Evaluation of the Kenya Hunger Safety Net Programme Phase 2

Emergency payments local economy-wide impact evaluation study

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Abbreviations

CT	Cash transfer
DFID	UK Department for International Development
FD	Factor demand
GoK	Government of Kenya
HSNP	Hunger Safety Net Programme
KES	Kenyan shilling
LEWIE	Local economy-wide impact evaluation
LRA	Long Rains Assessment
NDMA	National Drought Management Authority
NSNP	National Safety Net Programme
OPCT	Older Persons Cash Transfer
OPM	Oxford Policy Management
PILU	Programme Implementation and Learning Unit
RCT	Randomised control trial
RD	Regression discontinuity
SE	Standard error
VCI	Vegetation Condition Index

Executive summary

Phase 2 of the Government of Kenya's Hunger Safety Net Programme (HSNP2) provides two different unconditional cash transfers (CTs) to two different groups of households in four counties in northern Kenya: Mandera, Marsabit, Turkana, and Wajir. 'Group 1' households receive regular CTs, paid every two months, while selected 'Group 2' households receive an emergency CT for each month the sub-location in which they live experiences severe or extreme drought. As part of an evaluation of HSNP2's impact on households and the local economy, Oxford Policy Management's (OPM) is carrying out a local economy-wide impact evaluation (LEWIE) to measure the impact of the emergency CTs on the local economy. The primary aim of the emergency payments LEWIE is to respond to the following question: 'For every shilling injected into the local economy through the emergency CTs, how much more money is generated by the local economy as a result?' A LEWIE has already been conducted to evaluate the impact of HSNP2's regular CTs, finding that for every shilling of the regular CTs that enters the local economy, between KES 0.93 and KES 0.38 of additional total income is generated. The rationale for conducting a LEWIE for the emergency CTs is that they may have a similar multiplying effect as that found for the routine CTs, and thereby potentially compensate the local economy to some extent for the negative impacts of droughts.

The HSNP2 emergency CTs are activated using satellite technology that monitors drought conditions using a Vegetation Condition Index (VCI). When the VCI indicates that any HSNP sub-locations are experiencing severe or extreme drought, the emergency CTs are triggered. The number of Group 2 households that receive an emergency CT is determined by the drought status, with recipient households selected based on wealth ranking scores. In the case of severe drought, the HSNP is scaled up to cover 50% of households. In extreme drought conditions it is scaled up to cover 75% of households. The emergency CT is worth the same as a single month of routine HSNP CT (KES 2,700), and is made directly into beneficiaries' bank accounts following each month the drought is in effect.

In order to analyse how far HSNP2's emergency CTs mitigate the negative effects of drought on the local economy we use our LEWIE model to simulate the impacts of a typical severe-to-extreme drought with and without the emergency CTs. Using data from a bespoke household, business, and livestock producer survey we build a model of the local economy that represents the inputs, outputs, consumption, and production of economic actors within the economy, which we then use to simulate how cash injections are transmitted within and outside it. By altering the model parameters to reflect the effects of a severe-to-extreme drought, we simulate the impact of drought on the local economy and the degree to which the HSNP2 emergency CTs offset or mitigate that impact.

One limitation of our approach is that we simulate the effect of a single drought, and the mitigation effect of a single emergency payment made in response to that drought. In reality, multiple droughts can sometimes occur in a single calendar year, with cumulative negative impacts on total annual incomes (and thus more pronounced effects on the local economy), and multiple rounds of emergency CTs made in response (with the positive multiplier effect engendered by the emergency CTs thereby likely to be more sustained). We do this because

multiple drought scenarios are relatively rare, and because modelling the effects of consecutive droughts is highly complex and thus might reduce the robustness of our results.

Using our LEWIE simulation we thus find that a typical drought decreases the total annual value of livestock production by some KES 1,493 million (in nominal terms) and livestock by-product production by KES 7,781 million, due to the loss of herds and the negative shocks to livestock and livestock by-product prices. Other production activities also decline, with the largest impact on retail sales. The reduction in production is found to decrease total annual incomes by KES 4,776 million in nominal terms, or KES 12,754 million in real or inflation-adjusted terms, equating to a loss of around 2% of total annual incomes in real terms. These negative impacts affect all HSNP households, reducing total annual incomes by between 0.24% and 3%, depending on household wealth. The smallest impacts occur for the poorest households, due to their smaller share of total livestock assets (though even small income changes can have major welfare impacts for this group, due to their higher degree of vulnerability).

At the same time, our simulation indicates that the HSNP2 emergency CTs have a meaningful mitigating effect on the negative impact of drought on the local economy, eliminating somewhere between 11% and 3% of that impact. The CTs do not prevent losses to livestock holdings, or significantly reduce the impacts of drought on livestock by-product production – they are found to mitigate less than 1% of losses in those areas – primarily because they are unpredictable and relatively small in size, and so insufficient to prevent serious depletion of livestock assets. However, by providing partial income insurance to recipient households they do have a substantial mitigating effect in other sectors of the local economy, with the emergency CTs offsetting close to 12% of losses to all other sectors (barring food processing). The LEWIE results also indicate that all recipient household groups benefit from the mitigating effect of the emergency CTs, with the poorest recipients benefitting the most (around 62% of their losses are covered by the emergency CTs). Thus, despite being somewhat constrained in terms of ameliorating the impact of drought on livestock holdings and livestock by-product production, the mitigating effect of the HSNP2 emergency CTs is nevertheless substantial relative to the value of cash injected into the local economy, amounting to just over two (2.03) times the cost of the CTs themselves.

In conclusion, the LEWIE reveals that a typical drought has significant negative impacts on households in HSNP areas, and these negative impacts are magnified as the repercussions are transmitted throughout the local economy, with all household groups and all production activities negatively affected. However, just as local economic linkages magnify the negative impacts of severe and extreme drought, they also magnify the positive impacts of the HSNP2 emergency CTs provided in response. By providing partial income insurance for beneficiaries, the emergency CTs provide insurance to the economies of which they are part, dampening the negative impact of drought on total local income by somewhere between 11% and 3%. This 'local economy insurance' impact of HSNP2 represents 2.03 times the cost of the emergency CTs and appears to most benefit the poorest recipients.

The implications of these findings for policy include the following: As the multiplier effects of HSNP2 CTs depend on the local supply of goods and services, and the availability of factors to produce commodities, complementary programmes that increase the local supply response (e.g. access to credit) could increase HSNP2's positive impact. Interventions that buffer local production against weather shocks (e.g. drought-resistant varieties of seeds and livestock, or veterinary medicines) could also be helpful. Investments in production value chains (e.g. abattoirs and cold chains) can further support livelihoods against climate vulnerability. Finally, the LEWIE findings show that the emergency CTs especially benefit poorer households, so improvements in the welfare measure used by HSNP would lead to improvements in the impacts of the emergency CTs.

1 Introduction

OPM is leading the independent evaluation of Phase 2 of the Government of Kenya's (GoK's) CT programme for northern Kenya, the HSNP. HSNP Phase 2 (HSNP2) runs from 2014 to 2019. The evaluation is conducted on behalf of DFID and funded by UK Aid. The evaluation comprises three components, covering: HSNP's impact on households and the local economy; its operational performance; and its strategic policy orientation. The evaluation also includes a communications and learning workstream to disseminate the outputs from the various activities carried out under each component.

This report is an output of the impact evaluation workstream.

1.1 HSNP

HSNP is a government-led unconditional CT programme that targets people living in extreme poverty in four counties in northern Kenya: Marsabit, Mandera, Turkana and Wajir. Its objective is to relieve extreme hunger and vulnerability. In its second phase, which runs from 2013 to 2019, it aims to provide 100,000 very poor households with regular cash payments[1]. These 'Group 1' households receive a transfer currently worth Kenya shilling (KES) 2,700 per month (approximately $27), paid in single instalments every two months (i.e. KES 5,400 each pay cycle)[2]. Almost every household has been registered with a bank account, into which money is paid directly. The HSNP transfer is targeted to households rather than individuals: each household selects one member who has a national identity card to open the bank account and collect the transfer. There is no obligation to collect the money on the first day of payment or to withdraw it all at once.

HSNP is implemented by the NDMA. A technical assistance team, the Programme Implementation and Learning Unit (PILU), was procured by DFID through a competitive process and sits within the NDMA. The PILU manages the HSNP, reporting to the NDMA and a Programme Steering Committee. HSNP is delivered in partnership with the Financial Sector Deepening Trust, and Equity Bank, which manage and deliver the payments component, respectively, and in partnership with Help Age International, which has been managing the programme rights component.

HSNP is one of four programmes[3] making up the National Safety Net Programme (NSNP). The other three programmes, managed by the Social Assistance Unit within the Ministry of Labour and East African Affairs, are: The CT for Orphans and Vulnerable Children, the Older Persons CT (OPCT) and the Persons with Severe Disability CT. In addition, the NSNP is in the process of establishing a universal CT to cover all individuals nationally who are over

[1] The HSNP first phase ran from 2009 to 2013 and supported around 69,000 households with bi-monthly CTs.

[2] The transfer value is revised annually in July to take into account inflation. It has been adjusted numerous times since the inception of HSNP, from its starting value of KES 2,300 in 2013/14.

[3] There were originally five programmes. The fifth programme – the Urban Food Subsidy Cash Transfer – ceased to function in July 2014.

the age of 70 years[4]. The NSNP is a GoK initiative to support enhancements to the social assistance sector in a coherent and coordinated way. It is supported by the World Bank Programme for Results.

An innovation in Phase 2 has been that HSNP has aimed also to register all other households in the four counties—nearly 300,000 additional households, known as 'Group 2'—without providing them with a routine transfer. Most of these households have already been given a bank account, and basic data have been collected on their characteristics as part of the process of ranking households' wellbeing. The reason for this is to enable HSNP to scale up and provide 'emergency payments' to potentially the whole population in times of drought or other types of shock[5].

The HSNP2 emergency payments are activated using a VCI generated using satellite technology and operated by the NDMA[6]. Emergency payments are triggered when HSNP sub-counties are classified as in severe or extreme drought by the VCI, or in other cases of emergency, such as El Niño (see footnote 5). Group 2 households are then selected from HSNP's management information system using the existing wealth ranking scores, identifying the Group 2 households with the lowest wealth ranking scores and an active bank account in the drought-affected sub-counties. The number of households that will receive an emergency payment is determined by the drought status of each sub-location in the sub-counties that are classified as being in ‘severe' or ‘extreme' drought, with 50% of the household population being covered in cases of severe drought, and 75% of the household population covered in the case of extreme drought[7]. The transfer to Group 2 beneficiaries is worth the same as a single monthly HSNP routine payment (i.e. KES 2,700) and is paid each month a given sub-location is deemed to be in severe or extreme drought. The transfer is made directly into beneficiaries' bank accounts in the same way as routine payments to Group 1 (although the transfer for Group 2 recipients does not necessarily take place on the same day as for Group 1 recipients). Some Group 2 recipients have thus received one or more emergency payments during the period of HSNP2, while others have received no payments[8].

[4] The relation between the OPCT and the 70+ CT has not yet been explicitly articulated, though it is de facto anticipated that the OPCT will gradually diminish as new entrants join the 70+ cohort and the current OPCT cohort exit the programme when they pass on.

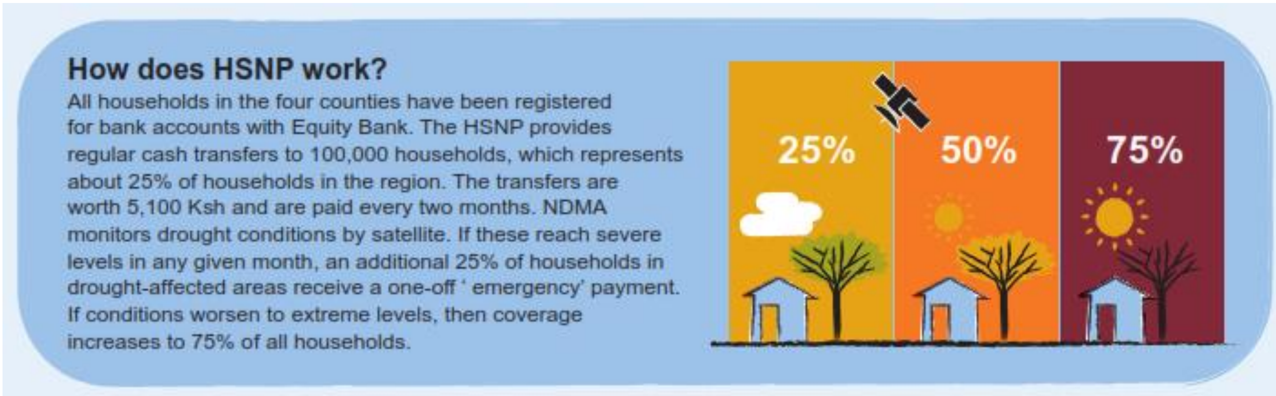
[5] In practice, HSNP scales up to cover either 50% or 75% of households in each location, depending on the severity of drought. A universal payment was made to every registered household with a functioning bank account in anticipation of El Niño in October 2015. For a detailed description of how the HSNP scale-up facility operates see Figure 1 below.

[6] The VCI compares the current Normalised Difference Vegetation Index to the range of values observed in the same period in previous years. The VCI is expressed in % and gives an idea as to where the observed value is situated between the extreme values (minimum and maximum) in the previous years. Lower and higher values indicate bad and good vegetation state conditions, respectively (Smets, Eerens, Jacobs, and Toté, 2015).

[7] See ‘HSNP Scalability Guidelines – Guidance for Scaling up HSNP Payments'. Produced by PILU within the NDMA, as an annex to the Operations Manual. Updated January 2016.

[8] For information on the perceptions of the impacts and operational experiences of the HSNP emergency payments facility see: Farhat *et al*. (2017) ‘Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Emergency payments deep dive study', OPM, and OPM (2016) ‘Evaluation of the Kenya Hunger Safety Net Programme Phase 2 – Drought Emergency Scale-up Payments Process Review Final report', OPM.

Figure 1 Emergency scale-up payments



The HSNP2 Group 1 caseload is jointly funded by DFID and the GoK. The GoK contributes funding as part of its commitments to the Ending Drought Emergencies Medium-Term Plan. During the last financial year (2016/17), the GoK funded 58% of total programme costs and 65% of the HSNP caseload for Group 1 payments[9]. DFID funds the cost of the remaining Group 1 caseload, the PILU, and the independent monitoring and evaluation. To date, the emergency payments have been funded largely by DFID, to the tune of KES 2,214,027,650. With the European Commission funding an additional KES 638,941,500 in 2017, the total emergency payments made up to January 2018 have had a value of KES 2,852,969,150.

1.2 OVERVIEW OF THE LEWIE STUDY

The goal of HSNP2 is to assist people living in extreme poverty in four counties in Northern Kenya: Marsabit, Mandera, Turkana and Wajir. By providing support to poor households, the programme thereby injects new cash into local economies. Viewed from a local economy-wide perspective, the beneficiary households are a conduit channelling new cash into the local economy. As households spend their cash, the impacts of the transfer spread from the beneficiary households to others inside and outside of the treated counties. Doorstep trade and purchases in village stores, markets, and nearby commercial centres transmit impacts from beneficiaries to non-beneficiaries in the region. Market linkages eventually transmit impacts outside the treated counties to the rest of Kenya, but while cash circulates within the four counties, it potentially creates income multipliers that exceed the amount of cash transferred.

A LEWIE is thus an evaluation method for estimating the impact or 'multiplier effect' of a programme on the local economy. In this case, the programme is HSNP2. Estimating the multiplier effect implies answering the following question: 'For every shilling injected into the local economy through the HSNP, how much more money is generated by the local economy as a result?'

[9] This is an increase from 17% of programme costs and Group 1 payments in 2013/14 at the start of the programme.

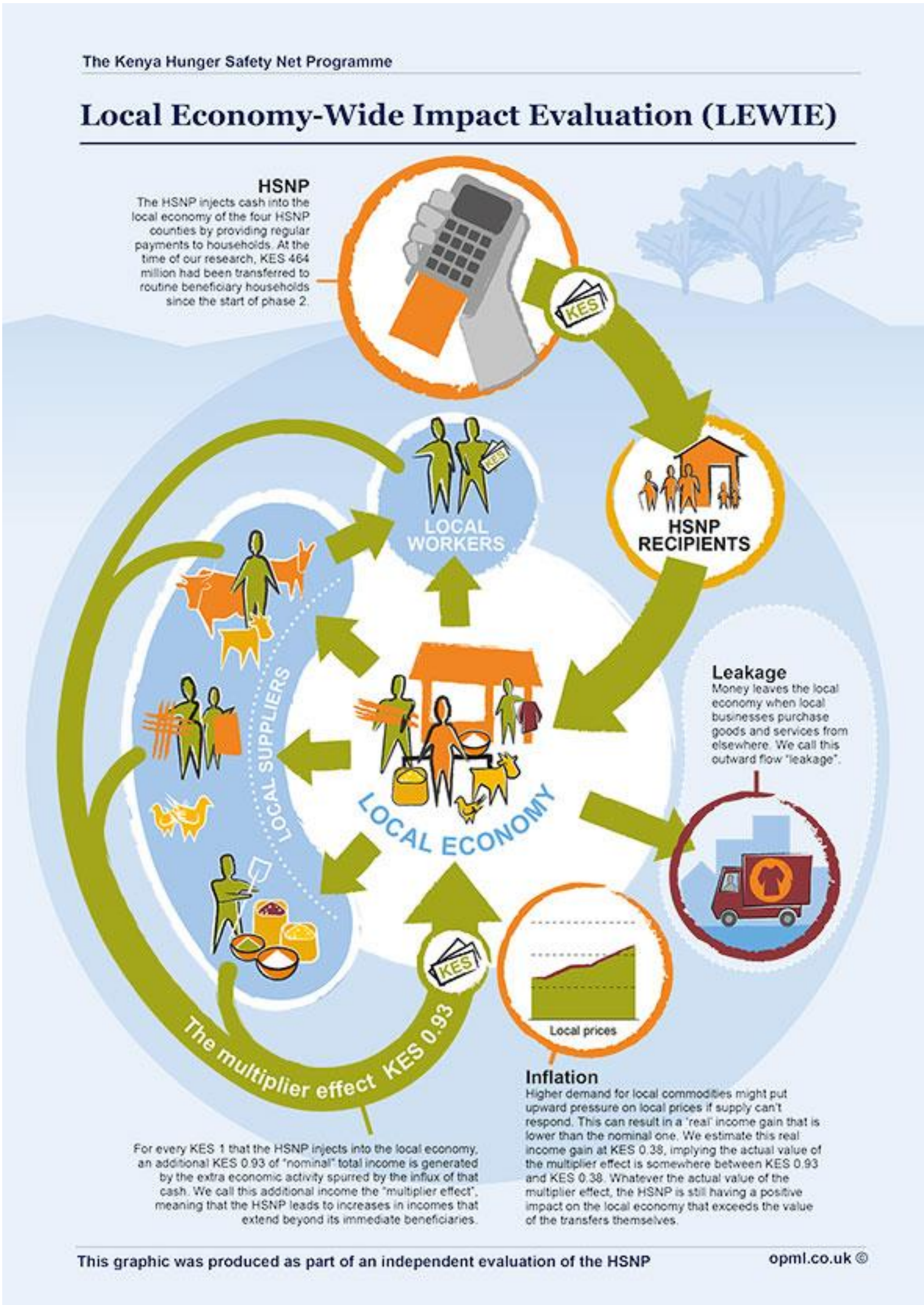
Multiplier effects can be positive and potentially substantial. If CTs are spent on goods and services produced within the local economy it will lead to higher incomes for both the local businesses that supply them and the households that provide labour and other inputs to these businesses. In other words, the transmission of cash from beneficiary households to other economic actors within the local economy can lead to a positive income effect that extends beyond the HSNP2 beneficiaries themselves. This results in overall income levels in the local economy increasing by *more* than the value of the initial injection of cash given by HSNP2. The presence of such effects on households not directly targeted by CTs is known as a positive 'spill-over'.

The extent of these positive spill-over effects to non-beneficiary households is conditioned by the portion of HSNP2 CTs that are spent on goods and services that are produced outside the local economy. Spending that takes place outside the local economy causes cash to 'leak' outside, rather than being passed on to other households within the economy. For example, if many local retailers purchase stock from wholesalers who are based outside the HSNP counties (such as in Nairobi or other commercial trading hubs), then this would represent a leakage of HSNP2 cash from the local economy. In addition, if the supply of local goods and services does not increase in response to the increased demand and expenditure by HSNP2 beneficiaries, then the introduction of CTs will have an inflationary effect. Price inflation would serve to diminish the programme's real benefits by making it more costly for households to increase their consumption and purchase assets.

There are, consequently, numerous possible local economy effects of the HSNP2, depending on the nature of the local economy and the actors, interactions, and production factors that define it. Understanding these dynamics is essential in order to situate the results of the other components of the impact evaluation, such as the qualitative and quantitative household-level impact evaluations. For example, our LEWIE study on the routine HSNP payments found that the HSNP2 does induce positive benefits for non-beneficiary households, implying that the measured impact at the household level (found by comparing beneficiaries with non-beneficiaries) only partially captures the total impacts of the programme[10].

[10] For a comprehensive analysis of the impact of HSNP2 on households and the local economy see Merttens *et al*. (2017) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Impact evaluation final report', OPM.

Figure 2 LEWIE



The LEWIE analysis conducted for this evaluation is based on building a model of the local economy, which is used to simulate how cash injections are transmitted within and outside it. For the purposes of this evaluation, 'the local economy' is defined as the four HSNP counties together – Marsabit, Mandera, Turkana, and Wajir. The model is designed to represent the inputs, outputs, consumption, and production of economic actors within the economy. These actors are a mixture of households and businesses. The aim is to characterise how these actors are linked, by modelling where and from whom they obtain their inputs, and where and to whom they sell or deliver their outputs. Crucially, the model also identifies the points of leakage where money exits the local economy.

By understanding these interlinkages and resource flows for a representative sample of all the key actors in the local economy, the LEWIE model is able to estimate the multiplier effect produced when a given intervention (in this case the HSNP CT) injects a given amount of cash or other resource into that local economy. It is also able to simulate what happens when other parameters of the local economy, such as local prices, are altered.

In addition, and as is the case for this particular study, by altering the model parameters to reflect the likely scenarios resulting from a severe or extreme draught, the LEWIE can also simulate the impact of the drought itself on the local economy and thus, subsequently, the degree to which HSNP emergency payments offset or mitigate that impact.

The LEWIE model for this study was developed using data from a bespoke household, business, and livestock producer survey.

1.3 IMPACTS OF HSNP2 ROUTINE PAYMENTS ON THE LOCAL ECONOMY

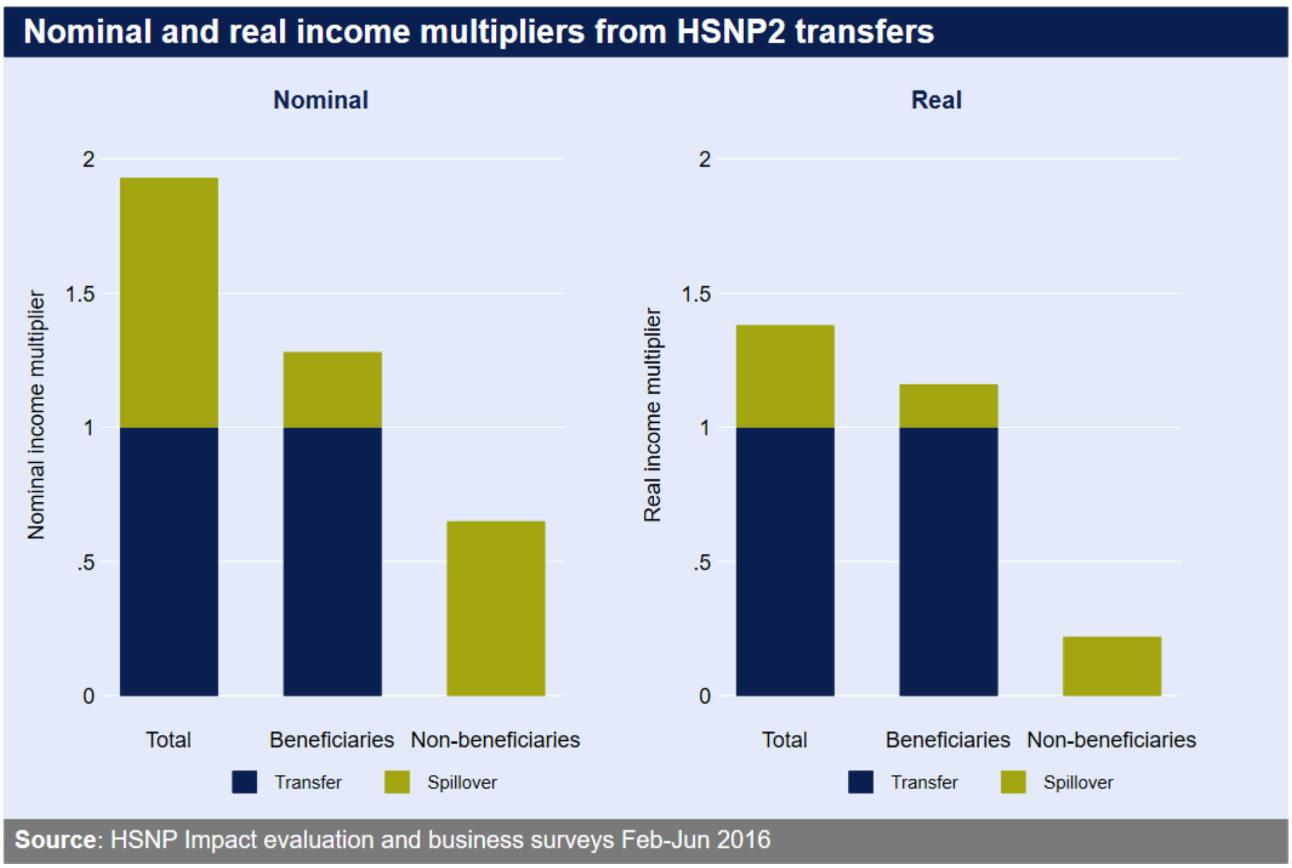
A previous study conducted as part of this impact evaluation measured this income multiplier effect of HSNP2 for the routine payments[11]. It found that HSNP2 leads to increases in incomes that extend beyond its immediate beneficiaries. The LEWIE study showed that for every shilling of HSNP transfer that enters the local economy, somewhere between KES 0.93 and KES 0.38 of additional total income is generated as a result (with the lower bound of the multiplier estimate given by accounting for possible inflationary effects of the transfers).

This striking result means that the overall impact of HSNP2 on incomes is almost double the value of the transfers themselves. The existence and extent of this income multiplier indicates that CTs are predominantly spent on goods and services purchased within the HSNP2 counties, rather than outside. Qualitative research conducted for the impact evaluation supports this view, highlighting that HSNP2 'pay days' often coincide with lively local market days, with vendors and traders gathering around pay points, and beneficiaries spending a large portion of their CT as soon as they receive it. Therefore, local trade is stimulated around pay days, enabling the HSNP2 transfers to confer indirect benefits on local suppliers and producers, which leads to the overall income multiplier effect that we observe.

[11] See Taylor, J.E., Thome, K. and Filipski, M. (2016) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Local Economy-Wide Impact Evaluation Report', OPM.

Figure 3 below illustrates how the real and nominal income multipliers arising from HSNP2 are divided between routine beneficiary households and non-beneficiaries. The distribution of benefits across beneficiaries and non-beneficiaries is shaped by the types of commodities purchased, the relative proportion of beneficiaries in the local population, households' access to livestock and other assets, and the structure of local markets. The 'nominal' income multiplier (displayed in the left-hand panel) is nearly twice as large as the transfer amount itself, with most of this multiplier effect occurring in the form of indirect effects for non-beneficiary households, plus a small additional multiplier occurring for beneficiary households in excess of the transfer amount itself. The corresponding distribution of 'real' income multipliers, which account for possible inflationary effects, is shown in the right-hand panel, where we observe a similar pattern, but with a slightly reduced multiplier size relative to the initial transfer amount.

Figure 3 Nominal and real income multipliers from HSNP2 transfers



In cash terms, we can say that for the KES 464 million that had been transferred to households through routine pay cycles at the time of our study, local incomes had increased by somewhere between KES 856 to 945 million in nominal terms, and by KES 624 to 661 million in real or inflation-adjusted terms[12].

1.4 RATIONALE FOR A LEWIE FOR HSNP EMERGENCY PAYMENTS

The HSNP2 emergency payments, which are contingent on the occurrence of drought, can have a similar effect to the routine payments, depending on how they are distributed across the population. However, there is a fundamental difference between routine and emergency payments from both an individual and local economy perspective. Emergency payments are triggered by the VCI falling into the severe (10<VCI<20) or extreme (VCI<10) drought ranges[13]. Severe and extreme drought, just like HSNP2 payments, have direct and indirect effects on the local economy. In the largely pastoralist economy of the HSNP2 region in northern Kenya, livestock loss (decline in animal mass and increase in animal mortality) is the major direct economic impact of drought. Negative impacts on livestock activities ripple through the local economy as the demand for goods and services contracts, and this results in negative income and production multipliers. Emergency HSNP2 payments provide income insurance to vulnerable households that may be negatively affected by drought, but by doing this, they also might provide insurance to the entire local economy of which beneficiaries are a part.

The extent to which emergency HSNP2 payments compensate the local economy for the negative impacts of droughts has to date never been quantified, but the LEWIE methodology makes it possible to do this, by estimating the impact of both the drought and the contingent emergency CTs on those local economies, including impacts on production activities of both beneficiary and non-beneficiary households. This study thus seeks to model first the impact of drought and then that of the HSNP2 emergency payments to assess how far HSNP offsets or mitigates against drought at the level of the local economy.

[12] The lower and upper bounds are estimated considering the nominal and real multiplier confidence intervals (nominal: (1.84-2.03); real (1.34-1.42)).

[13] The thresholds used at the NDMA for the monthly updated VCI and related drought categories are: VCI >= 50 – wet; VCI from 35 to 50 – no drought/normal; VCI from 21 to 34 – moderate drought; VCI from 10 to 20 – severe drought; and VCI <10 – extreme drought. In our simulated scenarios, we use 11 (rather than 10) and 21 (instead of 20) for extreme and severe, respectively, since the VCI is a continuous quantity and there is not really a discernible difference on the ground at the threshold. This approach enables us to account for the fuzziness at the threshold.

2 Methodology

2.1 STRUCTURE OF THE LEWIE MODEL

The structure of the LEWIE model reflects the principal economic activities in which households in HSNP counties participate, the households' income sources, and the goods and services on which households spend their income. A brief description of the LEWIE and its relationship to other impact evaluation methods appears in Annex A. Table 1 summarises and defines each of the accounts in the model. They include nine production activities and the corresponding commodities that they produce; six factors, including two types of labour (family and hired), land, capital, livestock capital (herd), and purchased inputs; and four different household analysis groups disaggregating between beneficiaries and non-beneficiaries of the programme. These four analysis groups are defined for the purposes of the household-level impact evaluation according to the regression discontinuity (RD) design used for that study. They are: Group A = HSNP2-eligible households below the RD band; Group B = eligible households within the RD band; Group C = ineligible households within the band; and Group D = ineligible households above the band[14]. These groups are organised according to the HSNP2 welfare score, meaning that, nominally, eligible households below the band (Group A) are likely to be the poorest, eligible and ineligible households within the band (Groups B and C), the next poorest, and ineligible households outside the band (Group D) the least poor.

It is crucial to include households that are ineligible for HSNP in the model because they interact with eligible households through local markets, and these market interactions can have important income-generating effects. Households in the study area purchase a variety of locally supplied goods and services, including crops, livestock and livestock products, transport services, processed foods, diverse services, and other locally produced goods. They also spend their income on goods sold in local stores (retail) or by petty traders. In addition to locally supplied goods, there is an 'outside' commodity, comprising all goods purchased by households or businesses outside the local economy as defined. Most of these are goods sourced by local businesses and traders outside the four HSNP counties then sold to households in our four groups. Bespoke household and business surveys gathered detailed information about the location and sources of purchases by both households and businesses.

[14] For a full description of the household-level impact evaluation methodology see Merttens, F., Binci, M., Haynes, A., Laufer, H., and Scott, M. (2017) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Quantitative Household Impact Evaluation Technical Report', OPM.

TABLE 1 ACCOUNTS IN THE KENYA HSNP2 LEWIE

CATEGORY	CODE	DESCRIPTION
Activities and Commodities	CROP	Crops
	LIV	Livestock and products
	TRANS	Transport
	FAFH	Food processing
	RETAIL	Retail
	TR	Petty trading
	SERV	Services
	PROD	Other locally-produced goods
	OUTSIDE	Produced outside the programme area
Factors	HL	Hired Labour
	FL	Family Labour
	LAND	Land
	K	Capital
	HERD	Livestock Capital (Herd)
	PURCH	Purchased Inputs
Households	A	HSNP2 eligible below the RD band
	B	HSNP2 eligible inside the RD band
	C	HSNP2 ineligible inside the RD band
	D	HSNP2 ineligible above the RD band

2.2 LEWIE DATA SOURCES

The LEWIE study relies on the data collected by the quantitative survey for the evaluation. This survey consists of three instruments:

- a household questionnaire;
- a business questionnaire; and
- a livestock trader questionnaire.

Fieldwork was conducted in 187 sub-locations across the four counties (44 in Mandera, 46 in Wajir, 48 in Marsabit, and 49 in Turkana)[15].

[15] This was based on sub-location sampling using the probability proportional to size method. The aim was to sample 200 sub-locations, but due to the varying population sizes of the sub-locations in our sample frame, some ended up being sampled twice using this method.

The household questionnaire

A household questionnaire was carried out in a total of 5,980 households, against a target of 6,384. This questionnaire included modules on livestock, assets, land, food and non-food consumption, transfers, food security, subjective poverty, saving and borrowing, household jobs, household business activities, and livestock trading. The survey covered both households that are receiving the HSNP transfers and those that are not.

Data from the household questionnaire were used for both the quantitative RD analysis, the propensity score matching analysis used in the quantitative household impact evaluation (see OPM, 2016), and the LEWIE analysis presented in this report. The sampling strategy for the household survey is described in detail in the quantitative impact evaluation report[16].

The business questionnaire

A business questionnaire was administered in the three main commercial hubs of each county. The purpose of the questionnaire was to learn more about local economic activities and livelihoods in the HSNP counties. The data were used for the LEWIE analysis. The aim was to capture information on three main sectors of the local economy:

- retail – shops that sell retail goods on which a price mark-up is applied;
- services; and
- producers – businesses that transform inputs into outputs.

In each sub-location, a sample of seven businesses from each category was targeted.

Since no sampling frame for local businesses was available, the survey research teams in each county undertook a listing exercise of all businesses operating in the main commercial centre of the selected sub-locations. The following categories of businesses were excluded from the listing:

- temporary stalls or mobile sellers located outside permanent kiosks;
- banks;
- education institutions (schools, universities etc.); and
- health facilities.

Once the listing was completed, the team leader sampled the required number of businesses using a step sampling approach. Overall, 282 business questionnaires were administered in the four counties. Field teams collected data from an additional replacement sub-location in some counties when this was close to an area for household data collection, and therefore more interviews were completed than expected. All data were retained for analysis.

The livestock questionnaire

Since livestock trading is a very important activity in the HSNP counties, we interviewed a number of livestock traders to understand better how the market works. In each county, three main livestock markets were targeted

[16] Merttens, F., Binci, M., Haynes, A., Laufer, H., and Scott, M. (2017) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Quantitative Household Impact Evaluation Technical Report', OPM.

for interviews. Each team was asked to interview four traders in each of the sub-locations, leading to a total sample size of 12 livestock trader interviews per county. Sampling of livestock traders was mostly done purposively. To the extent possible, team leaders sampled livestock traders in order to achieve a balance between those trading large animals, those trading small or medium value animals, those trading only within the HSNP counties, and those who also trade outside the HSNP counties.

The targeted sample size was achieved in all counties.

2.3 PARAMETERISING THE MODEL

The quantitative survey provides information on household expenditures and the location of purchases, as well as on income sources. These data were used to estimate household expenditure functions, which tell us how each of the four household groups spend an additional dollar of income. This is vital because it is through their expenditures that the beneficiary households pass on the impacts of the programme to others within the local economy, including ineligible (i.e. non-beneficiary) households. Ineligible households, in turn, transmit programme impacts to others through their own spending – including, perhaps, back to beneficiary households.

Table 2 summarises how the households spend their income by looking at the budget share of each item for each household group. It reveals that spending patterns are similar between the two groups inside the RD band (B and C), but they differ between the eligible and ineligible groups outside the band (A and D). This is likely to be the result of the nominal wealth differentials between these two groups. Households spend most of their income, by far, in retail businesses within the county in which they reside. Out of every KES 100 of income, households spend KES 56–80 in local retail activities. The highest local retail share is for Group A and the lowest for Group D. Again, this likely reflects the wealth status of these two groups. Group D households also spend a larger share of their income outside the county. As the wealthiest group, Group D tends to have the most diversified sources of livelihood[17], and this appears to be reflected in the way their expenditures are distributed across items.

[17] Otulana, S., Hearle, C., Attah, R., Merttens, F. and Wallin, J. (2016) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Qualitative Research Study - Round 1', OPM.

TABLE 2 HOUSEHOLD BUDGET SHARES

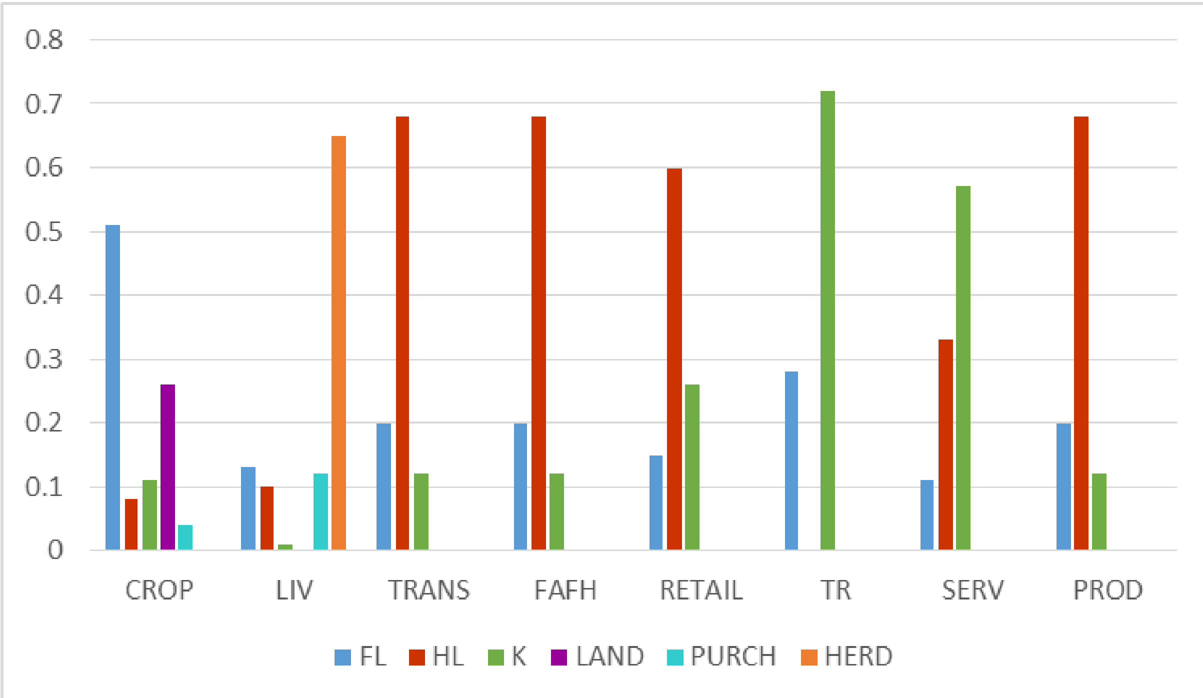
SECTOR/ITEM	HOUSEHOLD GROUP			
	A	B	C	D
CROP	0.6%	0.9%	3.4%	0.2%
LIV	0.1%	5.5%	6.2%	0.8%
TRANS	1.1%	1.2%	1.0%	1.8%
FAFH	0.6%	2.1%	1.7%	9.4%
RETAIL	80.0%	71.6%	68.7%	55.9%
TR	5.8%	5.8%	6.3%	12.5%
SERV	5.9%	4.3%	3.9%	1.8%
PROD	1.0%	1.3%	1.3%	1.4%
Outside	6.1%	7.3%	7.5%	16.2%

The income multipliers associated with HSNP2 depend in large part on whether people who live in the counties own retail businesses and engage in petty trade activities, whether these activities hire labour from within the counties, and whether they purchase their merchandise from people in the counties. The retail activities are located within the counties; however, retailers obtain most of their merchandise from trading centres or other sources outside the counties. Thus, the retail sector represents an important point of leakage from the local economy. Petty traders are more likely to source within counties. Because northern Kenya is not a rich agricultural area, the potential to create income multipliers through local crop production is limited. Livestock is widespread; however, two of the household groups spend only a relatively small percentage of their income on livestock products (Groups A and D) – the first because they do not have extensive livestock holdings and the second because they have more diversified productive investments.

We also use the survey data to estimate production functions for crop and livestock production, and to consider the intermediate demands for those activities. Data from both household and business surveys were used to estimate production functions for the remaining activities. It is important to include production functions in the LEWIE model because they tell us how local production responds to changes in demand stimulated by the HSNP2 payments. They also reveal how changes in production translate into changes in input demands, and thus into income for those who supply inputs – such as wage labourers, for example. Households that sell labour to others in the local economy benefit if demand for labour and/or wages increase because of the programme.

Figure 4 (constructed from Table 6 in 0) shows the share of each factor in the total value-added generated by each of the local production activities. The factor shares were estimated econometrically and are the exponents in Cobb-Douglas production functions.

Figure 4 Factor value-added shares by sector



Family labour accounts for just over 50 cents per KSH of value added in crop production, about 30 cents in petty trading, and 15 cents in retail (the blue bars in figure 2). The retail sector creates added value in the form of price mark-ups above the wholesale cost of merchandise sold by stores and venders. A large share of value-added in this sector goes to wages (0.6); the rest (0.26) is profits, or the return to capital (in the form of inventory; this is the investment people have made in their stores and merchandise). Hired labour shares are highest in transport, food processing, and other production (the red bars). Most livestock value-added is comprised of the return to livestock capital (herd). High labour and profit shares channel income from production activities into the households that supply labour or own capital. Purchased inputs account for only small shares of value-added in crop and livestock activities (the light blue bars).

2.4 CALCULATION OF HSNP2 INCOME MULTIPLIERS

Income multipliers from the HSNP2 are calculated by dividing the impact on total income by the amount of cash transferred to the beneficiary households. The income multipliers tell us the increase in income from each additional KES transferred to poor households. For example, a multiplier of 1.5 indicates that each KES transferred generates an additional KES 0.5 in income within the treated counties. We can calculate multipliers for total household income as well as for the income of each household group, including non-beneficiaries. The income gain to non-beneficiary households is called a programme ‘spill-over’. We can also derive production multipliers (the change in value of production per KES of HSNP2 transfer) using the model.

2.5 LEWIE DATA INPUT MATRIX

The complete data input sheet for the LEWIE model appears in Table 6 in 0. We structured the data input table to interface with the software used to program the LEWIE model, written in GAMS[18]. The columns give the names of variables or parameters, the names of the commodities produced or demanded, the factors used in production, and the values for each household group.

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

The values in the table are weighted[19] totals of each household income and expenditure category by household group. This ensures that we have the correct relative sizes of spending and incomes by each group, and a balanced representation of the treated counties.

Table 6 in Annex A includes the budget (*alpha*) and Cobb-Douglas exponents (*beta*), as well as the production function shift parameters (*acobb*), the starting values of factor demands (FD), and the standard errors (*se*) of the share estimates. The standard errors are generally small compared with the estimated value-added shares (*beta*) and budget shares (*alpha*). This indicates that the data from the survey permitted us to estimate these parameters with a great deal of accuracy, lending further confidence to the simulations that follow.

2.6 PARAMETERS AND FUNCTIONS USED IN THE LEWIE MODEL

Economies—even village ones—tend to be complex, and the LEWIE is a balancing act between complexity and feasibility. Our task is to design a model that is simple enough to implement and estimate using data from surveys, yet rich enough to capture the most relevant linkages that may transmit the impacts of HSNP2 payments through local economies.

The first few rows for each sector in Table 6 in Annex A give 'baseline' levels of intermediate demands for each household group[20]. These are followed by baseline levels of each factor, with different factor mixes in different

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[18] GAMS stands for General Algebraic Modelling System; see www.gams.com/.

[19] Population weights.

[20] It is important to clarify the use of the word 'baseline' here. This is because for the original LEWIE study on routine payments (see footnote 11) the estimation of the programme multiplier effect was performed by effectively 'reversing out' the HSNP payments, due to the fact that the household and business survey were undertaken after the start of the programme, and thus its impacts were already included in the survey data. However, for this study on emergency payments, the opposite is the case, and the survey effectively acts as a baseline on which we first simulate the impact of drought, then the injection of emergency payments to see what multiplier effect these have.

activities. We do not expect all inputs to generate value-added; the intermediate inputs are not substitutable for other inputs and their demand is represented by Leontief input-output coefficients.

The next set of rows give the estimated Cobb-Douglas production function exponents (*beta*) and standard errors of these estimates (*se*). The estimated production function shift parameters and their standard errors (*acobb* and *acobbse*) follow. The remaining rows contain consumption function parameters – *alpha* and *aphase* are the estimated budget share and standard error, respectively. The intercept of each demand function is assumed to be zero (corresponding to a Stone-Geary utility function without subsistence minima). We use the expenditures in the county or the household income from each activity to determine the size of each activity.

The lower panels of the LEWIE input matrix summarise where expenditures by households and businesses take place. The *revsh* parameters give the share of revenue coming from local sales versus sales outside the counties. The VA2IDsh parameters indicate the value of intermediate inputs purchased by each sector, from other sectors as well as from outside the county, per unit of value-added generated. These parameters reflect the spatial organisation of the four counties – the region across which we simulate the impacts of the CTs. Households consume and produce local commodities and they can export production or import goods from outside markets. The linkages between the counties and the rest of the world determine how the transfers' influences flow between households in the local economy, and whether spill-overs accrue to households locally.

The LEWIE computer program (GAMS) uses the parameter estimates and data in the input matrix to calibrate a general equilibrium model of the project-area economy. This model consists of separate models of household groups calibrated and nested within a model of the treated counties. The new demands created by HSNP2 payments (either routine or emergency, depending on which we are simulating) can stimulate production if the local supply response is high (elastic). If the local supply response is inelastic, however, increases in local demand may have inflationary instead of expansionary effects. The LEWIE model can be used to test the sensitivity of transfer impacts to the local supply response and distinguish nominal from real income (price-adjusted) multipliers, as described below.

2.7 VALIDATION

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

1. Use parameter estimates and starting values for each variable obtained from the microdata to calibrate a 'baseline' LEWIE model.
2. Use this model to simulate the impact of CTs to eligible households.

3. Make a random draw from each parameter distribution, assuming it is centred on the estimated parameter with a standard deviation equal to the standard error of the estimate. This results in an entirely new set of model parameters. Using these parameters, calibrate a new baseline LEWIE model, and use this model to simulate the impact of CTs to eligible households again.
4. Repeat Step 3 a large number of times to produce a large number of observed simulation results for each outcome of interest.
5. Finally, construct percentile confidence intervals $(\hat{Y}^*_{1-\alpha/2}, \hat{Y}^*_{\alpha/2})$, where $\hat{Y}^*_p$ is the p^th^ quantile of the simulated values $(\hat{Y}^*_1, \hat{Y}^*_2, ..., \hat{Y}^*_J)$. For example, for a 95% confidence interval, we find the cut-offs for the highest and lowest 2.5% of simulated values for the outcome of interest. This is similar to the percentile confidence intervals in bootstrapping.

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

2.8 PATHWAYS OF INFLUENCE AND MARKETS

The HSNP2 payments increase spending in the treatment households. This increases the demand for goods supplied inside the treated counties, as well as outside the counties in the rest of Kenya. The impact of increased demand on production and on the local income multiplier depends on the supply response to prices in the treated counties. The more elastic the supply response, the more the transfers will tend to create positive spill-overs in the county economy. The more inelastic that response, the more transfers will raise prices instead of stimulating production. If the production supply response is very inelastic (i.e. constraints limit producers' ability to increase output), the transfers will tend to be inflationary rather than having a real effect on the county economy. Higher output prices benefit producers but harm consumers. If wages increase, employed workers will benefit, but producers will be adversely affected. The total impact of the HSNP2 on the economy of the treated counties depends on the interplay of these price and output effects.

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

Prices may be determined inside or outside the counties. A challenge in the LEWIE is that we generally do not know exactly where prices are determined. In real life, changes in prices outside of an economy may be transmitted into the economy. Given the size of the HSNP2 transfers, there is little reason for transfers to affect prices outside the treated counties.

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

Simulations require making assumptions about where prices are determined, which in the LEWIE and other general equilibrium models is called 'market closure'. We evaluate the impacts of HSNP2 under assumptions that we believe reasonably reflect the structure of markets in and around the treated counties[21]. We assume local (county) markets for crops, livestock, retail, services, fish, other non-agricultural production, and both types of labour (family, hired). Even though most of the price of a good sold in a local store is determined outside the county, the mark-up – or value=added – may change when local demand changes. For example, if the demand for retail goods rises, prices charged by local stores and vendors may increase. The LEWIE simulations provide insight into whether there might be some inflationary effect of HSNP2 transfers.

We do not know what the elasticity of labour supply is. We assume a nearly perfectly elastic labour supply (η=100), reflecting an excess labour supply in the HSNP2 programme areas (this is similar to the way one treats labour in a Social Accounting Matrix multiplier model). Excess labour supply can lower inflationary pressures by limiting wage increases. Increases in labour demand raise employment but not wages. Inflationary pressures may remain, however, if land and capital constraints limit the local supply response to some extent.

Qualitative research conducted for this evaluation has largely found that *conditions provoking inflationary effects* are minimal in most places throughout HSNP operational areas: supply of goods and services is highly elastic and there is a surplus of labour[22]. However, in some more remote regions of the HSNP counties this is not always the

[21] These assumptions were investigated during the design phase of the household and business surveys, and were found to hold through direct observation and qualitative research with key informants (market traders, wholesalers, local government administrative staff, and households themselves). Some of these findings are discussed in the report from the first round of qualitative research conducted for this impact evaluation. See Otulana, S., Hearle, C., Attah, R., Merttens, F., and Wallin, J. (2016) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Qualitative Research Study - Round 1' OPM.

[22] See Otulana, S., Hearle, C., Attah, R., Merttens, F., and Wallin, J. (2016) 'Evaluation of the Kenya Hunger Safety Net Programme Phase 2: Qualitative Research Study - Round 1'. OPM.

case (i.e. where the elasticity of supply can be lower), and the LEWIE model thus accounts for this by estimating the degree to which HSNP transfers may produce some inflationary effect.

3 Mitigation of drought impacts in the local economy by HSNP2 emergency payments

Livestock loss is generally considered to be the greatest direct threat to the livelihoods of pastoralists. It also has ramifications for the local economies of which they are part. An extreme drought, resulting in herd loss, negatively affects production, incomes and the welfare of livestock herders, and market linkages then transmit these negative impacts throughout the local economy.

In order to analyse how far HSNP2 emergency payments might mitigate these negative effects of drought on the local economy we use our LEWIE model to simulate the impacts of a typical severe-to-extreme drought with and without HSNP2 drought-contingent payments.

As described above in Section 1.1, under HSNP2, emergency payments to registered households who do not receive routine HSNP payments are triggered if the VCI for any given sub-county falls into the 10–20 range for severe drought, or below 10 for extreme drought. In normal, i.e. non-drought, conditions, HSNP2 routine payments cover around 25% of households across the four counties, on average. In cases of severe drought, HSNP2 coverage is scaled up such that 50% of households in drought-affected locations are covered, and in extreme drought 75% of households in drought-affected locations are covered. This means that, when an average sub-location goes into severe drought, an additional 25% of households in that location are given emergency payments, over and above those already receiving routine payments – meaning that a total of 50% of households are temporarily covered in that location that month. Likewise, when an average sub-location goes into extreme drought, an additional 50% of households are given emergency payments, over and above those already receiving routine payments – meaning that a total of 75% of households in that location are temporarily covered that month. Whether the coverage of routine payments in any given sub-county is higher or lower than the average 25%, the programme still scales up to cover 50% or 75% of households, depending on whether there are severe or extreme drought conditions, respectively.

3.1 MODELLING THE IMPACT OF DROUGHT ON HOUSEHOLDS AND THE LOCAL ECONOMY

In order to simulate the drought using our LEWIE model we need to understand how drought affects different parts of the economy, as well as which locations – and, consequently, which populations – are affected. Below we present how we address each of these issues in turn.

Studies conducted by the Ministry of Finance and NDMA, including the post-drought needs assessment performed after the 2008–11 extreme drought and the regular Long Rains Assessments (LRAs)[23], indicate that various

[23] See GoK (2017) 'The 2017 Long Rains Season Assessment Report'. Kenya Food Security Steering Group (KFSSG), July; GoK. (2017) 'Mandera County 2017 Long Rains Assessment Report', Kenya Food Security Steering Group and County Steering Group, July; GoK. (2017) 'Marsabit County 2017 Long Rains Assessment Report', Kenya Food Security Steering Group and County Steering Group, July; GoK. (2017) 'Turkana County 2017 Long Rains Assessment Report', Kenya Food Security Steering Group

parameters of the local economy are affected by drought conditions. In HSNP areas these are primarily livestock and livestock by-products (such as milk), due to the fact that drought leads to poor pasture and grazing, which in turn leads to loss of livestock and poor livestock body condition, which in turn leads to a decline in milk production and consumption, and thus a rise in milk prices – as well as a decrease in the price of livestock. Decreased prices of livestock due to poor body condition can in turn lead to worsening terms of trade with other goods, such as maize. Agricultural production can also be affected, though in the drought-prone HSNP counties crop production is minimal (as shown in Table 4 below).

Thus, according to the national LRA, prices of livestock by-products (milk) rise in response to drought conditions, while livestock prices fall:

> 'Milk production is 1–2 litres compared with the normal 2–3 litres; the poor season lowered rates of conception and consequently rates of calving, kidding, and lambing … The short supply of milk and greater demand for it has increased the price to Ksh [KES] 60–120 per litre from the normal Ksh 40–80 … Livestock prices…are up to 40 percent below average.'[24]

The quote above implies a decrease in livestock by-product production of between one-third and a half, a 50% increase in the price of livestock by-products, and a 40% decrease in livestock prices. We thus take these values to adjust the relevant parameters in the LEWIE model.

However, the question of how to simulate the impact of a severe drought in terms of herd loss is not so simple, because, to our knowledge, there is no study available that links VCI readings to herd loss. Nor do the LRAs give an estimate of the level of herd loss due to drought. We thus use a 20% mortality rate for livestock because other studies regard this as the lower bound on extreme herd loss due to drought. For example, one study found that herd losses in excess of 20% occurred in 10%–20% of seasons between 2000 and 2008 at two study sites in Marsabit county[25].

These data provide us with a guide as to how to adjust the relevant parameters in our LEWIE model. However, in order to simulate the drought we also need to model which sub-locations within our survey sample are drought-affected, and to what degree. To do this, we analyse VCI data over the last three years (2015–2017) to calculate the probability of drought at the sub-location level within the driest months (March and April, on average). This analysis indicates that, in the driest part of the year, an 'average' or typical drought would see 25 (or 13% of) sub-locations in our sample of 187 fall into extreme drought and 113 (60%) fall into severe drought. This is further broken down by county in Table 3.

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and County Steering Group, July; GoK. (2017) 'Wajir County 2017 Long Rains Assessment Report', Kenya Food Security Steering Group and County Steering Group, July; and Gok. (2012) 'Kenya Post Disaster Needs Assessment (PDNA) 2008-2011 Drought', Kenya Post Disaster Needs Assessment Team.

[24] GoK (2017) 'The 2017 Long Rains Season Assessment Report'. Kenya Food Security Steering Group (KFSSG), July.

[25] Chantarat et al. (2017). 'Welfare Impacts of Index Insurance in the Presence of a Poverty Trap', in World Development Vol. 94, pp. 119–138, Elsevier Ltd.

TABLE 3 SIMULATED DISTRIBUTION OF SUB-LOCATIONS BY LEVEL OF DROUGHT AND COUNTY

COUNTY	DROUGHT LEVEL	NUMBER OF SUB-LOCATIONS	PERCENTAGE OF SUB-LOCATIONS
Mandera	Extreme	7	16%
	Severe	37	84%
	Moderate	0	0%
Marsabit	Extreme	15	31%
	Severe	23	48%
	Moderate	10	21%
Turkana	Extreme	0	0%
	Severe	10	20%
	Moderate	39	80%
Wajir	Extreme	3	7%
	Severe	43	93%
	Moderate	0	0%
All counties	**Extreme**	**25**	**13%**
	Severe	**113**	**60%**
	Moderate	**49**	**26%**
	Total	187	100%

Identifying which sub-locations are affected by what level of drought enables us to identify the proportion of the population residing in drought-affected areas, including relevant characteristics of that population, such as the percentage that own livestock or are involved in crop production. It also enables us to identify precisely which households would receive emergency drought-contingent payments from HSNP. Table 4 below presents this information disaggregated by analysis group. It shows that around 65% of households are located in sub-locations affected by either severe or extreme drought in our scenario. Within these, some 74% of households own livestock and are thus subject to livestock loss, with the livestock price shock also multiplied by this share. The price of livestock by-products is determined endogenously as part of the model solution. Only 1% of households in drought-affected areas are involved in crop production, so we ignore this dimension of the impact of drought on local production when adjusting our model parameters. Around 18% of all households receive an emergency payment in our simulation and these are distributed across the four analysis groups, as detailed in the second row of Table 4 (28% of Group A, 21% of Group B and 29% of Group C).

TABLE 4 PERCENTAGE OF HOUSEHOLDS RECEIVING HSNP2 SUPPORT, RAISING LIVESTOCK AND INVOLVED IN CROP PRODUCTION IN DROUGHT-AFFECTED SUB-LOCATIONS, BY ANALYSIS GROUP

INDICATOR / ANALYSIS GROUP	A	B	C	D	TOTAL
Percentage of HSNP Group 1 beneficiaries	71.97%	68.43%	14.66%	2.50%	26.48%
Percentage of emergency payments recipients	28.03%	21.27%	29.19%	0.00%	17.83 %
Percentage of non-beneficiaries	0.00%	10.30%	56.16%	97.50%	54.76%
Percentage of households located in drought-affected sub-locations	97.85%	59.82%	60.88%	75.61%	65.36%
Percentage with livestock in drought-affected sub-locations	70.40%	82.10%	70.76%	61.67%	73.66%
Percentage involved in crop production in drought-affected sub-locations	4.27%	1.54%	1.10%	1.36%	1.31%

Notes: All proportions are weighted using population weights.

The above information allows us to simulate the effect of a single drought on annual incomes and the degree to which a single emergency payment in response to that drought mitigates those effects. We thus model the impact of a typical severe-to-extreme drought on the local economy by taking account of the ways different economic activities are affected by drought conditions, and the different degrees to which they are affected.

The single annual severe-to-extreme drought scenario we select to model is based on analysis of actual VCI data over the last three years. These were in fact relatively bad drought years in comparison to historical data going back almost 20 years to the year 2000. However, in reality, some years multiple severe-to-extreme droughts throughout the calendar year do occur, as happened in 2008/9, 2011 and 2016/17. In other years, no severe-to-extreme droughts occur.

When multiple severe-to-extreme droughts do occur in a single year they likely have cumulative negative impacts on total annual incomes and thus their effects on the local economy may be more pronounced than the impact of the single severe-to-extreme drought that we simulate. This is because the cumulative negative effects on herd sizes and prices put increasing pressure on households' and businesses' consumption and expenditures, and thereby diminish their ability to recover. Market linkages then exacerbate these cumulative effects even further.

We do not opt to model such a multiple severe-to-extreme drought scenario for two reasons. Firstly, because such scenarios are relatively rare, and we consider it more useful to model a more 'typical' scenario of severe-to-extreme drought whereby HSNP2 emergency payments are triggered, which more routinely tends to occur in the driest months of the year. Secondly, we do not simulate such an extreme multiple drought scenario because modelling the cumulative effects of consecutive droughts throughout the year would be highly complex and would involve more and stronger underpinning assumptions. These would risk reducing the robustness of the results, as well as the ease with which they could be interpreted.

Our chosen scenario errs on the side of caution in as far as it is likely to produce conservative estimates of the degree to which the HSNP2 emergency payments offset or mitigate the negative impacts of drought on the local economy. This is because our approach effectively assumes that the negative impacts of drought persist for the whole year, in as far as we aggregate those effects to the level of total annual incomes. If herd sizes and prices recover more rapidly than over the course of a full year, the negative impact of the drought would be reduced. If this was the case, the mitigation effect of the HSNP2 emergency payments would increase, because though the impact of the drought is reduced the value of the emergency payments would remain the same, and therefore would offset a larger proportion of the negative impact of the drought.

Impact of drought on households and the local economy

Table 5 below summarises the results of our simulated drought on the local economy, as well as the impact of HSNP drought-contingent emergency payments in mitigating the negative effects of drought. Column 1 reports what the local economy impacts of the 20% herd mortality and livestock price shocks in the affected sub-locations would be without drought-contingent HSNP2 payments. Column 2 shows the impacts if the herd and price shocks are accompanied by emergency payments at the coverage level specified by the simulated degree of drought. Column 3 reports the percentage mitigation achieved by the emergency payments, calculated as the difference between drought impacts with and without the emergency payments as a share of impacts without the payments.

Summarising this analysis we can say that a typical drought decreases the total value of livestock production by some KES 1,493 million (in nominal terms) and livestock by-product production by KES 7,781 million, due to the loss of herds and the negative shocks to livestock and livestock by-product prices. Among other production activities, the largest impacts are on retail sales, which fall by KES 3,076 million, with the losses in production value across the other activities ranging from KES 99 million (crop production) to KES 422 million (transportation). This reduction in production has the effect of decreasing total annual incomes in the HSNP2 counties by an estimated KES 4,776 million in nominal terms, or KES 12,754 million in real or inflation-adjusted terms. This represents a loss of around 2% of total annual incomes in real terms.

The real income loss is larger than the nominal impact because the shock is effectively double: firstly, households lose livestock to death and the price of livestock drops due to poor livestock body condition. This hits households as producers by reducing the net value of their assets, as well as the cash income they receive from those assets. Secondly, the prices of animal by-products, such as milk, go up, and where household income has declined their terms of trade with other goods goes down, which hits households as consumers. Taken together, this double effect magnifies the impact of the shock, which is then further compounded by linkages within the local economy which spread and exacerbate it.

TABLE 5 IMPACTS OF SIMULATED DROUGHT ON INCOMES AND PRODUCTION, AND MITIGATION BY HSNP2 EMERGENCY PAYMENTS IN KES MILLIONS

IMPACTS (KES MILLIONS)	LIVESTOCK LOSS AND LIVESTOCK PRICE SHOCK	LIVESTOCK LOSS AND LIVESTOCK PRICE SHOCK WITH HSNP EMERGENCY PAYMENTS	% MITIGATION
Nominal level	-4,776	-4,237	11.30%
	(-3,906 ; -5,814)	(-3,374 ; -5,280)	
Real	-12,754	-12,377	3.00%
	(-10,387 ; -15,248)	(-10,011 ; -14,871)	
By household group			
A nominal	-7	-6	22.50%
real	-4	-2	33.30%
B nominal	-1,632	-1,468	10.10%
real	-4,366	-4,237	2.90%
C nominal	-2,893	-2,563	11.40%
real	-7,539	-7,270	3.60%
D nominal	-244	-201	17.90%
real	-845	-867	-2.60%
Production volumes (in nominal terms)			
prod	-210	-185	11.50%
trans	-422	-370	12.30%
ser	-163	-145	11.30%
liv	-1,493	-1,494	0.00%
Lbyp	-7,781	-7,764	0.20%
crop	-99	-87	11.50%
fafh	-273	-261	4.40%
tr	-348	-305	12.30%
ret	-3,076	-2,695	12.40%

These negative impacts affect all household analysis groups, albeit in different ways and to varying degrees. The largest impacts are in household Group C, which sees a reduction in total income of KES 7,539 million in real terms. The next worse affected is Group B, whose real income falls by some KES 4,366 million, followed by Group D which loses KES 845 million in real terms. The smallest impacts are on the poorest households, Group A (KES 4 million real), reflecting this group's relatively small share of the region's total livestock assets. However, even though the impacts on Group A are smallest in absolute terms, due to this group's higher degree of vulnerability, even small income changes can have major welfare impacts. These losses represent around 3% of total annual income for Groups B and C, 0.3% for Group D and 0.24% for Group A. At the household level, these results imply average losses to annual income per household of KES 4,327 for Group A, KES 42,676 for Group B, KES 46,895 for Group C and KES 6,893 for Group D.

3.2 IMPACT OF THE HSNP2 EMERGENCY PAYMENTS IN MITIGATING THE EFFECTS OF DROUGHT

According to our simulation, just over KES 186 million is injected into the local economy by HSNP in the form of emergency payments in response to the drought: KES 0.7 million of this amount goes to Group A, KES 58.75 million to Group B and KES 126.68 million to Group C. Group D receives no emergency payments.

The impacts of the drought combined with HSNP2 emergency payments appear in Column 2 of

Table 5. This shows that the HSNP2 emergency payments reduce the negative impact of the drought on total income from KES 4,776 million to KES 4,237 million in nominal terms, and from KES 12,754 million to KES 12,377 million in real terms. In other words, they mitigate 11% (or KES 539 million) in nominal terms, or 3% (or KES 377 million) of the total real income loss from drought in the four counties.

These results tally with the findings from other studies conducted by this evaluation, which found that while beneficiaries of emergency payments tend to value the transfers and feel they are timely (though they do not claim to understand the targeting mechanism very well), the size, infrequency, and unpredictability of payments means their impacts at the household level are relatively constrained in comparison to the routine transfers: emergency payments are used to support basic needs but are insufficient to prevent serious depletion of productive assets, such as livestock[26]. This is confirmed by

Table 5, which shows that the HSNP2 payments mitigate less than 1% of the loss to both livestock production and livestock by-products production.

In other sectors of the local economy, the mitigating effect of the HSNP2 emergency payments is much more significant, with somewhere close to 12% of losses to all other sectors (barring food processing (4%)) being offset. In absolute terms, retail is the biggest beneficiary of HSNP2's mitigating effect, with total losses of KES 3,076 million offset to the tune of KES 381 million.

Among household groups, the degree to which HSNP2 emergency payments mitigate the negative impacts of the drought vary. For the poorest Group A, HSNP emergency payments actually mitigate one-third (33.3%) of the impact in real terms. For the other three groups, the mitigating effect is much more modest, at 2.9% for Group B, and 3.6% for Group C; while the impact is actually exacerbated by 2.6% for Group D. This is likely due to the fact that none of the contingent payments go to Group D, whose purchasing power in the context of rising prices

[26] See Farhat *et al*. (2017).

thereby worsens more than for the other groups, some of whom do receive the emergency payments. The much higher mitigation effect on Group A is likely explained by the smaller livestock holdings and lower consumption expenditure generally of this group, who thereby suffer smaller losses in comparison to the other groups. For actual recipients of the emergency payments in this group (we should recall that only a portion of households in each group actually receive the emergency payments, see Table 4 above), those payments constitute a significant injection of income, with 62% of average household loss to income covered by the payment of KES 2,700. For emergency recipients in Groups B and C, the payment covers just 6% of their total loss to annual income.

In summary, we see that, despite being somewhat constrained in terms of ameliorating the impact of drought on livestock holdings and livestock by-product production, the mitigating effect (KES 377) of the HSNP2 emergency scale-up facility is nevertheless significant relative to the value of cash injected into the local economy, amounting to just over two (2.03) times the cost of the emergency payments (KES 186 million) themselves.

Again, this 'mitigation multiplier' varies across groups, being largest for the poorest households (Group A), at 2.86, 2.20 for Group B, and 2.12 for Group C. Households in Group D do not receive emergency payments so a mitigation multiplier cannot be calculated for them[27].

Once again, qualitative research into these mitigating effects bears testament to these results, with local NDMA officials, among others, within the HSNP counties, stating that without HSNP the impact of the drought would have been much worse[28]. In this regard, the LEWIE model shows how market linkages significantly magnify the positive impacts of the HSNP2 emergency payments, transmitting the benefits across activities and from recipient to non-recipient households.

In conclusion, we can say that the LEWIE model indicates that the HSNP2 emergency cash payments have a meaningful mitigating effect on the impact of drought on the local economy, eliminating somewhere between 11.3% and 3.0% of the negative impacts of the drought on total incomes. They do not prevent losses to livestock holdings or significantly reduce the negative impacts of drought on livestock by-product production, but they do do so for all other sectors of the local economy, including retail, petty trade, transport, services, food processing and other production. All recipient household groups benefit from the mitigating effect of the emergency payments, including the emergency payment recipients themselves, routine HSNP beneficiaries, and non-beneficiaries. Furthermore, this effect is particularly marked for the poorest emergency recipients, for whom the emergency payment covers around 62% of their losses on average.

These results require careful interpretation. As discussed in Section 3.1 above, the drought scenario that we model for the purposes of this study is effectively a single drought incidence, of a particularly intense drought, during the driest month of the year, followed by a single round of emergency payments made in response to that drought by HSNP. Our approach then assumes that the negative impacts of drought persist for the whole year, in as far as we

[27] The mitigation multiplier is calculated by dividing the total real mitigation effect by the total value of emergency payments paid to that group.

[28] Statements to this effect made by various local officials and other key stakeholders were heard by the HSNP evaluation team members while undertaking research for various studies conducted as part of this evaluation.

aggregate those effects to the level of total annual incomes. The impact of the drought on the local economy may thus be overstated if herd sizes and prices recover more rapidly than over the course of a full year. Unfortunately, we cannot tell if this is the case or not, as the NDMA LRAs or post-disaster assessment of the 2008–11 drought do not contain information about how quickly herd sizes regenerate or prices recover. However, if it were the case, the mitigation effect of the HSNP2 emergency payments would be larger than that estimated by this study because, though the impact of the drought would be smaller than the one expected assuming a longer recovery period, the value of the emergency payments remain the same and therefore offset a larger proportion of the negative impact of the drought.

Furthermore, in reality, drought may sometimes be stretched out in time, albeit likely with less intensity at less dry times of the year, with multiple rounds of emergency payments occurring in response. Our previous LEWIE study on routine HSNP payments showed that repeated payments had substantial economic multiplier effects (see Section 1.3 above). Therefore, if multiple emergency payments are provided, one might expect similar effects to occur. Although the negative impact of drought on productive capacity may also be magnified, the positive multiplier effect engendered by the emergency payments would likely be more sustained.

In addition, our special study on emergency payments[29] showed that, at the household level, emergency payments differ substantially from routine HSNP payments because they are infrequent, unpredictable, and small in size. This means households cannot plan for their use and they are not large enough to offset losses to herds. However, at the aggregate local economy level, they still represent a substantial injection of cash and thereby protect other sectors of the economy from drops in incomes beyond livestock and production of livestock products, including – and in particular – retail, petty trade, transport, services, food processing and other production.

We thus conclude that while only offsetting somewhere between 11% and 3% of the total negative impact of drought on aggregate income in the local economy, the mitigation effect achieved by the HSNP emergency payments is nevertheless real and not insubstantial, reducing the negative impact of drought by over twice the value of cash injected into the local economy by the programme.

[29] Farhat *et al*. (2017).

4 Conclusions and implications for policy

4.1 SUMMARY OF FINDINGS

An analysis of the degree to which the HSNP2 emergency scale-up facility mitigates the negative impacts of a typical severe-to-extreme drought on households and the local economy of HSNP counties using a bespoke LEWIE model reveals that a simulated 'average' drought has significant negative impacts on households in HSNP areas, and that these negative impacts are magnified as the repercussions are transmitted throughout the local economy. In other words, the weather shock creates substantial negative spill-overs, with our simulations showing that total annual income in the population decreases by over KES 12.7 billion in real terms, or KES 32,993 per household. All household groups and all production activities are negatively affected.

However, just as local economic linkages magnify the negative impacts of severe and extreme drought, they also magnify the positive impacts of the HSNP2 drought-contingent emergency payments made in response. By providing partial income insurance for beneficiaries, HSNP2 emergency payments also provide partial insurance to the economies of which they are part.

We find that the HSNP2 emergency payments dampen the negative impact of the drought on total local income by somewhere between 11% and 3%, or KES 539 million and KES 377 million. This 'local economy insurance' impact of HSNP2 represents 2.03 times the cost of the emergency payments (KES 186 million). In addition, the poorest households (analysis Group A in our model; see Section 2.1) appear to benefit disproportionately from the emergency payments. Emergency payments compensate around one-third of the total annual income loss caused by the drought for this group, and around 62% of the average per household loss of income for actual recipients of the emergency payment in this group.

4.2 IMPLICATIONS FOR POLICY

The multiplier effects of HSNP2 payments depend on the local supply of goods and services, and the availability of factors to produce commodities. Complementary programmes that increase the local supply response (such as access to credit to invest in capital and other productive inputs) could increase the real income and production impacts of HSNP2; so, obviously, could interventions that buffer local production against weather shocks – for example, drought-resistant varieties of seeds and livestock, veterinary medicines and other services that help strengthen livestock against drought, commercial livestock production support services (such as training on commercial destocking and restocking practices), as well as index-based livestock insurance. These livestock services are particularly important because HSNP2 emergency payments do not mitigate the loss of livestock due to drought, with livestock being the primary productive asset for most households in these areas, nor the negative impacts of this loss on the production of livestock by-products. In addition, investments in production value chains (such as abattoirs and cold chains) by county or national governments will further support livelihoods against climate vulnerability over the long term. As ongoing efforts to link the HSNP to complementary programming develop, it will thus be important to consider the dimension of the HSNP2 scale-up facility and how other services may benefit the aims of the programme in this regard.

The findings also show that the emergency payments especially benefit poorer households. Improvements in the welfare measure used by the programme will thus lead to improvements in the impacts of emergency payments.

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Annex A: LEWIE as an impact evaluation tool

LEWIE is an 'in silico' or simulation impact evaluation tool. In silico (meaning performed on computer or by computer simulation) approaches are used in addition to, or in lieu of, 'in vivo' (living conditions) and 'in vitro' (laboratory conditions) methods in scientific and medical research. Randomised control trials (RCTs) are akin to 'in vivo' experimentation. Climate models[30] and the Human Brain Project[31] are examples of efforts to build models of how systems operate, in order to simulate the impacts of alternative interventions.

The LEWIE approach takes advantage of the fact, predicted by theory and easily documented with data, that when households receive cash, they spend it. Our baseline surveys show this, and RCTs in a wide variety of settings also confirm it. With the survey data, we econometrically estimate the expenditure patterns of beneficiaries, which show how an additional KES of income gets spent: most is spent on food. RCTs for a variety of Social CT programmes also confirm this (for example, see Davis *et al*. 2017). The econometrics provide an *ex-ante* estimate of expenditure patterns – a reasonable approximation as long as SCTs do not significantly alter expenditure patterns. Unfortunately, although RCTs find increases in expenditures on food and other items as a result of SCTs, they generally do not try to test whether beneficiaries' expenditure patterns *change* as a result of SCTs. At the low levels of income prevalent in northern Kenya, it is probably safe to assume they do not change in a big way.

The HSNP2 survey data tell us where beneficiaries spend their income, linking expenditures by beneficiaries to sales by local farms and businesses. Household and business surveys provide the data to estimate production functions linking input demands to production and sales by each production activity. These production functions tell us how higher sales increase income in households that own businesses or supply labour or other inputs to them. Business owners are mostly non-beneficiary households. The household surveys provide the data to estimate expenditure functions for non-beneficiaries as well as beneficiaries, a necessary step in modelling additional rounds of income impacts beyond the treated.

With follow-on survey data on both eligible and ineligible households at treatment and control sites, we could estimate SCT multipliers experimentally, *ex-post*. Unfortunately, ineligible households are rarely included in baseline and follow-on surveys to evaluate SCT programmes. The evaluation of Lesotho's Child Grants Programme carried out by Taylor *et al*. (2017) is an exception. There, experimentally-estimated income multipliers exceeded simulated income multipliers. In that study, LEWIE simulations gave a conservative estimate of the programme's multiplier effects in local economies.

Considering the econometric rigour of the LEWIE approach, the size of multiplier effects from SCT programmes, and the challenges of documenting these effects using conventional experimental approaches, we believe that the LEWIE should be a basic part of the impact evaluation toolkit. The rapid ascendance of in silico methods in the sciences strengthens this argument. The term 'impact evaluation' has long been associated with general

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[30] For example, www.climate.gov/maps-data/primer/climate-models.

[31] See www.humanbrainproject.eu/en/.

equilibrium modelling, mostly of policy impacts. The LEWIE approach integrates general equilibrium and micro-econometric modelling to evaluate the impacts of programmes and projects at a local level.

TABLE 6 PRODUCTION AND DEMAND IN THE LEWIE DATA INPUT (EXCERPT FROM DATA INPUT MATRIX)

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
FD	liv		HERD	7589.6	946846.5	1332894.7	710309.9
FD	liv		K	95.7	11942.1	16811.1	8958.8
FD	liv		PURCH	3234.7	203141.9	275655.2	435100.0
FD	liv		HL	1157.6	144416.8	203298.4	108339.3
FD	liv		FL	1464.9	182753.8	257266.1	137099.1
beta	liv		HERD	0.65	0.65	0.65	0.65
beta	liv		K	0.01	0.01	0.01	0.01
beta	liv		PURCH	0.12	0.12	0.12	0.12
beta	liv		HL	0.10	0.10	0.10	0.10
beta	liv		FL	0.13	0.13	0.13	0.13
se	liv		HERD	0.06	0.06	0.06	0.06
se	liv		K	0.01	0.01	0.01	0.01
se	liv		PURCH	0.03	0.03	0.03	0.03
se	liv		HL				
se	liv		FL				
acobb	liv			1.29	1.29	1.29	1.29
acobbse	liv			0.61	0.61	0.61	0.61
FD	crop		LAND	4.2	1892.9	2037.5	1621.9
FD	crop		K	1.8	811.7	873.7	695.5
FD	crop		PURCH	6.6	1067.4	679.0	740.6
FD	crop		HL	1.3	585.5	630.3	501.7
FD	crop		FL	8.2	3713.8	3997.5	3182.1
beta	crop		LAND	0.26	0.26	0.26	0.26
beta	crop		K	0.11	0.11	0.11	0.11
beta	crop		PURCH	0.04	0.04	0.04	0.04
beta	crop		HL	0.08	0.08	0.08	0.08
beta	crop		FL	0.51	0.51	0.51	0.51
se	crop		LAND	0.08	0.08	0.08	0.08

EMERGENCY PAYMENTS LEWIE

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
se	crop		K	0.06	0.06	0.06	0.06
se	crop		PURCH	0.03	0.03	0.03	0.03
se	crop		HL				
se	crop		FL				
acobb	crop			7.94	7.94	7.94	7.94
acobbse	crop			0.48	0.48	0.48	0.48
INTD	tr	trans		5.3	1135.4	1600.7	1069.5
INTD	tr	liv		4.1	873.7	1231.7	822.9
INTD	tr	crop		2.6	566.9	799.2	534.0
INTD	tr	ser		3.7	799.6	1127.3	753.2
INTD	tr	prod		3.3	720.3	1015.5	678.5
INTD	tr	tr		15.7	3375.2	4758.3	3179.1
INTD	tr	ret		32.8	7052.0	9942.0	6642.5
INTD	tr	OUTSIDE		42.5	9138.9	12884.1	8608.1
FD	tr		FL	616.8	23323.3	37389.5	16647.4
beta	tr		FL	0.28	0.28	0.28	0.28
se	tr		FL	0.15	0.15	0.15	0.15
FD	tr		K	1577.9	59669.9	95656.3	42590.4
beta	tr		K	0.72	0.72	0.72	0.72
se	tr		K				
acobb	tr			7.80	7.80	7.80	7.80
acobbse	tr			0.52	0.52	0.52	0.52
INTD	ret	trans		190.5	7017.1	21743.8	39871.3
INTD	ret	liv		21.6	796.4	2467.9	4525.4
INTD	ret	crop		3.5	128.3	397.5	729.0
INTD	ret	ser		27.1	998.8	3095.0	5675.2
INTD	ret	prod		70.4	2594.3	8038.7	14740.5
INTD	ret	tr		236.6	8716.4	27009.2	49526.6
INTD	ret	ret		271.9	10019.9	31048.5	56933.3
INTD	ret	OUTSIDE		1425.5	52524.0	162754.4	298441.3
FD	ret		HL	2332.6	735330.9	7174237.6	83886.6
FD	ret		FL	23.9	6842.4	5609.1	58969.8

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
FD	ret		K	11599.4	1296923.5	12653400.7	147953.2
beta	ret		FL	0.15	0.15	0.15	0.15
beta	ret		HL	0.60	0.60	0.60	0.60
beta	ret		K	0.26	0.26	0.26	0.26
se	ret		FL	0.20	0.20	0.20	0.20
se	ret		HL	0.12	0.12	0.12	0.12
se	ret		K				
acobb	ret			8.83	8.83	8.83	8.83
acobbse	ret			0.69	0.69	0.69	0.69
INTD	ser	trans			132.1	357.8	573.3
INTD	ser	liv			698.7	1892.2	3031.5
INTD	ser	crop			0.8	2.2	3.5
INTD	ser	ser			249.4	675.4	1082.1
INTD	ser	prod			107.8	291.9	467.7
INTD	ser	tr			614.9	1665.3	2668.1
INTD	ser	ret			2340.4	6338.5	10155.3
INTD	ser	outside			2213.7	5995.5	9605.6
FD	ser		HL		8741.7	14642.5	96584.1
FD	ser		FL		1365.9	620.9	34635.9
FD	ser		K		7168.3	3258.5	181771.4
beta	ser		HL		0.33	0.33	0.33
beta	ser		FL		0.11	0.11	0.11
beta	ser		K		0.57	0.57	0.57
se	ser		HL		0.07	0.07	0.07
se	ser		FL		0.29	0.29	0.29
se	ser		K				
acobb	ser				8.60	8.60	8.60
acobbse	ser				0.99	0.99	0.99
INTD	trans	trans		3.6	174.4	17308.4	22667.6
INTD	trans	ser		0.6	28.8	2855.9	3740.1
INTD	trans	liv		0.0	0.5	44.7	58.6
INTD	trans	prod		0.0	0.1	5.8	7.6
INTD	trans	tr		0.0	1.5	145.6	190.7

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VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
INTD	trans	ret		0.1	6.2	618.5	810.0
INTD	trans	OUTSIDE		1.2	55.9	5547.3	7264.9
FD	trans		HL	23.9	266.7	5821.5	6913.2
FD	trans		FL	295.7	48152.8	8320025.4	3370.8
FD	trans		K	177.2	28851.9	4985137.6	2019.7
beta	trans		HL	0.68	0.68	0.68	0.68
beta	trans		FL	0.20	0.20	0.20	0.20
beta	trans		K	0.12	0.12	0.12	0.12
se	trans		HL	0.05	0.05	0.05	0.05
se	trans		FL	0.11	0.11	0.11	0.11
se	trans		K				
acobb	trans			7.43	7.43	7.43	7.43
acobbse	trans			0.35	0.35	0.35	0.35
INTD	prod	trans		0.1	151.1	18.7	546.0
INTD	prod	ser		0.0	25.4	3.1	91.7
INTD	prod	prod		0.5	631.4	78.1	2282.2
INTD	prod	tr		0.1	119.0	14.7	430.0
INTD	prod	ret		0.5	640.8	79.3	2316.1
INTD	prod	OUTSIDE		0.7	936.8	115.9	3386.0
FD	prod		HL	2.4	5333.5	8299.4	11248.2
FD	prod		FL	209.9	15214570	19592660	118836.2
FD	prod		K	125.8	9116165.2	11739400.6	71203.5
beta	prod		HL	0.68	0.68	0.68	0.68
beta	prod		FL	0.20	0.20	0.20	0.20
beta	prod		K	0.12	0.12	0.12	0.12
se	prod		HL	0.05	0.05	0.05	0.05
se	prod		FL	0.11	0.11	0.11	0.11
se	prod		K				
acobb	prod			7.43	7.43	7.43	7.43
acobbse	prod			0.35	0.35	0.35	0.35
INTD	fafh	trans			133.7	127.5	163.2

EMERGENCY PAYMENTS LEWIE

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
INTD	fafh	liv			2485.4	2369.4	3033.7
INTD	fafh	crop			4.3	4.1	5.3
INTD	fafh	prod			8641.4	8238.3	10547.8
INTD	fafh	ser			2504.3	2387.5	3056.8
INTD	fafh	tr			1329.6	1267.6	1622.9
INTD	fafh	ret			2004.4	1910.9	2446.5
INTD	fafh	OUTSIDE			2016.1	1922.0	2460.8
FD	fafh		HL		47696.1	4149.7	13091.3
FD	fafh		FL		1920.1	600112.6	85288.0
FD	fafh		K		1150.5	359571.5	51102.3
beta	fafh		HL		0.68	0.68	0.68
beta	fafh		FL		0.20	0.20	0.20
beta	fafh		K		0.12	0.12	0.12
se	fafh		HL		0.05	0.05	0.05
se	fafh		FL		0.11	0.11	0.11
se	fafh		K				
acobb	fafh				7.43	7.43	7.43
acobbse	fafh				0.35	0.35	0.35
cmin	prod			0.00	0.00	0.00	0.00
cmin	trans			0.00	0.00	0.00	0.00
cmin	ser			0.00	0.00	0.00	0.00
cmin	liv			0.00	0.00	0.00	0.00
cmin	crop			0.00	0.00	0.00	0.00
cmin	fafh			0.00	0.00	0.00	0.00
cmin	tr			0.00	0.00	0.00	0.00
cmin	ret			0.00	0.00	0.00	0.00
cmin	outside			0.00	0.00	0.00	0.00
alpha	prod			0.01	0.01	0.01	0.01
alpha	trans			0.01	0.01	0.01	0.02
alpha	ser			0.06	0.04	0.04	0.02
alpha	liv			0.00	0.05	0.06	0.01
alpha	crop			0.01	0.01	0.03	0.00
alpha	fafh			0.01	0.02	0.02	0.09

EMERGENCY PAYMENTS LEWIE

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
alpha	tr			0.06	0.06	0.06	0.12
alpha	ret			0.80	0.72	0.69	0.56
alphase	prod			0.00	0.00	0.00	0.00
alphase	trans			0.00	0.00	0.00	0.01
alphase	ser			0.01	0.00	0.01	0.01
alphase	liv				0.01	0.01	0.01
alphase	crop			0.01	0.00	0.03	0.00
alphase	fafh			0.00	0.00	0.00	0.03
alphase	tr			0.02	0.01	0.01	0.03
alphase	ret			0.04	0.02	0.02	0.03
endow			HL	8599.7	335717.6	516251.7	705019.4
ROWendow			HL	1885.6	240098.9	335833.7	1045092
Other Transf				41.1	26557.0	40359.0	5147.6
NumberHH				0.2	26.7	41.5	31.6
HHexp				13521.1	10892.7	9931.8	13374.4
HHinc				68284.0	57005.9	56491.2	86423.6
revsh_vil	ret			1.00	1.00	1.00	1.00
revsh_vil	tr			0.95	0.95	0.95	0.95
revsh_vil	ser			0.97	0.97	0.97	0.97
revsh_vil	prod			0.97	0.97	0.97	0.97
revsh_vil	trans			1.00	1.00	1.00	1.00
revsh_vil	fafh			1.00	1.00	1.00	1.00
revsh_row	ret			0.00	0.00	0.00	0.00
revsh_row	tr			0.05	0.05	0.05	0.05
revsh_row	ser			0.03	0.03	0.03	0.03
revsh_row	prod			0.03	0.03	0.03	0.03
revsh_row	trans			0.00	0.00	0.00	0.00
revsh_row	fafh			0.00	0.00	0.00	0.00
VA2IDsh	RET	trans		0.12	0.12	0.12	0.12
VA2IDsh	RET	liv		0.00	0.00	0.00	0.00
VA2IDsh	RET	crop		0.00	0.00	0.00	0.00
VA2IDsh	RET	ser		0.02	0.02	0.02	0.02

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
VA2IDsh	RET	prod		0.05	0.05	0.05	0.05
VA2IDsh	RET	tr		0.15	0.15	0.15	0.15
VA2IDsh	RET	ret		0.18	0.18	0.18	0.18
VA2IDsh	RET	outside		0.92	0.92	0.92	0.92
VA2IDsh	TR	trans		0.00	0.00	0.00	0.00
VA2IDsh	TR	liv		0.00	0.00	0.00	0.00
VA2IDsh	TR	crop		0.00	0.00	0.00	0.00
VA2IDsh	TR	ser		0.00	0.00	0.00	0.00
VA2IDsh	TR	prod		0.00	0.00	0.00	0.00
VA2IDsh	TR	tr		0.01	0.01	0.01	0.01
VA2IDsh	TR	ret		0.01	0.01	0.01	0.01
VA2IDsh	TR	outside		0.01	0.01	0.01	0.01
VA2IDsh	SER	trans		0.00	0.00	0.00	0.00
VA2IDsh	SER	liv		0.00	0.00	0.00	0.00
VA2IDsh	SER	crop		0.00	0.00	0.00	0.00
VA2IDsh	SER	ser		0.00	0.00	0.00	0.00
VA2IDsh	SER	prod		0.00	0.00	0.00	0.00
VA2IDsh	SER	tr		0.00	0.00	0.00	0.00
VA2IDsh	SER	ret		0.02	0.02	0.02	0.02
VA2IDsh	SER	outside		0.01	0.01	0.01	0.01
VA2IDsh	PROD	trans		0.00	0.00	0.00	0.00
VA2IDsh	PROD	ser		0.00	0.00	0.00	0.00
VA2IDsh	PROD	prod		0.00	0.00	0.00	0.00
VA2IDsh	PROD	tr		0.00	0.00	0.00	0.00
VA2IDsh	PROD	ret		0.00	0.00	0.00	0.00
VA2IDsh	PROD	outside		0.00	0.00	0.00	0.00
VA2IDsh	TRANS	trans		0.09	0.09	0.09	0.09
VA2IDsh	TRANS	ser		0.01	0.01	0.01	0.01
VA2IDsh	TRANS	liv		0.00	0.00	0.00	0.00
VA2IDsh	TRANS	prod		0.00	0.00	0.00	0.00
VA2IDsh	TRANS	tr		0.00	0.00	0.00	0.00
VA2IDsh	TRANS	ret		0.00	0.00	0.00	0.00
VA2IDsh	TRANS	outside		0.03	0.03	0.03	0.03

EMERGENCY PAYMENTS LEWIE

VARIABLE	COMM-ODITY	COMM-ODITY	FACTOR	HOUSEHOLD GROUP			
				A	B	C	D
VA2IDsh	FAFH	trans		0.00	0.00	0.00	0.00
VA2IDsh	FAFH	liv		0.01	0.01	0.01	0.01
VA2IDsh	FAFH	crop		0.00	0.00	0.00	0.00
VA2IDsh	FAFH	ser		0.02	0.02	0.02	0.02
VA2IDsh	FAFH	prod		0.06	0.06	0.06	0.06
VA2IDsh	FAFH	tr		0.01	0.01	0.01	0.01
VA2IDsh	FAFH	ret		0.01	0.01	0.01	0.01
VA2IDsh	FAFH	outside		0.01	0.01	0.01	0.01