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Local Economy-wide Impact Evaluation (LEWIE) of Malawi's Social Cash Transfer (SCT) Programme

PtoP from PROTECTION to PRODUCTION

Local Economy-wide Impact Evaluation (LEWIE) of Malawi's Social Cash Transfer (SCT) Programme

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The programme is also part of a larger effort, the Transfer Project, together with UNICEF, Save the Children and the University of North Carolina, to support the implementation of impact evaluations of cash transfer programmes in sub-Saharan Africa.



For more information, please visit PtoP website: http://www.fao.org/economic/ptop

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Abstract

The Government of Malawi's (GoM's) Social Cash Transfer (SCT) Programme is an unconditional cash transfer programme targeted to ultra-poor, labor constrained households. The objectives of the programme include reducing poverty and hunger in vulnerable households and increasing school enrolment. The programme began as a pilot in Mchinji district in 2006. Since 2009, the programme has expanded to reach an additional eight districts (Chitipa, Likoma, Machinga, Mangochi, Phalombe, Salima, Thyolo and Balaka) out of 28 total districts in Malawi. The programme has gone to full scale in Mchinji, Chitipa and Likoma and by 2012, had reached nearly 30,000 households and approximately 103 000 individuals.

The SCT provides a significant infusion of cash into Malawi's rural economy. When beneficiaries spend the cash transfer, they transmit the impact to others inside and outside the local economy, creating benefits for non-recipient households as well, who often provide the goods and services purchased by beneficiary households. The impact on the local economy was simulated using a LEWIE (Local Economy Wide Impact Evaluation) model.

This study finds that the Malawi SCT generates a total income multiplier of 1.25 in nominal terms. Each Mk of transfer generates an additional Mk 0.25 of total income gain within the programme area.

That is, each Mk of transfer generates an additional Mk 0.25 of total income gain within the project area. In addition, it creates a gain of Mk 0.68 for trading centres directly, because households spend a large share of their incomes there, and indirectly, because retail, service and other production activities taking place in the Village Cluster buy a large share of their inputs there.

The SCT programme has significant production impacts. The transfers stimulate the production of crops by Mk 0.31 and livestock by Mk 0.14 per Mk transferred. The largest effect is on the retail sector, where sales increase by Mk 0.60 per Mk transferred to eligible households. Most of this extra income accrues to non-beneficiary households, who are better off and tend to own more of the local businesses.

Acknowledgments

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List of Acronyms

CI	(see Table 5 on page 16)
CPI	current price index
FAO	Food and Agriculture Organization of the United Nations
FD	factor demands
FISP	Fertilizer Input Subsidy Programme
GAMS	General Algebraic Modelling System
HH	household
LEWIE	Local Economy-wide Impact Evaluation
Mk	Malawian kwacha
MoGCSW	Ministry of Gender, Children and Social Welfare
PtoP	From Protection to Production
SAM	Social Accounting Matrix
SCT	Social Cash Transfer
TA	traditional authority
UNICEF	United Nations Children's Fund
USD	United States dollar
VC	village cluster
ZOI	zone of influence

Executive summary

The programme

The Malawi Social Cash Transfer (SCT) is an unconditional cash transfer to households that are unable to meet urgent consumptions need and households without members fit-to-work. The objective of the programme is to reach the poorest ten percent of households in Malawi. The size of the SCT varies from Mk 1 000 to Mk 2 400 a month, depending on the household size. Households also receive an extra Mk 300 per month for each child attending elementary school and Mk 600 a month for each child attending secondary school. The eligible households interviewed for this evaluation received on average Mk 1 940 (5.88 USD) per month, or Mk 23 100 annually. This represents, on average, 17 percent of the consumption of eligible households which is a little below the levels of similar programmes in sub-Saharan Africa.

The SCT pilot began in 2006 in the Mchinji district. Since 2009, the SCT has expanded to include a total of 8 out of 28 districts in Malawi (Balaka, Chitipa, Likoma, Machinga, Mangochi, Mchinji, Phalombe and Salima), reaching about 30 000 households. Within these districts, the SCT is currently at scale in Chitipa, Likoma and Mchinji. This programme evaluation focuses on the SCT scale-up in the Mangochi and Salima districts.

The SCT transfers inject new cash into local economies. Viewed from a local economy-wide perspective, the beneficiary households are a conduit through which cash is channelled into the local economy. As these households spend their cash, the impacts of the transfer spread from the beneficiary households to others inside and outside of the treated village clusters (VCs). Doorstep trade and purchases in village stores, in markets and outside the village potentially set in motion income multipliers within the treated VCs. In Malawi, considerable impacts are seen outside of the treated VCs, due to household spending in periodic markets. Periodic markets diffuse the SCT income multipliers across a larger geographic area, beyond what was covered by the surveys used to conduct this evaluation.

The LEWIE (local economy-wide impact evaluation) methodology is designed to examine the full impact of cash transfers on local economies, including on the production activities of both beneficiary and non-beneficiary households, as well as how these effects change when programmes are scaled up to larger regions and why these effects happen. All of these aspects are important for designing projects and explaining their likely impacts to governments and other sponsoring agencies.

The Malawi SCT LEWIE Model

The Malawi SCT LEWIE models representative household economies and interactions between eligible and ineligible households within the 14 programme VCs in Mangochi and Salima districts. The household models describe each group's production activities, income sources and expenditure patterns. In a typical model households participate in activities such as crop and livestock production, retail, service provision and other activities, as well as in the labour market. These activities, as well as household expenditures, are modelled using data from household surveys.

Household groups in a given village are linked through local trade, and villages are linked through regional trade. The entire programme region interacts with the rest of the country, importing and exporting goods and selling labour. Interactions among households within the programme area, and between the programme area and the rest of the economy, are modelled

using the survey data. The parameters in the LEWIE model are estimated econometrically. Sensitivity analysis, combined with Monte Carlo methods, allows one to test the robustness of simulated impacts for errors in parameter estimates and model assumptions.

The LEWIE simulations assume that locally grown crops, livestock, retail and other services, including labour, were traded locally. Given high transaction costs with the rest of the country and abroad, it is reasonable to assume that the prices of the goods produced were determined in local markets. A nearly perfectly elastic labour supply (η=100) was assumed, which reflects excess labour supply in rural Malawi. This can be expected to lower inflationary pressures by limiting wage increases. Increases in labour demand raise employment but not wages. Inflationary pressures are not entirely removed, however, because land and capital constraints continue to limit the local supply response to some extent.

Results

The SCT generates a total income multiplier of 1.25 in nominal terms with a confidence interval of 1.22 to 1.28. That is, each Mk of transfer generates an additional Mk 0.25 of total income gain, or spillover, within the project area. In addition, it creates a gain of Mk 0.68 for trading centres directly, because households spend a large share of their incomes there, and indirectly, because VC retail, service and other production activities buy a large share of their inputs there.

The SCT programme has significant production impacts. The transfers stimulate the production of crops by Mk 0.31 and livestock by Mk 0.14 per Mk transferred. The largest effect is on the retail sector, where sales increase by Mk 0.60 per Mk transferred to eligible households.

Liquidity constraints appear to have little impact on our simulation results. This is because of the eligibility criteria for the SCT programme, which targets the poorest of the poor in terms of income, assets and labour availability. For these households, the lack of capital, land and labour represents far more of a constraint than the lack of liquidity to buy inputs.

The structure of maize markets, on the other hand, has a comparatively large influence on the SCT multipliers. The SCT increases the beneficiary households' demand for food, including maize. Findings show that, when the maize market is local instead of integrated, each Mk of SCT stimulates maize production by Mk 0.12. The local income multiplier rises from 1.27 to 1.59 in nominal terms, and higher income stimulates other local activities, as well. The local retail multiplier jumps from 0.72 to 0.91. The impact on trading centres rises from 0.69 to 0.87. Nevertheless, consumers pay the price (literally), because food costs increase; for this reason, the real-income multiplier rises from 1.18 to 1.28, less than the increase in nominal income.

Finally, the LEWIE simulations show that the distribution of benefits across household groups—beneficiary and non-beneficiary—in the SCT-treated communities is shaped by the types of commodities purchased, the relative proportion of beneficiaries in the local population and the structure of local markets. Much of the production and income spillovers created by the SCT are found in the ineligible households. Overall, these findings reveal that the SCT programme treats not only the beneficiary households but also the economies in which they participate, with significant benefits for non-beneficiary households, as well.

1. Introduction

The Malawi Social Cash Transfer (SCT) is an unconditional cash transfer to ultra-poor and labour-constrained households.[1] The objective of the programme is to reach the poorest ten percent of households in Malawi. The size of the SCT varies from Mk 1 000 to Mk 2 400 a month, depending on the household size. Households also receive an extra Mk 300 per month for each child attending elementary school and Mk 600 a month for each child attending secondary school. The eligible households interviewed for this evaluation received on average Mk 1 940 (5.88 USD) per month, or Mk 23 100 annually.[2] This represents, on average, 17 percent of the consumption of eligible households (Abdoulayi *et al*., 2014), which is a little below the levels of similar programmes in sub-Saharan Africa.

The SCT pilot began in 2006 in the Mchinji district. Since 2009, the SCT has expanded to include a total of 8 out of 28 districts in Malawi (Balaka, Chitipa, Likoma, Machinga, Mangochi, Mchinji, Phalombe and Salima), reaching about 30 000 households. Within these districts, the SCT is currently at scale in Chitipa, Likoma and Mchinji. This programme evaluation focuses on the SCT scale-up in the Mangochi and Salima districts.

The SCT transfers inject new cash into local economies. Viewed from a local economy-wide perspective, the beneficiary households are a conduit through which cash is channelled into the local economy. As these households spend their cash, the impacts of the transfer spread from the beneficiary households to others inside and outside of the treated village clusters (VCs). Doorstep trade and purchases in village stores, in markets and outside the village potentially set in motion income multipliers within the treated VCs. In Malawi, considerable impacts are seen outside of the treated VCs, due to household spending in periodic markets. Periodic markets diffuse the SCT income multipliers across a larger geographic area, beyond what was covered by the surveys used to conduct this evaluation.

The LEWIE (local economy-wide impact evaluation) methodology is designed to examine the full impact of cash transfers on local economies, including on the production activities of both beneficiary and non-beneficiary households, as well as how these effects change when programmes are scaled up to larger regions and why these effects happen. All of these aspects are important for designing projects and explaining their likely impacts to governments and other sponsoring agencies.

The LEWIE model is one component of the mixed method impact evaluation of the SCT programme led by the University of North Carolina and the Centre for Social Research of the University of Malawi, with the support of The Transfer Project. Construction of the model stems from an ongoing collaboration between the United Nations Children's Fund (UNICEF) and the Food and Agriculture Organization of the United Nations (FAO) as part of the From Protection to Production (PtoP) project, which is studying the impact of cash transfers in seven countries in sub-Saharan Africa using a mixed method approach that combines econometric analysis, LEWIE models and qualitative methods. The research project seeks to uncover the potential productive and economic impacts of cash transfers on beneficiary

[1] Ultra-poor households are unable to meet urgent consumption needs. Labour-constrained households have no members fit-to-work, or have a dependency ratio of greater than 3, where members fit-to-work are those between 18 and 64 years old with no chronic illness or disability.

[2] The exchange rate used was Mk 330/USD, corresponding to the summer of 2013.

households and on the communities and local economies in which they live and work. The PtoP project aims to provide insight on how social protection interventions can contribute to sustainable poverty reduction and economic growth at the household and community levels.[3]

2. Evaluation Design

The impact evaluation of the SCT uses a mixed method approach, including a quantitative assessment of impact based on an experimental design, a local economy-wide simulation approach and qualitative methods.

Quantitative assessment of impact

The quantitative assessment of impact will be carried out *ex post*, after completion of the baseline and follow-up household surveys. It will assess the impacts of SCT transfers by comparing households in the treated VCs with those in the comparison clusters. Randomization of SCT treatment ensures that the treated and control households are similar except for the treatment.

Experiments are mostly used to estimate average effects of the treatment on the treated households. However, the baseline and follow-on surveys also gather information on ineligible households in both the treated and non-treated VCs. This opens up the possibility of testing for impacts, or spillover effects, on ineligible as well as treated households. The impact evaluation design can be used to test whether the SCT affects ineligible households by comparing changes in outcomes between ineligible households in treated and control clusters.

Experimental methods do not necessarily reveal why a programme like the SCT has the effect that it does, only whether there is an effect. In economics parlance, they are a "reduced-form" rather than a "structural" approach to project impact evaluation. Experimental analysis requires data from follow-on surveys; thus, it cannot be conducted *ex ante*.

Local Economy-wide Impact Evaluation (LEWIE)

The second component of the evaluation is designed to complement the quantitative assessment of impact and address the limitations outlined above. LEWIE simulation methods can be used to assess the likely impacts of the SCT on the treated VCs, including on ineligible households. The basic idea behind LEWIE is that by treating the beneficiary households, the SCT programme also treats the local economy. We can think of the beneficiary households as the conduit through which new cash enters the local economy. As this cash circulates within VCs, it may create benefits for non-beneficiary households there as well.

The LEWIE analysis can help us understand the mechanisms by which project impacts are transmitted within the treated VCs. It can be carried out *ex ante*, using baseline survey data. *Ex post* experimental analysis and LEWIE can complement and inform one another, making it possible to achieve a more comprehensive evaluation of project impacts than is possible using either method alone.

[3] www.fao.org/economic/ptop/en/.

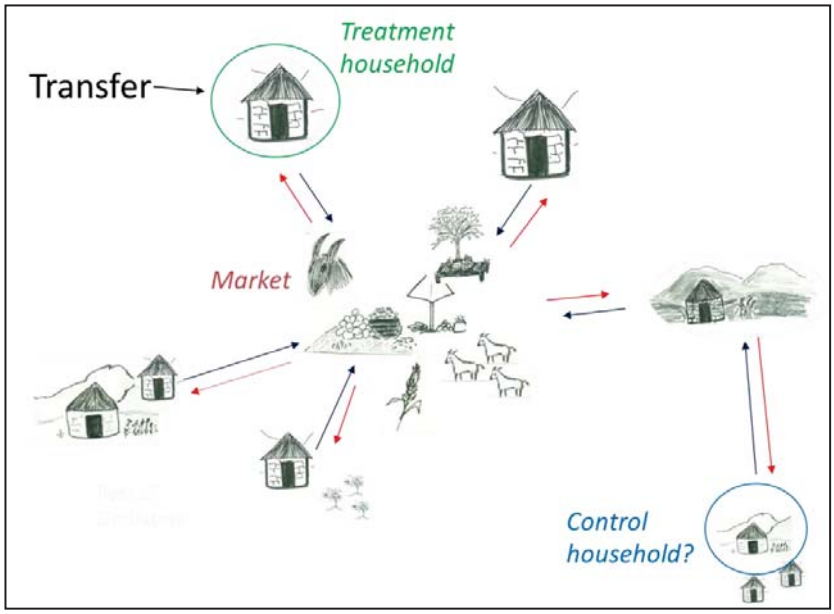
This paper reports preliminary findings from our baseline LEWIE simulations. It begins by describing how the programme's impacts may be transmitted through the economy, followed by an explanation of the LEWIE modelling approach, data, findings and implications for programme design.

2.1. Treatment Effects in a General Equilibrium Setting[4]

Figure 1 illustrates how local markets transmit the impacts of cash transfers from treated to non-treated households. The red arrows in this Figure represent goods and services, the blue arrows represent cash. The household in the upper left corner of the Figure is the treatment household. It receives the cash transfer and then spends it in markets in which other households, including those ineligible for the transfer, also transact. The baseline survey revealed that the market might be a large trading centre, or it could be a very simple village market—or even informal trade with neighbours ("doorstep trade").

Households that sell goods or services to the treated household see their incomes rise; in this way, they also become treated by the transfer. They, in turn, treat other households through their spending. If neighbouring villages participate in this market, the transfer will treat them indirectly, as well. If researchers are not careful, control households may participate in this (or a related) market, resulting in contamination of the control group.

Figure 1 **Illustration of how the impacts of cash transfers are transmitted from treatment to non-treatment (and possibly control) households through markets.**



Source: Taylor and Filipski (2014).

A LEWIE model to quantify the local economy-wide impact of the SCT programme captures the linkages that transmit impacts from treated to non-treated households. While the experimental component of the SCT evaluation focuses on the actors, especially the households receiving transfers, LEWIE pays particular attention to the arrows connecting

[4] This section draws heavily from Chapter 2 of Taylor and Filipski (2014).

them in this diagram. With a good model of how local economies work, we can simulate the effects of the transfer programme on both treated and non-treated households, as well as the total impact on the project-area economy. For example, we can determine the potential local income multiplier of each dollar transferred to a treatment household in the SCT programme.

2.2. The Evaluation Design

The evaluation was randomized at the VC level. The VC contains households eligible and ineligible for the SCT. The selection of the evaluation sample of households began by choosing two traditional authorities (TAs) in each of the two districts: Mbwana Nyanbi and Jalasi (Mangochi district) and Ndidi and Maganga (Salima district

Targeting was done through the TAs. First, community-based targeting generated a list of eligible households at the VC level. Then the beneficiary households were selected from this list. The intention is that around ten percent of the population will be beneficiaries of the SCT, which means there will be around 90-100 beneficiary households in each VC. In all, 29 VCs are included in the household evaluation survey. Fourteen of them were treated after the baseline survey; the rest will enter the programme in two years.

The Malawi SCT LEWIE models representative household economies and interactions between eligible (Group A) and ineligible (Group B) households within the 14 programme VCs in Mangochi and Salima districts. Assuming that the experimental design is valid, interactions across the programme VCs and the control VCs should be minimal to nil; however, there may be significant interactions between the eligible and ineligible households within VCs. Table 1 summarizes all of the household groups included in the baseline survey. Our LEWIE analysis focuses on the treated VCs, which consist of household groups A and B.

Table 1 **Household Group in the LEWIE**

		Household Type	
		Eligible	Ineligible
VC Type	Beneficiary	A	B
	Non-Beneficiary	C	D

For purposes of the evaluation we define the zone of influence (ZOI) of the SCT programme as the treated VCs. The ZOI is the area across which spillovers occur and programme benefits can be measured using the LEWIE methodology.

Sample Size and Selection of Ineligible Households

Table 2 reports the sample size for each household group. In Salima all eligible households were surveyed, while eligible households were randomly selected in Mangochi (for an in-depth description of eligible household, VC and TA selection, see Abdoulayi *et al*. 2014).

Table 2 Number of Households Surveyed by Group

VC Type	Household type	
	Eligible	Ineligible
Treated	1677	386
Control	1853	435

Additionally, 821 randomly selected ineligible households were surveyed. While complete lists of eligible households were available, the most recent complete census including ineligible households was conducted in 2008. We began with the census lists of all households by census enumeration area in the selected TAs. The VC boundaries used by the Ministry of Gender, Children and Social Welfare (MoGCSW) do not map exactly to the enumeration areas, so villages in each enumeration area were mapped to a VC directly by the MoGCSW; thus our ineligible sample was restricted to households in VCs in the evaluation area. In each village, the chief or programme administrator eliminated eligible households from the census list. We then surveyed a random selection of the remaining households.

Ideally, we would like to have a representative sample of ineligible households. The fact that our data on ineligible households come from a slightly earlier survey raises some concerns about potential biases, particularly with regard to migration. However, it is not clear what the direction of these biases might be, and it is unlikely that migration was on a scale large enough to change the parameters we estimate to describe the average economic behaviour of all ineligible households in the study area. Thus, we believe that it is safe to consider the households selected from the 2008 census list as representative of the ineligible households in the study area.

3. The LEWIE Structure

The model structure is based on the principal economic activities in which the households participate, the households' income sources, and the goods and services on which households spend their income. Table 3 summarizes and defines each of the accounts in our model. They include seven production activities and the corresponding commodities which they produce, and ten factors, including three types of labour (family, hired, and *ganyu*), each disaggregated by gender. The three different labour factors have different prices (wages) in our model and households can choose which labour markets to participate in. We do not explicitly model seasonality in agricultural production, which would be most obvious in the labour intensity of different activities (e.g. harvest versus post-harvest periods).[5] Agricultural activities are disaggregated into maize and other crops. Maize is the dominant crop in the study area and is also targeted by other social programmes in Malawi (most importantly the FISP).

[5] Seasonal agricultural labour use data are available, but no other seasonal information is available on labour, incomes or expenditures. This model is representative of average labour use across the year.

Table 3 Accounts in the Malawi SCT LEWIE

Activities	
Crop	Crops
Maize	Maize
Live	Livestock production
Fish	Fishing (for sale)
Ret	Retail
Serv	Services
Prod	Other production activities
Commodities	
Crop	Crops
Maize	Maize
Live	Livestock products
Fish	Fish
Retail	Retail
Serv	Services
Prod	Other locally-produced goods
Outside	Produced outside the programme area
Factors	
HLF, HLM	Hired labour (Female and Male)
GLF, GLM	*Ganyu* labour (Female and Male)
FLF, FLM	Family labour (Female and Male)
Herd	Herd (livestock)
Inv	Inventory
Land	Land
K	Capital/Physical Assets

The LEWIE also includes a fishing activity. Despite the proximity to Lake Malawi, very few eligible households participate in fishing (see Baseline Report); however, fishing is an important activity for some of the ineligible households, who are generally better-off and have access to more labour. While only 1.3% of the ineligible households participated in fishing, the mean annual income from fishing for these households is greater than income for all other household activities combined.

The households in the study area may purchase goods locally or through shared rotating markets and traders. Thus, in addition to the locally produced goods (i.e. produced within the VC), there is an "outside" commodity, comprising all goods produced outside the VC.

In Malawi, there is a strong culture of trading centres and individual roving traders. According to the household and business surveys, we know that these are an important source of purchased items in the area.

While we have good information about the location and sources of purchases by households and businesses, we don't know as much about the identity of the businesses themselves. The businesses contacted in the business survey were not randomly selected and thus are not

representative of the composition of businesses in the programme area.[6] We used the expenditures in the ZOI and household incomes from each activity to determine the size of each production sector in each VC.

However, we cannot be sure where the owners of the businesses at the trading centres or the itinerant traders reside (in the same VC, a nearby VC or elsewhere in Malawi). Table 4 shows that trading centres and itinerant trading are indeed an important source of revenue for local businesses. If this is the case, then these markets would incorporate spillovers from the SCT programme, both among households in the same VC and among the different VCs that share the same trading centre.

Table 4 Location of Sales for Businesses in the Business Survey

Location	Business Type		
	Retail	Service	Production
VC	15.3%	11.7%	7.9%
Trading Centres*	78.4%	68.8%	70.2%
Outside Area	6.3%	19.5%	21.9%

* includes traders

In order to appropriately model the shared market location we would have to know what share of business owners reside in which VC and which ones reside outside of the area (for example, in Lilongwe).

As it stands, the shared markets are represented by the outside commodity, which means they are modelled as a location of spillover effects outside of the programme area. However, it may be that as recipients of the SCT spend cash in the trading centres, some of that money flows back into the treated communities, either via the factor market (e.g. labour), or through purchases by those businesses of locally produced goods and agricultural products. If this is the case, SCT multipliers may be higher than what we estimate. Our multiplier estimates thus serve as a lower boundary on the potential spillover impact across the programme area. The larger the share of businesses in the trading centres that are owned within the VC, the more our LEWIE will understate the VC multiplier effect of cash transfers.

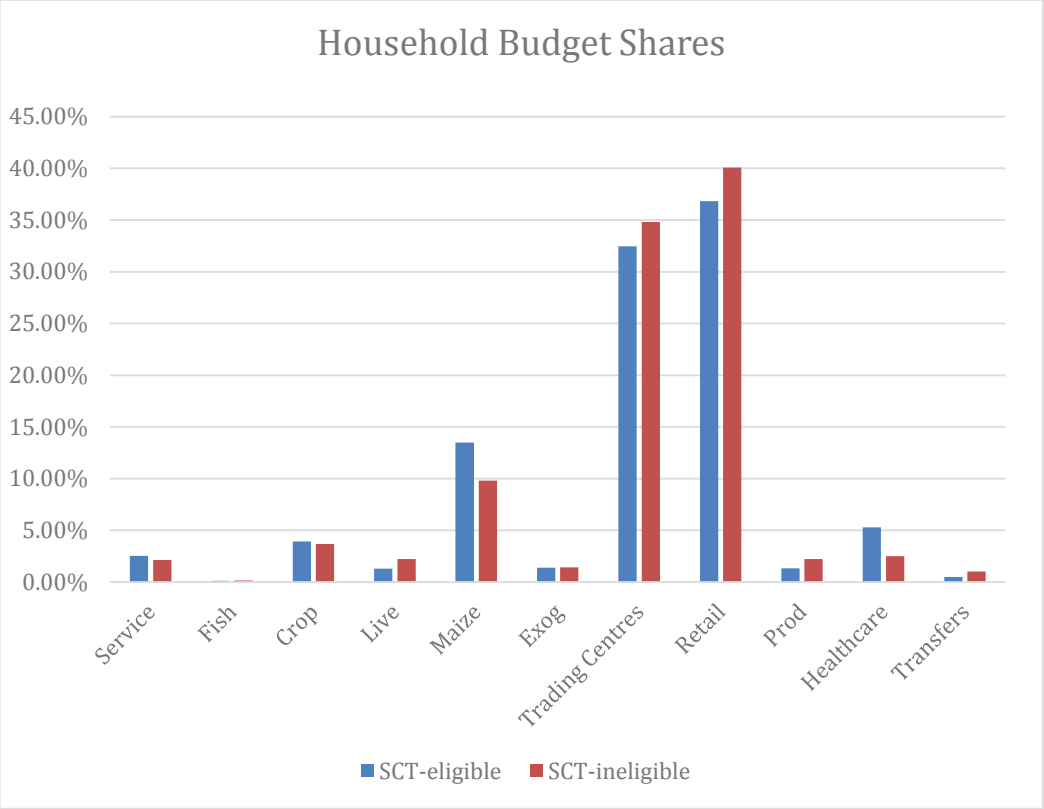
It is important that we include the ineligible households in our model because they interact with the eligible households through businesses, the labour market and inter-household transfers in a given VC, and the spillover between the eligible and ineligible groups can have important income-generating effects.

The baseline household survey provides information on household expenditures and location of purchases, as well as on income sources. We used data from this survey to estimate household expenditure functions, which tell us how each additional dollar of income is spent by each of the two household groups. This is extremely important, because it is through their expenditures that the beneficiary households pass on impacts of the programme to others, including ineligible households, within the local economy. Ineligible households, in turn, transmit programme impacts to others through their own spending.

[6] There was no existing census of businesses, and time did not permit canvassing the area.

Figure 2 (based on Appendix Table A1) shows how the households in these two groups spend their income. The blue bars show the budget shares for SCT-eligible households and the red bars indicate shares for SCT-ineligible households. The Figure reveals that spending patterns are similar between these two groups. By far, households spend most of their income in trading centres and in retail activities within the VC. Out of every dollar of income, households spend 30-35 cents in trading centres and 35-40 cents in local retail activities. The third largest expenditure item is maize, representing 10-13 cents out of each dollar spent.

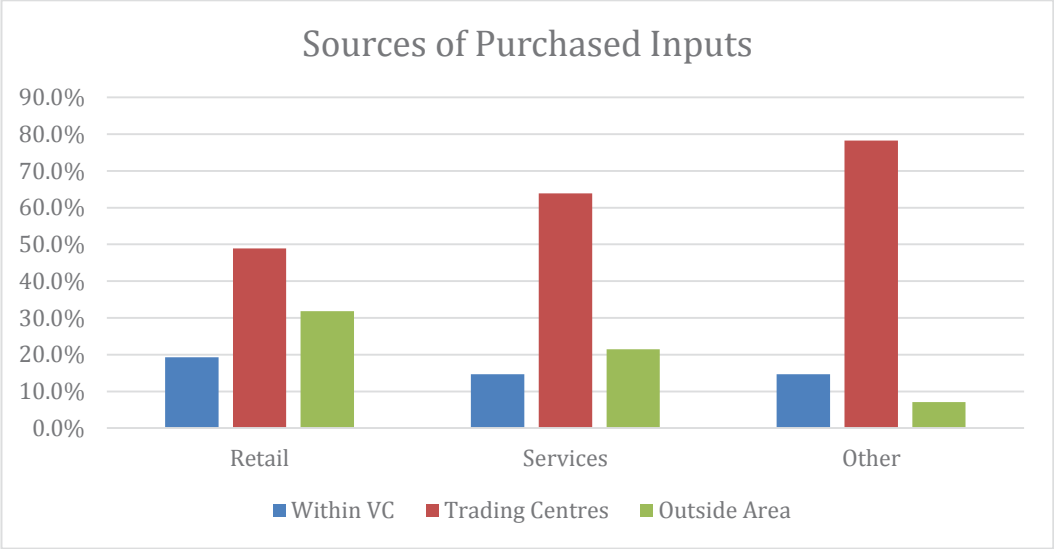
Figure 2 **Household Budget Shares**



Note: The largest household budget shares are on purchases in local retail within the VC or trading centres outside the VC.

This Figure leads us to expect that the income multipliers associated with SCTs are not likely to be large. Trading centres lie outside the VC, and the income spent there cannot create local spillover effects unless the businesses there are owned by people who live in the VC, hire labour from within the VC or purchase their merchandise from people in the VC. The retail activities are located within the VC; however, they obtain most of their merchandise from trading centres or other sources outside the VC, as shown in Figure 3 (from Appendix Table A2). Only 19 percent of inputs for retail come from within the VC. Thus, the retail sector represents an important leakage from the local economy.

Figure 3 Source of Purchased Inputs



Note: Local businesses obtain most of their purchased inputs outside their VC.

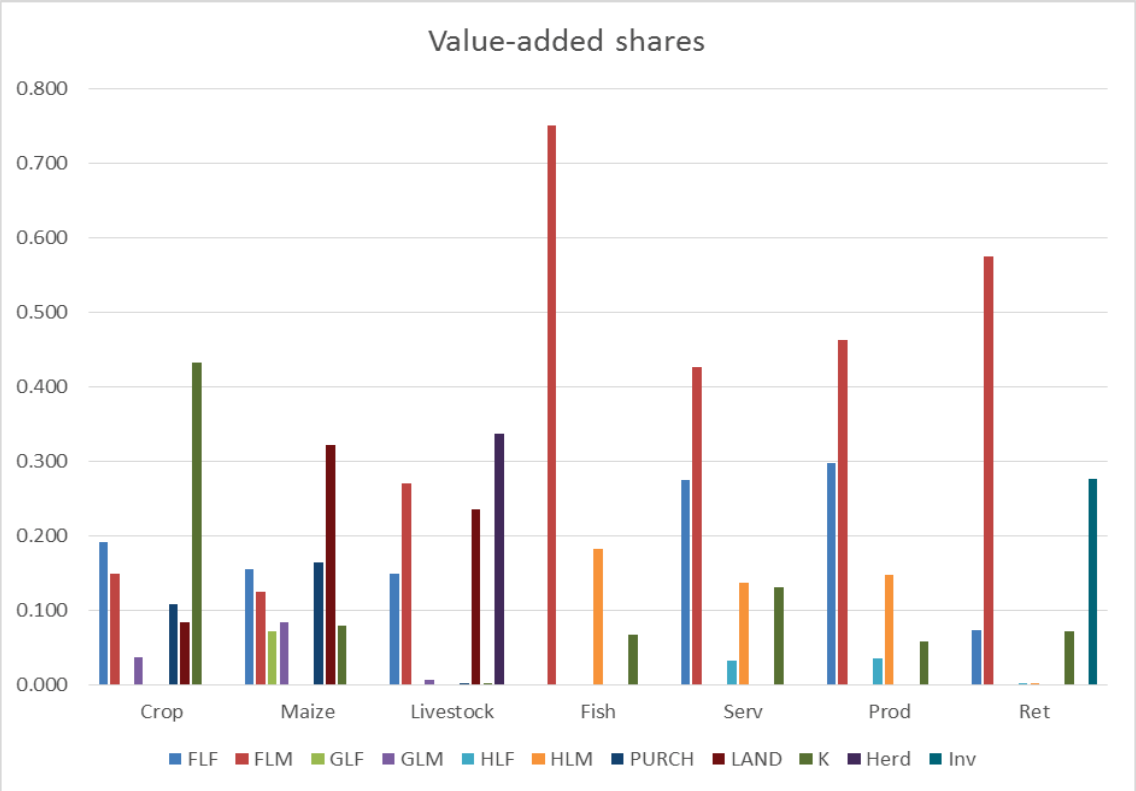
Consumption linkages with the maize sector could contribute to the SCT income multiplier if maize markets were local—that is, if maize were a non-tradable commodity whose price is determined within the VC. However, maize producers in Malawi appear to be connected with outside markets, which determine the maize price. Thus, we take the price of maize to be exogenous, or given, in our model. There is empirical support for this assumption. The maize price increased during 2012/13, influenced by the devaluation of the Malawian kwacha (Mk) and consequent export and inflationary pressures. If the rural economy were not connected with outside maize markets, we would expect increased maize production resulting from the FISP to exert downward pressure on the maize price. Thus, the evidence seems to point to an integrated maize market and maize prices, therefore, are not influenced heavily by changes in demand and supply within rural Malawi—or within the treated VCs. Later, we use the SCT-LEWIE model to test the sensitivity of our findings with regard to this assumption. Changes in the local demand for maize, in this case, will affect the amount sold to other parts of the country, but they will not affect maize production. Nevertheless, the SCT may have some impact on production indirectly, by providing beneficiaries with cash to purchase inputs.

We also use the household data to estimate production functions for crop and livestock production, and to consider the intermediate demands for those activities. Data from the business survey were used to do the same for service, retail and other production activities. Production functions are critical to include in our LEWIE model, because they tell us how local production responds to changes in demand stimulated by the SCT. They also reveal how changes in production translate into changes in input demands and thus into income for those who supply inputs – for example, wage labourers. Households that sell labour to others in the local economy benefit if labour demand and/or wages increase as a result of the programme.

Figure 4 (from Appendix Table A3) shows the share of each factor in total value added by each of the local production activities. Tall bars above a factor tell us that the activity makes intensive use of the factor. For example, family labour accounts for just over 35 cents per dollar of value added in crop production (combining Family Labour Female—blue bar—and Family Labour Male—red bar), with most of that amount (20 cents) created by female labour.

Fish production is very intensive in male family labour, which accounts for 75 percent of value added in this activity. Male hired labour accounts for most of the rest. Retail activity is intensive in male family labour and inventory capital. Livestock production is intensive in family labour, land and animal capital (herd).

Figure 4 Value-added shares[7]



Notes: Factors: FLF - females family labour; FLM - males family labour; GLF - females *Ganyu* labour; GLM - males *Ganyu* labour; HLF – females hired labour; HLM – males hired labour; PURCH – purchases; K - capital/physical assets; Herd- Livestock; Inv- Inventory. Activity: Serv- Services; Prod- Other locally-produced goods; Ret- Retail.

The retail sector creates added value in the form of price mark-ups above the wholesale cost of merchandise sold by stores and venders. More than half of this value added is attributable to family labour, indicating that retail operations rely heavily on family members' time. Most of the rest of retail value added is attributable to capital (in the form of inventory). This is the investment people have in their stores and merchandise.

The short bars above "Hired Labour" reveal that the project-area economy relies only marginally on wage labour. Hired workers create 18 cents of every dollar of value added in fishing but only 13-15 percent in services and other non-agricultural production and a negligible amount in the other activities. *Ganyu* labour generates an estimated 3.6 percent of value added in crops, 15.5 percent in maize, and less than 1 percent in livestock. Based on these figures, we would not expect the local labour market to play a particularly important role in transmitting project impacts through the local economy.

[7] Most production activities are intensive in family labour, with little hired labour.

The Importance of Liquidity Constraints

The model also assumes that households face liquidity constraints on expanding crop and other production activities—a problem endemic to poor rural economies with missing or incomplete credit markets. In this environment, the SCT may loosen liquidity constraints on crop production. Liquidity constraints on production are well documented in rural Malawi, as they are in rural areas of other poor African countries. Evidence from a number of African countries shows that cash transfers to poor households, which loosen liquidity constraints, increase the purchase of inputs, crop production and crop sales (Tirivayi, Knowles and Davis, 2013).

In the constrained model, cash outlays on purchased inputs are limited to what we see in the baseline data, and the input demand is equal to this cash outlay divided by the price of the input.

Calculation of SCT Income Multipliers

Income multipliers of the SCT are calculated by dividing the impact on total income by the amount of cash transferred to the beneficiary households. The SCT income multipliers tell us the increase in income from each additional Mk transferred to poor households. For example, a multiplier of 1.5 indicates that each Mk transferred generates an additional Mk 0.5 in income within the treated VCs. We can calculate these multipliers for total household income as well as for the income of each household group, including non-beneficiaries. The income gain to non-beneficiary households is called a programme spillover. We can also derive production multipliers (the change in value of production per Mk of SCT).

3.1. LEWIE Data Input Matrix

The complete data input sheet for the LEWIE model appears as an Appendix to this report. The data input table was structured to interface with the General Algebraic Modelling System (GAMS), where the LEWIE model resides. The columns give the names of variables or parameters, the names of the commodities produced or demanded, the factors used in production, and the values for each household group.

The baseline survey data have two main purposes in the construction of LEWIE models. First, they provide initial values for each variable of interest: output of crops and other activities; demand for commodities and factors in each activity; consumption expenditures; public and private transfers; etc. Second, they provide the data to econometrically estimate each of the parameters of interest in the model and their standard errors: exponents and shift parameters in Cobb-Douglas production functions for each activity; marginal budget shares for consumption functions; etc.

The baseline values in the table are weighted totals of each household income and expenditure category by household group (A and B). This ensures that we have the correct relative sizes of spending and incomes by each group and a balanced representation of the treated VCs.

The Appendix includes the budget (alpha) and Cobb-Douglas exponents (beta), as well as the production function shift parameters (acobb), the starting values of factor demands (FD), and the standard errors (se) of share estimates. The standard errors are small compared with the estimated value-added shares (beta) and budget shares (alpha). This indicates that the data

from the baseline surveys permitted us to estimate these parameters with a great deal of accuracy and it lends confidence to the simulations that follow.

3.2. The LEWIE Model

Economies—even village ones—tend to be complex, and LEWIE is a balancing act between complexity and feasibility. Our task is to design models simple enough to implement and estimate using data from surveys, yet rich enough to capture the most relevant linkages that may transmit the impacts of SCT payments through local economies.

The first few rows for each sector in Appendix Table A4 give baseline levels of intermediate demands for each household group. These are followed by baseline levels of each factor, with different factor mixes in different activities. We do not expect all inputs to generate value added; the intermediate inputs are not substitutable for other inputs and their demand is represented by Leontief input-output coefficients.

The following rows give the estimated Cobb-Douglas production function exponents (*beta*) and standard errors of these estimates (*se*). The estimated production function shift parameters and their standard errors (*acobb* and *acobbse*) follow. The remaining rows contain consumption function parameters – *alpha* and *aphase* are the estimated budget share and standard error, respectively. The intercept of each demand function is assumed to be zero (corresponding to a Stone-Geary utility function without subsistence minima).

The businesses canvassed in the businesses survey are not representative of the composition of local businesses. We use the expenditures in the ZOI or the household income from each activity to determine the size of each industry.

The complete LEWIE input matrix (not shown) includes the spatial organization of the ZOI, the region across which we simulate the impacts of the SCTs. Households consume and produce local commodities and they can export production or import goods from outside markets. The linkages between the ZOI and the rest of the world determine how the transfer's influences flow between households in the local economy and whether spillovers accrue to households locally.

The LEWIE computer programme, written in GAMS,[8] uses the parameter estimates and baseline data in the input matrix to calibrate a general equilibrium model of the project-area economy. This model consists of separate models of household groups calibrated and nested within a model of the treated VC. The new demands created by SCT payments can stimulate production if the local supply response is high (elastic). If the local supply response is inelastic, however, increases in local demand may have inflationary instead of expansionary effects. The LEWIE model can be used to test the sensitivity of transfer impacts to the local supply response and distinguish nominal from real-income (price-adjusted) multipliers, as described below.

[8] http://www.gams.com/

3.3. Validation

Validation is always a concern in simulations. Econometrics provides us with a way to validate the model's parameters; significance tests provide a means to establish confidence in the estimated parameters and functions used in our simulation model. As we have seen, our parameter estimates are highly significant, lending credibility to the model and credence to our simulation results. Econometric estimation of model parameters opens up a new and interesting possibility in regard to validation. The estimated standard errors for each parameter in the model can be used together with Monte Carlo methods to perform significance tests and construct confidence intervals around project impact simulation results, by means of the following steps:

1. Use parameter estimates and starting values for each variable obtained from the microdata to calibrate a baseline LEWIE model.

2. Use this model to simulate the impact of SCT cash transfers to eligible households.

3. Make a random draw from each parameter distribution, assuming it is centred on the estimated parameter with a standard deviation equal to the standard error of the estimate. This results in an entirely new set of model parameters. Using these parameters, calibrate a new baseline LEWIE model, and use this model to simulate the impact of SCT cash transfers to eligible households again.

4. Repeat Step 3 one thousand times, which will produce one thousand observed simulation results on each outcome of interest.

5. Finally, construct percentile confidence intervals $(\hat{Y}^*_{1-\alpha/2}, \hat{Y}^*_{\alpha/2})$, where $\hat{Y}^*_p$ is the pth percentile of the simulated values $(\hat{Y}^*_1, \hat{Y}^*_2, ..., \hat{Y}^*_J)$. For example, for a 90 percent confidence interval, we find the cutoffs for the highest and lowest 5 percent of simulated values for the outcome of interest. This is similar to the percentile confidence intervals in bootstrapping.

This Monte Carlo procedure allows us to use what we know about the variances of all our parameter estimates simultaneously to perform a comprehensive sensitivity analysis grounded in econometrics. If the model's parameters are estimated imprecisely, this will be reflected in wider confidence bands around our simulation results, whereas precise parameter estimates will tend to give tighter confidence intervals. The precision of some parameter estimates might matter more than others within a general equilibrium framework. Structural interactions within the model may magnify or dampen the effects of imprecise parameter estimates on simulation confidence bands. The method is described in Taylor and Filipski (2014).

3.4. Pathways of Influence and Markets

In the LEWIE model, the SCT payments increase spending in the treatment households. This increases the demand for goods supplied inside the treated VCs as well as outside the VCs – for example, in trading centres. The impact of increased demands on production and on the local income multiplier depends on the supply response to prices in the treated VC.

The more elastic the supply response, the more the transfers will tend to create positive spillovers in the local (VC) economy. The more inelastic that response, the more transfers will raise prices instead of stimulating production. If the production supply response is very inelastic (i.e. constraints limit producers' ability to raise output), the transfers will tend to be inflationary rather than having a real effect on the VC economy. Higher output prices benefit producers but harm consumers. If wages increase, employed workers will benefit, but producers will be adversely affected. The total impact of the SCT on the economy of the treated VCs depends on the interplay of these price and output effects.

The retail sector purchases some goods locally; however, most of the items sold in local stores come from outside the VC. Because of this, retail is largely an "import" sector, making tradable goods from outside available to households and businesses within the VC. The mark-up (difference between wholesale and purchase prices) represents the value added of the retail sector. It is the non-tradable component of retail sales. An increase in household demand for retail goods does not affect the prices stores pay for their inventory (these prices are set outside the VC). However, it can have an influence on the mark-up. Increases in the demand for locally produced food and livestock products can affect the prices of these goods. In response, households may resort to buying food, livestock and non-agricultural goods from local stores, trading centres, markets or other sources linked to markets outside the VC.

Prices may be determined inside or outside the VC. A challenge in LEWIE is that we generally do not know exactly where prices are determined. In real life, changes in prices outside of an economy may be transmitted into the economy. Given the size of the SCT, there is little reason for transfers to affect prices outside the treated VCs in the SCT programme as currently implemented.

Transaction costs in local markets can limit the transmission of prices. If transaction costs are high, there may be limited trade between the VC and the rest of the country. In this case, prices are determined by the interaction of local supply and demand. In Malawi, changes in local demand may affect the prices of food and livestock products purchased directly from producers in the treated VCs (including the implicit prices of home-produced food) as well as through local retail activities. In practice, it is common to find that some goods are non-tradable—that is, their prices are determined locally—while other goods are tradable, with prices set outside the local economy.

Simulations require making assumptions about where prices are determined, which in LEWIE and other general equilibrium models is called "market closure." We evaluate the impacts of the SCT under assumptions that we believe reasonably reflect the structure of markets in and around the treated VC. We assume local (VC) markets for crops, livestock, retail, services, fish, other non-agricultural production and all six types of labour (male and female family, hired and *ganyu*). Even though most of the price of a good sold in a local store is determined outside the VC, the mark-up – or value added – may change when local demand changes. For example, if the demand for retail goods rises, prices charged by local stores and vendors may increase. The LEWIE simulations provide insight into whether there might be some inflationary effect of SCTs.

We do not know what the elasticity of labour supply is. We assume a nearly perfectly elastic labour supply (η=100). This reflects an excess labour supply in rural Malawi; it is similar to the way labour is treated in Social Accounting Matrix (SAM) multiplier models. Excess

labour supply can be expected to lower inflationary pressures by limiting wage increases. Increases in labour demand raise employment but not wages. Inflationary pressures are not entirely removed, however, because land and capital constraints continue to limit the local supply response to some extent.

4. The Direct and Indirect Impacts of the SCT: LEWIE Results

The LEWIE model was used to simulate the impacts of SCTs on the treated VC economy, taking into account non-linearities and local price effects. Specifically, we simulate the impact of a transfer of Mk 23 100, the average annual amount transferred to an eligible household in the treated VCs.[9]

Column I in Table 5 summarizes the income and production findings from the LEWIE SCT evaluation using our preferred model specification, which assumes an elastic labour supply (consistent with rural un- and under-employment), cash constraints on input purchases and an integrated maize market. The latter assumption makes the VC a price taker with respect to maize, i.e. maize producers cannot influence the market price of this good. All other prices of goods and factors, except those of purchased inputs, outside goods, animal capital (herds) and retail inventory, are determined within the ZOI. In addition to the multiplier effects, 90 percent confidence bounds were constructed around the SCT income multipliers using 1000 random draws from each parameter distribution.

The SCT generates a total income multiplier of 1.25 in nominal terms with a confidence interval of 1.22 to 1.28. That is, each Mk of transfer generates an additional Mk 0.25 of total income gain, or spillover, within the project area. In addition, it creates a gain of Mk 0.68 for trading centres directly, because households spend a large share of their incomes there, and indirectly, because VC retail, service and other production activities buy a large share of their inputs there. Trading centres are not modelled as part of the VC.

The impacts on trading centres are not directly comparable to the impacts on income in the VC, because the first is a change in total revenue (for which traders incur costs) and the second is a pure income effect. Nevertheless, they reveal the stimulus that the SCT programme creates for economies surrounding the treated VC, as well as having an income impact within the VC. To the extent that traders demand goods, services and labour from within the VC, our VC income multiplier will understate the true impact of SCTs on local income.

Higher demand for local commodities may put upward pressure on prices, raising consumption costs for all households and resulting in a real-income multiplier that is lower than the nominal one. Under the assumptions of this simulation, the real-income multiplier of the SCT within the treated VC is 1.18. Although this is lower than the nominal multiplier, with a confidence interval of 1.15 to 1.20 it is significantly greater than 1.0.

[9] The average transfer was simulated instead of the total transfer (average x number of beneficiaries), because the model is scaled so that each of the two household groups represents the average household in each group. This makes the average transfer the appropriate shock to simulate in the model when calculating SCT multipliers.

Table 5 **Simulated Impacts of the Malawi SCT Programme**

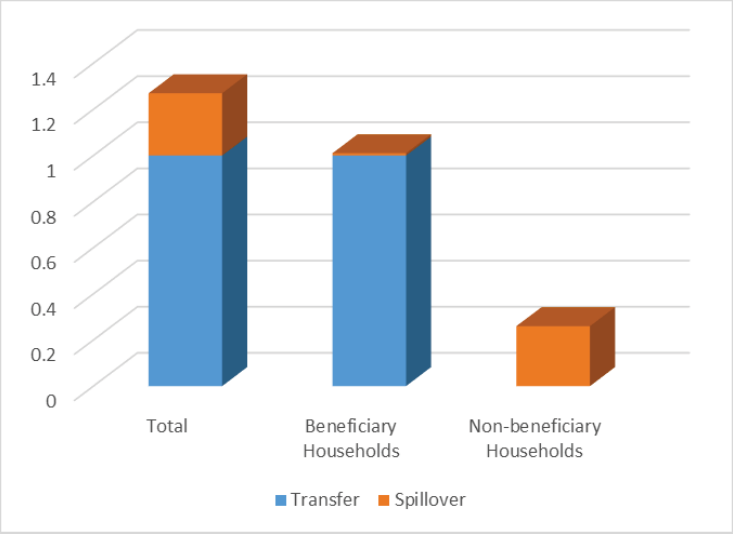
Assumptions	Simulation		
	I	II	III
Elasticity of Labour Supply		100	
Liquidity Constraint	Yes	No	Yes
Village Cluster Markets	Crop , Live, Sser, Prod, Ret, Fish, FLF, FLM, GLF, GLM, HLF, HLM		
Integrated Markets	Outside, HERD, INV, PURCH		
Maize Market	Integrated	Integrated	Local
Transfer to HH Group A		23,100	
iterations		1,000	
	MULTIPLIERS		
Total income multiplier			
Nominal	1.27	1.27	1.59
(CI)	(1.25 – 1.30)	(1.25 – 1.30)	(1.55 – 1.64)
Real	1.18	1.19	1.28
(CI)	(1.16 – 1.20)	(1.17 – 1.21)	(1.24 – 1.33)
Hh income multiplier (nominal)			
A Nominal	1.01	1.01	1.03
CPI Increase (%)	0.21	0.18	0.83
Real	1	1	1
B Nominal	0.26	0.26	0.56
CPI Increase (%)	0.22	0.19	0.68
Real	0.18	0.19	0.29
Production Multipliers			
Maize	0	0	0.12
Crop	0.03	0.04	0.04
Livestock	0.06	0.06	0.09
Services	0.09	0.09	0.11
Non-agricultural Production	0.03	0.03	0.04
Retail	0.72	0.72	0.91
Fish	0	0	0

On the one hand, this finding confirms that the SCT will generate local income multipliers that are significantly greater than 1.0, regardless of whether they are measured in nominal or real terms. On the other hand, they illustrate that, without efforts to ensure a high supply response in the local economy, part of the impact may be inflationary instead of real. Even a relatively small increase in the local current price index (CPI) can result in a much smaller real-income multiplier, because it potentially affects all expenditures by all household groups.

The middle panel of Table 5 gives the simulated impacts on the nominal and real incomes of each household group. Treated households (Group A) receive the direct benefit of the transfer and a small spillover effect of Mk 0.01 per Mk transferred. The ineligible households do not receive the transfer but still benefit from an Mk 0.26 increase in nominal income for each Mk transferred. Their real-income multiplier is smaller – 0.18.

Figure 5 illustrates the spillover effects of the SCT transfers. The blue part of each bar indicates the transfer itself, which goes entirely to the beneficiary households. The red part represents the spillover, which accrues mostly to the non-beneficiary households. The SCT's spillover effect on local economies is statistically significant and it strongly favours the households that do not receive transfers.

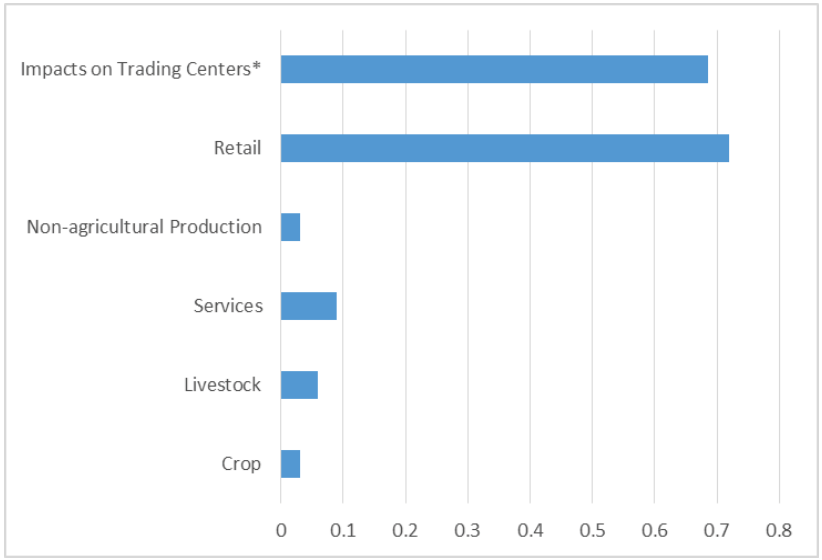
Figure 5 **Spillover effect of the SCT**



Note: The blue portion of each bar represents the SCT transfer and the red portions indicate the potential spillover effect of the transfer within the VC. The impact on local incomes significantly exceeds the amount transferred.

The SCT programme has significant production impacts, illustrated in Figure 6. The transfers stimulate the production of crops by Mk 0.31 and livestock by Mk 0.14 per Mk transferred. The largest effect is on the retail sector, where sales increase by Mk 0.60 per Mk transferred to eligible households.

Figure 6 SCT's production impacts



Note: The SCT's production impacts are on retail within the VC and trading centres outside the VC. Nevertheless, the SCT has some positive impacts on production activities in the VC.

* Direct, via household spending in trading centers, plus indirect, via retail, services and other production.

The Role of Liquidity Constraints and Maize Markets

The results presented in Column I of Table 5 are from a simulation in which we assume that households' input demands are cash-constrained and maize farmers are integrated with outside markets, so that the maize price is given. The results in Columns II and III are from simulations in which we change these assumptions. We do this in order to see how sensitive the SCT impacts are to the presence of liquidity constraints and to the structure of local maize markets.

Liquidity constraints appear to have little impact on our simulation results. This is because of the eligibility criteria for the SCT programme, which targets the poorest of the poor in terms of income, assets and labour availability. For these households, a lack of capital, land and labour represents far more of a constraint than the lack of liquidity to buy inputs. In theory, the SCT could provide beneficiary households with liquidity to purchase inputs. However, until the follow-on survey data become available, we will not know whether the SCT did, indeed, have such an impact. We would not expect the SCT to loosen input constraints in the households that did not get the transfer (Group B).

The structure of maize markets, on the other hand, has a comparatively large influence on the SCT multipliers. The SCT increases the beneficiary households' demand for food, including maize. If the VC is closely integrated with outside maize markets, the increase in local demand will affect the amount of maize sold to (or purchased from) outside markets at whatever price is given by those markets, but unless the maize price changes, it will not affect local production. If, on the other hand, the local maize market is not integrated with outside markets, an increase in maize demand will put upward pressure on the local maize price. This will stimulate maize production, adding to the SCT production and income multipliers.

Column III of Table 5 shows that, when the maize market is local instead of integrated, each Mk of SCT stimulates maize production by Mk 0.12. The local income multiplier rises from 1.27 to 1.59 in nominal terms, and higher income stimulates other local activities, as well. The local retail multiplier jumps from 0.72 to 0.91. The impact on trading centres rises from 0.69 to 0.87. Nevertheless, consumers pay the price (literally), because food costs increase; for this reason, the real-income multiplier rises from 1.18 to 1.28, less than the increase in nominal income.

5. Conclusions

The preliminary results from our LEWIE simulations show that the SCT can have a significant positive impact on incomes of both beneficiary and non-beneficiary households in the SCT-treated VCs. The income benefits of this programme within the VC are larger than the amount transferred to poor households. Our simulations show that each Mk transferred to a poor household raises total nominal income in the treated VC by at least 1.27.

This SCT multiplier is lower than what we have found in some other African countries, where trading centres outside the VC do not play as large a large role as they do in rural Malawi. The baseline survey reveals that households in this study area spend one-third of their income in these trading centres. They also spend a considerable portion of their income in local retail activities that, in turn, stock their shelves from trading centres outside the VC.

On one hand, the presence of trading centres outside the treated VCs creates leakages that reduce the SCT income and production multipliers within the VCs. From a different perspective, however, the SCTs not only create positive spillovers within VCs but also stimulate the economy surrounding the treated VCs, by increasing the demand for goods and services there. We find that each Mk transferred to a poor household increases the demand in trading centres outside the VC by Mk 0.69. If outside traders, in turn, purchase goods and services or hire labour from within the VCs, this could result in higher SCT multipliers than what we have reported here.

Increased demand for local commodities may put upward pressure on prices if the local supply response is constrained. Inflation raises consumption costs for all households and, in our simulations, results in a real-income multiplier that is lower than the nominal multiplier. This real-income multiplier of the SCT can be as low as 1.18, with a 90 percent confidence interval of 1.15-1.20. Although the multiplier is lower than the nominal (cash income) multiplier, it is still significantly greater than 1.0, meaning that under the worst of circumstances each Mk transferred leads to an increase of more than one Mk in local income.

The trade-off between supply response and inflation depends on the availability of factors to produce commodities. Complementary programmes that increase the supply response (such as access to credit to invest in capital and other productive inputs) could increase the real-income and production impacts of the SCT programme.

The LEWIE simulations show that the distribution of benefits across household groups—beneficiary and non-beneficiary—in the SCT-treated communities is shaped by the types of commodities purchased, the relative proportion of beneficiaries in the local population and the structure of local markets. The SCT stimulates demand in the local economy, triggering a supply response that creates production spillovers. Much—but not all—of the production and

income spillovers created by the SCT are found in the ineligible households. Overall, these findings reveal that the SCT programme treats not only the beneficiary households but also the economies in which they participate, with significant benefits for non-beneficiary households, as well.

6. References

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Appendix

Table A1 Household Expenditures by Sector/Item (% of Total Expenditures)

Sector/Item	Household Group	
	SCT-eligible	SCT-ineligible
Service	2.54%	2.11%
Fish	0.10%	0.15%
Crop	3.93%	3.66%
Live	1.31%	2.23%
Maize	13.50%	9.82%
Exog	1.37%	1.42%
Trading Centres	32.45%	34.83%
Retail	36.82%	40.06%
Prod	1.32%	2.22%
Healthcare	5.29%	2.49%
Transfers	0.48%	1.01%

Table A2 Sources of Business Inputs (% from Each Source)

Source	Business Type		
	Retail	Services	Other
Within VC	19.3%	14.6%	14.6%
Trading Centres	48.9%	63.9%	78.3%
Outside Area	31.8%	21.5%	7.1%

Table A3 Value-added Shares, by Activity and Factor

Factor	Activity						
	Crop	Maize	Livestock	Fish	Serv	Prod	Ret
FLF	0.191	0.155	0.149		0.274	0.000	0.074
FLM	0.148	0.124	0.270	0.751	0.426	0.000	0.575
GLF		0.072					
GLM	0.036	0.083	0.006				
HLF					0.032	0.000	0.002
HLM				0.182	0.137	0.000	0.002
PURCH	0.108	0.165	0.000				
LAND	0.083	0.322	0.236				
K	0.433	0.079	0.002	0.067	0.131	0.000	0.072
Herd			0.337				
Inv							0.276

Notes: Factors: FLF - females family labour; FLM - males family labour; GLF - females *Ganyu* labour; GLM - males *Ganyu* labour; HLF – females hired labour; HLM – males hired labour; PURCH – purchases; K - capital/physical assets; Herd- Livestock; Inv- Inventory. Activity: Serv- Services; Prod- Other locally-produced goods; Ret- Retail.

Table A4 **Production and Demand in the LEWIE Data Input (Excerpt from Data Input Matrix)**

Variable	Commodity	Commodity2	Factor	Households	
				A	B
INTD	crop	live		6.901415	32.27147
FD	crop		FLF	670.5444	2396.131
FD	crop		FLM	520.7644	1860.905
FD	crop		GLM	126.5687	452.282
FD	crop		PURCH	379.9402	1357.683
FD	crop		LAND	292.9884	1046.968
FD	crop		K	2874.817	4070.971
beta	crop		FLF	0.196161	0.196161
beta	crop		FLM	0.152344	0.152344
beta	crop		GLM	0.037026	0.037026
beta	crop		PURCH	0.111147	0.111147
beta	crop		LAND	0.085711	0.085711
beta	crop		K	0.28886	0.28886
se	crop		FLF		
se	crop		FLM		
se	crop		GLM	0.00416	0.00416
se	crop		PURCH	0.011675	0.011675
se	crop		LAND	0.0164	0.0164
se	crop		K	0.012823	0.012823
acobb	crop			6.105221	6.105221
acobbse	crop			0.139213	0.139213
alpha	crop			0.039272	0.036634
alphase	crop			0.004569	0.007134
cmin	crop			0	0
INTD	maize	live		296.9961	800.1067
FD	maize		LAND	4825.984	8765.5
FD	maize		PURCH	2874.817	4070.971
FD	maize		K	1182.066	2147.003
FD	maize		GLF	1075.562	1953.558
FD	maize		GLM	1249.208	2268.954
FD	maize		FLF	2320.874	4215.435
FD	maize		FLM	1860.67	3379.56
beta	maize		LAND	0.31784	0.31784
beta	maize		PURCH	0.175803	0.175803
beta	maize		K	0.077851	0.077851
beta	maize		GLF	0.070837	0.070837
beta	maize		GLM	0.082273	0.082273
beta	maize		FLF	0.152853	0.152853

beta	maize		FLM	0.122544	0.122544
se	maize		LAND	0.038672	0.038672
se	maize		PURCH	0.020724	0.020724
se	maize		K	0.026414	0.026414
se	maize		GLF		
se	maize		GLM		
se	maize		FLF		
se	maize		FLM		
acobb	maize			8.691232	8.691232
acobbse	maize			0.223692	0.223692
alpha	maize			0.135003	0.098169
alphase	maize			0.011109	0.010563
cmin	maize			0	0
INTD	live	maize		3.173163	0
FD	live		GLM	23.45516	85.41242
FD	live		FLF	582.2162	2120.151
FD	live		FLM	1057.829	3852.106
FD	live		K	5.907949	22.35872
FD	live		PURCH	0	1.358376
FD	live		HERD	1319.057	4803.37
FD	live		LAND	922.7044	3360.046
beta	live		GLM	0.005849	0.005849
beta	live		FLF	0.145177	0.145177
beta	live		FLM	0.263772	0.263772
beta	live		K	0.007654	0.007654
beta	live		PURCH	0.01856	0.01856
beta	live		HERD	0.32891	0.32891
beta	live		LAND	0.230079	0.230079
se	live		GLM	0.00769	0.00769
se	live		FLF		
se	live		FLM		
se	live		K	0.002665	0.002665
se	live		PURCH	0.005238	0.005238
se	live		HERD	0.012287	0.012287
se	live		LAND	0.027257	0.027257
acobb	live			6.668557	6.668557
acobbse	live			0.137643	0.137643
alpha	live			0.013058	0.022325
alphase	live			0.001723	0.003104
cmin	live			0	0
INTD	fish	ret		0	150.9397
FD	fish		FLM	0.62095	1004.947

FD	fish		HLM	0.15029	243.2292
FD	fish		K	1.731545	87.65957
beta	fish		FLM	0.7028	0.7028
beta	fish		HLM	0.1701	0.1701
beta	fish		K	0.1271	0.1271
se	fish		FLM	0.3984	0.3984
se	fish		HLM	0.4587	0.4587
se	fish		K	0.1428	0.1428
acobb	fish			6.2386	6.2386
abobbse	fish			0.9647	0.9647
alpha	fish			0.001005	0.001538
alphase	fish			0.000256	0.000501
cmin	fish			0	0
INTD	ser	zoi		151.9434	891.2685
INTD	ser	outside		50.99784	299.1428
INTD	ser	crop		0.033213	0.194823
INTD	ser	live		2.503522	14.68514
INTD	ser	prod		0.05313	0.311652
INTD	ser	ser		27.39837	160.7132
INTD	ser	retail		4.79304	28.11498
FD	ser		FLF	345.8463	1191.352
FD	ser		FLM	538.4433	1854.8
FD	ser		HLF	40.77916	140.4738
FD	ser		HLM	172.5272	594.3123
FD	ser		K	99.67544	633.9835
beta	ser		FLF	0.167	0.167
beta	ser		FLM	0.26	0.26
beta	ser		HLF	0.019691	0.019691
beta	ser		HLM	0.083309	0.083309
beta	ser		K	0.048	0.048
se	ser		FLF	0.096	0.096
se	ser		FLM	0.091	0.091
se	ser		HLF		
se	ser		HLM		
se	ser		K	0.027	0.027
acobb	ser			9.489	9.489
acobbse	ser			0.366	0.366
alpha	ser			0.025398	0.021126
alphase	ser			0.005976	0.005376
cmin	ser			0	0
INTD	prod	zoi		421.3984	12037.16
INTD	prod	outside		38.30422	1094.153

INTD	prod	crop		0.379809	10.84916
INTD	prod	prod		24.81502	708.8363
INTD	prod	ser		13.99076	399.6435
INTD	prod	ret		39.62133	1131.776
FD	prod		FLF	637.3908	4357.2
FD	prod		FLM	992.3449	6783.665
FD	prod		HLF	75.15553	513.7628
FD	prod		HLM	317.9657	2173.612
FD	prod		K	60.66193	920.5766
beta	prod		FLF	0.167	0.167
beta	prod		FLM	0.26	0.26
beta	prod		HLF	0.019691	0.019691
beta	prod		HLM	0.083309	0.083309
beta	prod		K	0.048	0.048
se	prod		FLF	0.096	0.096
se	prod		FLM	0.091	0.091
se	prod		HLF		
se	prod		HLM		
se	prod		K	0.027	0.027
acobb	prod			9.489	9.489
acobbse	prod			0.366	0.366
alpha	prod			0.013158	0.022169
alphase	prod			0.002585	0.004855
cmin	prod			0	0
INTD	ret	zoi		698.3133	36018.54
INTD	ret	outside		454.0269	23418.4
INTD	ret	crop		4.404641	227.1884
INTD	ret	maize		1.219747	62.91372
INTD	ret	live		100.6499	5191.453
INTD	ret	fish		0.494411	25.50136
INTD	ret	ser		84.02913	4334.166
INTD	ret	ret		84.61196	4364.228
FD	ret		FLF	99.70409	2469.741
FD	ret		FLM	780.1845	19325.73
FD	ret		HLF	2.213716	54.83531
FD	ret		HLM	2.771489	68.65175
FD	ret		K	72.17589	2430.506
FD	ret		INV	373.8903	9261.53
beta	ret		FLF	0.04	0.04
beta	ret		FLM	0.313	0.313
beta	ret		HLF	0.000888	0.000888
beta	ret		HLM	0.001112	0.001112
beta	ret		K	0.084	0.084

beta	ret	INV	0.15	0.15
se	ret	FLF	0.072	0.072
se	ret	FLM	0.079	0.079
se	ret	HLF		
se	ret	HLM		
se	ret	K	0.029	0.029
se	ret	INV	0.047	0.047
acobb	ret		8.56	8.56
acobbse	ret		0.449	0.449
alpha	ret		0.36816	0.400603
alphase	ret		0.012176	0.01312
cmin	ret		0	0