Local Economy-wide Impact Evaluation (LEWIE) of Ghana's Livelihood Empowerment Against Poverty (LEAP) programme

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Local Economy-wide Impact Evaluation (LEWIE) of Ghana's Livelihood Empowerment Against Poverty (LEAP) programme

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Abstract

The Livelihood Empowerment Against Poverty (LEAP) programme provides cash and health insurance to extremely poor households with the goal of alleviating short-term poverty and encouraging long-term human capital development. The LEAP provides a significant infusion of cash into Ghana's rural economy. When beneficiaries spend the cash transfer they transmit the impact to others inside and outside the local economy, more often to households not eligible for the cash transfer who tend to own most of the local businesses. The impact on the local economy was simulated using a LEWIE (Local Economy Wide Impact Evaluation) model, focusing on the communities in seven districts included in the LEAP impact evaluation. The LEWIE model for the LEAP programme found that the transfers could lead to relatively large income multipliers of GHS 2.50. That is, every cedi transferred to poor households had the potential to raise local income by GHS 2.50. Eligible households receive the direct benefit of the transfer while ineligible households the bulk of the indirect benefit. However, if labour, capital and land markets do not function well, upward pressure on prices could result. This would raise consumption costs for all households and lead to a real income multiplier as low as GHS 1.50. Complementary programmes that increase the supply response (such as access to credit to invest in capital) could increase the real-income and production impacts of the programme.

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Executive summary

The programme

The Livelihood Empowerment Against Poverty (LEAP) Programme provides cash and health insurance to extremely poor households with the goal of alleviating short-term poverty and encouraging long-term human capital development. A unique feature of LEAP is that beneficiaries are also provided free health insurance through the National Health Insurance Scheme (NHIS). Largely funded from general revenues of the Government of Ghana, LEAP is the flagship programme of the National Social Protection Strategy. As of 2013, LEAP reached over 71,000 households in the 10 regions of Ghana with a monthly cash transfer. At the time of data collection for this study, households received GHS 8-15 per month, depending on the number of eligible beneficiaries per household, which represented on average 11 percent of beneficiary household consumption at baseline. The transfer was subsequently tripled in 2012. In either case, the LEAP programme provides a significant infusion of cash into Ghana's rural economy.

Viewed from a local economy-wide perspective, the beneficiary households are the conduit through which cash is channelled into the local economy. The programme's immediate impact is to raise the purchasing power of beneficiary households. These households spend about 80 percent of their income inside the local economy. As the cash is spent, the transfers' impacts immediately spread from the beneficiary households to others inside (and outside) of the targeted villages. Income multipliers within the targeted areas are set in motion by doorstep trade, purchases in village stores, periodic markets and purchases outside the village. Some impacts extend beyond the project area potentially unleashing income multipliers in non-target sites.

The Local Economy-Wide Impact Evaluation (LEWIE) methodology is designed to detail the full impact of cash transfers on local economies, including on the productive activities of both beneficiary and non-beneficiary groups, how these effects change when programmes are scaled up to include larger regions and why such effects occur. The resulting simulations can provide inputs into programme design and to explain related potential impacts.

The LEWIE model for the LEAP programme

A LEWIE model for a cash transfer programme begins by nesting household farm models for eligible and ineligible households within a region of interest. 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 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 Monte Carlo methods, allows testing the robustness of simulated impacts for errors in parameter estimates and model assumptions.

The Ghana LEAP LEWIE analysis focused on the seven districts in Brong Ahafo, Central and Volta regions from which data were collected on LEAP beneficiary (or treatment) households in 2010 and 2012 as part of the impact evaluation commissioned by the Government of Ghana. Data on LEAP control households were taken from a matched subset of the ISSER/Yale national household survey, while data on households ineligible for the LEAP programme were taken from the full 2010 ISSER/Yale baseline. The LEWIE model is built for treatment and control villages and includes households both eligible and ineligible for inclusion in the LEAP programme.

The simulations presented below 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 Ghana. This can be expected to lower inflationary pressures from the programme by limiting wage increases. It does not remove inflationary pressures completely, however, because land and capital constraints may continue to limit the local supply response.

Results

The LEWIE model simulation showed that the LEAP programme has a potential total income multiplier of GHS 2.50 in nominal terms, with a 90 percent confidence interval (CI) of 2.38 – 2.65. That is, each cedi transferred to poor households can raise local income by GHS 2.50.

However, if supply constraints are binding – that is, if local production or supplies of goods do not increase sufficiently to meet the increased demand brought on by the cash transfer – then the result can be 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. According to the LEAP LEWIE, this real income multiplier of the programme could be as low as GHS 1.50 (CI: 1.40 – 1.59).

These findings illustrate that, without efforts to ensure an adequate supply response in the local economy, part of the programme's impact may be inflationary rather than real. Even a relatively small increase in the local consumer price index (CPI) can result in a smaller real-income multiplier because it potentially affects all expenditures of all household groups. The higher the local supply response, the larger the real expansion in the local economy and the smaller the resulting inflation effect.

Eligible households receive the direct benefit of the transfer while ineligible households would receive the bulk of the indirect benefit. Of the GHS 2.50 nominal income multiplier, ineligible households would receive GHS 1.20 for each GHS 1.0 given to eligible households,

while the eligible households receive the value of the transfer plus an extra GHS .29 for a total of GHS 1.29. Beneficiary households thus would benefit both directly and indirectly from the transfer programme.

The impact of the LEAP varies considerably across sectors. The cash transfers stimulate the production of crops and livestock by GHS .27 and GHS .16 per GHS transferred respectively. The largest positive effects are on retail which has a multiplier of GHS .78.

The trade-off between supply response and inflation depends on the availability of factors to produce commodities. The LEAP programme is already integrated with the provision of social services, particularly the NHIS. Complementary programmes that increase the supply response (such as access to credit to invest in capital) could increase the real-income and production impacts of the programme.

A key finding of this study is thus that measures to increase the local supply response may be important if the intention is to increase the positive spillover effects of the LEAP programme. These complementary measures should be targeted not only at LEAP beneficiary households, but also at non-eligible households that provide many of the goods and services in the local economy.

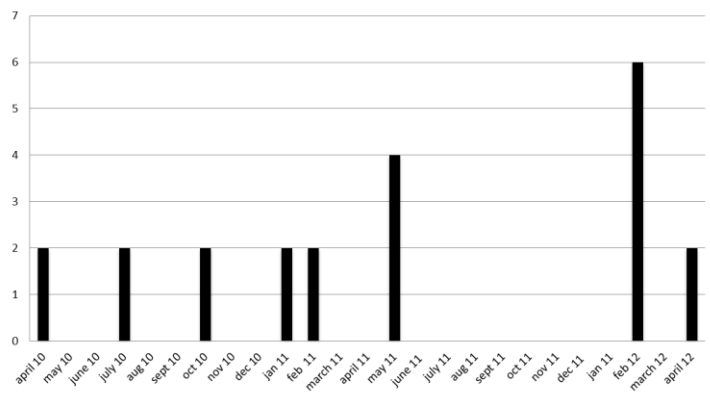
1. Introduction

The Livelihood Empowerment Against Poverty (LEAP) Programme is the flagship programme of the Ghanaian National Social Protection Strategy. Implemented by the Department of Social Welfare in the Ministry of Gender, Children and Social Protection, the LEAP programme provides cash transfers to extremely poor households with the goal of alleviating short-term poverty and encouraging long-term human capital development. LEAP eligibility is based on poverty status and having a household member in at least one of three demographic categories: single parent with orphan or vulnerable child, elderly poor, or person with extreme disability and unable to work. A unique feature of LEAP is that beneficiaries are also provided free health insurance through the National Health Insurance Scheme (NHIS). LEAP is largely funded from the general revenues of the Government of Ghana, along with funding from the World Bank and DFID.

Launched in 2008, as of 2013 the programme reached over 71,000 households in the ten regions of the country. At the time of baseline data collection for this study, households received GHS 8-15 per month, depending on the number of eligible beneficiaries per household, which represented on average 11 percent of beneficiary per capita consumption (Handa et al, 2013). This was reduced to 7 percent due to inflation by the time of follow up in 2012. The transfer value was subsequently tripled in the second half of 2012 and now reaches from a minimum of GHS 24 (US$12.5) per beneficiary per month to a maximum of GHS 45 (US$24.6) for four or more dependents per month. Beneficiaries are paid bimonthly through the national postal service.

However, implementation of the transfer has been inconsistent and LEAP households did not receive a steady flow of predictable cash with which to smooth their consumption. Over the 24-month evaluation period households received only 20 months' worth of payments. A long gap in cash payments to households in 2011 was followed by a triple payment in February 2012 to settle arrears (Figure 1). The unpredictable and lumpy nature of payments appears to have had implications for how beneficiaries spent the transfer, hindering their ability to effectively smooth consumption (Handa et al, 2013).

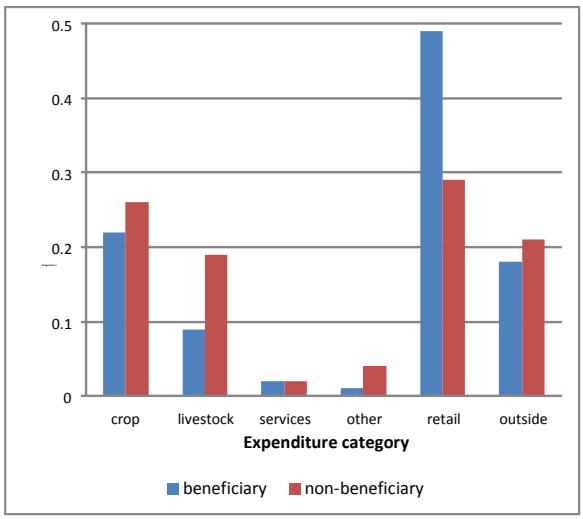
Figure 1 **Payment of LEAP transfers during period of impact evaluation (2010-12)**



Payments are scheduled bimonthly; the y-axis shows the number of "months" of payment made at each period

The LEAP programme provides a significant infusion of cash into Ghana's rural economy. Viewed from a local economy-wide perspective, the beneficiary households are the conduit through which cash is channelled into the local economy. The programme's immediate impact is to raise the purchasing power of beneficiary households. These households spend most (about 80 percent) of their income inside the local economy (Figure 2), primarily at retail stores, and the local nature of household expenditures was described in the qualitative fieldwork (OPM, 2013). As the cash is spent, the transfers' impacts immediately spread from the beneficiary households to others inside (and outside) of the targeted villages. Income multipliers within the targeted areas are set in motion by doorstep trade, purchases in village stores, periodic markets and purchases outside the village. Some impacts extend beyond the project area, potentially unleashing income multipliers in non-target sites.

Figure 2 **Budget shares by expenditure categories, LEAP beneficiaries**



The Local Economy-Wide Impact Evaluation (LEWIE) methodology is designed to detail the full potential impact of cash transfers on local economies, including the productive activities of both beneficiary and non-beneficiary groups, how these effects change when programmes are scaled up to include larger regions and why such effects occur[1]. Our analysis uses a new Monte Carlo method to construct confidence bands around simulation results. This is made possible by the availability of micro-survey data and the use of econometrics to estimate LEWIE model parameters. The resulting simulations can provide inputs into programme design and for explaining potential impacts.

The construction of the LEWIE model for the LEAP programme in Ghana forms part of the From Protection to Production (PtoP) project[2], which is studying the impact of cash transfer

[1] An in-depth treatment of the analysis of treatment effects in general-equilibrium settings can be found in Taylor and Filipski (forthcoming).
[2] http://www.fao.org/economic/ptop. The first formulation of the LEWIE methodology for the From Protection to Production project can be found in Taylor (2013).

programmes on household economic decision making, the local economy and community dynamics in seven countries in sub-Saharan Africa. The research project seeks to understand the potential productive and economic impacts of cash transfers on the rural poor. PtoP aims to provide insights on how social protection interventions can contribute to sustainable poverty reduction and economic growth at household and community levels. The project uses a mixed method approach combining econometric analysis of impact evaluation data, local economy LEWIE models and qualitative methods.

2. The design of the LEAP programme impact evaluation

In Ghana, the development of the LEWIE model forms part of the overall impact evaluation of the LEAP programme implemented by a consortium of partners led by the Carolina Population Center at the University of North Carolina (UNC) and the Institute for Statistical, Social and Economic Research (ISSER) at the University of Ghana. The design of the quasi-experimental impact evaluation takes advantage of a nationally representative household survey implemented by ISSER and Yale University during the first quarter of 2010. The initial treatment sample of 699 households was randomly drawn from a group of 13 500 households that were selected into the programme in the second half of 2009, located in seven districts across three regions (Brong Ahafo, Central and Volta). These households were interviewed prior to receiving any indication that they had been selected for the LEAP programme (Handa and Park, 2011). The baseline survey instrument was a reduced version of the national household survey instrument, and the national survey sample and the treatment household sample were surveyed at the same time by ISSER. The evaluation strategy was to draw the control households from the national survey using propensity score matching (PSM) techniques. A comparison group of 699 "matched" households was selected from the ISSER sample – plus an extra similarly matched 215 households – and re-interviewed after two years, in April–May 2012 along with LEAP beneficiaries, in order to measure changes in outcomes across treatment and comparison groups. Further details of the design of the impact evaluation can be found in Handa, *et al.* (2013).

3. The Local Economy-Wide Impact Evaluation

The Ghana LEWIE models the spillovers from the LEAP programme between beneficiary (A) and non-beneficiary (B) households in treated communities, as well as spillovers in neighbouring non-treated communities (household groups C and D) in rural Ghana. The four types of households in the LEWIE model of rural Ghana are described in Table 1.

Table 1 Types of households in the LEAP LEWIE

		Household type	
		Eligible for LEAP	Ineligible for LEAP
Community type	Has LEAP (treated)	(A) Beneficiary Households	(B) Non-beneficiary households in treated communities
	No LEAP (non-treated)	(C) Eligible, untreated households	(D) Ineligible households in non-treated communities

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. These constitute the accounts in the LEWIE model (Table 2). 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 goods outside the village), in the rest of the project area and in the rest of Ghana. It also includes households' spending outside the village but within the project area. Production activities use different factors: hired labour, family labour, land, capital, livestock and purchased inputs. Local markets for commodities and labour and inter-household transfers link the two household groups in a given community. The LEAP and non-LEAP communities also interact through shared "Zone of Influence" (ZOI) markets. Finally, communities are linked with the rest of Ghana, importing and exporting goods and selling labour.

Table 2 Accounts in the LEAP LEWIE

Households	
A	LEAP beneficiary households
B	Non-beneficiary households in LEAP communities
C	Eligible households in non-LEAP communities
D	Ineligible households in non-LEAP communities
Activities	
Crop	Crops
live	Livestock
ret	Retail
ser	Services
prod	Other production activities
Commodities	
crop	Crops
live	Livestock
ret	Retail
ser	Services
prod	Other production
outside	Produced outside the ZOI
Factors	
HL	Hired labour
FL	Family labour
Land	Land
K	Capital
Purch	Purchased (intermediate) inputs
Herd	Herd (livestock)
ROW	Rest of world (exogenous to model)

3.1. Sources of data and the region of study

The design of the LEWIE model is conditioned by the design of the overall impact evaluation study. We use the label "LEAP data" to refer to the baseline data that were collected on beneficiary households (Group A – LEAP evaluation households) in seven districts in Brong Ahafo, Central and Volta regions in 2010, prior to programme scale-up. These LEAP data were collected at the same time as the on-going nationally-representative household survey conducted by ISSER and Yale University; some of the ISSER sample is in the same districts as the LEAP households.

For purposes of the impact evaluation, Handa and Park (2011) used PSM techniques to select a group of comparison households that did not receive LEAP from within the national ISSER sample. They eventually selected matched households using data drawn from the same three regions as the LEAP households as well as bordering regions with similar agro-ecological conditions within the ISSER sample, since restricting the sample to the districts or regions where the LEAP data were located did not result in sufficiently good matching. We combine the two sets of control households to model group C, the potentially eligible households in non-treated communities.

It would have been ideal to model group C based only on the sample of matched households in the same regions as the LEAP households, but there were insufficient observations to allow for this. LEAP community selection is based on "locally-identified" poverty criteria including

factors such as access to services. Accordingly, "there does not appear to be a clear or consistent methodology for weighting these various poverty criteria" (OPM, 2013). As LEAP communities are not selected at random we cannot assume households in these communities are like households in non-LEAP communities, especially in terms of the attributes we are modelling (e.g. income levels). Our model, however, does not require groups A and C to be similar in the same way as randomized control trials. The current group C is a good approximation of potentially eligible, non-treated households in rural Ghana.

ISSER and Yale constructed an additional subset of the 2010 ISSER data that does not include the control households used for the impact evaluation, which they called "ineligibles". We use this sample to model household groups B and D which are identical and representative of households in rural Ghana. Since the ISSER sample contains a relatively small number of households in the same districts as the LEAP households, we assume that the representative sample of ineligible households in rural Ghana that we use to model group B are similar to the ineligible households in the LEAP communities (which we would assume are poorer than the rest of rural Ghana).

While the baseline surveys (LEAP and ISSER) contain most of the information we need to construct the LEWIE, they do not contain information about location of expenditures and identities of trading partners (i.e. household or business). There was a follow-up survey of the LEAP and control households (but not the ISSER ineligibles) in 2012. We use locations of purchases from the follow-up survey to impute locations in the baseline data for the LEAP, control and ineligible households. These imputations assume that all households (eligible and ineligible) purchase goods in the same locations, but it does not assume they purchase the same goods.

Since inter-household trading can be important in rural areas we want to directly link purchases of agricultural products to the households that produce them, instead of erroneously assuming that all trade flows through the retail sector. The follow-up surveys do not have information on trading partners, so we impute shares of crop and livestock purchased directly from households using the shares from a similar survey in Zambia, used to create a LEWIE model in that country (Thome, *et al.* 2013).

The final data source is a business enterprise survey, designed by the PtoP team, which we use to estimate intermediate demand shares and production functions for non-agricultural activities. The business survey was conducted by ISSER at the same time and in the same communities as the follow-up household survey in 2012.

3.2. Scale of the LEAP programme

An important component of the LEWIE involves the scale of the programme, because the share of households in a community that receive LEAP shape the distribution of programme spillovers between groups. In Ghana only some communities within a district are selected for the LEAP programme. To model the impacts of LEAP in a community and in a district we need to know the share of households in a village that receive LEAP, as well as the share of population that is in a community that receives LEAP.

We began to construct these shares with the number of LEAP households and communities in the LEAP study districts. We used district populations and number of households from the 2010 Census to formulate estimates of the rest of the population sizes. Table 3 presents our calculation of the size of the populations of each of the four household groups in the seven LEAP study districts. Table 4 shows the relative size of each population group as compared to group A, the households that received the LEAP transfer, which we use to approximate the scale of the programme in rural Ghana.

Table 3 **Populations in the seven LEAP study districts**

		Household type	
		Eligible for LEAP	Ineligible for LEAP
Community type	Has LEAP (treated)	5 019 (A)	10 303 (B)
	No LEAP (non-treated)	25 646 (C)	52 646 (D)

Table 4 **Relative sizes of household groups**

		Household type	
		Eligible for LEAP	Ineligible for LEAP
Community type	Has LEAP (treated)	1.0 (A)	2.1 (B)
	No LEAP (non-treated)	5.1 (C)	10.5 (D)

3.3. LEWIE data input

The baseline survey data serve 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 for 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 and subsistence minima for consumption functions, etc.

Table 5 is an excerpt from the LEWIE data input spreadsheet for Ghana showing the parameters and initial values related to crops for each household group. The data input table was structured to interface with GAMS, the software programme 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 values in the table are means of each household income and expenditure

category by household group (A, B/D, and C). We weight the values for groups B/D and C to ensure that we have the correct relative sizes of spending and incomes by each group and a balanced representation of rural Ghana.

In this model crop production demands three types of intermediate or commodity inputs (INTD): Crop, Services, and Retail; and five kinds of factors (FDs): Hired labour, Family labour, Land, Capital and purchased intermediate products (see Table 2 for the definition of the labels for factors and commodities). The first three rows give baseline levels of intermediate demand for each household group. The next five rows give 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 subsequent 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*) then follow. The remaining rows contain consumption function parameters: *alpha* and *aphase* are the estimated budget share and standard error and the last row, the intercept, is assumed to be zero (corresponding to a Stone-Geary utility function without subsistence minima).

In the Ghana LEWIE this panel is followed by similar panels for detailing production and consumption of each of the other commodities: livestock, services, retail, and other production. The businesses canvassed in the business enterprise survey were not representative of the composition of local businesses. As a result of this we use the expenditures in the ZOI or the household income from each activity to determine the size of the local service, retail and other production sectors.

The spatial organization of the ZOI, the region across which we simulate the impacts of the LEAP transfers, is also represented in the LEWIE input sheet. Households consume and produce local commodities and they can sell production to, or import goods from, markets outside the region. The ZOI for the Ghana LEWIE includes the community and nearby villages and the town; the initial values for intermediate demands, factor demands, and consumption of commodities are disaggregated between expenditures within and outside of the ZOI.

Table 5 **LEWIE Panel for Crop production and consumption**

Variable	Commodity2	Factor	Households A	Households B	Households C	Households D
INTD	Crop		18.09	35.97	31.96	35.97
INTD	Services		3.31	14.22	6.52	14.22
INTD	Retail		9.17	15.58	8.59	15.58
FD		FL	42.15	154.76	85.98	154.76
FD		HL	51.74	189.99	105.55	189.99
FD		PURCH	27.64	101.50	56.39	101.50
FD		K	10.58	27.07	24.69	27.07
FD		LAND	161.87	594.35	330.20	594.35
beta		FL	0.1360	0.1360	0.1360	0.1360
beta		HL	0.1669	0.1669	0.1669	0.1669
beta		PURCH	0.0892	0.0892	0.0892	0.0892
beta		K	0.0857	0.0857	0.0857	0.0857
beta		LAND	0.5222	0.5222	0.5222	0.5222
se		FL	0.0608	0.0608	0.0608	0.0608
se		HL	0.0425	0.0425	0.0425	0.0425
se		PURCH				
se		K	0.0319	0.0319	0.0319	0.0319
se		LAND	0.0623	0.0623	0.0623	0.0623
acobb			4.2287	4.2287	4.2287	4.2287
acobbse			0.2151	0.2151	0.2151	0.2151
alpha			0.1425	0.1466	0.2117	0.1466
alphase			0.0063	0.0174	0.0205	0.0174
cmin			0	0	0	0

4. The direct and indirect impacts of the LEAP programme: LEWIE results

The simplest behavioural assumption we can make is that future behaviour is proportional to past behaviour. This means that households will spend the same share of an additional unit of income as the share spent from current income on a given good or service; that input-output coefficients in production activities remain stable before and after the transfer, that the share of income transferred to other households will remain constant and so on. The linearity assumptions allow one to simulate the LEAP's impacts in an unconstrained Social Accounting Matrix (SAM) multiplier model. The boon of a multiplier model is its computational simplicity.

However, SAM multiplier models assume that all responses are linear and there are no price effects within the ZOI. Linearity means that there are not diminishing marginal returns to production activities. The absence of price effects reflects the assumption that all supplies (of factors as well as goods) are perfectly elastic; thus a 1-cedi increase in demand for labour,

food, etc., stimulates an equivalent increase in supply. This assumption may be appropriate in an economy with surplus labour and where producers have the ability to adjust their output before increases in demand push up prices in the ZOI. However the assumptions of linearity and elastic supplies in such a multiplier analysis could otherwise overstate the multiplier effect of LEAP.

The alternative is to use the parameter estimates and baseline data (Table 5) to calibrate a general-equilibrium LEWIE model.[3] Here the LEWIE is analogous to the computable general-equilibrium (CGE) model widely used for policy analysis. However, the LEWIE consists of separate models of household groups calibrated and nested within a model of the programme area economy. The general-equilibrium LEWIE model is more flexible and arguably more realistic than SAM LEWIE multiplier models, and the general equilibrium model lends itself to validation in ways that SAM multipliers do not. The 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.

4.1. The general-equilibrium LEWIE model

One can think of the SAM-based LEWIE model above as the output of a general equilibrium model that includes all production activities, incomes, and household expenditures in the village. SAMs are the basic data input for CGE models; many or most of the parameters in a CGE model can be computed directly from a SAM.[4] The SAM-based LEWIE is different from a conventional SAM however because it is constructed using parameters econometrically estimated from the baseline data. Thus we do not need the SAM to parameterize our general-equilibrium LEWIE model; both the SAM and general equilibrium models are constructed from the same data input sheet illustrated in Table 5.

Validation is always a concern in general equilibrium modelling. 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. If the structural relationships in the simulation model are properly specified and precisely estimated this should lend credence to our simulation results. Assumptions concerning functional form are critical to general equilibrium models, but they are equally critical to any econometric estimation exercise (including those involving experiments). The same methods used to choose among functions in econometric modelling can be used to decide upon functions in a simulation model. The same methods used to verify any econometric model (e.g. out-of-sample tests) are relevant when parameterizing simulation models.

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 by using the following steps:

[3] Actually, a SAM multiplier model is a general equilibrium model. Usually when we refer to general equilibrium models, though, we refer to models with nonlinear responses, resource constraints and prices.
[4] Taylor (2013) explains how to use a SAM-based LEWIE to parameterize production and expenditure functions.

1. Use parameter estimates and starting values for each variable obtained from the micro-data, consistent with the household SAMs, to calibrate a baseline general-equilibrium LEWIE model.

2. Use this model to simulate the LEAP programme cash transfer 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 general-equilibrium LEWIE model and use this model to simulate the same programme again.

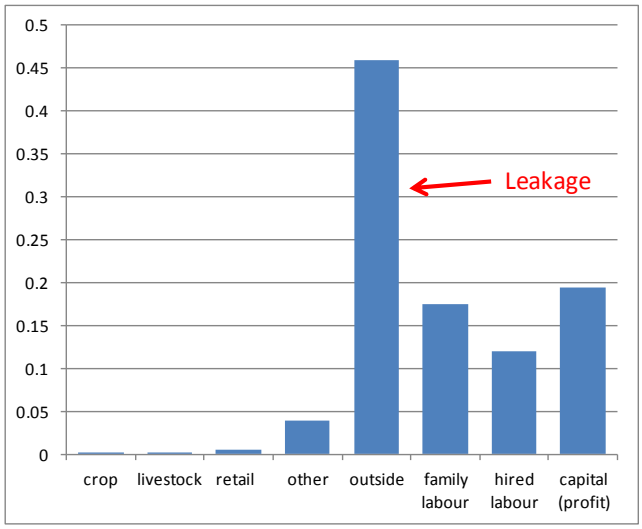
4. Repeat step 3 J (say, 1 000) times. This will yield 1 000 observed simulation results on each outcome of interest.

5. 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 cut-offs 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 were 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.

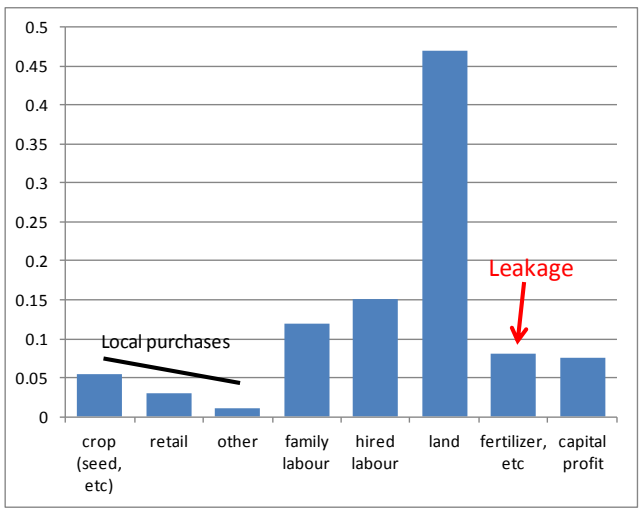
In the general-equilibrium LEWIE model, LEAP transfers increase spending by the treatment households. This increases the demand for goods supplied inside the treated communities as well as outside them. The impact of increased demands on production and on the local income multiplier depends on the supply response to prices. The more elastic the supply response, the more the transfers will tend to create positive spillovers in the 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 LEAP programme on the economy of the treated communities depends on the interplay of these price and output effects.

Figure 4 **Retail activity expenditures, community businesses**



The retail sector purchases some goods locally; however, most of the items sold in local stores come from outside the local economy (Figure 4). Because of this retail is largely an "import" sector, making tradable goods from outside the ZOI available to households and businesses within the community. This is in contrast to crop production (Figure 5), for example, which is produced locally with a lower share of inputs from (or leakages to) the outside. In retail, the mark-up (difference between sale and purchase prices) represents the value-added of the retail sector. It is the non-tradable 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 ZOI). 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 ZOI.

Figure 5 **Crop production expenditures, LEAP beneficiaries**



4.2. LEWIE findings

The LEWIE model was used to simulate the impacts of the initial LEAP transfer on the programme-area economy, taking into account nonlinearities and local price effects. In these simulations prices may be determined inside or outside the community or ZOI.

A challenge in general equilibrium analysis 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; for example, higher world prices for maize might have an effect on domestic prices at the port of entry into the country (if trade policies permit this) and changes in port-of-entry prices may be transmitted to a greater or lesser extent through the rural economy. Given the size of the LEAP programme and the incomplete district coverage, there is little reason for transfers to affect prices outside the treated communities in the initial phase of the 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 Ghana, changes in local demand may nonetheless affect the prices of food and livestock products purchased directly from producers in the treated communities (including the implicit prices of home-produced food), unless retail purchases are a perfect substitute for these goods. In practice, the qualitative field work found little evidence of price effects from the LEAP transfer, either within or outside the treated communities (OPM, 2013).

Simulations require making assumptions about where prices are determined, that is, market closure. We first evaluate the impacts of the LEAP programme under assumptions which we believe reasonably reflect the structure of markets in the treated communities. Then we test the sensitivity of our simulation results to these closure assumptions, as well as to the elasticity of labour supply.

We do not know what the elasticity of labour supply is. We start by assuming a nearly perfectly elastic labour supply (η=100).[5] This reflects excess labour supply in rural Ghana; 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. It does not however remove inflationary pressures because land and capital constraints in the model continue to limit the local supply response.

Table 6 summarises the results from the base LEWIE simulation model for the LEAP programme. The base model assumes an elastic labour supply and that all prices except purchased factor and outside goods are determined within the ZOI. We constructed 90 percent confidence bounds around the multiplier effects using 1 000 random draws from each parameter distribution.

[5] Higher elasticities do not have an appreciable effect on LEAP multipliers.

Table 6 **Simulated income multiplier of the LEAP programme**

	Base model
Income multiplier	
Nominal	2.50
(CI)	(2.38 – 2.65)
Real	1.50
(CI)	(1.40 – 1.59)

The LEWIE model for the LEAP programme found that if households spend the transfer as they spend other cash the transfers would lead to relatively large income multipliers of GHS 2.50, with a 90 percent confidence interval of 2.38 – 2.65. That is, every cedi transferred to poor households had the potential to raise local income within the ZOI by GHS 2.50. One key assumption here is that households will spend the transfer as they spend other cash – as we mentioned earlier, LEAP transfers tended to be infrequent and lumpy, and households may therefore be unable to effectively smooth consumption and thus spend the money differently than expected (Handa *et al*. 2013). For this reason, the income multipliers estimated here reflect a context in which payments are regular and predictable, as the programme was originally envisioned to be implemented.

Moreover, if land and capital constraints limit the supply response, higher demand for local commodities puts upward pressure on prices. Higher prices would raise consumption costs for all households and result in a real-income multiplier that is lower than the nominal multiplier. According to the LEAP LEWIE, this real-income multiplier of the programme could be as low as GHS 1.50, with a confidence interval of 1.40 – 1.59. Although this is lower than the nominal multiplier, it is significantly greater than 1.0, indicating significant income gains from spillovers even in the context of binding supply constraints.

On the one hand, this finding confirms that LEAP is likely to generate income multipliers within the treated communities 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 sufficient supply response in the local economy, part of the impact may be inflationary instead of real. Even a relatively small increase in the local consumer price index (CPI) can result in a much smaller real-income multiplier because it potentially affects all expenditures by all household groups. We will return to this concern below.

Figure 6 **Distribution of LEAP nominal and real-income multipliers on beneficiary and non-beneficiary households**

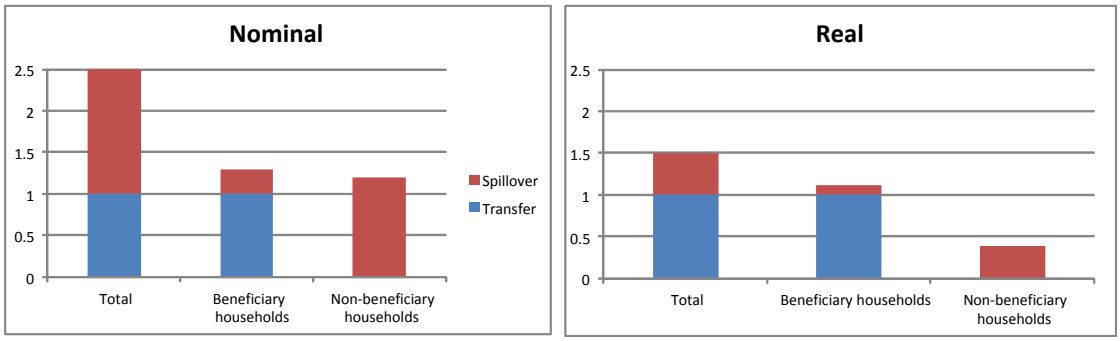
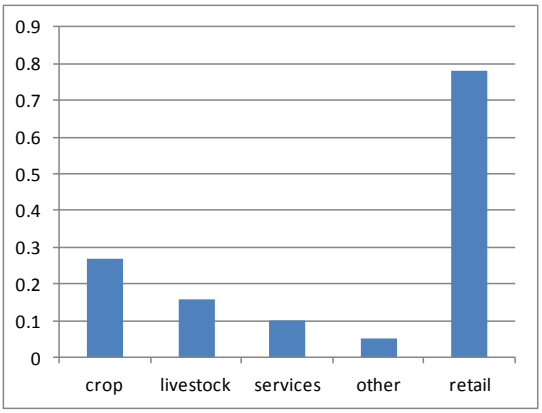


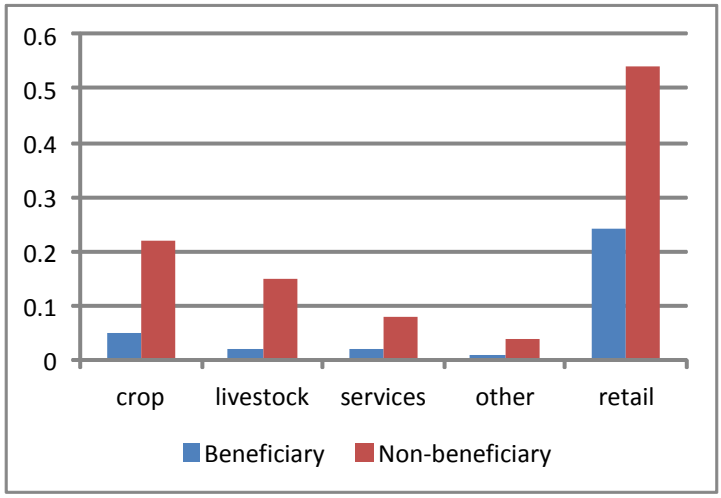
Figure 6 and the middle panel of Table A1 give the simulated impacts on the nominal and real incomes of each household group. Beneficiary (or treated) households (Group A) receive the direct benefit of the transfer plus a nominal indirect benefit of GHS 0.29 per cedi transferred. The ineligible households do not receive the transfer but still benefit from a GHS 1.20 increase in nominal income per each cedi transferred. Their real income multiplier is smaller (0.39) but still significant.

Figure 7 **LEAP production multipliers**



The income multiplier works through productive activities, and Figure 7 (and Table A1) show the corresponding production multipliers. The transfers stimulate the production of crops by GHS 0.27 and livestock by GHS 0.16 per cedi transferred. The largest effect is on the retail sector which has a multiplier of GHS 0.78. Not surprisingly, production multipliers are larger for non-beneficiary households though the multipliers are still sizeable for beneficiary households, particularly in retail (Figure 8). Increasing demand stimulates these sectors by putting upward pressure on prices. Prices are the mechanism by which impacts are transmitted within the local economy. The higher the local supply response, the larger the real expansion in production and the smaller the resulting inflation level.

Figure 8 **LEAP production multipliers, by beneficiary status**



4.3. Robustness tests

We tested the robustness of the simulation results to different assumptions concerning market closure and the liquidity constraint. The simulation in Table 7 (and the second column of Table A1) is a constrained simulation. The constrained simulation is identical to the base simulation except that it assumes that the liquidity constraint is binding. That is, households are limited in their ability to purchase the productive factors for crop production, fertilizer in this case. The nominal income multiplier is the same in this simulation as in the base model; however, the real multiplier is slightly lower (1.42). The liquidity constraint limits the supply response which means the increase in demand from the transfer leads to higher inflation than in the base model. The production multiplier is also smaller for crops (from 0.27 to 0.21) but unchanged for the other sectors because the purchased input in question, fertilizer, is used only in crop production (see Table A1). The impacts of the constraint are small because the baseline level of input usage is low compared to the value of output and other factors (see Table 5).

Table 7 **Simulated effects of liquidity constraints on the LEAP income multiplier**

	Base model	Liquidity constrained
Income multiplier		
Nominal (CI)	2.50 (2.38 – 2.65)	2.50 (2.38 – 2.67)
Real (CI)	1.50 (1.40 – 1.59)	1.42 (1.32 – 1.52)

The simulations presented in the second and third columns of Table 8 (the first column is the base model) represent alternate market closure models. In the base model, all markets are local (i.e. prices are determined within a community, with the exception of purchased factors and outside goods). In the alternate simulations the LEAP and non-LEAP communities

interact in shared ZOI markets for some commodities. In the first alternate model the prices for Livestock, Production Good, and the HERD (Livestock) factor are determined in the ZOI market (which in this case represents a district-wide market), while the other prices are local (determined within a community). In the second alternate model (column 3), all goods are traded in the ZOI market.

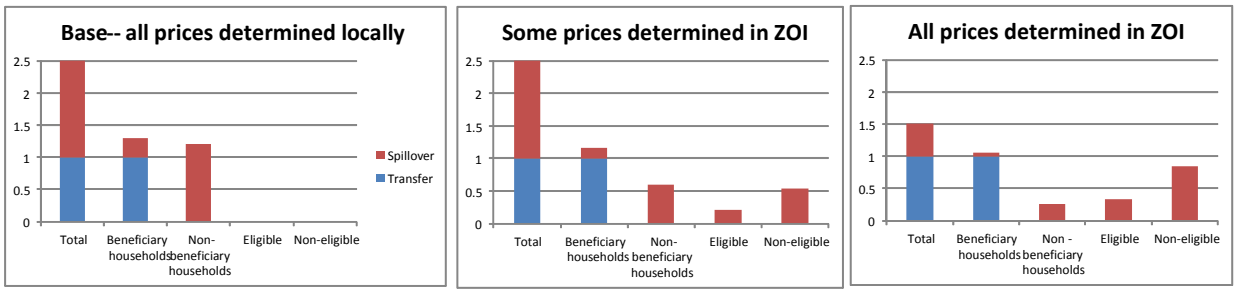
Table 8 **Simulated effects of alternative market closures on the LEAP income multiplier**

	Base model-all markets local	Some prices ZOI	All prices ZOI
Income multiplier			
Nominal (CI)	2.50 (2.38 – 2.65)	2.50 (2.37 – 2.65)	2.49 (2.40 – 2.62)
Real (CI)	1.50 (1.40 – 1.59)	1.49 (1.39 – 1.59)	1.48 (1.41 – 1.55)

The total income multipliers (real and nominal) in the alternate models are not significantly different from the base model nor are the aggregate production multipliers (see Table A2). Instead, including the ZOI markets changes the allocation of spillovers among the households and communities. When all markets are local, as in the base model, there is no way for prices to transmit increases in demand to other communities. When different communities share markets, prices are able to transmit these increases in demand to the other communities.

Household groups C and D, which are located in neighbouring non-LEAP communities, receive significant spillovers from LEAP when they share markets with treated communities. Moreover the spillover benefits in the LEAP community become smaller; since some of the increase in demand is for products traded in the shared market the benefits accrue proportionally to the households that sell goods in those markets. As the non-LEAP communities have larger populations, they own proportionally more factors and receive more spillover income (the eligible and non-eligible household columns seen in the three graphs of Figure 9).

Figure 9 **Household level multipliers under alternative market closures**



There is a concern that the findings presented thus far are sensitive to differences in data sources used to construct the model for LEAP communities. We perform a final out-of-sample simulation to test the robustness of our results to data sources. The ISSER data are nationally-representative. We repeat the base simulation but give LEAP transfers to eligible

households in the non-treated communities (i.e. in generic rural Ghana) instead of in the LEAP communities. We do this simulation with local (community) markets only, in order to isolate differences in the structure of the two communities we model. Results are presented in Table A3 in the Appendix.

The overall income multiplier in the two scenarios is almost the same. There are some differences in production multipliers among the activities because the LEAP households and other households spend money on different goods. The difference between simulations is dampened because the locations of purchases of a commodity are assumed to be the same across households groups, owing to the lack of availability of necessary data. We would not expect richer households to purchase the same bundle of goods as poorer households, nor would we necessarily expect them to shop in the same places. Since we lack expenditure location for the ineligible households we must assume that the locations of purchases are the same. If the ineligibles did in fact spend more money in cities (a leakage out of the ZOI here) then the multiplier would be smaller.

We notice some differences in income multipliers for individual household groups. Group C receives more spillover income in the second model than group A did in the base model. This reflects the fact that these households own more assets and factors; LEAP is supposed to target poorer communities and the eligible households in LEAP communities are poorer than those in the rest of rural Ghana (Handa and Park, 2011).

5. Conclusions and recommendations

Overall, the findings reveal that LEAP treats not only the beneficiary households but also the economies of which they are part. The LEAP programme has a potentially large and significant impact on incomes of both beneficiary and ineligible households in the treated (LEAP) communities. In our base model, each cedi transferred to a LEAP household potentially generates GHS 2.50 of total income within the ZOI (with a 90 percent confidence interval of 2.38 to 2.65). In other words, the income benefits of this programme may be significantly larger than the amount transferred – even one and a half times as large.

One key assumption is that households will spend the transfer as they spend other cash. As mentioned earlier, LEAP payments tended to be infrequent and lumpy, and because of this, households may have spent the money differently than expected given their inability to effectively smooth consumption (Handa, *et al*. 2013). For this reason the income multipliers estimated here reflect a context in which payments are regular and predictable, as the programme was originally envisioned to be implemented.

Higher demand for local commodities may put upward pressure on prices if supply response is constrained. Price inflation is well known in Ghana. This inflation raises consumption costs for all households and, in our simulations, results in a real-income multiplier that is lower than the nominal income multiplier. This real-income multiplier of LEAP may be as low as 1.50 with a 90 percent confidence interval of 1.40 – 1.59. Although the real income multiplier is lower than the nominal (cash income) multiplier, it still is significantly greater than 1.0.

Our simulations show that the distribution of benefits across household groups is shaped by the types of commodities purchased and the assumptions about market closure. The LEAP programme stimulates demand in the local economy, triggering a supply response that creates production spillovers. Most – but not all – of the production and income spillovers created by LEAP are found in the non-beneficiary and/or ineligible households, whether located in the treatment or neighbouring communities.

The trade-off between supply response and inflation depends on the availability of factors to produce commodities. The LEAP programme is already integrated with the provision of social services, including NHIS. Complementary programmess that increase the supply response (such as access to credit to invest in capital) could increase the real-income and production impacts of the programme.

6. References

Handa, S. & Park, M. 2011. *Livelihood Empowerment Against Poverty program: Ghana baseline report.* Technical Report. Chapel Hill (NC): UNC Carolina Population Center, October 5.

Handa, S., Park, M., Osei Darko, R., Osei Akoto, I., Davis, B. & Daidone, S. 2013. *Livelihood Empowerment Against Poverty program impact evaluation.* Chapel Hill (NC): UNC Carolina Population Center, August.

OPM. 2013. *Qualitative research and analyses of the economic impact of Cash Transfer programmes in sub-Saharan Africa. Ghana Country Case Study Report*, PtoP project report, FAO.

Taylor, J.E. & Filipski, M. 2014. *Beyond Experiments: Evaluating Development Impacts with Local Economy-wide Models.* Oxford: Oxford University Press (forthcoming).

Taylor, J.E. 2013. *A methodology for local economy-wide impact evaluation (LEWIE) of cash transfers*, PtoP project report, FAO and The World Bank.

Thome, K., Taylor, J.E., Davis, B., Handa, S., Seidenfeld, D. & Tembo, G. 2013. *Evaluating local economy-wide impacts of Zambia's Child Grant programme*, draft PtoP project report, FAO and The World Bank.

7. Appendix

Table A1 LEAP income multiplier; base and liquidity constrained models

Elasticity of HL/FL		100/100	100/100
Liquidity constraint		No	Yes
Village markets		Crop, Live, Ser, Prod, Ret, FL, HL, HERD	Crop, Live, Ser, Prod, Ret, FL, HL, HERD
ZOI markets		Null	null
Integrated markets		outside, PURCH	outside, PURCH
MULTIPLIERS			
Total income multiplier			
	Nominal	2.5	2.5
	(CI)	(2.38 – 2.65)	(2.38 – 2.67)
	Real	1.5	1.42
	(CI)	(1.40 – 1.59)	(1.32 – 1.52)
Household income multiplier			
A	Nominal	1.29	1.3
	CPI % increase	0.18%	0.19%
	Real	1.11	1.09
B	Nominal	1.2	1.21
	CPI % increase	0.20%	0.21%
	Real	0.39	0.33
Production multiplier			
Crop		0.27	0.21
	(CI)	(0.22 – 0.32)	(0.16 – 0.27)
Live		0.16	0.16
	(CI)	(0.13 – 0.20)	(0.13 – 0.19)
Ser		0.1	0.1
	(CI)	(0.09 – 0.11)	(0.09 – 0.11)
Prod		0.05	0.05
	(CI)	(0.04 – 0.06)	(0.03 – 0.06)
Ret		0.78	0.78
	(CI)	(0.71 – 0.84)	(0.71 – 0.84)
Production multiplier by household			
Crop	A	0.05	0.04

	B	0.22	0.17
Live	A	0.02	0.02
	B	0.15	0.15
Ser	A	0.02	0.01
	B	0.08	0.08
Prod	A	0.01	0.01
	B	0.04	0.04
Ret	A	0.24	0.24
	B	0.54	0.54

Table A2 Alternate market closure scenarios

Village markets		Crop, Live, Ser, Prod, Ret, FL, HL, HERD	Crop, Ser, Ret, FL, HL	FL
ZOI markets		Null	Live, Prod, HERD	Crop, Live, Ser, Prod, Ret, HL, HERD
Integrated markets		outside, PURCH	outside, PURCH	outside, PURCH
MULTIPLIERS				
Total income multiplier				
	Nominal	2.5	2.5	2.49
	(CI)	(2.38 – 2.65)	(2.37 – 2.65)	(2.40 – 2.62)
	Real	1.5	1.49	1.48
	(CI)	(1.40 – 1.59)	(1.39 – 1.59)	(1.41 – 1.55)
Household income multiplier				
A	Nominal	1.29	1.16	1.06
	Real	1.11	1.05	1.03
B	Nominal	1.2	0.6	0.26
	Real	0.39	0.2	0.14
C	Nominal	0	0.21	0.33
	Real		0.07	0.09
D	Nominal	0	0.54	0.84
	Real		0.17	0.22
Production multiplier				

Crop		0.27	0.28	0.28
Live		0.16	0.16	0.16
Ser		0.1	0.1	0.1
Prod		0.05	0.05	0.05
Ret		0.78	0.76	0.75
Production multiplier by household				
Crop	A	0.05	0.03	0.01
	B	0.22	0.13	0.03
	C	0	0.04	0.08
	D	0	0.08	0.17
Live	A	0.02	-0.01	0.00
	B	0.15	-0.05	0.02
	C	0	0.06	0.03
	D	0	0.17	0.11
Ser	A	0.02	0.00	0.00
	B	0.08	0.02	0.01
	C	0	0.02	0.03
	D	0	0.05	0.06
Prod	A	0.01	-0.02	0.00
	B	0.04	-0.1	0.01
	C	0	0.05	0.01
	D	0	0.12	0.03
Ret	A	0.24	0.17	0.04
	B	0.54	0.39	0.09
	C	0	0.06	0.19
	D	0	0.14	0.43

Table A3 Out-of-sample robustness check

Elasticity of HL/FL		100/100	100/100
Liquidity constraint		No	No
Village markets		Crop, Live, Ser, Prod, Ret, FL, HL, HERD	Crop, Live, Ser, Prod, Ret, FL, HL, HERD
ZOI markets		null	Null
Integrated markets		outside, PURCH	outside, PURCH
Transfer		A	C
MULTIPLIERS			
Total income multiplier			
	Nominal	2.5	2.48
	(CI)	(2.38 – 2.65)	(2.36 – 2.63)
	Real	1.5	1.43
	(CI)	(1.40 – 1.59)	(1.34 – 1.52)
Household income multiplier			
A	Nominal	1.29	
	Real	1.11	
B	Nominal	1.2	
	Real	0.39	
C	Nominal		1.42
	Real		1.12
D	Nominal		1.06
	Real		0.31
Production multiplier			
Crop		0.27	0.32
Live		0.16	0.17
Ser		0.1	0.09
Prod		0.05	0.06
Ret		0.78	0.61

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