Determinants of Household Welfare and Poverty in Botswana, 2002/03 and 2009/10

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BOTSWANA INSTITUTE FOR DEVELOPMENT POLICY ANALYSIS

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Acknowledgements

Abstract

This paper investigates household determinants of welfare and poverty in Botswana. Using the 2002/03 Household Income and Expenditure Survey (HIES) and the 2009/10 Botswana Core Welfare Indicator Survey (BCWIS), and employing regression analysis, we identify education level and employment status of the household head, as some of the key determinants of household welfare and poverty in Botswana. Moreover, we find that residing in rural areas increases the likelihood of being poor and negatively relates to welfare. Therefore, public policy must continue to emphasize on education and job creation amongst the strategies for poverty reduction in Botswana. Still, initiatives for rural development are also critical for poverty reduction.

JEL Classification: I32; I38

Keywords: Botswana; Welfare; Consumption; Poverty

1. Introduction

At its independence in 1966, Botswana was classified as a Least Developed Country, with per capita GDP estimated at US$304 (BIDPA, 2010). However, the country has managed to maintain sustainable economic growth, and has transformed itself into an upper middle income country, with its per capita GDP estimated at US$8,533 in 2011 (World Bank and BIDPA, 2013). Despite the impressive GDP growth, Botswana still faces a number of developmental challenges. One of the challenges is unemployment, which is currently estimated at 17.8 percent (Statistics Botswana, 2013). The high unemployment has contributed to poverty, especially in rural areas where employment opportunities are limited.

Despite declining over time, estimated at 19.3 percent in 2009/10 (Statistics Botswana, 2013), income poverty is considered to be still high for a country that has experienced rapid GDP growth over the past four and a half decades since independence. The Gini coefficient of inequality, which was estimated at 0.49 in 2009/10, is also high and indicates that Botswana's rapid economic growth has not equally benefitted the country's population (MFDP, 1997; Statistics Botswana, 2013a).

Public policy has aimed to reduce poverty through both social and economic programs, and substantial effort has been devoted to poverty reduction since independence. In 2003, the government adopted a National Strategy for Poverty Reduction (NSPR) to bring the poverty reduction effort more clearly into the country's development agenda, and to ensure that poverty reduction initiatives were coordinated (MFDP, 2003). "The strategy also recognized the potential role played by social safety nets to reduce poverty" (BIDPA, 2010, pp.2).

To further intensify efforts on the fight against poverty, in 2009, the government of Botswana shifted focus towards eradicating abject poverty through the launching of numerous poverty eradication programs. Similar aspirations had however long been expressed in Botswana's *Vision 2016*, through its pillar, *a compassionate, just and caring nation*, which aims to achieve equitable income distribution and to eradicate absolute poverty by the year 2016 (Republic of Botswana, 1997).

In line with the aforementioned strategies, government has launched a number of welfare programs aimed at reducing poverty amongst the poor, the needy and other vulnerable groups (Seleka et al., 2007)[1]. Given such efforts, it is fundamental to understand the determinants of poverty in Botswana, to provide useful information to policymakers regarding where to focus attention to further reduce poverty and improve household welfare. This paper therefore, conducts an econometric analysis of the determinants of household welfare and poverty in Botswana using the 2002/03 Household Income and Expenditure Survey (HIES) and the 2009/10 Botswana Core Welfare Indicator Survey (BCWIS). Past studies (Watanabe and Mueller, 1984; BIDPA, 1996; CSO, 2008; Statistics Botswana, 2013a) have focused on descriptive analysis of the characteristics of the poor, and to our

knowledge, no study has employed empirical modeling of the determinants of welfare and poverty in Botswana.

The rest of this paper is organized as follows. Section 2 presents the review of the empirical literature while section 3 specifies the econometric model for analyzing the determinants of household welfare and poverty. In section 4, we discuss the data sources and provide descriptive statistics for the considered variables. Section 5 presents the empirical results and Section 6 concludes the study.

2.   Literature Review

There is a vast amount of empirical literature on the measurement and determinants of poverty. However, most poverty studies have focused on the monetary dimension of poverty, which uses income or consumption expenditure as measures of household welfare. Consumption and income can be justified as measures of welfare since they both indicate an individual's ability to obtain goods and services. However, consumption is preferred because it contains smaller measurement errors compared to income, it fluctuates less than income and can therefore provide a more accurate and less volatile measure of the individual's permanent income over time, and survey respondents are more willing to reveal their consumption behavior than their income (Ravallion, 1992). Moreover, income has been criticized for underestimating the true welfare because people tend to under-report it or have difficulties in quantifying their earnings if those stem from self-employment and capital income (Atkinson et al., 1995). Again, those engaged in multiple income generating activities in a given year may find it difficult to recall and aggregate their income, which may result in some measurement errors.

For the aforementioned reasons, this paper adopts consumption as a measure of welfare. The literature review shall therefore be limited to studies that have followed the same approach to analyze the determinants of household welfare or poverty (Cheema and Sial, 2012; Gounder, 2012; Akerele and Adewuyi, 2011; Litchfield and McGregor, 2008; Datt and Jolliffe, 2005; Geda et al., 2005; Mukherjee and Benson, 2003; Grootaert, 1997; Sekhampu, 2013; Mok et al., 2007; Geda et al., 2005; Khalid et al., 2005; Serumaga-Zake and Naude, 2002; Malik, 1996; Shiraz, 1995). Studies on the determinants of household consumption have commonly used the ordinary least squares estimation procedure to regress household per capita consumption on a number of factors that contribute to one's welfare (Cheema and Sial, 2012; Gounder, 2012; Akerele and Adewuyi, 2011; Litchfield and McGregor, 2008; Datt and Jolliffe, 2005; Geda et al., 2005; Mukherjee and Benson, 2003; Grootaert, 1997). However, studies that have modelled the determinants of poverty have used logit or probit regressions to capture the contributions of a number of factors on one's probability of being poor (Sekhampu, 2013; Mok et al., 2007; Geda et al., 2005; Khalid et al., 2005; Serumaga-Zake and Naude, 2002; Malik, 1996; Shiraz, 1995). A key commonality across these different studies is that the determinants of both household welfare and poverty may be generally grouped into household head characteristics, household characteristics and fixed geographical factors.

2.1   Household head characteristics

Variables that have been prominently used to capture the impact of household head characteristics on household consumption and poverty include age, gender, employment status and educational level of the household head (HH). Age of the HH may capture work experience and a stage in the life cycle (Grootaert, 1997), and was found to negatively relate to the probability of being poor in South Africa (Sekhampu, 2013) and Pakistan (Khalid et al., 2005; Malik, 1996). Along similar lines, some studies have found age to positively relate with welfare. For example, an increase in age brought gains in welfare in Tanzania (Litchfield and McGregor, 2008), Fiji (Gounder, 2012), Egypt (Datt and Jolliffe, 2005) and in Pakistan (Cheema and Sial, 2012). Thus, an increase in age of the HH may reflect increased work experience, which is associated with increased income and asset ownership, both of which enhance household consumption and in turn reduce the probability of being poor.

The other issue that has arisen from past studies is that the relationship between age and poverty may be non-linear, implying that poverty is relatively higher at a young age, decreases at middle age and then increases again at an old age (Datt and Jolliffe, 2005). To capture this phenomenon, some studies used age-squared as one of the explanatory variables, which they found to negatively relate with household welfare (Gounder, 2012; Cheema and Sial, 2012; Datt and Jolliffe, 2005). These results are consistent with the life cycle phenomenon of higher earning capacity with greater experience and smoothing of consumption over a life cycle (Datt and Jolliffe, 2005).

Gender of the HH was found to influence household welfare and poverty in Kenya (Geda et al., 2005) and Nigeria (Anyanwu, 2013). Female-headed households (FHHs) were more likely to be poor than male-headed households (MHHs). Along similar lines, FHHs in Tanzania and Nigeria had lower living standards compared to MHHs (Litchfield and McGregor, 2008; Akerele and Adewuyi, 2010).

Some studies have found that marriage brings an array of economic benefits to the household, since marriage generally adds a potential earner to the household (Anyanwu, 2013; Waite, 1995) and enhances wealth accumulation (Waite, 1995). In terms of consumption, economies of scale suggest that married people may achieve the same level of utility with less combined expenditure than the sum of their individual consumption if living apart (Anyanwu, 2013). Thus, marriage reduces the risk of falling into poverty and unmarried individuals and single-parent families are more likely to be poor than their married counterparts (White and Rodgers, 2000).

Education level of the HH is also a significant factor in explaining welfare. Evidence suggests that HHs with lower levels of education experience higher poverty levels. For example, an increase in education level reduced the probability of being poor in Cote d' Ivoire (Grootaert, 1997), Kenya (Geda et al., 2005), South Africa (Serumaga-Zake and Naude, 2002) and Pakistan (Cheema and Sial, 2012). Similarly, higher levels of education

provided higher levels of household welfare in Malawi (Mutherjee and Benson, 2003), Fiji (Gounder, 2012) and Tanzania (Litchfield and McGregor, 2008). Thus, "educational attainment enhances human capital and participation in labour markets and has been accepted as a veritable tool for poverty reduction and improving peoples' welfare" (Akerele and Adewuyi, 2010, pp.6).

Employment of the HH enhances household welfare. Sekhampu (2013) found that employment of the HH was negatively associated with the probability of being poor in South Africa. Similarly, Mukherjee and Benson (2003) found that having at least one household member engaged in formal wage employment led to a significant increase in household welfare in Malawi.

2.2 Household characteristics

Household characteristics have also been used to explain household welfare. The most prominently used are household size and household dependency ratio. Increasing household size raised the probability of being poor in South Africa (Sekhampu, 2013; Serumaga-Zake and Naude, 2002), Kenya (Geda et al., 2005), China (Meng and Gregory, 2007) and Pakistan (Khalid et al., 2005; Shiraz, 1995; Baulch and McCulloh, 1998). Similarly, increasing household size reduced household welfare in Fiji (Gounder, 2012), Tanzania (Litchfield and McGregor, 2008), Egypt (Datt and Jolliffe, 2005), Malawi (Mukherjee and Benson, 2003) and Sierra Leone (Fagernas and Wallace, 2003). Some studies (Mukherjee and Benson, 2003; Fagernas and Wallace, 2003; Gounder, 2012) found that household size squared positively related with household welfare, suggesting economies of scale in household consumption derived from increasing household size.

Baulch and McCulloch (1998) found that in Pakistan, households with higher dependency ratios had higher probabilities of being poor than those with lower dependency ratios. Similarly, increasing the dependency ratio exerted a negative impact on household welfare in Nigeria (Akerele and Adewuyi, 2011) and Tanzania (Litchfield and McGregor, 2008), due to the reduction in resources required to cater for the needs of each household member.

2.3 Regional dimensions

Poverty in Africa (and other developing countries) is higher in rural areas than in urban areas (World Bank, 1990; 2001). This is mainly because of lack of renumerative employment opportunities, infrastructure and quality services in rural areas (Gounder, 2012). In fact, Glewwe (1991) found that the determinants of poverty were significantly different in rural and urban areas, implying that strategies for poverty reduction should vary between the two areas. Similarly, in Botswana, income poverty is more prevalent in rural than in urban areas (BIDPA, 1996; CSO, 2008; Statistics Botswana, 2013).

3. Methodology

This study adopts two approaches to model the determinants of household welfare and poverty in Botswana. The first approach involves regressing the natural logarithm of per capita consumption against a series of independent variables using the ordinary least squares (OLS) estimation procedure. Many studies have employed this approach to model welfare determinants elsewhere in the developing world (Gounder, 2012; Akerele and Adewuyi, 2011; Litchfield and McGregor, 2008; Mukherjee and Benson, 2003; Datt and Jolliffe, 2005).

The econometric model is expressed as:

$$\ln C_j = \beta_0 + \sum_{i=1}^{n} \beta_i X_{ij} + \varepsilon_j \qquad (1)$$

where C_j denotes per capita consumption for household j, X_{ij} represents the value of explanatory variable i for household j, β_0 and β_i are parameters to be estimated, ln denotes natural logarithm and ε_j is a random error term. The specific explanatory variables used in this model are defined in Table 1. Two separate models are estimated for 2002/03 and 2009/10.

A second approach is to run a probit or logit regression to make inferences about poverty status. Logit and probit models have been widely used to measure the determinants of the probability of being poor in developing countries (Sekhampu, 2013; Mok et al., 2007; Geda et al., 2005; Khalid et al., 2005; Serumaga-Zake and Naude, 2002; Malik, 1996; Shiraz, 1995). These studies specified the dependent variable as a binary variable taking a value of 1 if the household is poor and a value of 0 if the household is non poor. Despite the popularity of this approach, it has been criticized for leading to loss of information from collapsing income or consumption data into a binary variable, since all non poor households are treated alike, as censored data (Datt and Jolliffe, 2005).

The logit model is specified as:

$$\ln \left[\frac{P_j}{(1-P_j)} \right] = \delta_0 + \sum_{i=1}^{n} \delta_i X_{ij} + u_j \qquad (2)$$

where P_j is the probability that the jth household is poor, δ_0 and δ_i are parameters to be estimated, u_j is the random error term and X_{ij}'s are the explanatory variables defined in Table 1. As with the previous model, separate equations are estimated for 2002/03 and 2009/10.

Table 1: Description of Variables used in the model

Variable	Variable description
Dependent Variables	
C	Per capita consumption expenditure (welfare)
POORM	Poverty status; 1=poor, 0= non-poor
Household Head Characteristics	
AgeHH	Age of the head of household
AgeHHSQ	Squared Age of the head of household
Gender	Gender of the head of household; 1=Male, 0=females
Marital status	
Married	Marital status of the head of household; 1=Married, 0=otherwise
Living Together	Cohabiting household head; 1=living together, 0 otherwise
Separated	Separated household head; 1=separated, 0=otherwise
Divorced	Divorced household head; 1=divorced, 0=otherwise
Widowed	Widowed household head; 1=widowed, 0=otherwise
Never married	Household head who has never married; 1=never married, 0 otherwise
Education	Number of years schooling
Employment status	
Paid_Emply	Household head engaged in formal paid employment; 1=yes, 0=otherwise
Self_Emply	Household head engaged in self-employment; 1=yes, 0=otherwise
UnpFam	Household head working as unpaid family helper; 1=yes, 0=otherwise
Own_farm	Household head self-employed in agriculture; 1=yes, 0=otherwise
UnEmply	Household head not working; 1=yes, 0=otherwise
Household Characteristics	
HHSIZE	Household size
HHSQ	Squared household size
Dep_ratio	Proportion of persons aged below 15 and those above 64 to the total number of persons aged between 15 and 64
Cattle Ownership	
c19	Owned cattle between 1 and 9
c1019	Owned cattle between 10 and 19
c2039	Owned cattle between 20 and 39
c4059	Owned cattle between 40 and 59
c60plus	Owned 60 or more cattle
c0	Did not own any cattle
Geographical Regions	
Cities/Towns	1= cities/town, 0=otherwise
Urban Villages	1= urban village, 0 otherwise
Rural areas	1= rural areas, 0=otherwise

4. Data and Descriptive Statistics

4.1 Data sources

The data sources for this study are the 2002/03 HIES and the 2009/10 BCWIS datasets (CSO, 2008; Statistics Botswana, 2013a). Both datasets were derived from nationally representative cross-sectional surveys covering all the districts in the country. The HIES collected information from a total of 6053 households whereas BCWIS collected information from 7732 households, selected from rural areas, urban villages and cities/towns. The questionnaires were administered using a two-stage stratified selection process. The first-stage involved a random selection of Enumeration Areas (EAs) as primary sampling units (PSUs) with probability to measure of size (PPS). In the second stage, households were drawn systematically from each PSU. The design also stratified selection on three (3) regions (cities/towns, urban villages and rural areas).

Both surveys captured the information using the household questionnaires which covered demographic data, economic activity and employment, sources of income, housing, household possessions and livestock ownership, household enterprises, agricultural income and expenditure during the last 12 months, employment earnings and deductions for the past 30 days and regular payments (monthly and annual). The surveys also used a 'daily record' which was administered to households for the duration of the survey round (30 days). The 'daily record' covered daily expenditures, household cash receipts, household cash given out, goods and services received, rations and food aid received, goods and services given, business receipts, business expenditure and own produce consumed.

4.2 Poverty line calculation

Statistics Botswana used the cost of basic needs approach to develop poverty lines (CSO, 2008; Statistics Botswana, 2013a). To calculate the Poverty Datum Line (PDL), five components were used: food, clothing, personal items, household goods and shelter. The cost of each of the five components of the PDL basket was calculated taking into account household size, individuals' gender and age, and region. The poverty line for each household was obtained by adding the poverty lines for each of the five components. For each of the sampled households, a PDL was calculated and compared with the reported total consumption, which was used as a measure of welfare. A household whose consumption expenditure was below its poverty line was categorized as being poor and that whose consumption expenditure was higher than its poverty line was classified as non poor.

4.3 Variables used in the model

Dependent variables

In this study, we use the natural logarithm of per capita consumption expenditure as the dependent variable in the welfare model. This variable (unlogged) is used as a measure of

welfare. To derive per capita consumption for a household, we divided total consumption expenditure by the number of individuals in the household. This welfare measure assumes equal allocation of items consumed by household members, and that every household member has the same needs irrespective of age or gender. It also assumes that the cost of two or three people living together is the same as if they lived separately (Mukherjee and Benson, 2003). The dependent variable for the poverty model is the poverty status of the household, expressed as a dummy variable taking a value of 1 if the household is poor and a value of 0 if the household is non poor. The household was categorized as poor if its consumption expenditure fell below its poverty datum line; otherwise it was classified as non poor.

Independent variables

The choice of independent variables was largely guided by the empirical literature on the determinants of welfare and poverty in developing countries. The independent variables used in the study are defined in Table 1. These variables are broadly grouped into HH characteristics, household characteristics, cattle ownership and geographical region. Under HH characteristics, we included age (linear and quadratic terms), gender, marital status and education. Given the life-cycle hypothesis we expect the coefficients for age and age-squared to respectively carry positive and negative signs in the per capita consumption models. However, the coefficients for these variables should carry opposite signs in the poverty models.

With respect to gender, a binary variable, we expect females to be worse-off than their male counterparts. Since the female dummy serves as the base variable, we expect the coefficient for gender to be positive in the per capita consumption models and negative in the poverty models. Marital status (whether the HH was married, cohabiting, separated, divorced, widowed or had never married) captured the effects of marital status on household welfare and poverty. Consistent with the empirical literature, we expect marriage to enhance welfare and reduce the probability of being poor. Since the "married" dummy serves as a base variable, we expect the dummies for other marital status categories to carry negative coefficients in the per capita consumption models and positive coefficients in the poverty models.

Education status of the HH was measured as the number of years of schooling, while employment status was captured through the type of work done by the HH (whether the HH is involved in paid employment, self-employment, unpaid family work, self-employment in own cattle post/lands (agriculture), or unemployed). *A priori,* we expect both education and employment to enhance welfare and reduce poverty. Therefore, we expect positive coefficients for years of schooling in the per capita consumption models and negative coefficients in the poverty models. Similarly, dummies for all employment categories are expected to be positive in the per capita consumption models and negative in the poverty models, since the category for the "unemployed" serves as a base variable.

Household characteristics included household size (linear and quadratic terms) and dependency ratio (measured as the number of individuals aged 0 to 14 years and 65 years and above as a ratio of those aged 15 to 64 years). Consistent with the empirical literature, we expect the relationship between household size and welfare to be non-linear. Therefore, the coefficients for household size and household size-squared are expected to be respectively negative and positive in the per capita consumption models and to carry opposite signs in the poverty models. Thus, an increase in household size should yield a decline in per capita consumption and an increase in the probability of being poor, up to certain levels of household size, after which the opposite should prevail. Dependency ratio is also expected to be negatively related with household welfare and positively related with poverty. Thus, an increase in the dependency ratio would result in a reduction in household welfare and an increase in the probability of being poor.

Cattle ownership dummies were used to categorize households according to the number of cattle owned, using dummy variables. Our *a priori* expectation is that ownership of larger cattle herds should be associated with attainment of higher welfare levels and lower probabilities of being poor. This is because an increase in cattle herd-size should increase the capacity of households to generate cash income through sales.

Regional dummies classified households according to their area of residence: rural area, urban village or city/town. Given that economic opportunities are limited in rural Botswana than in urban villages and cities/towns, we expect our results to indicate that welfare is lower and the probability of being poor is higher in rural villages than in urban villages and cities/towns. Therefore, as the rural village dummy serves as a base variable, we expect dummies for urban villages and cities/towns to carry positive signs in the per capita consumption models and negative signs in the poverty models.

4.4 Descriptive statistics[2]

Table 2 provides descriptive statistics for both dependent and independent variables used in the study. About 17 percent of the sampled households in 2002/03 were poor, and the rate had declined to about 11 percent by 2009/10. Per capita consumption expenditure averaged P1024 in 2002/03 and P1407 in 2009/10 (in current prices). Average age of the HH was estimated at 43 (45) years in 2002/03 (2009/10). About 55 (54) percent of the HHs were males and the remaining 45 (46) percent were females in 2002/03 (2009/10). With regard to the marital status of the HH, about 31 (27) percent were married in 2002/03 (2009/10). Cohabiting couples (living together) accounted for about 18 (20) percent, whilst widowed HHs accounted for about 10 (12) percent of the households in 2002/03 (2009/10). Separated and divorced HHs accounted for a paltry 1 and 2 percent, respectively, in both 2002/03 and 2009/10. The majority of the HHs were never married, accounting for 38 (37) percent of the households in 2002/03 (2009/10). Years of schooling averaged 6 (7) in 2002/03 (2009/10), implying that many HHs had not completed primary education (7 years of education).

Table 2: Descriptive Statistics of variables used in the model (unweighted)

	2002/03 HIES[a]			2009/10 BCWIS[b]		
	Mean	Min	Max	Mean	Min	Max
Dependent variables						
POORM	0.17	0	1	0.11	0	1
C	1024	4.76	48906	1407	0.6	142023
Household Head Characteristics						
AgeHH	43	12	98	45	13	98
AgeHHSQ	2148	144	9604	2360	169	9604
Gender	0.55	0	1	0.54	0	1
Marital Status:						
Married	0.31	0	1	0.27	0	1
Living Together	0.18	0	1	0.20	0	1
Separated	0.01	0	1	0.01	0	1
Divorced	0.02	0	1	0.02	0	1
Widowed	0.10	0	1	0.12	0	1
Never married	0.38	0	1	0.37	0	1
Edu_year	5.86	0	17	6.93	0	17
Employment Status						
Paid_Emply	0.58	0	1	0.52	0	1
Self_Emply	0.09	0	1	0.07	0	1
Own_farm	0.06	0	1	0.10	0	1
Unpfamily	0.00	0	1	0.02	0	1
UnEmply	0.27	0	1	0.29	0	1
Household Characteristics						
HHSIZE	3.94	1	26	3.52	1	23
HHSQ	23.95	1	676	20.06	1	529
Dep_ratio	0.66	0	10	0.83	0	12
Cattle Ownership						
c0	0.66	0	1	0.69	0	1
c19	0.18	0	1	0.16	0	1
c1019	0.07	0	1	0.08	0	1
c2039	0.05	0	1	0.04	0	1
c4059	0.02	0	1	0.02	0	1
c60plus	0.02	0	1	0.02	0	1
Regional Dimensions						
Cities	0.24	0	1	0.26	0	1
Urban	0.29	0	1	0.32	0	1
Rural	0.47	0	1	0.42	0	1

Source: Author computed from HIES 2002/03 and 2009/10 BCWIS.
[a]: Based on the 6047 cleaned observations (6 omitted)
[b]: Based on the 7720 cleaned observations (12 omitted).

An estimated 58 (52) percent of the HHs engaged in paid employment in 2002/03 (2009/10). This was followed by self-employment at 9 (7) percent of the households in 2002/03 (2009/10). Those who indicated that they were self-employed in agriculture accounted for about 6 (10) percent in 2002/03 (2009/10). A paltry 0.04 (2) percent worked as unpaid family helpers in 2002/03 (2009/10). About 27 (29) percent of the HHs did not engage in any type of work in 2002/03 (2009/10).

Household size averaged 4 (3) members in 2002/03 (2009/10). The decline in household size could be attributed to the declining fertility rate that has occurred over the years, with the latest estimate registered at 2.8 (Statistics Botswana, 2013b). Dependency ratio averaged 0.66 (0.83) in 2002/03 (2009/10), signifying an increase in the number of dependents relative to those in the economically active age cohorts.

Turning into cattle ownership, about 18 (16) percent of the surveyed households owned between 1 and 9 cattle in 2002/03 (2009/10), followed by 7 (8) percent who owned between 10 and 19 cattle and 5 (4) percent who owned between 20 and 39 cattle in 2002/03 (2009/10). A paltry 2 percent owned between 40 and 59 cattle and more than 60 cattle during both survey periods. The remaining 66 (69) percent did not own any cattle in 2002/03 (2009/10). In general, the ratios of households across herd-size categories declined with an increase in herd-size, implying that the majority of cattle owners kept small herd-sizes. Of the sampled households in 2002/03, 24 percent were from cities/towns, 29 percent were from urban villages and the remaining 47 percent were from rural areas. A similar pattern is observed for 2009/10, with 26, 32 and 42 percent residing in cities/towns, urban villages and rural areas, respectively.

5.   Results and Discussions

5.1   Determinants of welfare

Table 3 presents regression results for the log of per capita consumption (welfare) model for 2002/03 and 2009/10. Since the dependent variable is in log form, the estimated regression coefficients for continuous variables measure the percentage change in household per capita consumption due to a unit increase in the independent variable (Giles, 2011; Halvorsen and Palmquist, 1980). For categorical (dummy) variables, we computed the percentage change in per capita consumption due to the change in the considered binary variable from a value of 0 to 1 as: $100(e^{\alpha} - 1)$, where α represents the estimated coefficient for the considered independent variable (Seleka and Lekobane, 2014; Giles, 2011; Halvorsen and Palmquist, 1980).

The independent variables account for about 51 percent of the variation in the dependent variables in both models. We did not expect a very high R^2 for cross-sectional data, and the current estimate is therefore reasonable. The F-statistics are highly significant (p<0.001), implying that the explanatory variables jointly exert significant influence on household

welfare. The estimated coefficients for any given variable generally carry the same and expected signs across the models for 2002/03 and 2009/10, and the levels of significance are the same for each variable, across the two periods. The minor differences that exist are with respect to employment status variables.

The estimated coefficients for *AgeHH* are positive for both survey periods and those for *AgeHHSQ* are negative. These conform to the findings of previous studies, and indicate that as age of the household head increases, welfare increases at a decreasing rate, reaches a maximum and declines at old age. This is consistent with the life-cycle phenomenon of higher earning capacity with greater experience and smoothing of consumption over the life cycle (Gounder, 2012; Datt and Jolliffe, 2005).

Turning to the gender of the HH, we find that MHHs attained 14 (19) percent higher per capita consumption than FHHs in 2002/03 (2009/10), an indication that households headed by males are better-off in terms economic welfare than those headed by females. These findings are consistent with those of Akerele and Adewuyi (2010) and Litchfield and McGregor (2008) who respectively found that in Nigeria and Sierra Leone MHHs were better-off in terms of economic welfare than FHHs.

In Table 3, the dummy variable for married HHs was omitted and served as a base (reference) variable. Generally, marriage enhances household welfare. Households whose heads were cohabiting (living together) attained 24 (17) percent lower per capita consumption in 2002/03 (2009/10) than households with married HHs. Similarly, households headed by separated couples attained 25 (16) percent lower per capita consumption in 2002/03 (2009/10) than those with married HHs. In the same token, households whose heads were never married attained 20 (18) percent lower per capita consumption in 2002/03 (2009/10) compared to households with married HHs. However, the results indicate that household welfare for divorced and separated HHs did not statistically differ from that for households headed by married HHs. Generally, the results are consistent with other studies which found that marriage brings an array of benefits, in economic terms, since it adds a potential earner to the household, thereby increasing the economic well-being of members of the household, including children (Waite, 1995).

Education level of the HH has a positive influence on household welfare. A one year increase in schooling resulted in 5 (7) percent increase in per capita consumption in 2002/03 (2009/10), implying that attainment of higher levels of education provides higher levels of household welfare (Mukherjee and Benson, 2003). This is expected as an increase in educational attainments increases the chances of one's absorption in the labour market and increased earnings, further leading to increased welfare (Akerele and Adewuyi, 2010; Gounder, 2012; Litchfield and McGregor, 2008).

Households headed by individuals engaged in paid employment attained 61 (51) percent higher per capita consumption in 2002/03 (2009/10) than those whose heads were not engaged in any type of work. These results are consistent with those of Mukherjee and Benson (2003) who concluded that having at least one member engaged in formal wage

employment leads to a significant increase in per capita consumption. Households whose heads were self-employed attained 36 (65) percent higher per capita consumption than those whose heads were not engaged in any type of work in 2002/03 (2009/10). Similarly, households whose heads were unpaid family workers, attained 50 (11) percent higher per capita consumption in 2002/03 (2009/10) than those whose households heads were not engaged in any type of work. We found the unexpected result that households whose heads were self-employed in agriculture attained 15 (8) percent lower per capita consumption in 2002/03 (2009/10) than those whose HHs were not engaged in any type of work.

Household size has a negative effect on welfare. The inverse relationship between household size and per capita consumption, and by implication the positive relationship between household size and poverty, is a common finding in the empirical literature (Gounder, 2012; Litchfield and McGregor, 2008; Datt and Jolliffe 2005). However, household size squared has a positive effect on per capita consumption, implying that there may be economies of scale associated with larger households. These findings are consistent with other studies (Gounder, 2012; Litchfield and McGregor, 2008; Datt and Jolliffe, 2005; Mukherjee and Benson, 2003; Fagernas and Wallace, 2003).

Dependency ratio also negatively influences household welfare, suggesting that an increase in the dependency ratio would result in a reduction in household welfare as a result of the decline in resources for catering for each dependent in the household. In 2002/03 (2009/10), a unit increase in the dependency ratio resulted in a 7 (8) percent reduction in per capita consumption. These results are consistent with those of Akerele and Adewuyi (2010) and Litchfield and McGregor (2008) who found that increased dependency resulted in reduced resources available to each household member.

Cattle ownership positively relates to household welfare. The results show that per capita consumption increases with an increase in herd-size, implying that households owning larger herd-sizes attained higher per capita consumption than those with a few or no cattle. In 2002/03 (2009/10), households owning between 1 and 9, 10 and 19, 20 and 39, 40 and 59 and more than 60 cattle attained 8 (11), 17 (27), 51 (32), 64 (46) and 71 (116) percent higher per capita consumption than those households not owning any cattle. This is expected because ownership of cattle can generate cash income through sales, which results in increased consumption.

Regional analysis showed that urban households (those residing in cities/towns and urban villages) were better-off in terms of welfare than rural households. Households residing in cities/towns attained 52 (82) percent higher per capita consumption in 2002/03 (2009/10) than rural households. Similarly, households residing in urban villages attained 31 (51) percent higher per capita consumption in 2002/03 (2009/10) than rural households. This is expected because of inadequate employment opportunities, infrastructure and quality of services in rural areas (BIDPA, 2010). It is also because agriculture, which plays an important role as a source of rural livelihood, has performed poorly since independence in 1966, leading to widespread poverty among rural dwellers (TRANSTEC and BIDPA, 2010).

Table 3: OLS estimates of log of per capita consumption (welfare)

Variable	2002/03 HIES		2009/10 BCWIS	
	Coefficient	P-value	Coefficient	P-value
Household head characteristics				
AgeHH	0.045	0.000***	0.029	0.000***
AgeHHSQ	-0.0003	0.000***	0.000	0.000***
Gender	0.134	0.000***	0.170	0.000***
Marital Status (Married omitted)				
Living Together	-0.275	0.000***	-0.186	0.000***
Separated	-0.292	0.029**	-0.173	0.068*
Divorced	-0.112	0.206	-0.007	0.921
Widowed	-0.065	0.156	0.010	0.816
Never married	-0.225	0.000***	-0.198	0.000***
Edu_years	0.084	0.000***	0.072	0.000***
Employment Status (UnEmply omitted)				
Paid_Emply	0.473	0.000***	0.412	0.000***
Self_Emply	0.304	0.000***	0.499	0.000***
Own_farm	-0.166	0.003***	-0.078	0.053*
Unpfamily	0.406	0.028**	0.108	0.152
Household characteristics				
HHSIZE	-0.269	0.000***	-0.314	0.000***
HHSQ	0.011	0.000***	0.013	0.000***
Dep_ratio	-0.074	0.000***	-0.086	0.000***
Cattle ownership*(c0 omitted)*				
C19	0.078	0.012**	0.107	0.000***
c1019	0.160	0.000***	0.235	0.000***
c2039	0.414	0.000***	0.277	0.000***
c4059	0.495	0.000***	0.378	0.000***
c60plus	0.536	0.000***	0.772	0.000***
Regional dimensions (Rural areas omitted)				
Cities	0.417	0.000***	0.601	0.000***
Urban	0.271	0.000***	0.415	0.000***
Constant	4.836	0.000***	5.401	0.000***
Adjusted R Square	0.512		0.512	
F statistic	276.87	0.000***	352.62	0.000***
No. of Observations[†]	6047		7720	

***; ** and *: statistically significant at 1, 5 and 10 percent, respectively. [†]:4 and 12 observations were excluded from the analysis in 2002/03 and 2009/10, respectively, due to data cleaning.

5.2 Determinants of poverty

Table 4 presents results for the estimated logit regressions for 2002/03 and 2009/10. The table reports the coefficients, associated p-values and marginal probabilities. The log-likelihood ratio (LR) tests show that there are significant relationships between the probabilities of being poor and the explanatory variables included in both models (p<0.001). Thus, using the LR test, we conclude that the logit models fitted the data quite well. Most estimated coefficients exhibit similar levels of statistical significance across the two periods. However, there are some exceptions, particularly with respect to marital status variables and gender, and most unexpectedly livestock ownership variables. Generally however, most coefficients for both models conform to *a priori* expectation.

The results show that the relationship between age of the HH and poverty is nonlinear. Age of the HH carries negative coefficients whilst age-squared has positive coefficients. Thus, consistent with the life-cycle hypothesis, poverty is relatively higher at young ages, decreases at middle age and then increases again at old age (Datt and Jolliffe, 1999). The results are consistent with those for Sekhampu (2013), Khalid et al. (2005) and Malik (1996). Gender of the HH was not significant in determining poverty in 2002/03, but negatively related with poverty in 2009/10. MHHs were 1.3 percentage points less likely to be poor in 2009/10 than FHHs.

Households headed by HHs who lived together (cohabited), were widowed or were never married in 2002/03 were 4, 2.5 and 5 percentage points (respectively) more likely to be poor than those headed by married HHs. In the same year, being headed by a divorced or a separated HH did not have a significant differential impact on poverty status than being headed by a married HH. In 2009/10, a household headed by an individual who was never married was 4.4 percentage points more likely to be poor than that household headed by a married HH. However, being headed by a separated, a divorced, a widowed or a cohabiting HH did not affect poverty status differently than being headed by a married HH in 2009/10.

Education of the HH is negatively related with poverty. A one year increase in schooling in 2002/03 (2009/10) led to a 1.2 (0.6) percentage points decrease in the probability of being poor. This is expected as education enhances the skills of individuals and increases the possibility of getting a job and the earning capacity of a person (Shiraz, 1995). The results are consistent with the findings of other studies (Shiraz, 1995; Malik, 1996; Serumaga-Zake and Naude, 2002; Khalid et al., 2005; Mok et al., 2007).

Employment status of the HH plays an important role in the poverty status of the household. Households whose heads were engaged in paid employment in 2002/03 (2009/10) were 8.6 (3.0) percentage points less likely to be poor than those whose heads were not engaged in any type of work. Similarly, households whose heads were self-employed in 2002/03 (2009/10) were 4.7 (2.5) percentage points less likely to be poor than those whose heads were not engaged in any type of work. However, households whose heads worked in own

lands/ cattle posts (self-employed in agriculture) in 2002/03 were 2.8 percentage points more likely to be poor than those households whose heads were not engaged in any type of work. This does not conform to *a priori* expectation since we expected self-employment in agriculture to enhance welfare and reduce poverty than being unemployed. For 2009/10, there was no differential impact on poverty status for working in own land/cattle post (self-employed in agriculture) compared to not working. Similarly, working as an unpaid family helper had no differential impact on poverty status compared to not doing any type of work in both 2002/03 and 2009/10.

Household size carries positive coefficients whilst household size-squared carries negative coefficients for both periods. This means that the relationship between household size and the likelihood of being poor is non-linear. Therefore, increasing household size at lower initial levels would increase poverty faster than at higher initial level of household size. Ultimately, at very high levels, increasing household size would lower poverty. These findings are consistent with those of Shiraz (1995), Baulch and McCulloh (1998), Serumaga-Zake and Naude (2002), Khalid et al. (2005), Meng and Gregory (2007) and Sekhampu (2013).

Dependency ratio positively related with poverty. This means that increasing the dependency ratio by one unit resulted in 11 (12) percentage points increase in the probability of being poor in 2002/03 (2009/10). These results are consistent with those of Baulch and McCulloch who found that increased dependency ratio resulted in higher probabilities of being poor in Pakistan.

With regard to cattle ownership, the results show that the probability of being poor generally declined with increasing herd size. In 2002/03, households that owned between 1 and 9, 10 and 19, 20 and 39, 40 and 59 and more than 60 cattle were respectively 3.3, 3.5, 6.4, 7.8 and 8.6 percentage points less likely to be poor than those households that did not own any cattle. The results are consistent with the findings of Baulch and McCulloh (1998), who concluded that ownership of assets such as livestock reduces the probability of being poor. However, for 2009/10, the differential impacts only occurred for households owning 20-39 and over 60 cattle, while *a priori* we expected negative coefficients for all the herd-size categories

Regional dummies show that poverty is more widespread in rural areas than in urban villages and cities/towns. Households that resided in cities/towns in 2002/03 (2009/10) were 8.2 (1.8) percentage points less likely to be poor than those that resided in rural areas. Moreover, households that resided in urban villages in 2002/03 (2009/10) were 5.5 (1.5) percentage points less likely to be poor than their rural counterparts. This is expected since more job and other economic opportunities are in urban areas than in rural areas, leading to higher prevalence of poverty in rural areas. Again, rural area dwellers are heavily dependent on agriculture, which has one of the lowest outputs amongst Botswana's economic sectors, despite being the leading employer, particularly in rural areas (IPC and BIDPA, 2005; TRANSTEC and BIDPA, 2010).

Table 4: Logit estimates of the Determinants of Poverty

Variable	2002/03 HIES			2009/10 BCWIS		
	Coefficients	P-value	Marginal Effects	Coefficients	P-value	Marginal Effects
Household head characteristics						
AgeHH	-0.037	0.007***	-0.004	-0.063	0.000***	-0.004
AgeHHSQ	0.000	0.005***	0.000	0.000	0.000***	0.000
Gender	0.026	0.784	0.003	-0.219	0.032**	-0.013
Marital Status (Married omitted):						
Living Together	0.367	0.003***	0.040	0.122	0.348	0.008
Separated	0.212	0.598	0.023	0.049	0.897	0.003
Divorced	0.016	0.960	0.002	-0.022	0.942	-0.001
Widowed	0.238	0.083*	0.025	-0.186	0.217	-0.011
Never married	0.485	0.000***	0.050	0.262	0.044**	0.016
Edu_years	-0.120	0.000***	-0.012	-0.106	0.000***	-0.006
Employment Status (UnEmply omitted)						
Paid_Emply	-0.819	0.000***	-0.086	-0.492	0.000***	-0.030
Self_Emply	-0.572	0.000***	-0.047	-0.484	0.008***	-0.025
Own_farm	0.257	0.082*	0.028	-0.357	0.148	-0.019
Unpfamily	-0.952	0.101	-0.065	-0.009	0.944	-0.001
Household characteristics						
HHSIZE	0.284	0.000***	0.028	0.472	0.000***	0.029
HHSQ	-0.009	0.000***	-0.001	-0.014	0.000***	-0.001
Dep_ratio	0.110	0.009***	0.011	0.121	0.000***	0.007
Livestock ownership(c0 omitted)						
C19	-0.364	0.000***	-0.033	-0.005	0.968	0.000
c1019	-0.411	0.005***	-0.035	-0.136	0.400	-0.008
c2039	-0.875	0.000***	-0.064	-0.385	0.090*	-0.020
c4059	-1.245	0.000***	-0.078	-0.449	0.152	-0.023
c60plus	-1.499	0.000***	-0.086	-0.814	0.069*	-0.035
Regional dimensions (Rural areas omitted)						
Cities	-0.835	0.000***	-0.082	-0.316	0.016**	-0.018
Urban	-0.608	0.000***	-0.055	-0.255	0.007***	-0.015
Constant	-0.513	0.181		-1.044	0.014**	
Pseudo R-Square	0.208			0.206		
Log likelihood	-2203.38			-2130.08		
LR Chi-Square	1157.20	0.000***		1105.90	0.000***	
No. of Observations†	6047			7720		

***; ** and *: statistically significant at 1, 5 and 10 percent, respectively. †:4 and 12 observations were excluded from the analysis in 2002/03 and 2009/10, respectively, due to data cleaning.

6.   Conclusions and Policy Implications

The main objective of this paper was to identify the determinants of household welfare and poverty in Botswana using household survey data for 2002/03 and 2009/10. The paper concludes that age brings gains in household welfare and negatively relates to poverty. However, the relationship between age and poverty (or welfare) is non-linear, implying that poverty is relatively higher at young ages, decreases at middle ages and then increases again at old ages. Similarly, consumption is lower at young ages, increases at middle ages and then decreases again at old ages. Therefore, poverty reduction strategies should target those households headed by young individuals or the elderly, since they are amongst the most vulnerable groups.

Gender of the HH negatively related to poverty in 2009/10, implying that MHHs had lower probabilities of being poor than FHHs. Moreover, gender of HH positively related with per capita consumption in both 2002/03 and 2009/10, implying that MHHs enjoyed higher welfare than FHHs. The paper concludes that higher poverty rates (and low welfare status) amongst FHHs also imply higher rates of poverty amongst children since the majority of children are found in FHHs (CSO, 2013). The foregoing underlines the importance of further studies to ascertain the extent, level and the many dimensions of female poverty in Botswana, to further provide information for formulating antipoverty strategies targeting vulnerable female populations.

The paper also concludes that marriage plays an important role in wealth accumulation and poverty reduction since it increases the well-being of the family. Marriage can therefore be used as a strategy for poverty reduction at household level. Public policy should encourage non-married couples to get into marriage and be able to sustain it. Programs that promote relationship enhancement and marriage education services, where unmarried couples can learn skills necessary to enter into and sustain healthy marriages, should be considered.

We also ascertain that educational attainment positively relates with welfare and lowers poverty. This is expected since education enhances human capital and participation in the labour market, and may enhance business performance amongst self-employed households. Public policy should therefore continue to emphasize human capital development (education and training) as part of poverty reduction strategy.

Households whose heads were employed were less likely to be poor and attained higher per capita consumption than those with unemployed HHs. Therefore, efforts to diversify the Botswana economy and expand employment opportunities should be intensified. Cattle ownership enhances welfare since cattle may be sold to finance household consumption. Similarly, cattle ownership reduces the probability of being poor, although the results were mixed for 2009/10.

Both household size and the dependency ratio positively relate with poverty and negatively impact on per capita consumption. Thus, larger households typically attain lower

consumption and the consumption level is reduced further if the household has many dependents. So, given that poverty increases with increases in household size, there is a need to intensify family planning initiatives, especially in rural areas. Since high dependency ratios may also be due to increased orphanhood resulting from HIV/AIDS related deaths, measures for preventing new HIV infections should continue to be emphasized, including public education geared at influencing behavioural change. Moreover, Antiretroviral Treatment and Prevention of Mother to Child Transmission programs, which have yielded positive results in Botswana (BIDPA, 2010), should continue to be provided and improved to reduce the potential adverse effects of HIV/AIDS on household welfare.

Regional analysis shows that poverty in Botswana is more prevalent in rural areas than elsewhere. This may accelerate rural-urban migration since most people might opt to move to urban areas in search for better livelihood opportunities such as employment, to usher themselves out of poverty. In order to reduce rural poverty, increased effort needs to be put into the provision of infrastructure and quality services in rural areas to promote investment and employment creation. A study by BIDPA (2009) identified agricultural infrastructural needs (mainly in rural areas), such as telecommunications, electricity and roads. Government should prioritize such infrastructural needs to ensure that infrastructure services are provided to further promote trade, improved technology transfer and overall competitiveness in rural areas.

Moreover, efforts to improve productivity in the agricultural sector would go a long way in promoting poverty reduction, as agriculture is the key economic activity in rural Botswana. Existing input subsidy programs in the agricultural sector have promoted an expansion in land cultivation but have not been effective in enhancing sustained productivity growth through technology adoption (TRANSTEC and BIDPA, 2010). Therefore, more effort should go into improving productivity through promoting improved technology adoption in the subsistence economy where poverty is more widespread.

In sum, strategies and or policies aimed at poverty reduction need to identify these factors that are strongly related to poverty as key ingredients in poverty reduction efforts. Short-term policies for poverty reduction should concentrate on those areas where poverty is higher (rural areas, larger households, female-headed households and households with many dependents). Thus, as part of the short-term strategy, public works and social assistance programs should continue to be provided to vulnerable groups, with increased emphasis now placed on improving targeting, efficiency and effectiveness of such programs (Seleka et al., 2007). Public policy should also consider targeted social assistance to poor households with many dependents (World Bank and BIDPA, 2013; Republic of Botswana, 2010) since existing social programs are not effective in targeting the poor, as selection criteria for most of the programs are not based on poverty status. This will also reduce poverty amongst FHHs since dependency is higher amongst such households.

Long-term policies against poverty should continue to encourage investment in human capital development, to increase education levels amongst the poor and to further enhance

household earnings. However, increased emphases should also be placed on improving the quality of education services, particularly in rural areas which still lag behind in terms of the provision of quality education. Initiatives for promoting economic diversification and creations of gainful employment should be intensified. Moreover, rural development strategies should emphasize the provision of agricultural infrastructure, promotion of agricultural productivity growth through improved technology adoption and community development approaches to exploit areas of competitive advantage through shared community resources.

NOTES

1. Both cash and food transfer programs have been launched. Food transfer programs include the Destitute Persons Program, the Orphan Care Program, the Community Home Based Care Program, the Vulnerable Feeding Program and the School Feeding Programs. Cash transfer program include the Old Age Pension and the World War II Veterans Program. See Seleka et al. (2007) and Seleka and Lekobane (2014) for elaborate discussions on the design, objectives and implementation issues surrounding these programs.

2. The descriptive figures may slightly differ with the CSO (2008) and Statistics Botswana (2013) estimates since the current estimates are based on the unweighted sample.

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