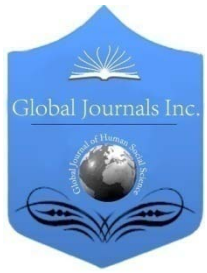
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Household Wealth Status in Botswana: An Asset Based Approach

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Abstract- Wealth has traditionally and commonly been measured using monetary indicators such as income and consumption (Hargreaves et al., 2007). Income is "the amount of money received during a period of time in exchange for labour or services, from the sale of goods or property, or as a profit from financial investments" (O' Donnell et al., 2008; 70). On the other hand, consumption is "the final use of goods and services, excluding the intermediate use of some goods and services in the production of others" (pp, 70). While there could be some differences in defining these two concepts, the approach to use them as welfare indicators has resulted in the production of social protection policies in various countries including Botswana. However, some researchers have debated the adequacy of the two monetary indicators in capturing status of welfare; hence alternative approaches have been proposed to serve this purpose.

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Household Wealth Status in Botswana: An Asset Based Approach

David Mmopelwa [α] & Khaufelo Raymond Lekobane [σ]

I. Introduction

Wealth has traditionally and commonly been measured using monetary indicators such as income and consumption (Hargreaves et al., 2007). Income is "the amount of money received during a period of time in exchange for labour or services, from the sale of goods or property, or as a profit from financial investments" (O' Donnell et al., 2008; 70). On the other hand, consumption is "the final use of goods and services, excluding the intermediate use of some goods and services in the production of others" (pp, 70). While there could be some differences in defining these two concepts, the approach to use them as welfare indicators has resulted in the production of social protection policies in various countries including Botswana. However, some researchers have debated the adequacy of the two monetary indicators in capturing status of welfare; hence alternative approaches have been proposed to serve this purpose. It has been observed that despite the findings of assets being the underlying determinants of poverty in the developing world, little attention (safe for human capital proxied by education) is given to them, resulting in the objectives to address only income (and/or expenditure) poverty (Sahn and Stifel, 2003).

The use of assets as a welfare indicator has however, not escaped criticism. Some argue that ownership does not capture the issue of assets quality (Falkingham and Namazie, 2002). Thus, the process of collecting data on assets may not differentiate households that own new or old assets, cheap or expensive ones etc. Notwithstanding that, the authors argue that in a number of countries, such traits would not change the overall picture of wealth. Filmer and Scott (2008) make references to the extensive use of asset indices in previous studies. The authors indicate that this index has been used for analysis of poverty change, inequality (in health and education outcomes), and for program targeting and evaluation. While this pattern is observed in the literature, little (or no) evidence exists in Botswana for utilizing assets to inform welfare status. This is despite that the surveys conducted and the previous census collected data on assets. This paper therefore fills this gap. The paper compliments poverty analysis efforts done so far as it extends understanding of multi-dimensions of poverty.

Results of this paper are important as they may assist policy makers to identify areas of concern to uplift household wealth, which should facilitate not only the attainment of MDGs but also the country's Vision 2016 aspirations. The rest of the paper is organised as follows. Section II discusses the methodology while section III discusses data source and descriptives. Results are presented and discussed in section IV, and section V concludes.

II. Methodology

a) Computation of an Index

The use of asset/welfare index is common in situations where data on either income or consumption was not collected. This approach is therefore relevant for this paper, with the 2011 population and housing census, which only asked about the source of income. Moreover, "the index captures a dimension of economic status" (Filmer and Scott, 2008; 4) and gives more reflection on long run household wealth (Filmer and Pritchett, 2001). Some of the issues to be considered in computing the index include choice of assets and their weights. Several approaches to computing the index exist. One of them is the simple total sum of assets from a dummy variable of whether a particular household owns assets or not (Case, Paxson and Ableidinger, 2004; Montgomery et al., 2000). This approach has been termed an "arbitrary approach" as it assumes equal weights for the different assets (O' Donnell et al., 2008; Vyas and Kumaranayake, 2006). Another approach is the use of statistical techniques which address the issues of weights in the index. The two commonly used techniques are the factor analysis and Principal Component Analysis (PCA). In this paper we computed the wealth index from a technique of PCA, which is a tool used to reduce a number of variables into one. It is mathematically specified as follows:

$$PC_1 = \beta_{11}Y_1 + \beta_{12}Y_2 + \beta_{13}Y_3 + \ldots + \beta_{1n}Y_n$$

$$\vdots$$

$$PCm = \beta_{m1}Y_1 + \beta_{m2}Y_2 + \beta_{m3}Y_3 + \ldots + \beta_{mn}Y_n$$

In the above specification, β_{mn} is the weight for the m^{th} Principal Component (PC) and the n^{th} variable, given set of variables from Y_1 to Y_n. The weights of the

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PCs are represented by the *eigenvectors* of the correlation matrix. However, if the data is standardized the eigenvectors would be of the co-variance matrix. On the other hand, the variance of the PCs is given by the *eigenvalues* (Vyas and Kumaranayake, 2006). In the output, components are ordered according to their proportion of variation that they explain in the original data; with those in the top positions explaining larger amounts of variation. The index was computed from housing conditions (type of houses, wall, floor, and roof materials), living conditions (water source, toilet facility and energy sources for lighting, cooking and heating) as well as ownership of durable assets (Television, radio, sewing machines, watch etc).

While there is no defined criteria for the choice of assets (Montgomery et al., 2000); ours was influenced by the bearing that the variables might have on the Millennium Development Goals. For instance, source of water, sanitation and flooring material affect hygiene. Source of energy for cooking may affect the environment and respiratory diseases that cause deaths. Some of the variables were in categorical form, which is not suitable for the PCA technique and were therefore converted to binary variables. After computing the wealth index, households were then classified into quintiles. The decision to choose five groups (quintiles) was among others informed by previous empirical work. According to literature, the commonly used cut-off points are classification into quintiles (Gwatkin et al. 2000; Filmer and Pritchett 2001). This is done to differentiate households into socio economic categories; to show wealth status within a population. We used SPSS (Version 18) for analysis.

III. Data Source and Descriptives

The paper used data from the 2011 population and housing census, which had 550944 households. Table A1 in the annex presents descriptive statistics. The fourth column of Table A1 shows the factor score, which is basically the first principal component (weight), used to create a household score (Houweling et al., 2003). A positive score suggests that a variable is associated with a higher economic status (wealth) while the opposite is true for a negative score. Thus, from Table A1, with regard to the type of housing unit, traditional, mixed, movable, shacks and rooms will be associated with lower economic status. The use of mud bricks/blocks or poles and reeds for floor would also reduce household wealth.

The pattern for type of housing unit is dominated by *detached* houses (43%) followed by *rooms* and *traditional house* with 23 percent and 13 percent, respectively. Other types (town house, mixed, flat, shacks and movable) accounted for a share of 10 percent or less. Majority (82%) of households had their walls made out of *conventional bricks/blocks* while the remaining shares were distributed amongst *corrugated iron*, *asbestos*, *wood*, *stones* and *poles* and *reeds*. A larger proportion (65%) had *cement* as a floor material, 22 percent with *floor tiles* and 0.07 percent with *brick/stone*. Roof material is dominated by *corrugated iron* (74%), followed by roof tiles (13%), while the least share was for *concrete* (0.3%).

Regarding water supply, majority (40%) of households had *piped outdoors* while 30 percent had *piped indoors*. Thus, majority appear to be accessing water from improved sources. This pattern was also observed by previous studies (Statistics Botswana, 2011). About 15 percent of households sourced water from *communal taps*. Other water sources including *bouser/tanker*, *well*, *borehole*, and *dam/pan* had a share of less than 10 percent. Those who owned *flush toilet* accounted for a share of about 25 percent followed by those who owned *pit latrines* with 24 percent. However, 18 percent of households shared pit latrines, 5 percent used neighbor`s pit latrines, and 9 percent shared flush toilet. While there is dominance of use of pit latrines, it is promising that the use of flush toilets (whether owned or shared) is also visible. The shares for those who used communal toilet facilities were less than a percent. The above presents a hopeful trend towards the achievement of the Millennium Development Goal 7 of ensuring environmental sustainability. More than half of households used *electricity* as a principal source of energy for lighting while 30 and 11 percent used *paraffin* and *candles* respectively. About 41 percent of households used wood as a source of energy for cooking followed by 38 percent who used *gas*. The use of wood also dominated sources of energy for heating (48%), followed by electricity with a share of 17 percent.

About 15 percent of households owned van/bakkie; 2 percent owned tractors and 20 percent owned cars. The shares of ownership status for donkey carts and bicycles stood at 12 and 10 percent respectively, while motor bike and boat were each owned by about a percent of households. About 43 percent owned the refrigerator and 5 percent owned sewing machine. Given that these assets have a positive factor score, their ownership implies the likelihood of improved welfare for households. On the other hand, majority (90%) owned cell phones while 11 percent had telephones (landlines). About 61 percent owned radios and 54 percent owned televisions. This pattern presents a positive outcome towards an “informed nation” as these assets are among the primary sources of information.

IV. Results and Discussions

We begin by presenting the welfare status by census district (Table 1). The numbers in brackets are proportions. As can be seen in the table, Gaborone, Francistown, and Orapa districts have larger proportions

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of households with better status of wealth. The proportions of households increase as we move from the lower (poorest) wealth status to the higher (richest) status. For instance, 0.6 (1.2) percent of households are in the poorest wealth status in Gaborone (Francistown) compared to 45 and 29 percent in the richest status respectively. This pattern is also observed in Lobatse, Selebi Phikwe, Sowa Town and Jwaneng, with some minor variations. These results corroborate findings from previous studies, that these districts had lower poverty incidence compared to others (CSO, 2008; Statistics Botswana, 2013). For instance in 2002/03 poverty incidence stood at 0.076, 0.159, and 0.018 percent for Gaborone, Francistown and Orapa respectively.

The districts of Ngamiland West, Kweneng West, Ngwaketse West, CKGR, and Ghanzi had the highest proportions of households in the poorest status (all over 40%). These results are consistent with those of previous survey by Statistics Botswana (2013) where poverty rates were found to be higher in such districts. Ngwaketse, Ngwaketse West, Mahalapye, Bobonong, Tutume, Ngamiland and Kgalagadi are generally characterized by larger proportions of households in the poorer status of wealth than those in the richer status. For instance, about 49 percent of households in Ngwaketse West are in the poorest status of wealth compared to 7 percent of those in the richest status; while 29 percent of households in Kgalagadi North are in the lower wealth status compared to 13 percent for those in a richer state. We conclude that generally the urban (or city/town) districts are characterized by better wealth status than their rural counterparts. One of the possible explanations for the observed pattern could be employment opportunities found in urban areas and cities/towns. Although there are various modes of assets acquisition (including inheritance), income from employment is likely to improve status of asset ownership.

Table 1 : Wealth Status by Census District

District	Poorest	Second	Middle	Fourth	Richest
Gaborone	448 (0.6)	8692 (11.6)	15049(20.1)	17019 (22.7)	33749(45.0)
Francistown	384(1.2)	5153(16.5)	7333(23.4)	9501(30.4)	8926(28.5)
Lobatse	200(2.2)	1898(20.6)	2438(26.5)	2012(21.8)	2666(28.9)
Selebi Phikwe	281(1.7)	2851(17.8)	3347(20.8)	5097(31.7)	4483(27.9)
Orapa	0(0.0)	1(0.0)	62(1.9)	732(22.2	2497(75.9)
Jwaneng	449(7.6)	281(4.7)	1063(17.9)	1400(23.6)	2747(46.2)
Sowa Town	28(2.4)	44(3.7)	42(3.5)	534(44.8)	543(45.6)
Ngwaketse	7551(24.0)	8503 (27.0)	5947(18.9)	5841(18.6)	3639(11.6)
Barolong	3300(24.0)	5146(37.4)	2389(17.4)	1614(11.7)	1309(9.5)
Ngwaketse West	1725(48.5)	999(28.1)	328(9.2)	264(7.4)	240(6.7)
South East	952(4.0)	2894(12.1)	5689(23.7)	7519(31.3)	6936(28.9)
Kweneng East	8488(12.4)	14158(20.7)	17961(26.3)	17128(25.2)	10504(15.4)
Kweneng West	6948(56.8)	2524(20.6)	907(7.4)	751(6.1)	11012(9.0)
Kgatleng	3427(13.8)	5866(23.5)	5474(22.0)	5622(22.6)	4528(18.2)
Serowe/Palapye	12508(27.1)	9953(21.5)	8974(19.4)	8234(17.8)	6519(14.1)
Mahalapye	8731(29.3)	8227(27.6)	5217(17.5)	4265(14.3)	3359(11.3)
Bobonong	6186(32.3)	5025(26.2)	3607(18.8)	2544(13.3)	1794(9.4)
Boteti	5879(41.7)	2309(16.4)	2527(17.9)	2114(15.0)	1281(9.1)
Tutume	14764(38.5)	9064(23.6)	6658(17.4)	4621(12.0)	3246(8.5)
North East	3001(18.9)	4476(28.2)	3446(21.7)	2800(17.6)	2142(13.5)
Ngamiland East	6262(28.8)	3806(17.5)	4648(21.4)	4263(19.6)	2758(12.7)
Ngamiland West	8413(63.9)	1888(14.3)	1299(9.9)	900(6.8)	664(5.0)
Chobe	1142(16.7)	1030(15.1)	1675(24.5)	1817(26.6)	1166(17.1)
Okavango Delta	191(29.2)	242(36.9)	200(30.5)	21(3.2)	1(0.2)
Ghanzi	4636(40.8)	1731(15.2)	1626(14.3)	1920(16.9)	1442(12.7)
CKGR	10(47.6)	0(0.0)	1(4.8)	2(9.5)	8(38.1)
Kgalagadi South	2682(33.7)	1967(24.7)	1221(15.3)	1076(13.5)	1010(12.7)
Kgalagadi North	1607(29.0)	1444(26.1)	1073(19.4)	682(12.3)	736(13.3)

Source: Author computed from 2011 population and housing census data set

Figure 1 presents household wealth status by gender of the household heads. Comparatively, the overall picture presented in Figure 1 suggests that female headed households are better off. This pattern is observed up to the fourth category of welfare. About 22 percent of male headed households are in the poorest status of wealth compared to 18 percent of female headed households. However, in the richest category we observe higher proportion of male headed households than that of female headed households. While this is the case, it is also evident that from the second to the richest status of wealth the proportions of female headed households declined while that of male headed households increased.

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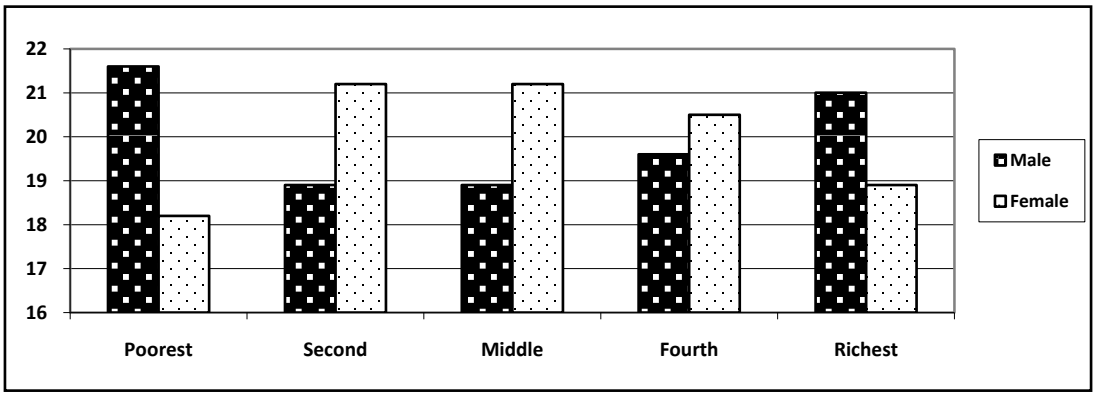


Figure 1 : Share(%) of Wealth Status by Gender of Household Heads

Source : Author computed from 2011 population and housing census data set

Table 2 presents the share of wealth status by marital status of heads of households. Among households with *married* heads, a higher proportion (25.6%) is in the richest category of wealth followed by those in the fourth category (20.7%). The least share of households whose heads are married is accounted for by those in the poorest status of wealth. This may suggest that being married is likely to improve the household status of wealth. Similarly, households whose heads were *never married* are more concentrated in the richest category than in the poorest category. This may not be surprising given that pervious studies found a comparable poverty incidence in households with *married* and *never married* heads (BIDPA, 2010).

There are higher proportions (in the poorest category) of households whose heads are *separated, living together* and *widowed*. As seen in Table 2, 24 percent of households whose couples are living together are in the poorest category of wealth compared to 16 percent of those in the richest category. About 30 percent of households headed by separated heads are in the poorest category compared to 14 percent in the richest category. As for widowed households, the proportions are 24 and 12 percent for poorest and richest categories respectively. The pattern for households with *divorced* heads is interestingly similar to that of households with married and never married heads, safe for the third category of wealth status. This could be argued to be against the expectations as divorce may result in a reduced status of assets ownership.

Table 2 : Share(%) of Wealth Status by Marital Status of Household Heads

Marital Status	Poorest	Second	Third	Fourth	Richest
Married	17.1	18.4	18.2	20.7	25.6
Never Married	18.3	19.5	21.0	21.0	20.1
Living Together	24.3	20.8	20.4	18.8	15.7
Separated	29.8	21.9	18.7	15.4	14.3
Divorced	17.1	19.0	18.0	19.8	26.1
Widowed	23.7	24.9	21.1	17.9	12.4
Source: Author Computed from 2011 population and housing census data set					

Table 3 presents the pattern for wealth status by level of education attained by households' heads. As evident in the table, the status of wealth is positively related to the level of education of the household head. For instance, about 7 percent of households headed by those who have never been to school are in the richest category of wealth compared to about 40 percent in the poorest category. A similar pattern is observed for households whose heads had *primary* and *secondary* education, who however appear to be faring better than those whose heads had no education. On the other hand, households whose heads had tertiary education are more concentrated in the better status of wealth. In fact the proportions in both the poorest and richest categories are a mirror image of the pattern observed in households with uneducated heads. This could suggest that education might be a determinant of households' wealth status; it may improve acquisition of assets to better the status of household wealth.

Table 3 : Share (%) of Wealth Status by Education Status of Household Heads

Level	Poorest	Second	Third	Fourth	Richest
Never Attended	39.6	24.4	16.5	12.5	7.1
Primary	28.9	27.4	19.4	15.3	9.0

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Secondary	24.8	24.4	21.4	17.9	11.5
Non-Formal	14.8	20.1	23.7	22.6	18.8
Tertiary	6.8	11.9	16.3	24.7	40.3
Source: Author Computed from 2011 population and housing census data set					

V. Conclusions

This paper assessed welfare status using the index computed from the technique of Principal Component Analysis. To our knowledge this approach has not been done in Botswana. Therefore, it may not be easy to conclusively note whether there has been an improvement or not, in addition to what has been done so far. Therefore this paper may be seen as the baseline against which future progress will be tracked. Results have shown that generally there is better status of wealth among urban districts, female headed households as well as in households with married heads. Further, education also appears to be an important determinant of asset acquisition. Results revealed a positive relation between wealth status and educational level of heads of households.

Results from our analysis suggest that from a policy point of view, there is need to broaden issues of consideration in designing programmes for poverty eradication. Thus, there is need to also focus on economic and social forces that contribute to assets inequality, given that sometimes both the policies and programmes for poverty eradication would be based on individuals' ability to accumulate productive assets. Moreover, the problem of income inequality might be exacerbated by unequal distribution of income generating assets, hence the need for consideration of assets. Although some reports suggest that Botswana is on track to meeting MDG 1 of halving extreme poverty and hunger, such needs to be supplemented by consideration of assets with the view to try to address the multidimensionality of poverty, especially that the target may be seen to have been narrowed to "income' or expenditure as welfare measures.

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Annex

Table A 1 : Descriptive Statistics and Results of the Principal Component Analysis

Variable	Mean	Standard Deviation	Score
Type of Housing Unit			
Traditional	0.1319	0.3384	-0.618
Mixed	0.1000	0.3001	-0.175
Detached	0.4340	0.4956	0.463
Semi Detached	0.0457	0.2089	0.176
Townhouse/terraced	0.0193	0.1375	0.130
Flats/apartments	0.0153	0.1229	0.168
Part of commercial building	0.0014	0.3789	0.003
Movable	0.0070	0.8351	-0.071
Shack	0.0167	0.1282	-0.163
Rooms	0.2286	0.4199	-0.039
Wall Material			
Conventional Bricks/Blocks	0.8150	0.3883	0.677
Mud bricks/blocks	0.0871	0.2820	-0.442
Mud and Poles/Cow dung/thatch reeds	0.0548	0.2276	-0.392
Poles and reeds	0.0100	0.996	-0.152
Corrugated Iron/zinc	0.0216	0.1455	-0.171
Asbestos	0.0028	0.0531	0.004
Wood	0.0040	0.0635	-0.080
Stone	0.0005	0.0221	-0.019
Floor Material			
Cement	0.6471	0.4779	-0.097
Floor tiles	0.2199	0.4142	0.613
Mud	0.0535	0.2250	-0.382
Mud/dung	0.0499	0.2177	-0.379
Wood	0.0019	0.0437	-0.007
Brick/stone	0.0007	0.0261	-0.016
None	0.0235	0.1516	-0.239
Roof Material			
Slate	0.0067	0.0815	0.012
Thatch	0.1113	0.3145	-0.560
Roof Tiles	0.1292	0.3354	0.429
Corrugated Iron	0.7352	0.4412	0.060
Asbestos	0.0091	0.0951	0.090
Concrete	0.0028	0.0527	0.039
Other	0.0057	0.0755	-0.077
Water Supply			
Piped indoors	0.3020	0.4591	0.695
Piped outdoors	0.3990	0.4897	-0.004
Neighbour`s tap	0.0564	0.2307	-0.190
Communal tap	0.1477	0.3548	-0.417
Bouser/tanker	0.0114	0.1062	-0.100
Well	0.0093	0.0958	-0.143
Borehole	0.0491	0.2160	-0.314
River/stream	0.0139	0.1171	-0.172
Dam/pan	0.0072	0.0844	-0.121
Rain water tank	0.0010	0.0316	-0.021
Spring Water	0.0005	0.0230	0.000
Toilet Facility			
Own Flush	0.2524	0.4349	0.657
Own VIP	0.0183	0.1339	-0.008
Own pit latrine	0.2367	0.4251	-0.141
Own dry compost	0.0028	0.0526	-0.063
Shared Flush	0.0860	0.2803	0.197
Shared VIP	0.0143	0.1187	0.005

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Shared pit latrine	0.1823	0.3861	-0.039
Shared dry compost	0.0010	0.0321	-0.032
Communal Flush	0.0012	0.0340	0.007
Communal VIP	0.0004	0.0206	-0.017
Communal pit latrine	0.0060	0.0769	-0.060
Communal dry compost	0.0006	0.0249	-0.034
Neighbours` Flush	0.0013	0.0355	-0.014
Neighbours`VIP	0.0020	0.4460	-0.037
Neighbours pit latrine	0.0462	0.2100	-0.212
Neighbour`s compost	0.0003	0.0162	-0.016
Energy for Lighting			
Electricity	0.5324	0.4990	0.808
Petrol	0.0015	0.0388	0.000
Diesel	0.0077	0.0873	-0.108
Solar power	0.0051	0.0709	-0.015
Gas	0.0028	0.0527	0.007
Bio Gas	0.0002	0.0146	-0.003
Wood	0.0356	0.1854	-0.311
Paraffin	0.3002	0.4583	-0.522
Candle	0.1101	0.3130	-0.296
Energy for Cooking			
Electricity	0.1779	0.3824	0.457
Petrol	0.0006	0.0252	0.001
Diesel	0.0009	0.0300	0.011
Solar Power	0.0008	0.0278	0.010
Gas	0.3789	0.4851	0.427
Bio Gas	0.0092	0.0954	0.036
Wood	0.4119	0.4922	-0.768
Paraffin	0.0167	0.1280	-0.062
Cow dung	0.0007	0.0273	-0.013
Coal	0.0004	0.0191	0.004
Crop Waste	0.0002	0.0130	0.010
Charcoal	0.0013	0.0364	0.005
Energy for Heating			
Electricity	0.1675	0.3735	0.533
Petrol	0.0009	0.0303	0.004
Diesel	0.0003	0.0169	0.001
Solar Power	0.0014	0.0369	0.016
Gas	0.0102	0.1005	0.071
Bio Gas	0.0006	0.0236	0.010
Wood	0.4766	0.4995	-0.680
Paraffin	0.0026	0.0506	-0.023
Cow dung	0.0005	0.0217	-0.008
Coal	0.0013	0.0367	0.008
Charcoal	0.0015	0.0392	0.021
Other Assets (durables)			
Van/bakkie	0.1509	0.3579	0.298
Tractor	0.0197	0.1390	0.073
Car	0.1981	0.3986	0.482
Donkey Cart	0.1170	0.3214	-0.246
Bicycle	0.0989	0.2985	-0.007
Mokoro/Boat	0.0065	0.0802	-0.014
Motor Bike	0.0062	0.0787	0.057
Wheel barrow	0.3314	0.4707	-0.014
Sewing Machine	0.0464	0.2104	0.120
Refrigerator	0.4347	0.4957	0.708
Cell phone	0.8973	0.3036	0.406
Telephone	0.1083	0.3108	0.326
Radio	0.6149	0.4866	0.323
Television	0.5409	0.4983	0.723

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Laptop	0.1123	0.3157	0.421
Desktop	0.0963	0.2949	0.393
Source: Author Computed from 2011 Population and Housing Census Data Set			

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