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Farmers' health and agriculture in low income economies: investigating farm households and wider health interactions in rural Malawi

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Background and motivation of the study

- **Poor smallholder farmers are the locus of critically important health-agriculture linkages through supply of farm labour, capital and the disease and nutritional outcomes that affect their productivity**

- **They also interact with off-farm labour markets, thus affecting households' poverty and food security status, and thus welfare.**

- **Their production, consumption and marketing activities are affected by seasonality of the production cycle – we split the season into 4 periods**

- **Households are also heterogenous, with varying levels of resilience to shocks – seven types of poor farm households are modelled**

Study's objectives

Overall Objective:

To determine the potential impact of ill-health on the welfare of poor rural agricultural livelihoods, through changes in the seasonal supply of agriculture labour and in short-term cash resources

Specifically, the study

1. **Elaborates on the conceptual, theoretical and empirical understanding of the pathways through which health and agriculture interact in poor farm households in low income economies, through a comprehensive review of literature and empirical model formulation**
2. **Extends on the methodological approaches used in modelling and understanding farm households behaviour, specifically the determination of the differential responses to the effects of seasonal ill-health and the resulting welfare changes**
3. **Recommends pro-poor health and economic development policies based on the empirical findings**

1 Methods- Model structure

- **<u>Non-linear programming model</u> of poor Malawian farm households**

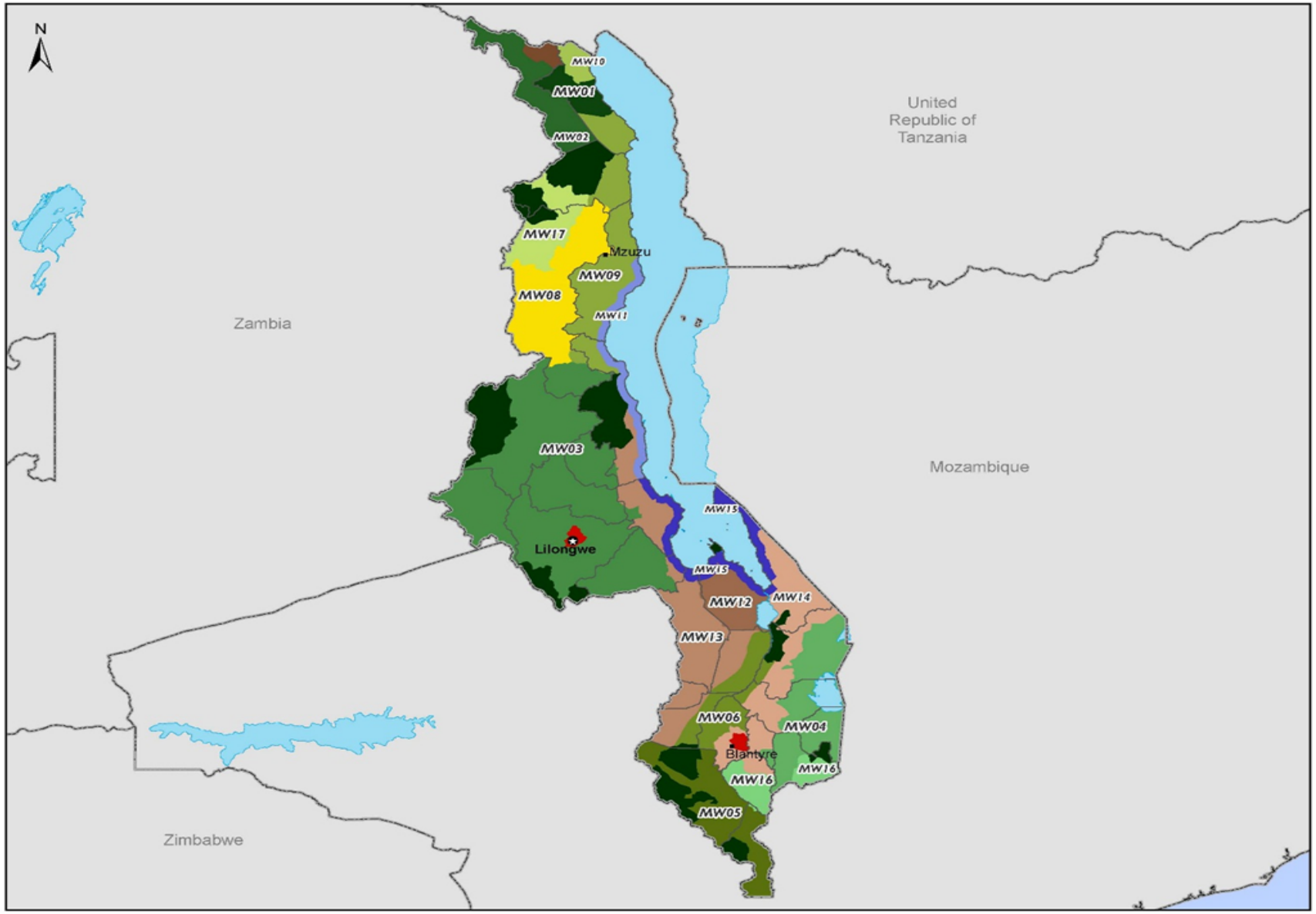
- **Development of the farm household livelihoods model structure follows the approach described in Dorward (2006)**

- **The key elements of a programming model – utility maximisation optimization problem**
  - **Objective function (maximise utility – cash, calories, leisure)**
  - **Assets (land, seasonal labour, pre-seasonal stocks of cash and grain, inputs)**
  - **Constraints (minimum cash and calories consumption per seasonal period)**
  - **Activities (own-farm production of multiple crops and off-farm wage work)**
  - **Input-output coefficients**
  - **Seven representative household types identified using cluster analysis (K-mean technique using LSMS-IHS3)**
  - **Non-separability of production and consumption decisions**

Classification of households using cluster analysis technique

Type of household	Number of households
Dimba	140
Poor female headed	171
Employed	166
Non-farm Enterprises	177
Remittances & other income	141
Credit	100
Poor male headed	553
Total Sample	1448

MALAWI - LIVELIHOOD ZONES



- MW01 - Central Karonga
- MW02 - Chitipa Millet & Maize
- MW03 - Kasungu Lilongwe Plain
- MW04 - Lake Chilwa - Phalombe Plain
- MW05 - Lower Shire
- MW06 - Middle Shire Valley
- MW07 - Misuku Hills
- MW08 - Mzimba Self Sufficient
- MW09 - Nkhata Bay Cassava
- MW10 - Northern Karonga
- MW11 - Northern Lakeshore
- MW12 - Phirilongwe Hills
- MW13 - Rift Valley Escarpment
- MW14 - Shire Highlands
- MW15 - Southern Lakeshore
- MW16 - Thyolo Mulunje Tea Estates
- MW17 - Western Rumphi & Mumba
- National Parks and Reserves
- Urban Areas

- International Boundaries
- Districts
- Lakes
- Capital
- Cities

0 30 60 120 180 240 Kilometers

2 Methods- Implementation of the model procedure

- **Calibration and validation of the base (deterministic) farm household for each type of household – point of reference for the simulation models**

- **Models coefficients estimated from LSMS–IHS3 (2010/2011), and the model formulation and results validated to mimic normal/expected households' production and consumption behaviour**

- **For each household type, we simulate effects of and responses to seasonal losses in unskilled family labour and cash resources due to the effects of malaria (period 1) and HIV/AIDS**

- **Simulate losses in first cropping period, thus study emphasises on planned/strategic approaches to ill-health, and the adjustments on farm plans to minimise the effects of morbidity.**

- **Results show different responses to similar labour and cash losses, by the different types of household, under the alternative simulations scenarios and the consequent welfare changes**

5 Methods -Simulation model scenarios

Assumptions	Sickness Scenarios and adjustments
Base model	High level of background ill-health implicit in the base model
Simulation models (Malaria) •Simulates additional early season ill-health •Assumes out-of-pocket cost incurred in the treatment of malaria in the absence of free health care	Loss of unskilled family labour and cash capital in period 1 due to Malaria (Median and Mean estimates)
Simulation models (HIV/AIDS) •Simulates additional ill-health across all seasonal periods •Incidental expenses incurred by HIV/AIDS patients excluding ART care	Loss of unskilled labour (50% of adult male's labour) in each of the four seasonal periods to the effects of HIV/AIDS

Key findings-1

Descriptive analysis results

- Smallholder farmers in rural Malawi often suffer from bouts of ill-health, particularly malaria (46% of all persons ill in the 2 weeks before the interview)
- Where a productive member is sick, average loss of 6.5 days over two weeks
- Many seek free health care (56%), thus spending on health care is minimal (MK 55 or USD 0.4 per hh per month)
- But labour is abundant - small landholdings, poverty, high population density in an underdeveloped non-farm rural economy, hence off-farm labour demand constrictions
- On-farm labour use is approx. 29% of total labour supply in the peak season
- Off-farm labour use is approx. 3%, and higher in Feb-Mar “hunger” period (4%)

Key findings -2

Base models results:

- Predictive not prescriptive – show best farm plans for utility maximisation
- Cropping patterns comparable to those of smallholder Malawian households-all major crops enter the model
- Production of hybrid maize and fertilizer use is predicted among all households up to the subsidised amount – FISP effect
- Economically better off households opt for input intensive tobacco – higher pre-seasonal capital stocks, while poorer ones do more local maize - cassava intercrop

Simulation models results :

- Modest cash losses (up to $5) lead to reduction in input investment, hence changing cropping patterns, losses in farm and ganyu income, and subsequent welfare losses mainly through the input-output multiplier effects

Key findings -3

- **Welfare impacts of ill-health are transmitted through cash rather than labour losses, and tighter cash constraints results in infeasible results for the PFH**

- **Three basic dynamics in production responses to the effects of morbidity by the household groups**
  1. **cash reduction leads to lower input use thus reducing area under tobacco**
  2. **Reduced high return to capital and land tobacco means poorer households cannot meet future income targets and thus reduce current consumption expenditure**
  3. **In "Dimba", cash losses from less severe malaria prompts reduction of current consumption and marginal increase in inputs to increase tobacco income**

Key findings -4

- **E.g. in the HIV/AIDS scenario, inputs expenditure reduces by between 3% and 19%, while welfare losses are between 4% and 8.5%**

- **Poorer households with no alternative livelihood strategies other than ganyu and low asset holdings have diminished ability to cope with the effects of ill-health, and not only respond by reducing input investment but also by reducing cash and caloric consumption over different time periods**

- **Better off households with alternative livelihoods strategies and with more assets are more resilient to the effects of ill-health, and have greater capacity to manage risk and cope with shocks, and respond only by reducing input investment**

Recommendations for policy

1. **Improved free health care services - we find considerable dependency on the free government health facilities**

2. **Expansion of the social cash transfer programme to target the more vulnerable households, e.g. the poor female headed household group**

3. **Implementation of policies such as "the cash for work" to engage the abundant unskilled rural labour**

4. **In the long-run, implementation of government policies that promote development of a non-farm rural economy, to generate both wage work and self-employment opportunities, to take advantage of the abundant rural supply of labour and reduce poverty.**

Thank you!

Methods - Model structure

<u>Max expected utility using a LES</u>

$$MaxE\ (U) = \sum (C_{j*m} - \gamma_{j*m})^{\beta j*m}$$

Such that for m=1 to 2

$$-t_{jm} + t_{j\,(m+1)} + \sum e_{ijm} x_i + C_{j*m} \leq 0$$

for m=3 to 4

$$-t_{jm} + t_{j\,(m+1)} + \sum e_{ijm} x_i + C_{j*m} \leq D_{jm}$$

for m=4 (closing stock = opening stock)

$$-\ t_{j\,(m+1)} = t_{j\,(m=1)}$$

where

- m are four periods within a year
- j^* is the subset of commodities/ resources directly consumed by the household and for which consumption is included in the objective function: cash consumption by period, consumption of maize (or calorific equivalents from other crops) by period, leisure ('slack' labour) by period, and end of season cash savings
- jm constrained resources j include: land; supply of labour; cash stocks; maize stocks; purchased crop inputs; and post-harvest cash crop stocks in period m
- C_{j^*m} total consumption of commodity j^* in period m
- γ_{j^*m} minimum consumption requirements for commodity j^* in period m
- β_{j^*m} marginal propensities to consume commodity resource j^* in period m
- t_{jm} transfers of resource j from period m to period $m+1$
- e_{ijm} technical and price coefficients of use/ production of resource/commodity j by activity x_i in period m
- x_i the *ith* activity undertaken by the household, $i = 1 \ldots n$. and includes: cropping activities, buying and selling of stocks and labour, and cash and maize grain stock transfers between periods
- D_{jm} are supply constraints on commodity/ resource j in period m