

An Assessment of the Effectiveness of Administrative Data vs. Survey Data for Humanitarian Assistance Targeting

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1 Abstract

One of the most difficult challenges for governmental bodies and non-profit organizations in the process of giving aid is ensuring the correct population is receiving aid. Governments and organizations allocate aid via a number of proxy mechanisms such as geographic or demographic targeting, self or community targeting, or proxy means tests (PMTs). Each of these methods exhibit variation across their implementations, contexts, and performance. PMTs are a common model for poverty targeting. PMTs use existing survey data to select a small set of predictors to then survey the eligible population and determine which participants are eligible for the aid. In this method, researchers typically assign consumption or expenditure data as a dependent variable to serve as a proxy for poverty and derive a model that weighs factors to predict the poverty level in the eligible population.

In this report, we develop an econometric expenditure prediction model for refugees in Kenya based on data from the survey “Kenya Socio-economic Profiling Survey of Refugees in Kalobeyei 2018” conducted by the United Nations High Commissioner for Refugees. To develop the poverty prediction model, we create a restricted (verifiable variables) and unrestricted data set (verifiable and unverifiable variables). We ran ridge, lasso, and elastic net models on both data sets and additionally, we predict inclusion and exclusion error rates. Our study found that error rates for both inclusion and exclusion of refugees significantly decrease for the unrestricted data set in comparison to the restricted. Our findings further support that the survey of all refugees will prove beneficial for more accurate aid targeting of the refugee population.

2 Background

We base our report on the survey “Kenya Socio-economic Profiling Survey of Refugees in Kalobeyi 2018” conducted by the United Nations High Commissioner for Refugees. Kenya has served as a host site for refugees since 1992, but over the past five years, the Kakuma Refugee Camps significantly increased in population. Currently, the refugee population is excluded from national household surveys, which measure various indicators such as poverty monitoring. The exclusion of the refugee population from surveys poses a significant problem given that this population carries substantial impact on the local Kenyan population and national surveys are not accurately capturing differences in poverty between refugees and locals. In conjunction with the World Bank, the United Nations High Commissioner for Refugees (UNHCR) conducted a survey to inform government policy and poverty monitoring of refugee populations. (United Nations High Commissioner for Refugees, 2020).

The survey addresses the following criteria: Education, Employment, Household Characteristics, Assets, Access to Services, Vulnerability, Social Cohesion, Consumption and Expenditure Food, Nonfood, Education, and Energy (United Nations High Commissioner for Refugees, 2020). The UNHCR uses two socio-economic questionnaires to conduct the survey, which includes a basic and an extended questionnaire. The extended questionnaire is based on a systematic random sample. All 6,004 households received the basic questionnaire, but only 1,102 (18.5%) of households received the extended questionnaire. There is a non-response rate of 2%, most commonly associated with the lack of an adult household member when the survey was conducted (United Nations High Commissioner for Refugees, 2020).

3 Data

In the appendix, Table 1, shows descriptive statistics of individual level demographic information on refugees from the Kalobeyi settlement collected through the socioeconomic profiling interview. The refugee population surveyed is predominantly young, uneducated, evenly split by gender, and largely members of female-led households. Almost half of the population can read (46.30%) and write (44.97%). Additionally, less than half have no education (43.86%), indicating that about 51.14% of refugees have some level of education. Of those with an education, 27.86% have a primary education, while 15.64% have a secondary education.

In addition to demographic information, we also have information about household assets for the sample refugee population. Table 2 in the appendix shows descriptive statistics of all of the assets at a household level. The majority of households own a mosquito net and about half of the households own charcoal. Very few of the refugees own electrically powered items such as a television, a generator, or a refrigerator. Interestingly, 23.49% of refugees own smartphones, which is significantly more common than other electronically powered items.

Less than a quarter of refugees own a table (22.84%), while very few own a bed (5.41%). Similarly, 40.01% of refugees own a toilet. Very few refugees own a means of transportation with bicycles being the most common transportation asset (3.39%). Furthermore, less than half of the sample owns a toilet and only 19.81% of refugee households have purchased food in the past seven days. Less than a fourth (19.82%) of households received food for free, which is the same percentage of households that purchased food in the last seven days. This indicates that those households which purchased food also receive their food for free.

Table 1 displays summary statistics of total expenditure per capita and the natural log of total expenditure per capita in Kenyan Shillings (KSH). On average, the refugees in our sample population spent 1,853.32 KSH per capita on a weekly basis.

Table 1: Total Expenditure per Capita

	Mean	Std	N
Expenditure per Capita (KSH)	1853.32	4650.88	1090.0
ln (Expenditure per capita)	7.07	0.87	1090.0

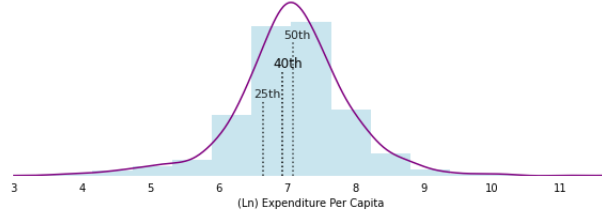
Summary statistics on total spend per capita broken down by category are shown in Table 2 suggesting that refugees spent the majority of their money on food followed by education, while they spent significantly less money on non-food assets and energy sources per week.

Table 2: Summary Statistics on Total Spend per Capita by Category

	Mean	Std	N
Energy Total Spend	362.75	334.23	1090.0
Food Total Spend	4829.03	2984.09	1090.0
Education Total Spend	2093.95	6675.01	1090.0
Nonfood Total Spend	479.57	436.24	1090.0

Figure 1 provides a density histogram visualization of the natural log of total expenditure per capita with the 25th, 40th, and 50th percentile thresholds.

Histogram of (Ln) Expenditure Per Capita



4 Prediction Model

Our models are based solely on households chosen for the extended Socio-economic Profiling (SEP) interview. We use demographic information and assets at a household level as independent variables while the natural log of expenditure per capita is the dependent variable. We predict expenditure per capita (in KSH) for all households who received extended SEP interviews between November 2018 and January 2019. Unique identifiers allowed us to merge individual and household level data for further analysis. After cleaning outliers and merging each data set, we ended with a total of 1,090 households.

Our approach relies on the ridge regression, the lasso regression, and the elastic net regression. The lasso and elastic net models provide alternative penalty parameters to the ridge model. We fit the models based on our training data set which is 75% of the sample (817 households). We use 10-fold cross validation to select the best alpha parameter and refit the model. We then use the estimated coefficients derived from the training set to predict expenditure using the remaining 25% of the sample in our validation set (273 households). We assess the discrepancies between the predictions for expenditure by comparing predicted and actual expenditure.

We use the following specification for the ridge regression:

$$\min_{\beta_1, \dots, \beta_p} \sum_{i=1}^n (y_i - \beta_0 - \beta_1 x_1 - \dots - \beta_p x_p)^2 + \lambda \sum_{j=1}^p \beta_j^2$$

where y_i represents $\ln(\text{expenditure/capita})$, β_0 represents the common intercept and $\lambda \sum_{j=1}^p \beta_j^2$ represents the penalty term which penalizes model complexity.

We use the following specification for the lasso regression:

$$\min_{\beta_1, \dots, \beta_p} \sum_{i=1}^n (y_i - \beta_0 - \beta_1 x_1 - \dots - \beta_p x_p)^2 + \lambda \sum_{j=1}^p |\beta_j|$$

where y_i represents $\ln(\text{expenditure/capita})$, β_0 represents the common intercept and $\lambda \sum_{j=1}^p |\beta_j|$ represents the penalty term which penalizes model complexity. Unlike the ridge regression, the parameter estimates in the lasso regression can be 0 due to the construction of the model.

We use the following specification for the elastic net regression:

$$\frac{\sum_{i=1}^n (y_i - x_i^J \hat{\beta})^2}{2n} + \lambda \left(\frac{1-\alpha}{2} \sum_{j=1}^m \hat{\beta}_j^2 + \alpha \sum_{j=1}^m |\hat{\beta}_j| \right)$$

where y_i represents $\ln(\text{expenditure/capita})$ and $\lambda \left(\frac{1-\alpha}{2} \sum_{j=1}^m \hat{\beta}_j^2 + \alpha \sum_{j=1}^m |\hat{\beta}_j| \right)$ represents the penalty term. The elastic net model is a combination of both the ridge and lasso penalties.

5 Outcome and Prediction Variables

We distinguish between verifiable variables and non-verifiable variables in our analysis to take into account potential inaccuracies in survey reporting. We create a restricted data set which includes verifiable information including demographic variables and assets. Additionally, we create an unrestricted data set which includes demographic variables and household assets in addition to non-verifiable household assets such as possession of a bank account. See tables 2 and 3 for summary statistics on all variables in the restricted and unrestricted data sets. While the information in the restricted data set is typically available in administrative data, the information in the unrestricted data set is collected by surveying specific populations.

Our goal is to determine to what extent humanitarian assistance targeting improves if we use administrative data such as the restricted set compared to surveying the refugee population based on the unrestricted set. We run the ridge, lasso, and elastic net models on both the restricted and unrestricted data sets. See tables 4 and 5 in the appendix for our results. We replace all missing values with NAs so that all households can receive a predicted expenditure score.

6 Prediction Accuracy

We use two error metrics to assess the accuracy of our models. Exclusion error represents eligible households who fail to receive cash transfers. On the other hand, the inclusion error metric reflects the percentage of refugees who receive transfers given they were ineligible for the program. We report the exclusion and inclusion errors at the 25, 40, and 50th percentiles of the expenditure per capita distribution in Table 3 and Table 4.

For the restricted models based on the 50th percentile of expenditure per capita, the elastic net model displays the lowest exclusion error rate of 33.82%

Table 3: Exclusion Error of Expenditure per Capita as Percentages

Percentile	Restricted			Unrestricted		
	Lasso	Ridge	Elastic Net	Lasso	Ridge	Elastic Net
25%	60.29	61.76	64.71	48.52	42.64	45.59
40%	48.62	44.95	45.87	35.78	31.19	32.11
50%	36.76	34.56	33.82	24.26	24.26	25.00

compared to the ridge model with a 34.55% exclusion error and the lasso model with a 36.76% exclusion error. However, the unrestricted data set provides substantial improvement in exclusion error rates relative to the restricted data sets. The unrestricted models based on the 50th percentile of expenditure per capita suggest that the ridge and lasso models have the lowest exclusion error of 24.26% followed by the elastic net model with a 25.00% exclusion error. We show that the different penalty terms in the regression equation make little difference to prediction performance.

Table 4: Inclusion Error of Expenditure per Capita as Percentages

Percentile	Restricted			Unrestricted		
	Lasso	Ridge	Elastic Net	Lasso	Ridge	Elastic Net
25%	61.35	76.36	78.57	45.21	59.79	46.10
40%	53.34	56.52	57.86	44.44	40.48	43.95
50%	47.24	44.03	43.40	39.05	30.41	40.00

At the 50th percentile for the restricted set, the elastic net model has the smallest inclusion error of 43.40%, followed by the 44.03% inclusion error in the ridge model and the 47.24% inclusion error in the lasso model. On the other hand, the unrestricted models based on the 50th percentile of expenditure per capita display slightly lower error rates. The ridge model has a 30.41% inclusion error while the lasso and elastic net have inclusion errors of 39.05% and 40.00% respectively.

7 Conclusion

We conclude that surveying the refugee population reduces inclusion and exclusion errors in humanitarian assistance targeting in comparison to relying on administrative data from the restricted data set. Therefore, our findings suggest that the survey of all refugees is beneficial for more accurate targeting of the refugee population in Kenya. It is worth noting that our models based on administrative data exhibit higher error rates relative to Altındag et al.’s research

(2019). As a result, it is necessary to explore whether there are other variables that should be included in our administrative data set to improve prediction accuracy. Another explanation for these results is that the data necessary to target aid is population specific. It may be more effective to rely on survey data to target assistance to refugees in the Kalobeyi settlement while administrative data is sufficient to target other populations.

Future research should explore which variables in the survey data set are heavily weighted and thus contributing to significantly lower error rates in the survey data relative to the administrative data. Other considerations are related to whether there are differences in error rates when targeting specific subgroups, as well as the cost implications of obtaining survey data in comparison to administrative data.

8 References

1. Altindag, Onur, et al. “Targeting Humanitarian Aid Using Administrative Data: Model Design and Validation.” SSRN Electronic Journal, 2019, doi:10.2139/ssrn.3444974.
2. “Kenya Socio-economic Profiling Survey of Refugees in Kalobeyi 2018.” United Nations High Commissioner for Refugees, 2020.
3. “Understanding the Socio-economic Conditions of Refugees in Kalobeyi, Kenya.” United Nations High Commissioner for Refugees, 2018.

A Appendix

Table 1: Descriptive Stats of Individual Demographic Information

	Mean	Std	N
Head Female	0.66	0.48	1100.0
Share Female	0.49	0.26	1100.0
% Members Aged 0-4	0.19	0.17	1100.0
% Members Aged 5-9	0.19	0.17	1100.0
% Members Aged 10-14	0.15	0.16	1100.0
% Members Aged 15-24	0.22	0.25	1100.0
% Members Aged 25-49	0.22	0.23	1100.0
% Members Over Age 50	0.01	0.07	1100.0
% Male Members Aged 10-19	0.16	0.20	1100.0
% Female Members Aged 10-19	0.12	0.15	1100.0
% Male Members Aged 20-49	0.16	0.27	1100.0
% Female Members Aged 20-49	0.15	0.14	1100.0
% Members with No Education	0.44	0.44	1100.0
% Members with Early Childhood Education	0.00	0.03	1100.0
% Members with Primary Education	0.28	0.39	1100.0
% Members with Secondary Education	0.16	0.31	1100.0
% Members with Vocational Education	0.02	0.13	1100.0
% Members with University Education	0.02	0.11	1100.0
% Members with Other Education	0.02	0.11	1100.0
% Members who Speak	0.65	0.47	1100.0
% Members who Read	0.46	0.45	1100.0
% Members who Write	0.45	0.44	1100.0

Table 2: Descriptive Stats of Restricted Data for Household Level

	Mean	Std	N
Number of Dwellings	1.32	0.56	1090.0
Number of Habitable Rooms	1.40	0.67	1090.0
Owns a Radio	0.05	0.22	1090.0
Owns a Television	0.01	0.09	1090.0
Owns a Satelite Dish	0.01	0.08	1090.0
Owns a Smartphone	0.23	0.42	1090.0
Owns a Refrigerator	0.00	0.05	1090.0
Owns a Table	0.23	0.42	1090.0
Owns a Bed	0.05	0.23	1090.0
Owns a Mattress	0.32	0.47	1090.0
Owns a Mosquito Net	0.93	0.26	1090.0
Owns a Fan	0.01	0.07	1090.0
Owns a Bicycle	0.03	0.18	1090.0

Table 2: Descriptive Stats of Restricted Data for Household Level

	Mean	Std	N
Owns a Motorcycle	0.02	0.12	1090.0
Owns a Generator	0.00	0.05	1090.0
Owns Solar Panels	0.06	0.23	1090.0
Owns Kerosene Stove	0.04	0.19	1090.0
Owns Charcoal	0.59	0.49	1090.0
Owns a Wheelbarrow	0.04	0.19	1090.0
Owns Iron Fencing	0.01	0.10	1090.0
Owns Farm Animals	0.20	0.40	1090.0
Head of Household - Female	0.66	0.47	1090.0
Share of Household - Female	0.49	0.26	1090.0
% Members Aged 0-4	0.19	0.17	1090.0
% Members Aged 5-9	0.19	0.17	1090.0
% Members Aged 10-14	0.15	0.16	1090.0
% Members Aged 15-24	0.22	0.25	1090.0
% Members Aged 25-49	0.22	0.23	1090.0
% Members Over Age 50	0.01	0.07	1090.0
% Male Members Aged 10-19	0.16	0.20	1090.0
% Female Members Aged 10-19	0.12	0.15	1090.0
% Male Members Aged 20-49	0.16	0.26	1090.0
% Female Members Aged 20-49	0.16	0.14	1090.0
% Members with No Education	0.45	0.44	1090.0
% Members with Early Childhood Education	0.00	0.03	1090.0
% Members with Primary Education	0.28	0.39	1090.0
% Members with Secondary Education	0.16	0.31	1090.0
% Members with Vocational Education	0.02	0.13	1090.0
% Members with University Education	0.02	0.11	1090.0
% Members with Other Education	0.02	0.11	1090.0
Owns Lighting Source	2.43	1.56	1090.0
Owns Floor Material	1.32	0.82	1090.0
Owns Roof Material	1.04	0.33	1090.0
Owns Wall Material	1.29	0.67	1090.0
Toilet Type	2.64	0.98	1090.0
Owns Toilet	0.40	0.49	1090.0
Receives Free Food	0.20	0.40	1090.0
Household Purchased Food in last 7 days	0.20	0.40	1090.0

Table 3: Descriptive Stats of Unrestricted Data for Household Level

	Mean	Std	N
Size of Household	5.76	3.08	1090.0
Head of Household - Female	0.66	0.47	1090.0
Share of Household - Female	0.49	0.26	1090.0

Table 3: Descriptive Stats of Unrestricted Data for Household Level

	Mean	Std	N
% Members Aged 0-4	0.19	0.17	1090.0
% Members Aged 5-9	0.19	0.17	1090.0
% Members Aged 10-14	0.15	0.16	1090.0
% Members Aged 15-24	0.22	0.25	1090.0
% Members Aged 25-49	0.22	0.23	1090.0
% Members Over Age 50	0.01	0.07	1090.0
% Male Members Aged 10-19	0.16	0.20	1090.0
% Female Members Aged 10-19	0.12	0.15	1090.0
% Male Members Aged 20-49	0.16	0.26	1090.0
% Female Members Aged 20-49	0.16	0.14	1090.0
% Members Age Not Available	0.02	0.10	1090.0
% Members with No Education	0.45	0.44	1090.0
% Members with Early Childhood Education	0.00	0.03	1090.0
% Members with Primary Education	0.28	0.39	1090.0
% Members with Secondary Education	0.16	0.31	1090.0
% Members with Vocational Education	0.02	0.13	1090.0
% Members with University Education	0.02	0.11	1090.0
% Members with Other Education	0.02	0.11	1090.0
% Member who Speak	0.66	0.47	1090.0
% Members who Read	0.47	0.44	1090.0
% Members who Write	0.46	0.44	1090.0
Household Purchased Food in last 7 days	0.20	0.40	1090.0
Receives Free Food	0.20	0.40	1090.0
Size of Family 1	5.34	2.87	1090.0
Size of Family 2	0.37	1.13	1090.0
Size of Family 3	0.04	0.36	1090.0
Size of Family 4	0.01	0.11	1090.0
Size of Family 5	0.00	0.00	1090.0
Number of Dwellings	1.32	0.56	1090.0
Number of Habitable Rooms	1.40	0.67	1090.0
Number of Dwellings	1.32	0.82	1090.0
Number of Habitable Rooms	1.04	0.33	1090.0
Owns Floor Material	1.29	0.67	1090.0
Owns Roof Material	1.04	0.29	1090.0
Owns Wall Material	2.64	0.98	1090.0
Drinking Water Source	2.43	1.56	1090.0
Toilet Type	0.00	0.00	1090.0
Lighting Source	1.82	0.62	1090.0
Household Members Per Room	1.82	0.62	1090.0
Livelihood Coping Strategy Index	0.06	1.68	1090.0
Asset index based on PCA	1.90	0.00	1090.0
International Poverty Line (2011)	1.82	0.62	1090.0
Being below the International Poverty line (201...	0.16	0.21	1090.0

Table 3: Descriptive Stats of Unrestricted Data for Household Level

	Mean	Std	N
Poverty severity from cons aggregate and intern...	0.07	0.12	1090.0
Owens Radio	0.05	0.22	1090.0
Owens Television	0.01	0.09	1090.0
Insufficient Drinking Water	0.66	0.47	1090.0
Owens a Satelite Dish	0.01	0.08	1090.0
Owens a Smartphone	0.23	0.42	1090.0
Owens a Refrigerator	0.00	0.05	1090.0
Owens a Table	0.23	0.42	1090.0
Owens a Bed	0.05	0.23	1090.0
Owens a Mattress	0.32	0.47	1090.0
Owens a Mosquito Net	0.93	0.26	1090.0
Owens a Fan	0.01	0.07	1090.0
Owens a Bicycle	0.03	0.18	1090.0
Owens a Motorcycle	0.02	0.12	1090.0
Owens a Generator	0.00	0.05	1090.0
Owens Solar Panels	0.06	0.23	1090.0
Owens Kerosene Stove	0.04	0.19	1090.0
Owens Charcoal	0.59	0.49	1090.0
Owens a Wheelbarrow	0.04	0.19	1090.0
Owens Iron Fencing	0.01	0.10	1090.0
Owens Farm Animals	0.20	0.40	1090.0
Relatives Aborad	0.13	0.33	1090.0
Relatives Outside Kenya	0.10	0.30	1090.0
Owens Bank Account	0.28	0.45	1090.0
Borrowed from Sources Past 12 Months	0.14	0.35	1090.0
Borrowed from Bank Past 12 Months	0.02	0.13	1090.0
Borrowed from Community Past 12 Months	0.03	0.17	1090.0
Borrowed from Family/Friends Past 12 Months	0.11	0.31	1090.0
Remittances from Aborad	0.06	0.23	1090.0
Purchased Insurance	0.01	0.07	1090.0
Sell Goods Lack of Food	0.16	0.37	1090.0
Health and Education Reducation Lack Food	0.14	0.35	1090.0
Sell Assets Lack Food	0.09	0.29	1090.0
Spend Savings Lack Food	0.22	0.42	1090.0
Borrowed Money Lack Food	0.33	0.47	1090.0
Sell House/Land Lack Food	0.02	0.13	1090.0
Withdraw Children From School Lack Food	0.04	0.19	1090.0
Sells Animals Lack Food	0.05	0.22	1090.0
Sell Last Female Animal Lack Food	0.04	0.19	1090.0
Beg Lack Food	0.13	0.33	1090.0
Shares Toilet	0.40	0.49	1090.0

Table 4: Model Coefficients for Restricted data set

	Ridge	Lasso	Elastic Net
number_dwellings	-0.07	-0.02	-0.04
number_habitable_rooms	-0.05	-0.05	-0.08
own_radio_Yes	0.16	0.16	0.18
own_television_Yes	0.05	0.00	0.00
own_satelitedish_Yes	0.25	0.34	0.00
own_smartphone_Yes	0.07	0.00	0.03
own_refrigerator_Yes	0.46	0.00	0.00
own_table_Yes	0.07	0.06	0.08
own_bed_Yes	0.15	0.05	0.07
own_mattress_Yes	0.06	0.02	0.05
own_mosquitoset_Yes	0.02	0.00	0.00
own_fan_Yes	0.08	0.00	0.00
own_bicycle_Yes	0.14	0.08	0.04
own_motorcycle_Yes	0.01	0.00	0.00
own_generator_Yes	-0.24	0.00	0.00
own_solarpanels_Yes	-0.00	-0.00	-0.00
own_kerosenestove_Yes	0.18	0.08	0.10
own_charcoaljiko_Yes	0.12	0.10	0.14
own_wheelbarrow_Yes	0.16	0.05	0.05
own_ironfencing_Yes	0.10	-0.00	-0.00
own_farmanimals_Yes	-0.03	-0.00	-0.00
headFemale	-0.04	-0.00	-0.02
shareFemale	-0.08	-0.02	-0.03
shareAgeZeroToFour	-0.33	-0.24	-0.18
shareAgeFiveToNine	-0.32	-0.09	-0.03
shareAgeTenToFourteen	-0.24	-0.00	-0.00
shareAgeFifteenToTwentyfour	0.26	0.51	0.51
shareAgeTwentyfivetofourty-nine	0.14	0.31	0.33
shareAgeFiftyPlus	0.10	0.00	0.00
shareMaleAgeTenToNineteen	0.01	0.00	0.00
shareFemaleAgeTenToNineteen	-0.02	-0.00	-0.00
shareMaleAgeTwentytoFourty-nine	0.15	0.34	0.29
shareFemaleAgeTwentytoFourty-nine	0.41	0.44	0.33
shareWithNoEducation	-0.17	-0.30	-0.36
shareWithEarlyChildhood	-0.70	-0.36	-0.00
shareWithPrimary	-0.10	-0.20	-0.28
shareWithSecondary	0.07	0.00	-0.00
shareWithVocational	0.36	0.15	0.00
shareWithUniversity	0.33	0.00	0.00
shareWithOther	0.13	0.00	-0.00
lighting_source	-0.01	-0.01	-0.03
floor_material	0.02	0.00	0.02
roof_material	0.00	-0.00	-0.00

Table 4: Model Coefficients for Restricted data set

	Ridge	Lasso	Elastic Net
wall_material	-0.06	-0.02	-0.06
toilet_type	0.01	0.00	0.03
share_toilet_Yes	0.06	0.01	0.06
foodwasfree_Yes	-0.03	-0.00	-0.00
hh_purchasedfood7d_Yes	-0.03	-0.00	-0.00

Table 5: Model Coefficients for Unrestricted data set

	Ridge	Lasso	Elastic Net
size	-0.02	-0.04	-0.07
headFemale	-0.01	-0.00	0.00
shareFemale	-0.07	-0.06	-0.07
shareAgeZeroToFour	-0.19	-0.20	-0.07
shareAgeFiveToNine	-0.09	-0.00	-0.00
shareAgeTenToFourteen	-0.09	-0.00	0.00
shareAgeFifteenToTwentyfour	0.19	0.31	0.28
shareAgeTwentyfivetofourty-nine	-0.00	0.00	0.00
shareAgeFiftyPlus	-0.03	-0.00	-0.00
shareMaleAgeTenToNineteen	0.04	0.00	0.00
shareFemaleAgeTenToNineteen	0.03	-0.00	0.00
shareMaleAgeTwentytoFourty-nine	0.05	0.04	0.00
shareFemaleAgeTwentytoFourty-nine	0.23	0.00	0.00
shareAgeNaN	-0.18	-0.07	-0.00
shareWithNoEducation	-0.09	-0.06	-0.18
shareWithEarlyChildhood	-0.70	-0.25	-0.00
shareWithPrimary	-0.07	-0.00	-0.16
shareWithSecondary	0.07	0.17	0.03
shareWithVocational	0.30	0.31	0.00
shareWithUniversity	0.29	0.09	0.00
shareWithOther	0.10	0.00	0.00
shareSpeaks	-0.07	-0.06	-0.04
shareReads	0.02	0.00	0.05
shareWrites	0.02	0.00	0.00
hh_purchasedfood7d_Yes	-0.02	-0.00	-0.00
foodwasfree_Yes	-0.02	-0.00	-0.00
familysize1	-0.02	-0.00	-0.00
familysize2	-0.01	0.00	0.01
familysize3	-0.04	-0.00	-0.01
familysize4	-0.03	-0.00	-0.00
familysize5	0.00	0.00	0.00
number_dwellings	0.02	0.00	0.12
number_habitablerooms	-0.00	0.00	-0.00
floor_material	0.04	0.02	0.06

Table 5: Model Coefficients for Unrestricted data set

	Ridge	Lasso	Elastic Net
roof_material	0.04	0.00	0.02
wall_material	-0.06	-0.02	-0.06
drikingwater_source	0.04	0.00	0.00
toilet_type	0.01	0.00	0.02
lighting_source	-0.01	-0.01	-0.03
rentpaid_shillings	0.00	0.00	0.00
crowdindex_room	0.02	0.05	0.03
LCS_index	0.02	0.00	0.04
asset_idx	0.02	0.04	0.05
pline_ipl	0.00	0.00	0.00
poorIPL	0.02	0.00	0.03
pgi	-0.56	-1.15	-0.94
spg	-0.57	-0.00	-0.00
own_radio_Yes	0.12	0.05	0.04
own_television_Yes	-0.03	0.00	-0.00
drinkingwater_insufficientquantities_Yes	-0.00	-0.00	-0.00
own_satelitedish_Yes	0.15	0.00	0.00
own_smartphone_Yes	0.03	0.00	-0.00
own_refrigerator_Yes	0.44	0.00	0.00
own_table_Yes	0.05	0.00	0.01
own_bed_Yes	0.13	0.02	0.00
own_mattress_Yes	0.03	0.00	-0.00
own_mosquitonet_Yes	0.03	0.00	0.00
own_fan_Yes	0.08	0.00	0.00
own_bicycle_Yes	0.12	0.02	0.00
own_motorcycle_Yes	-0.08	-0.00	-0.00
own_generator_Yes	-0.15	-0.00	-0.00
own_solarpanels_Yes	-0.06	-0.00	-0.11
own_kerosenestove_Yes	0.11	0.00	0.00
own_charcoaljiko_Yes	0.09	0.04	0.07
own_wheelbarrow_Yes	0.16	0.03	0.00
own_ironfencing_Yes	0.07	-0.00	-0.00
own_farmanimals_Yes	-0.02	-0.00	-0.00
relatives_abroad_Yes	0.04	0.00	0.00
relatives_outsidekenya_Yes	0.09	0.01	0.05
own_bankaccount_Yes	-0.13	-0.10	-0.17
borrowedfrom_sources12mo_Yes	0.05	0.07	0.12
borrowedfrom_bank12mo_Yes	0.11	-0.00	-0.00
borrowedfrom_community_Yes	0.12	0.00	0.00
borrowedfrom_familyorfriends12mo_Yes	-0.02	0.00	0.00
remittances_abroad_Yes	0.04	0.00	0.00
purchased_insurance_Yes	-0.16	-0.00	-0.00
sellhghgoods_lackfood_Yes	0.09	0.03	0.08

Table 5: Model Coefficients for Unrestricted data set

	Ridge	Lasso	Elastic Net
healthandeduc_reduction_Yes	0.11	0.13	0.16
sellassets_lackfood_Yes	0.05	0.00	0.00
spendsavings:lackfood_Yes	0.01	0.00	0.01
borrowmoneyfood_lackfood_Yes	0.01	0.00	0.00
sellhousetand_lackfood_Yes	-0.12	-0.00	-0.00
withdrawchildrenschool_lackfood_Yes	0.01	0.00	0.00
sellanimals:lackfood_Yes	-0.18	-0.13	-0.16
sellfemaleanimal_last_Yes	-0.15	-0.04	-0.06
beg_lackfood_Yes	0.01	-0.00	0.00
share_toilet_Yes	0.04	0.00	0.01