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A METHODOLOGY FOR LOCAL ECONOMY-WIDE IMPACT EVALUATION (LEWIE) OF CASH TRANSFERS

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As soon as a household receives a cash transfer, it usually spends it. This transmits the transfer's impacts from the beneficiary household to others inside and outside the local economy, including households not eligible for the transfer. As the programme's influences swirl around the project's zone of influence (ZOI), they create *local general equilibrium* (LGE) effects in addition to the programme's direct impact on the beneficiary households. Local economy-wide impact evaluation (LEWIE) is designed to capture the full impact of government programmes (as well as other exogenous shocks; see Taylor and Filipski, 2012) on local economies.

Understanding the LGE effects of transfers and other public programmes is important. Governments want to know how transfers affect the non-recipient as well as recipient households before committing significant resources to transfer programmes. Transfers may affect production in beneficiary or non-beneficiary households, and indirect effects can significantly alter an intervention's overall impact (positively or negatively).

Evaluating project impacts with an experiment may be difficult if LGE effects are present, because these effects can transmit impacts from treated to control households. Effects of programmes on control groups frequently confound experimental research in the social sciences.[1] If general equilibrium (GE) linkages are strong and positive, and if they extend to control households, it may be difficult to identify the programme's income impact, because income will rise in both the treated and non-treated households. This is a form of control-group contamination.

Once a project is scaled up, GE effects are almost certain to create outcomes that were not captured in the experiment, including feedback effects on treated and non-treated households. The reliability of experimental methods depends critically on the *invariance assumption*, which states that the actual programme will act like its experimental version. GE effects are the main reason we worry about violations of the invariability assumption in randomised control trials (RCTs).[2]

Well-designed experiments, i.e. those using random assignment at the cluster level including ineligible households, can capture some of the spillover impacts of programmes (i.e. on the ineligible households at the programme sites, or eligible households excluded due

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to budget constraints). However, they generally do not tell us why these spillovers occur (e.g. through local price effects), how we might be able to influence them or how GE effects may alter impacts once a programme is scaled up. Experimental economists often ignore the effects of programmes on ineligible groups, instead focusing on the average effects of treatments on the treated. Ignoring GE effects can give an incomplete and often biased picture of how cash transfers affect local economies, including production activities. The total impact will be different from the programme's average effect on the treated.

This paper presents a methodology to understand the full impact of cash transfers on local economies, including on the production activities of both beneficiary and non-beneficiary groups; how these effects change when programmes are scaled up to larger regions; and why these effects happen. All of these are important for designing projects and explaining their likely impacts to governments and other sponsoring agencies.

The simulation methods presented here are not a substitute for good impact evaluations. Experimental findings are important to test and quantify the likely impacts of interventions on beneficiary households and, under some conditions, on ineligible households. They can also help validate some of the predictions of simulation models and, in some cases, improve the accuracy of model parameters.

Validation is a strength of conventional experimental methods but a major concern in GE modelling. We econometrically estimate the LEWIE model parameters and use Monte Carlo methods to perform significance tests and construct confidence intervals around project impact simulation results. We believe that this is an important step towards providing simulation impact evaluation with validation tools that are largely absent in the GE literature.

1 METHODS OVERVIEW

Our goal is to develop a method to estimate the full impacts of cash transfers on local economies, including on households that do not receive cash transfers, using simulation methods. The basic idea behind LEWIE is to create models of beneficiary and non-beneficiary households, then link them together within a GE model of the local economy.

A Social Accounting Matrix (SAM) is the basic data input for conventional (aggregate) GE models (Burfischer, 2011). Traditionally, in GE modelling there is one SAM for a given geographic area, be that country, village, province etc. For project impact evaluation, separate SAMs are needed to model household groups with different economic structures. Just as one would not want to aggregate two disparate national economies (say, Mexico and the USA) into a single model to evaluate an economic policy (say, free trade), so we would not want to assume that different household groups share the same economic structures when we do project impact evaluation. Thus, data from the baseline household survey are used to construct separate SAMs for treatment, control and ineligible households within the study area.

Project impact evaluation involves comparing distinct groups of households. If we have a valid control group, the economic structure of the households within it, on average, should be identical to that of the treatment group. However, we would not want to combine treatment and control households within a single SAM; experiments require keeping the two groups separate.

LEWIE requires considering at least two other groups of economic actors: the ineligible households in treated and control villages. There is a compelling reason to think that the structure of their household economies is quite different from that of the eligible households, in ways related to programme eligibility and/or uptake. These differences may include access to productive assets, activity mixes, technologies, market participation and expenditure patterns. Household groups may be disaggregated further, depending on the needs and interests of the evaluation. For example, if a group of households is socially excluded (perhaps because of a different ethnicity), it might trade among its own members, and this would imply different linkages with the ZOI economy.

Household-village (local) SAMs are used to construct a LEWIE model to analyse the cash transfer programme's impacts on the local economy. Household SAMs are constructed using household, enterprise and community survey data collected as part of the baseline and/or follow-up surveys in each of the countries in which evaluations of cash transfer programmes are carried out. Separate SAMs are constructed for the households that will receive the randomised transfer, for control-group households and, when available, for ineligible households in both the beneficiary and control villages.

LEWIE improves on past GE project impact evaluation methods (e.g. Filipski and Taylor, 2012) by econometrically estimating production, demand and other function parameters in the model. Monte Carlo methods can be used to perform significance tests and construct confidence intervals around project impact simulation results, as described at the end of this document.

After the randomised cash transfers are given out, *ex post* surveys are used to verify the simulations and, where appropriate, improve the parameterisation of the models. The simulation methods for impact evaluation that we develop are intended to complement the experimental analysis of average effects of cash transfers on the treated households.

As in any RCT, surveys are carried out before and after the roll-out of cash transfer programmes, and they need to meet the needs of both the experimental and simulation impact evaluations. For the simulation impact evaluations, they need to provide the information necessary to construct SAMs for beneficiary and non-beneficiary households and estimate model parameters. The rest of this document explains the household SAMs and survey data needed to construct them; how the LEWIE model is parameterised from survey data and used to simulate transfer impacts; and how to validate LEWIE simulation results.

2 HOUSEHOLD SAMS

The starting point for constructing simulation models for project impact evaluation is to build SAMs for beneficiary and non-beneficiary groups within the ZOI of our impact evaluation. Defining the ZOI is an important part of any impact evaluation, and we discuss how to do this later. This section explains what household SAMs are and how they are used as a basis for impact evaluation. The next section will present the data requirements for constructing these household SAMs and how to design the surveys needed to satisfy these requirements.

Table 1a presents a stylised elemental SAM for a poor household or group of households that will be randomly selected to receive a cash income transfer; that is, it represents the beneficiary or treatment group.[3] The household group represented in this illustrative example produces 80 value-units (say, dollars) of agricultural output and 140 of a non-agricultural good. These numbers are both the column and row totals for the two production accountsin the SAM. This beneficiary group carries out its agricultural production (Column A) with intermediate inputs, which are provided by its other production activities or else purchased on the market, and with labour and capital. The intermediate inputs include 10 units obtained from the household's own agricultural activities (e.g. seed). The non-agricultural activity (Column B) uses 15 units of agricultural inputs (e.g. a crop that is processed) and 20 units of non-agricultural inputs. Many inputs are obtained from the market. For its agricultural production the household purchases 15 units of inputs within the ZOI for our impact evaluation and 25 units outside the ZOI. These might include high-yielding seeds, fertiliser or other chemical inputs. Finally, it uses 20 units of labour and 10 of capital for agricultural production and 50 units of labour and 25 of capital for its non-agricultural production activities. These numbers represent the labour and capital added value created by household production activities.

This poor household engages with markets in a number of ways. It sells 55 units of agricultural output and 45 units of non-agricultural output outside the ZOI, and 75 units of non-agricultural output within the ZOI. It supplies labour to wage work activities inside the ZOI (20 units; Column F). It also sends labour outside the ZOI, either as day labour or migrants (10 units; Column G). In the latter case, the number in column G represents migrant remittances. Thirty per cent of the poor household's labour income thus comes from off-farm work. Finally, the household depicted here is fully integrated with the market for consumption. Column E reveals that its income is used to purchase goods and services supplied inside (100) or outside (35) the ZOI. In real life, the household could supply some of its own consumption goods from home production or purchase some of these goods from other poor households represented in this SAM. However, if households are fully integrated with markets, as in a conventional agricultural household model, they will be indifferent between consuming their own product or selling their output and subsequently buying from the market (Singh, Squire and Strauss, 1996).

TABLE 1A

An Elemental SAM for Beneficiary Households

SAM ACCOUNTS	SUB-ACCOUNTS	Treatment Households					ZOI	ROW	TOTAL
		ACTIVITIES		FACTORS		Cons			
		Ag	Non Ag	Labor	Capital				
		A	B	C	D	E	F	G	H
ACTIVITIES	Ag	10	15	0	0	0	0	55	80
	Non Ag	0	20	0	0	0	75	45	140
FACTORS	Labour	20	50	0	0	0	20	10	100
	Capital	10	25	0	0	0	0	0	35
	INCOME	0	0	100	35	0	0	0	135
ZOI		15	15	0	0	100			130
ROW		25	15	0	0	35			75
TOTAL		80	140	100	35	135	95	110	695

If, on the other hand, high transaction costs drive poor households into autarky with respect to one of the activities (e.g. food), a subsistence constraint will link consumption with production in each poor household. This could be reflected in the SAM by moving consumption expenditures up from the ZOI and/or ROW to the Ag row in Column E. If the SAM depicts a group of similar poor households, this would be consistent with partially closing off each elemental household economy from outside markets; however, it would also be consistent with poor households buying food from each other. We need a model, not just a SAM, to explore how interactions with markets shape the impacts of policy shocks on production as well as income in poor households.

If we were to hand a cash transfer to the poor household depicted in Table 1a, the household's income would increase by the amount of the transfer. With all markets exogenous to the household, the income multiplier of the transfer in this elemental SAM would be zero. With before and after data, experimental and econometric methods could be used to test, *ex post*, whether the transfer indeed had a unitary effect on the poor household's income and whether it affected specific parameters underlying the model—for example, factor value-added shares (the exponents in a Cobb-Douglas production function) and budget shares. If so, these impacts could be incorporated into the SAM *ex post*.[4]

Ex ante, an SAM multiplier analysis can be used as a first step in exploring the impact of the cash transfer on the local economy. Suppose in this simple economy there is one other household group, which we shall call the non-treated. At the experimental stage of testing a new cash transfer programme, this other group could be the ineligible group within the targeted villages. Well-designed experiments try to select a control group that is physically separate from the beneficiary group, i.e. in other localities. Nevertheless, inside the beneficiary villages there will always be households that do not qualify for transfers. Even if the control group is selected so as to minimise contact with treated households, there are likely to be economic linkages between treated and ineligible households within the treated villages during the experimental phase. Once the transfer programme is fully implemented after the experimental phase, the control group disappears, and the only households in the non-beneficiary group are those deemed to be ineligible for the programme.

Table 1b shows an elemental SAM for the non-beneficiary group.

TABLE 1B

An Elemental SAM for the Non-beneficiary Households

SAM ACCOUNTS	SUB-ACCOUNTS	Non-treatment Households					ZOI	ROW	TOTAL
		ACTIVITIES		FACTORS		Cons			
		Ag	Non Ag	Labor	Capital				
		A'	B'	C'	D'	E'	F	G	H
ACTIVITIES	Ag	20	20	0	0	0	35	30	105
	Non Ag	0	40	0	0	0	125	65	230
FACTORS	Labour	20	90	0	0	0			110
	Capital	40	45	0	0	0			85
	INCOME	0	0	90	85	0			175
ZOI		10	20	20	0	135			185
ROW		15	15	0	0	40			70
TOTAL		105	230	110	85	175	160	95	960

The non-treated households in this SAM engage more heavily in non-agricultural production than the treated households, they use less labour-intensive production technologies, and they hire but do not sell labour inside or outside the ZOI. If the households represented by the elemental SAMs in Tables 1a and 1b constitute the entire ZOI economy, then presumably the treated households supply 20 units of labour to non-treated households, while non-treated households supply 25 units of consumer goods to treated households.[5]

Once elemental SAMs have been constructed, they can be stacked along the diagonal of a 'mega-SAM' for the project ZOI, as shown in Table 2. The shared ZOI account captures interactions among households within the ZOI. A shared 'rest of ZOI' account is an essential ingredient of any simulation model, capturing market linkages among the economic actors within the region that may be stimulated by project interventions. These linkages are vital for a cash transfer to have a multiplier effect on local incomes. Multipliers vanish in models with non-interacting 'autarkic' households (no entries in the 'rest of ZOI' accounts) as well as in models in which all households are fully integrated with outside markets, as implied by models of agricultural households that are price takers in all markets (all market interactions are with the exogenous 'rest of world' accounts).[6]

The simplest simulation model for impact evaluation is an unconstrained SAM accounting multiplier model for the ZOI. This is a particular kind of LEWIE model in which certain assumptions about markets and household behaviour (discussed below) are satisfied.

Let y denote a vector of total incomes and x a vector of final (in our example, rest of world) demands for the endogenous accounts in the SAM. Both are of dimension (I x 1), where I is the number of endogenous accounts (in the present case, 11: four production sectors, four factors, two household incomes and the ZOI market). An SAM coefficient matrix is derived for these endogenous accounts by dividing each internal element by its corresponding column total. Let A refer to this shares matrix. The relationship between y and x, then, is:

$$y = (I - A)^{-1} x = M_a x$$

The change in income (dy) resulting from a change in final demand (dx) is given by:

$$dy = (I - A)^{-1} dx = M_a dx$$

The beauty of a LEWIE SAM multiplier model is its computational simplicity; the nested SAM flows matrix in Table 2 is easily converted into an SAM multiplier matrix in three steps: (1) the shares matrix is computed; (2) the shares matrix is subtracted from an identity matrix of the same dimensions; then (3) the resulting matrix is inverted. This is easily accomplished in Excel, using the matrix command *minverse*.[7] A LEWIE SAM multiplier model can also be programmed into GAMS.

The SAM multipliers of a \$1 cash transfer to the beneficiary households appear in Table 3. These represent the total (direct plus indirect) effects of the exogenous transfer (modelled as a payment from the ROW to the treated household). If the assumptions underlying the SAM multiplier model are correct (these are discussed below), a \$1 cash transfer to the treated households has a multiplier effect of \$1.50 on the incomes of treated households and \$0.78 on the incomes of non-treated households. These income multipliers result from an increase in expenditures by treated household on goods supplied within the ZOI, which in turn stimulate production in both the treated and non-treated households. Agricultural production increases by \$0.08 in treated households and \$0.42 in non-treated households, and non-agricultural production jumps by \$0.62 and \$1.07 in the two households, respectively. As incomes in both households increase, so do expenditures, which in turn stimulate further rounds of income increases. In this way, both non-treated and treated households benefit from the cash transfers. Under the best of circumstances, the programme can help jump start a stagnant economy.

Constructing SAMs is always a first step in carrying out simulation analysis using economy-wide models. Real-life SAMs for LEWIE would be more complicated than the one in this example. They would have more production activities (as much disaggregation as the investigator wishes and has data to support), instead of aggregating activities into large categories. They might have more factors of production—for example, labour by skill level, gender or other type; physical capital as well as land (for agricultural activities) and so on. They might also contain elemental SAMs for actors besides household-firms. For example, pure firms would have activity but not household income-consumption accounts, while pure households would have incomes and expenditures but not activities. Governments are also easily represented, like in a village model,[8] either as a single account or a set of accounts for different government levels (e.g. village, county, state, federal). For complex projects, an account for the project itself may be included to model the local economy-wide impacts of project spending. Finally, a set of capital accounts may be included to capture savings and channel them into various kinds of investments: physical capital, human capital and financial instruments. If informal capital markets are important in the ZOI economy, it is important to include them in the SAMs, as they can be an important source of economic linkages across households.

The ZOI might consist of distinct regions. A regional focus can be incorporated into our simulation model by constructing a series of composite SAMs like the one in Table 2, one for each region, then stacking them into a multi-region SAM with a shared regional market (analogous to the rest of ZOI account in our illustrative SAM). If households and firms in a region share the same production technologies, the production activities in the elemental region SAMs can be aggregated into a set of shared accounts, as in more conventional SAMs, alongside multiple household accounts. At a minimum, each household group adds a row and column to the regional SAM; this is the case when households differ in their expenditure patterns and income sources but share production technologies and market behaviour. However, if household groups differ in fundamental ways with respect to their production technologies or market behaviour (e.g. some are subsistence producers, others commercial), each regional SAM should be decomposed into its elemental household SAMs, as in our simple example.

BEYOND SAMS: LIMITATIONS OF SAM MULTIPLIER MODELS AND WHAT TO DO ABOUT THEM

Building SAMs is a useful first step for LEWIE, because SAMs contain most of the data needed to construct any kind of economy-wide simulation model. SAM multipliers give a sense of how large linkages might be in an economy that satisfies the basic assumptions underlying the model. Because of this, LEWIE SAM multiplier analysis is a reasonable preliminary step in conducting impact analysis using simulation methods. Because the row and column total for every account in an SAM must be equal, arranging survey data into a LEWIE SAM ensures that we begin our study with a consistent set of accounts and that there are not significant data errors or omissions that could affect study findings. SAMs provide a snapshot of the ZOI economy in the baseline, which can serve as a benchmark to measure changes in the economy *ex post*. They are also a critical guide for designing survey questionnaires and sampling strategies (see Section 3, below).

The most important assumptions underlying SAM multiplier models include:

a) Perfectly elastic supplies of all goods, services and factors, so that increases in demand translate into increases in quantities, not prices. This assumption is violated when there are significant obstacles to increasing supply in some activities, or when factors are fully employed in the ZOI. In real life, increases in demand can put upward pressure on prices in the ZOI, in addition to having real (i.e. quantity) effects. In this case, an SAM multiplier which assumes that prices do not change when demand increases may overstate the real effect of income transfers and other types of interventions on the ZOI economy.

b) Linear responses all around, including in production activities (that is, a Leontief production function with fixed input–output coefficients) and in household consumption (fixed budget shares). In other words, the share of an increase in income that a household spends on a given good (that is, the marginal budget share) equals the average budget share. If households shift their demand patterns when their incomes rise, this assumption will be violated. Similarly, average input shares (that is, the Leontief input–output coefficients) determine how an increase in production will translate into increased demands for intermediate inputs, labour and capital in an SAM multiplier model. This assumption is not defendable if there are diminishing marginal returns to inputs in production activities.

TABLE 2

Integrated ZOI SAM

House-hold Group	SAM ACCOUNTS	SUB-ACCOUNTS	Treatment Households					Non-treatment Households					ZOI	ROW	TOTAL
			ACTIVITIES		FACTORS		Cons	ACTIVITIES		FACTORS		Cons			
			Ag	Non Ag	Labour	Capital		Ag	Non Ag	Labour	Capital				
			A	B	C	D	E	A'	B'	C'	D'	E'	F	G	H
Treatment	ACTIVITIES	Ag	10	15										55	80
		Non Ag		20									75	45	140
	FACTORS	Labour	20	50									20	10	100
		Capital	10	25											35
		INCOME			100	35									135
Non-treatment	ACTIVITIES	Ag						20	20				35	30	105
		Non Ag							40				125	65	230
	FACTORS	Labour						20	90						110
		Capital						40	45						85
		INCOME								90	85				175
	ZOI		15	15			100	10	20	20		135			315
	ROW		25	15			35	15	15			40			145
	TOTAL		80	140	100	35	135	105	230	110	85	175	255	205	1655

These assumptions are easier to defend in some situations than in others. For example, in an economy with unemployed labour and other resources and where there is excess capital capacity, fixed input–output coefficients may reasonably represent technologies, and increases in demand may translate directly into increases in local production. If the local economy is a price taker in outside markets for inputs and outputs, higher demand should not put upward pressure on prices. And for relatively small changes in income, household demand patterns are not likely to change significantly as income goes up. In general, an SAM multiplier analysis is more reasonable in ZOIs with high unemployment and without severe capital constraints than in economies at full employment or where technological limitations on production are more severe.

TABLE 3

SAM Multipliers of a $1 Cash Transfer to the Beneficiary Households

Household and Outcome	Simulated Multiplier Effects of a $1 Transfer to Treatment Households
	Accounting Multiplier
Treatment Households	
Activities	
AG	0.08
NONAG	0.62
Factor Incomes	
LABOUR	0.38
CAPITAL	0.12
Income	1.50
Non-treatment Households	
Activities	
AG	0.42
NONAG	1.07
Factor Incomes	
LABOUR	0.50
CAPITAL	0.37
Income	0.78
COMBINED INCOME	2.28
Trade	
ZOI	1.80

EXTENDING LEWIE SAM MODELS: FIXED-PRICE AND CONSTRAINED MULTIPLIERS

The effects of such constraints can be explored in fixed-price and constrained multiplier models. A fixed-price multiplier model is one in which we replace marginal for average budget shares to reflect changes in household demand patterns at different income levels. Constrained models impose inelastic supplies for some (constrained) sectors or beyond certain levels of output (Lewis and Thorbecke, 1992; Parikh and Thorbecke, 1996). These modifications can make SAM multiplier models a more realistic tool for evaluating project impacts.

As an example, let us revisit our simple two-household SAM accounting model and turn it into a fixed-price multiplier model by incorporating marginal budget shares. We econometrically estimate marginal budget shares for the two households and compare them to the average shares calculated from the SAM in Table 2:

TABLE 4

Average and Marginal Budget Shares

Expenditure	Treatment Households		Non-treatment Households	
	Average	Marginal	Average	Marginal
ZOI	0.74	0.76	0.77	0.82
ROW	0.26	0.24	0.23	0.18

In this example the marginal budget share for goods purchased within the ZOI is higher than the average for both poor and non-poor households (0.76 and 0.82, respectively, compared with average budget shares of 0.74 and 0.77, respectively). Intuitively, it seems clear that these modifications will increase linkages within the ZOI and thus the multiplier. Making the replacement in the unconstrained SAM multiplier model, we obtain a new fixed-price coefficient matrix (A_{fp}) and new SAM multiplier (M_{fp}):

$$dy_{fp} = (I - A_{fp})^{-1} dx = M_{fp} dx$$

We do indeed obtain slightly higher production and income multipliers from the cash transfer in the fixed-price multiplier model (Table 5). The income multiplier rises from 1.50 to 1.55 for poor households and from 0.78 to 0.85 for non-poor households (see Table 5).

An inelastic supply response might reflect liquidity or other constraints preventing households from increasing their agricultural output in response to increases in demand. It also might reflect high transaction costs, which in effect prevent market signals from reaching the household. The methodology to incorporate inelastic supply responses into an SAM multiplier model appears in Lewis and Thorbecke (1992). Suppose some accounts are unconstrained, and let y_{nc} denote a vector of incomes in these unconstrained accounts, while others are constrained, such that the value of their total income is fixed. We let y_c represent the vector of (fixed) incomes in these constrained accounts. An account, in this case, might be a production activity with fixed output, or it might be a fixed factor (e.g. capital) or even a ZOI market constraint preventing trade between the households. Final demand (in our model, the ROW demand for output and payments from the ROW into the households) is fixed at x_{nc} for the unconstrained sectors. In contrast, the only way that constrained sectors can respond to increases in local demand is by diverting goods or services from the ROW to the local market; thus, for these sectors, the final or ROW demand, x_c, is endogenous. The multiplier model becomes partitioned between unconstrained and constrained accounts, such that:

$$\frac{dy_{nc}}{dx_c} = M_m d\begin{bmatrix} \frac{x_{nc}}{y_c} \end{bmatrix}$$

Where the constrained multiplier matrix, M_m, is given by:

$$M_m = \begin{bmatrix} (I - C_{nc}) & 0 \\ -R & -I \end{bmatrix}^{-1} \begin{bmatrix} I & Q \\ 0 & -(I - C_c) \end{bmatrix}$$

C_{nc}, R, Q and C_c are all sub-matrices of the coefficient matrix A_{fp}: C_{nc} corresponds to the intersection of unconstrained rows and columns; R to the intersection of supply-constrained rows with unconstrained columns; Q to the intersection of unconstrained rows with constrained columns; and C_c to the intersection of constrained rows and columns.

TABLE 5

Accounting and Fixed Price Multipliers Compared

Household and Outcome	Simulated Multiplier Effects of a $1 Transfer to Treatment Households	
	Accounting Multiplier	Fixed Price Multiplier
Treatment Households		
Activities		
AG	0.08	0.08
NONAG	0.62	0.68
Factor Incomes		
LABOUR	0.38	0.42
CAPITAL	0.12	0.13
Income	1.50	1.55
Non-treatment Households		
Activities		
AG	0.42	0.46
NONAG	1.07	1.17
Factor Incomes		
LABOUR	0.50	0.55
CAPITAL	0.37	0.40
Income	0.78	0.85
COMBINED INCOME	2.28	2.40
Trade		
ZOI	1.80	1.98

Although the matrix representation of M_m is slightly cumbersome, in our GAMS multiplier programme it is simple to impose the constraint that the agricultural supply is inelastic: we simply fix total income (output value) and free up final (ROW) demand for the constrained sector(s) while leaving all other accounts unchanged.

We can use the constrained model to see how inelastic agricultural supplies affect the income multipliers from our cash transfer. Table 6 reveals that the combined household income multiplier drops from 2.40 to 2.33 when the treated household group's agricultural supply is perfectly inelastic, and to 1.85 when both households have inelastic agricultural supplies. Naturally, the largest income effect is in the household facing the supply constraint. Nevertheless, a cross-household effect is also evident. For example, a constrained beneficiary group's agricultural supply reduces the non-treated group's income multiplier from 0.85 to 0.83. The beneficiary group's income multiplier drops from 1.50 to 1.39 when the non-poor supply constraint is imposed on the model.

If there is concern that an economy faces serious capital or technological constraints, we should incorporate these into our simulation models. We should also consider including a component in the project to address these constraints. An example might be micro-credit for capital investments in the non-beneficiary households, so that their production can expand as demand increases and contribute to local income multipliers.

An attractive feature of constrained multiplier models is that they can be used to simulate the effect of loosening the constraints. Because supply is fixed in the constrained sector(s), it is possible to increase the supply in the constrained sector and use the model to estimate the multiplier effect on the ZOI economy. This is easily accomplished in our simulation models. One could imagine various simulations in which constrained supplies are loosened together with the income transfer.

Table 7 compares multipliers from the cash transfer with and without a $1 loosening of the beneficiary household's agricultural supply constraint. When the agricultural supply constraint is loosened, income increases by 2.07 instead of 1.50 in the beneficiary group and by 1.14 instead of 0.83 in the non-beneficiary group. The transfer creates a multiplier effect in the ZOI economy, and loosening the beneficiary group's agricultural supply constraint increases this multiplier. The combined income gain is now 3.21, compared with 2.33 when the constraint is unchanged. Unfortunately, unlike the cash transfer, the cost of the intervention to loosen the agricultural supply constraint is not known. More information is needed to perform a cost–benefit analysis or compare the efficiency of the two programmes at raising household incomes.

TABLE 6

Unconstrained and Constrained Fixed Price Multipliers Compared

Household and Outcome	Base Income	Simulated Effect of a $1 Income Transfer to the Poor Household, Fixed-price Multipliers		
		Unconstrained	Constrained	
			Poor Ag	Both Ag
Poor Household				
Activities				
AG	81.21	0.08	NA	NA
NONAG	149.9	0.68	0.66	0.51
Factor Incomes				
LABOUR	106.1	0.42	0.39	0.30
CAPITAL	36.92	0.13	0.12	0.09
Income	143.02	1.55	1.50	1.39
Non-poor Household				
Activities				
AG	111.73	0.46	0.45	NA
NONAG	247.12	1.17	1.14	0.89
Factor Incomes				
LABOUR	117.98	0.55	0.53	0.35
CAPITAL	90.91	0.40	0.39	0.17
Income	187.44	0.85	0.83	0.46
COMBINED INCOME	330.46	2.40	2.33	1.85
Trade				
ZOI	283.85	1.98	1.92	1.50
ROW	205	NA	-0.07	-0.34

TABLE 7

Multiplier Effects of a $1 Cash Transfer to Beneficiary Households with and Without Loosening These Household's Agricultural Production Constraint

Household and Outcome		Base Income	Simulated Multiplier Effects of a $1 Transfer to Poor	
			Leaving the Poor Household's Agricultural Supply Constraint Unchanged	Loosening the Poor-Household Agricultural Production Constraint
Poor Household				
Activities				
	AG	80	NA	1.00
	NONAG	149.6	0.66	0.90
Factor Incomes				
	LABOUR	105.6	0.39	0.78
	CAPITAL	36.71	0.12	0.29
Income		142.34	1.50	2.07
Non-poor Household				
Activities				
	AG	111.53	0.45	0.61
	NONAG	246.6	1.14	1.56
Factor Incomes				
	LABOUR	117.74	0.53	0.73
	CAPITAL	90.74	0.39	0.54
Income		187.07	0.83	1.14
COMBINED INCOME		329.41	2.33	3.21
Trade				
	ZOI	282.98	1.92	2.63
	ROW	205	-0.07	0.78

PRICES

In a ZOI economy with nonlinearities, resource constraints and locally endogenous prices that transmit impacts among households, a more general model may be needed to evaluate the impacts of the cash transfer programme. If endogenous prices play an important role in transmitting project impacts or if prices are a focus of our evaluation, they need to be included in our evaluation model. For example, we may be interested in exploring changes in wage rates or food prices as a result of a cash transfer programme. These price changes are not inevitable. In an economy with high levels of unemployment, a stimulus programme such as cash transfers may increase the local demand for labour without exerting upward pressure on wages. In an economy with access to food from regional markets, higher demand for food might not push up local food prices.

Nevertheless, in ZOI economies that are largely self-sufficient in food, in which there are high costs of transacting in outside markets or in which there are resource (e.g. labour) constraints, our models should be constructed to reflect these characteristics of the economy. Typically, some goods (services, labour, land, often food, and sometimes other items) are non-tradable, with prices determined in local markets, while others (e.g. non-farm goods sold in local stores, most purchased agricultural inputs) are tradable. Cash crops such as coffee clearly are tradable. Livestock is likely to be, given the difficulty of transporting animals, as are perishable food crops, unless villages are closely integrated with outside markets, buying and selling at exogenous prices. Wages typically vary across villages, reflecting transaction costs that limit arbitrage in labour markets. They are likely to play a critical role in transmitting project impacts to labour-supplying households.

Imported goods and factors may be imperfect substitutes for local ones. Goods that are obviously tradable have a non-tradable component. For example, the purchase of a bar of soap in a local grocery will have a tradable (wholesale price plus some transport costs) and a non-tradable (grocery mark-up plus some local transport costs) component. Others are tradable but not perfect substitutes; an example is imported and locally produced corn for tortillas in Mexico. One might imagine an aggregation function that combines imperfectly substitutable imported and local corn to produce tortillas. Even if locals prefer their own corn, they might be willing to mix in imported corn if the price is right. One way to model this is via a constant elasticity of substitution (CES) aggregation function. In any GE model, households may shift from consumption of non-tradable to tradable goods as relative prices change. One way to respond to rising non-tradables prices is to purchase from stores (retail), for which a high share of the output price is the fixed price of intermediate goods (for example, soft drinks) purchased from suppliers outside the local economy.

Price effects are absent from SAM multiplier models, constrained or unconstrained. Incorporating them into our analysis generally requires moving from a LEWIE SAM multiplier model to a GE modelling approach in which prices for locally non-tradable goods are determined by the interaction of supply and demand within the ZOI. Filipski and Taylor (2012) use this approach. The ability to analyse impacts of cash transfers and other interventions on local prices is a particular advantage of simulation models.

It is useful to keep it in mind the role of prices and the local supply response while thinking about the market assumptions underlying simulation models. If ZOI 'imports' and local goods are complements but supply is so elastic within the ZOI that changes in demand are instantaneously matched by changes in local supplies, prices will not rise as demand increases (consistent with an SAM multiplier model), but otherwise they may. Supply elasticities clearly shape impacts in the ZOI and the way in which we should model them.

BEHAVIOUR

A premise of some cash transfer programmes is to change household behaviour. An example is a change in expenditures favouring food, schooling or children's health. Experimental methods can be used to test whether programmes succeed in shifting household preferences (for example, see Kenya CT-OVC Evaluation Team (2012), which shows that the programme indeed succeeded in shifting household preferences). If so, LEWIE model parameters will change. This is true for SAM multiplier models (constrained or unconstrained) as well as for more general models.

In a LEWIE SAM multiplier model, new shares can be substituted for old ones using the method of Lewis and Thorbecke (1992) and Parikh and Thorbecke (1996) described earlier. In more general LEWIE models, parameters can be econometrically updated using the findings from the experimental analysis. Substituting parameters in these ways makes it possible to model the local economy-wide impacts of changes in behaviour. In theory, it is possible that spillovers within the local economy influence the parameters of non-treated households—for example, by transmitting new information or norms (nutritious eating, children's education and health etc.). In practice, this may be unlikely, at least in the short term (although, data permitting, the hypothesis that the behaviour of the non-treated households changes as a result of the programme could be tested experimentally with the same methods used to test changes in behaviour of treated households). Once a LEWIE model exists, updating model parameters is straightforward and does not require any changes in the model code.

3 DATA REQUIREMENTS FOR CONSTRUCTING HOUSEHOLD SAMS

Under certain conditions no information other than what is in a ZOI SAM is required to calibrate LEWIE models (see, for example, Filipski and Taylor (2012)). Flexibility is a virtue of simulation models; the model may be as detailed and complex as needed to evaluate programme impacts of interest. For example, beneficiaries might not be integrated with local markets prior to the intervention, but the programme, by providing them with cash benefits, might affect their market participation. Jonasson et al. (2011) model market participation in their evaluation of agricultural policies in six less-developed countries; however, to date, market participation has not been addressed explicitly in a project impact evaluation simulation model.[9] A related question concerns the potential effects on migration: migrant remittances are private transfers to households from the rest of the world, yet cash transfers may loosen liquidity constraints on migration or possibly crowd out remittances. Migration and remittances can be explicitly modelled as in Taylor and Dyer (2009), and these two papers' modelling approaches can be integrated to simulate the impacts of cash transfers on migration and remittances.

Before dashing off and estimating a more constrained non-linear LEWIE GE model, it is worth asking whether some variant of the multiplier model might be useful in focusing attention on the constraints that prevent transfers from unleashing a development dynamic, as well as to design complementary policies to loosen these constraints. We will revisit LEWIE GE analysis after reviewing the data requirements for constructing household SAMs.

This section is a guide to the nuts and bolts of: (1) designing household SAMs and identifying the data needed to construct them; and (2) designing surveys to fill information gaps.

DESIGNING LEWIE SAMS AND IDENTIFYING DATA NEEDS

The first step in constructing a simulation impact model is to define household groups and sketch out the structure of the SAMs to be created for them. This is a prerequisite for determining data needs and designing baseline surveys—or, more accurately, modifying experimental baseline surveys to meet the needs of GE modelling.

The structure of the SAMs, and thus the data requirements for the model, depend on what one wants to simulate, the economy in which to simulate it, and the outcomes of interest. All of these must be reflected in the LEWIE SAM. If the SAM does not reflect the structure of the economy in question, or if the economy is ill defined geographically or conceptually, simulations using the model will not be reliable, like a flight simulator programmed for the wrong aircraft. There must be a point of entry in the model for the intervention to be simulated, and this needs to be reflected in the SAMs. For example, the simulation of a cash transfer to poor households with high dependency ratios requires having an SAM for these households and an account in the SAM through which the transfer is channelled to the beneficiary group. If the project to be simulated concerns stimulating human capital investments, then labour factors in the SAMs should be disaggregated by educational categories, and investment accounts should be disaggregated to highlight human capital. If it involves raising incomes of poor, female-headed households, then we will need a separate SAM or disaggregation of a larger SAM to highlight this group. If one of the outcomes we wish to simulate is the project's impact on crop productivity on marginal lands, land factor accounts in the SAM will have to be disaggregated by quality.

There may be an interest in outcomes other than those depicted in the SAMs. For example, we might want to know how a cash transfer programme is likely to affect calorie consumption. Nutritional impacts are likely to be influenced by GE linkages between treated and non-treated households. Quantifying them requires translating changes in food demands into calories. Provided that there is a sufficiently detailed food-demand disaggregation in the household SAMs, this can be accomplished using calorie-conversion coefficients from country nutrition authorities or the World Health Organization.[10]

The structure of the SAM, in turn, guides the data collection. For our simulation impact analysis, the major goal of data collection is to fill in the cells of each SAM for each household group.

Figure 1 provides a broad-brush illustration of a typical micro-SAM for a household group in the impact evaluation model. The entries in this general SAM framework and their interpretation are completely analogous to those in the illustrative SAMs in Section 2. For a given household group, the activity accounts reveal where output goes (rows) and all intermediate and factor inputs (columns). These are all disaggregated by location, most importantly whether inside or outside the ZOI. The factor accounts collect wages and rents (rows) and channel them into the household, rest of the ZOI, or world outside the ZOI (columns). There is a single household account in an elemental household SAM. It collects income from all sources as well as borrowing or dis-savings (row) and channels it into demand for goods and services produced by the household, obtained elsewhere in the ZOI, or purchased outside the ZOI; it also allocates income to savings (column). The capital accounts gather up savings (row) and allocate it to formal or informal credit or risk-sharing inside or outside the ZOI (column).

The ZOI account is the critical link among our household SAMs. We include a ZOI account in each household SAM. However, when we combine the elemental household SAMs into a meta-SAM for the ZOI, we aggregate the ZOI accounts into a shared account in the meta-SAM. In our simulations, it serves to transmit impacts through the ZOI. The account for the rest of the world (outside the ZOI) collects expenditures on goods and services made outside the ZOI (row) and channels them into the rest of the world (column). Purchases outside the project area are lumped together as 'imports' from the rest of the country outside the project area or the rest of the world. It is an exogenous account which captures leakages from, and exogenous injections into, the ZOI economy.

The SAMs also include a government account. It gathers taxes from inside the ZOI and transfers from outside the ZOI (row) and allocates these to the government demand for goods and services and public transfers. To facilitate our simulations of programme effects, it is usually helpful to disaggregate this account into sub-accounts representing the project being evaluated and other government activities.

As in the simpler SAMs in the last section, all accounts must balance: total income (rows) must equal total expenditures (column). The exceptions are the ZOI and rest-of-world accounts, because the household group is not required to achieve a trade balance separately with each of these. The sums of the two accounts' row and column totals must balance, however.

It should be clear from this description that all accounts except the rest of the world outside the ZOI and government are endogenous to the ZOI. The capital account is exogenous only if the ZOI is integrated with outside capital markets. The classification of accounts between endogenous and exogenous is central to model closure.

The correspondence between the activity accounts and the household expenditure categories is critical: for every category of household expenditures on locally supplied goods and services, there must be a corresponding sector in the activity accounts. If the households pay direct taxes, these are allocated by the household columns to the government row. If households receive government transfers, they appear as a payment by the government (column) to the household (row). Migrant remittances are transfers received by the household (row) from the rest of the world in which the family migrant works (column). The latter may be the rest of the country, in the case of internal migration, or rest of world, in the case of international migration.

DEFINING THE ZOI

Two main considerations guide the definition of the ZOI. The first is the evaluation itself: over how large an area do we wish to document the impacts of an intervention? This is the ZOI for purposes of the evaluation. If a policy goal is to achieve specific outcomes (e.g. income and employment growth) within villages or village clusters, it may be appropriate to designate the village or cluster as the ZOI for our evaluation. On the other hand, if the intervention covers multiple villages within a district or region, the district or region might be a more ideal choice.

FIGURE 1

General Structure of a Typical Household SAM

Incomes	Expenditures							
	1 ACTIVITIES	2 COMMODITIES	3 FACTORS	4 INSTITUTIONS	5 CAPITAL	6 Rest of ZOI	7 Rest of World	TOTAL
1. ACTIVITIES Staples Other Ag Livestock Services		Supply of Commodities to Own Production Activities and Consumption				(i) Sales Inside the ZOI	(i') Sales Outside the ZOI	(e) Total Production Value
2. COMMODITIES Staples Other Ag Livestock Services	(a) Home-produced Intermediate Inputs (Input-Output Matrix)			(g) Own Consumption	(h) Implicit Investment or Storage			Total Value of Home Production
3. FACTORS Family Hired Labor Land Capital	(b) Value-Added from Production						(o) Wages, rental income	Total Factor Receipts
4. INSTITUTIONS Households			(f) Household Value-Added Income	(j) Public and private transfers			(k) Migrant remittances	Total Household Income
Government	(c) Indirect Taxes							
5. CAPITAL				(l) Savings (incl. investments)				Total Savings
6. Rest of ZOI 7. Rest of World	(d) Purchased inputs by place purchased			(m) Market Consumption	(n) Investment good purchases, formal and informal savings			Total Market Purchases
TOTAL	(e) Total Production Expendtures	Total Value of Home Production	Total Factor Payments	Total Household Expenditures	Total Investments		Total Market Sales	Total Incomes and Expenditures

The second consideration has to do with the linkages that transmit the intervention's impacts through the economy. To some extent, multiplier effects depend on the size of the ZOI. Like the ripples in a pond, the influences of transfers and other interventions continue on through the economy, eventually making their way into regional and national urban centres and even abroad (through imports). How widely we wish to cast our net may depend not only on our ZOI but also on the strength of linkages. The larger the area over which we carry out our analysis (e.g. defining the ZOI as a village cluster rather than single village) and the stronger the linkages within this area as opposed to between it and the rest of the economy, the more indirect impacts our analysis will capture. Even if our main interest is income growth within villages, if strong linkages transmit impacts from one village to another within a cluster, limiting the evaluation to a single village may miss important feedback effects that shape project impacts.

These considerations have led to the creation of policy evaluation models for villages, village-town economies, districts, regions and even whole rural economies. (Some of these are featured in Taylor and Filipski, 2012 (forthcoming) and in Taylor, 2011.) A current project (at IFPRI) is evaluating the impacts of new irrigation projects by defining the ZOI as the districts touched by the projects and embedding these within a national model, to test for potential feedback between rural and urban areas and across districts.

In many cases, high transaction costs result in strong linkages in and around project areas. Most expenditures occur close to home, many of the goods and factors purchased are local non-tradables, and one does not have to cast the net too far to capture significant impacts missed by conventional experiments.

To illustrate, for the Zambia business survey (Appendix A), we constructed the master list from which businesses were randomly selected for the survey by considering a business to be within the ZOI of a sample village if it was inside the village or regularly (at least around once a month) made transactions with households in the sample village. These transactions can involve sales to households, purchases from households or employment of individuals that are members of households within the sample village. To identify which businesses belong on this list, a supervisor or experienced enumerator talked with village contacts. The population of businesses sampled was divided into three categories (retail, services and manufacturing), and then the sample was stratified to make sure that it included at least one business from each category.

MODIFYING BASELINE SURVEYS FOR SIMULATION IMPACT EVALUATION

All experiments require baseline surveys of treatment and control groups. Both consist of eligible households located at the treated or control sites. To capture the indirect effects of programmes on non-beneficiary groups, experimentally or using simulation methods, we also need information about ineligible groups.

Broadly speaking, there are four critical household groups for which we need to construct SAMs and, thus, for which we need data from both baseline and follow-up surveys: beneficiary households (eligible households in the treated villages); the control group: eligible households in the non-treated or control villages; ineligible households in the treated villages; and ineligible households in the control villages.

If the baseline surveys are based on Living Standard Measurement Surveys (LSMS), much of the data needed for simulation impact evaluation will already be gathered. We simply have to make sure that no cell of the SAM is overlooked. The most important single modification required to construct elemental SAMs is to obtain information about where transactions take place and, in particular, the tradable and non-tradable component of purchases. Few economic models make the distinction between tradables and non-tradables, and those that do usually invest little effort into determining which is which. For example, de Janvry et al. (1991) and Taylor and Adelman (2006) perform 'what if' simulations on the implications of non-tradable food and labour on autarkic households and villages, respectively. Neither, however, attempts to determine whether food (or particular food items) is, indeed, non-tradable.

These are difficult questions to get at, but they are critical if we wish to capture the local GE effects of projects. Local informants can be valuable in classifying goods into tradable and non-tradable groups. It is not hard to figure out whether local farmers are supplying national markets or simply local demand. Surveys of retail businesses can provide information on the origins of goods sold in stores as well as mark-ups. Adding the 'where/with whom?' question to business and household surveys provides additional important information. In addition to knowing the values of everything the household purchased and sold, we need to know where the exchange took place and/or with whom. This information can be recorded by entering a location/transactor code next to each sale or purchase. A typical list of locations might include: households within the village; households in a neighbouring village; a trader who buys and sells locally; a trader who also buys and sells in other parts of the country; in a town within the ZOI; or outside the ZOI. This information is crucial to know where to allocate each expenditure or source of income in the SAMs. Where transactions take place and with whom shape GE impacts.

The second critical addition is a survey of businesses. Households spend their income on goods and services provided by businesses, which in turn play a crucial role in transmitting impacts within economies. Typically, at least in rural areas, most businesses are associated with households and thus at risk of being picked up by baseline household surveys, particularly if these surveys include non-eligible households in treated villages. Nevertheless, households may also spend income in non-household businesses in the treated and neighbouring locales. Non-household businesses may differ from household firms in terms of the goods and services they provide, production technologies (e.g. labour intensity) and linkages with the rest of the economy. As a result, if these businesses are excluded, our models may not provide an accurate representation of the programme's GE effects. A separate business survey is required if we wish to reflect these businesses in our model.

The ideal, naturally, is to have household and business data for all study villages, including programme and non-programme locations within the ZOI. In practice, just as one must make statistical inferences from a sample of agents, surveying all villages in the ZOI often is unrealistic. When many villages are involved, surveys can be carried out in a subset of (randomly chosen) beneficiary and control villages, and within each village, from random samples of both eligible and ineligible households. In theory, if all villages were identical, we would only need to collect data on a single study village. In practice, however, villages, like the agents within them, are heterogeneous, and the larger the sample of locales included in the study, the more accurately we can model project impacts.

The critical data that we need from these surveys are summarised in Table 8. They include:

DATA ON BENEFICIARY AND NON-BENEFICIARY HOUSEHOLDS

The household data needed to construct an SAM include income from supplying labour or capital to production activities inside and outside the project area (including home production), other sources of income, and the shares of income or expenditures spent on individual goods and services. In economies characterised by a high level of in-kind exchanges (e.g. bartering of goods or labour exchanges), these exchanges are typically valued at local market prices and can be integrated into like accounts or else included as separate accounts in the SAM. In the second case, the model could be used to evaluate the intervention's impacts on both market and non-market activity, although we are not aware of any study that does this to date.

Most baseline surveys collect wage income by type of work for each household member; if so, only the location code has to be added to the survey. Agricultural and non-agricultural production modules are also usually a part of baseline surveys. However, where output is sold and where inputs are purchased is not. Location codes need to be added for each sale and purchase, including payments of wages ('Where do the workers you hired live?') and rent paid for land and other types of capital ('Where does the person to whom you paid rent live?'). If the household received rent, it is important to record where the payer resides. If family labour in household production activities is not covered, it needs to be added to the survey.

Construction of household SAMs requires having values of total supplies and demands of the goods and services bought and sold by each household group. The entries in the SAMs are value flows. Quantities generally are not critical except when needed to compute values or when market transactions do not take place (subsistence production and family inputs, including labour, land, animal traction and other capital). When we do not observe prices, quantities may be needed to estimate values.

Baseline household surveys also include information on consumption expenditures, investments and savings. We need to know where these expenditures took place. Savings might be in banks (usually not part of the local economy) or informal (in which case they may be a source of capital to others in the local economy). Risk-sharing institutions may help circulate income within the local economy. It is likely that household payments and receipts related to risk sharing and informal credit are already included in the baseline survey, but sometimes they are not. Periodic markets are often an important source of consumption goods and/or an outlet for home-produced goods; if so, they should have their own location code and be included in the business survey.

TABLE 8

Survey Data Needed to Construct Household SAMs[11]

SAM Cell	Data Needed to Fill Cell
(a–e)	What economic activities (production, retail, services etc.) did your household or your business do in the last 12 months?
(e)	How much did you or your business produce, whether you sold it or not, and what is it worth? (Q, $).
(a, g–i)	What did you do with what you produced? (Q used as inputs for your other production activities (e.g. corn fed to animals)); home consumption (Q); sold to buyer in the ZOI (Q, $), sold to buyer outside ZOI (Q, $)).
(b)	What labour and capital did you use for this economic activity? Your own labour (Q=days); hired labour (Q, $, where purchased (WP; from inside or outside ZOI)); your own land (Q=hs); other people's land (hs, $ paid, WP); your own capital (Q: e.g. tractor or oxen-days); other people's capital (Q, $, WP).
(d)	What inputs did you buy to produce it? (Q, $ and WP; e.g. amount of fertiliser, cost, bought outside the ZOI).
(c)	What taxes did you pay to do this activity? ($, to government agency inside our outside the ZOI?).
(f, j, k, o)	How much income did your household receive in: wages ($, WP: working inside or outside the ZOI); rents ($, WP); transfers from other households ($, WP); migrant remittances ($, WP); transfers from government (WP: government inside or outside ZOI); NGOs or other sources ($, WP).
(m)	How much did you spend on consumption ($, spent inside or outside the ZOI; this requires an expenditure-recall module, noting if expenditure was inside or outside the ZOI.
(l, n)	What investments did you make? ($, WP of investment goods); savings; requires list of investment expenditures, e.g. housing, productive investments, schooling.

The minimum household sample sizes required for simulation modelling are not unlike those for experimental impact evaluation, with the exception that we need to sample households in all four groups. Many baseline surveys for experimental studies cover only beneficiary households (eligible households in the treated villages) and the control group:

eligible households in the non-treated or control villages. Some also include non-beneficiary households at programme sites. Including the latter is critical if we wish to model programme impacts of non-treated households.

DATA ON BUSINESSES

The surveys of businesses gather the same sort of information as the production modules of household surveys. The critical data needed to fill in the column for each production activity include gross income, the value of intermediate inputs produced inside and outside the ZOI, payments to factors (wages, capital costs and profits), taxes paid, subsidies received and business savings. This information is used to obtain input–output coefficients and value-added shares for each activity. The most difficult information to collect is on profits. However, they can be estimated as the difference between gross sales and expenditures on intermediate inputs and factors. As always, the location codes identify where each input was purchased. For wages, this means asking business owners what part of the wages they paid went to workers who live inside and outside the ZOI. It is also important to ask the residence of the business owner, because that is where profits from the business flow. An example of a business survey (from Zambia) appears in Appendix A.

If the business is seasonal, the data need to be collected for each season, and the number of months in each season must also be recorded. If the owner finds it difficult to calculate annual figures, it might be useful to ask questions such as 'How much did you sell in a typical week during the high season?'. It is also useful, as a check, to ask what share of every dollar of sales went to wages, purchasing inputs, rent etc. It is very important to document businesses' payments for intermediate inputs and factors from within the ZOI, as they generate the principal economic linkages from business activities.

If rotating markets are important, their vendors should be interviewed as part of the business survey. Where these venders are based and where they acquire the goods they sell and labour they hire may play an important role in shaping local GE linkages. Periodic markets could mop up money from households and send it outside the ZOI economy, creating large leakages. Alternatively, they could gather products from one part of the ZOI and sell them in others, they might hire local labour, and their owners might live in the ZOI. If so, they could lower transaction costs for local producers and contribute towards creating income linkages in the ZOI economy.

A brief community survey conducted with community leaders and other informants can be a useful way to construct lists of businesses in the community, learn about periodic markets and other places where households spend their income, and get a sense of how the village fits into the surrounding economy or whether it is largely self-sufficient. A short data collection instrument can be used for this purpose.

When designing surveys, it is usually ideal to ask the locations of purchases and sales in the corresponding modules of the questionnaire. For example, after asking 'How much (crop) did you sell?', follow with 'Where did you sell it?'. In some cases, we must ask these questions as an add-on to an existing survey questionnaire, or time and space constraints might make it difficult to ask where every transaction documented in a survey took place. As a second-best strategy, a matrix can be included at the end of the survey questionnaire to get an idea of where different kinds of transactions take place. An example is included as Appendix I.

The questions in this Appendix are also useful guides for asking the locations of transactions within the appropriate survey modules.

Typically, business surveys are an add-on to household surveys conducted as part of the baseline for experiments. This raises the question of sample size. The standard equation used to determine the optimal sample size for surveys is:

$$n \geq \left(\frac{z_{\alpha/2}\sigma}{\delta} \right)^2$$

where z is the value of the t statistic corresponding to the desired confidence interval, σ is the standard deviation of the variable we wish to estimate from the data, and δ is the desired level of confidence of our estimate.

Usually, we do not have access to the information needed to determine the optimal sample size for enterprise surveys in project ZOIs. Registers of businesses in rural areas are rare, let alone estimates of standard deviations of variables of interest. One way to get an idea of the sample size needed for our enterprise surveys is to consider the parameters we wish to estimate—for example, labour shares in value added, and how they are distributed. Fortunately, the standard deviation of a share estimate is relatively straightforward: $\sigma = \sqrt{p(1-p)}$, where p represents the labour share in value added. Assuming that the true share is 0.35 to 0.6 (the range commonly found in agricultural census and household surveys), for α=*.05* and a margin of error of 3 per cent, we obtain an optimal simple size of between 350 and 369 businesses. If these exceed 5 per cent of the population of businesses in the ZOI, however, they may be too high. The correction by Cochran (1977) can be used to obtain an adjusted sample size (n_{aj}) as follows:

$$n_{aj} \geq \frac{n}{(1+\frac{n}{N})}$$

where *n* is the minimum sample size given by the general formula (248 to 270), and *N* is the population of businesses in the ZOI. For example, if there are 300 businesses in the ZOI, the minimum sample reduces to 162 to 166. We might expect similar sample sizes to be needed to estimate other parameters, such as average enterprise value added, output value and demands for inputs. Given the heterogeneity of businesses, it is likely that we will want to estimate these parameters for different groups of activities—for example, retail, other services and other production activities. Balancing theory and practicality, and considering that many businesses are connected with households and thus picked up in household surveys, a reasonable target is on the order of 100–120 surveys for each major business type (e.g. retail, other services and other production activities).

Sampling theory dictates having larger samples, the more heterogeneous the population (this explains the appearance of σ in the numerator of the minimum sample size expression). In some cases, there may be unique businesses missed by the randomisation strategy used to sample businesses. For example, one village in the ZOI might contain an influential food processing or furniture factory. Omitting this business from the survey (and SAMs) might introduce bias into the simulation model. A periodic market is another example. Ideally, individual stalls at the market would be included in the population of businesses from which the sample is drawn, but in practice this may not be the case. It is useful, therefore, to do some reconnaissance work prior to carrying out the business survey, to avoid missing potentially important economic actors not picked up by randomised sampling designs.[12]

OTHER DATA THAT MAY BE NEEDED TO CONSTRUCT SIMULATION MODELS

Projects and policies may have local fiscal impacts that should be captured in simulation models. If so, then it is important to include governments and entities associated with the project in the ZOI SAM. Public agencies may collect fees and allocate their budgets to locally produced goods and services (activities), factors (labour and capital) and outside purchases. Data to construct government accounts are usually available from government agencies. It may also be important to include other economic actors in the model. For example, a temple may be an important endogenous actor receiving contributions from households, hiring labour and purchasing goods, and providing some households with income support (see the Indian village model in Taylor and Adelman, 1996). In this way, it might add to GE linkages in the economy.

Theory guides data collection, and surveys for the experimental evaluation of programme impacts may not provide data on all the economic actors we wish to consider in our simulation models. Hopefully, this will change in the future, but in the meantime other data sources might be useful to fill the void. For example, many impact evaluations do not collect information on ineligible households in either the treatment or control communities. In Malawi and Ghana, Filipski and Taylor (2012) used data from multi-purpose household surveys to construct household groups, based on their eligibility for different types of transfer, and constructed an SAM for each.

USING SURVEYS AND OTHER DATA TO CONSTRUCT SAMS

Constructing SAMs from the survey data is relatively straightforward and easily accomplished using Excel spreadsheets. If the household and business survey data are organised into a case-by-variables format in a spreadsheet, additional worksheets can be linked to this—one for each SAM—and formulas can be inserted into their cells to aggregate across households in each group, selecting on a group identifier in the data sheet. The cell in a household SAM is filled in by adding up the data corresponding to the cell from all of the survey questionnaires administered to households corresponding to the SAM. For example, the total value of maize production (the maize activity row and column total) for the beneficiary group is the sum of the value of maize production for all surveyed households in this group. When we go from survey data to SAM construction, we insert a formula in each SAM cell that sums up the relevant information from all of the households represented in the SAM.

BALANCING ACT

The SAM is a double-entry accounting system: every unit of income recorded in the rows must have an equal expenditure associated with it in the corresponding column. In some parts of the SAM, balancing is nearly automatic: the activity accounts (rows) send all of their production into the commodity accounts (columns). A reason for having both is that there may not be a one-to-one mapping of activities to commodities. For example, in Mexico, the traditional *milpa* multi-cropping activity produces three different commodities: maize, beans and squash. Moreover, while small farmers often use ox-and-plough methods to cultivate traditional maize varieties with low yields, large farmers are highly capitalised, grow high-yielding hybrids and have yields sometimes not that different from corn farmers in the USA. The activities are where production functions lurk. In this example, different activities (that is, farms with different technologies reflected in their production functions) produce the same or perhaps different commodities (depending on the elasticity of substitution in consumption between hybrids and traditional varieties). Having a separate SAM for the two farmer groups allows us to explicitly capture differences in technologies used in maize production activities as well as differences in quality or maize commodities. In many applications, there will be a one-to-one matching between activities and commodities, or households may have different production technologies (activities) to produce the same commodities (e.g. rice).

By immediately allocating output from activities to the commodity accounts, we ensure that they are consistent. This leaves us with a balancing act on either side though. On the activity side, total expenditures (the columns) must equal total output value. As we fill in the expenditure column, accounting for intermediate input demands inside and outside the ZOI, wages and rents paid, eventually we are left with a residual, which is the implicit payment to family factors. For some applications it might be appropriate to leave this family factor value added as an aggregate 'family factor' account in the SAM. However, with information on quantities of family inputs (labour, land and other capital), straightforward econometrics can be used to decompose the aggregate family factor into its distinct components. This can be important if our research has a labour or land-use focus, or if a specific fixed family factor (e.g. land, in the absence of an agricultural frontier or local land markets) is likely to limit the agricultural production response to prices and other shocks. Treating the family value added as a residual virtually guarantees that the activity accounts will balance. Immediately allocating commodities to their end uses as intermediate inputs, consumption in the household or rest of the ZOI or 'exports' to markets outside the ZOI ensures that the commodity accounts also balance.

Following the double-entry rule while constructing SAMs should enable us to balance—or nearly balance—the other accounts in the matrix. For example, when recording a wage payment from agriculture (row: wage; column: agricultural activity), we add the same amount as a payment from the wage labour factor (column) to the row account corresponding to the origin of the labour (same household group, rest of ZOI, or rest of world outside the ZOI).

The household account is balanced by taking household income from all sources (the household row total) and allocating it across consumption demand for all goods produced by the household (commodity rows), goods obtained in the rest of the ZOI (ZOI row), goods bought outside the ZOI (rest-of-world row), taxes (government row) and savings (capital rows). The most efficient way to do this is to first estimate expenditure shares from the household survey data, then apply these shares to the total income in our SAM. This ensures that the household account will balance.

As we do our household SAM-building, each time account A (column) makes a payment to account B (row), account B is temporarily out of balance, with excess income. Accounting for where this income goes (account B, column) restores balance. As the SAM takes shape, any imbalances tend to get pushed down to the bottom right-hand corner of the matrix—that is, into the exogenous accounts, where final adjustments can be made without having any major impact on the endogenous SAM.

The goal of balancing is to use the double-entry accounting rule and, hopefully, good survey data to achieve the greatest balance possible in the SAM's endogenous accounts. Household survey data are inherently imperfect. Whether for experimental or other types of analysis, inevitably there are errors in the reporting and recording of survey data. However, once a relatively large number of households are aggregated into a household SAM, these errors should wash out on average, provided they are random. Errors that remain may create imbalances in the SAM. This could occur if, for example, households do a better job of recalling expenditures than income. Many surveys use questions about recent consumption (e.g. two-week recall) to construct household expenditures; however, seasonality may cause recent expenditures to diverge from the average, resulting in imbalances between reported income and consumption. In other cases, reported expenditures may be more reliable than reported income. The double-entry nature of SAMs offers a major advantage here, because if data on a consumption (or income) item are missing or deemed unreliable, often data on income (expenditures) can be used to fill in the gap.

When designing surveys, careful thought should be given to the most efficient and natural way to obtain accurate information about incomes and expenditures. Ideally, the structure of the survey should reflect the ways in which respondents think about these things. For example, if farmers cultivate different plots of land differently, it might be more efficient to gather plot-level than crop-level agricultural data. However, this may not be necessary if farmers have few plots, manage these plots similarly or find it natural to think about inputs and outputs on a crop level. The same considerations apply to other modules. For example, people might find it natural to recall their expenditures in terms of place (e.g. in the periodic market, in butcher's shops etc.). Although there are obvious advantages to eliciting recall data on recent purchases in consumption modules, if recent purchases are not likely to reflect typical purchases, any expenditure survey should make an effort to address this problem. For example, a question such as 'How much rice did your household purchase in the past week?' could be followed with 'Is this more or less rice than you purchase in most weeks? How much rice do you purchase in most weeks?'. In some cases, asking more questions (e.g. about plots) not only improves data quality but actually shortens the time needed for a survey, by avoiding side calculations (e.g. summing fertiliser or labour days across plots) and enabling people to report on their activities in the same way they think about them.

When an endogenous account does not balance, we look for missing income or expenditures in the data and record them in the SAM. Our rule of thumb is to get to within 90 per cent of balancing each account (that is, a 10 per cent discrepancy between row and corresponding column totals, at most) before moving on to the final balancing exercise. Usually, with good data, we are able to do considerably better.

The final stage of balancing involves the use of information theoretic tools to spread errors as efficiently as possible through the matrix. We should proceed to this stage only once we are certain that we have done the best we can with the data to balance the matrix 'by hand', and no other data are available to do this. At this point, we have done the best we can do, and the objective is to complete the balancing while inflicting as little damage as possible on the matrix. This does not necessarily mean spreading the errors across the matrix in proportion to the size of each account, because we may have more confidence in the numbers in some accounts than others. For example, if we know the value of government transfers to the households used to construct an SAM, we do not want these to change as a result of the final balancing. If we are confident about the production information obtained in the survey but less so about the consumption data (perhaps because a one-week recall of expenditures was multiplied by 52 to estimate annual expenditures), it might be better to let expenditures take more of the hit while fine-tuning the SAM.

Various methods are available to perform the final SAM balancing. The most common one, the RAS algorithm, takes the unbalanced SAM coefficients matrix and adjusts it by iterative multiplying it by the ratio of row (column) to column (row) totals until it converges to a balanced matrix. Robinson et al. (2001) propose a cross-entropy method that permits incorporating additional information into the SAM updating. Under some conditions, it can be more efficient than RAS, in the sense of achieving consistency with smaller adjustments to the SAM cells and/or more accurately estimating the 'true' SAM. (The latter is demonstrated using Monte Carlo simulations.)

4 USING SAMS AND EXPERIMENTS TO CALIBRATE EVALUATION MODELS

Depending on how production and consumption demand are modelled, most or all of the data needed to calibrate LEWIE GE models can be found within the LEWIE SAMs. Once the SAMs are complete, they can be used immediately for multiplier and constrained multiplier evaluations, as described above.

Parameters for other kinds of ZOI GE models can be calculated directly from the data in the SAMs, as described in Taylor and Filipski (2012, Chapter 2). Exponents on factor inputs in Cobb-Douglas production functions are equal to the factor shares in total value added of each activity for each household group. Consumption demands, if modelled using a linear expenditure system without minimum required quantities, as in Deaton and Muellbauer (1980) and Taylor et al. (2005), can also be modelled with data from the SAM. If there are minimum required consumption quantities, defined by basic food requirement as in Pauw and Thurlow (2010), the marginal budget shares in the demand functions need to be econometrically estimated from a semi-log inverse function suggested by King and Byerlee (1978). Alternatively, as in the impact evaluation of transfers in Malawi and Ghana by Filipski and Taylor (2012), both sets of parameters may be estimated econometrically from the household survey data.

Taylor et al. (2005) found the results of experiments using similar models to be robust to the specification of functional forms, including more complex production and expenditure functions with assumed elasticities. This is not surprising, inasmuch as the model is always estimated at the same point given by the survey data, and our experiments will involve marginal changes in exogenous transfers. Despite linearity of individual household-group responses, aggregate outcomes of transfer on local economies are non-linear, shaped by specific household groups' production and demand parameters and, in some cases, endogenous prices. The goal is always to do what the data permit to test the sensitivity of chosen functional forms; nevertheless, the latter are not likely to be as important as the structure of local economies in shaping project linkages.

Experiments may be useful in parameterising impact-evaluation simulation models. For example, low fertiliser use in Africa is often blamed on liquidity constraints. Cash-constrained farmers may underutilise fertiliser even if its marginal product is high, because cash outlays on inputs precede the harvest. A cash transfer loosens the liquidity constraint. One might assume *ex ante* (as in Filipski and Taylor, 2012) that the marginal effect of cash transfers on fertiliser purchases is the same as that of income from other sources; however, any potential effect on production will depend on when and how this new income is spent. Experimental data can be used *ex post* to estimate the effect of the transfer on fertiliser (and other) expenditures, testing the *ex ante* model's assumptions.

Experimental evidence can be used to validate the impact-simulation model in other ways. For example, it can enable us to compare observed changes in incomes, expenditures or other variables with those predicted by the model. Cash transfers potentially also change model parameters. The impacts of transfers on expenditure patterns, time allocations, technologies and other outcomes are a focus of many experiments. *Ex ante*, structural parameters by necessity must be estimated, using methods that sometimes require strong assumptions. *Ex post*, findings from carefully designed experiments might be useful to validate and update parameter estimates.

Ex post SAMs for beneficiary and non-beneficiary groups, constructed from follow-up survey data, can be compared to SAMs constructed using baseline data. Even in the absence of the programme, SAM coefficients may change between the baseline and the follow-up. If this is the case, then calibration on baseline data may not allow us to recover the experimental estimates; however, constructing an SAM for the control group household cluster might give us the counterfactual of interest—i.e. what would the linkages between households through local markets and with the rest of the world have been, if the programme had not been in place? By comparing SAM coefficients of control group clusters before and after the programme, we would pick up the effect of all other time-varying factors not due to the programme. We might then be able to attribute other changes in the coefficients of the matrix to the programme.[13]

Ultimately, the impacts of cash transfer programmes on the local economy might be shaped by impacts on household behaviour reflected in model parameters. Our simulation models can offer insights into how changes in these parameters might influence impacts on the local economy.

5 ECONOMETRIC PARAMETERISATION AND VALIDATION OF LEWIE

When parameters are calculated from SAMs, we do not know how much confidence to place in them. For example, the share of a household group's expenditures on food crops is calculated by taking the group's expenditure on food (household column, food row of the SAM) and dividing it by total expenditures (the household column total). In essence, then, it is calculated from a single data point.

We can improve on this by using econometric methods to estimate production, expenditure and other functions in the LEWIE model. As in any econometric model, significance tests provide a means to establish confidence bounds around the estimated parameters and functions used in our simulation model. In theory, if the structural relationships in the simulation model are properly specified and estimated with confidence, 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. The same methods used to choose among functions in econometric modelling can be used to decide on functions in a simulation model. The same methods used to verify any econometric model (e.g. out-of-sample tests) are relevant when parameterising simulation models. Econometric estimation of parameters also makes it possible to validate LEWIE simulation findings, as described below.

CONSTRUCTION OF CONFIDENCE INTERVALS USING MONTE CARLO METHODS

Validation is always a concern in GE modelling. Econometric estimation of model parameters opens up a new and interesting possibility in this regard, because we have estimated parameters as well as their standard errors. This means that we can use Monte Carlo methods to perform significance tests and construct confidence intervals around project impact simulation results, using the following steps:

1. Use parameter estimates and starting values for each variable obtained from the micro-data to calibrate a baseline LEWIE model.
2. Use this model to simulate the project—for example, a cash transfer to eligible households.
3. Now make a random draw from each parameter distribution, assuming it is centred on the estimated parameter with a standard deviation equal to the standard error of the estimate. This results in an entirely new set of model parameters. Using these parameters, calibrate a new baseline LEWIE model, and use this model to simulate the same project again.
4. Now repeat Step 3 *J* (say, 1000) times. This will yield 1000 observed simulation results on each outcome of interest.
5. We can 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 per cent confidence interval, we find the cut-offs for the highest and lowest 2.5 per cent of simulated values for the outcome of interest. This is similar to the percentile confidence intervals in bootstrapping.

This Monte Carlo procedure allows us to use what we know about the variances of all our parameter estimates simultaneously to perform a comprehensive sensitivity analysis grounded in econometrics. If the model's parameters are estimated imprecisely, this will be reflected in wider confidence bands around our simulation results, whereas precise parameter estimates will tend to give tighter confidence intervals. Structural interactions within the model may magnify or dampen the effects of imprecise parameter estimates on simulation confidence bands. This method is illustrated in Taylor, Thome and Filipski (2012).

6 LIMITATIONS AND EXTENSIONS

Most local GE impact evaluation models to date have focused on linkages among households. The paper by Filipski and Taylor (2012) explores the effect of liquidity constraints within households, echoing the econometric study of the household income-multiplier effects of cash transfers by Sadoulet, de Janvry and Davis (2001). Just as LEWIE nests distinct household groups within the larger economy of the ZOI, it should be possible to nest individuals within households to get at intra-household impacts of projects. Other research documents how conflict within households can shape project impacts.[14] Filipski, Taylor and Msangi (2011) take a step in this direction by including the allocation of time to housework (reproduction activities) in their study of the impacts of CAFTA on welfare in the rural Dominican Republic.

Seasonality is another important question that can arise in impact evaluations, whether experimental or simulation. For example, in Malawi, Chirwa, Dorward and Vigneri (2012) emphasise that prices and wages vary across seasons, reflecting seasonally binding resource constraints. This raises the possibility that a cash transfer loosens a liquidity constraint in one season (say, by enabling households to invest in fertiliser), while tightening constraints in other seasons (say, labour during harvest). Many locales are cut off from outside markets during some seasons. At these times, all goods become non-tradable.

Seasonality can be incorporated into LEWIE by including seasonal accounts in LEWIE SAMs, as in Taylor, Filipski and Lybbert's (2012) study of the impacts of saffron prices in a region of Morocco. To do this, decisions need to be made about how to model seasonality, how many seasons to model, and what data need to be seasonally disaggregated. The Taylor et al. study distinguishes the period of intense labour demand around the saffron harvest from the rest of the year. Dorward and colleagues would call for a similar distinction between pre-harvest and post-harvest periods in Malawi.

LEWIE is no different from experimental and other impact analysis in that addressing new questions requires access to new data. Incorporating an intra-household focus requires having information on how resources as well as transfers are allocated within households. To address seasonality, data are needed on changes in prices, activities and resources across seasons. For example, the Malawi IHS 2004 and 2011 are year-long surveys, composed of nationally representative surveys carried out every month which are then aggregated together. They pick up seasonality on many indicators, most importantly food prices, food consumption/expenditure and food security. Impact evaluations may employ staggered surveys to get at seasonality. The Mchinji impact evaluation in Malawi included follow-up surveys six and 12 months after the baseline survey; some important seasonal differences are evident in programme impacts. Recall is more difficult to carry out systematically across all the necessary areas of information.

In short, data quality, not modelling technology, is the major constraint on extending impact evaluation in these (and other) directions. These considerations are likely to be important not only for impact analysis but also for programme design and complementary investments; thus, the benefits of addressing them might well outweigh the cost.

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NOTES

1. For example, see Edward Miguel and Michael Kremer's (2004) study of an experiment to raise school attendance by treating Kenyan children for worms.

2. There may be other difficulties with scaling up— for example, the effectiveness of targeting and other administrative and cost problems tend to arise (e.g. Maliro, 2011). We have not explored these yet in LEWIE models, but with the right information, the models could be used to evaluate the local economy-wide implications of these scaling-up inefficiencies —for example, by reallocating transfers from eligible to ineligible households.

3. If there is significant heterogeneity among the beneficiary households, an SAM could be constructed for each beneficiary group.

4. Note that the SAM is perfectly balanced: each row sum (total receipts or income) equals its corresponding column sum (total expenditures). The exception is the two rest-of-world accounts, the sums of which must balance. (The household, like any economy, is not required to maintain a trade balance with each rest-of-world account— only an aggregate trade balance.)

5. This last number is obtained from Table 1b by subtracting non-beneficiary households' consumption demand from ZOI markets (135) from their supply of agricultural and non-agricultural goods to these markets (35+125=160), or alternatively, from Table 1a by subtracting the consumption demand in the ZOI (100) from the output supply to the ZOI (75).

6. See Holden, Taylor and Hampton (2002).

7. Each column of the *Ma* matrix gives the multiplier effect of a $1 exogenous change in the column-account's income on the row-account's income. The exogenous change could be a change in final demand for production activities, exogenous (e.g. government) employment for a factor or (as in our example) a direct income transfer for a household.

8. See Taylor and Adelman (1996).

9. A number of studies include subsistence and/or labour-constrained households, which by definition are outside the market for the subsistence good or labour. However, the market-participation decision is not explicitly modelled.

10. Examples using nutrient-conversion coefficients in econometric food-demand models include Behrman and Deolalikar (1987) and Ye and Taylor (1995).

11. Q – quantity; $ – value or price needed to calculate value; WP, where purchased (i.e. inside or outside ZOI). SAM cells correspond to the Social Accounting Matrix that follows.

12. This represents a type of stratification approach that makes statistical sense when a population consists of a large number of relatively homogeneous businesses but a very small number of influential businesses unlikely to be drawn in a randomised sample and expanding the sample size to substantially increase the probability of inclusion is not economically feasible.

13. Thanks to Habiba Djebbari for pointing this out.

14. For example, see Judith A. Carney (1992).

Appendix A. Zambia Business Survey Questionnaire

CLUSTER ID

SN

REPUBLIC OF ZAMBIA

MINISTRY OF COMMUNITY DEVELOPMENT, MOTHER AND CHILD HEALTH

CGP Business Enterprise Questionnaire 2012

♦ FOR THE SUPERVISOR:			
Q.1	District Name and code		
Q.2	Constituency name and code		
Q.3	Ward name and code		
Q.4	ACC name and code		
Q.5	CWAC name and code		
Q.6	Name of the village where the business was selected		
Q.9	Does the owner of the business live in the village given in Q.6?	**Yes =01** **No = 02**	
Q.12	Type of business *If multiple indicate the one for which the person was selected and that will be the object of the interview*	See business codes below.	

Business Codes:		
1. Kantemba	10. Carpentry	19. Fish selling
2. Petty trader	11. Metal works(blacksmith, tinsmith)	20. Grocery store
3. Home brewery	12. Traditional healer	21. Grass cutting and selling
4. Public phone	13. Construction	22. Crafts(basket making, reedmat making..)
5. Food preparation	14. Charcoal burning and selling	23. Shoe repair
6. Transport service	15. Mechanic	24. Bicycle repair
7. Bar/tarven/shabeen	16. Agricultural inputs and tools rental	25. Selling game meat
8. Money lender	17. Seamstress/tailor/clothes repair	26. Other (specify):_________
9. Miller	18. Hairdresser	

Q.13	**Date**: dd/mm/yyyy	**Time at start:** hh/mm	**Time end:** hh/mm	**Interviewer ID Code**

Hello. How are you? My name is [ENUMERATOR NAME], and I am working with a team from the Ministry of Community Development, Mother and Child Health in Lusaka. We are conducting a survey of households in this district, and your household/business was chosen to be interviewed in this community.

I would like to ask you some questions about your business of (mention business type for which the person was selected). It is important that throughout the interview you refer to this business only, and not to other businesses that you may also operate. Your business was randomly selected amongst the other businesses of this village. You don't need to be currently receiving the Child grant in order to participate in this study. The information you provide is strictly confidential. Your assistance is critical to this study. We hope that this information will eventually benefit the entire community by allowing us to understand the challenges that businesses like yours face, and how to mitigate them.

You do not need to talk to me if you do not want to. And if there is any question you do not want to answer, that will be fine. It is important you understand that the answers you give will in no way affect your status with respect to the Ministry of Community Development, Mother and Child Health. If you have any problems, or if you feel uncomfortable answering any question, you should feel free to stop talking with me at any time. You can speak with people in the District Social Welfare Office in Town for more details or clarification of this study.

Will you please give me some time to speak with you?"

By signing below, you signify that you agree to participate in the study and that your participation is entirely voluntary.

SIGNATURE_______________________________

DATE____________________________________

Supervisor signature when Questionnaire completed:

Q.14	**Which goods and services do you sell / provide?**	*Mark 01 for the relevant rows* *Leave blank otherwise*
1.	Processed food (eg chips, soft drinks-retail)	
2.	Unpackaged foodstuffs (meat, grains, eggs)	
3.	Prepared food	
4.	Fresh fruit, vegetables	
5.	Alcohol (home made)	
6.	Alcohol (branded)	
7.	Household goods/personal items	
8.	Wood products (chairs, coffins)	
9.	Metal products	
10.	Phone cards	
11.	Clothes	
12.	Agricultural inputs	
13.	Phone calls/airtime	
14.	Transport service	
15.	Personal services (traditional healer, repairs, etc)	
16.	Building materials	
17.	Shearing and other livestock services	
18.	Grass cutting and selling	
19.	Charcoal burning and selling	
20.	Medicine	
21.	Loans/money lending	
22.	Training/informal school	
23.	Clothes/sewing	
24.	Hairdressing	
77.	Other? Please specify__________	

Q.15	Since when have you been operating this business?	*YYYY*	
Q.16	Do you keep any accounting (written records) of your costs and sales? ♦ ***Interviewer:*** *if so, ask to see them for next questions, if possible*	01 =Yes 02 =No	
Q.17	What was your **total revenue** in the last **<u>30 days</u> in ZMK**? *(revenue = total sales without detracting costs)*		
Q.18	What was your **total revenue** in the last **<u>12 months</u> in ZMK**? *(revenue = total sales without detracting costs)*		
Q.19	What was your total revenue in the **worst month** for this business last **<u>12 months</u>** in **ZMK**?*(revenue = total sales without detracting costs)*		
Q.20	What was your total revenue in the **best month** for this business last **<u>12 months</u>** in **ZMK**? *(revenue = total sales without detracting costs)*		
Q.21	How many months have you been in operation in last **<u>12 months</u>**?	*No. of Months*	
Q.22	During the last 12 months, did you sell anything/provide your services to........? Yes = 01 No = 02	a) Residents from village in Q6	
		b) Other businesses in village in Q6	
		c) Intermediaries/middlemen in the village	
		d) Roving Markets	
		e) Public/gov institutions in village in Q6	
		f) To neighboring villages	
		g) Other Parts of Zambia	
		h) Abroad (Exports)	
Q.23	About what percentage of your total sales of the last 12 months were to each of these (i.e. those	a) Residents from village in Q6	
		b) Other businesses in village in Q6	

	mentioned above)? (*Rows should sum to 100%. If respondent cannot estimate, use stones or mention 'half', 'quarter'..)*	c) Intermediaries/middlemen in the village		
		d) Roving Markets		
		e) Public/gov institutions in village in Q6		
		f) To neighboring villages		
		g) Other Parts of Zambia		
		h) Abroad (Exports)		
Q.24	How many of your household members helped with this business in the last 12 months? Whom? How many? *(write numbers and include respondent/owner)* ***(Enter '0' if none)*** ♦ ***Interviewer:*** *Probe for number of adult males, adult females and children under 15 years*		*a) Adult males*	
			b) Adult females	
			c) Girls under 15	
			d) Boys under 15	
Q.25	For how many weeks did […] work in the business in the last 12 months? *Interviewer: include respondent* ***(Enter '0' if none)***		*a) Adult males*	
			b) Adult females	
			c) Girls under 15	
			d) Boys under 15	
Q.26	For how many hours a week, on average, did […] work? *Interviewer: include respondent* ***(Enter '0' if none)***		*a) Adult males*	
			b) Adult females	
			c) Girls under 15	
			d) Boys under 15	
Q.27	Did you hire in any employees in the past 12 months?		01 =Yes 02 =No >> Q.36	

Q.28	Q.29	Q.30		Q.31		Q.32		Q.33	Q.34		Q.35	
What type of employees did you have in the past 12 months? *(please list each type that applies)*	How many [….] did you employ at a time in the past 12 months?	How many of your employees live in […]?		For how many [months or weeks] did you employ […] in the last 12 months?		How much did you pay each employee type per week or month? *(cash only, not in-kind)in* ***ZMK***		Did you provide any meals, insurance or other benefits to this type of employee in the last 12 months?	For how many [months or weeks] did you provide these benefits in the last 12 months?		What was the value of meals, insurance, or other benefits provided to this type of employee each [month or week]?	
01= clerks 05 =cook 02 =helpers 06=driver 03 =cleaners 77=other 04 =apprentice (specify)	*Write number of employees for each* *category*	01= in the village mentioned in Q6 02= in a neighboring village 03= elsewhere		*01= Month* *02= Week* ***Number***	***Code***	***(Record the total)*** *01= Month* *02= Week* ***Amount***	***Code***	*01= Yes* *02= No >>****Next Item***	*01= Month* *02= Week* ***Number***	***Code***	***(Record the total)*** *01= Month* *02= Week* ***Amount***	***Code***
		01										
		02										
		03										
		01										
		02										
		03										
		01										
		02										
		03										
		01										
		02										
		03										
		1										
		2										
		3										

Q.36	During the last 12 months did you purchase (with **cash** only, not obtain in kind) any inputs for this business *in the village in Q6*?	01 =Yes 02 =No >> **Q. 43**	

Only include inputs ***purchased from village in Q6***	**Q.37** In the last 12 months, did you purchase [__] for the business in the village?	**Q.38** How many months in the last 12 months did you purchase [__] in the village? *(cash only)*	**Q.39** How many times each month do you purchase […] in the village?	**Q.40** On average how much do you spend each time you purchase […] in the village? in **ZMK**	**Q.41** Of the purchases you made in the village, did you purchase any […] from : a) Other Household b) Other Business c) Intermediary/Middleman d) roving market e) public/government institution		**Q.42** What % of this [__] was purchased from: a) Other Household b) Other Business c) Intermediary/Middleman d) roving market e) public/government institution ***(Use proportional piling)***	
	01=yes 02= no >> **Next item**			***Amount***	01= Yes 02 =No >> **Next item**		%	
a) Food crops such as maize, sorghum, wheat, potatoes, fruits, and vegetables					a)		a)	
					b)		b)	
					c)		c)	
					d)		d)	
					e)		e)	
b) Meat or other animal products					a)		a)	
					b)		b)	
					c)		c)	
					d)		d)	
					e)		e)	
c) Local crafts					a)		a)	
					b)		b)	
					c)		c)	
					d)		d)	
					e)		e)	
d) Other goods (specify):					a)		a)	
					b)		b)	
					c)		c)	
					d)		d)	
					e)		e)	
e) Other goods (specify):					a)		a)	
					b)		b)	
					c)		c)	
					d)		d)	
					e)		e)	

Q.43	During the last 12 months did you purchase (with **cash** only, not obtain in kind) any inputs for this business *outside the village mentioned in Q6*? *(that is, you or someone associated with this business travelled outside this locality to purchase the inputs)*	01 =Yes 02 =No >>**Q.49**	

	Q.44	**Q.45**		**Q.46**	**Q.47**		**Q.48**	
	In the 12 months, what inputs for your business did you purchase outside of village in Q6?	How many months in the last 12 months did you purchase [__] outside of the village? *(**cash only**)*	How many times each month do you purchase […] outside of the village?	How **much** do you spend each time you purchased […] outside of the village? in **ZMK**	Of the purchases you made outside of the village, did you purchase any […] in : a) a nearby village b) close town c) elsewhere		What % of this [__] was purchased in: a)) a nearby village b) close town c) elsewhere ***(Use proportional piling)***	
				Amount	**1=Yes, 2=No**>> **Next input**		**%**	
1.					**a)**		**a)**	
					b)		**b)**	
					c)		**c)**	
2.					**a)**		**a)**	
					b)		**b)**	
					c)		**c)**	
3.					**a)**		**a)**	
					b)		**b)**	
					c)		**c)**	
4.					**a)**		**a)**	
					b)		**b)**	
					c)		**c)**	

Other expenses	Q.49 Did you spend anything on [...] for this business during the last 12 months?	Q.50 On average how much did you spend **for** [...] per month during the last 12 months?**(ZMK)**	Q.51 For how many months in the last 12 months did you have this expense?	Q.52 Was any part of […] purchased from an individual, business or institution in the village?	Q.53 What % of this expense was paid to an individual, business or institution in the village? ***(Use proportional piling)***
	01 = Yes 02 = No >> **Next item**	**Amount**		01 = Yes 02 = No >> **Next item**	%
1. Electricity					
2. Telephone (including cell)					
3. Transport					
4. Rent on your building					
5. Rent on machinery or other (specify):					
6. Insurance					
7. Taxes					
8. License/permits					
77. Other (please specify)					

Business Assets	**Q.54**	**Q.55**	**Q.56**	**Q.57**	**Q.58**	**Q.59**	**Q.60**	**Q.61**
	Do you own […] for use in your business?	In what year did you acquire […]?	What is the current value of […]?**(ZMK)**	How much did you pay for {…} in the last 12 months? **(ZMK)**	How much did you pay for materials for the maintenance and repair of […] n the last 12 months? **(ZMK)**	Where did you purchase supplies for maintaining or repairing […]?	How much did you pay for labor for the maintenance or repairs of […] in the last 12 months?**(ZMK)**	Where did the maintenance or repairs of […] take place?
	01 = Yes 02 = No >> **Next item**	YYYY			*If '0'* >> Q 60	01= in the village mentioned in Q6 02 =in another village 03= in town/city	*If '0'* >> next item	01= in the village mentioned in Q6 02 =in another village 03= in town/city
1. Building/Storefront								
2. Vehicle								
3. Machinery (please specify):								
4. Bicycle								
5. Motorbike								
6. Boat								
7. Canoe								
8. Cell phone								
9. Fishing nets								
10. Wheel barrow								
11. Musical system								
12. Other (specify)								
13. Other (specify)								

Q.62	In the last 12 months, did you borrow money or repay money you borrowed to run this business?	01 =Yes 02 =No >> **Q.67**	

	Q.63	**Q.64**	**Q.65**	**Q.66**
	*From whom did you borrow or repay money for your business in the last year?**(Record up to 3 in order of importance)*** 01= Family/friends 02= Micro-lender 03= Community 04= Local enterprise 05 =Bank or financial institutions 06= NGO 07= Government 08=Loan sharks 09=Other(specify)	Where was […] located? 01= in the village 02= in a nearby village 03= elsewhere	How much money did you borrow from […] in the last 12 months?(**ZMK)**	How much money did you repay […] in the last 12 months?(**ZMK)**
	Write code		If none, mark "00"	If none, mark "00"
1.				
2.				
3.				

Now we would like to ask you some questions about your customers and your relationship with them

Q.67	On an average day in a 'good' month (many customers), how many customers do you have for this business?	*Number of customers*	
Q.68	On an average day in a 'bad' month (not many customers), how many customers do you have for this business?	*Number of customers*	
Q.69	Thinking back of the last 12 months, was your business able to earn a good, average or poor income during each of the following months? 01 = Good 02 = Average 03 = Poor	a) September	
		b) August	
		c) July	
		d) June	
		e) May	
		f) April	
		g) March	
		h) February	
		i) January	
		j) December	
		k) November	
		l) October	
Q.70	Do your customers ever buy on credit from you?	01 = Yes 02 = No >>**72**	
Q.71	What % of your customers usually buy on credit?**(use proportional piling)**	%	

Contact information:

Q.76	**Business name**	
Q.77	**Address**	
Q.78	**Proprietor name**	

Q.72	Do you operate any other business additional to the one this interview has focused on?	01 = Yes 02 = No >> 74	
Q.73	What kind of business do you also operate?	See business codes on the first page.	
Q.74	Do you ever set up your sales point in a location different from your usual/fixed business location?	01 = Yes 02 = No	
Q.75	Have you ever sold goods/services at any payment point (e.g. post office, bank,…)	01 = Yes 02 = No	

Q.79	**Cell number**	

THE END OF INTERVIEW

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