Food and Agriculture Organization
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Evaluating local general equilibrium impacts of Zimbabwe's Harmonized Social Cash Transfer Programme (HSCT)

PtoP from PROTECTION to PRODUCTION

Evaluating local general equilibrium impacts of Zimbabwe's Harmonized Social Cash Transfer Programme (HSCT)

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2014

The From Protection to Production (PtoP) programme is, jointly with UNICEF, exploring the linkages and strengthening coordination between social protection, agriculture and rural development. PtoP is funded principally by the UK Department for International Development (DFID), the Food and Agriculture Organization of the UN (FAO) and the European Union.

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: www.fao.org/economic/ptop

Contents

Abstract

The Harmonized Social Cash Transfer (HSCT) is an unconditional cash transfer introduced in 2011 by the Ministry of Public Service, Labour and Social Welfare (MPSLSW) in order to strengthen the purchasing power of ultra-poor households who are labour constrained through cash transfers. The objectives of the programme include enabling recipient households to increase consumption above the poverty line, reduce the number of ultra-poor households and help beneficiaries avoid risky coping strategies such as child labour and early marriage. Moreover, the programme is expected to lead to improved nutritional status, health and education outcomes, as well as a reduction in violence. As of March 2014, 55 509 households in 20 districts had been enrolled, covering 247 645 individuals.
Local economy-wide impact evaluation (LEWIE) simulation methods are used to assess the likely impacts of cash transfers on the local economy. When the Harmonized Social Cash Transfer programme gives money to beneficiary households, they spend it, buying goods and services. As this cash swirls around within wards and districts, it creates benefits for non-recipient households as well who may provide the goods and services purchased by beneficiary households.

This study finds that the Zimbabwe HSCT generates a total income multiplier of 1.73 in nominal terms with a confidence interval of 1.42 to 2.00. Each dollar of transfer has the potential to generate 1.73 dollars of total income within the project area.

Acknowledgements

The authors acknowledge the support and cooperation of the Government of Zimbabwe's Ministry of Public Service Labour and Social Welfare; UNICEF; FAO; and donors to the Child Protection Fund - United Kingdom Department for International Development (DFID), Kingdom of the Netherlands, Swedish International Development Cooperation Agency (Sida), Swiss Development Cooperation (SDC) and the European Union (EU). We would also like to acknowledge the extremely helpful discussion and suggestions and comments provided by participants at the February, 2014 Harare baseline workshop of the impact evaluation of the Zimbabwe Harmonized Social Cash Transfer Program. All mistakes and omissions are our own.

Executive Summary

Local economy-wide impact evaluation (LEWIE) simulation methods are used to assess the likely impacts of cash transfers on the local economy. When the Harmonized Social Cash Transfer programme gives money to beneficiary households, they spend it, buying goods and services. As this cash swirls around within wards and districts, it creates benefits for non-recipient households as well, who may provide the goods and services purchased by beneficiary households.

This study finds that the Zimbabwe HSCT generates a total income multiplier of 1.73 in nominal terms with a confidence interval of 1.42 to 2.00. Each dollar of transfer has the potential to generate 1.73 dollars of total income within the project area.

The programme

The Harmonized Social Cash Transfer (HSCT) is an unconditional cash transfer introduced in 2011 by the Ministry of Public Service, Labour and Social Welfare (MPSLSW) in order to "strengthen purchasing power of 55 000 ultra-poor households who are labour-constrained through cash transfer". Targeted to food poor, labour-constrained households, the objectives of the programme include enabling recipient households to increase consumption above the poverty line, reduce the number of ultra-poor households and help beneficiaries avoid risky coping strategies such as child labour and early marriage. Moreover the programme is expected to lead to improved nutritional status, health and education outcomes as well as a reduction in violence. Eligible households receive bi-monthly unconditional cash payments that range in size from $10 to $25 per month based on household size. As of March 2014, 55 509 households in 20 districts had been enrolled, covering 247 645 individuals. The government's plan is to support 250 000 households in all of Zimbabwe's 65 districts by 2015.

The immediate impact of the HSCT is to raise the purchasing power of recipient households. The value of the transfer represents approximately 20 percent of median pre-programme household expenditure. As these households spend their cash, the transfer's impacts immediately spread from the recipient households to others inside the recipient communities. Doorstep trade, purchases in village shops, periodic markets and purchases outside the village potentially set in motion income multipliers within the district. Some impacts leak out of the project area as well, potentially unleashing income multipliers in districts where the HSCT has not yet been rolled-out.

The local economy-wide impact evaluation (LEWIE) methodology is designed to understand the full impact of cash transfers on local economies, including on the production activities of both recipient and non-recipient groups; 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 budget holders and other sponsoring agencies.

The Zimbabwe HSCT LEWIE Model

The Zimbabwe HSCT LEWIE models the workings of the local economy and the household economic activities within it, and the interactions between eligible households who receive the cash transfer and ineligible households who do not. Household models describe the productive activities, income sources and expenditure patterns of eligible and ineligible households. In a typical model households participate in activities such as crop and livestock production, retail, service and other production 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 by local trade and villages are linked by regional trade. The whole project region interacts with the rest of the country, importing and exporting goods and selling labour. Interactions among households within the project area and between the project 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 statistical methods, allow us to test the robustness of simulated impacts to errors in parameter estimates and model assumptions. In the simulation presented in this brief we assume that locally-grown crops, livestock, retail and other services, as well as labour, are tradable across villages within each cluster. The household survey documents trade in crops and livestock with neighbouring villages and outside the cluster. Given high transaction costs with the rest of the country and abroad, it is reasonable to assume that the prices of these goods are determined in village-cluster markets.

The assumption that villages cannot freely "import" wage workers from outside the cluster is reasonable where transportation is expensive, unreliable or non-existent. In this case the HSCT can potentially affect local wages. Wage effects are muted to the extent that households have an elastic supply of labour, which we assume is high to reflect excess labour supply in rural Zimbabwe. The high labour supply elasticity does not remove inflationary pressures, however, because land and capital constraints continue to limit the local supply response.

Results

The HSCT generates a potential total income multiplier of US$ 1.73 in nominal terms, with a 90-percent confidence interval (CI) of 1.42 to 2.00. That is, the US$ 11 780 million provided by the HSCT as of December 2013 has potentially generated US$ 20 379 million in project-area income.

By stimulating demand for locally supplied goods and services, cash transfers have productive impacts. These effects are found primarily in households ineligible for the transfers, as can be seen in the graph. This finding is not surprising given that the eligibility criteria for the HSCT favour asset and labour-poor households. Recipient households receive the direct benefit of the transfer plus a small spillover effect of US$ 0.09 per US$ 1.0 transferred. Their total income has potentially increased by US$ 12 840 million. The ineligible (or non-recipient) households benefit from spillovers in the amount of US$ 0.64 for every dollar spent, amounting to an increase in income of US$ 7 539 million since the beginning of the programme.

The productive impacts vary by sector. The cash transfers stimulate the production of crops and livestock by US$ 0.31 and 0.14 per dollar transferred. The largest positive effect is on retail, which has a multiplier of 0.60.

Increasing demand stimulates these four sectors by putting some upward pressure on prices. The higher the local supply response, the larger the real expansion in the local economy and the smaller the resulting inflation level will be. However if supply constraints are binding, higher demand may put upward pressure on prices. This would raise consumption costs for all households and could result in a real-income multiplier that is lower than the nominal multiplier described above. In the case of the Zimbabwe HSCT, the real income multiplier is US$ 1.40 (CI: 1.12 to 1.63).

These findings illustrate that, without efforts to ensure a high supply response in the local economy, part of the impact may be inflationary instead of real. Measures to increase the local supply response may be important in order to increase the positive spillover effects of the HSCT programme. These complementary measures should be targeted not only at HSCT recipient households, but also non-eligible households who provide goods and services in the local economy.

1. Introduction

The Zimbabwe Harmonized Social Cash Transfer (HSCT) programme is an unconditional cash transfer introduced in 2011 and targeted to the poorest labour-constrained households. Eligibility is based on a food poverty line and other poverty indicators as well as a household's dependency ratio. Eligible households in the programme areas receive $10 - $25 per month depending on household size. Implemented by the Ministry of Public Service, Labour and Social Welfare (MPSLSW), as of March 2014 more than 55 500 households in 20 districts had been enrolled, covering 247 645 individuals. The government's plan is to support 250000 households in all of Zimbabwe's 65 districts by 2015 (AIR, 2013).

The cash transfers provided by the HSCT represent a significant increment to beneficiary-household incomes. They also inject a considerable amount of liquidity 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 transfer's impacts immediately spread from the beneficiary households to others inside (and outside) of the treated communities. Doorstep trade and purchases in village shops, in markets, and outside the village potentially set in motion income multipliers within the treated wards. Some impacts leak out of the project area as well, potentially unleashing income multipliers in non-treated localities.

The LEWIE (local economy-wide impact evaluation) methodology is designed to understand the full impact of cash transfers on local economies, including on the production activities of both beneficiary and non-beneficiary households; 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 HSCT programme led by American Institutes for Research, under contract with UNICEF-Zimbabwe. Construction of the model stems from an ongoing collaboration between UNICEF and 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 households and the communities and local economy 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.[1]

[1] www.fao.org/economic/ptop/en/. The first formulation of the LEWIE methodology for the From Protection to Production project can be found in Taylor (2013).

2. Evaluation design

The impact evaluation of the HSCT uses a mixed method approach, including a quantitative impact assessment based on a quasi-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 HSCT cash transfers by comparing households in the treated wards with those in the comparison wards. A randomized controlled trail design was not possible for political and ethical reasons. Randomization of treatment would ensure that the treated and control households are similar except for the treatment. Instead of randomization, comparison districts were chosen to be as similar as possible to treatment districts. The current design leaves open the possibility that observed differences between treatment and control households could result from an effect other than that of the HSCT. Econometric techniques will be used to check for any observed differences.

Experiments are mostly used to estimate average effects of the treatment on the treated households. However the baseline and follow-on surveys also gathered information on ineligible households in both the treated and non-treated wards. 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 HSCT affects ineligible households by comparing changes in outcomes between ineligible households in treated and control wards.

Experimental methods do not necessarily tell us why a programme like the HSCT has the effect that it does, only whether there is an effect. In economics parlance, they are a 'reduced-form' rather than '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. Local economy-wide impact evaluation (LEWIE) simulation methods can be used to assess the likely impacts of the HSCT on the treated wards, including on ineligible households. The basic idea behind LEWIE is that by treating the beneficiary households the HSCT 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 swirls around within wards and districts it may create benefits for non-beneficiary households as well.

The LEWIE analysis can help us understand the mechanisms by which project impacts are transmitted within the treated wards. It can be carried out *ex ante*, using baseline survey data. *Ex post*, experiments 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.

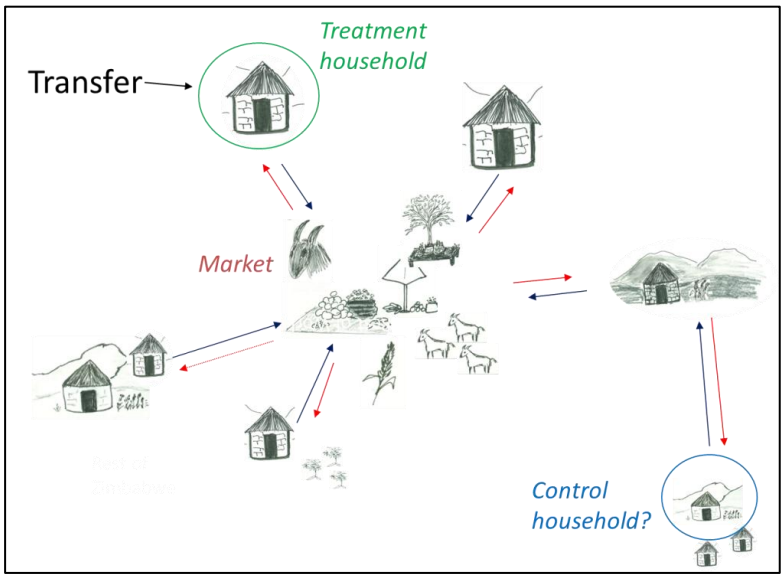
This paper reports preliminary findings from our baseline LEWIE simulations. It begins by describing how the programme's impacts may be transmitted through the economy, followed by an explanation of the LEWIE modelling approach, data, findings and implications for programme design.

2.1.Treatment Effects in a General-Equilibrium Setting[2]

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 cash. The household in the northwest corner of the figure is the treatment household. It receives the cash transfer then spends it in markets in which other households, including those ineligible for the transfer, transact. The market might be a large periodic market, or it could be a very simple village one – even informal trade with neighbours (or "doorstep trade").

Households that sell goods or services to the treated household see their incomes rise; that is, they 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 and control-group contamination could result.

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 HSCT programme captures the linkages that transmit impacts from treated to non-treated households. While the experimental component of the HSCT evaluation focuses on the actors, especially the households receiving transfers, LEWIE pays particular attention to the arrows connecting

[2] 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 non-treated as well as treated households, as well as the total impact on the project-area economy. For example, we can determine the local income multiplier of each dollar transferred to a treatment household in the HSCT programme.

2.2.The evaluation design

As random allocation to treatment and control groups was not possible, the impact evaluation design is quasi- (or non-) experimental, with treatment households in three Phase 2 districts of the HSCT to be compared to eligible households in three districts to be brought in as part of Phase 4 of the HSCT in 2015. The Phase 4 districts were selected to be geographically and, on average, culturally and economically contiguous to Phase 2 districts. The evaluation includes 60 wards in the Phase 2 districts and 30 in the Phase 4 (comparison) districts.[3]

The Phase 2 districts are Binga (Matabeleland North), Mwenezi (Masvingo) and Mudzi (Mashonaland East). The Phase 4 comparison districts include Chiredzi (Masvingo), Hwange (Matabeleland North), and Uzumba/UMP (Mashonaland East). All treatment and comparison households are rural. Payments to Phase 2 districts commenced after completion of the baseline survey in 2013.

Within the treatment wards, all eligible households receive the HSCT in the short run. Within the comparison wards, they do not. In all wards there are also households that are ineligible for the HSCT. Many of these households are poor—just not poor enough to qualify for the treatment. A great advantage of LEWIE is that it reveals the likely spillover effects of the HSCT on the non-treated (ineligible) households within the treated wards.

[3] More details on the evaluation design can be found in AIR (2013).

3. The Zimbabwe HSCT LEWIE

The Zimbabwe HSCT LEWIE models household economies and the interactions between eligible (Group A) and ineligible (Group B) households within the 60 wards treated in Phase 2. We model a representative rural Phase 2 district made up of two types of households: eligible and ineligible.

The model structure is centred on the principal economic activities in which these households participate, the households' income sources and the goods and services on which households spend their income (see Table 1). These constitute the accounts in the LEWIE model. Household groups participate in crop and livestock production, retail, service, and other production activities, and in the labour market. The retail sector includes shops in the village (which obtain most of their merchandise from outside the village), at growth points in the district and in the rest of Zimbabwe. Production activities use different factors: hired labour, family labour, land, capital, livestock and purchased inputs.

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 district, and the spillovers among the different groups can have important income-generating effects. The programme districts are linked with the rest of Zimbabwe, importing and exporting goods and selling labour.

For purposes of the evaluation we define the zone of influence (ZOI) of the programme as the district consisting of wards treated in Phase 2. The ZOI is the area across which spillovers occur and programme benefits can be measured using the LEWIE methodology.

3.1. Data and estimation of LEWIE parameters

We use two data sources: the HSCT baseline household survey and the business enterprise survey (BES), both conducted in 2013.[4]

The BES contains information on costs and revenues from a selection of businesses operating in the programme districts. Random selection of businesses would require a list of individual businesses in the study area, which was not however available. Instead we listed the different types of businesses in the area (retail, services and production) and interviewed some of each type in each evaluation district. We assume businesses of each type use the same technology and we use the BES data to estimate that technology.

[4] See AIR (2013) for a detailed description of the baseline surveys.

Table 1 **Accounts in the Zimbabwe LEWIE**

Households	
A B	HSCT beneficiaries Non-beneficiary (in programme district)
Activities	
crop live ret ser prod	Crops Livestock Retail Services Other production activities
Commodities	
crop live ret ser prod outside	Crops Livestock Retail Services Other production Produced outside the programme district
Factors	
HL FL Land K Purch Herd	Hired labour Family labour Land Capital Purchased (intermediate) inputs Herd (livestock)
ROW	Rest of world (exogenous to model)

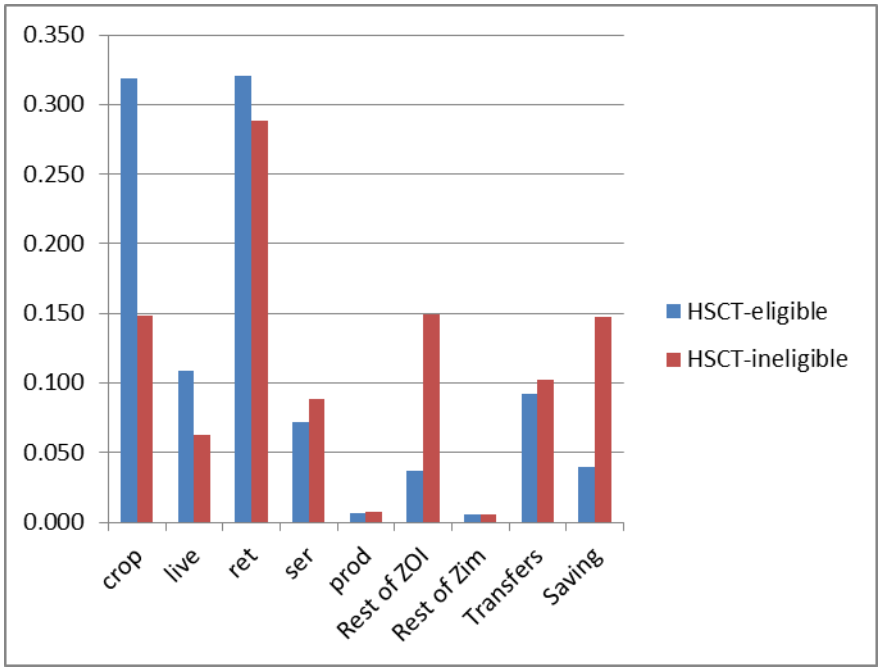
The HSCT household survey was administered to eligible and ineligible households. The household survey provides information on household expenditures and location of purchases as well as on income sources. We used data from this survey to estimate household expenditure functions, which tell us how each 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 spending.

Figure 2 shows how the households in these two groups spend their income. The blue bars show the budget shares for HSCT-eligible households and the red bars for HSCT-ineligible households. The figure reveals that, out of every dollar of income, eligible households spend more than 30 cents on locally-produced crops compared to 15 cents for ineligible households. From this we can conclude that an increase in income in eligible households stimulates the demand for local crops more than a comparable increase in income in ineligible households. The demand patterns of eligible households also favour local livestock products more than the demand patterns of ineligible households. Ineligible households spend a larger share of their income outside the ward, in other parts of the district (15 cents). They also save more (15 cents compared with less than 5 cents for eligible households).

The two groups have similar expenditure shares in local retail establishments (around 30 cents per dollar spent). Most goods purchased in local shops come from outside the district; thus impacts leak out of the local economy through the retail sector. In this way they create benefits for other parts of Zimbabwe.

Transfers among households are also important in rural Zimbabwe. Even poor, eligible households give a large share of their income (10 cents per dollar) to other households in the form of transfers. Through these transfers, programme impacts may be transmitted among households.

Figure 2 **Household budget shares**



We also use the household data to estimate production functions for crop and livestock production and to recover 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 HSCT programme. They also reveal how changes in production translate into changes in input demands and thus in income for those who supply inputs, such as 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.

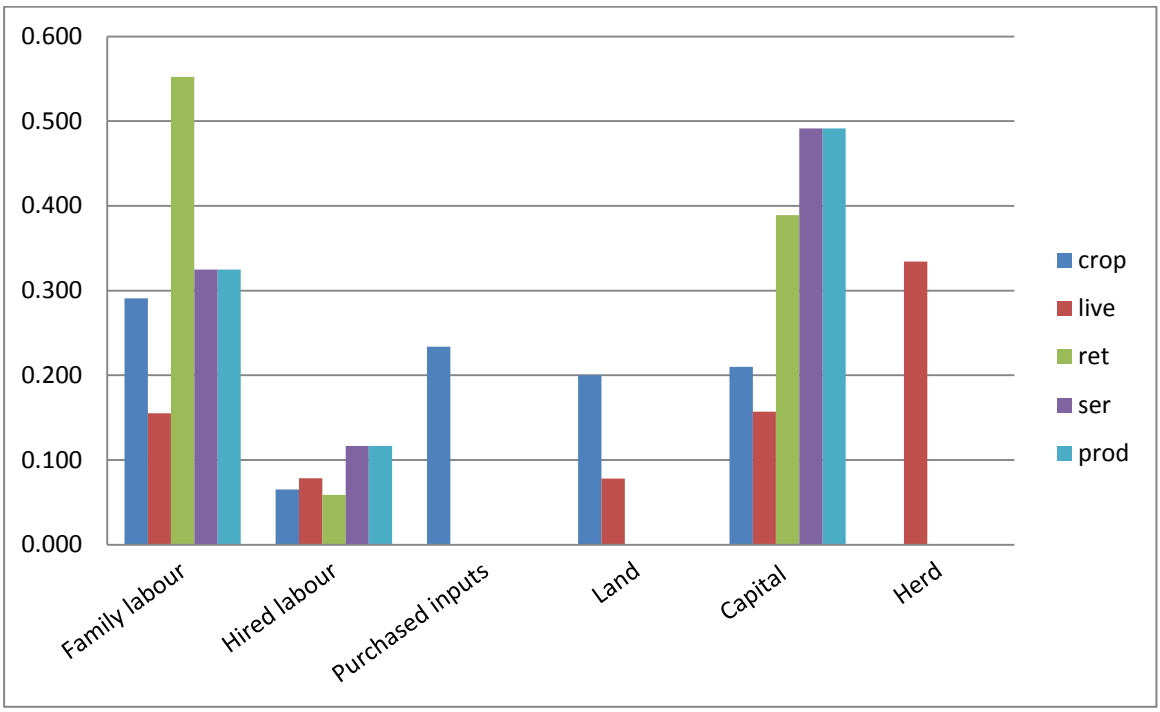
Figure 3 shows the share of each factor in total value added created by each of the local production activities. Tall bars above a factor tell us that the activity makes intensive use of the factor. For example, family labour accounts for just fewer than 30 cents out of every dollar of value added in crop production (blue bar above "Family labour" in the figure). Family labour accounts for just over 30 cents per dollar of value added in non-retail services (purple bar) and other production (light blue bar). It accounts for a smaller share (around 15 cents per dollar) in livestock production, where much of the value added is created by the herd itself (tall red bar above "Herd").

The retail sector creates value added in the form of price mark-ups above the cost of merchandise that shops and vendors sell. More than half of this value added is attributable to family labour. This indicates that retail operations rely heavily on family members' labour.

Most of the rest of retail value added is attributable to capital. This is the investment people have in their shops and merchandise.

The short bars above "Hired labour" reveal that the project-area economy does not rely heavily on wage labour. Hired workers create less than 10 cents of every dollar of value added in crop, livestock and retail production, and just over 10 cents in service and other production activities. Based on this result, we would not expect the local labour market to play a particularly important role in transmitting project impacts through the local economy.

Figure 3 **Factor value-added shares in local production activities**



3.2. LEWIE data input matrix

The complete data input sheet for the LEWIE model appears as Table 3A in the Appendix to this report. The data input table was structured to interface with GAMS, where the LEWIE model resides. The columns give the names of variables or parameters, the names of the commodity produced or demanded, the factor 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 crop and other activities; demand for commodities and factors in each activity; consumption expenditures; public and private transfers; and so on. 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 Table 3A 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 for each group and a balanced representation of the treated wards.

The Appendix includes the budget (*alpha*) and value-added shares (*beta*) just reported, and in addition, the production functions shift parameter (*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, lending confidence to the simulations that follow.

3.3. 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 to estimate using data from surveys, yet rich enough to capture the most relevant linkages that may transmit the impacts of HSCT payments through local economies.

In this model, as the Appendix reveals, crop production demands three types of intermediate inputs (INTD): Ser, Ret, and Outside, and five kinds of factor demands (FDs): HL, FL, Land, K, and PURCH. The first few rows for each sector in the Appendix table give baseline levels of intermediate demands for each household group. These are followed by baseline levels of each factor. 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 parameter and its standard error (*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 HSCT transfers. 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,[5] 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

[5] GAMS is the acronym for General Algebraic Modeling System; http://www.gams.com/ .

within a model of the Phase-2 project districts. The new demands created by HSCT 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 (price-adjusted) income multipliers, as described below.

3.4. 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 with 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, using the following steps:

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

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

4. We repeat step 3 1 000 times, which gives us 1 000 observed simulation results on each outcome of interest.

5. Finally, we construct percentile confidence intervals $(\hat{Y}^*_{1-\alpha/2}, \hat{Y}^*_{\alpha/2})$, where $\hat{Y}^*_p$ is the p^{th} quantile 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.

3.5. Pathways of Influence and Markets

In the LEWIE model, the HSCT payments increase spending in the treatment households. This increases the demand for goods supplied inside the treated wards as well as outside the wards, for example, through growth points in the district. The impact of increased demands on production and on the local income multiplier depends on the supply response to prices in the district. The more elastic the supply response, the more the transfers will tend to create positive spillovers in the local (district) economy. The more inelastic, the more transfers will raise prices instead of stimulating production. If the production supply response is very inelastic (that is, constraints limit producers' ability to raise output), the transfers will tend to be inflationary rather than having a real effect on the local 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 HSCT on the economy of the treated wards and districts 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 shops come from outside the district. Retail is therefore largely an "import" sector, making tradables from outside available to households and businesses within the ward. The mark-up (difference between sale and purchase prices) represents the value-added of the retail sector. It is the nontradable component of retail sales. An increase in households' demand for retail goods does not affect the prices shops pay for their inventory (these prices are set outside the ward). 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 shops, periodic markets or other sources linked to markets outside the ward.

Prices may be determined inside or outside the ward or district. 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 HSCT, there is little reason for transfers to affect prices outside the treated districts in the initial phase of the HSCT programme.

Transaction costs in local markets can limit the transmission of prices. If transaction costs are high prices may be determined by the interaction of local supply and demand. In Zimbabwe, changes in local demand may nonetheless affect the prices of food and livestock products purchased directly from producers in the treated wards (including the implicit prices of home-produced food), unless retail purchases are a perfect substitute for these goods.

We do not know what the elasticity of labour supply is. We assume a nearly perfectly elastic labour supply (η=100).[6] This reflects excess labour supply in rural Zimbabwe; it is similar to the way labour is treated in 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. It does not remove inflationary pressures, however, because land and capital constraints continue to limit the local supply response to some extent.

[6] Higher elasticities do not have an appreciable effect on HSCT multipliers.

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 HSCT under assumptions that we believe reasonably reflect the structure of markets in and around the treated wards. We assume local (district) markets for crops, livestock, retail, family labour and hired labour. Even though most of the price of a good sold in a local shop is determined outside the ward and district, 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 shops and vendors may increase. The LEWIE simulations provide insight into whether there might be some inflationary effect of HSCT transfers.

3.6. The direct and indirect impacts of the HSCT: LEWIE results

The LEWIE model was used to simulate the impacts of the Phase 2 HSCT on the project-area economy, taking into account nonlinearities and local price effects. Specifically, we simulate the impact of a $300 ($25/month x 12 months = $300) transfer of income to the eligible households in the treated wards. The base model has an elastic labour supply, and all prices except purchased inputs and outside goods are determined within the ZOI. In addition to the multiplier effects, 90 percent confidence bounds were constructed using 1 000 random draws from each parameter distribution.

As can be seen in Table 2, the HSCT generates a total income multiplier of 1.73 in nominal terms with a confidence interval of 1.42 to 2.00. Each dollar of transfer generates 1.73 dollars of total income within the project area.

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 HSCT is 1.40. Although this is lower than the nominal multiplier, with a confidence interval of 1.12 to 1.63, it is significantly greater than 1.0. Sensitivity analysis reveals that, as supply elasticities in the local economy increase, the real multiplier increases and converges toward the nominal one. Thus 1.73 may be considered as the upper bound on the HSCT income multiplier in the local economy.

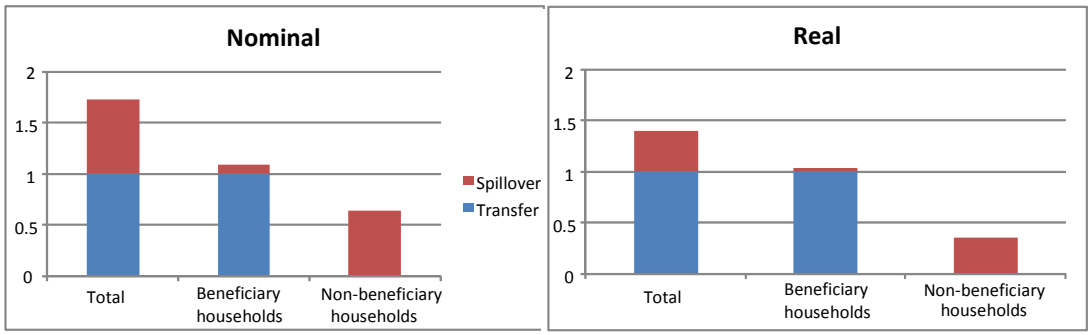
Table 2 **Simulated income multiplier of the HSCT programme**

	Base model
Income multiplier	
Nominal	1.73
(CI)	(1.42 – 2.00)
Real	1.40
(CI)	(1.12 – 1.63)

One the one hand, this finding confirms that the HSCT 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.

Figure 4 gives the simulated impacts on the nominal and real incomes of each household group. Treated households receive the direct benefit of the transfer (the blue bar) and a small spillover effect of 0.09 dollars per $1 transferred (in red). The ineligible households do not receive the transfer but still benefit from a 0.64 dollar increase in nominal income for each dollar transferred (again in red). The real income multiplier for these households is smaller: 0.36. The HSCT's spillover effect on local economies is significant and strongly favours the households that do not get transfers.

Figure 4 **Distribution of HSCT nominal income multiplier on beneficiary and non-beneficiary households**



The HSCT programme has significant production impacts (Table 4A in the Appendix). The transfers stimulate the production of crops by $0.31 and livestock by $0.14 per $1 transferred. The largest effect is on the retail sector where sales increase by $0.60 per $1 transferred to eligible households. The impact on the service industry, a relatively small component of the rural economy, is negative. This is due to the assumption that capital (which is important in the service industry as can be seen in Figure 3) is fixed and that labour is more productive in other sectors of the economy.

4. Conclusions

The preliminary results from the LEWIE simulations show that the HSCT can have a large and significant impact on incomes of both beneficiary and non-beneficiary households in the treated (HSCT) communities. The income benefits of this programme are significantly larger than the amount transferred.

Nevertheless, higher 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 HSCT can be as low as $1.40, with a 90 percent confidence interval of 1.12-1.63. Although the multiplier is lower than the nominal (cash income) multiplier it still is significantly greater than 1.0, meaning that under the worst of circumstances each dollar transferred leads to an increase of more than $1 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 HSCT programme.

The LEWIE simulations show that the distribution of benefits across household groups – beneficiary and non-beneficiary – in the HSCT-treated communities is shaped by the types of commodities purchased, the relative size of the beneficiaries in the local population and the structure of local markets. The HSCT 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 HSCT are found in the ineligible households. Overall, these findings reveal that the HSCT programme treats not only the beneficiary households but also the economies of which they are part, with significant benefits for non-beneficiary households as well.

5. References

AIR, 2013. *Baseline report for the impact evaluation of Zimbabwe's Harmonized Social Cash Transfer Programme*. Washington, D.C.

Taylor, J.E. 2013. *A Methodology for Local Economy-wide Impact Evaluation (LEWIE) of Cash Transfers, PtoP Project Report*, FAO and The World Bank. Rome and Washington, D.C.

Taylor, J.E. & Filipski, M. 2014. *Beyond Experiments in Development Economics: Local Economy-wide Impact Evaluation*, Oxford: Oxford University Press.

6. Appendix

Table 3A **Production and demand in the LEWIE data input (excerpt from data input matrix)**

Variable	Commodity	Commodity 2	Factor	Households	Households
				A	B
FD	crop		FL	173.328404	994.774138
FD	crop		HL	28.45718	182.16035
FD	crop		PURCH	2.256777	17.614005
FD	crop		LAND	119.264084	684.48577
FD	crop		K	125.047156	717.676237
beta	crop		FL	0.2909591	0.2909591
beta	crop		HL	0.0652298	0.0652298
beta	crop		PURCH	0.2336961	0.2336961
beta	crop		LAND	0.2002036	0.2002036
beta	crop		K	0.2099114	0.2099114
se	crop		FL	0.0204612	0.0204612
se	crop		HL	0.0125028	0.0125028
se	crop		PURCH	0.0181756	0.0181756
se	crop		LAND	0.0156165	0.0156165
acobb	crop			1.835109	1.835109
acobbse	crop			0.1392711	0.1392711
alpha	crop			0.3188526	0.1486861
alphase	crop			0.0075417	0.0129336
FD	live		FL	33.50122	89.7762
FD	live		HL	7.069927	59.6819498
FD	live		K	14.126374	119.250106
FD	live		HERD	30.0325594	253.524782
FD	live		LAND	7.0398396	59.4279621
beta	live		FL	0.1551716	0.1551716
beta	live		HL	0.0786712	0.0786712
beta	live		K	0.1571924	0.1571924
beta	live		HERD	0.3341898	0.3341898
beta	live		LAND	0.0783364	0.0783364
se	live		FL	0.0433161	0.0433161
se	live		HL	0.0391935	0.0391935
se	live		K	0.0789111	0.0789111
se	live		HERD	0.0384521	0.0384521
se	live		LAND	0.0325711	0.0325711
acobb	live			0.8351021	0.8351021
acobbse	live			0.3119006	0.3119006
alpha	live			0.1086986	0.0631691
alphase	live			0.0040581	0.0054514

INTD	ser	Prod		0.66277889	52.5408212
INTD	ser	Ret		28.0963638	2227.2979
INTD	ser	Ser		18.0601	1431.68786
INTD	ser	outside		53.9376573	4275.82842
FD	ser		FL	68.1156154	1188.25877
FD	ser		HL	24.4411652	426.369619
FD	ser		K	103.059819	1797.85111
beta	ser		FL	0.3247416	0.3247416
beta	ser		HL	0.1165234	0.1165234
beta	ser		K	0.4913383	0.4913383
se	ser		FL	0.4095108	0.4095108
se	ser		HL	0.152805	0.152805
se	ser		K	0.1462853	0.1462853
acobb	ser			2.174299	2.174299
acobbse	ser			1.982535	1.982535
alpha	ser			0.0719864	0.0881722
alphase	ser			0.0030236	0.0050452
INTD	prod	Crop		3.23217288	41.037931
INTD	prod	Prod		7.38230698	93.7309406
INTD	prod	Ret		111.204904	1411.93536
INTD	prod	Ser		89.5173555	1136.57505
INTD	prod	outside		180.318361	2289.44822
FD	prod		FL	196.236866	522.213879
FD	prod		HL	70.4134821	187.380172
FD	prod		K	296.908952	790.116449
beta	prod		FL	0.3247416	0.3247416
beta	prod		HL	0.1165234	0.1165234
beta	prod		K	0.4913383	0.4913383
se	prod		FL	0.4095108	0.4095108
se	prod		HL	0.152805	0.152805
se	prod		K	0.1462853	0.1462853
acobb	prod			2.174299	2.174299
acobbse	prod			1.982535	1.982535
alpha	prod			0.0065174	0.0076729
alphase	prod			0.000869	0.0017577
INTD	ret	Crop		1.35402417	39.587045
INTD	ret	Live		5.66519142	165.63086
INTD	ret	Prod		4.2365443	123.862095
INTD	ret	Ret		171.331828	5009.15785
INTD	ret	Ser		296.286066	8662.39324
INTD	ret	outside		400.077358	11696.8963
FD	ret		FL	226.982748	3112.72584
FD	ret		HL	24.1458116	331.123366

FD	ret	K	159.96334	2193.6558
beta	ret	FL	0.552146	0.552146
beta	ret	HL	0.0587358	0.0587358
beta	ret	K	0.3891182	0.3891182
se	ret	FL	0.213876	0.213876
se	ret	HL	0.0908732	0.0908732
acobb	ret		6.288426	6.288426
acobbse	ret		0.8342338	0.8342338
alpha	ret		0.3202406	0.2888367
alphase	ret		0.0059496	0.0126082

Table 4A Simulated impacts of the Zimbabwe HSCT programme

Elasticity of hl/fl lab supply	100.00/100.00
Liquidity constraint on/off	off
Local markets	Crop, live, ret, FL, HL
Integrated markets	outside, PURCH, HERD
Transfer to HH Group A	300
Iterations	1000
Total income multiplier	
Nominal	1.73
(CI)	(1.42 – 2.00)
Real	1.40
(CI)	(1.12 – 1.63)
Hh income multiplier (nominal)	
A nominal	1.09
cpi increase in %	0.73%
real	1.04
B nominal	0.64
cpi increase in %	0.54%
real	0.36
Production multiplier	
crop	0.31
live	0.14
ser	-0.54
prod	0.00
ret	0.60