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The Effect of Foreign Direct Investment on Food Security:

A Case Study from Rural Mozambique

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Abstract

Poverty and food insecurity in the sub-Saharan African region have been exacerbated by the worst drought in 23 years, which impacted 25 countries in Southern and Eastern Africa from 2015-2016. In Mozambique alone it was estimated that the 2015-2016 drought resulted in over 1.5 million people becoming food insecure (FAO, 2016). To mitigate the increasing problem of household food insecurity in sub-Saharan Africa, the World Food Program recommends job creation to target the most vulnerable populations. Job creation is often the result of Foreign Direct Investment (FDI). However, critics of FDI often cite concerns of human rights abuses, inadequate working conditions, pollution, sourcing, and revenue flows back to the multinational firm that hinder the sustainable, equitable economic development of the host community. This study analyzed increases in behavioral indicators of household food security amongst employees of an agricultural FDI (New Horizons) in Nampula, Mozambique. The data reveals improvements in financial security and several behavioral markers of household food security amongst employees of the FDI over time. While there is no silver bullet to improving economic development and food security in sub-Saharan Africa, socially responsible, agriculturally-based FDIs like New Horizons could be a missing piece to the puzzle.

Introduction and Literature Review

According to the Food and Agriculture Organization (FAO) of the United Nations, 224 million people in sub-Saharan Africa (SSA) suffered from undernourishment, or a lack of access to a sufficient number of calories and nutrients in 2016 (FAO, 2015). According to a World Food Program study, the main causes of undernourishment globally are low-income levels and food insecurity (WFP, 2016). Poverty and food insecurity, which is a function of the supply of food and the income available for households to purchase their requirements, in sub-Saharan Africa have been exacerbated by the worst drought in that region in the last 23 years, which impacted 25 countries in Southern and Eastern Africa peaking in 2015-2016. Globally, the food security effects of droughts are difficult to mitigate, but sub-Saharan African countries are particularly susceptible to suffering the worst effects of drought due to the large concentration of undiversified economies, which primarily consist of rain-fed agriculture and livestock, with limited infrastructure, and low levels of disposable income (Benson & Clay, 1998). Drought hits the rural poor in Africa the hardest as nearly 90% of sub-Saharan Africa's agricultural products are the result of rain-fed agriculture, which is problematic for ensuring food security and price stability (Rosegrant, Cai, Cline, & Nakagawa, 2002). Mitigating poverty and food insecurity in sub-Saharan Africa is increasingly important because climate scientists have found that droughts in sub-Saharan Africa have intensified in their frequency, severity, and geographical dispersion since 1990 (Masih, Maskey, Mussá, & Trambauer, 2014). Thus food insecurity could increase as function of climate change given its potential to increase food supply and thus food price volatility.

When yields in an agriculturally-based economy are diminished because of a natural disaster like a drought, a region can experience economic shocks, such as fluctuations in the

supply and price of staple crops, such as maize in Sub-Saharan Africa. Given that more than 46.1% of people in sub-Saharan Africa live below the poverty line, at less than \$1.90 per day (CIA Factbook, 2018), even a marginal increase in staple food prices can exacerbate food insecurity both locally and regionally. The combination of drought and its subsequent economic shocks in SSA was estimated to increase the number of food insecure individuals from 11.0 million in 2015 to 23.4 million in 2016 (GC-RED, 2017). FAO released a list of the most food insecure nations resulting from the 2015 drought as Angola, Zimbabwe, Malawi, Madagascar, Lesotho, Swaziland, and Mozambique, all of which have diets which rely on rain-fed maize as their staple crop (GC-RED, 2017).

South Africa, an upper-middle income country was also afflicted by the 2015-2016 drought. The 2015-2016 drought, paired with urban migration and a lack of urban infrastructure in South Africa, has led to increasing stress on water systems (Tatlock, 2006). In South Africa, a reported 22% of the population ran out of money to buy food in 2014 because of the drought (Statistics South Africa, 2016). In the Northwest province, which is agriculturally based, 41% of households ran out of money to purchase food. These numbers independently are concerning but looking at a regional context they are alarming given that South Africa is the wealthiest country in SSA and a food exporter. As such, future droughts in more marginalized areas could have deeper and wider impacts for poverty and food security.

The 2014-2015 drought created two distinct problems for food security in South Africa. First, subsistence farmers produced lower yields due to water shortages and a lack of irrigation so supply decreased. Second, the supply shortage caused prices of agricultural goods to rise markedly, making what food was produced to be out of the economic reach of the poorest of the poor. For example, in 2015 grain prices in South Africa rose by 19.7%. A near 20% increase in

staple food prices in areas which already struggle with food insecurity can push millions into food insecurity, because low-income populations are much more responsive to changes in prices (Braun, 2007). The price of yellow maize more than doubled from 2010 to 2015 when the drought began. The price in 2010 was approximately 1100 rand per ton (approximately 80 USD per ton), which rose to approximately 2250 rand per ton (165.50 USD per ton) in 2015 (AFF, 2016). The very poor in South Africa rely on maize as their staple crop. Food insecurity is a function of the supply of food and the income of households to purchase their requirements. As food prices doubled, and income regionally remained stagnant, food insecurity worsened.

The 2014-2015 drought forced food, specifically maize, which the average South African consumes 222 grams a day of (Ranum, Pena-Rosas, & Garcia-Casal, 2014), prices to substantially increase. Between 2014 and 2015, the drought resulted in maize prices increasing by 41% in the Free State's urban areas and 38% in the North West's urban areas, leading to widespread food shortages because people did not have adequate economic resources or capital to purchase enough food (Yende, 2015). Price increases, specifically on staple crops, have the greatest impact on those already experiencing hunger and poverty (FAO, 2016). If people have sufficient amounts of disposable income from employment, they can lessen the impacts of drought by being able to afford elevated food prices. Over 70 percent of people in sub-Saharan Africa face poor employment opportunities, with over 60-80% of employment in the region originating from the informal market with little to no regulation on compensation, workers' rights, etc. (ILO, 2016).

Drought, such as that experienced in SSA in 2015, contributes to poverty and food insecurity through its effect on agricultural commodity prices. This ultimately leads to lower consumption of staple goods (Zimmerman & Carter, 2003; Holden & Shiferaw, 2004). Increased

commodity prices with no additional increase in per capita income levels identifies the root of food insecurity at the household level during the 2015-2016 drought.

To help solve the increasing problem of household food insecurity in sub-Saharan Africa, the WFP has identified job creation as method to assist the most vulnerable populations persevere through climatic shocks such as droughts. Job creation attempts to provide a stable source of income, which improves household welfare and food security during the highs and lows (shocks) of economic and food production cycles. Job creation in low income countries is often the result of Foreign Direct Investment (FDI).

Foreign, financial investments in low-income countries totaled 1.4 billion US dollars in 1980 (Owusu-Sekyere, Eyden, & Kemengue, 2014). This number grew to 59 billion US dollars in low-income countries by 2016 (UNCTAD, 2017). The World Bank classifies a low-income country as having an annual, per capita income level below roughly \$2.75 per day. A low per capita income level signals that a country may have relatively lower wage rates, and often other attractive characteristics that lower production costs such as relaxed environmental standards for multinational companies which makes foreign investments (OECD, 2002). However, FDI can also be valuable to a host nation in that it has the potential to increase a country's overall Gross Domestic Product (GDP) via job and income creation. Whereas, currently 50-80% of GDP in sub-Saharan Africa originates in the informal market (ILO, 2016), FDI's development of the formal market has the potential to accelerate economic activity and growth by creating jobs, increasing trade, building capital, and introducing new technology (Delay, 2017). However, while FDI can potentially increase a country's GDP in this way, it can also hinder sustainable, equitable economic development if the FDI acts in self-interest and seeks to maximize profits

with most profits flowing out of the host country and back to multinational firms (Dele& Olufemi2016).

In this sense, some cases of FDI relationships in low-income countries are not symbiotic. A multinational firm will invest money in a host country to benefit their business (often to lower production costs), and other sectors of the economy are neglected by the host government in this process. Also known as Dutch Disease, the inflow of foreign investment into one sector of an economy can lead to currency appreciation, decreasing export competitiveness, and a decline in production within other sectors (Owusu-Sekyere et al., 2014). Low/lower-middle-income countries which find new deposits of oil or minerals often have a large inflow of FDI and, if not carefully monitored, can experience Dutch Disease. Thus once the natural resources are mined to depletion and the FDI leaves, the host country is often left with little to show for their mineral extraction. Furthermore, often LIC's will focus the majority of their economic efforts on mineral extract and neglect other parts of the economy such as agricultural production. As such, when the jobs created from the FDI leave the citizens of the host country can be as food insecure as they were prior to the FDI.

Extracting or exploiting resources is often done with little to no regard to the well-being of the native population of the host country. As funds and resources are diverted into the FDI's sector, funds and resources are taken from other sectors which are pivotal to development. When the FDI withdraws from the host country, there can oftentimes be little to show in regards to development improvements (Vissak & Roolaht, 2014). When economic growth through FDI is not positively correlated with improved economic and community development for citizens of the host country, it leads to positive financial investments that are not beneficial to natives of the host country. As such, economic growth (an increase in GDP) can fail to enhance economic

development (improving quality of life) (Delay, 2017). Thus, from a balance sheet standpoint, FDI looks attractive as per capita GDP increases. However; in reality the average citizen of the host country is no better off than prior to the FDI. Both growth (increases in per capita GDP) and development (increases in quality of life) are needed in low-income countries so that the benefits are spread over the many instead of the few. If political elites and oligarchs are the only benefactors of FDI, then one has to question if it was actually beneficial to have hosted the FDI.

Not all FDI negatively impacts host country populations. Global Trade Analysis and Policy (GTAP) simulations reveal that foreign agricultural investments can be beneficial to host country populations in sub-Saharan Africa. Over a span of 2001 to 2011, data were analyzed revealing that foreign agricultural investments resulted in a decline in local food supply due to increased exports, which would lead to an increase in local food prices. However, the loss from higher food prices would be offset by employment and imports would increase as a result (Rakotoarisoa, 2011). Thus, domestically produced food prices may have increased but not as fast as the rate of wage increases from new employment opportunities. In a country with an economy that is primarily agriculturally-based, jobs, resources, and infrastructure provided by an FDI project could be the catalyst for economic growth and development.

Mozambique, which was one of the worst affected countries in the 2015-2016 drought, is a low-income country on the eastern coast of Africa with an economy centered on subsistence agriculture and an emerging mining industry (CIA Factbook, 2018). In Mozambique more than 46.1% of people were living below the national poverty line of 18.40 Metacais per day in 2016, which is the equivalent of \$0.31 USD (CIA Factbook, 2018). As a result of the country's low per capita income levels, 80% of Mozambicans were unable to obtain a nutritionally adequate diet in 2015 (WFP, 2015), meaning they were undernourished. In Mozambique alone, it was estimated

that the 2015-2016 drought resulted in over 1.5 million people becoming food insecure (FAO, 2016). In parts of Mozambique, namely the Nampula and Zambezia, the two poorest provinces of the country, the drought was so severe that it was estimated that more than 10% of subsistence farmers abandoned their harvest of cereals in the 2015 growing season due to low yields (UNDP, 2016).

Mozambique has also recently seen an influx of FDI. In 2017, 48% of Mozambique's GDP was attributed to FDI (The Global Economy, 2017). However, these FDI firms have been seen as a hindrance to sustainable economic growth. Based on an in-depth analysis of South African investments in Mozambique, it appears that investments have been concentrated in the Maputo region due to influence from self-interested agents (Castel-Branco, 2004). These agents appear to be focused on oligopolistic strategies, competition, and globalization for business growth. This sheds light on the potential inequitable spread of resources from investments in Mozambique, in that few may really be benefitting from investments. Castel-Branco found a need for social, sectoral, and regional expansions in investments to include more groups within the spread of investments and link investments with opportunities to reduce economic, working, and social conditions for the majority of the population (Castel-Branco, 2004).

Evidence from The Club of Mozambique, a well-known news source, also reveals that Mozambique is experiencing the effects of Dutch Disease. As previously mentioned, this phenomenon allows FDI operations to leave the country after extracting resources, human capital, and other invaluable resources that negatively impacts the potential for sustainable development within a country. According to the author, who cites an Investment Report from the United Nations Conference on Trade and Development, foreign investment fell by 26% in 2018 due to a national debt crisis (UNCTAD, 2018). The declining rate of foreign investment in

Mozambique is likely due to the country's economic dependence on coal, natural gas, and oil coupled with falling prices for oil in 2018 (The Club of Mozambique, 2018).

An example of an agriculturally-based, holistic FDI approach in Mozambique is New Horizons poultry farm in Mozambique. The farm was founded by Andrew Cunningham of Zimbabwe in 2005. The company is for-profit, and seeks to, “nurture fruitful work through integrating markets, supplies, holistic training and support” (Novos Horizontes, 2019). Since its founding, New Horizons has expanded to partner with three other companies: Eggs for Africa, Frango King, and Mozambique Fresh Eggs to increase its protein offerings in a region which is protein deficient. The farm has provided employment to approximately 500 Mozambicans in the fields of construction, veterinary practice, egg selecting and packaging, as well as managerial positions. Cunningham also employs other local families offsite through an outgrower program which contracts farmers to raise chicks to maturity for the company. New Horizons is unique because the organization is led by business-minded individuals who promote sustainable development of economic, social, and spiritual aspects of the individual employee, his/her family, and the community (VerSteeg, 2010).

To gauge the effectiveness of New Horizons in promoting the sustainable development of economic, social, and spiritual aspects of employees and the community, this study analyzes improvements in food security among employees relative to the length of time employed at New Horizons. A standard instrument of measuring food insecurity levels is the USDA Household Food Security Survey Module (HFSSM), which is an 18-item, three stage design that allows families to self-report experiences and behaviors related to food insecurity due to limited financial resources. It also accounts for other possible reasons for reduced food consumption by specifying “because of a lack of money or the ability to afford food” in each question prompt.

Researchers have since adapted the HFSSM module to fit international communities, such as a study conducted in Bolivia, Burkina Faso, and the Philippines (Quinonez-Melgar, 2006). A team from Ohio State University modified the module to contain questions that gauge the potential reduction of the quantity and quality of their household food consumption. An overall negative correlation in food consumption levels and food insecurity was found in Bolivia. This correlation was found in all food groups, including oils and fats, animal products, and grains and cereals (Quinonez-Melgar, 2006).

A similar study conducted by the International Food Policy Research Institute (IFPRI) addresses methods utilized by development agencies to gauge household food security in globally. The author, Hoddinott, compares measuring individual food intake, household caloric acquisition, dietary diversity, and indices of household coping strategies. The study reveals that the most feasible, low-cost options for measuring household food security are dietary diversity and indices of coping strategies (Hoddinott, 1999). Dietary diversity can be measured through cataloging the number of different foods eaten within a household over time; while coping strategies can be calculated by counting the number of coping strategies used by a household. Coping strategies are outlined in the USDA HFSSM as consuming less of a preferred food, reducing the quantity of food consumed, and skipping meals (Hoddinott, 1999). Due to time restraints and language barriers, coping strategies and indicators of food insecurity were the focus of this study. By measuring indicators of food insecurity amongst employees, we are able to better understand and quantify the impact of FDI on determinants of well-being (in this case, food security) in the host country population to reveal the strength of FDI as a catalyst for development against concerns of exploitation of native populations. If food security is improved

among host country citizens, the case could be made for FDI as a method of sustainable, equitable development amongst New Horizons employees.

This study is timely because it took place at the height of the 2014-2015 drought, when local food prices were at their peak in the Nampula province of Mozambique. The specific study objectives were to observe the relationship between a steady income source, and how that relationship changed as length of employment increased, of income and common coping strategies for food insecure households, as established by the USDA through the HFSSM. Prior research on New Horizons found that before becoming employed by New Horizons, only 21% of employees said they were confident in providing for their families, whereas 95% of employees said they were confident after obtaining a job at New Horizons (Hansen, 2016). However, while some New Horizon employees now feel they can meet their family's overall needs, it has yet to be determined whether or not they have an adequate level of food security across time and during extreme food price shocks such as drought. That is, just because someone can provide basic needs most of the time does not indicate they have sufficient food supply when food prices spike, like in time of drought. The nexus of this project is a case study gauging how foreign agricultural direct investments can raise household incomes, which can provide more stable food consumption even in the face of suddenly increased food prices. Results from this study can be used to give development agencies, NGOs, and local and federal governments information as to how promoting foreign agricultural investments can improve people's financial conditions and food security levels.

Methods

A survey aimed at eliciting food security and its relationship with New Horizons was created by four University of Arkansas students in May of 2016. The survey instrument was based on a modified version of the USDA Household Food Security Survey Module (HFSSM). The HFSSM was developed to gauge the severity of various indicators of food insecurity. The survey module combined a variety of factors to gauge the presence of food insecurity including household conditions, events, behaviors, and subjective reactions. Examples of this include anxiety related to insufficient food consumption, the experience of not having food, substituting fewer or cheaper foods than usual, and instances of reduced food intake (Bickel, Nord, Price, Hamilton, & Cook, 2000).

The survey was developed using Qualtrics software. Qualtrics was chosen due to its capability to work and save responses while in “offline” mode, meaning it could be used in rural areas with no access to the internet. The survey was distributed in May and June of 2016 to New Horizons employees in the Nampula province of Mozambique. The official language of Mozambique is Portuguese, but many people in rural communities of Nampula speak a local dialect Makhuwa, which required using two translators. The team collected 127 responses related to improvements in quality of life, food security, financial stability, and access to medical care over the course of three weeks. The questions and results were then split into three topics: economic improvement, food security, and healthcare since the employees started working at New Horizons.

The purpose of the survey was to determine if food security had improved amongst employees of New Horizons, even during times of high food prices which resulted from the drought, based on the number of years of employment, defined as:

- 1) Increased percentage of income spent on food. Ideally, this would decrease as time employed at New Horizons increased. As total, proportionate expenditures on food decreases, the better a household is at absorbing shocks in food prices.
- 2) Increased number of people supported. As income increases in SSA, a confounding factor to food security can often unfold, households begin caring for extended families and neighbors. Thus, income can increase and food security could remain stagnant if a household starts providing food for additional people.
- 3) Decreased percentage of skipped meals due to lack of money. Ideally, this would decrease as time employed at New Horizons increased. This could be attributed to increased income or increased savings.

These questions were derived from the USDA's Household Food Security Survey Module in conjunction with the aforementioned modified international studies conducted by Bickel (2000), Quinonez-Melga (2006), and Hoddinott (1999), to elicit the conditions, events, behaviors, and subjective reactions common in food insecure households (Bickel et al, 2000). Survey questions specific to this study (found in Appendix 1) included the amount of income spent on food, the types of food consumed, and potential coping strategies for food insecurity. The survey in its entirety, including information on household demographics, financial stability, and healthcare can be found in Appendix 1.

Three models were specified from the survey questions to test the implied hypotheses in the three objectives listed above: (1) the potential increase in income spent on food relative to the number of years worked at New Horizons, (2) the probability of providing food for more people relative to the number of years worked at New Horizons, and (3) the probability of decreasing the size/skipping meals relative to the number of years employed at New Horizons.

Four independent variables are used in the modeling of the three objectives: (1) $\ln years_{nh_i}$ represents the natural log of the number of years employee i worked at New Horizons, $numchildren_i$ represents the number of children in household i , $female$ is a dummy variable which represents gender of responder i (1=female, 0=male), and $numhouse_i$ represents the total number of people in household i .

These models used the independent variable $\ln years_{nh_i}$ to measure the number of years (estimated as the natural log of number of years) respondent i worked at New Horizons. The number of years employed at New Horizons is used to estimate how indicators of food insecurity are impacted relative to the number of years the employee has worked for New Horizons. The estimated models indicate how income levels and food insecurity are affected relative to years formally employed.

Three logit regression models were estimated measure the impact of determinative factors on the three objectives. The models are:

$$P(y = 1|X) = 1/(1+EXP(-1*(c_1 + \beta_2 \ln years_{nh_i} + \beta_3 numchildren_i + \beta_4 female_i + \beta_5 numhouse_i)))$$

where β is a vector of parameters to be estimated. Table 1 defines the dependent and independent variables. Table 2 gives the specification of each model. Table 3 displays the estimated coefficients which were estimated using Eviews[®] 8.0 software. Table 4 displays the marginal effects from each model which can be interpreted as the estimated change in probability for a one-unit increase of each independent variable.

Results and Discussion

Table 1 and Table 2 introduce the models that were utilized, with Table 1 being Variable Names and Definitions and Table 2 being Model Specifications. As such, Table 1 and Table 2 can be used to better understand the models that were designed within the study. More specifically, Model 1 measures the likelihood that employees purchased greater quantities of food with income generated from employment at New Horizons. Model 2 determines if employees could provide food for additional people in their household after obtaining employment at New Horizons. Model 3 estimated the likelihood families were skipping or cutting the size of meals.

Table 3 introduces the overview statistics, while Table 4 and Table 5 introduce results from the logit model and the marginal effects, respectively. Figure 1 displays a slightly more intuitive overview and discussion of the results. Figure 1 shows the estimated probability of the increase in income from formal employment at New Horizons being spent on food items; estimated probability of an increase in the number of people provided for as a result of formal employment at New Horizons; and probability of a change in frequency of the reduction in size of meals or skipping meals altogether after becoming employed at New Horizons.

Table 1.

Variable Names and Definitions

<u>Dependent variables</u>	<u>Definition</u>
<i>NewIncome</i>	Change in percentage of income spent on food
<i>ProvideFood</i>	Change in number of people provided food for since starting employment at New Horizons
<i>CutMeal</i>	Change in number of meals skipped or reduced in size
<u>Independent variables</u>	<u>Definition</u>
<i>lnyearsnh</i>	Logarithm of years employed at New Horizons
<i>numchildren</i>	Number of children (less than 18 years old) in household
<i>female</i>	Has value “1” if respondent female, 0 otherwise
<i>numhouse</i>	Number of people living in household

Table 2.

Model Specifications

<u>Model #</u>	<u>Dependent Variable</u>	<u>Independent Variables</u>	<u>Dependent Variable Names</u>
Model 1	Amount of Income Spent on Food Increased	<i>lyearsnh, numchildren, female, numhouse</i>	<i>NewIncome</i>
Model 2	Number of People Provided For Increased	<i>lyearsnh, numchildren, female, numhouse</i>	<i>ProvideFood</i>
Model 3	Number Skipped Meals Increased	<i>lyearsnh, numchildren, female, numhouse</i>	<i>CutMeal</i>

Table 3.

Overview Statistics

Variable	Mean	Standard Dev	Min	Max	Percentage
Male	-	-	-	-	86.61
Household Size	5.82	2.39	2	15	-
Number of Children	3.37	2.46	0	13	-
I was confident in providing for my family before NH					
Yes	-	-	-	-	27.56
Maybe	-	-	-	-	4.72
No	-	-	-	-	66.14
I am confident in providing for my family now					
Yes	-	-	-	-	71.65
Maybe	-	-	-	-	16.54
No	-	-	-	-	10.24
I provide for more people now working at NH	-	-	-	-	86.61
If yes, how many more people?	3.31	2.42	0	12	-
I provide these people with					
Food	-	-	-	-	74.8
Shelter	-	-	-	-	8.66
Education	-	-	-	-	20.47
I was able to save money before NH	-	-	-	-	29.13
I am able to save money now working at NH	-	-	-	-	59.06
Most of my new income has gone to					
House	-	-	-	-	24.41
Food	-	-	-	-	51.18
Education	-	-	-	-	11.02
Transportation	-	-	-	-	3.94
Reinvest in Farm	-	-	-	-	4.72
I always get the type of food I want to eat	-	-	-	-	50
If not, why not?					
Not enough money	-	-	-	-	90.95
Too hard to locate	-	-	-	-	4.76
On a diet	-	-	-	-	0
Type of food isn't available	-	-	-	-	3.17
Good quality isn't available	-	-	-	-	0
What was staple in diet before NH					
Meat	-	-	-	-	2
Produce	-	-	-	-	54.33
Cassava	-	-	-	-	47.24
Rice	-	-	-	-	8
Meal	-	-	-	-	38
What was staple in diet after NH					
Meat	-	-	-	-	6.3
Produce	-	-	-	-	3.15
Cassava	-	-	-	-	10
Rice	-	-	-	-	20
Meal	-	-	-	-	60
Before NH how many meals/day	2.26	0.659	1	4	-
After NH how many meals/day	2.62	0.656	1	4	-
I eat more meat now working for NH	-	-	-	-	66.14
Before NH, I cut the size of meals	-	-	-	-	51.96
After NH, I cut the size of meals	-	-	-	-	26.77
I have a budget	-	-	-	-	48
I get most of my food from					
Home garden	-	-	-	-	8.66
Marketplace	-	-	-	-	79.53
If my income increased I would devote more to	-	-	-	-	92.92
I would buy					
Meat and eggs	-	-	-	-	17.32
Fruits and Veggies	-	-	-	-	11.81
Meal	-	-	-	-	39
Cassava	-	-	-	-	0
Rice	-	-	-	-	24
This has improved the most for me since NH					
Food Increase	-	-	-	-	22
Medical Care	-	-	-	-	0.06
Home Improvements	-	-	-	-	6
Education	-	-	-	-	0.05
Transportation	-	-	-	-	2.36

Table 4.

Estimated Logit Coefficients for Models 1, 2, and 3 (no intuitive interpretations, other than the signs)

<u>Variable</u>	<u>NewIncome</u>	<u>ProvideFood</u>	<u>CutMeal</u>
Constant	0.00697	0.171	-1.37*
lnyearsnh	-0.779*	1.22	0.117
numchildren	-0.137	-0.0306**	-1.20
female	0.0929	-0.275	0.392
numhouse	0.139	0.233	0.118

*indicates a statistically significant result at $P < .05$

**indicates a statistically significant result at $P < 0.01$

Table 4 provides the estimated change in probability of increasing the amount of food purchased for a one unit increase in *lnyearsnh* Model 1; the estimated change in probability of providing for more people as a function of time employed at New Horizons for Model 2, and the estimated change in probability of not skipping or cutting the size of meals as a function of time employed at New Horizons for Model 3. These estimated marginal effects are evaluated at the sample means of years worked at New Horizons from each logit model. All models measure the responses of all 125 participants.

Model 1 measures the likelihood that employees purchased greater quantities of food with income generated from employment at New Horizons. That is, when people became employed at New Horizons, did they use this new income to purchase food? Further, we wanted to analyze how that probability changed as employees years at New Horizons increased. That is, would an employee who worked at New Horizons 10 years use the same percentage of his/her money to purchase food as someone who had been working at New Horizons just one year? The sample revealed a significant ($P < 0.05$) negative relationship between years worked at New Horizons and increased spending on food. We can infer that as the number of years worked at New Horizons increases, the percentage of income spent on food decreases. This implies that once employees are established at New Horizons, their basic food requirements are being met and they are using their disposable income on other things, possibly home improvements or schooling for their children. This inverse relationship could also indicate that as food price shocks (increases) occur (attributed to drought or exogenous policies), those who have had formal employment longer would be better able to absorb these shocks.

The marginal effects for the variable *lnyrsnh* in Model 1 was estimated to be -0.194, which implies that there is a strong negative relationship between a one-year increase in the

independent variable (the number of years employed at New Horizons) and a probability of increased spending on food¹. This marginal effect is significant at the ($P < 0.05$) level. This finding could be explained by many factors. For instance, if income changes, food consumption may not. If income goes up, the relative proportion of income spent on food would go down but the absolute amount would not.

Model 2 determines if employees could provide food for additional people in their household after obtaining employment at New Horizons. This is a common behavior of families with stable income and increased food security in sub-Saharan Africa (Bickel, G. et al., 2000). All independent variables (*lnyearsnh*, *female*, *numhouse*) besides *numchildren*, or the number of children living in the household, were found to be insignificant ($P > 0.10$). Marginally significant results ($P < 0.10$), although negative, were found for the number of kids living in the household relative to the number of years worked at New Horizons. An intuitive interpretation is difficult to obtain. Other than the negative relationship, it appears to suggest that as the number of children in a household increases, the number of people provided for outside of the family decreases. However, this finding in Model 2 has little significance with a marginal effect of only -0.00369, meaning that only a very small change in probability occurs with the addition of one more child. Also for Model 2, as seen in Table 4, the marginal effects for independent variable *lnyearsnh* were significant ($P < 0.10$) with a value of 0.147. Our results indicate a significant ($P < 0.05$), positive relationship between the increase in years worked at New Horizons and number

¹ We cannot interpret -0.194 as the marginal increase of an additional year because the independent variable, *lnyearsnh*, is in logarithms. At the mean number of years, 3.7, the marginal effect for new income would be $-0.194/3.693 = -0.0525$. Similar computations could be done for the coefficients of *lnyearsnh* in Models 2 and 3.

of people provided for. This finding is a positive indicator for FDI's ability to improve overall food security among members of rural communities as the result of spillover effects from a family member or friend becoming formally employed as a result of FDI.

Model 3 estimated the likelihood families were skipping or cutting the size of meals (dependent variable *cutmeal*) which is a common coping mechanism in food insecure households (Hoddinott, J., 1999). The independent variables were insignificant meaning that none of the defined variables (*lnyearsnh*, *numchildren*, *female*, *numhouse*) influenced employee's decision to cut or reduce the size of meals. However, the constant variable is significant at -1.37, which indicates a significant ($P < 0.05$) indication that something changed in the frequency of employees cutting or reducing the size of meals. Given that the percentage of employees cutting meals declined from 52% to 26% at ($P < 0.01$), it is apparent that food security amongst employees has improved but we failed to identify the root cause of improvements.

Table 5.

Estimated Marginal Effects²

<u>Variable</u>	<u>NewIncome</u>	<u>ProvideFood</u>	<u>CutMeal</u>
lnyearsnh	-0.194*	0.147**	0.0231
numchildren	-0.0341	-0.00369	-0.0237
female	0.0231	-0.0357	0.0820
numhouse	0.0346	0.0280	0.0232

*indicates a statistically significant result at $P < .05$

**indicates a statistically significant result at $P < 0.01$

² (How much probability of improvements change if there were a one-unit increase in the independent variable)

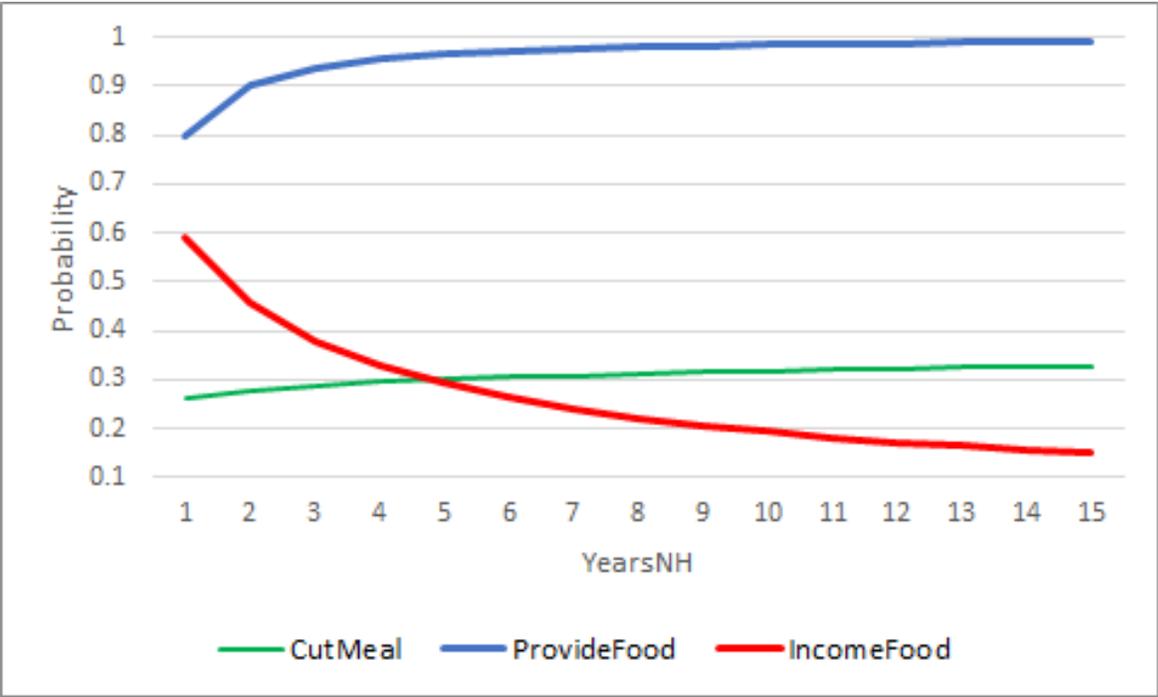


Figure 1. Estimated probability of the increase in income from formal employment at New Horizons being spent on food items (shown in red). Estimated probability of an increase in the number of people provided for as a result of formal employment at New Horizons (shown in blue). Estimated probability of a change in frequency of the reduction in size of meals or skipping meals altogether after becoming employed at New Horizons (shown in green).

Figure 1 illustrates the marginal effects, or percent increase in success, in dependent variables *NewIncome* (an increase in the percentage of income spent on food), *CutMeal* (the likelihood that families were cutting or skipping meals), and *ProvideFood* or an increase in the number of people provided for relative to a one-year increase in the independent variable *lnyearsnh*, which is the years worked at New Horizons. These graphs were derived from the coefficients in Table 3.

IncomeFood, represented by the red line in Figure 1, represents the estimated probability that income from formal employment would be used to purchase food, based on the number of years worked at New Horizons. The figure shows a steady decline in the total percentage of income spent on food. For example, the probability of employees using additional income to purchase food in year 1 was approximately 62.5%, and in year 10 the probability fell to approximately 20%. This substantial reduction in probability makes the case for New Horizons providing financial stability and increasing food security by possibly enabling its employees to better absorb price fluctuations in food. This could be the result of a steady source of formal income, which allows the family to become more financially stable and have more disposable income to devote to other areas such as housing, transportation, and education. It could also be because the relative percentage of income spent on food remained constant as income levels rise.

ProvideFood, represented by the blue line in Figure 1, shows the observed probability of providing food for more people relative to the number of years worked at New Horizons. The model reveals an increase from years 1 to 7, where the effect appears to plateau. The minimal change in probability, which causes the function to flatten, is likely the reason for an insignificant logit model as seen in Tables 3 and 4. In year 1 approximately 80% of employees were providing food for more people than they did prior to working at New Horizons, while in

year 7 at the plateau approximately 95% of employees were providing for a larger number of people. This increase in providing food for more people within the first seven years of formal employment allows us to infer—at least in this case study—foreign direct investment can have spillover effects on employees' abilities to provide for their families and communities.

Lastly CutMeal, represented by the green line in Figure 1, displays the almost constant estimated probability of employees reducing the size of meals for themselves or their families, or skipping meals altogether after becoming employed at New Horizons. This result was surprising, in that there was a slight increase in the probability of cutting and skipping meals within the first two years of employment followed by a plateau around 30%. In year 1, approximately 25% of employees were cutting the size of meals, which increases slightly in years 2 and 3 to the 30% level. While this is a nominal increase in percentage, this figure points to the existence of food insecurity in the community even amongst those with formal employment. The existence of food insecurity amongst those with employment opportunities reveals the need for further assistance and development in the Nampula region, which could be done through more FDIs. This counterintuitive result could also be a function of the fact that it was found that New Horizons employees also provided for additional family members at an increasing rate as time of employment increased. Thus, while food intake per capita decreased those who were provided food increased. We also caution that the coefficients of *lnyearsnh* is statistically insignificant so that these findings could be due to nothing more than random fluctuations.

Conclusions

One of the most pressing issues related to international development efforts in sub-Saharan Africa is improving household food security. International agencies and governments use a variety of approaches to reduce food insecurity levels. Activities range from subsidizing staple food products, to funding agricultural research and development, and to education initiatives. This study analyzed the utilization of a Foreign Direct Investment to increase food security in a region through economic development via job creation, formal employment, and consistent income. The goal of the FDI, New Horizons, was to enhance financial wellbeing of the community in province of Nampula, Mozambique. Our results reveal there is a significantly ($P < 0.05$) increased probability of employees providing food for more people within the first two years, with almost 100% of employees providing for more people after two years of formal employment. This seems to indicate there are spillover benefits from employment. Given that providing for more people in the community is an indicator for food security in sub-Saharan Africa. This increased probability suggests that the longer a person is formally employed by an FDI in the low-income world, the more likely they are to be food secure.

Another behavioral measure of household food security is the frequency of skipping or reducing the size of meals so that everyone has a portion of food to consume within the household. This is common amongst parents who do not have access to enough food for the entire family. The results show that employees of New Horizons are skipping or cutting the size of meals less often than before they obtained employment, with the percentage falling from 52% to 26% before and after obtaining employment at New Horizons. However, all the independent variables were insignificant, as seen in Table 2, meaning we failed to identify the cause of

reductions amongst employees. As such, it can be assumed FDI has a positive effect on food security in rural communities, but the reason is yet to be identified.

There are several other measures of household food security available: the percentage of income spent on food over the range of observed years employed at New Horizons was also measured. Our results indicate a steady decline in the percentage of income spent on food. This indicates that as employees stay with New Horizons, over time their basic food needs are being met and their disposable income is being spent on other goods potentially things such as housing improvements or schooling for their children. However, given that employees' income levels either stayed the same or increased over time, it can be assumed that the relative percentage of income spent on food remained the same or declined due to an increase in disposable income.

This study could be improved by modifying the survey to include a subset of people in the community who were unaffiliated with New Horizons. The changes in people's lives outside of New Horizons were not accounted for, so it is not known whether there were other, external forces that may have improved food security within the community. Ideally, we would have access to accurate census data from the Nampula region to compare the average population to our sample.

These results appear to show that people who worked for New Horizons experienced a rapid improvement in food security over the first few years of employment. This is likely because FDIs provide an avenue for formal employment within a community, which many people in sub-Saharan Africa currently cannot access. Over time, as revealed in this study, formal employment can improve financial security and several behavioral markers which point to increased household food security amongst employees. While there is no silver bullet to improving overall food security in sub-Saharan Africa, holistic, agriculturally-based FDIs like

New Horizons could be a missing piece to the puzzle. As such, New Horizons serves as a case study for international institutions, governments, and agencies looking to employ a less common method of improving international food security in rural communities.

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Appendix A

Survey

Q1. Are you willing to participate in a survey assessing food security and economic wellbeing in Northern Mozambique?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey.

Q2. We are interested how your economic well-being and food security has changed since starting employment at New Horizons. The information collected here will be used to evaluate the effect of job creation in Northern Mozambique. Confidentiality: all information will be recorded anonymously with use of an assigned number. Right to withdraw: you are free to refuse in the research or stop the s at any time. If you have questions or concerns about this study, you may contact llnalley@uark.edu. For questions or concerns about your rights as a research participant, please contact Ro Windwalker, the University's Compliance Coordinator, at 1+(479) 575-2208 or by email at irb@uark.edu. Thank you for your participation!

Q3. What is your gender?

- Male (1)
- Female (2)

Q4. Are you over 18?

- Yes (1)
- No (2)

Q14. Do you work for New Horizons?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q5. Where do you live?

- Nampula (1)
- Rapale (2)

- Nicala (3)
- Other (4)

Q6. Were you born in Mozambique?

- Yes (1)
- No (2)

Q86. If not, where were you born?

- Zimbabwe (1)
- Congo (2)
- Tanzania (3)
- Rwanda (4)
- Burundi (5)
- Other (6)

Q7. If you are not from Mozambique, why did you leave?

- War (1)
- Money (2)
- Better economic opportunity (3)
- Education (4)
- Political instability at home (5)
- Obtained a job here before leaving (6)

Q91. How much formal schooling have you received?

- None (1)
- Some Primary Education (2)
- Primary Education (3)
- Secondary Education (4)
- Higher Education (5)

Q8. How many people live in your household?

Q9. How many children do you have?

If How many children do you have? Is Equal to 0, Then Skip To Do you work for New Horizons?

Q10. If you have children, how many of them go to school?

If If you have children, how m... Is Equal to 0, Then Skip To Would you like to see your children
r...

Q11. Do your kids have knowledge about health?

- Yes (1)
- No (2)

Q15. How many years have you worked for New Horizons?

Q16. Did you have a formal job and income before coming to work for New Horizons?

- Yes (1)
- No (2)

Q17. Did you feel confident in the ability to provide food for your family before working for
New Horizons?

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)

Q18. Do you feel confident in the ability to provide food for your family now?

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)

Q19. Do you currently provide for more friends/family since working for New Horizons?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Have you made improvements to your ho...

Q20. If so, how many additional people?

Q89. If so, what do you provide to these people?

- Food (1)
- Shelter (2)
- Education (3)

Q21. Have you made improvements to your home since you started working for New Horizons?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Since working at New Horizons have yo...

Q22. If yes, select all that apply:

- Concrete Wall (1)
- Tin Roof (2)
- New House (3)
- New Rooms (4)
- Built a Well (5)
- Electricity (6)

Q23. Since working at New Horizons have you changed your mode of transportation?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Were you able to save money before wo...

Q24. If yes, select what you for transportation use now:

- Bike (1)
- Walk (2)
- Car (3)
- Carpool (4)
- Motorcycle (5)
- Bus (6)

Q25. What type of transportation did you use before?

- Bike (1)

- Walk (2)
- Car (3)
- Carpool (4)
- Motorcycle (5)
- Bus (6)

Q26. Were you able to save money before working at New Horizons?

- Yes (1)
- No (2)

Q27. Are you able to save money now?

- Yes (1)
- No (2)

Q28. Do you think you are more likely to send your children to school now that you work for New Horizons?

- Yes (1)
- No (2)

Q29. Since you began working for New Horizons, where has the majority of your newly acquired income gone to?

- House (1)
- Increase in Food (2)
- Education (3)
- Transportation (4)
- Reinvest in the Farm (5)

Q92. Do you always get the types of food that you want to eat?

- Yes (1)
- No (2)

Q35. If not, why do you not get the types of food that you want to eat?

- Not enough money for the kinds of food we want (1)
- Too hard to get to the store (2)
- On a diet (3)

- The kinds of food we want aren't available (4)
- Good quality food isn't available (5)

Q42. Before working for New Horizons, what was the main part of diet?

- Meat (1)
- Produce (3)
- Cassava (4)
- Rice (5)
- Meal (6)

Q43. After working for New Horizons did you ever rely on foods that are low in nutritional value to feed your family because you were running out of money to buy food?

- Meat (1)
- Produce (2)
- Cassava (3)
- Rice (4)
- Meal (5)

Q44. On average, before working for New Horizons how many meals per day did you eat?

- 1 (1)
- 2 (2)
- 3 (3)
- 4+ (4)

Q45. On average, after working for New Horizons how many meals per day do you eat?

- 1 (1)
- 2 (2)
- 3 (3)
- 4+ (4)

Q46. Does your family consume more meat now that you work for New Horizons?

- Yes (1)
- No (2)

Q47. Before working for New Horizons, did you ever cut the size of you or your children's meals because there wasn't enough money for food?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To After working for New Horizons, did y...

Q48. If yes, how many times per week did you cut the size of you or your children's meals because there wasn't enough food?

Q49. After working for New Horizons, did you ever cut the size of you or your children's meals because there wasn't enough money for food?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Before working for New Horizons, did ...

Q50. If yes, how many times per week did you cut the size of you or your children's meals because there wasn't enough food?

Q51. Before working for New Horizons, did you or your children ever skip a meal because there wasn't enough food?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To After working for New Horizons, how m...

Q52. If yes, how many times per week did you skip a meal because there wasn't enough food?

Q53. After working for New Horizons, did you or your children ever skip a meal because there wasn't enough food?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Do you have a budget for food?

Q54. If yes, how many times per week did you or your children skip a meal because there wasn't enough food?

Q55. Do you have a budget?

- Yes (1)
- No (2)

Q56. Where do you get most of your food from?

- Homegrown (1)
- Market (2)
- Other (3)

Q57. If your income increased, would you devote more of it to food?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Do you always have clean drinking wat...

Q58. If so, what foods would you use the extra money to buy?

- Meat and eggs (1)
- Fruits and vegetables (2)
- Meal (3)
- Cassava (4)
- Rice (5)

Q59. Do you always have clean drinking water available for you and your family year round?

- Yes (1)
- No (2)

Q60. Where do you get your water?

- River (1)
- Bucket Well (2)
- Pump (3)

Q61. Have you been to the doctor more, less, or the same for sickness since you began working for New Horizons?

- More (1)
- The Same (2)
- Less (3)

- Never (4)

Q93. Have you been to the doctor more, less, or the same for checkups since you began working for New Horizons?

- More (1)
- The Same (2)
- Less (3)
- Never (4)

Q62. Where do you and your family typically go when you are sick?

Q64. Have you or anyone in your family gone to the hospital?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Where was your last child born?

Q65. If so, why did you go to the hospital?

Q66. Where was your last child born?

- Hospital (1)
- Home (2)

Q67. Have you had a biological child die?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To If you know someone who is sick, has ...

Q68. If so, how many?

Q69. If you are sick, would it affect your ability to go get food?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Block

Q71. What has improved the most since working at New Horizons?

- An Increase in Food (1)
- Medical Care (2)
- A Better Home (3)
- Education (4)
- Transportation (5)

Q72. Are you an outgrower?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q87. Would you like to see your children raise chickens?

- Yes (4)
- No (5)

Q88. Why?

Q74. How many birds did you start with when you began working for New Horizons?

Q76. What aspect of your farm would you like to improve to make more money?

Q94. What would you improve about New Horizons?

Q77. Does it affect the well being of the crops or chickens when someone in your family is sick?

- Yes (1)
- No (2)