

One plus one can be greater than two: evaluating synergies of development programmes in Malawi

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Abstract

This paper investigates the interplay between the Social Cash Transfer Programme (SCTP) and the Farm Input Subsidy Programme (FISP) in Malawi. We take advantage of data collected from a seventeen month evaluation of a sample of households eligible to receive the SCTP, which also provided information about inclusion into the FISP. Adopting a difference-in-difference approach with generalized propensity score weighing adjustment, we provide doubly robust estimates of the average stand-alone and joint treatment effects of the two interventions, as well as their synergies on a variety of outcomes. The analysis shows that there are synergies between SCTP and FISP in increasing expenditure, the value of agricultural production, agricultural activities and livestock, and weakly, in improving food security. Furthermore, the heterogeneity analysis based on labour constraints shows that positive synergies between SCTP and FISP in increasing household expenditures are stronger for labour unconstrained households, while, on the contrary, the synergies between the two interventions in increasing the value of production, crops production and livestock are stronger for labour constrained households

Keywords: cash transfers, agricultural subsidies, programme complementarity, impact evaluation, household expenditure, productive impact.

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1 Introduction

There is a growing body of literature on the impacts of policy interventions implemented in developing countries to tackle hunger and poverty in the short and long run. These programmes include cash transfers, food and/or supplements, provision of subsidies for agricultural inputs and activities, provision of information and/or training sessions on matters broadly related to education and health. It is plausible that there are interactions between these programmes, yet programme evaluators are generally only able to estimate the stand-alone impact of each programme without much attention to the potential synergies and degree of complementarity between them. However, this kind of analysis is relevant for several reasons. First, resources are scarce: it is necessary to run programmes that reinforce each other rather than programmes that reciprocally reduce their effectiveness. Second, if the synergies and the degree of complementarity is high and significant, policy makers could in principle reduce the resources allocated to various programmes to reach the same desired results. Third, if the degree of substitutability is high and significant, policy makers should carefully prioritize desired outcomes and define a realistic timeline to avoid ‘crowding out’ the effects of the various programmes.

This paper focuses on the experience of a Sub-Saharan country, Malawi, in which in recent years the Social Cash Transfer Programme (SCTP) and the Farm Input Subsidy Programme (FISP) have been implemented simultaneously as instruments for reducing poverty and vulnerability to hunger among poor households that mostly rely on agriculture as main source of income.

The FISP and SCTP are expected to have direct impacts on several outcomes. The FISP is expected to directly influence production decisions, but its contribution towards 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 small poor farmers as net buyers or net sellers of grains in food markets. The SCTP programme is a welfare intervention that acts directly on the consumption capability of the recipients: the additional cash can be used directly to increase both quantity and quality of food. Recipients of the cash can, in addition, use this for purchasing productive inputs and assets. Several prior studies focus on the isolated impact of the SCTP (Covarrubias, Davis &

Winters, 2012; Handa, Angeles, Abdoulayi, Mvula & Tsoka, 2015b; Asfaw, Pickmans & Davis, 2015) and FISP in Malawi (among others, Arndt, Pauw & Thurlow, 2015; Chirwa & Dorward, 2013; Jayne & Ricker-Gilbert, 2011; Dorward, Chirwa, Matita, Mhango, Zvula & Thome, 2013).

This paper is the first attempt to shed light on the interplay between the FISP and the SCTP using survey data. More specifically, the paper investigates the impacts on poor and ultra-poor households when these participate in either the FISP or the SCTP alone or when these participate in both programmes simultaneously. We focus on a variety of outcomes, including household expenditure (food and non-food), food security and on contributing outcomes such as productive activities (crop production, input use) and livestock. In assessing the impacts of the two combined interventions, we focus on two types of synergies: i) we study whether there is complementarity between SCTP and FISP, i.e. whether the impact of both interventions run together is larger than the sum of the impacts of these interventions when run separately; ii) we estimate 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 (Gertler, Martinez, Premand, Rawlings & Vermeersch, 2011). For the empirical analysis we take advantage of data collected from a seventeen month evaluation (2013-2014) on a sample of households eligible to receive the SCTP, which also provided information about inclusion into the FISP. Since only the assignment into SCTP is random, we deal with potential sample selection issue adopting Uysal's (2015) strategy that allows to obtain doubly robust estimates of causal effects through a combination of regression analysis, implemented through difference-in-difference approach, and generalised propensity score weighting adjustment. Since the impacts of the two programmes are likely to differ across different groups of the study population, we carry-out the analysis by groups of households with different labour endowments (unconstrained versus constrained households), as well as on the whole sample. We define a household as labour constrained if there is no able-bodied member of household who is fit-to-work, i.e. no adult without chronic illness and/or disabilities. Labour constraints are factors that can be considered proxies of wealth and capacity to generate income and therefore likely to mediate the effect of both SCTP and FISP.

The analysis shows that, despite lack of coordination, there are synergies between SCTP and FISP in increasing expenditure, the value of agricultural production, crops production and livestock, and weakly, in improving food security. More specifically, we find that SCTP and FISP are complementary instruments in increasing total household expenditure and expenditure on food and education, and in increasing the value of production, production of crops, and livestock. Furthermore, the heterogeneity analysis based on labour constraints shows that the positive synergies between SCTP and FISP in increasing household expenditures are stronger for labour unconstrained households, while the positive synergies in increasing the value of production, crops production and livestock are stronger for labour constrained households.

The rest of the paper is organized as follows. Section 2 discusses previous evidence on the impacts of input subsidies and social cash transfers programmes in Sub-Saharan Africa. Section 3 describes the FISP and SCTP. Section 4 presents the empirical approach and the estimation method. The main results are presented and discussed in Section 5. Finally, section 6 concludes.

2 Literature Review

This paper fits into three branches of the literature: i) the impact evaluation of social protection interventions through randomized field experiments; ii) the analysis of agricultural subsidy programmes in low income countries; and iii) the joint evaluation of social protection and agricultural development interventions. Given the main focus of this paper, in this section we focus only on contributions relating to the experience of African countries. For contributions concerning the experiences of countries in Latin America or Asia we refer to three broad literature reviews by Tirivayi, Knowles and Davis (2013), Jayne and Rashid (2013), and Veras, Knowles, Daidone and Tirivayi (2017) respectively for the impact evaluation of social protection interventions, the effects of agricultural subsidy programmes, and the combined effects and synergies between the two.

2.1 Impacts of fertilizer subsidies programmes in Sub-Saharan Africa

Input subsidy programmes are one of the most debated policy interventions in Africa (Jayne & Rashid, 2013). The literature on the impacts of input subsidy programmes in sub-Saharan Africa finds mixed results (among others, see Arndt et al. 2015; Jayne & Rashid 2013; Sachs, 2012; World Bank, 2008; Dorward & Chirwa, 2011). Given the focus of the current paper we only review previous contributions related to two key points, i.e. the impact of input subsidy programmes on total fertilizer use, and agricultural growth and poverty reduction.

As far as the impact of input subsidy programmes on total fertilizer use is concerned, empirical evidence suggests that the receipt of subsidized fertilizer induces some farmers to buy less fertilizer from commercial retailers than they otherwise would have done in the absence of the subsidy programme. This “crowding out” of commercial fertilizer tends to be less when subsidy programmes are targeted to relatively poor farmers and in areas where the commercial demand for fertilizer is low (Mason & Jayne 2013; Ricker-Gilbert, Jayne & Chirwa, 2011). Meanwhile, Saweda, Liverpool-Tasie and Takeshima (2013) found evidence of “crowding in” of commercial fertilizer demand in a pilot subsidy scheme in one district of Nigeria where fertilizer vouchers were mainly targeted to areas where private commercial markets were relatively weak and to households that were relatively poor. Results from randomized control trials (RCTs) on the impact of input subsidy programmes have found mixed evidence on their effectiveness at raising fertilizer utilization (Duflo, Kremer & Robinson, 2011; Carter, Laajaj & Yand, 2014).

As far as poverty reduction is concerned, the review of the micro-level evidence by Jayne and Rashid (2013) shows that the input subsidy programmes have raised national food production. Arndt et al. (2015) study the economy-wide impact of FISP in Malawi adopting a computable general equilibrium model. Their approach that also account for indirect benefits, yields benefit-cost ratios about 60 per cent higher than existing partial equilibrium studies. However, the effects of these kinds of programmes are highly asymmetric across the distributions of farm size and wealth. This is mainly due to the fact that poor households tended to receive proportionately less of the subsidy than wealthier farmers (Jayne & Ricker-Gilbert, 2011; Ricker-Gilbert & Jayne, 2012; Marenya & Barrett, 2009; Tittonel & Giller, 2012). The unequal distribution of food production gains may explain why rural poverty rates

have not declined in either Malawi or Zambia between the early 2000s and 2010 (50.7 per cent in Malawi and 60.5 per cent in Zambia in 2010). Rural headcount poverty rates in Zambia have consistently floated around 80 per cent throughout the 10-year period of the implementation of the farm input support programme (Mason & Jayne, 2013). However, results from a RCT in Mozambique (Carter et al. 2014) show that the input subsidies programme had a positive and statistically significant effect on several poverty indicators, such as household consumption asset holdings and housing improvements. Beck, Mussa and Pauw (2013) re-estimate poverty incidence from the 2010/11 Integrated Household Survey dataset and find an 8.2 percentage point decrease in national poverty from 2004/5 to 2010/11.

2.2 Impacts of social cash transfers programmes in sub-Saharan Africa

There is evidence from numerous countries that cash transfers generally affect total household consumption and food security worldwide. Evidence on the impacts of cash transfer programmes in seven countries (Ethiopia, Ghana, Kenya, Lesotho, Malawi, Zambia and Zimbabwe) in sub-Saharan Africa shows that overall these improved food consumption (FAO, 2016). In Kenya, the Cash Transfer for Orphan and Vulnerable Children programme (CT-OVC) significantly increased food consumption coming from home production (Asfaw, Davis, Dewbre, Handa & Winters, 2014). In Zambia the Child Grant (CG) model of the Social Cash Transfer increased expenditure, with the majority of the increases going to food, health and hygiene, clothing and transportation (Handa, Seidenfeld, Davis & Tembo, 2015a). A large body of evidence shows that food security and child nutrition improved as a result of these interventions (Tiwari et al. 2016; FAO, 2015; Hjelm, 2016). A meta-review identified 17 out of 20 studies that reported an increase in food intake, diversity and quality, all factors that contribute to food security (Independent Evaluation Group, 2011). Qualitative findings on the LEAP programme in Ghana and CT-OVC in Kenya showed improvements in the quantity and diversity of food produced (OPM 2013a; OPM 2013b). Contrary to previous empirical findings, Beegle, Galasso and Golberg (2015) find no evidence that the Social Action Fund in Malawi improved food security and, in addition, document some negative spillover to untreated households.

As far as the effects of social cash transfers on production activities are concerned, the majority of the available evidence from sub-Saharan Africa shows that social protection encourages investments and the accumulation of agricultural assets, but to varying degrees and depending on several factors, such as the availability of labour given the demographic profile of beneficiary households, the relative distribution of productive assets, the local economic context, the relevance of messaging and soft conditions for social spending, the regularity and predictability of the transfers themselves and finally, the level of transfer as a share of per capita income (Tirivayi et al. 2016). Andersson, Mekonnen and Stage (2011) found that the Productive Safety Net Programme in Ethiopia increased the number of trees planted by beneficiaries. In Zambia, the CG programme increased the share of households planting maize, groundnuts and rice, and increased crop input expenditures and the value of crop production, but did not have a significant impact on the quantity harvested (Handa et al. 2015a). The study suggested that the inconsistency between increased crop input expenditure and the small impact on output harvested may have been due to inefficient use of inputs by beneficiaries. In Ghana and Kenya, qualitative assessments suggested that unconditional cash transfers modestly increased farm production, but only for economically active beneficiaries (OPM, 2013a; OPM, 2013b).

As for the effects of cash transfer programmes on farm implements and livestock ownership, the CG in Zambia and the SCT in Malawi had positive and significant effects (Handa et al. 2015a; Covarrubias et al. 2012; Boone et al. 2013). As with the programmes in Zambia and Malawi, the Kenya CT-OVC programme led to a modest increase in the ownership of sheep and goats (Asfaw et al. 2014), while the Ghana LEAP programme had no impact on agricultural assets or livestock (Handa, Park, Darko, Osei-Akoto, Davis & Daidone, 2013). Qualitative assessments show that unconditional cash transfers in Ghana (LEAP) and Kenya (CT-OVC) stimulated asset acquisitions for economically active beneficiaries or those with relatively higher asset endowments only, leaving behind the elderly, infirm and poorest households (OPM, 2013a; OPM, 2013b). In other research, qualitative assessments of cash transfer programmes in Zambia and Lesotho showed that they increased livestock ownership (Devereux, Marshall, MacAskill and Pelham, 2005).

2.3 Joint evaluation of social protection and agricultural interventions in sub-Saharan Africa

This section focuses on previous contributions that investigated the potential synergies between social protection and agricultural development interventions in Sub-Saharan Africa. To the best of our knowledge, only five papers enter into this category, i.e. Carter, Laajaj and Yang (2015), Daidone et al. (2017), Ellis and Maliro (2013), Matita and Chirwa (2014) and Thome, Taylor and Filipowski (2014).¹

Carter et al. (2015) investigate the complementarities between input subsidies and a saving-oriented financial services intervention on household consumption and asset holding in Mozambique. In their experiment, study participants were randomly assigned to being offered either a subsidy for modern agricultural inputs, entrance into a saving facilitation programme, or both. They examine the impacts of subsidies and savings, separately and together, and they find that from the standpoint of raising consumption, subsidies and savings appear to be substitutes rather than complements. Daidone et al. (2017) study the combination of two types of agricultural and social protection programmes in Lesotho: the Child Grants Programme (CGP), an unconditional cash transfer, and the FAO-Lesotho Linking Food Security to Social Protection Programme (LFSSP) which provided vegetable seeds and training on homestead gardening. Their results show positive effects on homestead gardening and productive agricultural activities which seem to be driven by the combination of the two programmes, more than the programmes *per se*. 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 may be complements across a range of attributes and that they compensate for each other's weaknesses. Matita and Chirwa (2014) claim that targeting of SCTP and FISP should be better harmonized to avoid households to participate in both programmes simultaneously. Finally, Thome et al. (2014) explore the synergies between SCTP and FISP using a local economy-wide impact evaluation model. Using national representative data from the IHS3 they show that the combination of FISP and SCTs offers the dual advantage of stimulating production and creating local growth

linkages while better targeting the poor. They find that input subsidies significantly enhance the potential of SCTs to stimulate growth in the rural economy.

3 Background of the programmes

3.1 Farm Input Subsidy Programme

In Malawi, the FISP was initiated in 2005-2006. At that time it targeted approximately 50 per cent of farmers in the country and distributed fertilizers for maize production, with further vouchers for tobacco fertilizers and for improved maize seeds. The FISP is financed by the Government with international donor support (Chirwa et al., 2011). The primary objectives of the programme are to achieve national food-sufficiency and to increase income among resource-poor smallholder farmers through increased maize and legume production driven by access to improved agricultural inputs.

This kind of intervention was not new and actually followed 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 breakdown in the late 80s-early 90s and collapsed in the mid-90s and there was a widespread perception that falling fertilizer support was leading to declining maize production and to a food and political crisis. As a consequence, seed and fertilizer subsidies shifted from universal price subsidies to free provision of small ‘starter packs’ initially to all households (in 1998/99 and 1999/2000) and then to a more limited and varying numbers 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 2004/5 production season. This led to 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 the programme have undergone substantial changes in design and implementation summarized by Chirwa and Dorward (2013) and Dorward and Chirwa (2011).

Currently, the programme targets smallholder farmers who are resource-poor but own a piece of land. The targeting criteria also recognize special vulnerable groups, such as child-

headed, female-headed and orphan headed households, and households with members affected by HIV/ AIDS. These criteria remain broad and there are variations in the use of the targeting guidelines in different communities, particularly as the number of eligible households tends to be much larger than the available number of fertilizer coupons. Kilic et al. (2013) find that the FISP does not exclusively target the poor in Malawi. On the contrary it primarily reaches the middle of the income distribution (Kilic et al. 2013).² 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 reform to allow direct private sector retailing, reduce the subsidy level (from 95 per cent to 80 per cent). Furthermore, the Government selected 1.5 million beneficiaries at random amongst a list of maize producers, with the intention of alternating the farmers on annual basis and providing the subsidies to all farmers once in three years.

Several aspects of FISP implementation are currently under discussion:

- Alignment of FISP to the National Agricultural Policy to contribute to its overall objective of increasing national production, productivity and household incomes. - Stimulate overall fertilizer use, crop diversification and sustainable land management more actively.
- Change the targeting criteria, reducing gradually the total number of beneficiaries and/or reduce the subsidy level by shifting from subsistence towards market oriented farmers.

This should lead to a gradual shift towards more productive farmers and to a “reallocation” of poor subsistence farmers, previously included in the FISP, into social protection programmes (SCTP and/or public works programmes).

3.2 Social Cash Transfer Programme

The Social Cash Transfer Programme (SCTP) is an unconditional cash transfer aimed at reducing poverty and hunger among vulnerable households and increasing school enrolment. 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 is explicitly targeted towards ultra-poor households, defined as households unable to meet their most basic urgent needs, including food and essential non-food items, and labour-constrained households. A household is labour-

constrained if there are no ‘fit to work’ members in the household, or if the ratio of unfit to fit exceeds three. A pilot of this programme was initiated in 2006 in the district of Mchinji. The 2007-2008 impact evaluation of the pilot demonstrated that the programme had a range of positive outcomes including increased food security, ownership of agricultural tools and curative care seeking (Miller et al., 2010, Covarrubias et al. 2012). Since then the programme has undergone some changes in targeting and operations, as well as a significant expansion to 18 out of 28 districts in the country. As of April 2015, it reached over 100,000 households.³ The size of the transfer to each household is adjusted to the number of household members and their characteristics. As of May 2015, households with only one adult received bi-monthly payments which were equivalent to a monthly amount of 1,000 Malawian Kwacha (MWK), i.e. around 3USD and since then 1,700 MWK, plus additional amounts for the number of children enrolled in primary or secondary school.

4 Empirical analysis

4.1 Econometric method

The estimation of the causal effects of SCTP and FISP is slightly more complex than general impact evaluation of randomized control trials for two reasons: 1) we are considering three intervention groups (only SCTP, only FISP, and SCTP and FISP received jointly) that have to be compared with the control group, as opposed to a unique treatment group compared with the control group; 2) only inclusion into SCTP was randomized and in principle the groups may be different at baseline. If this problem occurs, than estimates that do not take into account these differences are biased. In order to deal with these features of the study design, we adopt a doubly robust method implemented by Uysal (2015) which combines regression modeling (based in our paper on a difference-in-difference approach) and generalized propensity score (GPS) weighting approach by Imbens (2000) applied to multiple treatments' intervention.⁴ The basic setup of Uysal's approach is based on Imbens (2000) and Lechner (2001). We are interested in estimating the causal effects of the treatment on several outcome variables where the treatment of interest, T_i , takes the integer values between 0 and K (in this paper K is equal to three). Consider N

units (households) which are drawn from a large population. For each household i , $i = 1, \dots, N$, the triple (Y_i, T_i, X_i) is observed. X_i denotes the vector of characteristics at household and community level (covariates) for the i^{th} household. Y_i represents the outcomes for household i . For each household there is a set of potential outcomes (Y_{i0}, \dots, Y_{iK}) . Y_{it} denotes the outcome for each household, for which $T_i = t$ where $t \in \mathfrak{T} = (0, \dots, K)$. Only one of the potential outcomes is observed depending on the treatment status. Indeed, households can be included in one of the three treatment groups: only SCTP, only FISP, both SCTP and FISP received jointly. Adopting the framework introduced by Rubin (1974), the observed outcome Y_i can be written in terms of treatment indicator, $D_{it}(T_i)$, and the potential outcomes, Y_{it} :

$$Y_i = \sum_{t=0}^K D_{it}(T_i) Y_{it} \quad (1)$$

where $D_{it}(T_i)$ is the indicator of receiving the treatment t for household i :

$$D_{it}(T_i) = \begin{cases} 1, & \text{if } T_i = t \\ 0, & \text{otherwise} \end{cases}$$

We are interested in estimating an intention to treat effect, which is the average effect of the treatment m relative to treatment l :

$$\tau^{ml} = E[Y_{im} - Y_{il}] = \mu_m - \mu_l \quad (2)$$

τ^{ml} measures the mean effect of treatment over the entire population.

An important assumption for the identification of the treatment effect is the strict overlap assumption which can be defined considering the concept of Generalized Propensity Score (GPS) by Imbens (2000). The GPS is the conditional probability of receiving a treatment (in our paper only SCTP, only FISP or both SCTP and FISP received jointly) given the pre-treatment variables. It is defined as follow:

$$r(t, x) \equiv \Pr[T_i = t | X_i = x] = E[D_{it}(T_i) | X_i = x] \quad (3)$$

The strict overlap assumption states that no value of the covariates can deterministically predict receipt (absence) of treatment. More formally:

$$0 < \varepsilon < \Pr[T_i = t \mid X_i = x], \text{ for some } \varepsilon > 0, \forall t \in \mathfrak{T} \text{ and } \forall x \text{ in the support of } X .$$

Under this assumption, together with the conditional independence assumption as defined by Imbens (2000), treatment effects can be estimated through parametric regression. Using the definition of the observed outcome in equation (1), the regression model can be written as in equation (4):

$$Y_i = \sum_{t=0}^K \mu_t D_{it}(T_i) + \sum_{t=0}^K D_{it}(T_i)(X_i - \bar{X})' \alpha_t + \varepsilon_i \quad (4)$$

The unconditional means μ_t and α_t are estimated by minimizing the objective function that is the sum of the squared residuals:

$$\min_{\tilde{\mu}_t, \tilde{\alpha}_t} \frac{1}{N} \sum_{i=1}^N \left(Y_i - \sum_{t=0}^K \tilde{\mu}_t D_{it}(T_i) - \sum_{t=0}^K D_{it}(T_i)(X_i - \bar{X})' \tilde{\alpha}_t \right)^2 \equiv \min_{\tilde{\mu}_t, \tilde{\alpha}_t} \frac{1}{N} \sum_{i=1}^N \tilde{\varepsilon}_i^2 \quad (5)$$

Using the estimators $\hat{\mu}_m^{reg}$ and $\hat{\mu}_t^{reg}$ (where the superscript 'reg' refers to the regression method), τ_{ml} can be estimated as

$$\hat{\tau}_{ml}^{reg} = \hat{\mu}_m^{reg} - \hat{\mu}_t^{reg} \quad (6)$$

The second approach followed for our doubly robust estimation consists on constructing the propensity score weighting type estimators for the treatment effect parameters. Imbens (2000) shows that, as for the binary case, the unconditional means of the potential outcomes can be identified using GPS by weighting:

$$E\left[\frac{Y_i D_{it}(T_i)}{r(t, X_i)}\right] = E[Y_{it}] \quad (7)$$

Based on this identification result, the treatment effect estimator is given by

$$\hat{\tau}_{ml}^{we} = \frac{1}{N} \sum_{i=1}^N \frac{Y_i D_{im}(T_i)}{\hat{r}(m, X_i)} - \frac{1}{N} \sum_{i=1}^N \frac{Y_i D_{il}(T_i)}{\hat{r}(l, X_i)} \quad (8)$$

where $\hat{r}(t, X_i)$ is the estimated GPS and the superscript 'we' denotes the weighting method. To get doubly robust estimators for the treatment effect, we combine the weighted regression method with the weights related to the weighting identification. In practice, we estimate the regression model in equation (4) by a weighted least squares regression with the following minimization problem:

$$\min_{\tilde{\mu}_t, \tilde{\alpha}_t} \frac{1}{N} \sum_{i=1}^N \left(\sum_{t=0}^K \frac{D_{it}(T_i)}{\hat{r}(t, X_i)} \right) \left(Y_i - \sum_{t=0}^K \tilde{\mu}_t D_{it}(T_i) - \sum_{t=0}^K D_{it}(T_i) (X_i - \bar{X})' \tilde{\alpha}_t \right)^2 \quad (9)$$

Using $\hat{\mu}_m^{dr}$ and $\hat{\mu}_l^{dr}$ instead of the unweighted regression estimators $\hat{\mu}_m^{reg}$ and $\hat{\mu}_l^{reg}$, we are able to obtain doubly robust estimates of τ^{ml} :

$$\hat{\tau}_{ml}^{dr} = \hat{\mu}_m^{dr} - \hat{\mu}_l^{dr} \quad (10)$$

We estimated the standard errors using the asymptotic variance formula proposed by Uysal (2015). Following the arguments in Wooldridge (2007), Uysal (2015) derived the asymptotic distribution for the estimators of the treatment parameters in cases in which the GPS, $\hat{r}(t, X)$, is estimated by multinomial response model. This approach adapts particularly well to our case, since we estimated the GPS by multinomial logit regression, as it will be explained in the following section.

4.2 Data and regression analysis

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 about inclusion into the FISP. Data collection for this study and preliminary analysis were implemented 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 (CST UNIMA) (Handa et al. 2015b). The UNC-CH and CST UNIMA took advantage of an expansion in the SCTP to build an experimental “delay-entry” control group implemented in two stages, referred to as random selection and random assignment. In the first stage, in the districts of Salima and Mangochi four Traditional Authorities (TAs) were randomly selected by lottery. Thereafter, the MGCSW targeted eligible households and their corresponding Village Clusters (VCs). The selection of eligible households was done through a proxy means test and a community-based approach with oversight provided by the local District Commissioner’s Office and the District Social Welfare Office. Overall, about 3,500 households were included in the study sample. Once the baseline survey was completed in July/August 2013, in the second stage, half of the VCs in the study sample 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 and, were supposed to enter the programme at the end of the evaluation period. The first follow-up survey was scheduled after twelve months from baseline when beneficiary households would have received eight to ten months of transfers. However, due to the delay in the start of the payment (May 2014), 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 already extensively analyzed by Handa et al. (2015b) and Asfaw et al. (2015), focusing exclusively on the stand-alone impact of the SCTP on a broad range of outcome variables that included household expenditure, food security, productive activities, labour supply among others.

With respect to the original sample, for this paper we selected a subsample in order to identify the stand-alone impact of the SCTP and FISP, their synergies, and the joint impact of FISP and SCTP when received jointly. We select 1,607 households (interviewed at both baseline and follow-up) that are divided into four groups: control households that neither received the SCTP nor the FISP (control group); households treated *exclusively* under the SCTP (treatment SCTP); households treated *exclusively* under the FISP⁵ (treatment FISP); and households treated under both programmes simultaneously (treatment SCTP&FISP) (respectively, 38.33, 30.18, 14.87, and 16.6 per cent of the sample). We excluded from the

sample the following categories of households: i) included in FISP in both baseline and followup (1,122); ii) included in FISP at baseline and in SCTP at follow-up (634).⁶ This kind of selection has advantages and disadvantages. The exclusion of these two groups of households allows us to obtain a clean setting of mutually exclusive groups over which to estimate the impacts of the two programmes in isolation and in combination. However, this selection procedure drastically reduces the sample size (from 3,363 to 1,607 households interviewed both at baseline and follow-up).⁷ Potentially, it could also affect the randomized nature of the experiment, creating groups with different characteristics at baseline. Indeed, unlike the SCTP, access to FISP was not randomized in the evaluation design. In such a case, the identification of the programmes' impact would be biased. In order to deal with this potential sample selection issue, we adopt the doubly robust estimation strategy by Uysal (2015) described in section 4.1 (combination of regression analysis and generalized propensity score weighting adjustment). Table A2 shows the unweighted tests of differences between the four groups included in the study sample. As suspected, the four groups show significant differences on a variety of baseline household characteristics and economic indicators.

The GPS were estimated via a multinomial logit regression using data at baseline, as in equation (11).

$$Pr[T_i = t] = f(\zeta + \theta X_i) \quad (11)$$

The variable $Pr[T_i = t]$ represents the probability of being included in one of the four groups (control, treatment SCTP, treatment FISP, treatment SCTP&FISP). This is modeled as a function of a vector of control variables (X_i) which includes household size and demographic composition, characteristics of the household head, proxies of wealth (total land owned, agricultural assets, labour constraints and livestock owned), distance to the markets and district fixed effect. The GPS weights allowed to "rebalance" the sample. Indeed, Table 1 shows that, with only one exception, the four groups are identical at baseline. Equation (12) presents the regression equivalent of difference-in-difference with covariates and weighting based on GPS.

$$\begin{aligned}
Y_{i,d} = & \zeta + \alpha D2014_i + \beta_1 SCTP_{i,d} + \beta_2 (D2014_i * SCTP_{i,d}) + \gamma_1 FISP_{i,d} + \\
& \gamma_2 (D2014_i * FISP_{i,d}) + \gamma_3 SCTP_{i,d} \& FISP_{i,d} + \delta (D2014_i * SCTP_{i,d} \& FISP_{i,d}) + \\
& \sum \beta X_i + \mu_{i,d}
\end{aligned} \tag{12}$$

$Y_{i,d}$ represents the outcome variables. SCTP and FISP are indicator variables for, respectively, *exclusive* assignment to either the SCT programme or FISP. SCTP&FISP is an indicator variable for assignment to both, the social cash transfers and the farm input subsidy programme. $D2014$ represents the survey year and is equal to 1 at follow-up, zero otherwise. X is a set of baseline household characteristics (household size and demographic composition, and characteristics of the household head) and controls at community level (a vector of contemporaneous cluster level prices, a set of exogenous shocks and district fixed effects). μ is an error term.

The parameters of interest are the coefficients β_2 , γ_2 and δ which are, respectively, the average treatment effect estimates of the SCTP for households treated only by SCTP, the effect of FISP for households treated only by FISP, and the estimate of the joint impact of SCTP and FISP for households treated by both programmes. These parameters allow to estimate the synergies between the two programmes, as well as their complementarity. In particular, the difference between δ (joint impact of SCTP and FISP when a household receives both), β_2 (stand-alone impact of SCTP) and γ_2 (stand-alone impact of FISP), i.e. $\delta - \beta_2 - \gamma_2$, measures the complementarity between the SCTP and FISP. The difference between δ and β_2 measures the incremental impact of FISP on SCTP. The difference between δ and γ_2 measures the incremental impact of SCTP on FISP. Note that SCTP, FISP and SCTP&FISP represent mutually exclusive groups. SCTP takes value one if the household is treated exclusively under SCTP, zero otherwise. FISP takes value one if the household is treated exclusively under FISP, zero otherwise. SCTP&FISP takes value one if the household is treated under both SCTP and FISP, zero otherwise (i.e. none of the programmes is received, only SCTP, only FISP). This variable does not represent an interaction between SCTP and FISP. It represents a completely different group of households. For this reason, the stand-alone impacts of SCTP and FISP are, respectively, simply β_2 and γ_2 , and the joint impact of SCTP and FISP is δ . See also Gertler et al. 2011.

5 Results of the standalone and combined impacts of SCTP and FISP

We begin this section by presenting four figures related to two main indicators of the demand side and the production side that are likely to be affected by the SCTP and FISP, namely total household expenditure and total value of agricultural production, by treatment group. Figures 1 and 2 show kernel densities of total household consumption at baseline and follow-up. While at baseline there are not significant differences among the distributions, at follow up the distributions of expenditure for the *SCTP* and for the *SCTP&FISP* groups, almost coincidentally, shifted significantly to the right. This suggests that, without controlling for potential confounding factors, the SCTP contributes to an increase in household expenditure. The SCTP and 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 seems to contribute weakly to the increase in expenditure. We replicate the same kind 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 not significant differences among the distributions at baseline. However, at follow-up, the distributions of value of production (maize, groundnuts, pigeon pea, nkhwani, rice, cotton, sorghum) for the *FISP* and especially *SCTP&FISP* groups significantly shifted to the right, meaning that the combination of FISP and SCTP increases the value of production. As opposed to total expenditure, here the effect seems to be driven mainly by the implementation of FISP.

The following sub-sections describe and discuss the main findings on a large set of outcomes, including household expenditure, food security, productive activities (agricultural production and input use) and livestock (ownership and expenditure). We present the results for the whole sample and by groups of households with different labour endowment, namely labor constrained and unconstrained. This heterogeneity analysis has not been chosen at random, rather it is justified by the relevance of labour capacity in the targeting mechanisms of both programs. In our analysis, a household is defined as “labor constrained” if there is no

able-bodied member of household who is fit-to-work, i.e. no adult without chronic illness and/or disabilities. 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 Consumption expenditure

Figure 5 provides a graphical representation of the estimated stand-alone impact of SCTP and FISP, the joint impact of the two programmes and their synergy on household expenditure. The thick horizontal bars represent the estimated coefficients, while the thin horizontal bars show the confidence interval. The figure shows, from the left to the right, 1) the stand-alone impact of SCTP, 2) the stand-alone impact of FISP, 3) their sum, and 4) (in red) the joint impact of SCTP and FISP when the households benefit from both simultaneously. The difference between 4 and 3 represents the precise measure of complementarity between the two interventions ($\delta - \beta_2 - \gamma_2$).

The figure shows that the stand-alone impact of SCTP on total household expenditure is positive and significant but the stand alone impact of FISP is positive but not statistically significant. The exclusive receipt of cash transfer leads to an increase of household expenditure of 9,481 MWK, equivalent to 29 USD (at the exchange rate of 2013). This represents an increase of 21 per cent of the baseline mean value for household expenditure. The joint impact is positive and significant (10,697 MWK, equivalent to 32 USD), and it is greater than the sum of the stand-alone impacts of the SCTP and FISP. Indeed, the joint impact corresponds to a 24 per cent increase with respect to the baseline mean of expenditure for households receiving both SCTP and FISP. Overall, the estimates for total household expenditure confirm and strengthen the main message of Figure 2: there are positive synergies when households participate in both programmes.

Table 2 shows the doubly robust estimates of the incremental impacts of SCTP on FISP and the incremental effect of FISP on SCTP. While the former is positive and statistically significant, corresponding to 12,289 MWK (37 USD), the latter is positive but not significant.

This means that the additional impact of cash transfer to households that received exclusively FISP would induce an increase of expenditure of 37 USD. Moreover, the heterogeneity analysis highlights strong differences between labour constrained and unconstrained households. Indeed, it shows that the stand-alone impact of SCTP is larger for households defined as labour constrained (a 24 per cent increase relative to baseline mean). However, synergies take place only for households with labour capacity. For this group of households, the incremental impact of SCTP on FISP is positive and significant, equivalent to 20,505 MWK (62 USD) and the complementarity estimate is positive and significant. It shows that the joint receipt of SCTP and FISP induces an increase of expenditure for labour unconstrained households which is 13,412 MWK (40 USD) greater than the sum of the stand-alone impacts of SCTP and FISP. Furthermore, the heterogeneity analysis shows that the baseline mean of expenditure is significant higher for labor constrained households. This seems to be counterintuitive but it is explained by differences in expenditure for food. While labour unconstrained households consume self-produced food, labour constrained households are more likely to buy it from the market. This explanation is supported by the differences in the baseline value of production for labour constrained and unconstrained households, discussed in the following section, significantly higher for the former group.

Table 3 shows the effect on several expenditure items, namely food, health, education, clothing and footwear (the results for additional expenditure items are reported in Table A.3 in the Appendix). The results for food expenditure are similar to those for total expenditure. Indeed, the stand-alone impact of SCTP is greater for the labour constrained households (the coefficient shows an increase of 18% of the baseline per adult equivalent expenditure on food), and the stand-alone impact of FISP is positive but not statistically significant. However, positive synergies occur only for the group of labour unconstrained households. Looking at the estimates of other consumption items, the results are more heterogeneous. In particular, we find synergies between SCTP and FISP for expenditure on health, education and clothing and footwear, but not for the other consumption items (shown in Table A.3). Most of the increase in expenditure is due to SCTP. Particularly relevant are the results for expenditure in education. The coefficient of the SCTP alone shows a significant increase of 211 MWK (0.64 USD), which more than doubles for labour constrained households (456 MWK, 1.38 USD).

Interestingly, expenditures on education for FISP only beneficiaries are significantly decreasing (-118 MWK, 0.36 USD) and this impact is much stronger for households with labour capacity (-329 MWK, 1 USD). This result unveils potential unintended adverse effects from agricultural interventions, which aims to boost production and that may end up in reduced investment in education in order to fully exploit the productive potential of the input subsidies. However, when programmes are offered in conjunction, the impact observed on education expenses is significantly positive (281 MWK, 0.85 USD), and this is again much stronger for the labour constrained households (426 MWK, 1.29 USD). This means that the two interventions are reinforcing each other in this domain, counteracting the possible negative effect on education brought by the productive support given by the FISP only.

Finally, with the exception of expenditure for clothing and footwear, the stand-alone impact of FISP is never positive and significant. This suggests that FISP does not produce an income effect. Indeed, when received alone, does not allow to release liquidity otherwise used for agricultural inputs such as fertilizers or seeds. This result is consistent with finding of previous studies, both quantitative and qualitative, which already document a weak impact of FISP on expenditure (Chirwa & Dorward, 2013; Ricker-Gilbert, 2011).

5.2 Food security

We consider several proxies of food security (see Table 4). First, we analyze a question included in the survey that asks respondents whether they worry that the 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 SCTP on food security is positive and significant (nine percentage points reduction in the probability of being worried about food availability), the stand-alone impact of FISP is statistically significant for the first indicator and for labour unconstrained households only. This is probably due to the nature of the indicator: the probability of being worried about food availability in the future reflects more a long-term food security status rather than a present condition. Households benefitting only from FISP (and with the labour capacity to fully exploit the subsidies) are therefore likely to improve their food security in the future after harvesting. SCT households instead can benefit immediately

from the available cash to increase the number of meals they consume daily (impact of 0.23 meals per day).

Finally, as a proxy of food security we consider also daily caloric intake per adult equivalent calculated using kilocalories per gram of edible portions of specific foods, multiplied by the quantity (in grams) of specific foods eaten. These kilo-calorie figures were summed up within the household, and then divided by the days per week and adjusted to the demographic composition to receive daily figures per adult equivalent. As for the other food security indicator, we find that the SCTP allows to increase caloric intake from purchased food for labor constrained households, a 75 per cent increase with respect to the 409 baseline caloric intake from purchased food. The stand-alone contribution of FISP is not significant. Overall, the estimates of the joint impact suggest that the two interventions improved food security, but positive synergies seem to take place only for the number of meals per day and only for households defined as labour unconstrained.

5.3 Agricultural production, agricultural inputs and assets and livestock

Figure 6 provides a graphical representation of the estimated stand-alone impact of SCTP and FISP, the joint impact and their synergies on value of production. The estimates confirm and strengthen the main message of Figure 4: the joint impact is positive and significant and there are positive synergies when households participate in both programmes in increasing the value of production. The figure also shows that most of the increase in the value of production is due to the FISP. Indeed, while the stand-alone impact of FISP is big in size, positive and significant (5,079 MKW, equivalent to 15 USD, a 53 per cent increase from baseline values), the coefficient of SCTP is small in size and insignificant. Table 5 provides the regression estimates for the value of production, including as additional regressor also the size of cultivated land at baseline. Moreover, the estimates of the joint impact of the two programmes received simultaneously show a much larger increase of the value of production, which ranges between 70 to 86 per cent of the baseline mean value for labor unconstrained and constrained households. 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 SCTP and FISP are larger for labour unconstrained households but positive synergies take place more for households defined as labour constrained. Indeed, for labour constrained households the incremental impact of FISP on SCTP is 7,129 MWK (22 USD), significantly greater than the same incremental impact for labour unconstrained households (5378 MWK, 16 USD), and the incremental impact of SCTP on FISP is 4390 MWK (13 USD). This is an important result: the combination of a social protection programme and an agricultural development intervention generates more synergies in agricultural production for the most disadvantaged households. We envisaged two potential explanations for the stronger synergies on production observed for labour constrained households. They may use part of the additional liquidity for 1) hiring labour and/or 2) purchasing agricultural assets. While the first potential explanation is not supported by our data (see table A.4 in the Appendix)⁹, the second explanation is upheld by the estimates of the impact of SCTP and FISP on an index of agricultural assets¹⁰ (see table A.5 in the Appendix). Synergies in increasing agricultural assets are stronger for labour constrained households

Table 6 shows the results for crop production (land area cultivated for each crop, percentage of households engaged in each crop production, and quantity of crop produced). The exclusive receipt of FISP increases the area of cultivated land for maize for labour constrained households (25 per cent compared to baseline mean) and increases the land cultivated for groundnut for all beneficiary households (23 and 20 per cent of the baseline mean value for households labor unconstrained and constrained households, respectively). The evidence of no significant impact on the size of land cultivated for other crops suggests that FISP alone and SCTP and FISP received jointly allow the cultivation of land otherwise left unused without the FISP and SCTP interventions.¹¹ Table 6 further shows that FISP positively affects the percentage of households engaged in maize production and also the quantity produced, especially for labour constrained households. For this group, FISP increases the percentage of households engaged in maize production by 15 per cent and the quantity of maize produced by 64 per cent compared to the baseline mean. A much larger increase is estimated for production of groundnut (100 and 300 per cent for labour constrained households but such large numbers are due to the extremely low value for participation and

quantity produced at baseline). Overall these results are not surprising, since at the time of the data collection, and before the latest reforms, FISP was mainly directed towards enhancing maize production, and only to a minor extent it was also supposed to increase other crops' production, for instance by providing improved seeds for legumes, including groundnuts.

For the quantity of maize produced, the stand-alone impact of SCTP is not statistically significant but the joint effect on participation is significant for the most disadvantaged group of households. For the production of these crops synergies are also taking place. Indeed, the incremental impact of FISP on SCTP on participation of labour constrained households is highly significant. The effect for labour unconstrained household is weak probably because the overwhelming majority of households is already engaged in farming activities ("ceiling effect").

As far as agricultural inputs is concerned, FISP significantly increases the percentage of users and quantity of chemical fertilizers used, and increases the percentage of users of improved or hybrid seeds (see Table 7). Both results are clearly expected due to the nature of the programme. Overall, the joint impact is positive and significant only for chemical fertilizers and the synergies between the two programmes seem to be weak. Unfortunately our data does not contain information on the use of commercial fertilizer and commercial seeds. Therefore, we are not able to assess whether FISP induced crowding-out of commercial inputs and whether the total use of chemical fertilizers increased or decreased. The impact on the value of production and on crop production seem to suggest that the total use of input increased but, unfortunately, we are not able to quantify the total increase, net of potential crowding-out. However, previous contribution in the literature (Mason & Jayne, 2013; Ricker-Gilbert et al., 2011) document that "crowding-out" of commercial fertilizer tends to be less when subsidy programmes are targeted to relatively poor farmers, which is the bulk of our sample. Finally, in Tables 8 and 9 we looked at whether SCTP and FISP had any impact on ownership of and household expenditure for livestock (chicken and other poultry, sheep or goats, ducks and pigs). Overall the results suggest that the stand-alone impacts of SCTP and FISP are positive and significant, and the two programmes are complementary instruments for investment in livestock. Indeed, the SCTP directly affects expenditure for livestock providing immediate cash to beneficiaries households. The positive impact of FISP on these expenditures

may be due to two reasons: FISP it is likely to ease liquidity used for agricultural inputs and the vouchers provided to FISP-beneficiaries being partially exchanged for cash. The results by labour constraints are striking: the incremental impact of FISP on SCTP, the incremental impact of SCTP on FISP, and the complementarity are stronger for labour constrained households.

6 Conclusions

This paper contributes to the literature on anti-poverty programme evaluation and to discussions on the design of poverty reduction and smallholder agricultural development strategies by shedding light on the interplay between a social protection intervention, the SCTP, and an agricultural programme, the FISP in Malawi.

Findings from this evaluation challenge important notions underling the approach to poverty reduction in Malawi. Firstly, findings challenge the notion that poor households should not participate in more than one programme simultaneously since this represents an inefficient use of resources. Secondly, findings challenge the notion that reducing poverty and vulnerability is only responsibility for social programmes and that productive interventions should only target the non-poor. The analysis shows that achieving the objectives of the FISP and the SCTP among poor households is best done by combining these programmes such that a household participates in both programmes simultaneously. When combined, there are synergies between SCTP and FISP in increasing expenditure, the value of agricultural production, livestock, and, weakly, in improving food security. More specifically, we find that SCTP and FISP are complementary instruments in increasing total household expenditure and expenditure on food and education, and in increasing the value of production, production of crops, and livestock.

These results are in contrast with Matita and Chirwa (2014) who argue that FISP should target households that are moderately poor while the SCTP should continue focusing on the poorest of the poor. According to their simulation results using data from the IHS3, the gains from harmonisation and targeting different households may be greater than delivering these two transfers to the same households. Our study supports a different view: the provision of

both SCTP and FISP to the same households generates positive synergies, and for some specific outcomes, the joint impact of the two programmes implemented simultaneously is actually significantly greater than the sum of the stand-alone contributions. These findings lead to important considerations related to the target population of programmes; productive agricultural interventions such as FISP have a role to play in reducing poverty and should therefore include ultra-poor households among their target populations, who should also continue participating in social protection programmes such as the SCTP.

Furthermore, the heterogeneity analysis conducted in this paper suggests that synergies between the two programmes are mediated by the households labour capacity. On the one hand, we find that the positive synergies between SCTP and FISP in increasing household expenditures are stronger for labour unconstrained households. On the other hand, the synergies in increasing the value of production, crops production and livestock are stronger for labour constrained households. This result seems to be mediated by the stronger synergies for labour constrained households in the purchase of agricultural assets which, in turn, contribute to an increase of the value of production. Similar considerations hold for expenses on livestock and ownership of livestock. The stronger synergies in increasing ownership of and expenditure on livestock suggest that FISP is more likely to ease liquidity, otherwise used for agricultural inputs and now invested in livestock, for labour constrained households.

Two features of this study need to be born in mind when interpreting the results. First, given the required eligibility for inclusion into the SCTP, our sample is representative of the lower income quantile of the population in Malawi. The SCTP explicitly targeted to ultra-poor households, defined as households unable to meet the most basic urgent needs, including 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. The analysis of the benefit-cost ratio of the implementation of the two different programmes on two different groups of households versus the joint and simultaneous implementation of the two programmes is certainly relevant from a policy point of view but it is out of the scope of this paper which is a purely impact evaluation study. In a companion research work, ... are conducting a local economy-wide benefit-cost

analysis using nationally representative data from the Malawi IHS3. Differently from standard benefit-cost analysis which focuses on the benefits on direct beneficiary households, the local economy wide benefit-cost analysis also takes into account the benefits on the local economy generated by positive spillovers in favour of non-beneficiary households over a ten-year time horizon.¹² Preliminary results of this companion research work show that the local economy-wide benefit cost ratios for the stand-alone SCTP provided to ultra-poor households, for the stand-alone FISP provided to poor and ultra-poor households with labour capacity and a piece of land, and for SCTP and FISP implemented jointly on a partially overlapping groups of households are all greater than 1, even though the current cost seems to largely overcome the estimated direct benefits over a seventeen month time horizon (between baseline and follow-up). More specifically, the local economy-wide benefit-cost ratio is 1.50 MWK for the SCTP alone, is 1.53 MWK for the FISP alone, and it is 1.51 MWK for the SCTP and FISP implemented simultaneously.

To conclude, the evidence showed here suggests that simultaneously providing agricultural and social protection intervention programmes, such as FISP and SCTP, to poor households can have positive effects in the short term, which are likely to support poor households in breaking out the cycle of disadvantage in the medium and long term and to prevent 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 better manage risks. On the other hand, FISP can also promote growth in the productivity of small family farmers, by addressing structural constraints that limit access to inputs.

Endonotes

¹ Filipski and Taylor (2012) carried out a simulation impact evaluation of rural income transfers in Malawi in which they compare the impact of three alternative transfer schemes, namely the SCTP, FISP and the output market price support programme. We did not include this paper in the literature review because it does not investigate the potential synergies between the SCTP and FISP.

² Kilic et al. (2013) explain that the limited pro-poor targeting stems from community-based targeting (i.e. open forums in which village residents identify beneficiaries in a collective fashion) that are co-opted by more influential community members. Their analysis suggests that, on average, households that are relatively well-off, connected to community leadership, and residing in agro-ecologically favorable locations are more likely to be FISP beneficiaries and receive more input coupons.

³ For details about the programme implementation and funding, see Asfaw et al. 2015 and Handa et al. 2015b.

⁴ The GPS weighting and the difference in difference estimation allow to control, respectively, for selection on observable and time-constant unobservable factors in the households. However, it should be noted that these two methods do not allow to control for unobservable factors which may be time variant and could be correlated with the receipt of FISP.”

⁵ One of the challenges with analyzing FISP is that households may receive different quantities and combinations of maize seed and inorganic fertilizer. Unfortunately from our survey data is not possible to get an exact measure of subsidized seeds and subsidized fertilizers, but only the equivalent amount in cash of FISP vouchers. Among recipients, we have some variability in the self-reported amounts, which may be due to misreporting or under/over-reporting (Table available upon request). There is likely to be a measurement error, which would complicate a lot the econometrics, without a clear advantage over the binary approach. In fact, we would need an instrument for the vouchers amount. For this reason we decided to take into account only whether they received FISP or not without taking into account potential differences in the amount of seeds and fertilizers received.

⁶ These groups of households represent, respectively, 33.3 and 18.8 per cent of the original sample.

⁷ Table A1 in the Appendix 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 received agricultural input subsidies already at baseline or in the previous two years.

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 SCTP and FISP improve food security since they contribute to reduce the concern of not having enough food.

⁹ Table A.4 shows the stand-alone impact of SCTP and FISP, as well as their joint impact and complementarities on a set of indicators of labor supply (total number of days in farming activities, total number of days in ganyu labour, total number of days in wage labour) and hired labor (days of workers hired, total and by sex). The results show a clear negative and significant impact of the SCTP on hours spent in casual labor (Ganyu labor), especially for labor unconstrained households. No effect is detected on the number of days in farming activities, number of hours in wage labour and number of days of hired labour.

¹⁰ This index is generated through a principal component analysis which include the following items: hand hoes, axes, panga knives, sickles, watering cans.

¹¹ To support this view, we regress the total land cultivated for any kind of crop over the same set of regressors included in all the estimates. The results (not included in the paper but available upon request) show that FISP alone and especially FISP combined with SCTP increase the size of total land cultivated. Moreover, the incremental impact of FISP on SCTP is positive and significant for labour constrained households.

¹² Details on this study, still unpublished, are available upon request.

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Figures

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

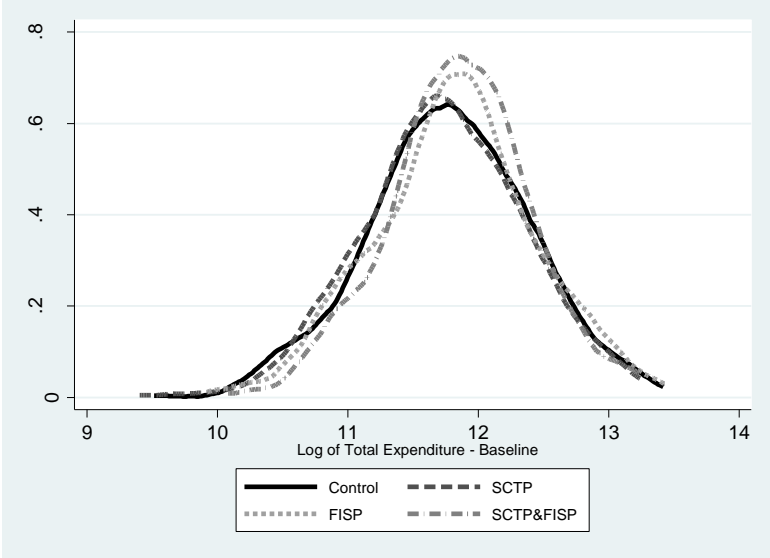


Figure 2: Kernel density of total household expenditure at follow up by treatment groups – real values in log

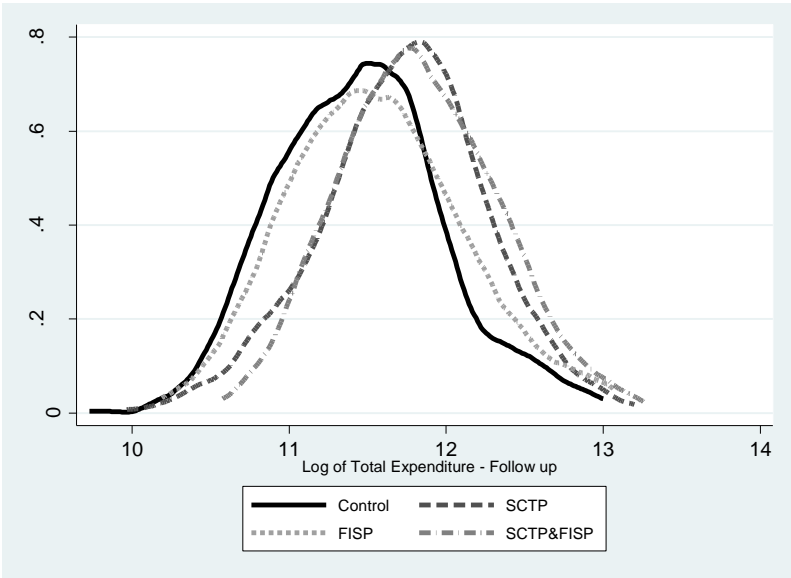


Figure 3: Kernel density of value of production at baseline by treatment groups – real values in log

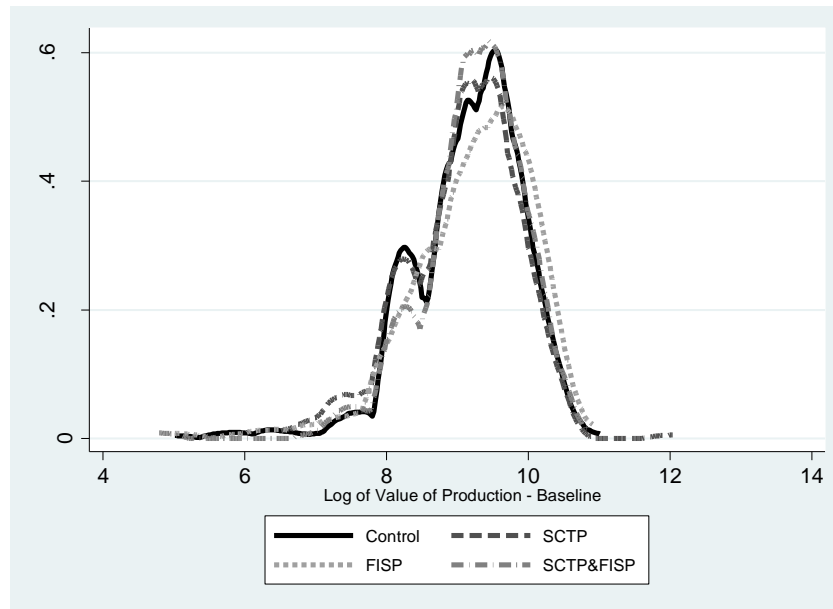


Figure 4: Kernel density of value of production at follow up by treatment groups – real values in log

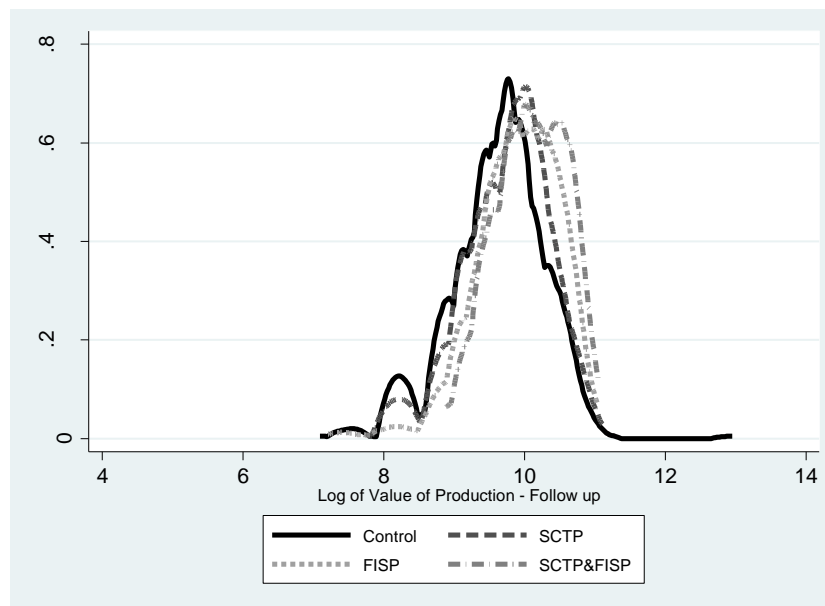
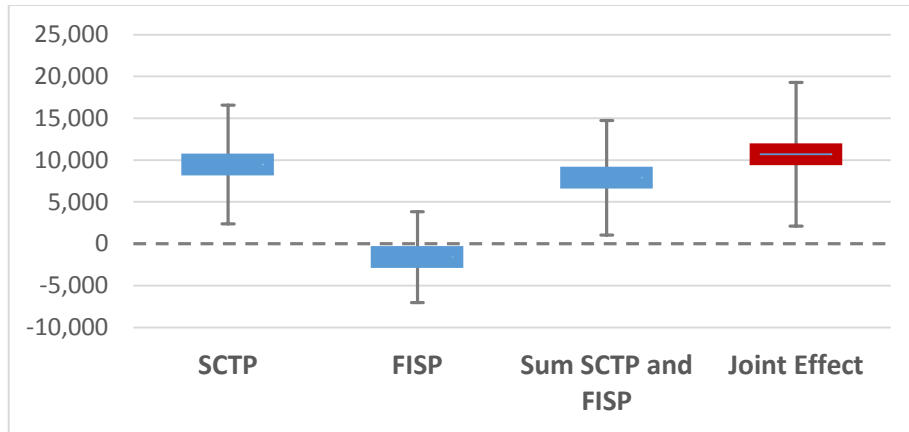
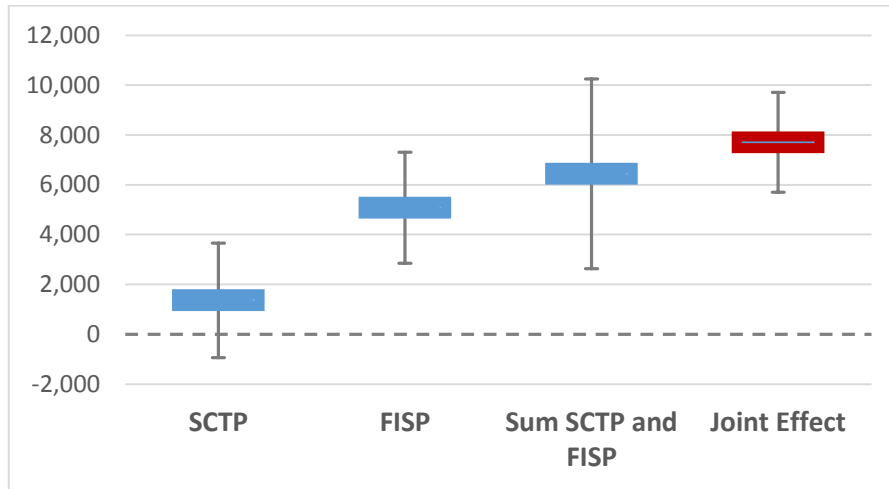


Figure 5: Impact on household expenditure per capita– MWK real values



Note: Exchange rate in 2013: 1 USD = 329.4768 MWK. 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: Exchange rate in 2013: 1 USD = 329.4768 MWK. 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.

Tables

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

	C	SCTP	FISP	SCT&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	164514.53	154514.02	163867.20	160596.98	0.56	0.639
hh consumption - food and beverages	127621.91	118176.74	124934.00	125507.52	0.75	0.523
Household 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 pigeonpea	0.098	0.111	0.068	0.115	2.14	0.094
Value of production	9505.84	9143.03	9570.90	9830.87	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 now	0.126	0.128	0.107	0.085	1.6	0.187
HH owns goat or a sheep now	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
obs	616	485	239	267		

Table 2: Impact on total expenditure per adult equivalent – MWK real values

	All		Labor unconstrained		Labor constrained	
	Total expenditure	Baseline Mean	Total expenditure	Baseline Mean	Total expenditure	Baseline Mean
SCTP*d2014	9480.703** [2.19]	46207.21	7092.684 [1.37]	38001.44	13290.677** [2.08]	56296.15
FISP*d2014	-1592.202 [-0.48]	50496.03	-7879.535 [-1.62]	45677.74	6388.564 [1.08]	55867.32
Joint impact SCT&FISP	10696.760* [2.04]	51667.82	12625.724* [1.79]	40800.66	10656.982** [2.05]	64295.13
Incremental impact of FISP on SCTP	1216.058 [0.32]		5533.04 [1.33]		-2633.695 [-0.44]	
Incremental impact of SCTP on FISP	12288.96** [2.24]		20505.26** [3.35]		4268.419 [0.57]	
Complementarity	2808.26 [0.55]		13412.58** [2.26]		-9022.259 [-1.09]	
R2	0.1671		0.1292		0.2666	
Observations	3,214		1,806		1,408	

Notes: Exchange rate in 2013: 1 USD = 329.4768 MWK. 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 per different items – MWK real values

	Expenditure		
	All	Labor unconstrained	Labor constrained
Food per adult equivalent			
SCTP*d2014	5020.689 [1.34]	2803.445 [0.61]	7984.099* [1.74]
FISP*d2014	-769.569 [-0.25]	-6198.528 [-1.38]	5565.393 [1.08]
Joint impact SCT&FISP	5538.983 [1.40]	6616.156 [1.11]	5666.645 [1.26]
Incremental impact of FISP on SCTP	518.29 [0.18]	3812.711 [1.14]	-2317.454 [-0.41]
Incremental impact of SCTP on FISP	6308.552 [1.57]	12814.68** [2.62]	101.2518 [0.02]
Complementarity	1287.863 [0.3]	10011.24* [1.86]	-7882.847 [-1.06]
R2	0.1743	0.104	0.2522
Health per adult equivalent			
SCTP*d2014	574.702 [1.51]	497.461 [1.42]	632.908 [0.92]
FISP*d2014	-554.987 [-0.86]	-417.04 [-0.80]	-762.646 [-0.50]
Joint impact SCT&FISP	980.121* [2.03]	1018.868 [1.69]	808.837 [1.34]
Incremental impact of FISP on SCTP	405.419 [0.81]	521.406 [0.82]	175.930 [0.21]
Incremental impact of SCTP on FISP	1535.108* [1.94]	1435.907** [2.04]	1571.48 [1.02]
Complementarity	960.406 [1.16]	938.446 [1.2]	938.58 [0.53]
R2	0.0733	0.1329	0.07
Education per adult equivalent			
SCTP*d2014	210.792*** [2.98]	-38.447 [-0.28]	456.396*** [3.41]
FISP*d2014	-117.666* [-1.84]	-328.706** [-2.53]	117.8 [0.94]
Joint impact SCT&FISP	281.521*** [2.84]	142.917 [1.19]	426.356** [2.30]
Incremental impact of FISP on SCTP	70.729 [0.63]	181.363 [1.18]	-30.039 [-0.54]
Incremental impact of SCTP on FISP	399.187*** [4.1]	471.622*** [3.5]	308.556* [1.68]
Complementarity	188.395 [1.51]	510.069** [2.5]	-147.839 [-0.81]
R2	0.143	0.154	0.175
Clothing and foot. per adult equivalent			
SCTP*d2014	1031.314*** [6.76]	1033.338*** [5.05]	1007.661*** [4.08]
FISP*d2014	167.566** [2.38]	26.962 [0.25]	410.703** [2.22]
Joint impact SCT&FISP	980.496*** [5.95]	1061.451*** [5.42]	880.214*** [3.72]
Incremental impact of FISP on SCTP	-50.818 [-0.34]	28.113 [0.13]	-127.447 -0.58
Incremental impact of SCTP on FISP	812.929*** [4.46]	1034.49*** [5.08]	469.5115 1.56
Complementarity	-218.385 [-1.25]	1.151 [0]	-538.1498 -1.85
R2	0.1258	0.1574	0.1325
Observations	3,214	1,806	1,408

Notes: Exchange rate in 2013: 1 USD = 329.4768 MWK. 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 of food security

	All	Labor unconstrained	Labor constrained
Worry about lack of food			
SCTP*d2014	-0.091** [-2.17]	-0.095** [-2.12]	-0.084 [-1.57]
FISP*d2014	-0.046 [-1.51]	-0.070** [-2.28]	0.002 [0.04]
Joint impact SCT&FISP	-0.076 [-1.68]	-0.109* [-1.72]	-0.043 [-0.76]
Incremental impact of FISP on SCTP	0.015 [0.58]	-0.014 [-0.29]	0.04 [0.72]
Incremental impact of SCTP on FISP	-0.030 [-0.70]	-0.039 [-0.62]	-0.045 [-0.59]
Complementarity	0.06 [1.56]	0.056 [0.92]	0.038 [0.44]
R2	0.0794	0.1056	0.1138
Number of meals per day			
SCTP*d2014	0.226*** [3.51]	0.174** [2.36]	0.278*** [3.03]
FISP*d2014	0.054 [0.92]	-0.016 [-0.13]	0.131 [1.57]
Joint impact SCT&FISP	0.244*** [3.25]	0.226** [2.17]	0.237*** [2.88]
Incremental impact of FISP on SCTP	0.018 [0.3]	0.05 [0.64]	-0.04 [-0.42]
Incremental impact of SCTP on FISP	0.190** [2.79]	0.241** [2.04]	0.11 [0.87]
Complementarity	-0.036 [-0.42]	0.07 [0.46]	-0.17 [-1.34]
R2	0.100	0.13	0.1259
Caloric intake in the past 7 days per adult equivalent			
SCTP*d2014	113.545 [1.03]	40.594 [0.39]	326.939 [1.45]
FISP*d2014	-94.816 [-1.66]	-148.706 [-1.60]	46.611 [0.31]
Joint impact SCT&FISP	103.907 [0.62]	91.432 [0.48]	240.37 [1.29]
Incremental impact of FISP on SCTP	-9.638 [-0.07]	50.839 [0.34]	-86.57 [-0.5]
Incremental impact of SCTP on FISP	198.72 [1.1]	240.14 [1.17]	193.76 [0.96]
Complementarity	85.18 [0.58]	199.54 [1.16]	-133.18 [-0.57]
R2	0.1271	0.1397	0.2236
Caloric intake from purchased food per adult equivalent			
SCTP*d2014	122.04	36.86	326.518**

	[1.17]	[0.30]	[2.55]
FISP*d2014	6.812	-46.622	108.267
	[0.08]	[-0.46]	[1.06]
Joint impact SCT&FISP	149.456*	124.957	245.018*
	[1.81]	[0.96]	[1.78]
Incremental impact of FISP on SCTP	27.42	88.10	-81.50
	[0.34]	[1.04]	[-0.65]
Incremental impact of SCTP on FISP	142.64	171.58	136.751
	[1.14]	[1.27]	[1.01]
Complementarity	20.60	134.72	-189.77
	[0.17]	[0.98]	[-1.23]
R2	0.2185	0.1895	0.3492
Caloric intake from produced food per adult equivalent			
SCTP*d2014	-48.521	-23.437	-88.974
	[-0.74]	[-0.33]	[-1.35]
FISP*d2014	-6.74	-7.456	-21.19
	[-0.31]	[-0.25]	[-0.85]
Joint impact SCT&FISP	-33.571	-0.653	-67.45
	[-0.53]	[-0.01]	[-0.86]
Incremental impact of FISP on SCTP	14.950	22.784	21.524
	[0.84]	[0.85]	[0.64]
Incremental impact of SCTP on FISP	-26.831	6.803	-46.260
	[-0.43]	[0.12]	[-0.63]
Complementarity	21.69	30.240	42.714
	[0.82]	[0.78]	[1.03]
R2	0.2999	0.3191	0.314
Caloric intake from gifts per adult equivalent			
SCTP*d2014	-7.539*	-3.867	-11.540**
	[-1.74]	[-0.93]	[-2.08]
FISP*d2014	4.225	1.481	8.283**
	[1.48]	[0.41]	[2.37]
Joint impact SCT&FISP	-3.03	-1.784	-3.967
	[-0.64]	[-0.39]	[-0.69]
Incremental impact of FISP on SCTP	4.509**	2.083	7.573***
	[1.97]	[0.56]	[3.34]
Incremental impact of SCTP on FISP	-7.255	-3.265	-12.25*
	[-1.34]	[-0.55]	[-1.92]
Complementarity	0.284	0.602	-0.710
	[0.08]	[0.12]	[-0.19]
R2	0.155	0.1435	0.2296
Observations	3,214	1,806	1,408

Notes: 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 – MWK real values

	All		Labor unconstrained		Labor constrained	
	Value of production	Baseline Mean	Value of production	Baseline Mean	Value of production	Baseline Mean
SCTP*d2014	1359.978 [0.97]	9143.033	2421.597* [1.75]	10501.45	67.177 [0.03]	7472.863
FISP*d2014	5079.694*** [3.74]	9570.896	5954.431*** [5.54]	11169.23	2806.269 [1.08]	7789.116
Joint impact SCT&FISP	7702.45*** [6.29]	9830.867	7798.565*** [5.87]	11101.51	7196.608*** [4.00]	8354.416
Incremental impact of FISP on SCTP	6342.471*** [6.93]		5376.968*** [3.68]		7129.431*** [3.97]	
Incremental impact of SCTP on FISP	2622.755* [1.81]		1844.134 [1.30]		4390.339** [1.99]	
Complementarity	1262.777 [0.78]		-577.463 [-0.35]		4323.162 [1.31]	
R2	0.275		0.313		0.284	
Observations	3,214		1,806		1,408	

Notes: Exchange rate in 2013: 1 USD = 329.4768 MWK. 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

	Land cultivated for each crop			% HH engaged in:			Quantity produced		
	All	Labor unconstrained	Labor constrained	All	Labor unconstrained	Labor constrained	All	Labor unconstrained	Labor constrained
Maize production									
SCTP*d2014	0.039 [0.50]	0.037 [0.49]	0.029 [0.26]	-0.001 [-0.03]	-0.004 [-0.19]	-0.008 [-0.15]	18.767 [1.22]	19.641 [1.29]	12.244 [0.52]
FISP*d2014	0.08 [1.06]	-0.03 [-0.33]	0.177* [1.78]	0.067** [2.48]	0.014 [0.72]	0.112** [2.52]	65.581*** [6.42]	61.179*** [5.97]	61.037*** [4.49]
Joint impact SCT&FISP	0.189*** [2.79]	0.206** [2.34]	0.161* [1.65]	0.033 [0.98]	0.003 [0.10]	0.081 [1.64]	81.418*** [4.32]	76.181*** [3.70]	82.667*** [4.28]
Incremental impact of FISP on SCTP	0.15*** [4.25]	0.17** [2.62]	0.13* [1.94]	0.034 [1.52]	0.007 [0.28]	0.089 [2.99]	62.651*** [5.40]	56.540*** [3.29]	70.423*** [4.08]
Incremental impact of SCTP on FISP	0.109 [1.5]	0.24** [2.27]	-0.016 [-0.16]	-0.034 [-0.94]	-0.011 [-0.39]	-0.031 [-0.56]	15.837 [0.78]	15.002 [0.70]	21.629 [0.97]
Complementarity	0.069 [0.82]	0.20* [1.77]	-0.045 [-0.36]	-0.033 [-0.94]	-0.007 [-0.22]	-0.023 [-0.4]	-2.93 [-0.19]	-4.639 [-0.25]	9.386 [0.43]
R2	0.1434	0.1090	0.2129	0.1900	0.0889	0.2600	0.3265	0.3224	0.3680
Grandnut production									
SCTP*d2014	0.061* [1.84]	0.075 [1.68]	0.05 [1.33]	0.090* [1.86]	0.089 [1.44]	0.088 [1.54]	7.954** [2.23]	8.654 [1.68]	7.076* [2.01]
FISP*d2014	0.068*** [3.36]	0.077** [2.65]	0.064* [1.94]	0.082*** [4.04]	0.096** [2.42]	0.082** [2.37]	7.861** [2.33]	6.145 [1.25]	9.508** [2.16]
Joint impact SCT&FISP	0.074** [2.07]	0.115** [2.59]	0.015 [0.38]	0.105** [2.14]	0.105* [1.74]	0.100* [1.99]	9.038** [2.38]	9.372** [2.19]	8.112** [2.21]
Incremental impact of FISP on SCTP	0.013 [0.44]	0.040 [1.2]	-0.035 [-0.84]	0.015 [0.34]	0.017 [0.31]	0.012 [0.19]	1.084 [0.47]	0.718 [0.27]	1.035 [0.24]
Incremental impact of SCTP on FISP	0.006 [0.15]	0.038 [0.81]	-0.050 [-0.94]	0.022 [0.45]	0.009 [0.14]	0.018 [0.3]	1.177 [0.25]	3.227 [0.60]	-1.397 [-0.25]
Complementarity	-0.055 [-1.5]	-0.037 [-0.82]	-0.01* [-1.82]	-0.067 [-1.43]	-0.079 [-1.2]	-0.069 [-0.95]	-6.777 [-1.63]	-5.428 [-0.98]	-8.472 [-1.39]
R2	0.1003	0.1372	0.0983	0.1159	0.1567	0.1027	0.1243	0.1791	0.1028
Pigeon pea production									

SCTP*d2014	0.003 [0.07]	0.048 [1.02]	-0.079 [-1.57]	0.016 [0.30]	0.102** [2.05]	-0.109 [-1.57]	1.506 [0.85]	2.648 [1.25]	-0.09 [-0.06]
FISP*d2014	0.071* [1.92]	0.092** [2.23]	0.029 [0.53]	0.094** [2.23]	0.095** [2.33]	0.071 [1.18]	3.706*** [2.85]	3.916** [2.43]	3.039** [2.31]
Joint impact SCT&FISP	-0.004 [-0.10]	0.01 [0.13]	-0.032 [-0.69]	0.001 [0.01]	0.027 [0.49]	-0.035 [-0.64]	1.929 [1.30]	1.405 [0.82]	2.28 [1.13]
Incremental impact of FISP on SCTP	-0.007 [-0.34]	-0.039 [-0.76]	0.047 [1.3]	-0.015 [-0.86]	-0.074** [-2.49]	0.074 [2.16]	0.424 [0.41]	-1.243 [-0.76]	2.37 [1.40]
Incremental impact of SCTP on FISP	-0.075 [-1.33]	-0.082 [-0.94]	-0.060 [-1.02]	-0.094 [-1.56]	-0.067 [-1.04]	-0.105 [-1.58]	-1.776 [-0.97]	-2.511 [-1.15]	-0.759 [-0.34]
Complementarity	-0.078* [-1.74]	-0.13* [-1.75]	0.019 [0.28]	-0.110** [-2.48]	-0.169*** [-3.18]	0.004 [0.05]	-3.282** [-2.14]	-5.159** [-2.40]	-0.669 [-0.32]
R2	0.2037	0.2482	0.1955	0.2751	0.3295	0.2662	0.1869	0.2422	0.1574
Nkhwani production									
SCTP*d2014	-0.034 [-1.07]	-0.059 [-1.19]	-0.019 [-0.54]	-0.086* [-1.89]	-0.122* [-1.95]	-0.069 [-1.52]	-0.954 [-0.66]	-2.396 [-1.28]	0.366 [0.25]
FISP*d2014	0.012 [0.33]	-0.032 [-0.62]	0.061 [1.63]	0.001 [0.03]	-0.043 [-0.86]	0.06 [1.06]	1.849 [1.45]	0.339 [0.19]	3.651*** [2.81]
Joint impact SCT&FISP	-0.009 [-0.22]	-0.055 [-1.03]	0.035 [0.87]	-0.07 [-1.28]	-0.104 [-1.39]	-0.057 [-1.36]	-0.3 [-0.19]	-2.457 [-1.26]	1.856 [1.19]
Incremental impact of FISP on SCTP	0.026 [1.16]	0.004 [0.18]	0.054 [1.34]	0.015 [0.57]	0.018 [0.42]	0.012 [0.38]	0.653 [0.90]	-0.061 [-0.09]	1.489 [1.14]
Incremental impact of SCTP on FISP	-0.021 [-0.48]	-0.024 [-0.47]	-0.026 [-0.51]	-0.072 [-1.28]	-0.061 [-0.86]	-0.117* [-1.77]	-2.149 [-1.44]	-2.796 [-1.53]	-1.795 [-0.96]
Complementarity	0.01 [0.3]	0.036 [0.67]	-0.007 [-0.13]	0.014 [0.26]	0.061 [0.95]	-0.048 [0.69]	-1.195 [-0.79]	-0.399 [-0.22]	-2.162 [-1.16]
R2	0.1436	0.1385	0.1984	0.1154	0.1116	0.1851	0.1294	0.1153	0.1918
Rice production									
SCTP*d2014	-0.017 [-0.66]	-0.008 [-0.21]	-0.037 [-1.45]	-0.034 [-0.80]	-0.025 [-0.45]	-0.045 [-1.07]	-2.551 [-0.86]	-1.567 [-0.45]	-2.568 [-0.80]
FISP*d2014	0.015 [0.54]	0.005 [0.17]	0.015 [0.57]	0.01 [0.33]	0.011 [0.34]	0.003 [0.08]	-0.451 [-0.20]	-1.754 [-0.89]	0.294 [0.13]
Joint impact SCT&FISP	-0.018 [-0.67]	-0.031 [-0.97]	0.004 [0.16]	-0.038 [-0.94]	-0.061 [-1.22]	0.004 [0.10]	-4.577 [-1.54]	-5.850* [-1.91]	-1.894 [-0.67]
Incremental impact of FISP on SCTP	0.000	-0.024	0.041*	-0.004	-0.035	0.049	-2.026	-4.283	0.674

	[-0.01]	[-0.5]	[1.75]	[-0.11]	[-0.65]	[1.32]	[-0.87]	[-1.39]	[0.34]
Incremental impact of SCTP on FISP	-0.032	-0.036	-0.011	-0.049	-0.072	0.001	-4.126	-4.096	-2.188
	[-0.93]	[-0.8]	[-0.36]	[-1.18]	[-1.27]	[0.02]	[-1.03]	[-1.04]	[-0.61]
Complementarity	-0.015	-0.028	0.025	-0.015	-0.047	0.045	-1.575	-2.529	0.38
	[-0.36]	[-0.53]	[0.67]	[-0.3]	[-0.75]	[0.77]	[-0.53]	[-0.77]	[0.14]
R2	0.1016	0.1064	0.1663	0.1023	0.1075	0.1422	0.0765	0.0685	0.1796
Observations	3,214	1,806	1,408	3,214	1,806	1,408	3,214	1,806	1,408

Notes: 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:	% HH that use:			Quantity		
	All	Labor unconstrained	Labor constrained	All	Labor unconstrained	Labor constrained
Chemical fertilizers						
SCTP*d2014	0.058 [0.85]	-0.004 [-0.04]	0.096 [1.01]	2.378 [0.99]	1.171 [0.34]	2.305 [0.65]
FISP*d2014	0.472*** [7.95]	0.354*** [3.55]	0.562*** [13.88]	21.638*** [7.80]	15.819*** [3.57]	26.205*** [7.93]
Joint impact SCT&FISP	0.338*** [5.03]	0.284*** [3.78]	0.435*** [4.17]	21.952*** [7.46]	21.792*** [6.20]	22.380*** [4.96]
Incremental impact of FISP on SCTP	0.279*** [4.04]	0.288** [2.97]	0.339** [2.82]	19.574*** [5.49]	20.621*** [4.08]	20.075*** [3.8]
Incremental impact of SCTP on FISP	-0.134** [-2.12]	-0.07 [-0.89]	-0.127 [-1.26]	0.314 [0.10]	5.972 [1.51]	-3.825 [-0.9]
Complementarity	-0.192** [-2.09]	-0.066 [-0.49]	-0.223* [-1.75]	-2.063 [-0.47]	4.802 [0.77]	-6.13 [-1]
R2	0.2783	0.2901	0.3149	0.2284	0.2397	0.2917
Organic fertilizers						
				Value (MWK real values)		
SCTP*d2014	0.046 [0.64]	-0.009 [-0.09]	0.122 [1.50]	213.131* [1.92]	207.302 [1.38]	208.637* [1.79]
FISP*d2014	-0.082 [-1.35]	-0.072 [-0.85]	-0.083 [-1.46]	-201.953** [-2.65]	-178.551* [-1.81]	-221.040*** [-2.81]
Joint impact SCT&FISP	-0.069 [-0.75]	-0.158 [-1.32]	0.077 [0.94]	114.853 [0.93]	91.057 [0.56]	162.463 [1.39]
Incremental impact of FISP on SCTP	-0.115 [-1.81]	-0.149 [-1.36]	-0.045 [-0.70]	-98.278 [-1.04]	-116.246 [0.65]	-46.175 [-0.63]
Incremental impact of SCTP on FISP	0.013 [0.16]	-0.086 [-0.81]	0.160* [1.86]	316.806*** [2.94]	269.607** [1.96]	383.503*** [3.38]
Complementarity	-0.033 [-0.36]	-0.077 [-0.53]	0.038 [0.46]	103.675 [0.86]	62.305 [0.31]	174.866* [1.77]
R2	0.0993	0.0885	0.1431	0.1032	0.0894	0.1640
Pesticides						
SCTP*d2014	-0.004 [-0.25]	-0.02 [-0.74]	0.012 [0.95]			
FISP*d2014	-0.01 [-0.74]	-0.023 [-1.16]	0.001 [0.06]			
Joint impact SCT&FISP	0.031 [1.60]	-0.004 [-0.15]	0.062** [2.68]			
Incremental impact of FISP on SCTP	0.035** [2.39]	0.015 [0.54]	0.051* [1.94]			
Incremental impact of SCTP on FISP	0.041** [2.46]	0.019 [0.77]	0.062** [2.33]			
Complementarity	0.045** [2.36]	0.039 [1.21]	0.05 [1.61]			
R2	0.0780	0.1352	0.084			
Improved or hybrid seeds						

SCTP*d2014	0.05 [1.04]	-0.021 [-0.36]	0.118* [1.67]
FISP*d2014	0.125*** [3.32]	0.121* [1.96]	0.136* [1.98]
Joint impact SCT&FISP	0.115 [1.49]	0.087 [1.01]	0.171* [1.93]
Incremental impact of FISP on SCTP	0.065 [0.83]	0.108 [1.13]	0.053 [0.76]
Incremental impact of SCTP on FISP	-0.01 [-0.11]	-0.034 [-0.31]	0.035 [0.37]
Complementarity	-0.06 [-0.67]	-0.013 [-0.11]	-0.083 [-0.82]
R2	0.1668	0.1537	0.2182
Observations	3,214	1,806	1,408

Notes: 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 – MWK real values

	Expenses			Sales		
	All	Labor unconstrained	Labor constrained	All	Labor unconstrained	Labor constrained
SCTP*d2014	1172.647*** [5.95]	1395.706*** [6.07]	761.950*** [2.83]	-78.668 [-0.54]	-44.992 [-0.18]	-247.801 [-1.23]
FISP*d2014	232.985*** [2.96]	493.282*** [3.66]	32.287 [0.28]	57.964 [0.37]	231.508 [0.76]	62.384 [0.27]
Joint impact SCT&FISP	1688.574*** [5.89]	1478.082*** [3.92]	1997.143*** [6.19]	395.800* [1.98]	383.684 [1.05]	335.607 [1.06]
Incremental impact of FISP on SCTP	515.926* [1.82]	82.3756 [0.2]	1235.193*** [4.68]	474.468** [2.03]	428.676 [1.08]	583.408 [1.57]
Incremental impact of SCTP on FISP	1455.59*** [5.04]	984.800** [2.52]	1964.855*** [5.33]	337.836* [1.7]	152.176 [0.5]	273.224 [0.8]
Complementarity	282.941 [0.99]	-410.906 [-0.94]	1202.906*** [3.83]	416.505 [1.50]	197.167 [0.43]	521.024 [1.17]
R2	0.1879	0.1887	0.2714	0.0528	0.0677	0.1323
Observations	3,214	1,806	1,408	3,214	1,806	1,408

Notes: Exchange rate in 2013: 1 USD = 329.4768 MWK. 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	Labor unconstrained	Labor constrained	All	Labor unconstrained	Labor constrained
Chicken						
SCTP*d2014	0.196*** [3.81]	0.150*** [2.77]	0.236*** [3.20]	0.931*** [3.03]	0.698** [2.62]	1.365*** [3.04]
FISP*d2014	0.103*** [2.80]	0.134** [2.29]	0.029 [0.77]	0.276* [1.96]	0.408 [1.34]	-0.067 [-0.31]
Joint impact SCT&FISP	0.244*** [4.31]	0.230*** [4.54]	0.263** [2.72]	1.677*** [3.90]	1.511*** [4.19]	1.828*** [3.03]
Incremental impact of FISP on SCTP	0.047** [2.32]	0.080* [1.81]	0.027 [0.46]	0.746* [1.90]	0.814** [2.68]	0.463 [0.98]
Incremental impact of SCTP on FISP	0.141** [2.56]	0.095 [1.43]	0.234** [2.13]	1.400*** [3.29]	1.104** [2.39]	1.894** [2.85]
Complementarity	-0.055 [-1.35]	-0.054 [-0.71]	-0.002 [-0.03]	0.469 [1.20]	0.406 [1.06]	0.529 [1.08]
R2	0.1052	0.1093	0.1487	0.0859	0.1062	0.1396
Goats and sheep						
SCTP*d2014	0.108*** [3.99]	0.114*** [2.99]	0.075* [1.91]	0.145 [1.36]	0.263* [1.84]	0.03 [0.35]
FISP*d2014	0.062* [2.01]	0.099 [1.53]	0.025 [0.59]	0.145 [1.30]	0.294 [1.46]	0.021 [0.19]
Joint impact SCT&FISP	0.238*** [5.79]	0.185*** [3.75]	0.300*** [5.93]	0.694*** [3.93]	0.758*** [2.99]	0.452*** [4.18]
Incremental impact of FISP on SCTP	0.131*** [4.31]	0.071 [1.44]	0.226*** [6.35]	0.549** [2.96]	0.495** [2.15]	0.422*** [4.87]
Incremental impact of SCTP on FISP	0.176*** [3.70]	0.086 [1.24]	0.276*** [4.48]	0.549** [2.89]	0.464* [1.73]	0.431*** [3.60]
Complementarity	0.069* [1.71]	-0.028 [-0.34]	0.201*** [3.44]	0.404* [1.86]	0.201 [0.68]	0.401** [2.91]
R2	0.1287	0.1276	0.2256	0.0829	0.1126	0.1382
Pigeons, doves or ducks						
SCTP*d2014	0.007 [0.48]	0.006 [0.37]	0.001 [0.06]	0.136* [1.71]	0.263** [2.33]	-0.083 [-0.83]
FISP*d2014	-0.005 [-0.38]	-0.006 [-0.27]	-0.006 [-0.34]	0.065 [1.21]	0.143 [1.20]	-0.045 [-0.63]
Joint impact SCT&FISP	0.060** [2.55]	0.064* [1.84]	0.052* [1.71]	0.280** [2.74]	0.336** [2.09]	0.238* [1.80]
Incremental impact of FISP on SCTP	0.053* [1.91]	0.058* [1.7]	0.051 [1.28]	0.144 [1.15]	0.072 [0.45]	0.320* [1.67]
Incremental impact of SCTP on FISP	0.064** [2.65]	0.070* [1.9]	0.057* [1.7]	0.215** [2.12]	0.192 [1.32]	0.283* [1.81]
Complementarity	0.057* [1.89]	0.064 [1.5]	0.056 [1.31]	0.079 [0.58]	-0.071 [-0.38]	0.365* [1.73]
R2	0.0386	0.0442	0.0801	0.0241	0.0309	0.0707
Observations	3,214	1,806	1,408	3,214	1,806	1,408

Notes: 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.