Spring 5-14-2020

Estimating Treatment Effect Heterogeneity in a Comprehensive Microenterprise Intervention

Mary Gathungu
gathunguwanjah.gw@gmail.com

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Gathungu Mary Wanja

Department of Economics
University of San Francisco
2130 Fulton St.
San Francisco, CA 94117

Thesis submission for the Master of Science Degree
in International and Development Economics

e-mail: mwgathungu@dons.usfca.edu

June 6, 2020

Abstract: Do cash transfer programs have heterogeneous treatment effects within the treatment group? I address this question through a comprehensive microenterprise intervention program carried out in Kenya, Africa obtaining economic outcome data from a randomized control trial that gives out conditional cash transfer that are conditional on business formation. I carry out an ANCOVA specification model to obtain the average treatment effect and the results show there is impact on assets. I further carry out a Lasso regression to estimate the heterogeneity in the treatment effect.

1.0. Introduction

Cash transfers have become an integral tool for policy formulation for increasing human capital in most developing countries. Cash transfers[1] can be defined as a direct transfer payment of money to an eligible person provided by organizations funded by individuals/ private donors, local/ the regional government. The transfer is usually in two forms which are either conditional where the transfer is made conditional on an action from the recipient or unconditional[2]. Providing regular and predictable cash transfers to the very poor households helps generate economic and productive impact on the household level and stimulates the local economy through the networks that link individuals, households, businesses, and institutions (Asfaw et al, 2014)[3]. The first conditional cash transfer incentives were implemented in the 1990s in Brazil and Mexico[4] (Aber and Rawlings, 2011) and the use of conditional cash transfer programs as a means of combating poverty has increased dramatically in the past decade (Jisnus et al, 2005). Programs such as Bolsa Escola in Brazil, Progresa/ Opportunidades in Mexico, and the Red de Proteccion Social in Nicaragua are focused on attaining current and future poverty reduction by providing cash to finance immediate consumption and foster investment in human capital (Berk Ozler,2005). The success of these first programs led to more countries adopting them at a very high rate. Over the past decade, programs on conditional cash transfers have become very popular and among the most widely anti-poverty initiatives adopted significantly by developing countries across the world.

According to Lybert and Wydick (2018) development economists have realized that psychological phenomenon influence decisions related to the economics that can significantly influence the dynamics of poverty and the outcome of welfare. This simply means that programs that have a higher chance of having indirect or direct effects on individual psychology have the probability of impacting the economic decision for the beneficiaries, as they present them with hope to achieve their aspirations and dreams.

Rawling and Rubio (2005) show that conditional cash transfer programs are an innovative technique used to deliver social services, especially in developing countries. The programs give

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[1] https://en.wikipedia.org/wiki/Cash_transfer
[2] Unconditional cash transfer are cash transfers that are given out with no condition attached to the transfer
[3] https://www.tandfonline.com/loi/fjds20
[4] The cash transfer was conditioned on school enrollment

grants to poor households based on various conditions to enable them to invest in human capacity through investing in children's education and/or enabling them to afford regular health care for their children and themselves. The element of conditionality in these social programs makes them long-term investment tools in human capital in addition to short-term social support.

Human capital is a nontrivial good with positive spillover effects (Romer, 1990); and such spillovers, when left to the market, tend to lead to under-investment in human capital relative to the social optimum (Stiglitz, 1989). Conditional cash transfer has two objectives. The first objective is the immediate reduction of poverty through cash transfers and an increase in household assets and secondly, achieving a long-term reduction of poverty by investing in human capital. The requirements and design for each conditional cash transfer program may differ depending on the geographical location, but the general aim of the programs is the short-term reduction of poverty and long-term breaking of the intergenerational poverty cycle (Wolf et al., 2013).

1.1 *Purpose of the Study*

The purpose of this study is to investigate if there are any heterogeneous effects that cash transfer has to a treatment group. The aim is to understand what these heterogeneous impacts are by addressing the subject through a program on microenterprise intervention involving cash transfers in a treatment group in Kenya. In this regards, the specific objectives of this research include

1. To investigate the impact of the microenterprise intervention on the total consumption,

2. To explore the impact of the microenterprise intervention on the total net assets,

3. To identify the impact of the microenterprise intervention on the total productive cash inflows

4. To investigate the heterogeneous effects of the microenterprise intervention.

1.2 Rationale of the Research

Using treatment in a study may affect different subjects being experimented in various ways. In this case, homogenous effects seek to study the differences across the subjects being

studied, identifying the big effect, the small impacts and whether the treatment causes adverse or beneficial impacts. Looking at previous studies, there is an insight gap on the heterogeneous effects associated to cash transfer in treatment groups. This research, therefore seeks to carry out an experiment to find insight that will help explain the heterogeneous impacts of cash transfer on the treatment group under study. The implication of the insight obtained from this research is that it will increase knowledge that can be used to enhance cash transfer initiatives and programmes so that they are able to result into more beneficial impacts on the treatment group.

2. Literature Review

This review explores the progression of Cash transfers from the benefits that are a result of both conditional and unconditional cash transfers to incorporating a summary of some of the poverty graduation models. Before we explore the literature on the probable determinants that could answer the question on heterogeneity, a summary of the impacts of cash transfers; both conditional and unconditional is warranted.

There have been positive impacts of both Conditional Cash transfers and Unconditional Cash transfers. (Edmonds and Schady, 2012) find that increased school attainment is accompanied by declines in child labor supply. (Banerjee and Duflo, 2011) find that social programs that encourage children to pursue desirable actions are potentially welfare-enhancing. Results of an evaluation conducted by Behrman, J.R., Parker, S. W., & Todd, P. E. (2011) to follow-up on the long-run impact of PROGRESA/ Opportunidades, a cash transfer that was done in Mexico using experimental and non-experimental estimators shows positive impacts on schooling, reductions in work hours for younger youth (consistent with postponing labor force entry), increases in work for older girls and shifts from agricultural to nonagricultural employment. The evaluation suggests that schooling effects are robust.

Poverty-targeted cash transfer programs can have positive impacts on adolescents' transitions to adulthood in resource-poor settings (Handa et al, 2015). In their analysis of the impact of a national Unconditional Cash transfer program namely the Kenya cash transfer for orphans and Vulnerable children, they find that among 1549 females who were included in the study, there was no significant impact on the likelihood of early marriage but the program reduced the likelihood of pregnancy by five percentage points. This was made possible through

the increase of enrollment of young women in school, financial stability of the household, and delayed age at first sex.

Kabeer and Taylor (2012) did a systematic review on the economic effects of conditional cash transfer programmes. The findings from the review indicated that the impacts of conditional cash transfer were consistent and strong for give types of impacts and less consistent and weaker for others. The evidence showed that the impacts were more consistent and stronger for increased overall consumption of households, specifically in reference to the diversity and amount of food consumption. More evidence indicated that the fact that the cash transfers were focused on women had had an impact on the expenditure patterns of households with a bias towards expenditure on educational, food, and certain typed of productive assets. There was also strong evidence that conditional cash transfer caused a reduction in child labour and an increase in school attendance among children, where the educational impact tended to be stronger than the labour impact. In the case of adult labour, the evidence seemed to be mixed up with a rise in market work by adult women and men in certain contexts and a rise in unpaid domestic work or leisure in other cases. The factors that were identified as being important in modifying the impact of conditional cash transfer included educational levels, ethnicity, location, and household income. Other factors that were seen to matter included children characteristics, specifically gender and age when it came to the impact of the transfer on schooling and child labour.

A cash transfer program on the empowerment of adolescent girls In Malawi had effects on increased access to financial resources, improved schooling outcomes, decreased teen pregnancies and early marriages, better health and generally enabled beneficiaries to improve their agency within their households (Baird et al., 2013).Results from the experiment revealed differences in program effects between young women who were in school at the start of the intervention and those that were not, as well as between young women who received cash transfers conditional on regular school attendance and those who received cash unconditionally. The results of this cash program show us that cash transfers had a significant impact on the livelihood of adolescent girls in Sub- Saharan Africa and at the same time, show us that there might be the heterogeneity of effects under different program designs.

Cespedes (2011) did an investigation of conditional cash transfer initiative that conditions the transfers of schooling children to some degree in an overlapping framework of generations within Mexico. Cespedes emphasized on the human capital role in the study of the long term

effects of conditional cash transfer programs. The resulting findings from his analysis revealed that the long term implementation of cash transfer anti-poverty programs helps in minimizing the intergenerational poverty transmission. It was also deduced that these conditional cash transfers aimed at reducing poverty increase households' human capital and through the present channels, a consistent reduction in income and poverty inequality is induced.

Another relevant study to this research was carried out by Oh and Reis (2011) also carried u a study to evaluate how the rise of targeted transfers during the great recession between 2007 and 2009 influenced output, employment, and consumption in the US. The analysis took a positive approach to describe the dynamic impacts of such transfers in such crises. The findings obtained from the study indicated that policy on transfers led to have a probable boost on employment and output, albeit by amounts that are relatively modest.

Afzal, Mizra and Arshad (2019) discussed the effectiveness of both unconditional and conditional cash transfer programs and initiatives across the globe and by employing data indicators they highlighted the right target groups that were in need of these interventions within Pakistan. The conclusion made from the research and discussion showed that Pakistan has managed to minimize poverty through the help of cash transfer initiatives. The introduction of the Benazir Income Support Program (BISP), which is a federal conditional transfer initiative in Pakistan set a foundation for a social protection initiative that is effective, which has enabled the program to have the expected effect on the recipients. The discussion also indicated that the program has potential to benefit the poor including the disabled and the widows.

IPA (2015) lists down some cash transfer programs and their impacts on the treatment group that they were meant for. The first listed program is the Zomba cash transfer program, which was initiated in Malawi aimed at girls' education and took both unconditional and conditional approaches. The findings from this programs showed that conditional cash transfer resulted to more gains in learning and enrollment outcomes compared to unconditional cash transfer and the likelihood of marriage and pregnancy declines in the unconditional than in the conditional cash transfer initiatives. The other listed program is the CT-OVC that was initiated in Kenya aimed at improving Health and reducing HIV. The resulting findings showed that the CT-OVC unconditional cash transfer program led to the reduction of sexual debut among children in the treatment households, even when there was no reproduction health or HIV messages that accompanied the transfer programs. Another example that IPA listed is the

Tayssir program that took place on Morocco with a purpose on enhancing education through parents. The results showed that both the labeled and conditional cash transfer programs were both as effective as each her and were not expensive. However , when it came to the incentivizing school enrollment, the labeled cash transfer was seen to be more effective than conditional cash transfers.

In a study by Ferro and Nicollela, (2007) on the impacts of conditional cash transfer programs on decisions related to household work in Brazil, the findings, which were obtained through a Heckma and Probit econometric model showed that conditional cash transfer caused a decline in the probability of children working but not necessarily the time they spent in the labour market. The findings also deduced that the program , which was used in Brazil, was more efficient for the girls than it was for boy. The program was found not to have any major impacts on the parents participation in labour, but the hours spent working were reduced as a result of the cash transfer program.

Another closely related study was done by Ham (2014) on the impact of conditional cash transfer on inequality of opportunities in education in Latin America. The results indicated that treatment groups involved considered vulnerable achievements more in relation to education access and that the interventions provided by the conditional cash transfer assisted in leveling the playing ground. The study also deduced that though the cash transfer programs did not eliminate inequality of education opportunities, they were significant in complement to policies meant for enhancing equity.

The paper by (Ferreira et al., 2009) uses evidence from a conditional cash transfer program in Cambodia where the eligibility varied substantially among siblings in the same household. The model used in the study is one that highlights three different effects which are an income effect, a substitution effect, and a displacement effect and it predicts that conditional cash transfer will increase enrollment for eligible children due to the three effects but it has an ambiguous effect on ineligible siblings. The ambiguity, in this case, arises from the interaction of a positive income effect with a negative displacement effect. The results of the study show that the children who were given the scholarship were more than 20 percentage points more likely to be enrolled in school and 10 percentage points less likely to work for pay while the school enrollment and work for ineligible siblings were largely unaffected by the program. One would

expect that since children are from the same household, they would have relatively positive spillover effects on each other, but this was not the case.

Galiani and McEwan (2013) researched the heterogeneous impacts of conditional cash transfers. The findings showed a cost-effectiveness ratio of $4.58 for every 1 % gain in school enrolment, which is an indication of the positive impact of cost-effectiveness of conditional cash transfer on school enrolment. Dammert (2008) did a similar study by focusing on the heterogeneous impacts that conditional cash transfer has using evidence from Nicaragua. The findings from this study estimated that the quantile treatment effects showed that there are significant heterogeneity in the effects of the conditional cash transfer used in Nicaragua program on the distribution of the expenditure on food and the total expenditures. Particularly, households that were at the lower end of the distribution of expenditure went through a less increase in expenditure as a result of the program..

Garcia and Saavedra (2017) research is another relevant study to understanding the heterogeneous impact of conditional cash transfer. The study focused on evaluating the educational effects and the cost effectiveness of conditional cash transfer initiatives in developing nations using a meta-analysis. The findings obtained indicated that all schooling outcomes related to the conditional cash transfer initiative had strong support for heterogeneity in effects, cost effectiveness and transfer effectiveness estimates. The results also deduced that primary attendance and enrollment effects estimates are more on per-dollar of transfer and an absolute basis in conditional cash transfer programs, which were compliment cash transfer to families that have a supply side intervention like cash transfer to parents –teacher association or to teachers and school grants . There was also evidence that suggested how the effect on per dollar transfer of transfer basis is less in reference to high baseline enrollment.

Malerba (2017) also focused their study on analyzing the heterogeneous effects that conditional cash transfer across geographical cluster and if contextual factors impact the differences . The findings from this study showed that the impacts of the adopted antipoverty policy varied across geographical clusters, specifically when focusing on the ultimate goals of the cash transfer programs such as the health status, compared to intermediate outcomes such as schools attendance. The results also underlined the key role of the energy infrastructure in defining the associated heterogeneity, presenting empirical evidence on the significance of energy for the reduction of poverty.

Leroy et al. (2009) also carried out a study on the impact that conditional cash transfer has on children's nutrition. The research found out that conditional cash transfer significantly improves the children's anthropometry but has minimal impact on the status of micronutrients. The research findings found out that conditional cash transfer programs have a positive influence on most of the assessed fundamental intermediate and underlying determinants of child nutrition. These determinants include diet quality, poverty, women's awareness, control, and awareness over resources, food security, and the use of education and health services, which are along the pathway of impacts through which the conditional cash transfer are hypothesized to enhance children nutrition. Conclusively, it means that by enhancing these determinants conditional cash transfer increases children's nutrition.

there are some significant findings that were made in a review of evidence by Millan et al (2019) on the long-term effects of conditional cash transfer. The focus of the review was on conditional cash transfer programs initiated in the 1990s within Latin America, which have set the foundation for poverty reduction in different developing nations in the region and across the world. The review indicates that most evaluations on conditional cash transfer based on e experimental design and use of treatment groups found positive impacts in the short-run, which include improved nutrition, increased educational achievement among older children, increased health for younger children and alleviation of poverty. However, the review indicated that there are minimal evidence on whether these short-term achievement eventually lead sustainable long-term benefits. The review also shows that the evidence existing on the long term impacts of conditional cash transfer is clearer for some outcomes. For instance experimental literature presented some consistent evidence of effects of conditional cash transfer on schooling, social-emotional sills, and learning and enhanced outcomes in the labour markets.

Neidhofer and Nino-Zarazua (2017) focused on evaluating the long-lasting impacts that conditional cash transfer has on human capital among children. The study used a social program that was initiated in Chile in 2002 to increase conditional cash transfer take-up among the poor households. Using a natural experiment to analyze the long lasting conditional cash transfer impacts to determine the causal effects, the study exploited the exogenous differences in children eligibility from different age groups. The results obtained from the experiment indicated that the achievements in the short-run of the initiative in connecting the poor household to the social protection scheme had constant impacts on children's human capital as evaluated by labour income and educational attainment.

Berriel and Zilberman (2011) results show that the cash transfer programs have significance implications. The first implication is that it leads to a rise in inequality in wealth by influencing the asymmetrically precautionary motives within the economy. The study also indicated that another important implication is that even cash transfer programs that are low-budget can have a big welfare impacts because the reduction in precautionary motives results to a sharp increase in consumption once the initiative is adopted. The other implication of the cash transfer program is that it can lead to high level of political support regardless of there being a few covered households, considering that many appreciate the provided insurance. It was also deduced that there are no clear impact on income inequality as a result of the cash transfer program, because labour supply and savings are significantly affected. The conclusion made based on these findings was that cash transfer programs which integrate transfers with the requirements of employment are more effective in increasing welfare and minimizing poverty.

According to Bernhardt et al. (2019), several empirical researches have shown that in most developing countries relaxing capital constraints for micro-entrepreneurs through grants access lead to substantial gains in profits. In most research, the findings show that micro-entrepreneurs that have high returns to capital often take advantage of the opportunities on investments when given access to resources that facilitate them to do so. Blattman, Fiala, and Martinez (2013) found out that most cash transfer recipients in Uganda invest their transfers invocations, which increases their earning by over 40% especially those that are patient, risk-averse and credit constrained. A few studies have shown evidence on high returns to cash grants in the same way as capital to established farmers and business owners. These studies observed growth in the intensive margin in most existing businesses (Fafchamps et al., 2011; De Mel et al, 2008).

Bernhardt et al. (2019) paper shows how endogenous household investment decisions impact the return to the household enterprise. This is done by studying the household microenterprise behavior using agricultural household models (Benjamin 1992), it shows that the returns to capital are influenced by the level of integration. The author of the paper shows that the differences in the return to capital investment between female and male entrepreneurs should be evaluated within the households rather than at the enterprise level. The approach is motivated by the fact that households in developing countries often have multiple investment opportunities within the household level as opposed to the enterprise level. The paper shows that endogenous household's enterprise composition is important in determining the returns to

capital. Returns to capital for female entrepreneurs at the household level are greater compared to the enterprise level. It also shows that single-enterprise households have higher gains from capital shocks compared to multiple-enterprise households (Bernhardt et al., 2019)

The concept of "microenterprise" in my thesis is used to broadly refer to programs that pursue income gains among the low and middle-income households by providing them with a cash transfer and/or productive asset as well as a coaching extension at no cost to the household. The incorporation of these components to the cash transfer intervention is referred to as a poverty graduation model. According to the UNHCR, the use of poverty graduation models by administering a comprehensive package that includes consumption assistance to meet basic needs, skill training, seed capital, or employment opportunity will significantly help eradicate poverty. The combination of such a graduation model is believed to generate long-lasting effects as opposed to just providing unconditional cash transfers. Despite the significant impact of the poverty graduation models, any increase in the funding of mentorship and training modules would lead to the reduction of the amount available for transfers. Shapiro (2017) shows that vocational training services exceed the cost of provision which can be very costly to implement.

Given the various impact of cash transfer programs, various designs are adopted by different organizations based on the challenges of conducting impact evaluations on existing or planned government-led programs (Benjamin et al., 2012). The different designs employed by such organizations will help determine the heterogeneity in treatment is the eligible participants within the program.

An important study that helps us understand the impact of the graduation model using cash transfer is the study done by the BRAC TUP Program in three of the poorest districts of Bangladesh, Rangpur, Kurigram, and Nilphamari (Asadullah & Ara, 2016). The program targets the bottom 10% of the population in the income distribution. The targeted population is further evaluated through an inclusion or exclusion criteria. To be selected for the program the participants must fulfill these five requirements: (1) the household is dependent on a female who is a domestic worker or in the informal sector; (2) the households holds less than 10 decimals of land; (3) no active male adult in the household; (4) there is no productive assets in the household and (5) The children in the household are all attending school. Once the participants are selected, they are assigned in choosing an income-generating activity and they undergo training, and cash transfers are provided to them. The paper uses the difference-in-difference estimator and finds a

38% increase in the participant's annual earnings as well as an 8% increase in the consumption expenditure.

The literature concludes that there is a significant effect of these conditional cash transfers in the various outcomes like nutrition, education, household assets, among others. It also shows that by incorporating an additional extension of the program, we can help increase the long-term effects of poverty reduction. Our study will replicate the study done by BRAC with a sample of 2,010 households from a randomized control trial conducted by the Village Enterprise Organization. The experiment aims to identify the average treatment effects of the pre-intervention and the post-intervention of the microenterprise program where participants are provided a combination of cash transfer and a graduation model extension that involves training, mentorship, and a saving component. I will also analyze the heterogeneity in the treatment effects of the participants in the treatment group, this will explain the variance in the outcome of the participants. The average treatment effect will be from the different outcome variables which include consumption, net income, and net assets between participants granted the cash transfer as well as the extension of the poverty graduation model compared to the participants who score 39 points and below in the poverty probability index in the control group.

3. Experimental Design

3.1 Program Context

Village Enterprise is a non-profit organization that works towards eradicating extreme poverty in rural Africa through innovation and entrepreneurship through the provision of grants. The organization implements microenterprise programs in Uganda, Congo, and Western Kenya in the following counties: Kakamega, Uasin gishu, Trans-Nzoia, West Pokot, Migori and Bungoma. Eligible participants are determined from a rigorous targeting process of the poorest households in the regions. The eligible households are given access to cash transfers which are conditional on business formation, training, and mentorship. The whole microenterprise program takes one year with training taking three months and mentorship at the group level taking nine (9) months.

Households are divided into groups of thirty (30) participants each also known as Business Saving Groups (BSGs) where the grant is disbursed, and training is administered. The

training component of the program is focused on providing the participants with skills that will aid in business selection, business management/planning, record keeping, and profit generation. The training increases business knowledge among the participants as some are illiterate. Once the training component is concluded, the Business Saving Groups are further divided into groups of three (3) participants and the first grant of 100 USD per person is transferred to the individuals at the group level conditional of business formation. The groups are meant to allow members to have access to capital, growth, and safety for their savings and help in building social capital. The grant is normally disbursed in two stages and the second cash transfer of 50 USD per person is conditional on having invested and sustained the first transfer in a group business venture.

3.2 Study Design

The sample used in this paper is from randomly selected villages in Western Kenya. Two villages are selected at random and a Poverty Probability Index measure designed by Banerjee, Duflo, Chattopadhyay, & Shapiro (2009) is administered to rank the villager's wealth. For an individual to be eligible they must score 39 points and below from 100 points with an exception of the following i) the house owns more than two cows; ii) There is a government-employed household member in the household; iii) The main dwelling area of the participants household has a cement floor, brick wall, and metal roof.

Households who score 40 points and above out of 100 points are considered ineligible with the exception of i) The households have 8 or more children below the age of 18 years; ii) If the household head is disabled or widowed; iii) The household head has a chronic illness; iv) The household has suffered through a natural catastrophic; v) The household head is unemployed. Among the two villages chosen at one village is randomly selected as the control and the other one is selected as the treatment group.

The study administers three households' surveys: the baseline survey and two follow-up surveys where data on the economic outcomes that indicate the poverty status is collected. The economic status of the sample is divided into three groups: consumption, assets, and productive cash flows. Table I shows the economic status of the eligible households at the baseline level in Kenyan Shillings (KES) per capita for the treatment and control group. The average consumption level of the sample amounts to KES 629,000 which is approximately 1.57 USD PPP per day

which is below the international poverty line of USD PPP 1.90 per day. This level shows that the targeting process was able to capture the extreme poor in the region.

3.3 Methodology

To begin the analysis, I first run a balance check of the baseline characteristics of the eligible participants for both the control and treatment group. The data is balanced in mean and standard deviation for the treatment and control groups. The results shown in Table 2, the average household size for the control and treatment is approximately 6 members and less than half of the participants are illiterate. The table also shows that approximately half of the treatment and control group were monogamously married with the other half of the participants having more than one wife which is acceptable in the African context.

3.1 Average Treatment Effect

The first step in the analysis carried out in my paper is capturing the average treatment effect of the microenterprise intervention on the economic status of the households who receive the intervention compared to the households in the control group. To do this I will carry out an empirical analysis using Analysis of Covariance (ANCOVA) model and the standard errors are clustered at the village level. The ANCOVA model is a more efficient because the data used is from a randomized control trial and I include the baseline economic outcomes of the treatment group as a control which is correlated with the dependent variable. The model will allow improved ability to detect treatment effects and reduce bias.

My model specifications are as follows:

$$\gamma_{ijt} = \alpha + \beta T_{ij} + \delta y_{ijb} + \theta X_{ijb} + \varepsilon_{ij}$$

Where, γ_{ijt} represents the economic status of the household i in village j at the end-line time t which will be the end line level of consumption, level of asset and productive cash inflows , T represents being treatment group 1 or 0 being the counterfactual, y_{ijb} represents the baseline

economic status of household i in village j, X_{ijb} is the vector of the baseline characteristics of the households for household i in village j. Standard errors are clustered at the village level. To capture the average treatment effect of the comprehensive intervention of the program of the treatment group, I will estimate and capture β in the specified model.

3.2 Heterogenous Treatment Effects

To investigate heterogeneity within the treatment effect, I will use Least Absolute Shrinkage and Selection Operator (LASSO) model (Tibshirani 1996) which is a machine learning model. The model is used as a method of fitting and selecting covariates that appear in the model and can allow fitting more covariates than the observations in the data. Lasso regression can be used for prediction, selection and inference, in this case we will use the machine learning model as a model selection. The selection process can be defined as selecting a set of covariates that predict the economic outcomes well, this means that the model selects covariates that correlate strongly with my outcome variable. The selection process helps improve model prediction because it alters the regression model by selecting covariates that can be used in the final model by predicting the sum of the absolute value of the covariate coefficient to be less than a fixed value and therefore come coefficients that are not correlated to the outcome variable are set to zero[5]

The model specification is as follows:

$$\sum_{k=1}^{n} (\gamma_{ijt} - \beta T_{ij} + \delta y_{ijb} + \theta X_{ijb} + \vartheta T_{ij}.X_{ijb})^2 + \lambda \sum_{j=1}^{m} |\vartheta_j|$$

Where, γ_{ijt} represents the economic status of the household i in village j at the end-line time t, T represents being treatment group 1 or 0 being the counterfactual, y_{ijb} represents the baseline economic status of household i in village j, X_{ijb} is the baseline characteristics at the

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[5] Details of the Lasso regression are obtained from the Lasso pack on stata.

baseline for household i in village j and ϑ represent the coefficient of the interaction between the treatment and baseline characteristics. I have chosen the cross-validation lasso model because it allows for the λ that minimizes the mean squared prediction error (MSE). The model splits the data into k fold and the first fold is treated as the validation dataset and the remaining k-1 folds are the training data for a given lambda and the mean squared prediction error for the first group is computed[6]. The process is repeated for the k folds and the lambda that minimizes the mean square prediction error is selected. This will allow the model to shrink some covariates to zero to determine the variables that are strongly correlated to the outcome variables.

4. Results

This section presents the estimated average treatment impact of the microenterprise intervention on the economic outcomes. The effects are in the different categories of the economic outcomes which include the impact on total consumption, impact on total assets, and impact on total productive cash inflows and this will allow me to analyze the impact of each level of economic outcomes. Understanding the impact of the intervention is meaningful in policy formulation as well understanding the impact of such intervention in the efforts of poverty reduction in developing countries. Finally, I use the data set to test heterogeneity in the treatment effect of the economic outcome within the treatment group. I will also carry out heterogeneity analysis in the different categories of economic outcomes.

4.1: Average Treatment Effect

Table 3 represents the statistical estimates of the impact of the comprehensive microenterprise intervention on the total consumption, total net assets, and the total productive cash inflows. The coefficient of being on the treatment group is not statistically significant in any of the outcomes. This is contrary to most studies conducted on the impact of cash transfer programs in some developing countries where the analysis showed a significant impact. One reason why I might have not found any significant impact could be because the data used in my thesis is from one-year outcomes and no follow-up survey data is included in the study. To better understand the impact of the microenterprise intervention, I plan to include follow-up data from the organization

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[6] https://statalasso.github.io/docs/lassopack/

and run the analysis in a longer period of time to estimate the long-term effect of the intervention. Contrarily to the results present in the paper, a study done by Richard Sedlmayr, 2019[7], using a cash transfer extension has a higher impact compared to the use of plain cash transfer. The integration of the training and mentorship components in the intervention seem to have a higher impact and I plan to extend my thesis and look at the heterogenous treatment effect of the intervention compared to the heterogenous treatment effect of plain cash transfers.

The estimates for the total consumption show a significant impact of the age of the household head age on the level of total consumption. There is a 3.65% significant increase in the level of total consumption as the household head age increases. The household size also has a significant impact, as the household size increases the level of consumption goes down by 4.3%. The household size is determined by the number of children the household head has as well as the number of wives the household head (male) has. Households with iron roof experience a 10.3% increase in their levels of total consumption compared to households who have earth floors who experience a decrease in their level of consumption.

In terms of total productive cash inflows, Household size also plays a critical role in determining the impact. I find that as your household size increases the level of the total productive cash inflows goes down by 4.14%.

4.1.1 Total Annual consumption

The total consumption level is divided into three categories which are food and beverage consumption, recurring consumption, and infrequent consumption. Food and beverage consumption represents the level of food consumption and beverage intake experienced by the households within a year, recurring consumption include consumption from items such as water, electricity, cosmetics, and charcoal for fuel. Infrequent consumption include consumption on items that are not experienced often within a span of three months, these items include clothing, uniform, taxes, and purchase of household appliances.

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[7] Essays on the Scale-up of Extensions to Cash Transfers , University of Oxford

As stated above, the microenterprise intervention has no significant impact on the different types of consumption. This can be shown in table 4.

4.1.2 Total Net assets

I further break down the analysis of the total net assets into three categories: Livestock assets, Durable Assets, and Net financial position. Table 5 presents the statistical estimates of the microenterprise intervention on the different types of assets. The first column shows the impact of being treated to the intervention on assets. There is a significant impact of the intervention on the level of livestock assets. This is shown by a 22.6% significant increase in the level of livestock assets. The age of the household head is also significant and as the age increases the level of livestock assets goes up by 0.541%. The microenterprise intervention required the participants to start income generating activities as stated earlier in the paper and most of the participants acquired income generating assets like livestock breeding and this explains the significant impact on the level of livestock assets held by the participants. The impact of the microenterprise intervention on the level of durable assets and the net financial position is not statistically significant and therefore meaningful inference cannot be drawn

4.1.3 Total Productive Cash Inflows

As shown in table 1, Total productive inflows are also divided into three categories for further analysis of the average treatment effect. Table 6 shows the estimates of the impact of the microenterprise on the level of productive cash inflows. Income from other self-employment is significantly impacted by the intervention. There is a 23.3% significant increase in income from other self-employment but there is not significant impact of the microenterprise intervention on net cash inflows from farming as well as income from paid employment.

4.2 Heterogeneity in treatment effect

To further investigate possible heterogeneous effects within the treatment group of the microenterprise intervention at the baseline covariates, table 7 presents the heterogeneity treatment effect of the microenterprise intervention on total consumption. The model specification used to estimate heterogeneity in the treatment effect is the Least Absolute Shrinkage and Selection Operator (LASSO) model. The model allows interaction of the baseline characteristics and treatment variable and generates a lambda value that minimizes the mean squared prediction error. This allows the model to select variables that strongly correlated with

my outcome variables. From the table, households who have the household head monogamously married appear to benefit more compared to other households. The results show there is a 3.1% increase in the level of total annual consumption compared to the other households in the study. By using the Least Absolute Shrinkage and Selection Model, the coefficient of the covariates that are not selected by the model are shrunk to zero and therefore they are not correlated with my outcome variable which is total consumption. Households who have iron roof also have a high correlation with total annual consumption compared to the other households with different baseline characteristics.

Table 8 presents the results of heterogeneity in the treatment effect on total annual assets. Households whose head is monogamously married also seem to benefit more in increasing its total annual assets compared to other households with different baseline characteristics. Households with earth floors also correlated strongly with the total assets accumulated in the region with an increase of 5.1%.

The lasso estimates for the total productive cash inflows are shown in table 9. The analysis shows that households whose head is literate seem to have more benefit from the microenterprise intervention compared to the other baseline characteristics. This is interesting because being literate in this context is being able to read and write and if a household head is literate the running the established business becomes easier and mentoring was more effective.

The Lasso estimates above explains the heterogeneity within the treatment group, this means that by running the model we can see why some participants were able to benefit more from the intervention compared to others. In this setting, household who are monogamously married[8] have fewer children compared to households whose head has more than one wife. Many children in the households put an economic strain on the resources allocated to the household and it can explain why such intervention have reduced overall impact of the living standards of the households. Understanding the heterogeneity impact is important to help improve the effect of all participants as opposed to some of the participants.

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[8] The parliament of Kenya passed a bill in 2014 allowing polygamy in the country

5. Conclusion

My thesis looks at the effects of a microenterprise intervention in Western Kenya, Africa. The intervention is composed of a conditional cash grant that is given out to eligible participants who are determined by a targeting process that implements a wealth participatory ranking process. (Banerjee et al, 2015) In the multi-faced graduation program targeted to the extreme poor show, there was a statistically significant impact on all key outcomes which include consumption, food security, assets, finance, time use, and income, and revenues. To create long term effects from the intervention, the programs incorporate training, mentorship, and saving components together with the conditional cash grant. Several studies have been conducted to estimate the impact of cash transfers and they find strong household monthly consumption response to the transfers (Shapiro and Haushofer, 2016)

The paper finds that microenterprise intervention has limited impact on the total level of annual consumption, level of total assets, and the total productive cash inflows. The results are not consistent with recent literature on microenterprise and cash transfers. The study further divides the total assets into three categories namely, livestock assets, durable assets, and net financial position where I find a significant impact of the level of livestock assets by the participants. Income from self-employment also has a significant average treatment from the microenterprise intervention. The paper also looks at the heterogeneity of treatment effect with the treatment group and finds that households whose household head is monogamously married and households whose head is literate seem to benefit more from the program.

The lack of statistical significance on the impact of the microenterprise intervention on the total consumption, assets, and productive cash inflows is a major limitation of the study. The data used in the analysis is limited to one year and this might explain the lack of significance. To determine the long term impact of the microenterprise intervention on the level of consumption, additional data on the household outcomes should be collected and this will determine whether the intervention has a significant impact in the long-term.

Determining the heterogeneity in the treatment effect of the microenterprise intervention can help develop policy implications for future interventions. Households whose head is monogamously married seem to have benefited more from the intervention compared to households with the other baseline characteristics. Government authorities may need to assume an active role in advocating the reduction of fertility rates particularly in developing countries.

Polygamy is usually associated with having many children which is deemed to be a source of wealth in the African context. Through the reduction of household size especially among the extremely poor in the community, interventions such as the microenterprise intervention understudy will experience a significant increase in the average treatment effect.

References

Aber. L, and Rawlings, L. B. (2011) 'North-South Knowledge Sharing on Incentive-based Conditional Cash Transfer Programs.' *Social Protection and Labour, The World Bank, SP Discussion paper*, 1101, pp. 1-22.

Afzal, A., Mizra, N., and Arshad, F. (2019) 'Conditional vs. unconditional cash transfers: a study of poverty demographics in Pakistan.' *Economic Research- Ekonomska Istraživanja, 32*(1), pp. 3360-3377.

Araujo, M. C., Bosch, M., & Schady, N. (2016). *Can Cash Transfers Help Households Escape an Inter-Generational Poverty Trap?* (No. w22670). National Bureau of Economic Research.

Asfaw, S., Davis, B., Dewbre, J., Handa, S., and Winters, P. (2014) 'Cash Transfer Programme, Productive Activities and Labour Supply: Evidence from a Randomized Experiment in Kenya.' *The Journal of Development Studies, 50*(8), pp. 1172-1196.

Baird, S. J., Chirwa, E., De Hoop, J., & Özler, B. (2013). *Girl power: cash transfers and adolescent welfare. Evidence from a cluster-randomized experiment in Malawi* (No. w19479). National Bureau of Economic Research.

Baez, J. E., & Camacho, A. (2011). *Assessing the long-term effects of conditional cash transfers on human capital: evidence from Colombia.* The World Bank.

Behrman, J. R., Parker, S. W., & Todd, P. E. (2011). Do conditional cash transfers for schooling generate lasting benefits? A five-year follow up of PROGRESA/Oportunidades. *Journal of Human Resources, 46*(1), 93-122.

Bergolo, M., and Galván. E. (2018) 'Intra-Household Behavioural Responses to Cash Transfer Programs. Evidence from a Regression Discontinuity Design.' World Development 103, pp.100–118.

Bernhardt, A., Field, E., Pande, R., and Rigol, N. (2019) 'Household Matters: Revisiting the Returns to Capital among Female Micro-entrepreneurs.' *AER: Insights, 1*(2), pp.141–160

Berriel, T. C., and Zilberman, E. (2011) *Targeting the Poor: A Macroeconomic Analysis of Cash Transfer Programs*

Blattman, C., Fiala, N., and Mrtinez, S. (2013) *The Economic And Social Returns To Cash Transfers: Evidence From A Ugandan Aid Program.* New York: Columbia University.

Cespedes, N. (2014) *General Equilibrium Analysis of Conditional Cash Transfers.* Banco Central de Reserva del Perú

Contreras, D., and Maître, P. (2013) 'Health Spillover Effects of a Conditional Cash Transfer Program.' *Monash Economics Working Papers 44-13, Monash University, Department of Economics.*

Dammert, A. C. (2009) Heterogeneous Impacts of Conditional Cash Transfers: Evidence from Nicaragua. Chicago: The University of Chicago.

De Janvry, A., and Sadoulet, E. (2006) Making Conditional Cash Transfer Programs More Efficient: Designing for Maximum Effect of the Conditionality. World Bank Economic Review, 20(1), pp. 1-29.

De Mel, S., McKenzie, D., and Woodruff, C. (2008) 'Returns to capital: results from a randomized experiment.' *Q J Econ., 123*(4), pp.1329–72.

Djebbari, H., and Smith, J. (2008) 'Heterogeneous Impacts in PROGRESA.' *IZA DP No. 3362*

Fafchamps, M., McKenzie, D., Quinn, S., and Woodruff, C. (2014) 'Microenterprise growth and the flypaper effect: evidence from a randomized experiment in Ghana.' *J Dev. Econ., 106*, pp. 211–26.

Fafchamps, M., McKenzie, D., Quinn, S., Woodruff, C., (2011) 'When is capital enough to get female microenterprises growing? Evidence from a randomized experiment in Ghana.' *Unpublished working paper.*

Ferreira, F. H., Filmer, D., & Schady, N. (2009). *Own and sibling effects of conditional cash transfer programs: Theory and evidence from Cambodia.* The World Bank.

Ferro, A. R., and Nicollela, A. C. (2007) 'The Impact Of Conditional Cash Transfer Programs On Household Work Decisions In Brazil.' *Research in Labour Economics*

Filmer, D., Friedman, J., Kandpal, E., and Onishi, J. (2016) Local Spillovers from Cash Transfers: Food Price Increases and Nutrition Impacts on Non-beneficiary Children. Washington DC: Development Research Group, World Bank.

Galiani, S., & McEwan, P. J. (2013). The heterogeneous impact of conditional cash transfers. *Journal of Public Economics, 103*, 85-96.

Garcia, S., and Saavedra, J. (2017) *Educational Impacts And Cost Effectiveness Of Conditional Cash Transfer Programs In Developing Countries: A Meta-Analysis.* Cambridge: National Bureau Of Economic Research

GiveWell. (2019) Spillover Effects of GiveDirectly's Cash Transfers Program. GiveWell. [Online] https://www.givewell.org/international/technical/programs/cash-transfers/spillovers [Accessed 9th December, 2019].

Guerrero, N., Oswaldo, M. and Diego, W. (2018) 'Conditional cash transfers, spillovers and informal health care: Evidence from Peru.' Mucivh Personal RePEc Archive

Handa, S., Peterman, A., Huang, C., Halpern, C., Pettifor, A., & Thirumurthy, H. (2015). Impact of the Kenya Cash Transfer for Orphans and Vulnerable Children on early pregnancy and marriage of adolescent girls. *Social Science & Medicine, 141*, 36-45.

Hussam, R., Rigol, N., and Roth, B. (2017) 'Targeting high ability entrepreneurs using community information: mechanism design in the field: Mimeo.' *MIT*

Innovations for Poverty Action (IPA). (2015) *Evaluations of Cash Transfer Programs in African Settings.* Innovations for Poverty Action

International Labour Office, Geneva. (2014) 'Transitioning from the informal to the formal economy.' *International Labour Conference, 103rd Session, 2014*

Jishnu D., Quy-Toan D., and Berk O. (2005) ' Reassessing Conditional Cash Transfer Programs.' The World Bank Research Observer, Volume 20, Issue 1, pages 57-80 .

Kabeer, N., and Taylor, L. (2012) *What Are The Economic Impacts Of Conditional Cash Transfer Programmes?: A Systematic Review Of The Evidence.* Technical Report. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

Laura B. Rawlings., and Gloria M. Rubio 'Evaluating the Impact of Conditional Cash Transfer Programs.' The World Bank Research Observer,vol.20,no.1

Ludena, M. G. P. (2019) Institutionalizing Segregation: Women, Conditional Cash Transfers, and Paid Employment in Southern Ecuador.' Population and Development Review 00(0), pp. 1–29.

McCaig, B., and Pavcnik, N. (2015) 'Informal Employment In A Growing And Globalizing Low-Income Country.*' National Bureau Of Economic Research*

Millan, T. M., Barham, T., Morcurs, K., Maluccio, and Stampini, M. (2019) 'Long-Term Impacts of Conditional Cash Transfers: Review of the Evidence.' *The World Bank Research Observer, 34*(1), pp.119-159

Neidhofer, G., and Nino-Zaraza, M. (2017) *The long lasting effect s of a conditional cash transfers on children's human capital . The case of Chile Solidario*

Oh, H., and Reis, R. (2011) *Targeted Transfers And The Fiscal Response To The Great Recession.* Cambridge: National Bureau Of Economic Research

Rawling, L. B, and Rubio, G. M. (2005) *Evaluating the Impacts of Conditional Cash Transfer Programs.* Oxford: Oxford University Press.

Rodríguez-Oreggia, E., & Freije, S. (2012). Long term impact of a cash transfers program on labor outcomes of the rural youth. *Center for International Development at Harvard University*, (230).

Jishnu D., Quy-Toan D., and Berk O. (2005) 'Reassessing Conditional Cash Transfer Programs.' The World Bank Research Observer, Volume 20, Issue 1, pages 57-80

Tamal, D., Chaudhuri. (1989) 'A theoretical Analysis of the Informal Sector.' World Development, 17(3), pp. 351-355

Wolf, S., Aber, J. L., and Morris, P. A. (2013) 'Drawing on Psychological Theory to Understand and Improve Antipoverty Policies: The Case of Conditional Cash Transfers.' *Psychology, Public Policy, and Law, 19*(1), pp. 3-14

Table 1

Descriptive Statistics

	Control		Treatment	
	Mean	**Std Dev**	**Mean**	**Std Dev**
Total Consumption (Annual)	**656,835**	**403,295**	**629,932**	**376,606**
Food & Beverage Consumption	511,801	326,196	482,900	298,459
Recurring Consumption	73,785	74,023	72,424	74,998
Infrequent Consumption	60,952	68,407	62,058	68,929
Total Net Assets	**95,878**	**111,299**	**92,168**	**112,455**
Livestock Assets	47,094	73,326	44,375	70,246
Durable Assets	44,456	53,730	43,158	54,173
Net Financial Position	1,122	7,134	788	6,926
S				
Total Productive Cash Inflows (Annual)	**165,313**	**248,117**	**177,418**	**266,563**
Net Cash Inflows from Farming	(279.35)	61,079	5,145	67,141
Income from Other Self-Employment	57,310	125,643	53,449	123,624
Income from Paid Employment	89,752	137,199	94,251	138,034

Notes: Table 1 represents the baseline economic status of both the treatment and the control group. The data is collected from the baseline survey administered before the microenterprise program is enrolled.

Table 2

Descriptive Statistics

	Control	Treatment
	Mean (Standard deviation)	Mean (Standard deviation)
HH size	5.724	5.879
	(2.786)	(2.759)
Age of HH Head	42.61	43.02
	(16.37)	(15.97)
HH Head is Female	0.261	0.294
	(0.439)	(0.456)
HH Head is monogamously married	0.571	0.552
	(0.495)	(0.498)
HH Head is Literate	0.465	0.464
	(0.499)	(0.499)
HH has iron roof	0.236	0.253
	(0.425)	(0.435)
HH has mud walls	0.404	0.398
	(0.491)	(0.490)
HH has earth floor	0.976	0.969
	(0.155)	(0.173)
HH has sanitary toilet	0.421	0.428
	(0.494)	(0.495)
HH uses wood as main cooking fuel	0.982	0.988
	(0.134)	(0.111)
HH uses electric light	0.0194	0.0142
	(0.138)	(0.118)
All HH members have two sets of clothes	0.637	0.632
	(0.481)	(0.483)
All HH members have a pair of shoes	0.235	0.223
	(0.425)	(0.417)
HH owns its home	0.858	0.863
	(0.349)	(0.344)

Table 3: ANCOVA MODEL

	(1) Total Consumption	(2) Total Net Assets	(3) Total Productive Cash Inflows
Treatment	0.0109	0.0779	-0.0132
	(0.0243)	(0.0476)	(0.0805)
HH size	-0.0430***	-0.00946	-0.0414*
	(0.00441)	(0.0100)	(0.0164)
Age of HH Head	0.00365***	0.00259	-0.00632
	(0.000958)	(0.00159)	(0.00314)
HH Head is Female	-0.0179	-0.0395	-0.180
	(0.0335)	(0.0619)	(0.108)
HH Head is monogamously married	-0.0607	-0.0768	-0.204
	(0.0312)	(0.0642)	(0.101)
HH Head is Literate	0.0176	0.0705	0.142
	(0.0246)	(0.0621)	(0.0796)
HH has iron roof	0.103**	0.0702	0.225
	(0.0363)	(0.0626)	(0.121)
HH has mud walls	0.0738**	-0.221**	0.191*
	(0.0266)	(0.0688)	(0.0820)
HH has earth floor	-0.131*	-0.148	-0.322
	(0.0545)	(0.107)	(0.356)
HH has sanitary toilet	0.0118	0.0123	-0.0253
	(0.0214)	(0.0442)	(0.0844)
HH uses wood as main cooking fuel	0.0133	0.132	-0.317
	(0.0895)	(0.208)	(0.241)
HH uses electric light	0.0696	0.376*	0.308
	(0.0518)	(0.169)	(0.354)
All HH members have two sets of clothes	0.0655**	0.176**	0.0284
	(0.0212)	(0.0558)	(0.0675)
All HH members have a pair of shoes	0.115***	0.184**	0.380***
	(0.0249)	(0.0558)	(0.0872)
HH owns its home	0.000268	0.0881	-0.00124
	(0.0353)	(0.0813)	(0.134)
Constant	10.78***	7.127***	10.75***
	(0.288)	(0.383)	(0.508)
N	**2010**	**1927**	**1368**

Standard errors in parentheses
="* $p<0.05$ ** $p<0.01$ *** $p<0.001$"

Table 4: ANCOVA Estimates for Consumption

	(1) Food and Beverage Consumption	(2) Recurring Consumption	(3) Infrequent Consumption
Treatment	0.0223	-0.0148	-0.0533
	(0.0254)	(0.0400)	(0.0450)
HH size	-0.0566***	-0.0330***	0.0371***
	(0.00487)	(0.00632)	(0.00857)
Age of HH Head	0.00442***	-0.00302*	-0.00168
	(0.000897)	(0.00134)	(0.00239)
HH Head is Female	-0.0432	-0.0129	0.0370
	(0.0331)	(0.0553)	(0.0738)
HH Head is monogamously married	-0.0535	-0.0319	-0.0880
	(0.0304)	(0.0469)	(0.0590)
HH Head is Literate	0.00212	0.0344	0.0947
	(0.0270)	(0.0460)	(0.0496)
HH has iron roof	0.102*	0.0755	0.204**
	(0.0378)	(0.0579)	(0.0689)
HH has mud walls	0.0967**	0.109**	0.0135
	(0.0311)	(0.0374)	(0.0531)
HH has earth floor	-0.0413	-0.224	-0.152
	(0.0738)	(0.116)	(0.119)
HH has sanitary toilet	0.000975	0.0148	0.0734
	(0.0216)	(0.0340)	(0.0468)
HH uses wood as main cooking fuel	0.0448	-0.118	-0.172
	(0.105)	(0.162)	(0.140)
HH uses electric light	0.0936	0.0763	0.0373
	(0.0490)	(0.130)	(0.119)
All HH members have two sets of clothes	0.0495	0.141***	0.0680
	(0.0247)	(0.0382)	(0.0470)
All HH members have a pair of shoes	0.0849**	0.166**	0.233***
	(0.0252)	(0.0483)	(0.0583)
HH owns its home	-0.0121	-0.0538	0.0754
	(0.0405)	(0.0468)	(0.0779)
Constant	11.05***	8.510***	7.664***
	(0.306)	(0.298)	(0.380)
N	2010	2010	2010

Standard errors in parentheses
="* $p<0.05$ ** $p<0.01$ *** $p<0.001$"

Table 5: ANCOVA Estimates for Net Assets

	(1)	(2)	(3)
	Livestock Assets	Durable Assets	Net Financial Position
Treatment	0.226*	-0.00393	-0.120
	(0.0845)	(0.0463)	(0.230)
HH size	-0.00673	-0.0137	-0.0607
	(0.0163)	(0.00731)	(0.0450)
Age of HH Head	0.00541*	0.00122	-0.00713
	(0.00209)	(0.00122)	(0.00831)
HH Head is Female	-0.0701	-0.0213	-0.248
	(0.0927)	(0.0548)	(0.236)
HH Head is monogamously married	-0.0848	-0.0559	-0.114
	(0.0933)	(0.0526)	(0.219)
HH Head is Literate	-0.0367	0.137**	-0.305
	(0.0685)	(0.0477)	(0.201)
HH has iron roof	-0.231*	0.259***	0.410
	(0.107)	(0.0549)	(0.261)
HH has mud walls	-0.428***	0.0201	-0.0852
	(0.0963)	(0.0508)	(0.187)
HH has earth floor	-0.0664	-0.155	-0.637
	(0.222)	(0.0947)	(0.439)
HH has sanitary toilet	0.0297	0.0106	0.204
	(0.0658)	(0.0413)	(0.183)
HH uses wood as main cooking fuel	0.163	0.104	0.395
	(0.296)	(0.139)	(0.383)
HH uses electric light	0.482**	0.382*	0.425
	(0.139)	(0.141)	(0.420)
All HH members have two sets of clothes	0.135	0.0924*	0.250
	(0.0815)	(0.0447)	(0.232)
All HH members have a pair of shoes	0.102	0.175**	-0.193
	(0.0694)	(0.0544)	(0.302)
HH owns its home	0.0919	-0.0268	-0.367
	(0.122)	(0.0736)	(0.374)
Constant	6.849***	5.761***	7.179***
	(0.437)	(0.305)	(1.305)
Tot	1552	1935	210

Standard errors in parentheses

="* p<0.05   ** p<0.01   *** p<0.001"

Table 6: ANCOVA Estimates for Productive Cash Inflows

	(1)	(2)	(3)
	Net Cash Inflows from Farming	Income from other Self-Employment	Income from Paid Employment
Treatment	-0.0309	0.233*	-0.0375
	(0.143)	(0.109)	(0.0669)
HH size	-0.0592	-0.0958***	-0.0543*
	(0.0299)	(0.0233)	(0.0234)
Age of HH Head	-0.000384	-0.00798	-0.00576
	(0.00649)	(0.00562)	(0.00367)
HH Head is Female	-0.462*	-0.114	-0.108
	(0.181)	(0.122)	(0.100)
HH Head is monogamously married	-0.296	-0.0723	-0.0214
	(0.202)	(0.155)	(0.102)
HH Head is Literate	0.0222	-0.0770	0.0585
	(0.161)	(0.122)	(0.0950)
HH has iron roof	0.0830	0.398*	0.475***
	(0.192)	(0.162)	(0.113)
HH has mud walls	0.0106	0.132	0.340**
	(0.199)	(0.148)	(0.104)
HH has earth floor	0.463	-0.101	-0.0916
	(0.717)	(0.549)	(0.356)
HH has sanitary toilet	0.179	0.0767	-0.0474
	(0.175)	(0.113)	(0.0997)
HH uses wood as main cooking fuel	-0.121	-0.433	-0.405
	(0.394)	(0.502)	(0.327)
HH uses electric light	0.804	0.314	-0.162
	(0.556)	(0.292)	(0.560)
All HH members have two sets of clothes	-0.256	-0.0158	0.146
	(0.211)	(0.130)	(0.0916)
All HH members have a pair of shoes	0.297	0.389*	0.321**
	(0.228)	(0.146)	(0.117)
HH owns its home	-0.183	-0.150	-0.0363
	(0.377)	(0.151)	(0.0986)
Constant	9.128***	12.19***	8.705***
	(1.136)	(0.979)	(0.857)
N	384	423	590

Standard errors in parentheses

="* $p<0.05$ ** $p<0.01$ *** $p<0.001$"

Table 7: LASSO Estimates (Total Consumption)

Unpenalized Independent Baseline Covariates

Treatment*
HH size*
Age of HH Head*
HH Head is Female*
HH Head is monogamously married*
HH Head is Literate*
HH has iron roof*
HH has mud walls*
HH has earth floor*
HH has sanitary toilet*
HH uses wood as main cooking fuel*
HH uses electric light*
All HH members have two sets of clothes*
All HH members have a pair of shoes*
HH owns its home*
Constant

Penalized variables Interacted with Treatment (Retained)

HH Head is monogamously married
HH has iron roof

*Variables not Retained

Treatment*
HH size*
Age of HH Head*
HH Head is Female*
HH Head is Literate*
HH has mud walls*
HH has earth floor*
HH has sanitary toilet*
HH uses wood as main cooking fuel*
HH uses electric light*
All HH members have two sets of clothes*
All HH members have a pair of shoes*
HH owns its home*
Cross-validation with 10 folds
Lambda =29.832

Table 8 : LASSO Estimates (Total Assets)

Unpenalized Independent Baseline Covariates	Impact on Total Assets
Treatment*	0.133
HH size*	-0.009
Age of HH Head*	0.003
HH Head is Female*	-0.038
HH Head is monogamously married*	-0.107
HH Head is Literate*	0.072
HH has iron roof*	0.069
HH has mud walls*	-0.223
HH has earth floor*	-0.176
HH has sanitary toilet*	0.012
HH uses wood as main cooking fuel*	0.136
HH uses electric light*	0.378
All HH members have two sets of clothes*	0.176
All HH members have a pair of shoes*	0.183
HH owns its home*	0.089
Constant	7.161
Penalized variables Interacted with Treatment (Retained)	
HH Head is monogamously married	0.058
HH has earth floor	0.051

*Variables not Retained

Treatment*
HH size*
Age of HH Head*
HH Head is Female*
HH Head is Literate*
HH has iron roof*
HH has mud walls*
HH has sanitary toilet*
HH uses wood as main cooking fuel*
HH uses electric light*
All HH members have two sets of clothes*
All HH members have a pair of shoes*
HH owns its home*

Cross-validation with 10 folds
Lambda =65.198

Table 9: LASSO Estimates (Total Productive Cash Inflows)

Unpenalized Independent Baseline Covariates	Impact on Total Productive Cash Inflows
Treatment*	0.014
HH size*	-0.042
Age of HH Head*	-0.006
HH Head is Female*	-0.183
HH Head is monogamously married*	-0.202
HH Head is Literate*	0.123
HH has iron roof*	0.219
HH has mud walls*	0.192
HH has earth floor*	-0.315
HH uses wood as main cooking fuel*	-0.325
HH uses electric light*	0.309
All HH members have a pair of shoes*	0.377
Constant	10.767
Penalized variables Interacted with Treatment (Retained)	
HH Head is Literate	0.028
All HH members have two sets of clothes	0.049

*Variables not Retained
Treatment*
HH size*
Age of HH Head*
HH Head is Female*
HH Head is monogamously married*
HH has iron roof*
HH has mud walls*
HH has earth floor*
HH uses wood as main cooking fuel*
HH uses electric light*
All HH members have a pair of shoes*

Cross-validation with 10 folds
Lambda = 70.281

Table 10 : LASSO Estimates (Total Consumption: Food and Beverage Consumption)

Selected Variables	Impact on Food and Beverage Consumption
HH size*	-0.057
Age of HH Head*	0.004
HH Head is Female*	-0.044
HH Head is monogamously married*	-0.076
HH Head is Literate*	0.003
HH has iron roof*	0.066
HH has mud walls*	0.096
HH has earth floor*	-0.036
HH has sanitary toilet*	0.002
HH uses wood as main cooking fuel*	0.047
HH uses electric light*	0.098
All HH members have two sets of clothes*	0.049
All HH members have a pair of shoes*	0.083
HH owns its home*	-0.009
Constant	11.049
HH Head is monogamously married	0.039
HH has iron roof	0.066

*Variables not Retained

 HH size*
 Age of HH Head*
 HH Head is Female*
 HH Head is Literate*
 HH has mud walls*
 HH has earth floor*
 HH has sanitary toilet*
 HH uses wood as main cooking fuel*
 HH uses electric light*
 All HH members have two sets of clothes*
 All HH members have a pair of shoes*
 HH owns its home*

Cross-validation with 10 folds
Lambda = 29.567

Table 11 : LASSO Estimates (Total Assets: Livestock Assets)

Selected Variables	Impact on Livestock Assets
HH size*	-0.006
Age of HH Head*	0.005
HH Head is Female*	-0.183
HH Head is monogamously married*	-0.080
HH Head is Literate*	-0.036
HH has iron roof*	-0.058
HH has mud walls*	-0.428
HH has earth floor*	-0.089
HH has sanitary toilet*	0.018
HH uses wood as main cooking fuel*	0.043
HH uses electric light*	0.639
All HH members have two sets of clothes*	0.113
All HH members have a pair of shoes*	0.104
HH owns its home*	0.080
Constant	6.958
HH Head is Female	0.206
HH has iron roof	-0.318
HH uses wood as main cooking fuel	0.235
HH uses electric light	-0.422
All HH members have two sets of clothes	0.048
*Variables not Retained	
HH size*	
Age of HH Head*	
HH Head is monogamously married*	
HH Head is Literate*	
HH has mud walls*	
HH has earth floor*	
HH has sanitary toilet*	
All HH members have a pair of shoes*	
HH owns its home*	
Cross-validation with 10 folds	
Lambda = 40.8	