

# Household Production and Dietary Diversity: Implications for Supply Chain Development

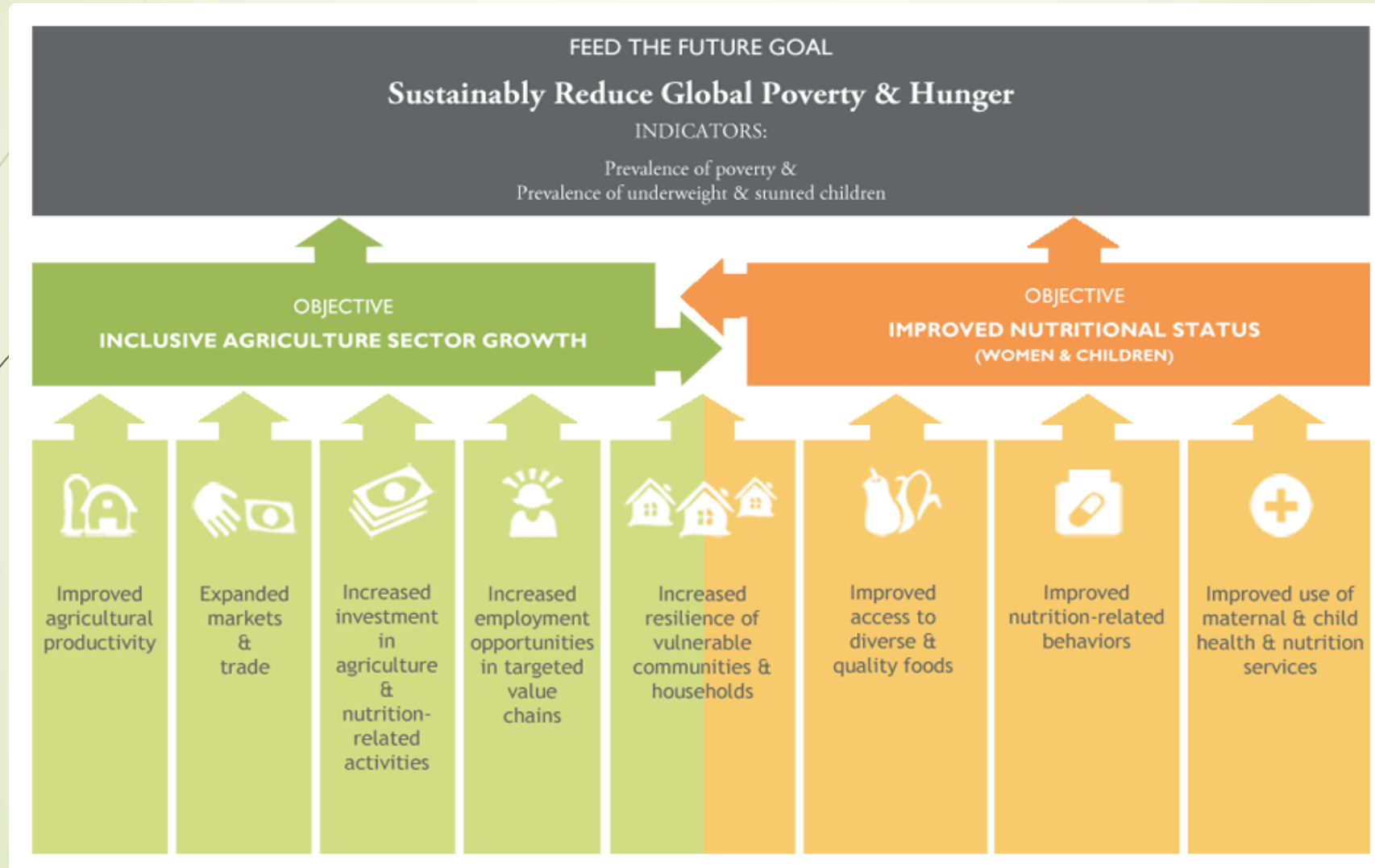


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# Feed the Future Goals





# Household Model

- ▶ The concept of improving nutrition through increasing smallholder returns through value chains can be developed in the household model.

$$\max U(z^*)$$

$$\text{s.t. } F(z, x, k, l) = 0$$

$$w'x \leq (p - \tau)'(z - z^*) + p_L(L - l)$$



# Evidence of Value Chain Interventions Increasing Smallholder Income

- ▶ Sustainable Partnerships to Enhance Rural Enterprises and Agricultural Development (SPREAD) – Coffee in Rwanda
  - ▶ Increase the share of fully-washed coffee marketed through higher value chains.
  - ▶ Average coffee price received in Rwanda/ICA filler coffee price increased significantly with SPREAD
  - ▶ Difference in difference – the control group (households that did not produce coffee commercially) had income -0.5033 lower than coffee growing households (this result was statistically significant at the 0.10 confidence level)
  - ▶ SPREAD resulted in a 14.3 percent reduction in the poverty rate

# Effect of Increased Income on Food Purchases – Workings's Model Results

- ▶ Does participation in SPREAD affect the share of income spent on food?

$$w_F = \tilde{\alpha}_F + \tilde{\beta}_F \ln(E) + \tilde{\alpha}_S E[f(z, \phi)] \\ + \tilde{\beta}_S E[f(z, \phi)] \times \ln(E) + \tilde{\varepsilon}_F$$

- ▶ There is no slippage – participation in SPREAD does not push out home production.
- ▶ No systematic differences between coffee households and non-coffee households

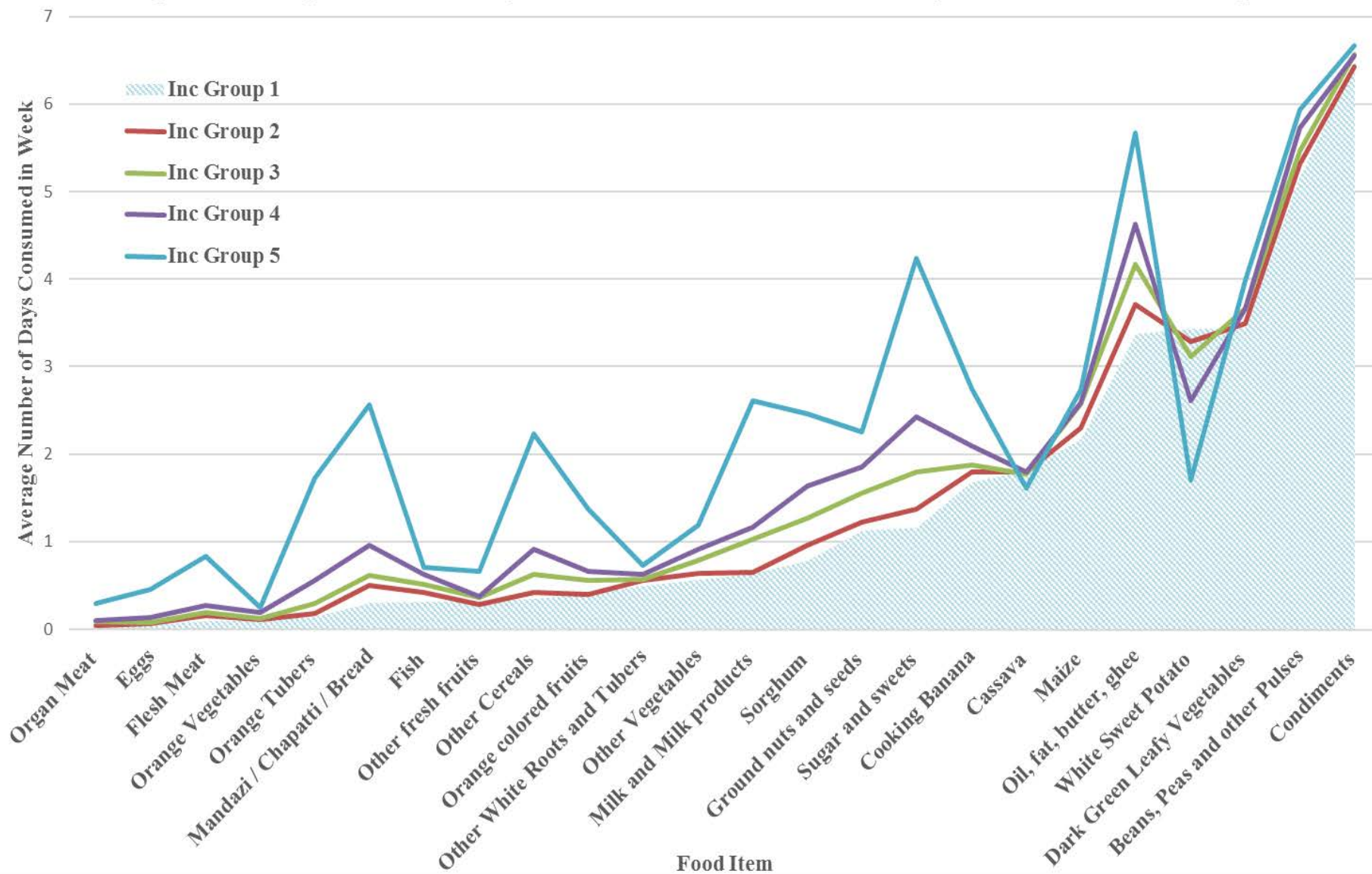


# Dietary Diversity Objective

Analyze nutritional quality of diets relative to **income** status, **prices** and policy

Does **agriculture and food policy** improve smallholder **dietary diversity** in ways that in turn contribute to better health outcomes.

Figure 1: Average Number of Days/Week a Food Item is Consumed by Household Income Group





# Data

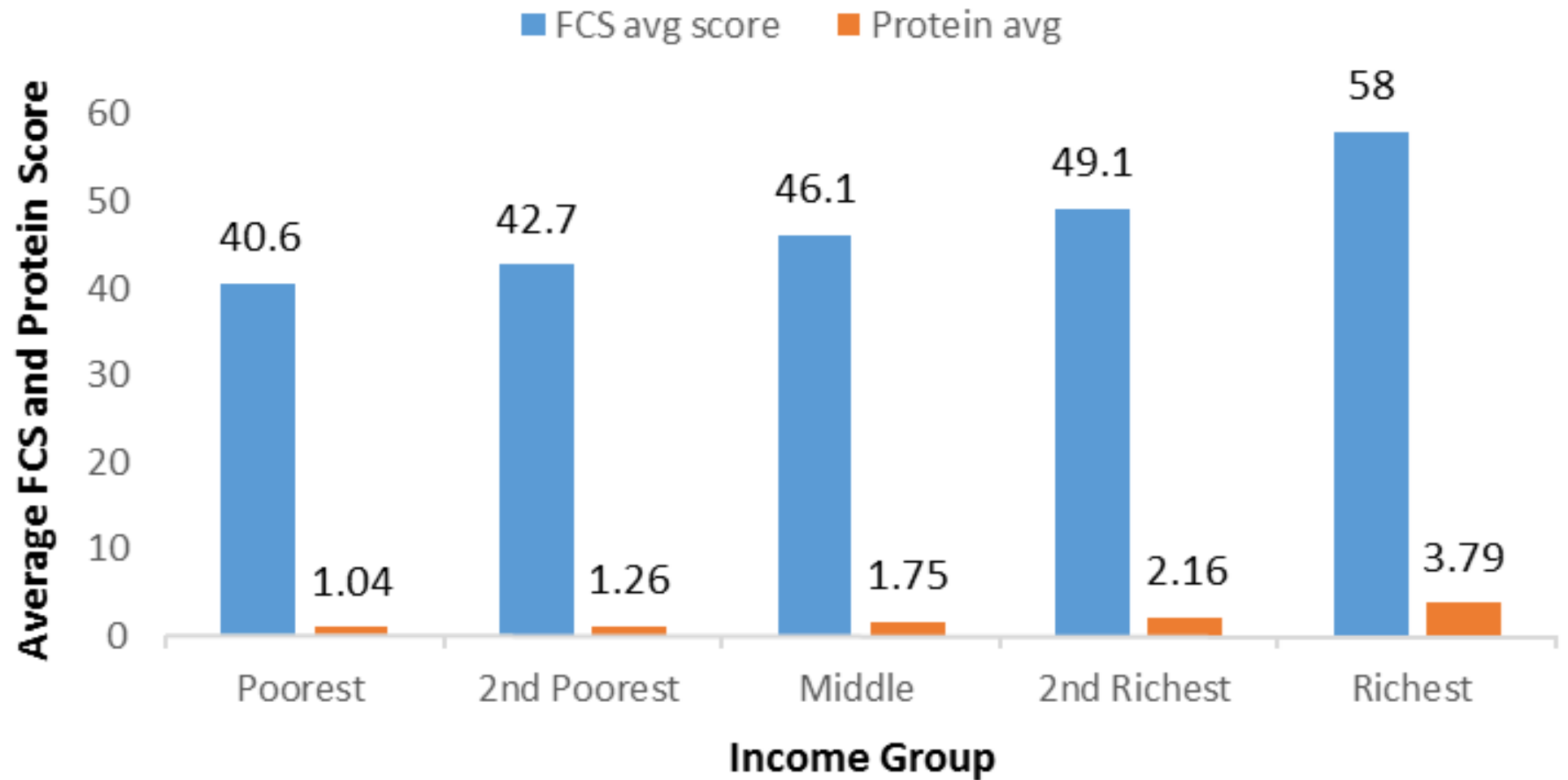
- ▶ Rwanda Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey
  - ▶ Household Questionnaire
  - ▶ 7,000 households in 2012
- ▶ A continuous Food Consumption Score (FCS) was used to measure dietary



# FCS Calculation

<b>FOOD ITEM (FROM SURVEY)</b>	<b>FOOD GROUP CLASSIFICATION</b>	<b>WEIGHT IN CALCULATION</b>
Maize / Maize Meal	Main Staples	2
Sorghum	Main Staples	2
Other Cereals	Main Staples	2
Cassava	Main Staples	2
White Sweet Potato	Main Staples	2
Other White Roots and Tubers	Main Staples	2
Bread	Main Staples	2
Sweet Potato and other Orange Tubers	Main Staples	2
Cooking Banana	Main Staples	2
Beans, Peas and other Pulses	Pulses	3
Dark Green Vegetables	Vegetables	1
Orange Vegetables	Vegetables	1
Other Vegetables	Vegetables	1
Ground Nuts and Seeds	Pulses	3
Orange colored Fruits	Fruit	1
Fish	Meat and Fish	4
Organ Meat	Meat and Fish	4
Flesh Meat	Meat and Fish	4
Eggs	Meat and Fish	4
Oil, fat, butter, Ghee	Oil	0.5
Sugar and Sweets	Sugar	0.5
Milk and Milk Products	Milk	4
Condiments	Condiments	0

**Figure 2: FCS and Protein Consumption by Income Group**



# OLS Food Prices and Expenditure Estimates

VARIABLES	All	Poorest	2nd Poorest	Middle	2nd Richest	Richest
Ln(Cereal Price)	<b>0.055***</b>	0.004	0.013	<b>0.091***</b>	<b>0.096***</b>	0.017
Ln(Root Price)	0.004	0.047	-0.036	-0.069	0.017	0.089
Ln(Banana Price)	<b>-0.034***</b>	<b>-0.072**</b>	-0.023	-0.042	-0.033	-0.032
Ln(Meat Price)	<b>0.157***</b>	<b>0.154***</b>	<b>0.194***</b>	<b>0.173***</b>	<b>0.172***</b>	<b>0.122***</b>
Ln(Bean Price)	<b>-0.225***</b>	<b>-0.379***</b>	<b>-0.283***</b>	<b>-0.224**</b>	<b>-0.222**</b>	<b>-0.253**</b>
Ln(Milk Price)	<b>-0.079***</b>	<b>-0.087*</b>	-0.081	-0.027	<b>-0.150***</b>	-0.074
Ln(Total Exp)	<b>0.119***</b>	<b>0.114***</b>	<b>0.117***</b>	<b>0.090***</b>	<b>0.128***</b>	<b>0.143***</b>

1% increase in the price of Cereals leads to a .05% increase in FCS, impacts middle to 2<sup>nd</sup> Richest groups

# OLS Policy Estimates

VARIABLES	All	Poorest	2nd Poorest	Middle	2nd Richest	Richest
Land Husbandry	0.013	-0.050	0.015	-0.019	-0.004	0.030
Milk	<b>-0.066***</b>	<b>-0.112**</b>	<b>-0.089**</b>	0.004	0.067	<b>-0.102*</b>
VUP	-0.009	-0.045	0.006	0.015	-0.039	<b>-0.071*</b>
Land Consolidation	-0.008	-0.030	0.012	0.025	0.005	-0.043
IDP	-0.005	-0.031	0.021	-0.014	-0.003	-0.002
Structured U	0.010	0.002	-0.024	-0.006	<b>0.059*</b>	0.046
Other Programs	<b>0.025*</b>	-0.016	0.003	0.033	0.027	0.048

If Rwanda Milk Quality Initiative was present in their village led to a 11% decrease in FCS for the poor.

Program reached 12% of villages surveyed (milk testing and training, cooling tanks to manage bacteria and insulated tanks for transportation of milk to increase quality)

# Pseudo FCS/Expenditure Elasticity

- ▶ Do policies that increase expenditures increase dietary diversity?
- ▶ Utilizing the total and food expenditure elasticities for each income group, the amount of additional income required to obtain an acceptable diet was calculated as follows:

$$\varepsilon_{\text{exp}} = \frac{\% \text{ change in FCS}}{\% \text{ change in total expenditure}}$$

## Additional Total Expenditure and Food Expenditure Needed by Income Group to Attain an Acceptable Diet or the Highest FCS diet in Rwanda.

	(1) FCS	(2) FCS Total (Food Only) Expend. Elasticity	(3) Average Total Expend.	(4) Average Food Expend.	(5) Extra Total Expend. Needed for Acceptable Diet	(6) Extra Food Expend. Needed for Acceptable Diet	(7) Extra Food Expend. Needed for Highest FCS
<b>Poorest</b>	40.6	0.11 (0.08)	RF 18,268	RF 6,849	RF 84,466	RF 45,131	RF 36,695
<b>2nd Lowest</b>	42.7	0.12 (0.08)	RF 20,964	RF 8,609	RF 80,988	RF 46,326	RF 36,725
<b>Middle</b>	46.1	0.09 (0.05)	RF 27,972	RF 10,540	RF 107,198	RF 68,594	RF 51,338
<b>2nd Richest</b>	49.1	0.13 (0.12)	RF 40,514	RF 14,272	RF 83,158	RF 31,778	RF 21,924
<b>Richest</b>	58	0.14 (0.13)	RF 87,771	RF 21,472	RF 42,330	RF 11,391	RF 0



# Implications



- Rwandans are price and expenditure sensitive on the demand side and thin markets exist on the supply side that provide little diversity of foods in the rural markets.
- Animal based protein was found to be the limiting factor for acceptable levels of dietary diversity for the poor.
- Policies that positively impact income/prices are important but not sufficient to result in acceptable diverse diets that dramatically improve health outcomes.



THANK YOU !



# OLS Production Estimates

VARIABLES	All	Poorest	2nd Poorest	Middle	2nd Richest	Richest
Own Land	0.027**	0.018	0.050*	0.027	-0.005	0.003
Land Size	0.024***	0.030***	0.016	0.018**	0.015	0.013
Beans Cropped	0.092***	0.140**	0.114**	0.139**	0.093*	0.119***
Maize Cropped	-0.026*	-0.013	-0.028	-0.032	-0.035	-0.107***
SPotato Cropped	-0.023**	-0.002	0.003	-0.014	-0.033	-0.127***
Poultry	0.056***	0.056*	0.059**	0.050	0.048	0.056*
Cattle	0.092***	0.130***	0.062**	0.113***	0.048	0.066**
Irrigation	0.100***	0.101*	0.106*	0.092**	0.073	0.104

Ownland, leads to a 2.7% increase in FCS score