ASSESSING HOUSEHOLD WEALTH STATUS: AN ASSET BASED APPROACH

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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 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. This paper intends to compliment efforts done so far for poverty analysis as it extends understanding of multi-dimensions of poverty. Results of this paper are important as they will assist policy makers to identify areas of concern to uplift household wealth, which should facilitate not only the attainment of MDGs but also the Vision 2016 aspirations. The rest of the paper is organised as follows; Section II discusses the methodology used while section III discusses data sources and descriptives, in sections IV and V we present results and conclude respectively.

II.   Methodology
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 data, 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 (Case et al., 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. In this paper we computed the wealth index from a technique of principal component analysis (PCA), which is a tool used to reduce a number of variables into a one. It is mathematically specified as follows:

$$PC_1 = b_1 Y_1 + b_2 Y_2 + b_3 Y_3 + ... + b_{1n} Y_n$$
$$\vdots$$
$$PCm = b_{m1}Y_1 + b_{m2}Y_2 + b_{m3}Y_3 + ... + b_m Y_n$$

In the above, is the weight for the mth principal component (PC) and the nth variable Y. In the output the weights of the 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 ownership of durable assets (Television, radio, watch etc), housing conditions (type of houses, floor and roof materials) as well as living conditions (water source, toilet facility and energy sources of cooking and lighting). 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 affects hygiene. Source of energy for cooking may affect the environment and respiratory diseases that cause deaths. We used SPSS (Version 18) for analysis. 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.

I.   Data source and Descriptives

The paper uses data from the 2011 population and housing census, which has 550944 households. Table A1 in the annex presents descriptive statistics. The pattern for type of housing unit is dominated by detached houses (43%) followed by rooms and town house with 23 percent and 19 percent respectively. Other types (traditional, mixed, flat, shacks) accounted for a share of less than 20 percent. Majority (82 percent) of households had their walls made out of conventional bricks/blocks while the remained shares are distributed amongst corrugated iron, asbestos, wood, stones and poles and reeds. A larger proportion (64%) had cement as a floor material, 22 percent with floor tiles and 0.7 percent with brick/stone. Roof material is dominated by corrugated iron (74 percent), while the least share is for concrete (0.3%).

Regarding water supply majority of households had piped outdoors (39%) while 30 percent had piped indoors. This pattern was also observed by previous studies (Statistics Botswana, 2011). About 15 percent sourced water from communal taps. Other water sources including bouser/tanker, well, borehole, dam/pan had a share of less than 5 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 while 9 percent shared flush toilet. The shares for those who used communal toilet facilities were less than a percent. A higher proportion (46%) used their neighbors` pit latrines. These present a hopeful trend towards the achievement of the Millennium Development Goal 7 of ensuring environmental sustainability. Thus, majority appear to be accessing water from improved sources. This is however not to suggest that the water sourced are safe as per the target of this MDG. Moreover, while this is dominance of use of pit latrines it is promising that the use of flush toilets (whether owned or shared) is also visible.

More than half of households used electricity as a principal energy for lighting with 30 percent using paraffin and 11 percent using candles. About 41 percent of households used wood as energy for cooking followed by 38 percent who used gas. The use of wood also dominated sources of energy for heating (48%).

About 15 percent owned van/bakkie; 2% owned tractors and 20 percent owned cars. On the other hand majority (89) owned cell phones while 11 percent had fixed telephone lines. About 61% owned radio sets and 54% owned television sets. This pattern presents a positive outcome towards an informed nation as these assets represent the primary sources of information.

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 higher economic status.

II.   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 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 whereas in Francistown 45 and 29 percent of households are 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 for Gaborone, Francistown and Orapa respectively.

The districts of Ngamiland West, Kweneng West, Ngwaketse West, CKGR, 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 lower status of wealth than those in the higher status. For instance, about 49 percent of households in Ngwaketse West are in the poorest status compared to 7 percent of those in the richest state; while 29 percent of households in Kgalagadi North are in the lower wealth status compared to 13 percent for those in a richer state.

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)	1(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)	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)	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 data set

Figure 1 presents wealth status by gender of the household head. Comparatively, the overall picture presented in Figure 1 suggests that female headed households are in a better wealth status. About 22 percent of male headed households are in the lower status of wealth compared to 18 percent for female headed households. This pattern is observed up to the fourth status of welfare. However, in the richest category we observe higher proportion of male headed households than for 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 for male headed households increased.
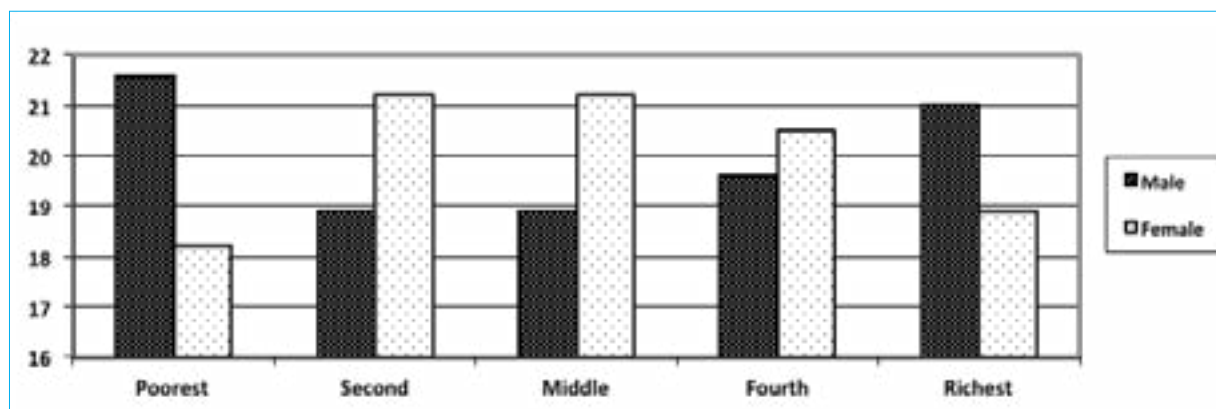
Figure 1: Share of Wealth Status by Gender of household head

Table 2 presents the share of wealth status by marital status. It shows a higher proportion of married head of household in the richest category followed by those in the fourth category. The least share is accounted for by those in the lowest status of wealth. This suggests that being married is likely to improve the household status of wealth. Heads of households who were never married are more concentrated in the richest category than in the poorest category. This may not be surprising given that previous studies found a comparable poverty incidence of about 28 percent for married and never married head of households (BIDPA, 2010). However, the proportion of heads who were never married in the richest category is lower than that for married head of households in the same category. There is a higher proportion (in the poorest category) of households whose heads are living together, separated and widowed. As seen in the Table, 24 percent of households whose couples are living together are in the lowest category of wealth compared to 16 percent in the richest category. About 30 percent of separated heads are in the poorest category compared to 14 percent in the richest category. As for widowed heads of households the proportions are 24 and 12 for poorest and richest categories respectively. The pattern for divorced household heads is similar to that of never married, safe for the third category of wealth.

Table 2: Share of Wealth Status by Marital Status

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	21	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	18	19.8	26.1
Widowed	23.7	24.9	21.1	17.9	12.4

Source: Author Computed

I.   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 the paper may be seen to be a baseline against which future progress will be tracked. Results from our analysis suggest that from a policy point of view, there is need to broaden issues of consideration in designing programmes of poverty eradication. Although some reports suggest that Botswana is on track of 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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Table A1: Descriptive Statistics and Results of the Principal Component Analysis

Variable	Mean	Standard Deviation	Score
Type of Housing Unit			
Traditional	0.132	0.338	-0.618
Mixed	0.1	0.300	-0.175
Detached	0.434	0.496	0.463
Semi Detached	0.046	0.209	0.176
Townhouse/terraced	0.019	0.138	0.13
Flats/apartments	0.015	0.123	0.168
Part of commercial building	0.001	0.379	0.003
Movable	0.007	0.835	-0.071
Shack	0.017	0.128	-0.163
Rooms	0.229	0.420	-0.039
Wall Material			
Conventional Bricks/Blocks	0.815	0.388	0.677
Mud bricks/blocks	0.087	0.282	-0.442
Mud and Poles/Cow dung/thatch reeds	0.055	0.228	-0.392
Poles and reeds	0.01	0.996	-0.152
Corrugated Iron/zinc	0.022	0.146	-0.171
Asbestos	0.003	0.053	0.004
Wood	0.004	0.064	-0.08
Stone	0.001	0.022	-0.019
Floor Material			
Cement	0.647	0.478	-0.097
Floor tiles	0.220	0.414	0.613
Mud	0.054	0.225	-0.382
Mud/dung	0.050	0.218	-0.379
Wood	0.002	0.044	-0.007
Brick/stone	0.001	0.026	-0.016
None	0.024	0.152	-0.239
Roof Material			
Slate	0.007	0.082	0.012
Thatch	0.111	0.315	-0.56
Roof Tiles	0.129	0.335	0.429
Corrugated Iron	0.735	0.441	0.06
Asbestos	0.009	0.095	0.09
Concrete	0.003	0.053	0.039
Other	0.006	0.076	-0.077
Water Supply			
Piped indoors	0.302	0.459	0.695
Piped outdoors	0.399	0.490	-0.004
Neighbour`s tap	0.056	0.231	-0.19
Communal tap	0.148	0.355	-0.417
Bouser/tanker	0.011	0.106	-0.1
Well	0.009	0.096	-0.143
Borehole	0.049	0.216	-0.314
River/stream	0.014	0.117	-0.172
Dam/pan	0.007	0.084	-0.121
Rain water tank	0.001	0.032	-0.021
Spring Water	0.001	0.023	0
Toilet Facility			
Own Flush	0.252	0.435	0.657
Own VIP	0.018	0.134	-0.008
Own pit latrine	0.237	0.425	-0.141
Own dry compost	0.003	0.053	-0.063
Shared Flush	0.086	0.280	0.197
Shared VIP	0.014	0.119	0.005
Shared pit latrine	0.182	0.386	-0.039

Table A1: Descriptive Statistics and Results of the Principal Component Analysis cont...

Variable	Mean	Standard Deviation	Score
Shared dry compost	0.001	0.032	-0.032
Communal Flush	0.001	0.034	0.007
Communal VIP	0.000	0.021	-0.017
Communal pit latrine	0.006	0.077	-0.06
Communal dry compost	0.001	0.025	-0.034
Neighbours` Flush	0.001	0.036	-0.014
Neighbours`VIP	0.002	0.446	-0.037
Neighbours pit latrine	0.046	0.21	-0.212
Neighbour`s compost	0.000	0.016	-0.016
Energy for Lighting			
Electricity	0.532	0.499	0.808
Petrol	0.002	0.039	0
Diesel	0.008	0.087	-0.108
Solar power	0.005	0.071	-0.015
Gas	0.003	0.053	0.007
Bio Gas	0.000	0.015	-0.003
Wood	0.036	0.185	-0.311
Paraffin	0.300	0.458	-0.522
Candle	0.110	0.313	-0.296
Energy for Cooking			
Electricity	0.178	0.382	0.457
Petrol	0.001	0.025	0.001
Diesel	0.001	0.03	0.011
Solar Power	0.001	0.028	0.01
Gas	0.379	0.485	0.427
Bio Gas	0.009	0.095	0.036
Wood	0.412	0.492	-0.768
Paraffin	0.017	0.128	-0.062
Cow dung	0.001	0.027	-0.013
Coal	0.000	0.019	0.004
Crop Waste	0.000	0.013	0.01
Charcoal	0.001	0.036	0.005
Energy for Heating			
Electricity	0.168	0.374	0.533
Petrol	0.001	0.030	0.004
Diesel	0.000	0.017	0.001
Solar Power	0.001	0.037	0.016
Gas	0.010	0.101	0.071
Bio Gas	0.001	0.024	0.01
Wood	0.477	0.500	-0.68
Paraffin	0.003	0.051	-0.023
Cow dung	0.001	0.022	-0.008
Coal	0.001	0.037	0.008
Charcoal	0.002	0.039	0.021
Other Assets (durables)			
Van/bakkie	0.151	0.358	0.298
Tractor	0.020	0.139	0.073
Car	0.198	0.399	0.482
Donkey Cart	0.117	0.321	-0.246
Bicycle	0.099	0.299	-0.007
Wheel barrow	0.331	0.471	-0.014
Mokoro/Boat	0.007	0.080	-0.014
Sewing Machine	0.046	0.210	0.12
Refrigerator	0.435	0.496	0.708
Motor Bike	0.006	0.079	0.057

Table A1: Descriptive Statistics and Results of the Principal Component Analysis cont...

Variable	Mean	Standard Deviation	Score
Desktop	0.096	0.295	0.393
Laptop	0.112	0.316	0.421
Radio	0.615	0.487	0.323
Television	0.541	0.498	0.723
Telephone	0.108	0.311	0.326
Cell phone	0.897	0.304	0.406

Source: Author Computed from Census Data

Variable	Mean	Standard Deviation	Score
Desktop	0.096	0.295	0.393
Laptop	0.112	0.316	0.421
Radio	0.615	0.487	0.323