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Evaluating Local General Equilibrium Impacts of Lesotho's Child Grants Programme

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J. Edward Taylor, Karen Thome, and Mateusz Filipski
Department of Agricultural and Resource Economics, University of California, Davis

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Abstract

This report presents findings from a local economy-wide impact evaluation (LEWIE) of Lesotho's Child Grants Programme. Simulations indicate that total income impacts significantly exceed the amounts transferred under the programme: each loti transferred stimulates local nominal income gains of up to 2.23 loti. By stimulating demand for locally supplied goods and services, cash transfers have productive impacts, mostly in households that do not receive the transfer. Our simulations reveal the importance of the local supply response to changes in demand. Capital and labor constraints exert upward pressure on local prices and reduce the programme's income multiplier in real terms. Nevertheless, real income multipliers remain significantly greater than 1.0 in most cases, even in the presence of factor constraints. Our findings raise questions about how to measure the impacts of cash transfers, which include effects on non-beneficiaries as well as targeted households. Evaluations focusing only on the treated households are likely to significantly understate programme impacts because of general-equilibrium feedbacks in local economies.

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Introduction

The main objective of Lesotho's Child Grants Programme (CGP) is to "improve the living standards of Orphans and Vulnerable Children (OVC) so as to reduce malnutrition, improve health status, and increase school enrolment among OVCs."[1] The CGP seeks to accomplish this via an unconditional cash transfer targeted to poor and vulnerable households. The transfer is in the amount of 360 maloti (LSL; US$48) per quarter and targets "poor households with children selected through a combination of Proxy Means Testing (PMT) and community validation."[2].

1. The CGP Impact Evaluation

The impact evaluation of the CGP has two components, one experimental, and the other using a local economy-wide simulation approach.

The experimental approach will be carried out ex-post and will exploit the randomized cluster programme design (discussed below). It will assess the impacts of CGP cash transfers by comparing households in the treated clusters with those in the control clusters. Randomization of treatments ensures that the treated and control households are similar except for the treatment. Thus, the average effect of the programme on an outcome of interest among the treated can be estimated by comparing changes in the outcome between the treated and control households. This difference-in-difference method controls for other variables than may have affected the outcome of interest in both treated and control clusters.

Experiments are most used to estimate average effects of the treatment on the treated households. However, the baseline survey also gathered information on ineligible households in both treated and non-treated clusters. This opens up the possibility of testing for impacts on ineligible as well as treated households. Experimental methods can be used to test whether the CGP affects ineligible households by comparing changes in outcomes between ineligible households in treated and control clusters. Randomization should ensure that the ineligible households in the control clusters are identical to those in the treated clusters, except for the presence of treated households within the cluster. Ex-post, once follow-on survey data become available, it should be possible to compare outcomes in ineligible households.

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

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[1] Manual of operation in use for round 1A of the CGP pilot. November 2008.
[2] Oxford Policy Management (OPM), CGP Impact evaluation, Targeting and baseline evaluation report (Unicef/FAO), January 2012. US$1=7.57 LSL.

The second component of the evaluation is designed to complement the experimental analysis and address the limitations outlined above. Local economy-wide impact evaluation (LEWIE) simulation methods can be used to assess the likely impacts of the CGP on the treated clusters, including on ineligible households. This analysis allows us to understand the mechanisms by which project impacts get transmitted within the treated clusters. It can be carried out ex-ante, using baseline survey data. Ex-post, experiments and LEWIE can complement and inform one another, enabling us to achieve a more comprehensive evaluation of project impacts than is possible using either method alone.

This paper reports the findings of 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 modeling approach, data, findings, and implications for programme design.

2. Local Economy-wide Impacts of the CGP

With an initial coverage of 2,299 households and a planned scale-up to 4,553 households, the CGP will provide a significant infusion of cash into Lesotho's rural economy (3.3 million LSL initially, 6.6 million eventually; Table 1).

Table 1 Initial and Scaled-up Child Grants Programme Coverage (LSL)

Project Phase	Program Disbursement	
	Disbursement	Households
Initial	3,310,560	2,299
Scaled Up	6,556,320	4,553
Payment/Household	1440	LSL Per Year

The Programme's immediate impact will be to raise the purchasing power of the beneficiary households. The 1,440 LSL transfer represents an average of 21.5 percent of the income of the treated households. As these households spend their cash, the transfer's impacts immediately spread from the beneficiary households to others inside (and outside) of the treated villages. Doorstep trade, purchases in village stores, periodic markets, and purchases outside the village potentially set in motion income multipliers within the treated clusters. Some impacts leak out of the project area, as well, potentially unleashing income multipliers in non-treated locales. In theory, if treated and control villages interact directly or indirectly, for example, through periodic markets, control group contamination could occur: the incomes of control households could rise. This might make it difficult to identify programme impacts on incomes and a wide range of other outcomes. The randomized cluster design was devised to minimize the likelihood that CGP impacts will be transmitted to the control clusters[3].

In the longer run, as the programme is scaled up, the control group will vanish, and the CGP payments will have direct and indirect effects throughout the region. The validity of randomized control trials (RCTs) turns on the "invariance assumption," which states that the actual programme will act like the experimental version of the programme. The possibility that treatments affect the non-treated (i.e., ineligible households in the treated clusters) is one reason why the invariance assumption can break down. Experiments, by their construction, cannot shed much light on this question. A LEWIE model, which captures local general-equilibrium effects, offers insights into how spillovers are likely to influence Programme outcomes in the pilot as well as the scale-up phases.

The LEWIE model was designed to analyze and quantify the direct and indirect effects of the CGP. In this report, we use the model to simulate the impacts in the short run, when only randomly selected villages receive the CGP treatment.

Validation of findings is generally viewed as a major strength of RCTs but a weakness of simulation methods. Our analysis uses a new Monte Carlo method to construct confidence bands around simulation results. This is made possible by the availability of micro-data from the baseline household survey and the use of econometrics to estimate LEWIE model parameters.

The results reveal important spillovers within the treated clusters (that is, from beneficiary to non-beneficiary households). Local general-equilibrium effects create impacts different from those documented by experiments focusing on treated and control households. By far, most of the indirect effects of the CGP, particularly on production, are on the non-beneficiary households. This is not surprising given the CGP's eligibility criteria, which favor households with limited productive potential (i.e., asset and labor-poor households). Our findings suggest that the CGP will have important spillover effects on production; however, we have to look for most of these effects in the non-beneficiary households.

Under what we believe are reasonable assumptions about the functioning of local markets (model closure), the initial (RCT) phase CGP has a multiplier effect within the project area of 2.23 per loti transferred, with a 90 percent confidence interval (CI) of 2.08 to 2.44. In other words, the 3.3 million LSL investment in the CGP during its initial phase increases total income by 6.89 to 8.08 million LSL. However, unless the local supply response is elastic, prices increase slightly, reducing real income for both beneficiaries and non-beneficiaries. Thus, in real terms (that is, adjusting for higher prices in the project area) the income multiplier is lower, 1.36 (CI: 1.25-1.45), and the programme increases total real income in the project area by 4.5 million LSL. The CGP in its initial phase stimulates most production

[3] Details of the sampling procedure can be found in: Oxford Policy Management/Luca Pellerano, CGP Impact Evaluation, Sampling Design and Targeting Evaluation Research, June 30, 2011.

activities. The majority of production impacts, and thus of the indirect benefits of the programme, accrue to households that are not eligible for transfers. As we shall see, the real income multipliers depend critically on the supply response in the local economy, and they increase as capital and liquidity constraints on production are loosened.

3. Treatment Effects in a General-Equilibrium Setting[4]

Let ρ denote the true effect of one unit of cash transfer on an outcome of interest (say, income) in the treated household. The power of randomization is that it can enable us to estimate ρ by comparing the outcome for those who get the treatment ($Y_{1,T}$, where subscript T denotes the treatment group) with the outcome for an otherwise identical control group ($Y_{1,C}$, where the subscript C denotes the control group).

The minute the treated household spends its cash, it transmits the impact of the treatment to another (non-treated or treated) household. (Assuming we have a viable control group, this spending will not directly affect control households.) Let $\alpha_{T,NT}$ and $\alpha_{T,T}$ denote, respectively, the resulting income impact on non-treated (NT) and treated households inside or outside the treated site (e.g., village). These households are now infected by the treatment, and they, in turn, affect other non-treated or treated households. We can denote these second-order effects by $\alpha_{NT,NT}$, $\alpha_{C,NT}$, $\alpha_{NT,C}$ and $\alpha_{C,C}$. The chain of impacts continues and converges on a total GE impact. Let α^{GE} denote the total GE effect of a 1-unit cash transfer to the treated. It is the sum of second and higher-round indirect effects of the treatment on the treated and non-treated populations within the treated economy; that is, $\alpha^{GE} = \alpha_{T}^{GE} + \alpha_{NT}^{GE}$. In a well-designed randomized control trial, the estimate of ρ includes the GE effects on the treated households; thus, the expected total impact of the treatment is:

$$\alpha^{GE} = \rho + \alpha_{NT}^{GE}$$

The classical experimental assumptions (including randomization) ensure that $E(Y_{1,T} - Y_{1,C}) = \rho$; however, the expected total impact of the programme does not equal ρ unless $\alpha_{T,NT} = 0$, which is not tenable given that the cash is spent, most likely near home. Otherwise, the direction and magnitude of the indirect effects depends on the sign and magnitude of all the α's.

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[4] This section draws heavily from Chapter 2 of J.E. Taylor and M. Filipski, *Beyond Experiments: Simulation Methods for Impact Evaluation* (book in progress), Department of Agricultural and Resource Economics, UC Davis.

This derivation assumes a viable control group; however, the control group, in practice, might not be immune to the GE effects of the treatment even in the short run. A valid experiment requires finding a control population for which $\alpha_{T,C}^{GE} = 0$ yet that is identical to the treatment group except for the treatment. In practice, often we end up with a control group that is not likely to be isolated from the GE effects of the treatment (e.g., drawn from the same villages as the treated households or nearby villages, in order to hold locality characteristics constant). If $\alpha_{T,C}^{GE} \neq 0$, this obviously raises the specter of bias in estimating ρ as well as adding a new component to the programme's total impact.

In the case of impact evaluations based on randomized cluster demand (as in Lesotho), control households are not chosen from the same or neighboring villages. This minimizes the potential for control group contamination, while randomization assures that on average the household and community characteristics will be balanced. In this evaluation, therefore, we will consider spillovers from treated to non-treated (that is, ineligible) households within the treated clusters and assume that the cluster design avoids spillovers to control households. It might be possible to verify this assumption ex-post, once the follow-on survey is completed. For example, it might be possible to test for changes in economic outcomes in the control households closest to treated clusters, following an approach similar to the one used (in a different context) by Kremer and Miguel.[5] Once projects are "ramped up," of course, the dichotomy of treated and control breaks down entirely.

Evaluating the expected full impact of a treatment within a treatment village requires quantifying the GE impacts on the non-treated as well as treated within the treatment area in the short run and, if the treatment is expanded, potentially everywhere in the long run. In the simplest case, α_{T}^{GE} and α_{NT}^{GE} might be estimated using SAM multiplier (or constrained multiplier) models that nest within them the treatment and non-treatment groups. We opt for a more flexible approach that allows us to consider the possible effects of resource constraints, nonlinearities, and price effects while performing LEWIE simulations.

4. CGP Impact Evaluation in Lesotho

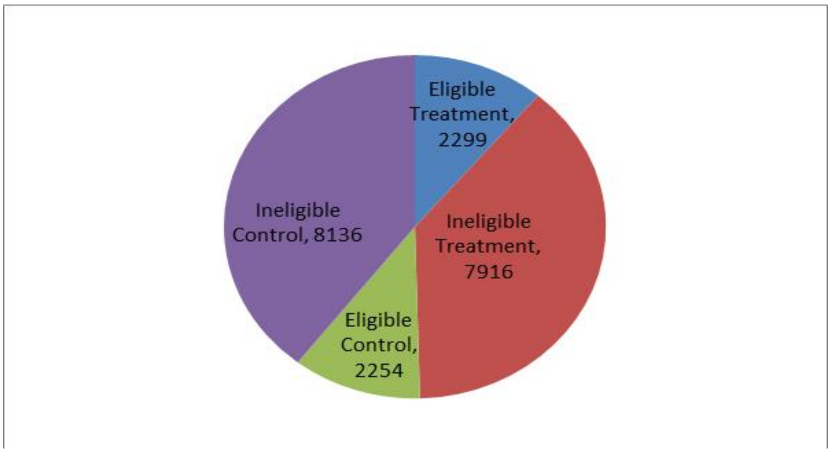
Our first step in modeling the direct and indirect effects of the CGP is to identify the relevant household groups. The intersection of treatment and control villages and eligible and non-eligible households generates four household groups: A. Treatment; B. Control; C. Non-Beneficiary; and D. Psuedo-non-beneficiary.

Groups A and B are eligible to receive the CGP; however, B is in the control village clusters and therefore does not receive the transfer. Groups C and D are the ineligible groups located

[5] Edward Miguel and Michael Kremer. "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities." *Econometrica* 72(1, January):159-217, 2004.

in the treatment and control clusters, respectively. Figure 1 illustrates these four groups and shows their composition in the study region.

Figure 1. Household Groups in the GE Impact Evaluation Model



Our evaluation focuses on the CGP round-2 pilot programme area in rural Lesotho. The programme region is comprised of two village types: treated villages in electoral districts that were selected to receive cash transfers under phase B of the programme pilot, and control villages in electoral districts that were not selected into the programme.[6]

Within each village we model two types of households: those eligible for the programme and those ineligible. Eligible households were selected based on the NISSA 1 and 2 criteria and being validated by their communities. These households have low incomes and high dependency ratios; they represent around one-quarter of all households in the programme area. They may have limited access to productive capital and labor, but they are the conduit through which the cash gets channeled to other households that may be better positioned to display a productive response.

It is important that we include the ineligible households in our model, since they interact with the eligible households through businesses, the labor market, etc., and these spillovers can have important income-generating effects. The treatment and non-beneficiary households interact in the treated villages and the control and pseudo-non-beneficiary households interact in the control villages. During the Programme's pilot phase, the randomized cluster design minimizes the likelihood that groups A and C will interact with B and D, potentially transmitting impacts to the control villages. Thus, groups A and C (the beneficiary and ineligible households within the treated village clusters) will be the focus of this report.

We also need to identify 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 will constitute the accounts in our model. Table 2 summarizes

[6] There are other village types in the five states covered by the program, i.e., community councils are not represented here).

these accounts. Household groups participate in crop and livestock production, retail, service, and other production activities, and in the labor market. The retail sector includes village stores, which obtain most of their goods outside the village, in the rest of the project area, in the rest of Lesotho, or abroad. It also includes households' spending outside the village but within the project area. Production activities use five different factors: hired labor, family labor, land, capital, and purchased inputs. The two household groups in a given village cluster are linked by the hired labor market, by local markets for commodities, and by inter-household transfers. Villages within a cluster are linked by trade in goods, services, and tradable factors. The treated clusters also interact with the rest of Lesotho and the rest of the world (principally South Africa), "importing" and "exporting" goods and selling labor.

5. LEWIE Data Input

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; inputs of land, labor, capital, and purchased inputs; 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, marginal budget shares and subsistence minima for consumption functions, etc. Tables 3a and 3b, below, present excerpts from the LEWIE data input spreadsheet for Lesotho, showing the parameters and initial values related to crops for each of four household groups (eligible/ineligible in treated/control villages; the spreadsheet is split into these two tables for ease of presentation).

Table 2. Accounts in the LEWIE Model

Households	
A	Eligible, Treated Villages
B	Eligible, Control Villages
C	Ineligible, Treated Villages
D	Ineligible, Control Villages
Activities	
crop	Crops
live	Livestock
ret	Retail
ser	Services
prod	Other Production
Commodities	
crop	Crops
live	Livestock
ret	Retail
ser	Services
prod	Other Production
outside	Purchased Outside Village in Project Area
Factors	
HL	Hired Labor
FL	Family Labor
LAND	Land
K	Capital
PURCH	Intermediate Inputs
ROW	Rest of Lesotho and Abroad

Table 3a. **Top Panel of LEWIE Input Spreadsheet**

Variable	Commodity	Factor	Households			
			Treated Villages		Control Villages	
			A	B	C	D
FD	crop	HL	150283.91	170974.01	1552819.18	2140229.31
FD	crop	FL	930154.11	818267.67	2859873.84	2432985.77
FD	crop	LAND	873093.98	768071.19	2684435.40	2283734.71
FD	crop	K	1092395.01	960992.93	3358703.55	2857356.10
FD	crop	PURCH	113174.87	99239.27	919594.60	838077.97
beta	crop	HL	0.0750011	0.0750011	0.0750011	0.0750011
beta	crop	FL	0.2401784	0.2401784	0.2401784	0.2401784
beta	crop	LAND	0.2254447	0.2254447	0.2254447	0.2254447
beta	crop	K	0.2820712	0.2820712	0.2820712	0.2820712
beta	crop	PURCH	0.1773046	0.1773046	0.1773046	0.1773046
se	crop	HL	0.0172838	0.0172838	0.0172838	0.0172838
se	crop	FL	0.0882176	0.0882176	0.0882176	0.0882176
se	crop	LAND	0.0661637	0.0661637	0.0661637	0.0661637
se	crop	K				
se	crop	PURCH	0.0391298	0.0391298	0.0391298	0.0391298
acobb	crop		4.238052	4.238052	4.238052	4.238052
acobbse	crop		0.2097159	0.2097159	0.2097159	0.2097159
alpha	crop		0.0915113	0.1289393	0.0188418	0.034959
alphase			0.0108685	0.0132612	0.0043281	0.0068111
cmin	crop		0.00	0.00	0.00	0.00

This data input table was structured to interface with GAMS, where the LEWIE model resides. Its columns give the names of variables or parameters, the name of the commodity, the factor name (in the case of factors), then the values for each household group. In this model, crop production involves four kinds of factor demands (FDs): hired labor (HL), family labor (FL), land, and capital (K), along with purchased inputs (PURCH). The first five rows give the baseline levels of each for each of the four household groups. The next five rows give the estimated Cobb-Douglas production function exponents (beta), and the next five the standard errors of these estimates (se). The following two rows (acobb and acobbse) give the estimated production function shift parameter and its standard error. The remaining rows contain consumption function parameters: alpha and alphase are the estimated budget share and its standard error, and the last row, the intercept, assumed here to be zero (corresponding to a Stone-Geary utility function without subsistence minima).

For the Lesotho LEWIE, this panel is followed by similar panels for livestock, retail, other services, and other production.

The bottom panel of the input table (3b) contains other household parameters and initial values of variables not related to production activities or commodities.

Table 3b. **Bottom Panel of LEWIE Input Spreadsheet**

Variable	Commodity	Factor	Households			
			Treated Villages		Control Villages	
			A	B	C	D
endow		HL	1075105.05	818409.82	6228443.37	3113530.86
endow		FL	4752302.88	3734097.21	45821811.45	39755606.63
endow		LAND	404896.84	539744.97	992408.91	344490.25
endow		K	27975026.43	17113373.18	252889068.03	231547916.73
ZOI LABOR ENDOW		HL	697947.43	741630.92	4665416.51	7577907.83
ROLES LABOR ENDOW			520542.34	628959.54	2906892.15	2682130.85
ROWendow		HL	295165.16	225433.36	2591160.11	2831404.48
transfout	alpha		0.0012663	0.0011821	0.0018765	0.0027138
	se					
transfin	alpha		0.0009271	0.0032502	0.0024569	0.0068431
	se		0.0004002	0.0004912	0.0005068	0.0004165
sav-informal	alpha		0.0468887	0.0348792	0.0669304	0.0737041
	se		0.0047567	0.0054993	0.0055992	0.0074673
sav-formal	alpha		0.0295651	0.0081229	0.1939786	0.2341901
	se		0.0037793	0.0016507	0.0111184	0.0093985
labexp	alpha		0.0017639	-0.000171	0.0070615	0.0142293
	se		0.0011685	0.0008516	0.0015431	0.0034445
EXP ZOI	alpha		0.22000711	0.262005593	0.310724082	0.268586968
EXP ROLES			0.07227429	0.114225807	0.124906518	0.099961632
NONSCtransfers			1544083.35	1105914.73	27898374.63	20052205.27
Remits			1141970.32	1317276.59	8958830.09	8458958.52
Number of HHs			2299	2254	7916	8136

The first four rows of this panel contain household endowments of each factor, and the following three rows, total endowments of hired labor in the ZOI, rest of Lesotho, and rest of world (here, South Africa). This model does not attempt to explain the supply of hired labor from ZOI households to the rest of the country or world, which is likely to be determined by a fairly complex, network-driven process. Thus, in the impact evaluation these are treated as fixed variables; however, the within-ZOI availability of labor depends on them, so it is important to collect data on these variables in the survey and include them in the LEWIE.

The rest of the last panel contains data on estimated parameters and standard errors on household private transfers outside (transfout) and inside (transfin) the village; savings, both informal and formal; hiring other than for production activities (e.g., for home improvements; labexp); expenditures outside the village (EXP ZOI and EXP ROLES, both residuals); non-SCT transfers; and remittances (Remits).

From Survey Data to LEWIE Data Input: A Few Observations

The baseline values in the table are weighted totals of each household income and expenditure category by household group (A, B, C, and D). The eligible households were oversampled relative to the population in the study region. We scaled the totals from the survey up by the ratio of households surveyed to total households in the population of each group. This ensures that we have the correct relative sizes of spending and incomes by each group and a balanced representation of the treated and control clusters.

Household demand for crops and livestock products that are home-produced or purchased directly from neighboring households are captured in the crop and livestock accounts. (Home consumption of agricultural goods is reported in the baseline survey.) Demand for crops, livestock, or any other goods in local stores or periodic markets are considered part of retail demand. We allocate household expenditures on food and non-food items within the cluster to retail, services or productive activities, as well as direct purchases of agricultural and livestock products from other households. The household expenditure accounts also include transfers to other households and purchases at locations outside the village.

We used data from the household survey to estimate Cobb-Douglas production functions for crops and livestock. Although the household survey reports profits from household businesses, profits and own consumption of agricultural goods are not directly reported. We calculated the residual value of crops as the value of production minus the value sold. This residual should include own consumption, crops used as feed for livestock, and profit accruing to household value added. We calculated the own consumption of crops based on the seven day recall expenditure module. This value is significantly larger than the residual, probably because it does not account for seasonality. Consequently, we assign crop residual to own consumption. We follow a similar procedure for livestock.[7]

Business surveys provide the data to estimate Cobb-Douglas production functions and calculate intermediate input demands for three different types of businesses (including hired labor), as well as shares of sales to each location in our SAM. Unlike the data input for the agricultural sectors, we do not expect all inputs to generate value added; the intermediate inputs are not substitutable for other inputs (for example a food store cannot substitute sugar for labor), and their demand is represented by Leontief input-output coefficients.

The household income account (row) includes wages earned and transfers to the household, as well as profits from the families' agricultural and business activities, which accrue to the family capital account. The wages and transfer amount come directly from the survey data. We do not know the source of the hired labor and thus use the shares of different locations in wages earned by households to allocate hired labor within and outside the village. We use the production functions to allocate the profit from activities among the factors. The businesses canvassed in the businesses survey are not representative of the composition of local businesses. We use the expenditures in the village to determine the size of each industry.

[7] Seasonality is a concern in expenditure surveys, which usually rely on recall over a recent time period (commonly seven days). An ideal strategy would be to use follow-on questions to elicit information on how well recent expenditures represent typical expenditures, and if they do not, how much does the household normally spend in a seven-day period.

6. Constructing the LEWIE-SAM

The LEWIE data input spreadsheet contains all of the information needed to construct a baseline social accounting matrix (SAM) for each relevant household group, the treatment and control villages, and the project area. The household SAMs are nested within village SAMs, and the village SAMs are nested within a SAM for the programme region.

The SAM represents a snapshot of the project area economy at a given point time. The estimated parameters together with baseline values of each variable in the spreadsheet were used to construct the SAM. The SAM is an intermediate output from our LEWIE model as well as a starting point for evaluating the impacts of the CGP within the project area. The use of production and expenditure functions estimated econometrically from the baseline household data distinguishes this from other SAMs and is a novel feature of this approach.

Table 4 presents the baseline SAM for the project region. This SAM is an output of the LEWIE model; its construction is described below. The SAM summarizes the flows of income within household groups, villages, and the project-area economy in millions of LSL.

We can get a sense of how the SAM works by following a cash transfer through the matrix. In the pilot phase, the cash transfer goes only to the treated households (Group A). Columns 32 through 35 show how households spend their income. Dividing each number in a column by the column total, we get average budget shares. The average budget shares are reported in Table 5. Expenditure shares are similar between the two groups eligible for the CGP (A and B). Both spend a high percentage (between one-fourth and one-fifth) of their income on home-produced crops. They spend around one-third of their income in village stores, and less (5 to 6 percent) on local non-agricultural goods and services. The ineligible groups spend a smaller share of their income on food and a larger share on goods from outside the project area.

Table 4. A Nested SAM for the Project Region

SAM Account			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Total Income
			ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	ACT	COMM	COMM	COMM	COMM	COMM	COMM	FACT	FACT	FACT	FACT	FACT	INST	INST	INST	INST	ROW	
			A	A	A	A	A	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D																	
			crop	live	ret	ser	prod	crop	live	ret	ser	prod	crop	live	ret	ser	prod	crop	live	ret	ser	prod	crop	live	ret	ser	prod	OUTSIDE	HL	FL	LAND	K	PURCH	A	B	C	D		
ACT	A	crop																					3.453																3.453
ACT	A	live																						3.848															3.848
ACT	A	ret																							6.297														6.297
ACT	A	ser																								0.347													0.347
ACT	A	prod																									0.603												0.603
ACT	B	crop																					3.010																3.010
ACT	B	live																						1.949															1.949
ACT	B	ret																							2.407														2.407
ACT	B	ser																								0.409													0.409
ACT	B	prod																									0.723												0.723
ACT	C	crop																					15.673																15.673
ACT	C	live																						40.252															40.252
ACT	C	ret																							55.265														55.265
ACT	C	ser																								15.118													15.118
ACT	C	prod																									2.621												2.621
ACT	D	crop																					18.385																18.385
ACT	D	live																						25.808															25.808
ACT	D	ret																							49.818														49.818
ACT	D	ser																								13.462													13.462
ACT	D	prod																									2.104												2.104
COMM		crop																																3.453	3.010	15.673	18.385		40.522
COMM		live																																3.848	1.949	40.252	25.808		71.857
COMM		ret			0.177	0.091	0.076			0.068	0.107	0.091			1.556	3.945	0.330			1.403	3.513	0.265												5.013	4.506	35.376	39.972	17.299	113.787
COMM		ser			0.189	0.001	0.022			0.072	0.002	0.027			1.660	0.056	0.097			1.496	0.050	0.078												0.591	0.524	5.874	7.158	11.441	29.337
COMM		prod																																0.267	0.220	2.479	1.655	1.430	6.052
COMM		OUTSIDE			4.498	0.055	0.355			1.719	0.065	0.426			39.475	2.389	1.542			35.584	2.127	1.238																	89.472
FACT		HL	0.259	0.056	0.233	0.051	0.038	0.226	0.029	0.089	0.060	0.046	1.176	0.589	2.045	2.211	0.165	1.379	0.378	1.843	1.969	0.133																12.972	25.943
FACT		FL	0.829	1.653	0.174	0.043	0.033	0.723	0.837	0.066	0.051	0.039	3.764	17.290	1.523	1.892	0.141	4.416	11.086	1.373	1.685	0.114																	47.732
FACT		LAND	0.778	0.937				0.679	0.475				3.534	9.806				4.145	6.288																				26.641
FACT		K	0.974	1.152	1.026	0.106	0.080	0.849	0.584	0.392	0.125	0.095	4.421	12.054	9.006	4.626	0.346	5.186	7.729	8.119	4.119	0.278																	61.267
FACT		PURCH	0.612	0.049				0.534	0.025				2.779	0.512				3.260	0.329																				8.099
INST		A																											1.659	3.498	1.716	3.338						5.229	15.440
INST		B																											1.953	3.069	1.154	2.046						4.081	12.302
INST		C																											11.312	23.844	13.340	30.453						53.516	132.465
INST		D																											11.019	17.320	10.432	25.430						57.462	121.664
ROW																												89.472		0.000			8.099	2.268	2.093	32.811	28.686		163.430
Total Expenditures			3.453	3.848	6.297	0.347	0.603	3.010	1.949	2.407	0.409	0.723	15.673	40.252	55.265	15.118	2.621	18.385	25.808	49.818	13.462	2.104	40.522	71.857	113.787	29.337	6.052	89.472	25.943	47.732	26.641	61.267	8.099	15.440	12.302	132.465	121.664	163.430	

Table 5. **Average Budget Shares, Treated and Control Households**

Account		INST A	INST B	INST C	INST D
COMM	crop	0.22	0.24	0.12	0.15
COMM	live	0.25	0.16	0.30	0.21
COMM	ret	0.32	0.37	0.27	0.33
COMM	ser	0.04	0.04	0.04	0.06
COMM	prod	0.02	0.02	0.02	0.01
ROW		0.15	0.17	0.25	0.24

Local expenditures indirectly benefit other households in the treated village, in the first instance, the households that supply the goods and services demanded by the treated households. Table 6, taken from the commodity (COMM) columns of the SAM, shows which households supply different goods and services. The two ineligible groups supply a small share of the goods and services sold in the project area. For example, they supply only 5 to 6 percent of crops and 8 percent of livestock products. The ineligible groups, in contrast, supply 22 to 24 percent of crops and 13 to 27 percent of livestock products. The message in this table is clear: if the CGP stimulates production, it is likely to be production by ineligible households. This highlights the importance of considering spillovers of cash transfers in our evaluations.

In order to increase their supply of goods and services, households and businesses hire labor and purchase inputs. This creates another round of spillovers. Table 7, taken from the activity (ACT) columns, shows how much money ineligible households in the treated villages spend on different inputs per loti of output value in each activity. The first data column reveals that, for every 100 LSL of crop output, this household group spends 8 on hired labor and 18 on purchased intermediate inputs; they invest 24 LSL of family labor; and the returns to land and capital are 23 and 28, respectively. Hired labor is most important in service activities (15 LSL per 100 of output value). Most of the value of retail sales (82 LSL per 100) goes to purchase goods from outside the project area. This is not surprising: retail sectors usually represent the major leakage from a local economy. Most of the goods stores sell are shipped in from other parts of the country or, in some cases, directly from abroad.

Table 6. **The Supply of Goods and Services by Household Group**

Account			COMM crop	COMM live	COMM ret	COMM ser	COMM prod
ACT	A	crop	0.06				
ACT	A	live		0.08			
ACT	A	ret			0.06		
ACT	A	ser				0.01	
ACT	A	prod					0.10
ACT	B	crop	0.05				
ACT	B	live		0.08			
ACT	B	ret			0.02		
ACT	B	ser				0.01	
ACT	B	prod					0.12
ACT	C	crop	0.24				
ACT	C	live		0.27			
ACT	C	ret			0.49		
ACT	C	ser				0.52	
ACT	C	prod					0.43
ACT	D	crop	0.22				
ACT	D	live		0.13			
ACT	D	ret			0.44		
ACT	D	ser				0.46	
ACT	D	prod					0.35

Table 7. Input Shares of Output Value by Sector, Household Group C

Account		ACT C crop	ACT C live	ACT C ret	ACT C ser	ACT C prod
COMM	ret			0.03	0.26	0.13
COMM	ser			0.03	0.00	0.04
COMM	prod					
COMM	OUTSIDE			0.82	0.16	0.59
FACT	HL	0.08	0.01	0.02	0.15	0.06
FACT	FL	0.24	0.43	0.02	0.13	0.05
FACT	LAND	0.23	0.24			
FACT	K	0.28	0.30	0.09	0.31	0.13
FACT	PURCH	0.18	0.01			

Spending by households in the treated villages create benefits in other parts of the project area. When households in the treated village buy goods outside their village but within the project area, non-treated villages benefit. An example is periodic markets, in which people from many surrounding villages trade. When a household from a treated village buys food or an animal in a periodic market where households from other villages come to trade, benefits go to other villages. The commodity (COM) columns in the LEWIE SAM show how much of the supply of commodities consumed in the project area come from each household group in the treated and non-treated villages, and how much is brought in from the rest of the world. Purchases by stores (retail) send benefits to other parts of the country and abroad. The latter are outside the scope of the local impact evaluation.

7. The Direct and Indirect Impacts of the CGP: LEWIE Results

The simplest behavioral assumption we can make is that future behavior is proportional to past behavior. 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 CGP's impacts in an unconstrained SAM accounting multiplier model. The beauty 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 clusters. 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-loti increase in demand for labor, food, etc., stimulates an equivalent increase in supply. This assumption may be appropriate in an economy with surplus labor 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 our multiplier analysis could overstate the multiplier effect of the CGT otherwise.

The alternative to use the parameter estimates and baseline data (Tables 3a and 3b) to calibrate a general equilibrium LEWIE (GE-LEWIE) model.[8] This is a LEWIE analogue to computable general equilibrium (CGE) model widely used for policy analysis. However, LEWIE consists of separate models of household groups calibrated and nested within a model of the project area economy. The GE-LEWIE model is more flexible and arguably more realistic than SAM-LEWIE multiplier models, and it lends itself to validation in ways that SAM multipliers do not. It 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.

8. The GE-LEWIE Model

You can think of the LEWIE-SAM, above, as the output of a GE model that includes all production activities, incomes, and household expenditures in the cluster. 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.[9] The LEWIE SAM is different from a conventional SAM, though, because it was constructed using parameters econometrically estimated from the baseline data. Thus, we do not need the SAM to parameterize our GE-LEWIE model; both the SAM and GE model are constructed from the same data input sheet illustrated in Tables 3a-3b. The equations in the GE-LEWIE model are summarized and compared to SAM multiplier assumptions in the Appendix.

Validation is always a concern in GE modeling. 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 GE 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 modeling 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.

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[8] Actually, a SAM multiplier model is a GE model. Usually when we refer to GE models, though, we refer to models with nonlinear responses, resource constraints, and prices.
[9] Taylor, J.E., "A Methodology for Local Economy-wide Impact Evaluation (LEWIE) of Cash Transfers" (FAO, 2012) explains how to use a LEWIE SAM to parameterize production and expenditure functions.

Econometric estimation of model parameters opens up a new and interesting possibility in regard to validation. The estimated standard errors for each parameter in the model can be used together with Monte Carlo methods to perform significance tests and construct confidence intervals around project impact simulation results, using the following steps:

1. Use parameter estimates and starting values for each variable obtained from the micro-data, consistent with the household SAMs, to calibrate a baseline GE-LEWIE model.
2. Use this model to simulate the project, for example, a cash transfer to eligible households.
3. Make a random draw from each parameter distribution, assuming it is centered 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 GE-LEWIE model, and use this model to simulate the same project again.
4. Repeat step 3 *J* (say, 500) times. This will yield 500 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 pth quantile of the simulated values $(\hat{Y}^*_1, \hat{Y}^*_2, ..., \hat{Y}^*_J)$. For example, for a 95% confidence interval, we find the cutoffs for the highest and lowest 2.5% 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 GE framework. Structural interactions within the model may magnify or dampen the effects of imprecise parameter estimates on simulation confidence bands.

In the GE-LEWIE model, the CGP transfers increase spending in the treatment households. This increases the demand for goods supplied inside the treated village clusters as well as outside the clusters. 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 CGP on the economy of the treated clusters depends on the interplay of these price and output effects.

The retail sector purchases some goods locally; however, most of the items sold in local stores come from outside the local economy. Because of this, retail is largely an "import" sector, making tradables from outside available to households and businesses within the village cluster. 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 stores pay for their inventory (these prices are set outside the cluster). However, it can have an influence on the mark-up. Increases in the demand for locally produced food and livestock products can affect the prices of these goods. In response, households may resort to buying food, livestock, and non-agricultural goods from local stores, periodic markets, or other sources linked to markets outside the cluster.

9. GE-LEWIE findings

The GE-LEWIE model was used to simulate the impacts of the initial CGP on the project-area economy, taking into account nonlinearities and local price effects. In these simulations, prices may be determined inside or outside the village cluster.

A challenge in GE 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 corn 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 CGP and the randomized cluster design, there is little reason for transfers to affect prices outside the treated cluster 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. Lesotho is a net food importer, but changes in local demand may nonetheless affect the prices of food and livestock products purchased directly from producers in the treated cluster (including the implicit prices of home-produced food), unless retail purchases are a perfect substitute for these goods.

The assumption that villages cannot freely "import" wage workers from outside the cluster is reasonable where transportation is expensive, unreliable, or nonexistent. In this case, programmes can affect local wages. Wage effects are muted to the extent that households have an elastic supply of labor. (Labor supply impacts can be estimated experimentally once follow-on survey data are available.)

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

In the simulation presented below we assume that locally-grown crops, livestock, retail, and other services, as well as labor, are tradable across villages within the cluster. The household survey documents trade in crops and livestock with neighboring 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.

If the villages in a cluster are not too far apart, they may hire workers from other parts of the cluster. Thus, we assume hired-worker wages are determined in the cluster. Some workers migrate to jobs in the city or abroad (e.g., in South Africa). However, the processes shaping migration tend to be complex and affected by factors other than wages.[10] The LEWIE assumes that the CGP will not affect migration or remittance income.

We do not know what the elasticity of labor supply is. We assume a nearly perfectly elastic labor supply (η=100).[11] This reflects excess labor supply in rural Lesotho; it is similar to the way labor is treated in SAM multiplier models. Excess labor supply can be expected to lower inflationary pressures by limiting wage increases. It does not remove inflationary pressures, however, because land and capital constraints continue to limit the local supply response.

Local service activities and stores primarily serve households within clusters. The prices of these, like labor, are therefore assumed to be determined at the village cluster level. Nevertheless, most of the merchandise sold in village stores is purchased from sources outside the cluster at fixed prices. The cost of this merchandise equals approximately 80% of gross income in the retail sector. This limits the extent to which increases in local retail demand can exert upward pressure on retail prices.

All of our simulations use the Monte Carlo method, described above, to construct confidence intervals around our estimates of local income multipliers.

Table 8 summarizes the income and production findings from the GE-LEWIE pilot-CGP evaluation. For the total nominal and real income multiplier effects, it presents both simulated impacts and, in parentheses, 90% confidence intervals around each impact. The confidence intervals were constructed using 500 random draws from each parameter distribution.

The pilot CGP generates a total income multiplier of 2.23 in nominal terms, with a 90-percent confidence interval of 2.08 to 2.44. That is, the 3.3 million LSL transfer programme produces a 7.4 million LSL increase in project-area income. However, higher demand puts upward pressure on prices. This raises consumption costs for all households and results in a real-income multiplier that, although significantly greater than 1.0, is lower than the nominal one: the real income multiplier of the programme is 1.36 (90-percent confidence interval: 1.25 to 1.45).

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[10] See, for example, *Worlds in Motion: Understanding International Migration at the End of the Millennium*, by Douglas S. Massey, Joaquin Arango, Graeme Hugo, Ali Kouaouci, Adela Pellegrino and J. Edward Taylor (Oxford University Press, 2005).

[11] Higher elasticities do not have an appreciable effect on CGP multipliers.

Table 8. Simulated Impacts of the CGP Pilot Using the GE-LEWIE Model (Simulation 1)

			Assumptions	
Recipient household			A only	
Elasticity of hired/family labor supply			100	
Liquidity constraint on/off			off	
Village Markets			crop, live, ret, ser, FL, HL	
Zoi-wide Markets			(none)	
Integrated Markets			prod, outside, purchased inputs	
Amount transferred			3310560 (A)	
iterations			500	
			Multiplier	Level Change
Total Income				
		Nominal	2.23	7.38
		(CI)	(2.08- 2.44)	(6.89 -8.06)
		Real	1.36	4.5
		(CI)	(1.25- 1.45)	(4.15 -4.80)
Household Income				
	A	nominal	1.15	3.79
		cpi increase in %	1.96%	1.96%
		real	1.03	3.42
	B	nominal	0	0
		cpi increase in %	0.00%	0.00%
		real	0	0
	C	nominal	1.08	3.59
		cpi increase in %	1.88%	1.88%
		real	0.33	1.08
	D	nominal	0	0
		cpi increase in %	0.00%	0.00%
		real	0	0
Production Effects (in Loti)				
		crop	0.19	614886
		live	0.28	930528
		ret	0.60	1971207
		ser	0.08	281137
		prod	-0.01	-25539

One the one hand, this finding confirms that the CGP will generate income multipliers within the treated clusters 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. We will return to this concern below.

The middle panel of the table gives simulated impacts on the nominal and real incomes of each household group. Treated households (Group A) receive the direct benefit of the transfer plus a small spillover effect of .15 loti per 1.0 loti transferred. Their total income increases by 3.79 million LSL (3.42 million LSL in real terms).

The ineligible households within the treated clusters do not receive the transfer, but they benefit from positive spillover benefits. Their nominal income increases by 3.59 million LSL (1.08 million LSL in real terms). The difference between nominal and income gains for this group reflect the fact that the income gain is not large relative to Group C's total expenditure on consumption, which becomes slightly more expensive due to higher prices; the total cluster consumer price index (weighted by expenditure shares) increases by 1.96%. Thus, the real income multiplier (0.33), while positive, is considerably lower than the nominal one (1.08).

Assuming the randomized cluster design is effective, impacts of the CGP are not transmitted from treated to control village clusters. In order for there to be spillovers to the control clusters, treated villages would have to transact with control villages (say, in regional markets), or with villages that transact with control villages. The more market layers there are separating treated and control clusters, the more muted the transmission of impacts will be, at least in the pilot phase.

The programme has significant production impacts. The cash transfers stimulate the production of crops and livestock in the treated clusters by 0.19 and 0.28 LSL per loti transferred. The largest positive effect is on retail, which has a multiplier of 0.60. The service sector also benefits (0.08). Increasing demand stimulates these four sectors by putting some upward pressure on prices. That is, 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 the local economy and the smaller the resulting inflation level will be.

Table 9 provides a breakdown of production impacts by household group. The first data column reports the average multiplier from all 500 runs of the simulation; the second, the standard deviation; and the final two, the 90-percent confidence interval on multiplier impacts. The programme generates positive productive impacts that are significant in all but tradables production. However, most of the production spillovers of the programme accrue to the ineligible households. For example, for each loti transferred to beneficiary households, the value of crop production increases by 0.03 loti in eligible households and 0.15 in ineligible households. The largest production multipliers are for livestock (0.26) and retail (0.52), both in the ineligible households. The finding of higher productive impacts on ineligible households reflects the eligibility criteria of the programme, which targets asset and labor-poor households least likely to have an elastic production response. Service and other production impacts in the beneficiary households are negligible.

Table 9 Production Impacts by Household Group and Sector

Sector. house hold	mean	stdev	pct5	pct95
crop.A	0.03	8.31E-03	0.02	0.05
crop.C	0.15	0.02	0.12	0.19
live.A	0.02	7.25E-03	0.01	0.04
live.C	0.26	0.04	0.18	0.33
ret.A	0.07	0.04	0.02	0.16
ret.C	0.52	0.06	0.41	0.59
ser.A	2.35E-03	1.44E-03	7.63E-04	5.11E-03
ser.C	0.08	9.78E-03	0.07	0.1
prod.A	-1.42E-03	7.46E-04	-2.81E-03	-5.32E-04
prod.C	-6.45E-03	3.61E-03	-0.01	-1.97E-03

The fifth sector, non-agricultural production, is assumed to be tradable, with prices set outside the clusters. Although it does not benefit from higher output prices, it is adversely affected by slightly higher wages. (Hired and family wages, in this high labor supply scenario, rise by 0.03% and 0.06%, respectively.) Thus, its output decreases slightly (by 0.01%). This result illustrates that the productive impacts of the CGP vary across sectors and can be negative under some circumstances.

There is good news and bad news about tradables sectors in LEWIE. The good news is that increased local demand does not lead to inflation in tradable goods, because by definition, the prices of tradables are exogenous to the local economy. The bad news is that local price increases cannot convey positive impacts on tradables sectors. This can reduce the multiplier effect of the CGP and other transfers on the local economy.

Robustness Tests

We tested the robustness of the simulation results to different assumptions concerning market closure and labor supply elasticities. Table 10 compares results under three alternative sets of assumptions. Simulation 1 is the same as in Table 8, above. It is included in this table for purposes of comparison. Simulation 2 is identical to Simulation 1, except that it assumes that the supply of both hired and family labor in the project area is unresponsive, with a low elasticity (1.0). This simulation illustrates the importance of labor supply in shaping project impacts. Simulation 3 is identical to Simulation 2, except it assumes that households face liquidity constraints that limit their purchase of productive inputs, e,g., fertilizer.

Despite their different assumptions, the two new simulations produce a nominal income multiplier similar to that of Simulation 1 (2.47; CI: 2.29-2.72). However, in both new simulations the multiplier is lower in real terms. The assumption of inelastic labor supply creates upward pressure on wages in Simulations 2 and 3; the local wage rises 2.9%, and the implicit family wage increases by 2.3%. In Simulation 2, higher wages put upward pressure on the prices of goods and services, raising the CPI by nearly 3% (compared with less than 2% in Simulation 1). The higher CPI has a particularly large impact on ineligible households. Although they continue to reap spillover benefits from the Programme, these benefits are small compared with the total expenditures of this group, which are now more expensive than before. The real multiplier for ineligible households drops from 0.33 to 0.13. The total real income multiplier for the treated clusters drops from 1.36 in Simulation 1 to 1.14 in Simulation 2—still significantly greater than zero, but with a CI (1.08-1.20) that comes close to zero at the lower bound and does not even overlap the CI from Simulation 1.

In Simulation 3, a liquidity constraint on purchasing crop variable inputs further limits the local supply response. This creates additional inflationary pressure. The CPI rises 3.3%, and the real total income multiplier falls to 1.02, with a CI (0.94-1.09) that now contains 1.0 and lies almost totally below that of Simulation 2. When households face liquidity constraints, we cannot reject the null hypothesis of zero spillovers in real terms. The nominal multiplier remains positive and significantly greater than 2.0.

The limiting effect of labor and liquidity constraints is evident in the production multipliers presented at the bottom of Table 10. For crops and livestock, these multipliers are less than half as large in Simulation 3 as in Simulation 1. In Simulation 2, the inelastic labor supply also constrains production responses, particularly in crops and livestock.

In the high unemployment environment that characterizes rural Lesotho, we believe it is unlikely that there are significant labor constraints on production. Nevertheless, Simulations 2 and 3 illustrate the importance of production constraints in shaping programme benefits. Liquidity constraints are likely to have an important effect on the local supply response, particularly in non-beneficiary households, which do not receive transfers that might loosen these constraints but which are far and away the main source of new supply. When these constraints bind, transfers may have an inflationary effect that negatively impacts some non-beneficiaries.

Which assumptions are most likely to characterize the project area is an important question. It is noteworthy, though, that all of the simulations presented above produce income multipliers that are significantly greater than 1.0 in nominal terms and, in all but one case (Simulation 3), in real terms as well. The finding that most of the positive spillovers of the programme accrue to the ineligible households reflects the eligibility criteria of the programme, which targets the poorest and most vulnerable households. Households that are poor in assets, including both physical and human capital, have a lower production response than ineligible households. The results suggest that there are productive impacts; however, to find them we need to look mostly in the ineligible households.

Table 10. Sensitivity of Results to Simulation Assumptions

Recipient household	A only	A only	A only
Elasticity of hired/family labor supply	100	1.00	1.00
Liquidity constraint on/off	off	off	on
Village Markets	crop, live, ret, ser, FL, HL		
Zoi-wide Markets	(none)		
Integrated Markets	prod, outside, purchased inputs		
Amount transferred	3310560 (A)		
iterations	500		
Total Income multipliers			
Nominal	2.23	2.47	2.47
(CI)	(2.08- 2.44)	(2.29- 2.72)	(2.29- 2.72)
Real	1.36	1.14	1.02
(CI)	(1.25- 1.45)	(1.08- 1.20)	(0.94- 1.09)
	0		
Wage effects			
Hired Labor	0.03%	2.32%	2.32%
Family Labor	0.06%	2.88%	2.88%
Household Income multiplier			
A nominal	1.15	1.17	1.17
cpi increase in %	1.96%	2.93%	3.31%
real	1.03	1.01	0.98
B nominal	0	0	0
cpi increase in %	0.00%	0.00%	0.00%
real	0	0	0
C nominal	1.08	1.3	1.3
cpi increase in %	1.88%	2.91%	3.17%
real	0.33	0.13	0.03
D nominal	0	0	0
cpi increase in %	0.00%	0.00%	0.00%
real	0	0	0
Production Multipliers			
crop	0.19	0.15	0.08
live	0.28	0.15	0.13
ret	0.6	0.6	0.6
ser	0.08	0.07	0.07
prod	-0.01	-0.04	-0.04

Targeting

A final concern relates to targeting. The impact simulations assume perfect targeting with no exclusion or inclusion errors. This means that the initial impacts are determined by eligible households' expenditure patterns. If some of the transfers go to ineligible instead of eligible households, the initial impacts of the programme will be influenced by ineligible households' expenditure patterns. Because indirect impacts depend on initial impacts, they will be affected, as well. To the extent transfers loosen production constraints in ineligible households, imperfect targeting could in theory enhance productive impacts while diminishing social ones; however, the overall impact is not clear a-priori. In principal, our model could be used to simulate the local economy-wide implications of imperfect targeting, but this was not done in this report.

10. A Note on Prices

All of our LEWIE simulations find a divergence between nominal and real multipliers from the cash transfer programme. This does not necessarily mean that price inflation necessarily will erode project benefits. LEWIE is not a prediction tool. Its value is to provide a method to systematically evaluate the likely impacts of government programmes on beneficiaries as well as non-beneficiaries and identify the key factors likely to shape them. All of our simulations find nominal income multipliers significantly greater than 1.0. All but one produce real income multipliers that are also significantly greater than 1.0.

LEWIE gives us insights into what might cause a divergence between nominal and real impacts and what would have to happen to avoid having an inflationary impact on the local economy. Divergence between nominal and real multipliers happens when supply response is inelastic. What makes this happen? A comparison of simulations 1 and 2 illustrates the importance of local factor supply. When the labor supply is inelastic, the Programme pushes up wages and local prices. An elastic labor supply closes the gap between nominal and real benefits. However, even a surplus rural labor supply (which is likely in rural Lesotho) is not enough to eliminate inflationary impacts. Fixed capital and land also limit the local supply response.

When one or more factors are fixed, increased demand has an inflationary effect on factor prices which limits the real growth of the economy. The notion that fixed factors influence price effects of government programmes is not new. Economists have long recognized the importance of fixed factors, particularly land, in shaping the impacts of government programmes. Studies from high-income countries find that much of the effect of government subsidy programmes becomes capitalized in higher land values and rental rates.[12]

In rural Lesotho, land markets are not sufficiently developed to tell us how cash transfers affect rental rates. LEWIE, however, does provide us with simulated impacts on implicit rental rates, which reflect the extent to which fixed factors (land and capital) constrain the

[12] A recent example is Kirwan, B. E. 2009. "The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates." *The Journal of Political Economy*, 117(1): 138-164. In high-income countries capital is generally not viewed as a constraint on agricultural production in the medium to long run, due to well-functioning capital markets.

local economy's supply response to the Programme. In Simulation 1 the implicit rental rates on land and capital increase between 4 and 7 percent in agricultural activities and up to 10 percent in retail. In a SAM multiplier model, capital (like other factors) would increase to meet its increased demand when transfers stimulate the local economy. In the LEWIE simulations presented above, capital and land are both assumed to be fixed. This, together with decreasing marginal returns to other inputs, constrains the local supply response.

We can modify the LEWIE model to allow capital to increase concurrent with the CGP transfers. This would correspond to there being unused capital that could be brought on line to support local production, or alternatively, access to credit or savings to invest in new capital in order to alleviate capital constraints.

Table 11 simulates the local economy-wide impact of the CGP transfers allowing crop and livestock capital to increase 5%. Capital in other sectors remains fixed. This simulation uses Simulation 1 as its base. That is, labor is assumed to be in abundant supply, and liquidity constraints on purchased variable inputs are not binding. To facilitate comparison, the results from Simulation 1 are presented in the first data column, and the new simulation's finding are in the column labeled "Simulation 4." The total multiplier does not change in nominal terms; however, it increases to 1.47 in real terms, with a 90% CI of 1.36-1.56 (compared with 1.25-1.45 in Simulation 1, where capital is not allowed to change at all). Larger increases in capital have a more or less proportionate impact on the real income multiplier of CGP transfers. For example, if capital in crops and livestock is allowed to increase by 10%, the real multiplier rises to 1.57 (CI: 1.47-1.67).

Loosening capital constraints closes the gap between nominal and real multipliers. This underlines the likely importance of complementary programmes to loosen capital and land constraints in the target economies. Given that the vast majority of productive impacts are among ineligible households, which do not benefit from the Programme, it is important to include them in such programmes.

There is another way to avoid inflationary pressures: fix prices by better integrating the treated clusters with the rest of Lesotho. Prices of tradables purchased outside the cluster do not change when cluster incomes go up. This includes wholesale prices of merchandise sold in the retail sector. One might think, then, that better integration with outside markets might increase the real income multiplier of cash transfer programmes. This is usually not the case, though, because trade with outside markets transmits Programme benefits out of the project area to the rest of Lesotho (or abroad). Such leakages might be good for people outside the treated cluster, but they erode local (nominal) multipliers. In the extreme, if all new expenditures stimulated by the CGP are on goods and services produced outside the cluster, the local multiplier will be 1.0: each loti transferred will increase the beneficiary households' income by 1 loti but have no local spillover effects.

This is one reason to focus complementary programmes on increasing the local supply response. A second reason is that many goods and most or all factors tend to be nontradable. Capital, labor, local services, the value-added portion of retail sales would not easily be replaced by "imports" into the village cluster, even if transaction costs with outside markets were low.

11. Conclusions

As the CGP injects cash into local economies the demand for goods and services increases. Higher spending immediately transmits impacts from beneficiary to non-beneficiary households inside and outside the treated villages. Our CGP impact simulations indicate total impacts that significantly exceed the amounts transferred under the programme. The Monte Carlo methods used in this LEWIE analysis make it possible to place confidence bounds around estimated multipliers. Our 90% confidence intervals on nominal income multipliers lie well above 2.0, indicating significant positive spillovers from transfers.

These findings raise questions about how we should measure the impacts of cash transfers, which include effects on the non-treated groups. They reveal that evaluations focusing only on the treated households are likely to significantly understate programme impacts because of general-equilibrium feedbacks in local economies.

By stimulating demand for locally supplied goods and services, cash transfers have productive impacts. However, these effects are found primarily in households ineligible for the transfers. This finding is not surprising, given that the eligibility criteria for the CGP favor asset and labor-poor households.

The LEWIE evaluation underlines the importance of a high local supply response in generating positive spillovers. Factor and liquidity constraints limit the ability of local households to increase the supply of goods and services in response to the new demand that transfers generate. This results in a greater likelihood of price inflation and a divergence between nominal and real income multipliers. Income multipliers fall when adjusted for the impacts of transfers on local prices. Inflationary effects of transfers and the divergence between nominal and real multipliers decrease if labor is readily available, households have the liquidity to purchase intermediate inputs, and capital constraints on production are less binding.

Table 11. Simulation 1 with 5% Increase in Capital Constraint

		Assumptions
Recipient household		A only
Elasticity of hired/family labor supply		100
Liquidity constraint on/off		off
Change in crop and livestock capital constraint		0.05
Village Markets		crop, live, ret, ser, FL, HL
Zoi-wide Markets		(none)
Integrated Markets		prod, outside, purchased inputs
Amount transferred		3310560 (A)
iterations		500
		Multiplier
Total Income		
	Nominal	2.23
	(CI)	(2.09- 2.43)
	Real	1.47
	(CI)	(1.36- 1.56)
Household Income		
	A nominal	3.79
	cpi increase in %	0.02
	real	3.49
	B nominal	0
	cpi increase in %	0
	real	0
	C nominal	3.59
	cpi increase in %	0.02
	real	1.37
	D nominal	0
	cpi increase in %	0
	real	0
Production		
	crop	0.27
	live	0.28
	ret	0.59
	ser	0.08
	prod	-0.01

Our simulations suggest that interventions to loosen constraints on the local supply response are likely to be critical in order to avoid inflationary effects and maximize the real impact of transfers in the treated village clusters. Given the dominant of ineligible households in local production, it is important for complementary interventions (e.g., micro-credit) to target these as well as CGP-eligible households.

Once data from the follow-on survey become available, it may be possible to test for changes in production, labor supply, and other variables related to the market-closure assumptions in this model. In the meantime, despite some uncertainty over which market assumptions are most appropriate for Lesotho, it is reassuring that the total income multipliers are high regardless of market-closure assumptions. Even allowing for price inflation, local income multipliers are significantly greater than 1.0 in all but the most capital- and liquidity-constrained scenarios, suggesting that the CGP will generate important spillovers in the project area.

Appendix

Some Basic Differences between SAM Multiplier and LEWIE Models

	SAM Multiplier	*LEWIE*
Production	**Leontief production function:** Q = Min((L/a),(K/b)) Where Q = quantity produced, L and K are quantities of labor and capital inputs, a and b are constants (or $Q = \overline{Q}$ for constrained sectors)	**More general production function:** Q = F(L, K) Most common: Cobb-Douglas: $Q=AL^aK^b$ (Intermediate input demand usually is modeled using Leontief input-output coefficients)
Household Demands	*Fixed budget shares:* $X_i=c_iY$ *Where X_i is the quantity demanded of good i, Y is household total expenditure, and c_i is the average budget share for good I (the marginal budget share in fixed-price models)*	*More general demand equations, usually linear expenditure system (from Stone-Geary utility function):* $$X_i = d_i + \frac{c_i}{p_i}(Y - \sum_j d_j p_j)$$ *Where p_i is the price of good i, c_i is the marginal budget share, and d_i is the subsistence minimum of good i as perceived by the household. When d_i=0, this reduces to the generalized Cobb-Douglas function.*
Prices	*None*	Determined in outside markets $p_i = \overline{p}_i^w$ By local market equilibrium conditions $p_i = p_i^e$ Or by internal household equilibrium, in the case of subsistence $p_{i,h} = \rho_{i,h} = \mu_{i,h} / \lambda_h$ *Where*

		ρ_{ih} = Household shadow price φ_i = Shadow value (Lagrange Multiplier) on subsistence constraint p_i^w = Outside (e.g., world) price p_i^e = Equilibrium market price
Trade	*Exports are exogenous; imports are a fixed share of production and household demands*	*Market equilibrium in the economy determines net exports (for tradables) or prices (nontradables)*

Source: J.E. Taylor and M. Filipski, *Beyond Experiments: Simulation Methods for Impact Evaluation*. (Book manuscript in progress.)