative position of poor smallholders as net buyers or sellers of grains in food markets. On the other hand, the SCTP is a welfare intervention that acts directly on the consumption capability of the recipients: the additional cash dispensed by the programme can be used to directly increase both quantity and quality of food. In addition, recipients of the cash transfer can use it for purchasing productive inputs and assets.

Due to cuts in public expenditure, the national debate focuses on reducing the cost of the FISP. One of the options being considered is to retarget the FISP to more commercially-oriented farmers. These are expected to generate a greater supply response to the FISP than do poorer households, which are often labour-constrained and which have been included in the FISP for the past several years. Since poor and ultra-poor households also participate in the SCTP, the debate is considering whether the FISP should aim to reach the same households as the SCTP or whether it should target entirely different categories of farmers (i.e. only commercially-oriented farmers). While the debate includes political, ethical and economic considerations, this paper is only concerned with the economic implications of the different targeting options under consideration.

The paper investigates the impacts on poor and ultra-poor households that participate in either the FISP or the SCTP or that take part in both programmes at the same time. In assessing the impacts of combined interventions, we focus on two types of synergies: i) the complementarity between the SCTP and the FISP, i.e. whether the impact of both interventions undertaken together is larger than the sum of the impacts of these interventions when undertaken separately; ii) the incremental impact of receiving the FISP when a household already receives the SCTP, as well as the incremental impact of receiving the SCTP when a household already receives the FISP. More formally, we consider two interventions – the FISP and the SCTP – whose impact on, for example, per capita expenditure when offered separately is, respectively, α and β, and whose impact when offered together is γ. For outcomes that are expected to be positively affected by each intervention (with a positive impact on per capita expenditure or value of production, for example), the two interventions are complementary if $\gamma > \alpha + \beta$, i.e. when the combined impact of the two interventions when implemented together is greater than the sum of impacts when implemented separately (Gertler *et al*., 2011). Furthermore, the difference between γ and α measures the incremental impact of FISP when a household already receives SCTP, and the difference between γ and β measures the incremental impact of the SCTP when a household already receives the FISP.

In recent years, several studies have focused on the impact of the SCTP (Covarrubias, Davis and Winters, 2012; Handa *et al.*, 2015; Asfaw, Pickmans and Davis, 2015) and the FISP in Malawi (see, for example, Chirwa and Dorward, 2013; Jayne and Ricker-Gilbert, 2011; Dorward *et al.*, 2013; Asfaw, Cattaneo and Pallante, 2016).[1] However, there is limited empirical evidence with regard to the potential synergies between the two programmes nor are there *ex ante* estimates of the effectiveness of the proposed changes to the existing FISP design and their potential complementarities with the SCTP. This paper contributes to filling this knowledge gap and thereby to informing the ongoing policy debate in the country. While the findings are specific to Malawi, it is likely that they will be of interest to other countries in the region that operate similar types of programmes.

The paper analyses the impacts of the programmes on a variety of outcomes, including household expenditure (on food and non-food) and food security, as well as intermediary outcomes such as productive activities (crop production, input use), and livestock owned. We take advantage of data collected from a seventeen-month evaluation (2013-2014) of a sample of households eligible to receive the SCTP. These data also contain information on whether the household was included into FISP.

Since the impacts of the two programmes are likely to differ across households with different labour endowments, we analyse labour-unconstrained and labour-constrained households separately as well as together. Labour constraints can be considered as proxies for wealth and the capacity to generate income, and are therefore likely to mediate the effect of both the SCTP

[1] Asfaw, Cattaneo and Pallante (2016) assess the cost and benefits from the current FISP in Malawi and compare them with costs and benefits from the implementation of a budget-neutral universal fertilizer subsidy, recently proposed as a policy option in the debate about the reform of the FISP. Asfaw *et al*. (which is still an unpublished manuscript) and this paper can be considered therefore as complementary research works.

and the FISP. We define a household as labour-constrained if it lacks an able-bodied member who is fit-to-work, i.e. every adult suffers from chronic illness and/or disability.

The next section of the paper gives some background on Malawi and briefly describes the FISP and the SCTP. Section 3 reviews previous evidence on the interplay between the two programmes in Malawi. Section 4 presents the empirical approach and the estimation method used in the paper. The main results are presented and discussed in Section 5. Finally, Section 6 offers some conclusions.

2. Background: Poverty and agricultural context and the FISP and SCTP in Malawi

The Republic of Malawi is among the poorest countries in the world. The Human Development Index (HDI) in 2014 ranked Malawi 174th out of 189 countries with an HDI of 0.414.

In 2014, Malawi's economy continued on a path to recovery in the aftermath of the economic crisis of 2012, which saw a contraction in real Gross Domestic Product (GDP) growth to 2.1 percent. Real GDP growth was 5.7 percent in 2014, largely driven by agriculture, but with significant contributions from manufacturing, wholesale and retail trade, and services (African Economic Outlook, 2015). Growth in 2015 was 5.5 percent, due to the late arrival of rains and the severe floods experienced in January, which damaged crops and infrastructure.

Agriculture accounts for nearly 35 percent of GDP, as compared with services and industry, which account, respectively, for 46 and 19 percent of GDP. Agriculture employs about 80 percent of the workforce, the majority of whom are women. Furthermore, agriculture accounts for more than 80 percent of export earnings. Overall, agriculture supports nearly 85 percent of the population and contributes significantly to national and household food security. According to the World Bank (2010), close to 2 million of the total 2.7 million hectares of cultivated land in the country are cultivated by smallholder farmers, who tend to work small and fragmented landholdings averaging less than 1 hectare per household.

Development resources, strategies and policies in Malawi since independence have emphasized agricultural development and the country continues to benefit from substantial, multiyear donor aid. Productivity and overall production remain low in the smallholder sector as compared to larger commercial estates. Indeed, even though maize yields almost doubled between 1980 and 2010 in Malawi, the overall yields are still lower than regional levels. The uptake of improved farming inputs has been low and smallholder agriculture remains unprofitable. Smallholder farmers have limited access to extension services and productivity-enhancing technologies due to their weak links to markets, high transport costs, limited and fragile farmers' organizations, poor quality control and inadequate information on markets and prices (FAO, 2012).

Despite the positive economic growth registered over much of the past decade, progress on poverty reduction has been limited. According to the Malawian National Statistical Office (NSO), Malawi's poverty level decreased only marginally from 52.4 percent in 2005 to an estimated 50.7 percent in 2011. The proportion of ultra-poor people increased from 22.2

percent in 2005 to 25.7 percent in 2011. The incidence of rural poverty in fact increased slightly from 55.9 percent in 2005 to 56.6 percent in 2012, while urban poverty fell sharply from 25 percent in 2004 to 17 percent in 2011. As a consequence, the pattern of income distribution has become more skewed, with the Gini coefficient increasing from 0.390 in 2005 to 0.439 in 2013 (World Bank, 2013). The slow progress in poverty reduction and worsening income distribution suggest that growth has not been inclusive and both poverty and income distribution have been aggravated by the high vulnerability of poor households to shocks (e.g. health, floods, drought and price increases).

Through the Malawi Growth and Development Strategy (MGDS) II, the Government of Malawi has reinforced its poverty reduction efforts using a multifaceted approach. This includes a focus on social development, the improvement of infrastructure, agricultural transformation and job creation.

Currently, the Government is working on measures to improve efficiencies and coherence across social protection programmes, as well as between social protection programmes and those of other sectors, including agriculture. The Social Cash Transfer Programme (SCTP) and the Farm Input Subsidy Programme (FISP), which are described in the next subsections, are examples of social protection and agricultural interventions that could be better coordinated in order to more effectively combat poverty and food insecurity in Malawi.

2.1 Farm Input Subsidy Programme

After being out of favour during the 1990s and early 2000s, input subsidy programmes have been reintroduced in many African countries as a major component of national agricultural policies (Jayne and Rashid, 2013). In Malawi, the Farm Input Subsidy Programme was initiated in 2005-2006.[2] At that time, it targeted approximately 50 percent of the farmers in the country, distributing fertilizers for maize production, with further vouchers for tobacco fertilizer and improved maize seeds.[3] The FISP is financed by the Government, with international donor support. (Chirwa, Matita and Dorward, 2011). The Ministry of Agriculture, Irrigation and Water Development leads the design and implementation of the FISP. The main objectives of the programme are to achieve national food sufficiency and increase the income of resource-poor smallholder farmers through increased maize and legume production driven by access to improved agricultural inputs (Dorward and Chirwa, 2011).

This kind of intervention is not new; it follows decades of agricultural policy interventions that varied in terms of generosity and targeting criteria. From the mid-70s to the early 90s, the Government financed a universal fertilizer subsidy, subsidized smallholder credit and controlled maize prices. This system began to break down in the late 80s-early 90s and collapsed in the mid-90s, which led to a widespread perception that falling fertilizer support was causing a decline in maize production and a food and political crisis. As a consequence, Malawi shifted from providing universal price subsidies for fertilizer and seed to providing

[2] At that time the programme was known as the Agricultural Input Subsidy Programme or AISP.
[3] For an extensive review of the implementation and impact of the programme, see Chirwa and Dorward (2013)

small ‘starter packs,’ initially to all households (in 1998/99 and 1999/2000) and then to a more limited and varying number of targeted households (from 2000/2 to 2004/5) (Harrigan, 2003). Despite these subsidies, many households continued to suffer from severe food insecurity, particularly after the poor production season in 2004/5. This prompted a significant political emphasis on larger subsidies, and in 2005/6, the Government decided to implement a large-scale input subsidy programme across the country. Over time, key features of this programme have undergone substantial modifications in terms of objectives (changing from social protection and food security for vulnerable households to national food production and self-sufficiency), scale (from a total programme cost of 4 480 million MWK in 2005/2006 to 23 455 million MWK in 2011/2012), quantity of subsidized fertilizer supplied (from nearly 15 000 tonnes in 2005/6 to 216 000 tonnes in 2007/8 and a subsequent decline to around 140 000 tonnes in 2011/2012), cash redemption of vouchers (through the Smallholder Farmers’ Fertilizer Revolving Fund of Malawi and the Agricultural Development and Marketing Corporation in 2005/2006 and, for cotton inputs, through Agricultural Development Divisions since 2007/2008, and the addition of tobacco inputs. Chirwa and Dorward (2013) and Dorward and Chirwa (2011) summarise the principal changes in design and implementation arrangements over time.

Currently, the programme targets smallholder farmers who are resource-poor but own a piece of land. The targeting criteria also recognise particularly vulnerable groups, such as child-headed, female-headed and orphan-headed households, and households with members affected by HIV/ AIDS. The criteria are broad and the application of the targeting guidelines varies in different communities, particularly as the number of eligible households tends to be much larger than the number of fertilizer coupons available. Kilic, Whitney and Winters (2013) find that the FISP does not exclusively reach the poor in Malawi. On the contrary, the programme primarily reaches people in the middle of the income distribution. The authors explain that this stems from community-based targeting (i.e. open forums in which village residents identify beneficiaries collectively), which is co-opted by the more influential community members. Their analysis suggests that, on average, households that are relatively well-off, connected to community leadership and reside in agro-ecologically favourable locations are more likely to be FISP beneficiaries and to receive more input coupons.

In 2013/2014, the Government of Malawi introduced a new tonnage allocation formula in order to reduce fertilizer costs. Subsequently in 2015, the Government introduced further reforms to facilitate direct private sector retailing and reduce the subsidy level (from 95 percent to 80 percent). Furthermore, the Government selected 1.5 million beneficiaries at random from a list of maize producers, with the intention of alternating beneficiaries on an annual basis and providing subsidies to all farmers once in three years.

Several aspects of FISP implementation have raised questions and are currently under discussion:

- How can FISP be aligned to the National Agricultural Policy to better contribute to Malawi’s overall objective of increasing national production, productivity and household income?

- How can FISP more actively stimulate fertilizer use, crop diversification and sustainable land management?
- Should targeting criteria be changed to gradually reduce the total number of beneficiaries and/or to reduce the subsidy level by shifting from subsistence to market-oriented farmers? This should lead to a gradual shift towards more commercial farmers and to a 'reallocation' of the poor subsistence farmers, previously included in the FISP, into social protection programmes (SCTP and/or public works programmes).

The paper intends to provide insights on the consequences of taking the action described in the final bullet point, in terms of missing opportunities to increase incomes and production among the most vulnerable people and enabling them to participate in the process of agricultural transformation.

2.2 The Social Cash Transfer Programme

The Social Cash Transfer Programme (SCTP) is an unconditional cash transfer programme aimed at reducing poverty and hunger among vulnerable households and increasing school enrolment. The programme falls under the broad prioritization of social protection in national development strategies, including the second theme of the Malawi Growth and Development Strategy (2006-2010) and the third theme of the Malawi Growth and Development Strategy II (2011-2016). At the national level, the SCTP is managed by the Ministry of Gender, Children and Social Welfare (MGCSW), with policy and design oversight by the Ministry of Finance, Economic Development and Planning (MFEDP). The programme explicitly targets ultra-poor households, which are defined as households unable to meet their most basic urgent needs, including for food and essential non-food items, and labour-constrained households.

A pilot SCTP was initiated in 2006 in the district of Mchinji. The 2007-2008 impact evaluation of the pilot demonstrated that the programme had a number of positive outcomes, including increased food security, ownership of agricultural tools and curative care-seeking (Miller, Tsoka and Reichert, 2010; Covarrubias, Davis and Winters, 2012). Since then, the programme has undergone some changes in targeting and operations, as well as a significant expansion to 18 out of the 28 districts in Malawi. As of April 2015, it reached over 100 000 households.[4]

The size of the transfer is adjusted to the number of household members and their characteristics. As of May 2015, households with one adult received bi-monthly payments that were equivalent to a monthly amount of 1 000 MWK, i.e. around US$3. The transfer has since been increased to 1 700 MWK, plus additional cash, based on the number of children enrolled in primary or secondary school.

Although the programme is unconditional, 80 percent of beneficiary households believed that they had to fulfil certain conditions in order to continue receiving payments. In particular, the households that believed that there was a conditionality thought that they were required to use

[4] For details about the programme implementation and funding, see Asfaw, Pickmans and Davis (2015) and Handa *et al.*, 2015.

the funds to purchase school supplies (70 percent), invest in farm or non-farm businesses (59 percent) or provide adequate food and nutrition for their children (57 percent).

3. Previous evidence of the interplay between FISP and SCTP in Malawi

To the best of our knowledge, only a few authors (Ellis and Maliro, 2013; Matita and Chirwa, 2014; Thome, Taylor and Filipski, 2014) have investigated the interplay between the FISP and the SCTP and none of these sought to estimate the impact of the synergies between the two programmes on direct beneficiaries.

Ellis and Maliro (2013) compare several features of fertilizer subsidies and cash transfers, such as output and market effects, impacts on vulnerability to hunger, unintended effects, targeting accuracy, asset and resource requirements, coverage boundaries, budgeting aspects and political dimensions. These comparisons suggest that input subsidies and cash transfers are complementary across a range of attributes and that they compensate for each other's weaknesses. In particular, they find that fertilizer subsidies are more effective in improving food security among farmers who are able to combine fertilizers with land, labour and improved seeds and less effective among farmers that lack land and labour.

Matita and Chirwa (2014) claim that targeting by SCTP and FISP should be better harmonized so that no household participates in both programmes simultaneously. Using a simulation analysis implemented with data from the Integrated Household Survey 3 (IHS3), the authors identified three target groups for the programmes: i) ultra-poor households with labour constraints to be treated under SCTP, ii) ultra-poor households with productive labour available to be treated under public works programmes and FISP, and iii) moderately-poor households with productive labour available to be treated under FISP. The authors' findings suggest that the gains from retargeting households to either FISP, or SCTP and/or public works are greater than from delivering both cash transfers and input subsidies to the same households.

Thome, Taylor and Filipski (2014) explore the synergies between SCTP and FISP using a local economy-wide impact evaluation model. Drawing on national representative data from the IHS3, they show that the SCTP has higher overall income multiplier effects than does the FISP but that the FISP tends to have higher production multipliers than does the SCTP. Moreover, they find that combining the FISP with the SCTP improves the income multipliers of FISP and, at the same time, increases the impact of SCTP on production. While Thome, Taylor and Filipski (2014) focus on the stand-alone and joint impact of the two programmes on the local economy, our contribution investigates the direct stand-alone impact of the two programmes, their synergies and the joint effect on beneficiary households.

4. Empirical analysis: data and econometric strategy

This study is based on data collected from a seventeen-month evaluation (2013-2014) of a sample of households eligible to receive the SCTP, which also provided information of whether the same households were included into the FISP. The data for this study were collected and preliminary analysis was carried out by the Carolina Population Center at the University of North Carolina at Chapel Hill (UNC-CH) and the Centre for Social Research of the University of Malawi (CSR UNIMA) (Handa *et al.*, 2015).

The UNC-CH and CSR UNIMA took advantage of an expansion in the SCTP to build an experimental 'delayed-entry' control group, which was implemented in two stages. In the first stage, four Traditional Authorities (TAs) in the districts of Salima and Mangochi were randomly selected by lottery (Ndidi and Maganga in Salima district and Mbwana Nyambi and Jalasi in Mangochi district). Next, eligible households were identified through a mix of proxy means testing and community-based targeting in all Village Clusters (VCs[5]) created in these four TAs for the purpose of implementing the programme. The targeting was done by the six members of the Community Social Support Committee (CSSC), who were chosen from different geographical locations in the VCs under the oversight of the District Commissioner's Office and the District Social Welfare Office.

A baseline survey of eligible households was completed in July/August 2013, covering 3 500 households in all four TAs. Just after the baseline survey, half of the VCs were randomly assigned to a treatment group and entered the programme immediately, while the other half served as a control group in order to measure the impact of the programme; the control group was supposed to enter the programme at the end of the evaluation period. The first follow-up survey was scheduled twelve months after the baseline survey when beneficiary households would have received eight to ten months' worth of transfers. However, due to a delay in the start of payments, the follow-up was postponed until November 2014, at which time beneficiary households would have received five payments only (10 months' worth). These data have been extensively analysed by Handa *et al.* (2015) and Asfaw, Pickmans and Davis (2015), focusing exclusively on the stand-alone impact of the SCTP on a broad range of outcome variables, including household consumption, food security, productive activities and labour supply, among others.

From the original sample, we selected a subsample in order to identify the stand-alone impacts of the SCTP and FISP, their synergies and the collective impact of participating in the FISP and SCTP simultaneously. We selected 1 607 households, which were interviewed for both the baseline and follow-up surveys. The households fell into four groups: control households that neither received the SCTP nor the FISP; households treated exclusively under the SCTP; households treated exclusively under the FISP; and households treated under both programmes at the same time (respectively, 38.33, 30.18, 14.87 and 16.6 percent of the study sample). We excluded the following categories of households from the sample: i) included in FISP in the previous two years but not in SCTP at the time of the follow-up survey (564); ii) included

[5] VCs are village groups comprising between 800 and 1 500 households each.

in FISP in the previous two years and in SCTP at the time of follow-up (558); iii) included in FISP at the time of the baseline survey (340); iv) included in FISP at the time of the baseline survey and in SCTP at the time of follow-up (294).[6] This kind of selection has advantages and disadvantages. The exclusion of the four groups of households allowed us to obtain a clean setting in which to estimate the effects of the two programmes. However, this selection procedure drastically reduced the sample size (from 3 363 to 1 607 households interviewed for the baseline and follow-up surveys).[7] Potentially, it could also affect the randomized nature of the experiment, creating groups with different characteristics at baseline. Indeed, unlike the SCTP, participation in the FISP was not randomized in the evaluation design.

To obtain consistent estimates, we used a quasi-experimental technique that combines regression analysis through a difference-in-differences approach and a generalized propensity score (GPS) weighting adjustment. We adopted the strategy suggested by Uysal (2015), which focuses on doubly robust estimates of multivalued and multifaceted treatments. The GPS weighting adjustment allowed us to 'rebalance' our study sample and to obtain doubly robust estimates of the causal effects of the multifaceted treatments we are analysing in this paper. The approach involves comparing the four 'rebalanced' groups of households interviewed at both baseline and follow-up: those treated exclusively under SCTP, exclusively under FISP, treated by both simultaneously, and households excluded by both programmes, which serve as a control group. Table A2 shows unweighted tests of the differences between the four groups included in the study sample. As suspected, the four groups show significant differences with regard to a variety of baseline characteristics and economic indicators. The adjustment implemented through the use of the GPS weights solves this problem. Indeed, Table 1 shows that, with only one exception, the four groups are identical at baseline.

By comparing outcomes between these groups, we can estimate the stand-alone impact of each programme, their joint impact and their synergies. More formally, equation (1) represents the regression equivalent of a difference-in-difference procedure:

$$Y_{i,d} = \zeta + \alpha D_i + \beta_1 SCTP_{i,d} + \beta_2 (D_i * SCTP_{i,d}) + \gamma_1 FISP_{i,d} + \gamma_2 (D_i * FISP_{i,d}) + \\ + \gamma_3 SCT_{i,d} * FISP_{i,d} + \delta (D_i * SCTP_{i,d} \,\&\, FISP_{i,d}) + \sum \beta X_i + \mu_{i,d} \quad (1)$$

Y represents the main outcome variables. SCTP and FISP are indicator variables for, respectively, assignment exclusively to the social cash transfers and the farm input subsidy programme. D represents the survey year and is equal to 1 at follow-up, otherwise zero. X is the set of household characteristics and controls at community level. μ is an error term. All of the estimates are adjusted using generalized propensity score weights.

[6] These groups of households represent, respectively, 16.7%, 16.6%, 10.1% and 8.7% of the original study sample.

[7] Table A1 in Appendix C provides tests of differences between households excluded versus households included in the analysis of this paper. The group of households excluded from the study sample is relatively better off. This is not surprising since it includes households that already received agricultural input subsidies at baseline or in the previous two years.

The parameters of interest are the coefficients β_2, γ_2, and δ which are, respectively, the average treatment estimates of the impact of the SCTP on households participating only in that programme (β_2); the impact of the FISP for households participating only in that programme (γ_2); and the estimated joint impact of the SCTP and the FISP on households in both programmes (δ). These parameters allow us to estimate the synergies between the two programmes. In particular, the difference between δ, β_2 and γ_2 measures the complementarity between the SCTP and the FISP. The difference between δ and β_2 measures the incremental impact of the FISP on the SCTP. The difference between δ and γ_2 measures the incremental impact of the SCTP on FISP.

5. Results of the stand-alone and combined impacts of the SCTP and FISP

Figures 1 and 2 show kernel densities of total household consumption at the time of the baseline and follow-up surveys. While at baseline there were no significant differences among the distributions, at follow up the distributions of expenditure for the SCTP and for the SCTP plus FISP groups, almost coincidentally, shifted significantly to the right. This suggests that without controlling for potential confounding factors, the SCTP contributed to an increase in household expenditure. The SCTP and the FISP seem to go in the same direction, but most of the change in expenditure is due to the effect of the SCTP. In other words, the FISP appears to contribute weakly to the increase in expenditure.

We replicated the same type of exercise for the value of production. Figures 3 and 4 show kernel densities of the value of production at baseline and follow-up. As for household expenditure, there are no significant differences among the distributions at baseline. However, at follow-up, the distributions of the value of production (maize, groundnuts, pigeon pea, nkhwani, rice, cotton and sorghum) for the FISP and especially the SCTP plus FISP groups shifted significantly to the right, meaning that combining the FISP and SCTP increases the value of production. As opposed to total expenditure, here the effect seems to be driven mainly by participating in the FISP.

The following subsections describe and discuss the main findings with regard to a set of outcomes: household expenditure and food security and their intermediate outcomes, including productive activities (agricultural production and input use) and livestock (ownership and expenditure). All estimates are doubly robust: they include a large set of control variables, namely, baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks, and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

5.1 Household expenditure

Figure 5 provides a graphical representation of the estimated stand-alone impact of the SCTP and the FISP, the total impact of the two programmes and their synergy with regard to household expenditure. The thick horizontal bars represent the estimated coefficients, while the thin horizontal bars show the confidence interval. The figure shows, from left to right: i) the stand-alone impact of the SCTP; ii) the stand-alone impact of the FISP; iii) the sum of the impacts of the two programmes; and iv) (in red) the joint impact of the SCTP and FISP when households benefit from both at the same time. The difference between iii) and iv) represents the precise measure of complementarity between the two interventions. Figure 5 shows that the stand-alone impact of the SCTP on total household expenditure is positive and significant but that the stand-alone impact of the FISP is positive but not statistically significant. The joint impact is positive and significant and it is 15 percent larger than the sum of the stand-alone impacts of the SCTP and FISP. Overall, the estimates for total household expenditure confirm and strengthen the main message represented in Figure 2: there are positive synergies when households participate in both programmes. Table 2 provides the doubly robust estimates of the impacts on total expenditure. In addition to the findings shown in Figure 5, Table 2 shows estimates of the incremental impacts of the SCTP on the FISP and the incremental impacts of the FISP on the SCTP. While the former is positive and statistically significant, the latter is positive but not significant. Moreover, the analysis by labour constraints suggests that the stand-alone impact of the SCTP and the FISP are larger for households defined as labour-constrained but synergies take place only for households defined as labour-unconstrained, and not for the other group.

Table 3 shows the effect of the programmes on several expenditure items (food, alcohol, health, education, clothing and footwear, housing and utilities, furnishing and transport). The results for food expenditure are similar to those for total expenditure. Here, the stand-alone impact of the SCTP is positive and significant, the stand-alone impact of the FISP is positive but not statistically significant, and the total impact is positive and significant. Looking at the estimates of other consumption items, the results are more heterogeneous. For example, we find that there are synergies between the SCTP and the FISP with regard to expenditures on health and education, but not for the other consumption items. Most of the increase in expenditure is due to the SCTP. The stand-alone impact of the FISP is significant only for expenditure on housing and utilities, but the joint impact of participation in the two programmes simultaneously is always positive and significant, with the only exceptions being the items ‘alcohol’ and ‘transport’. Looking at these results, we need to bear in mind that the FISP does not directly provide cash to recipient households. The impact of the FISP on these expenditures may be due to i) the FISP producing both a substitution and an income effects (i.e. it is likely to release liquidity used for agricultural inputs, such as fertilizers and/or seeds); and ii) the vouchers provided to FISP-beneficiaries being exchanged for cash.

The analysis by labour constraints suggests that synergies between the SCTP and the FISP in increasing expenditure on food, health, education, housing and furnishing only take place in labour-unconstrained households.

5.2 Food security

We consider several proxies for food security (see Table 4). First, we analyse a survey question that asked respondents whether they worry that their household will not have enough food.[8] Second, we consider the number of meals consumed per day in the household. Interestingly, while the stand-alone impact of the SCTP on food security is positive and significant, the stand-alone impact of the FISP is statistically significant only for the first indicator. Finally, we consider daily per capita caloric intake calculated using kilocalories per gram of edible portion of specific foods, multiplied by the quantity – in grams – of specific foods eaten. These kilocalorie figures were summed up for participating households, and then divided by the number of household members and the days per week, to reveal daily per capita figures. As for the other food security indicator, we find that the SCTP allows participating households to increase their caloric intake, especially from purchased food, but that the stand-alone contribution of the FISP is not significant. Overall, estimates of the joint impact suggest that the two interventions improved food security, but positive synergies seem to take place only with regard to the number of meals per day and only for households defined as labour-unconstrained.

5.3 Agricultural production, agricultural inputs and livestock

Figure 6 provides a graphical representation of the estimated stand-alone impact of the SCTP and the FISP, their joint impact and their synergy with regard to the value of production, controlling for a large set of confounding factors at household and community levels. The estimates confirm and strengthen the main message of Figure 4: the joint impact is positive and significant and there are positive synergies concerning the value of production when households participate in both programmes. Indeed, the value of production when households participate in the SCTP and the FISP at the same time is 22 percent larger than the sum of the stand-alone impacts. Figure 4 also shows that most of the increase in the value of production is due to the FISP. Table 5 provides additional information about the incremental effect of the SCTP on the FISP and the incremental effect of the FISP on the SCTP. The results show strong synergies between the two interventions, since the incremental effect of each programme on the other is positive and statistically significant. Moreover, the heterogeneity analysis suggests that the stand-alone impacts of the SCTP and the FISP are larger for labour-unconstrained households, but that more positive synergies take place in households defined as labour-constrained. This is an important result: the combination of a social protection programme and an agricultural development intervention generates more benefits for agricultural production in the most disadvantaged households.

Table 6 shows results for the production of several crops. The FISP positively affects the households engaged in maize production and also the quantity of maize produced, especially for labour-constrained households. The stand-alone impact of the SCTP is not statistically

[8] Note that the results for the variable "worry that household will not have enough food" need to be read differently. In this case, a negative and significant coefficient means that the SCTP and the FISP improve food security since they contribute to reducing concerns about not having enough food.

significant but the effect of joint participation is significant for the most disadvantaged group of households. Synergies also occur in the production of this crop. Indeed, the incremental impact of the FISP on the SCTP in the case of labour-constrained households is highly significant. The effect on labour-unconstrained households is weak, probably because the overwhelming majority of labour-constrained households is already engaged in farming activities ('ceiling effect'). As for the production of groundnut, we find that the stand-alone impact of the FISP and the joint impact of the FISP and the SCTP are positive and significant for both indicators (percentage of household engaged in farming activities and the quantity of groundnut produced).

With regard to the results on agricultural inputs, as expected, the FISP significantly increases the percentage of users and the quantity of chemical fertilizers used, and increases the percentage of users of improved or hybrid seeds (see Table 7). Overall, the joint impact is positive and significant only for chemical fertilizers and the synergies between the two programmes seem to be weak.

Finally, in Tables 8 and 9 we looked at whether the SCTP and the FISP had any impact on household expenditure for livestock and whether the ownership of chicken, sheep, goats, pigeons, doves and ducks increased. Overall, the results suggest that the stand-alone impacts of the SCTP and the FISP are positive and significant, and that the two programmes are complementary instruments for increasing ownership of livestock and expenditure on livestock. The SCTP directly affects expenditure on livestock by providing cash directly to beneficiary households. The positive impact of the FISP on livestock expenditures may be due to the fact that FISP it is likely to ease liquidity used for agricultural inputs when the vouchers provided to FISP-beneficiaries are exchanged for cash. The results by labour constraints are striking: the incremental impact of the FISP on the SCTP, the incremental impact of the SCTP on the FISP and their complementarities are stronger in labour-constrained households.

6. Conclusions

This paper aims to inform policy discussions on the reform of the FISP and, more specifically, how it can be coordinated with the SCTP to combat poverty and food insecurity and help small family farmers participate in the process of agricultural transformation. There is increasing recognition at the global level of the role that agriculture and social protection can together play in combating hunger and poverty and this document contributes to the existing empirical evidence by shedding light on the interplay between the FISP and the SCTP in Malawi.

The analysis shows that there are positive synergies between the SCTP and the FISP in increasing expenditure, the value of agricultural production, agricultural activities and livestock, and to a lesser extent, in improving food security. More specifically:

- The SCTP and the FISP are complementary instruments for increasing total household expenditure and expenditure on food, health and education. The stand-alone impact of the SCTP is larger than that of the FISP for these outcomes. The joint impact of the programmes on total expenditure when households benefit from both simultaneously is **15 percent larger** than the sum of the stand-alone impacts.

- The SCTP and the FISP are complementary instruments for increasing the value of production, production activities and livestock. The stand-alone impact of the FISP is larger than that of the SCTP for these outcomes. The joint impact of the programmes on the value of production when households benefit from both simultaneously is **22 percent larger** than the sum of the stand-alone impacts.

- An analysis based on labour constraints shows diverse impacts. On the one hand, the synergies between the SCTP and the FISP in terms of increasing household expenditures are stronger for labour-unconstrained households. On the other hand, the synergies between the two interventions in terms of increasing the value of production and production activities are stronger for labour-constrained households. This is an important result: the FISP acts more effectively in increasing productive activities for the most disadvantaged households when it is combined with cash provided by the SCTP.

Two features of this study need to be borne in mind when interpreting the results. First, given the eligibility criteria for inclusion in the SCTP, our sample represents the lower-income quantile of the population in Malawi. The SCTP explicitly targets ultra-poor households, which are defined as households that are unable to meet their most basic urgent needs, including for food and essential non-food items, and labour-constrained households. Second, in this study we do not consider any indirect benefits (such as spillover effects on the local economy), nor the implied costs of the two programmes. This is purely a study of the direct stand-alone impact, joint impact and synergies between the two programmes.

Our analysis shows that there are positive synergies between the SCTP and the FISP that benefit the poorest households in Malawi. In other words, one programme increases the

effectiveness of the other and, when households participate in both programmes, they improve their productivity and food security. Two factors may explain this result. First, by working together, the FISP and the SCTP can address more of the constraints facing poor rural households than either programme could do on its own. Second, ensuring coherence between the FISP and the SCTP may protect small farmers against unintended harm (Gavrilovic *et al*., 2016). Certain agricultural policies can inadvertently be unfavourable to small family farmers (Gollin, 2014). By the same token, social protection interventions might also inadvertently have negative impacts on agriculture (Devereux, 2009; Bundy *et al.*, 2009; Sumberg and Sabates-Wheeler, 2011).

To conclude, the evidence suggests that when agricultural and social protection interventions, such as the FISP and the SCTP, complement each other they can have positive medium and long-term effects, helping poor households to break the cycle of disadvantage and preventing the transmission of poverty across generations. On one hand, the SCTP provides liquidity and certainty for poor households and small family farmers, allowing them to invest in agriculture and human capital development and to better manage risks. On the other hand, the FISP can improve the productivity of small family farmers by addressing structural constraints that limit access to inputs, financial services and markets. In addition, as documented by Thome, Taylor and Filipski (2014), coordinating the FISP and the SCTP can promote local economic growth, increasing employment opportunities in the agricultural sector, improving food availability and keeping staple food prices low, with benefits for poor net food buyers (Gavrilovic *et al.*, 2016).

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Appendix A: Figures

Figure 1 **Kernel density of total household expenditure at baseline by treatment groups – real values in log**

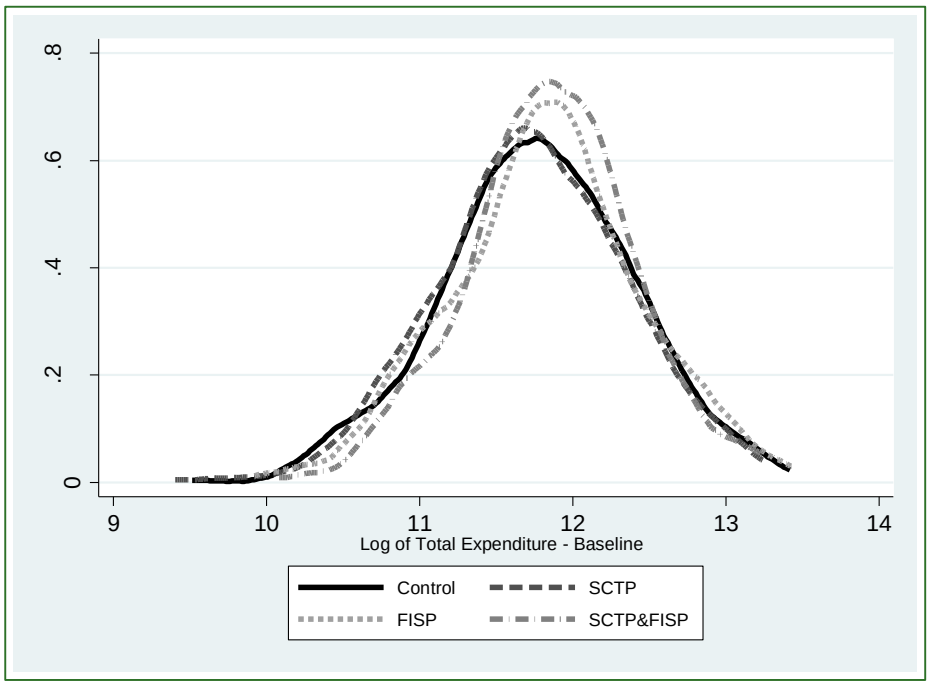


Figure 2 **Kernel density of total household expenditure at follow up by treatment groups – real values in log**

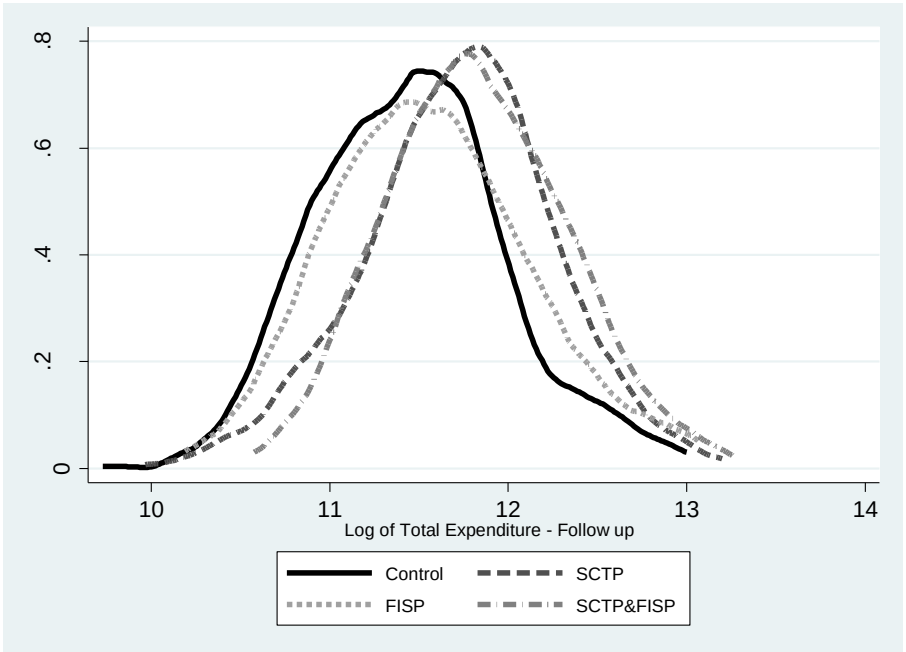


Figure 3 **Kernel density of value of production at baseline by treatment groups – real values in log**

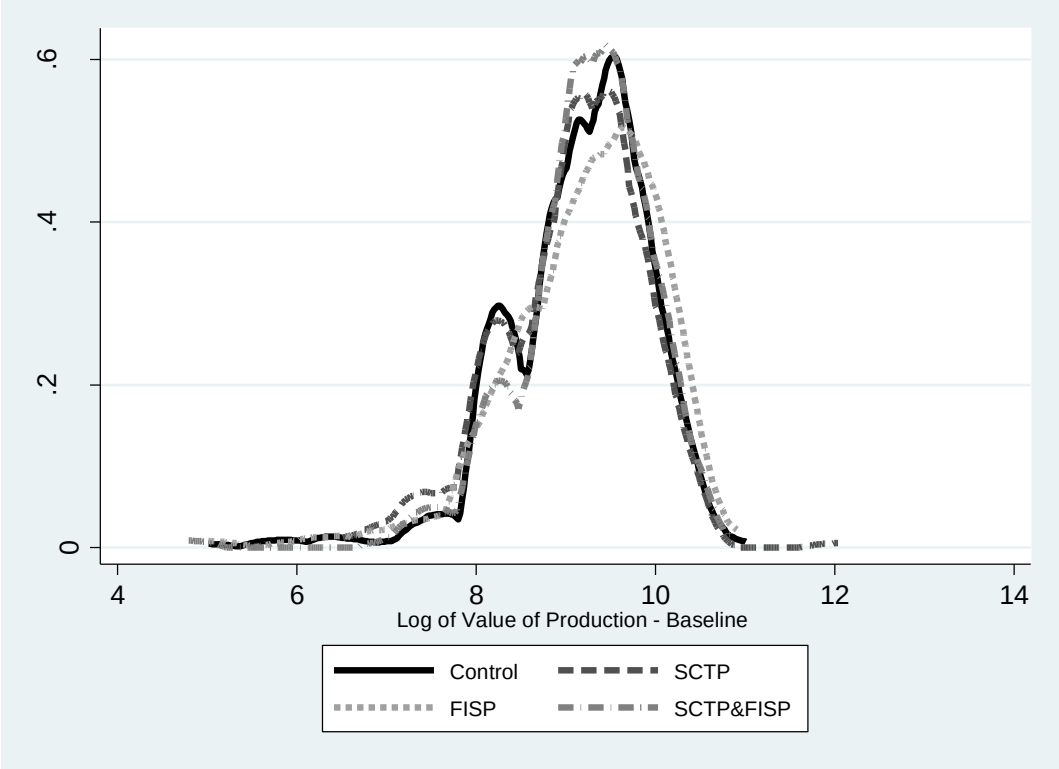


Figure 4 **Kernel density of value of production at follow up by treatment groups – real values in log**

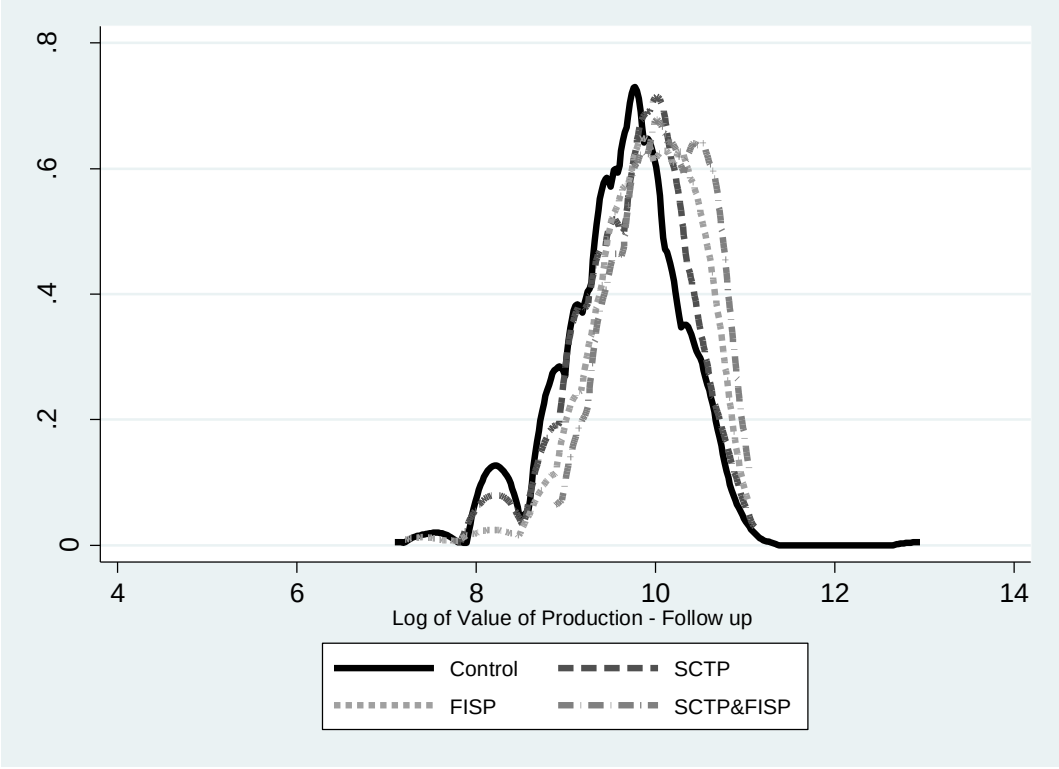
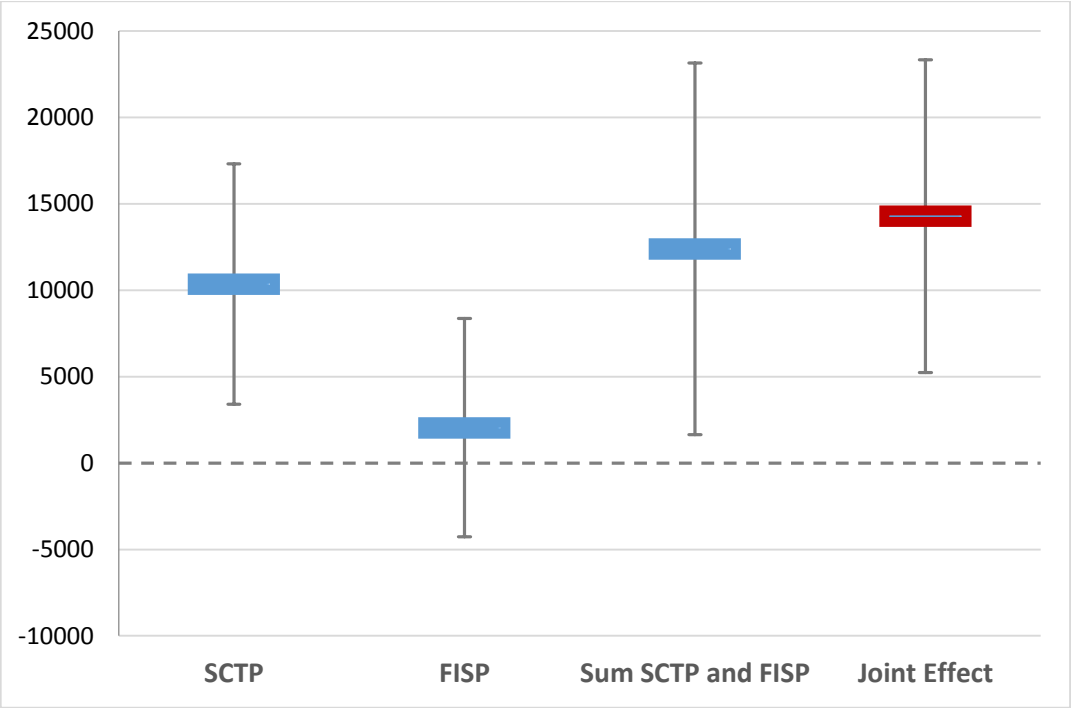
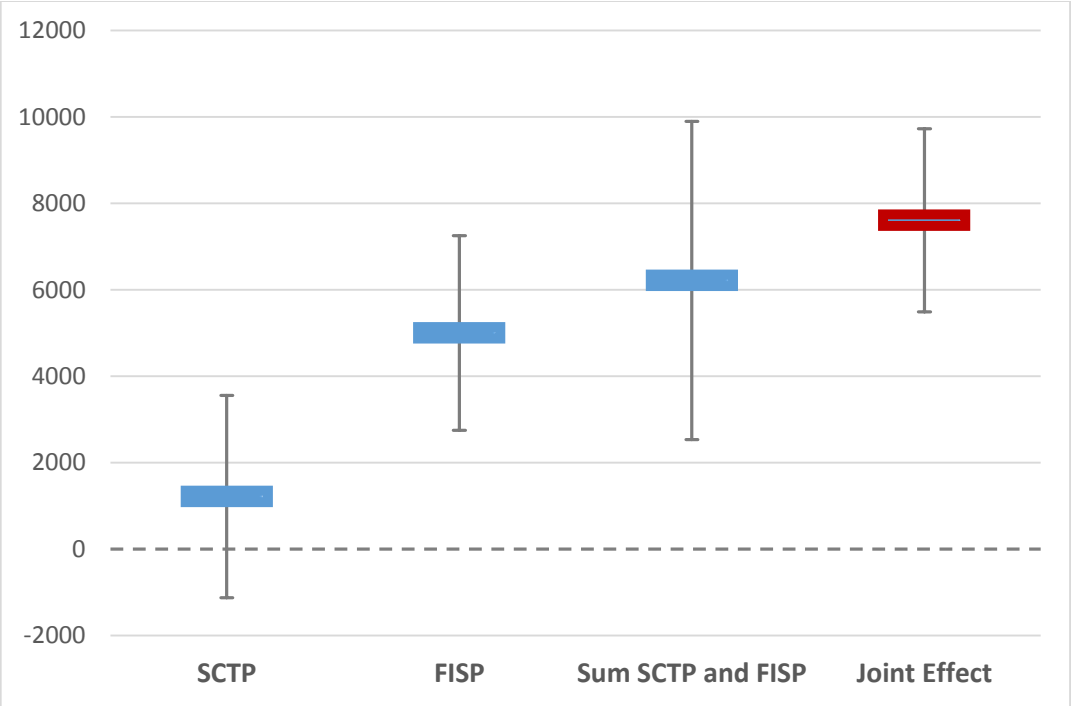


Figure 5 **Impact on household expenditure per capita– MWK real values**



Note: the y axis shows the range of the estimated coefficients. The thick horizontal bars represent the estimated coefficients, while the thin horizontal bars show the confidence interval.

Figure 6 **Impact on value of production – MWK real values**



Note: the y axis shows the range of the estimated coefficients. The thick horizontal bars represent the estimated coefficients, while the thin horizontal bars show the confidence interval.

Appendix B: Tables

Table 1 **Anova test for difference between groups of intervention: control, SCTP, FISP, SCTP and FISP (adjusted by the Generalized Propensity Score weights)**

	C	SCTP	FISP	SCTP and FISP	F-test	P-value>F
Single head of hh	0.748	0.730	0.751	0.740	0.18	0.9117
Female head of hh	0.851	0.838	0.820	0.837	0.49	0.692
Age of head of hh	54.495	54.161	55.087	54.719	0.150	0.927
# Members in the hh	4.633	4.633	4.454	4.544	0.59	0.618
# Members in the hh: 0-5 years old	0.783	0.769	0.728	0.771	0.27	0.846
# Members in the hh: 6-12 years old	1.250	1.256	1.162	1.195	0.74	0.527
# Members in the hh: 13-17 years old	0.905	0.905	0.873	0.891	0.11	0.956
# Members in the hh: 18-64 years old	1.178	1.196	1.195	1.170	0.07	0.976
# Members in the hh: >=65 years old	0.517	0.508	0.496	0.517	0.12	0.951
# Orphans in the hh	1.099	1.084	1.019	1.035	0.23	0.874
Yrs of education head of hh	1.272	1.296	1.245	1.385	0.28	0.840
HH severely labour-constrained	0.456	0.449	0.473	0.463	0.17	0.914
HH consumption - total	16 4514.5	15 4514.0	16 3867.2	16 0596.9	0.56	0.639
HH consumption - food and Beverages	12 7621.9	11 8176.7	12 4934.0	12 5507.5	0.75	0.523
HH owns or cultivates land	0.919	0.932	0.937	0.933	0.4	0.754
Total plot area operated within hh	1.210	1.238	1.220	1.247	0.13	0.944
HH has plot that is irrigated	0.045	0.045	0.051	0.066	0.76	0.515
HH applies chemical fertilizer	**0.276**	**0.270**	**0.353**	**0.424**	**9.59**	**0.000**
HH applies organic fertilizer	0.278	0.265	0.315	0.329	1.72	0.161
HH uses pesticides	0.015	0.030	0.040	0.030	1.5	0.212
HH uses improved or hybrid seed	0.283	0.271	0.328	0.348	2.51	0.057
HH planted maize	0.872	0.872	0.877	0.884	0.12	0.951
HH planted groundnut	0.094	0.091	0.089	0.136	2.23	0.083
HH planted pigeon pea	0.098	0.111	0.068	0.115	2.14	0.094
Value of production	9 505.8	9 143.0	9 570.9	9 830.9	0.35	0.786
HH owns hand hoe	0.813	0.814	0.837	0.855	1.18	0.317
HH owns axe	0.100	0.081	0.093	0.100	0.37	0.771
HH owns panga knife	0.192	0.226	0.242	0.217	1.02	0.383
HH owns sickle	0.126	0.128	0.107	0.085	1.6	0.187
HH owns chickens	0.126	0.128	0.107	0.085	1.6	0.187
HH owns goat or sheep	0.064	0.054	0.051	0.083	1.38	0.246
Total hh expenditure for livestock	87.79	97.95	43.83	80.277	0.86	0.462
Total hh livestock sales	275.48	321.27	119.46	293.949	1.63	0.180
Observations	616	485	239	267		

Table 2 **Impact on total expenditure per capita – real values**

	All		Labour-unconstrained		Labour-constrained	
	Total expenditure	**Baseline mean**	**Total expenditure**	**Baseline mean**	**Total expenditure**	**Baseline mean**
SCTP*d2014	10 348.555**	40 384.55	5 093.74	32 691.30	15 220.805**	49 843.35
	[2.44]		[0.96]		[2.76]	
FISP*d2014	2 041.03	44 615.69	-3 590.39	39 623.17	7 957.69	50 181.21
	[0.53]		[-0.68]		[1.53]	
Joint impact of SCTP and FISP	14 290.270**	44 988.36	14 443.217*	35 532.26	11 709.515**	55 976.07
	[2.59]		[1.97]		[2.39]	
Incremental impact of FISP on SCTP	3 941.715		9 349.475*		-3 511.29	
	[1.01]		[1.80]		[-0.75]	
Incremental impact of SCTP on FISP	12 249.25**		18 033.6**		3 751.827	
	[2.03]		[2.50]		[0.57]	
Complementarity	1 900.69		12 939.86*		-11 468.98	
	[0.34]		[1.80]		[-1.72]	

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 3 Impact on expenditure for different items – real values

	Expenditure		
	All	**Labour-unconstrained**	**Labour-constrained**
Food per capita			
SCTP*d2014	6 013.45	1 377.53	10 058.494**
	[1.63]	[0.29]	[2.2]
FISP*d2014	1 834.64	-2 976.59	6 723.04
	[0.54]	[-0.63]	[1.45]
Joint impact of SCTP and FISP	8 117.414*	7 650.87	6 774.536*
	[1.83]	[1.18]	[1.67]
Incremental impact of FISP on SCTP	2 103.96	6 273.344	-3 283.958
	[0.65]	[1.38]	[-0.72]
Incremental impact of SCTP on FISP	6 282.779	10 627.46*	51.4941
	[1.38]	[1.79]	[0.01]
Complementarity	269.3276	9 249.934	-10 007
	[0.06]	[1.43]	[-1.62]
Health per capita			
SCTP*d2014	515.10	441.73	545.76
	[1.45]	[1.21]	[0.93]
FISP*d2014	-391.02	-172.20	-857.66
	[-0.62]	[-0.37]	[-0.63]
Joint of impact SCTP and FISP	1 219.446**	1 428.233**	624.29
	[2.73]	[2.38]	[1.25]
Incremental impact of FISP on SCTP	704.3511	986.5052	78.52
	[1.56]	[1.61]	[0.12]
Incremental impact of SCTP on FISP	1 610.465**	1 600.429**	1 481.94
	[2.04]	[2.16]	[1.09]
Complementarity	1 095.37	1 158.701	936.18
	[1.36]	[1.48]	[0.61]
Education per capita			
SCTP*d2014	225.755***	-22.35	474.719***
	[2.94]	[-0.16]	[3.78]
FISP*d2014	-72.27	-241.111*	100.19
	[-1.09]	[-1.84]	[0.94]
Joint impact of SCTP and FISP	360.351***	263.51	401.553**
	[3.29]	[1.39]	[2.49]
Incremental impact of FISP on SCTP	134.5952	285.8555	-73.1667
	[1.11]	[1.54]	[-0.54]
Incremental impact of SCTP on FISP	432.6177***	504.6155**	301.3672*
	[3.84]	[2.42]	[1.85]
Complementarity	206.8622	526.9664**	-173.3522
	[1.52]	[2.21]	[-1.02]
Clothing and footwear per capita			
SCTP*d2014	962.313***	946.165***	906.557***
	[7.00]	[4.98]	[4.5]
FISP*d2014	187.030***	57.49	395.723***
	[3.05]	[0.57]	[2.95]
Joint impact of SCTP and FISP	902.583***	1 047.960***	659.761***
	[6.34]	[5.67]	[3.56]
Incremental impact of FISP on SCTP	-59.730	101.795	-246.796
	[-0.42]	[0.44]	[-1.37]
Incremental impact of SCTP on FISP	715.553***	990.476***	264.038
	[4.70]	[5.17]	[1.07]
Complementarity	-246.760	44.310	-642.519
	[-1.53]	[0.17]	[-2.84]

	Expenditure		
	All	**Labour-unconstrained**	**Labour-constrained**
Alcohol/tobacco per capita			
SCTP*d2014	904.796*	1 073.079*	1 152.33
	[1.84]	[1.9]	[1.47]
FISP*d2014	-639.47	-1 409.77	268.39
	[-1.45]	[-1.42]	[0.93]
Joint impact of SCTP and FISP	1264.42	1 317.242*	1 283.34
	[1.68]	[1.88]	[1.56]
Incremental impact of FISP on SCTP	359.628	244.163	131.0163
	[0.43]	[0.53]	[0.13]
Incremental impact of SCTP on FISP	1 903.891*	2 727.009*	1 014.958
	[1.83]	[1.85]	[1.36]
Complementarity	999.0956	1 653.93	-137.3696
	[1.05]	[1.54]	[-0.12]
Housing/utilities per capita			
SCTP*d2014	263.03	113.83	381.86
	[1.12]	[0.58]	[0.93]
FISP*d2014	262.71	362.361*	269.74
	[1.39]	[1.87]	[0.59]
Joint impact of SCTP and FISP	551.983**	637.101**	472.44
	[1.97]	[2.16]	[1.18]
Incremental impact of FISP on SCTP	288.95	523.268**	90.57807
	[1.10]	[2.47]	[0.19]
Incremental impact of SCTP on FISP	289.27	274.74	202.6946
	[0.87]	[0.85]	[0.36]
Complementarity	26.24	160.91	-179.1656
	[0.08]	[0.57]	[-0.30]
Furnishings per capita			
SCTP*d2014	514.225***	314.10	821.313***
	[3.97]	[1.55]	[4.66]
FISP*d2014	53.89	-15.64	257.12
	[0.27]	[-0.08]	[1.19]
Joint impact of SCTP and FISP	686.711***	762.469***	584.281***
	[4.43]	[3.21]	[2.88]
Incremental impact of FISP on SCTP	172.49	448.3676*	-237.03
	[1.23]	[1.70]	[-1.11]
Incremental impact of SCTP on FISP	632.820**	778.11**	327.1653
	[2.74]	[2.81]	[1.4]
Complementarity	118.60	464.01	-494.1479
	[0.48]	[1.44]	[-1.69]
Transport per capita			
SCTP*d2014	441.010**	444.09	403.254**
	[1.97]	[1.1]	[2.28]
FISP*d2014	351.38	616.15	66.10
	[1.34]	[1.17]	[0.29]
Joint impact of SCTP and FISP	463.75	681.59	126.02
	[1.59]	[1.58]	[0.66]
Incremental impact of FISP on SCTP	22.74	237.50	-277.23
	[0.07]	[0.41]	[-1.68]
Incremental impact of SCTP on FISP	112.3689	65.44	59.93
	[0.40]	[0.13]	[0.29]
Complementarity	-328.64	-378.65	-343.33

	[-0.74]	[-0.45]	[-1.15]
Communication per capita			
SCTP*d2014	53.835	81.204	30.842
	[1.59]	[1.37]	[0.86]
FISP*d2014	12.697	32.083	2.322
	[0.49]	[0.59]	[0.07]
Joint impact of SCTP and FISP	78.583	116.432	19.666
	[1.6]	[1.44]	[0.37]
Incremental impact of FISP on SCTP	24.748	35.229	-11.176
	[0.45]	[0.42]	[-0.25]
Incremental impact of SCTP on FISP	65.886	84.349	17.344
	[1.25]	[1.03]	[0.27]
Complementarity	12.051	3.145	-13.499
	[0.19]	[0.03]	[-0.24]
Recreation per capita			
SCTP*d2014	-1.08	1.63	-2.57
	[-0.46]	[0.28]	[-1.19]
FISP*d2014	-4.43	-9.90	0.51
	[-1.36]	[-1.67]	[0.28]
Joint impact of SCTP and FISP	-11.38	-13.79	-7.53
	[-1.65]	[-1.31]	[-1.37]
Incremental impact of FISP on SCTP	-10.30	-15.4121	-4.96
	[-1.35]	[-1.03]	[-1.24]
Incremental impact of SCTP on FISP	-6.95	-3.89	-8.05
	[-0.90]	[-0.35]	[-1.26]
Complementarity	-5.87	-5.52	-5.48
	[-0.69]	[-0.37]	[-1.09]
Hotels and restaurants per capita			
SCTP*d2014	265.650**	227.408*	239.05
	[2.17]	[1.68]	[-1.25]
FISP*d2014	216.315*	52.07	398.202*
	[1.76]	[0.35]	[1.74]
Joint impact of SCTP and FISP	121.09	77.29	209.70
	[0.63]	[0.45]	[0.66]
Incremental impact of FISP on SCTP	-144.56	-150.12	-29.3
	[-0.69]	[-0.69]	[-0.09]
Incremental impact of SCTP on FISP	-95.221	25.22	-188.50
	[-0.43]	[0.13]	[-0.53]
Complementarity	-360.871	-202.19	-427.6
	[-1.39]	[-0.76]	[-1.07]
Miscellaneous			
SCTP*d2014	190.47	95.33	209.19
	[1.5]	[0.68]	[1.4]
FISP*d2014	229.550***	114.67	334.014**
	[2.84]	[1.33]	[2.66]
Joint impact of SCTP and FISP	535.310***	474.311**	561.454***
	[3.54]	[2.22]	[3.2]
Incremental impact of FISP on SCTP	344.841**	378.98	352.2612*
	[2.91]	[1.62]	[1.84]
Incremental impact of SCTP on FISP	305.76**	359.65	227.4401
	[2.21]	[1.61]	[1.45]
Complementarity	115.29	264.32	18.247
	[0.82]	[1.04]	[0.08]

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district

fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 4 Impact on food security

	All	Labour-unconstrained	Labour-constrained
Worry about lack of food			
SCTP*d2014	-0.091**	-0.095**	-0.084
	[-2.17]	[-2.12]	[-1.57]
FISP*d2014	-0.046	-0.070**	0.002
	[-1.51]	[-2.28]	[0.04]
Joint impact of SCTP and FISP	-0.076	-0.109*	-0.043
	[-1.68]	[-1.72]	[-0.76]
Incremental impact of FISP on SCTP	0.015	-0.014	0.04
	[0.58]	[-0.29]	[0.72]
Incremental impact of SCTP on FISP	-0.030	-0.039	-0.045
	[-0.70]	[-0.62]	[-0.59]
Complementarity	0.06	0.056	0.038
	[1.56]	[0.92]	[0.44]
Number of meals per day			
SCTP*d2014	0.226***	0.174**	0.278***
	[3.51]	[2.36]	[3.03]
FISP*d2014	0.054	-0.016	0.131
	[0.92]	[-0.13]	[1.57]
Joint impact of SCTP and FISP	0.244***	0.226**	0.237***
	[3.25]	[2.17]	[2.88]
Incremental impact of FISP on SCTP	0.018	0.05	-0.04
	[0.3]	[0.64]	[-0.42]
Incremental impact of SCTP on FISP	0.190**	0.241**	0.11
	[2.79]	[2.04]	[0.87]
Complementarity	-0.036	0.07	-0.17
	[-0.42]	[0.46]	[-1.34]
Caloric intake in the past 7 days			
SCTP*d2014	187.382**	119.382	280.131**
	[2.13]	[1.24]	[2.24]
FISP*d2014	-12.874	-57.596	63.059
	[-0.29]	[-0.70]	[0.74]
Joint impact of SCTP and FISP	188.926	175.909	267.392**
	[1.40]	[1.03]	[2.14]
Incremental impact of FISP on SCTP	1.54	56.53	-75.80
	[0.01]	[0.4]	[-0.51]
Incremental impact of SCTP on FISP	201.80	233.50	-12.74
	[1.43]	[1.26]	[-0.11]
Complementarity	14.42	114.12	204.33
	[0.12]	[0.71]	[1.54]
Caloric intake from purchased food			
SCTP*d2014	181.329**	90.501	345.121***
	[2.23]	[0.93]	[4.32]
FISP*d2014	54.114	0.919	128.241
	[0.82]	[0.01]	[1.47]
Joint impact of SCTP and FISP	211.552**	163.367	294.328***
	[2.09]	[1.49]	[2.79]
Incremental impact of FISP on SCTP	30.22	72.87	-50.79
	[0.42]	[1]	[-0.55]
Incremental impact of SCTP on FISP	157.44	162.45	166.087

	[1.58]	[1.39]	[1.58]
Complementarity	-23.89	71.95	-179.03
	[0.24]	[0.65]	[-1.44]
Caloric intake from produced food			
SCTP*d2014	-41.163	-18.085	-77.454
	[-0.71]	[-0.29]	[-1.33]
FISP*d2014	-6.951	-6.514	-21.837
	[-0.38]	[-0.26]	[-1.03]
Joint impact of SCTP and FISP	-29.016	4.027	-63.326
	[-0.52]	[0.08]	[-0.90]
Incremental impact of FISP on SCTP	12.147	22.112	14.128
	[0.78]	[0.90]	[0.48]
Incremental impact of SCTP on FISP	-22.066	10.541	-41.489
	[-0.41]	[0.21]	[-0.63]
Complementarity	19.098	28.626	35.965
	[0.84]	[0.84]	[1]
Caloric intake from gifts			
SCTP*d2014	-4.915	-2.845	-7.85
	[-1.29]	[-0.81]	[-1.68]
FISP*d2014	3.677*	1.431	6.655***
	[1.78]	[0.50]	[3.04]
Joint impact of SCTP and FISP	-1.503	-1.061	-1.84
	[-0.37]	[-0.26]	[-0.39]
Incremental impact of FISP on SCTP	3.412*	1.784	6.010***
	[1.73]	[0.58]	[2.96]
Incremental impact of SCTP on FISP	-5.180	-2.492	-8.495
	[-1.18]	[-0.50]	[-1.91]
Complementarity	-0.265	0.353	-0.645
	[-0.1]	[0.09]	[-0.23]

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 5 Impact on value of production

	All		Labour-unconstrained		Labour-constrained	
	Value of production	Baseline mean	Value of production	Baseline mean	Value of production	Baseline mean
SCTP*d2014	1 215.245	9 143.033	2 338.955*	10 501.45	-170.595	7 472.863
	(0.85)		[1.66]		[-0.07]	
FISP*d2014	5 001.897***	9 570.896	5 874.043***	11 169.23	2 682.042	7 789.116
	(3.64)		[5.24]		[1.03]	
Joint impact of SCTP and FISP	7 609.484***	9 830.867	7 774.090***	11 101.51	7 060.743***	8 354.416
	(5.88)		[5.63]		[3.78]	
Incremental impact of FISP on SCPT	6 394.239***		5 435.135***		7 231.338***	
	(6.93)		[3.67]		[4.06]	
Incremental impact of SCTP on FISP	2 607.587*		1 900.047		4 378.7*	
	(1.70)		[1.28]		[1.9]	
Complementarity	1 392.342		-438.909		4 549.295	
	(0.86)		[-0.26]		[1.38]	

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 6 Impact on production

	% HH engaged in:			Quantity produced		
	All	Labour-unconstrained	Labour-constrained	All	Labour-unconstrained	Labour-constrained
Maize production						
SCTP*d2014	-0.001	-0.004	-0.008	18.767	19.641	12.244
	[-0.03]	[-0.19]	[-0.15]	[1.22]	[1.29]	[0.52]
FISP*d2014	0.067**	0.014	0.112**	65.581***	61.179***	61.037***
	[2.48]	[0.72]	[2.52]	[6.42]	[5.97]	[4.49]
Joint impact of SCTP and FISP	0.033	0.003	0.081*	81.418***	76.181***	82.667***
	[0.98]	[0.10]	[1.64]	[4.32]	[3.70]	[4.28]
Incremental impact of FISP on SCTP	0.034	0.007	0.089**	62.651***	56.540***	70.423***
	[1.52]	[0.28]	[2.99]	[5.40]	[3.29]	[4.08]
Incremental impact of SCTP on FISP	-0.034	-0.011	-0.031	15.837	15.002	21.629
	[-0.94]	[-0.39]	[-0.56]	[0.78]	[0.70]	[0.97]
Complementarity	-0.033	-0.007	-0.023	-2.930	-4.639	9.386
	[-0.94]	[-0.22]	[-0.4]	[-0.19]	[-0.25]	[0.43]
Grandnut production						
SCTP*d2014	0.090*	0.089	0.088	7.954**	8.654	7.076*
	[1.86]	[1.44]	[1.54]	[2.23]	[1.68]	[2.01]
FISP*d2014	0.082***	0.096**	0.082**	7.861**	6.145	9.508**
	[4.04]	[2.42]	[2.37]	[2.33]	[1.25]	[2.16]
Joint impact of SCTP and FISP	0.105**	0.105*	0.100*	9.038**	9.372**	8.112**
	[2.14]	[1.74]	[1.99]	[2.38]	[2.19]	[2.21]
Incremental impact of FISP on SCTP	0.015	0.017	0.012	1.084	0.718	1.035

	[0.34]	[0.31]	[0.19]	[0.47]	[0.27]	[0.24]
Incremental impact of SCTP on FISP	0.022	0.009	0.018	1.177	3.227	-1.397
	[0.45]	[0.14]	[0.3]	[0.25]	[0.60]	[-0.25]
Complementarity	-0.067	-0.079	-0.069	-6.777	-5.428	-8.472
	[-1.43]	[-1.2]	[-0.95]	[-1.63]	[-0.98]	[-1.39]
Pigeon pea production						
SCTP*d2014	0.016	0.102**	-0.109	1.506	2.648	-0.09
	[0.30]	[2.05]	[-1.57]	[0.85]	[1.25]	[-0.06]
FISP*d2014	0.094**	0.095**	0.071	3.706***	3.916**	3.039**
	[2.23]	[2.33]	[1.18]	[2.85]	[2.43]	[2.31]
Joint impact of SCTP and FISP	0.001	0.027	-0.035	1.929	1.405	2.28
	[0.01]	[0.49]	[-0.64]	[1.30]	[0.82]	[1.13]
Incremental impact of FISP on SCTP	-0.015	-0.074**	0.074	0.424	-1.243	2.370
	[-0.86]	[-2.49]	[2.16]	[0.41]	[-0.76]	[1.40]
Incremental impact of SCTP on FISP	-0.094	-0.067	-0.105	-1.776	-2.511	-0.759
	[-1.56]	[-1.04]	[-1.58]	[-0.97]	[-1.15]	[-0.34]
Complementarity	-0.110**	-0.169***	0.004	-3.282**	-5.159**	-0.669
	[-2.48]	[-3.18]	[0.05]	[-2.14]	[-2.40]	[-0.32]
Nkhwani production						
SCTP*d2014	-0.086*	-0.122*	-0.069	-0.954	-2.396	0.366
	[-1.89]	[-1.95]	[-1.52]	[-0.66]	[-1.28]	[0.25]
FISP*d2014	0.001	-0.043	0.06	1.849	0.339	3.651***
	[0.03]	[-0.86]	[1.06]	[1.45]	[0.19]	[2.81]
Joint impact of SCTP and FISP	-0.07	-0.104	-0.057	-0.3	-2.457	1.856
	[-1.28]	[-1.39]	[-1.36]	[-0.19]	[-1.26]	[1.19]
Incremental impact of FISP on SCTP	0.015	0.018	0.012	0.653	-0.061	1.489
	[0.57]	[0.42]	[0.38]	[0.90]	[-0.09]	[1.14]
Incremental impact of SCTP on FISP	-0.072	-0.061	-0.117*	-2.149	-2.796	-1.795
	[-1.28]	[-0.86]	[-1.77]	[-1.44]	[-1.53]	[-0.96]
Complementarity	0.014	0.061	-0.048	-1.195	-0.399	-2.162
	[0.26]	[0.95]	[0.69]	[-0.79]	[-0.22]	[-1.16]
Rice production						
SCTP*d2014	-0.034	-0.025	-0.045	-2.551	-1.567	-2.568
	[-0.80]	[-0.45]	[-1.07]	[-0.86]	[-0.45]	[-0.80]
FISP*d2014	0.01	0.011	0.003	-0.451	-1.754	0.294
	[0.33]	[0.34]	[0.08]	[-0.20]	[-0.89]	[0.13]
Joint impact of SCTP and FISP	-0.038	-0.061	0.004	-4.577	-5.850*	-1.894
	[-0.94]	[-1.22]	[0.10]	[-1.54]	[-1.91]	[-0.67]
Incremental impact of FISP on SCTP	-0.004	-0.035	0.049	-2.026	-4.283	0.674
	[-0.11]	[-0.65]	[1.32]	[-0.87]	[-1.39]	[0.34]
Incremental impact of SCTP on FISP	-0.049	-0.072	0.001	-4.126	-4.096	-2.188
	[-1.18]	[-1.27]	[0.02]	[-1.03]	[-1.04]	[-0.61]
Complementarity	-0.015	-0.047	0.045	-1.575	-2.529	0.380
	[-0.3]	[-0.75]	[0.77]	[-0.53]	[-0.77]	[0.14]

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 7 **Impact on agricultural inputs**

	% HH that use:			Quantity		
	All	Labour-unconstrained	Labour-constrained	All	Labour-unconstrained	Labour-constrained
Chemical fertilizers						
SCTP*d2014	0.058	-0.004	0.096	2.378	1.171	2.305
	[0.85]	[-0.04]	[1.01]	[0.99]	[0.34]	[0.65]
FISP*d2014	0.472***	0.354***	0.562***	21.638***	15.819***	26.205***
	[7.95]	[3.55]	[13.88]	[7.80]	[3.57]	[7.93]
Joint impact of SCTP and FISP	0.338***	0.284***	0.435***	21.952***	21.792***	22.380***
	[5.03]	[3.78]	[4.17]	[7.46]	[6.20]	[4.96]
Incremental impact of FISP on SCTP	0.279***	0.288**	0.339**	19.574***	20.621***	20.075***
	[4.04]	[2.97]	[2.82]	[5.49]	[4.08]	[3.8]
Incremental impact of SCTP on FISP	-0.134**	-0.070	-0.127	0.314	5.972	-3.825
	[-2.12]	[-0.89]	[-1.26]	[0.10]	[1.51]	[-0.9]
Complementarity	-0.192**	-0.066	-0.223*	-2.063	4.802	-6.130
	[-2.09]	[-0.49]	[-1.75]	[-0.47]	[0.77]	[-1]
Organic fertilizers				**Value**		
SCTP*d2014	0.046	-0.009	0.122	213.131*	207.302	208.637*
	[0.64]	[-0.09]	[1.50]	[1.92]	[1.38]	[1.79]
FISP*d2014	-0.082	-0.072	-0.083	-201.953**	-178.551*	-221.040***
	[-1.35]	[-0.85]	[-1.46]	[-2.65]	[-1.81]	[-2.81]
Joint impact of SCTP and FISP	-0.069	-0.158	0.077	114.853	91.057	162.463
	[-0.75]	[-1.32]	[0.94]	[0.93]	[0.56]	[1.39]
Incremental impact of FISP on SCTP	-0.115	-0.149	-0.045	-98.278	-116.246	-46.175
	[-1.81]	[-1.36]	[-0.70]	[-1.04]	[0.65]	[-0.63]
Incremental impact of SCTP on FISP	0.013	-0.086	0.160*	316.806***	269.607**	383.503***
	[0.16]	[-0.81]	[1.86]	[2.94]	[1.96]	[3.38]
Complementarity	-0.033	-0.077	0.038	103.675	62.305	174.866*
	[-0.36]	[-0.53]	[0.46]	[0.86]	[0.31]	[1.77]
Pesticides						
SCTP*d2014	-0.004	-0.02	0.012			
	[-0.25]	[-0.74]	[0.95]			
FISP*d2014	-0.01	-0.023	0.001			
	[-0.74]	[-1.16]	[0.06]			
Joint impact of SCTP and FISP	0.031	-0.004	0.062**			
	[1.60]	[-0.15]	[2.68]			
Incremental impact of FISP on SCTP	0.035**	0.015	0.051*			
	[2.39]	[0.54]	[1.94]			
Incremental impact of SCTP on FISP	0.041**	0.019	0.062**			
	[2.46]	[0.77]	[2.33]			
Complementarity	0.045**	0.039	0.050			
	[2.36]	[1.21]	[1.61]			
Improved or hybrid seeds						
SCTP*d2014	0.05	-0.021	0.118*			

	[1.04]	[-0.36]	[1.67]
FISP*d2014	0.125***	0.121*	0.136*
	[3.32]	[1.96]	[1.98]
Joint impact of SCTP and FISP	0.115	0.087	0.171*
	[1.49]	[1.01]	[1.93]
Incremental impact of FISP on SCTP	0.065	0.108	0.053
	[0.83]	[1.13]	[0.76]
Incremental impact of SCTP on FISP	-0.010	-0.034	0.035
	[-0.11]	[-0.31]	[0.37]
Complementarity	-0.060	-0.013	-0.083
	[-0.67]	[-0.11]	[-0.82]

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 8 **Impact on livestock expenses and sales**

	Expenses			Sales		
	All	Labour-unconstrained	Labour - constrained	All	Labour-unconstrained	Labour-constrained
SCTP*d2014	1 172.647***	1 395.706***	761.950***	-78.668	-44.992	-247.801
	[5.95]	[6.07]	[2.83]	[-0.54]	[-0.18]	[-1.23]
FISP*d2014	232.985***	493.282***	32.287	57.964	231.508	62.384
	[2.96]	[3.66]	[0.28]	[0.37]	[0.76]	[0.27]
Joint impact of SCTP and FISP	1 688.574***	1 478.082***	1 997.143***	395.800*	383.684	335.607
	[5.89]	[3.92]	[6.19]	[1.98]	[1.05]	[1.06]
Incremental impact of FISP on SCTP	515.926*	82.3756	1 235.193***	474.468**	428.676	583.408
	[1.82]	[0.2]	[4.68]	[2.03]	[1.08]	[1.57]
Incremental impact of SCTP on FISP	1 455.59***	984.800**	1 964.855***	337.836*	152.176	273.224
	[5.04]	[2.52]	[5.33]	[1.7]	[0.5]	[0.8]
Complementarity	282.941	-410.906	1 202.906***	416.505	197.167	521.024
	[0.99]	[-0.94]	[3.83]	[1.50]	[0.43]	[1.17]

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Table 9 Impact on livestock

	% HH that own:			Quantity		
	All	Labour-unconstrained	Labour-constrained	All	Labour-unconstrained	Labour-constrained
Chicken						
SCTP*d2014	0.196***	0.150***	0.236***	0.931***	0.698**	1.365***
	[3.81]	[2.77]	[3.20]	[3.03]	[2.62]	[3.04]
FISP*d2014	0.103***	0.134**	0.029	0.276*	0.408	-0.067
	[2.80]	[2.29]	[0.77]	[1.96]	[1.34]	[-0.31]
Joint impact of SCTP and FISP	0.244***	0.230***	0.263**	1.677***	1.511***	1.828***
	[4.31]	[4.54]	[2.72]	[3.90]	[4.19]	[3.03]
Incremental impact of FISP on SCTP	0.047**	0.080*	0.027	0.746*	0.814**	0.463
	[2.32]	[1.81]	[0.46]	[1.90]	[2.68]	[0.98]
Incremental impact of SCTP on FISP	0.141**	0.095	0.234**	1.400***	1.104**	1.894**
	[2.56]	[1.43]	[2.13]	[3.29]	[2.39]	[2.85]
Complementarity	-0.055	-0.054	-0.002	0.469	0.406	0.529
	[-1.35]	[-0.71]	[-0.03]	[1.20]	[1.06]	[1.08]
Goats and sheep						
SCTP*d2014	0.108***	0.114***	0.075*	0.145	0.263*	0.03
	[3.99]	[2.99]	[1.91]	[1.36]	[1.84]	[0.35]
FISP*d2014	0.062*	0.099	0.025	0.145	0.294	0.021
	[2.01]	[1.53]	[0.59]	[1.30]	[1.46]	[0.19]
Joint impact of SCTP and FISP	0.238***	0.185***	0.300***	0.694***	0.758***	0.452***
	[5.79]	[3.75]	[5.93]	[3.93]	[2.99]	[4.18]
Incremental impact of FISP on SCTP	0.131***	0.071	0.226***	0.549**	0.495**	0.422***
	[4.31]	[1.44]	[6.35]	[2.96]	[2.15]	[4.87]
Incremental impact of SCTP on FISP	0.176***	0.086	0.276***	0.549**	0.464*	0.431***
	[3.70]	[1.24]	[4.48]	[2.89]	[1.73]	[3.60]
Complementarity	0.069*	-0.028	0.201***	0.404*	0.201	0 .401**
	[1.71]	[-0.34]	[3.44]	[1.86]	[0.68]	[2.91]
Pigeons, doves, or ducks						
SCTP*d2014	0.007	0.006	0.001	0.136*	0.263**	-0.083
	[0.48]	[0.37]	[0.06]	[1.71]	[2.33]	[-0.83]
FISP*d2014	-0.005	-0.006	-0.006	0.065	0.143	-0.045
	[-0.38]	[-0.27]	[-0.34]	[1.21]	[1.20]	[-0.63]
Joint impact of SCTP and FISP	0.060**	0.064*	0.052*	0.280**	0.336**	0.238*
	[2.55]	[1.84]	[1.71]	[2.74]	[2.09]	[1.80]
Incremental impact of FISP on SCTP	0.053*	0.058*	0.051	0.144	0.072	0.320*
	[1.91]	[1.7]	[1.28]	[1.15]	[0.45]	[1.67]
Incremental impact of SCTP on FISP	0.064**	0.070*	0.057*	0.215**	0.192	0.283*
	[2.65]	[1.9]	[1.7]	[2.12]	[1.32]	[1.81]
Complementarity	0.057*	0.064	0.056	0.079	-0.071	0.365*
	[1.89]	[1.5]	[1.31]	[0.58]	[-0.38]	[1.73]

Note: Statistical significance at the 99% (***), 95 (**) and 90% (**) confidence levels. Robust t-statistics clustered at the community level are in brackets. All estimations control for baseline head of household's characteristics, household demographic composition and size, a vector of contemporaneous cluster level prices, a set of exogenous shocks and district

fixed effect, and are adjusted with the GPS weighting. Confidence intervals consider heteroskedasticity robust standard errors clustered at the community level.

Appendix C

Table A1 **Anova test for difference between groups included in the analysis and groups excluded**

	Excluded	Included	F-test	P-value>F
Single head of hh	0.665	0.750	28.78	0.0000
Female head of hh	0.827	0.854	4.51	0.034
Age of head of hh	60.021	55.583	43.230	0.000
# Members in the hh	4.543	4.528	0.03	0.857
# Members in the hh: 0-5 years old	0.600	0.747	22.23	0.000
# Members in the hh: 6-12 years old	1.153	1.218	3.06	0.080
# Members in the hh: 13-17 years old	0.948	0.898	2.28	0.131
# Members in the hh: 18-64 years old	1.193	1.126	3.56	0.059
# Members in the hh: >=65 years old	0.649	0.538	24.72	0.000
# Orphans in the hh	0.864	1.014	8.37	0.004
Yrs of education head of hh	0.994	1.157	4.89	0.027
HH severely labour-constrained	0.472	0.471	0.01	0.926
HH consumption - total	18 9278.4	15 8798.5	55.62	0.000
HH consumption - food and beverages	14 7563.4	12 3544.5	55.21	0.000
HH owns or cultivates land	0.991	0.919	112.79	0.000
Total plot area operated within hh	1.454	1.177	65.41	0.000
HH has plot that is irrigated	0.046	0.051	0.37	0.543
HH applies chemical fertilizer	0.947	0.323	2546.7	0.000
HH applies organic fertilizer	0.226	0.267	7.37	0.007
HH uses pesticides	0.026	0.019	1.65	0.199
HH uses improved or hybrid seed	0.511	0.269	217.16	0.000
HH planted maize	0.979	0.869	158.97	0.000
HH planted groundnut	0.236	0.122	74.26	0.000
HH planted pigeon pea	0.264	0.136	85.55	0.000
Value of production	16 412.3	10 009.8	371.21	0.000
HH owns hand hoe	0.922	0.814	89.57	0.000
HH owns axe	0.166	0.103	28.98	0.000
HH owns panga knife	0.258	0.203	14.14	0.000
HH owns sickle	0.218	0.145	29.39	0.000
HH owns chickens	0.189	0.120	30.74	0.000
HH owns goat or a sheep	0.131	0.067	37.93	0.000
Total hh expenditure for livestock	82.11	65.63	1.23	0.268
Total hh livestock sales	494.32	246.00	16.48	0.000
Observations	1 756	1 607		

Table A2 **Anova test for difference between groups of intervention: control (C), SCTP, FISP, SCTP and FISP (unadjusted)**

	C	SCTP	FISP	SCTP and FISP	F-test	P-value>F
Single head of hh	0.760	0.749	0.748	0.730	0.32	0.8097
Female head of hh	0.870	0.839	0.857	0.846	0.76	0.514
Age of head of hh	**53.160**	**54.294**	**58.477**	**60.199**	**9.93**	**0.000**
# Members in the hh	4.620	4.487	4.565	4.391	0.74	0.525
# Members in the hh: 0-5 years old	**0.822**	**0.798**	**0.596**	**0.636**	**5.13**	**0.002**
# Members in the hh: 6-12 years old	1.568	1.418	1.619	1.439	2.27	0.079
# Members in the hh: 13-17 years old	0.581	0.624	0.658	0.612	0.61	0.608
# Members in the hh: 18-64 years old	1.164	1.115	1.049	0.971	2.83	0.057
# Members in the hh: >=65 years old	**0.485**	**0.533**	**0.643**	**0.733**	**12.22**	**0.000**
# Orphans in the hh	1.030	1.026	0.955	1.009	0.14	0.937
Yrs of education head of hh	1.149	1.246	1.273	0.925	1.57	0.195
HH severely labour-constrained	0.438	0.461	0.534	0.500	2.51	0.057
HH consumption - total	15 7874.4	15 0568.1	17 1136.3	16 4813.3	1.41	0.238
HH consumption - food and beverages	12 2879.6	11 7390.8	13 0279.3	13 0018.5	1.89	0.129
HH owns or cultivates land	0.916	0.910	0.933	0.927	0.47	0.702
Total plot area operated within hh	**1.199**	**1.080**	**1.276**	**1.220**	**2.89**	**0.034**
HH has plot that is irrigated	0.049	0.047	0.047	0.063	0.41	0.747
HH applies chemical fertilizer	**0.279**	**0.278**	**0.370**	**0.448**	**11.2**	**0.000**
HH applies organic fertilizer	**0.274**	**0.222**	**0.279**	**0.319**	**3.22**	**0.022**
HH uses pesticides	0.013	0.021	0.020	0.027	0.8	0.494
HH uses improved or hybrid seed	0.279	0.232	0.271	0.311	2.15	0.092
HH planted maize	0.873	0.863	0.850	0.890	0.69	0.559
HH planted groundnut	**0.100**	**0.111**	**0.118**	**0.187**	**4.92**	**0.002**
HH planted pigeon pea	0.131	0.139	0.115	0.157	0.72	0.541
Value of production	**9 906.1**	**9 154.9**	**10 737.9**	**11 100.2**	**2.98**	**0.030**
HH owns hand hoe	**0.818**	**0.778**	**0.814**	**0.870**	**7.97**	**0.000**
HH owns axe	**0.096**	**0.079**	**0.106**	**0.152**	**13.01**	**0.000**
HH owns panga knife	**0.192**	**0.201**	**0.195**	**0.235**	**4.28**	**0.005**
HH owns sickle	**0.156**	**0.125**	**0.110**	**0.189**	**10.7**	**0.000**
HH owns chickens	0.133	0.117	0.115	0.102	7.85	0.000
HH owns goat or a sheep	**0.074**	**0.046**	**0.069**	**0.090**	**22.19**	**0.000**
Total hh expenditure for livestock	**90.12**	**49.37**	**43.69**	**63.720**	**47.69**	**0.000**
Total hh livestock sales	266.64	238.49	170.20	280.338	1.43	0.231
Observations	616	485	239	267		

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