

Trend Analysis of Determinants of Poverty in Ghana: Logit Approach

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Abstract: In this study a binomial logistic model is used to determine the factors which influence households' poverty status using data from three rounds of the Ghana Living Standards Survey (GLSS3, 1991/92; GLSS4, 1998/99 and GLSS5, 2005/06). The results obtained from the analysis indicate that households with large sizes, illiterate heads, and those with heads that have agriculture as their primary occupation are poorer. Also households in rural localities and the savanna zone are poorer. It was also evident that while the living standards of households with large sizes and those with agriculture as primary occupation were improving over the years, the households with illiterate heads and those who live in the savanna zone were becoming worse off.

Key words: Binomial logit model, expenditure, poor and non-poor households, standard of living

INTRODUCTION

Most people are of the view that there is a disparity in these spending variables, income-expenditure among different sectors of most third world countries. Thus, the rural sectors of these countries in contrast to the urban areas have lower incomes, lower expenditures and as such lower standards of living. This makes it very difficult for most households to make ends meet. The difference between rural and urban living conditions has been an important policy issue that has confronted many less-developed countries. Since less developed countries (LDC's) rely heavily on agriculture which is rural-based, the concept of rural development has gained greater priority not only as a means to improve the socio-economic life of the rural people, but in the wider sense to enhance growth and development in the country as a whole. Despite the successes of the Economic Recovery Programme in Ghana, many individuals remain in acute poverty. At the national level around 58% of those identified as poor are from households for whom food crop cultivation is the main activity. The effect of large-sized households has also contributed to the high dependency ratio on poverty.

Ewusi in 1984 analysed the income data of the 1974/75 household budget surveys. His findings are that, for the country as a whole, 75% of the sample falls below a poverty line defined as per capita household income of less than US\$100.00.

Available evidence from surveys (Ewusi, 1987) also shows that, incomes in rural Ghana are generally lower than incomes in the urban areas. This however, brings about the rural, urban income inequalities in the country.

Ravallion and Bidani (1994) outlined that the food energy intake method defines the poverty line by finding

the consumption expenditures or income level intake as just sufficient to meet a predetermined food energy requirement, if applied to different regions within the same country. Ravallion and Bidani (1994) concluded that, this method could yield differentials in poverty lines in excess of the cost of living differentials facing the poverty line. Awusabo Asare (1981/82) applied the Physical Quality of Life Index (PQLI) to indicate that the quality of life in rural Ghana is worse than that in urban Ghana. Recent estimates of the PQLI for the various regions of Ghana by UNICEF (1984) indicate that, the incidence of absolute poverty measured by this index is highest in the Upper and Northern regions. The World Bank in 1995 employed a poverty line of one US dollar per capita per day. The US purchasing power parity line was developed to enable international comparison of poverty to be made (World Bank, 1990). An attempt also has already been made to provide estimates of income elasticity of demand for food in Ghana by the Central Bureau of Statistics.

In 1994, the Ghana Statistical Service (GSS) used the GLSS3 data, and proposed an alternate measure which sets the poverty line at 171,205 cedis per year, per equivalent adult expressed in constant prices of Accra, May 1992, and an ultra poverty line of 128,404 cedis in the same units. The report then used the first three rounds of the GLSS to analyze poverty over the period 1987 to 1992. After some adjustments to ensure comparability of data over the years, the report concluded that significant reductions in poverty occurred between 1988 and 1992. Specifically, the proportion of the population living below the poverty line dropped from about 56% in 1987/88 to 51% in 1991/92, after hitting a high of 61% in 1988/89.

Canagarajah and Portner (2002) worked on the 'evolution of poverty and welfare in Ghana in the 1990s:

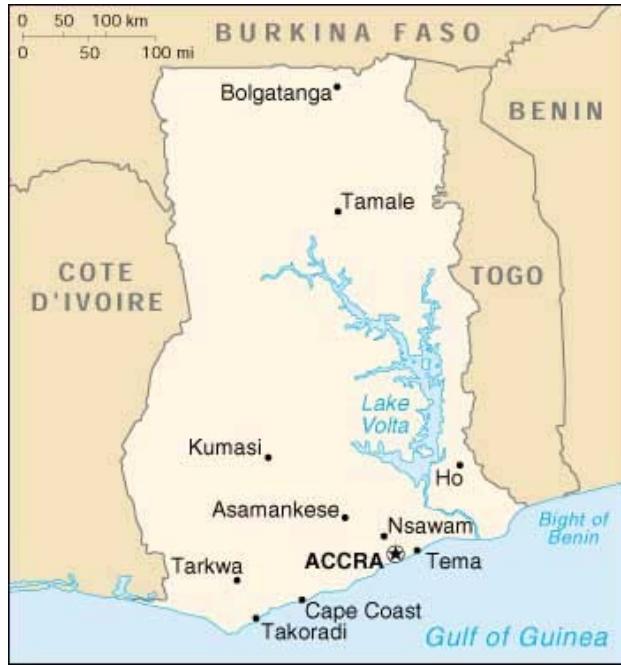


Fig. 1: Map of Ghana showing major cities

Achievements and Challenges'. They identified the causes of poverty in three dimensions: At the macro level that is, fiscal policies of the government, the household level and thirdly, the community level and found out that these dimensions are highly correlated with each other across various poverty levels. A similar study was also conducted by Oduro (2001).

Kyereme and Thorbecke, (1991) believed that economic and social issues such as (income generating activities, education, and so on) affect welfare, and are important in modelling the factors determining the likelihood of being poor. Gang *et al.* (2002) show the significance of education in their study of poverty among caste and ethnic groupings in rural India. They noted that education, in particular from the secondary level upwards is more likely to result in greater reduction in incidence of poverty among certain caste.

Grootaert (1997) in a study of poverty in Côte d'Ivoire showed that education was influential in reducing the likelihood of being poor with the effect being more pronounced and intensive in the rural areas. Okurut *et al.* (2002) also found similar results with respect to Uganda, where the odds change of being non-poor was higher for household heads with higher levels of education.

However, in Ghana and most African countries, the main economic aim has been to achieve high rate of economic growth and to ensure enough food supplies to the entire population as well as to satisfy their basic production and service needs such as education, good health, accommodation and social amenities which

immensely contribute towards improving the living standard of the citizens. Thus, the rural communities of these countries compared with the urban communities have lower income, lower expenditure and as such lower standard of living.

Addressing these issues, this study presents and discusses expenditure patterns of households in Ghana using the poverty status which classifies Ghanaian households into two poverty groups: poor and non-poor. The poor corresponds to households below the poverty line and non-poor households correspond to those above the poverty line. Furthermore, this study aims at revealing the discrepancies and trends in the distribution of poverty across locality, ecological zone and household size among others.

MATERIALS AND METHODS

Figure 1 is the map of Ghana showing the major cities. Ghana covers a total area of 238,537 km² (92,100 square miles). It is bordered on the north-west by Burkina Faso, on the east by Togo, on the south by the Gulf of Guinea and on the west by Côte d'Ivoire. The last population census in 2000 estimated the total population to be about 18.4 million. About 68% of the population lives in rural communities and the remaining 32% live in urban centres. About 57% of the total area of the country is covered by agricultural land.

Agriculture is the most widespread occupation in Ghana, accounting for about 60-70% of the labour force. Agriculture plays a major role in growth of the economy



Fig. 2: Map of Ghana showing distribution of urban centres

both in terms of contribution to Gross Domestic Products(GDP), foreign exchange earnings, tax revenue and employment, (ISSER 2000). Appendix A for GDP by Sectors.

The Fig. 2 shows the distribution of urban and rural communities in Ghana where enumeration took place. The figure indicates a higher concentration of urban centres in the south reflecting the effects of colonial and post-colonial development policies, and the availability of economic opportunities due to limited or abundant mineral and agricultural resources in some regions, Yeboah and Waters (1997) and Konadu-Agyemang and Adanu (2003).

Ghana's urban population for the past 30 years has undergone a number of changes. The urban centres defined as small towns (have populations between 5000 and 50,000) and the number of these centres increased from 114 in 1970 to 336 in 2000, GSS (1995). According to Owusu (2004), the growth and the present decentralized development process of these small towns, is aimed at improving rural areas and the development of a more balanced settlement pattern.

Data: This study used a secondary data obtained from the office of Ghana Statistical Service, GSS (1995, 2000, 2008) for the 3rd, 4th and 5th rounds, respectively of the

Ghana Living Standards Survey (GLSS), which were conducted in 1991/92 (GLSS3), 1998/99 (GLSS4) and 2005/06 (GLSS5). The Ghana Living Standards Survey focuses on the households as a key socio-economic unit and provides valuable insights into living conditions in Ghana hence the need for the study. In all, a sample of 4552, 5998 and 8687 households were selected nationwide in each of the rounds respectively, with approximately 200, 300 and 580 enumeration areas respectively, stratified by urban/rural and ecological zones. Detailed information was collected on demographic characteristics of respondents and all aspects of living conditions including health, education, housing, household income, consumption and expenditure, credit, assets and savings, price and employment.

In this study, all the households were categorized into two groups (poor and non-poor) based on their total consumption expenditure.

Growth incidence curve was incorporated in this study. These curves show the percentage increase in consumption obtain for various groups of the population according to their consumption level, GSS (1995).

Binomial logistic regression model was used to find which of the nine explanatory variables sampled from the survey, significantly influence poverty. Appendices B, C and D for the results of the logistic regression analysis of

the three consecutive rounds. Trend analysis was also carried out for the variable that significantly predicts poverty status of households.

Binomial modeling of expenditure patterns: Modeling poverty is an important criterion for the judgement of the poverty status of individual households. In choosing an appropriate method of modeling income and expenditure pattern the approach we follow intends to explain why some population groups are poor and others non-poor considering their expenditure pattern. Firstly, we identify the poor and non-poor based on their expenditure level. Secondly, we estimate the probability of being poor conditional on the logistic distribution function.

We assumed that the probability of being in a particular poverty category is determined by the proportional odds model by McCullagh (1980) which emphasizes an interpretation in terms of odds ratios. The log odds ratio is expressed as a linear function of the explanatory variables in the binomial logistic model.

Model assumptions: In using the logistic model, the assumptions below were made:

- The dependent variable Y is assumed to be binary taking on two values 0 and 1.
- The observations are independent of each other.
- Y is assumed to depend on k -observable variables, $i = 1, 2, \dots, k$. $P = P(Y = 1/X_1, \dots, X_k)$, where X denotes the set of k -independent variables X_i .
- No exact linear dependencies exist among the explanatory variables.

Model specification: The logistic model (the log-odds ratio) takes the form:

$$\begin{aligned} \ln(p_i) &= \log\left(\frac{P_i}{1-P_i}\right) \\ &= \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots \\ &\quad + \beta_{(k-1)} X_{(k-1)i} + \beta_k X_{ki} + e_i \end{aligned} \quad (1)$$

where, p_i is defined as the success probability corresponding to the i th observation $\log\left(\frac{P_i}{1-P_i}\right)$ is the

log odds ratio and $\left(\frac{P_i}{1-P_i}\right)$ is the odds ratio. The coefficients β 's, are the parameters in the model, X 's are the explanatory variables and e_i is an error term.

From Eq. (1) p_i can then be expressed in terms of the k explanatory variables, $X_{1i}, X_{2i}, \dots, X_{ki}$, as:

$$\begin{aligned} P_i &= \frac{\exp(\beta_0 + \beta_1 X_{1i} + \dots + \beta_{(k-1)} X_{(k-1)i} + \beta_k X_{ki})}{1 + \exp(\beta_0 + \beta_1 X_{1i} + \dots + \beta_{(k-1)} X_{(k-1)i} + \beta_k X_{ki})} \\ &= \frac{\ell \beta^t X}{1 + \ell \beta^t X} \end{aligned} \quad (2)$$

$$\text{where } \beta^t X = \beta_0 + \beta_1 X_{1i} + \dots + \beta_{(k-1)} X_{(k-1)i} + \beta_k X_{ki}$$

Interpretation of coefficients: The parameter β_0 is a constant term representing the nominal value of the log-odds ratio. Thus it is the value of the log-odds ratio when. $X_{1i} = X_{2i} = \dots = X_{(k-1)i} = X_{ki} = 0$ Each of the parameters β_i ($i = 1, 2, \dots, k$) represents the change in the log-odds ratio per unit increase in the value of X_i . These can be modified to obtain values that represent the rate of change of the odds ratio $P_i/(1-P_i)$ by taking log inverse of each of the β_i 's. Thus $\exp(\beta_i)$; $i = 1, 2, \dots, k$ represents the rate of change of the successes probability (p_i) corresponding to the i th observation to the probability of the failure ($1-p_i$) corresponding to the i th observation. This means that:

- when $\exp(\beta_i) = a > 1$ then a unit change in X_i would make the event (success) a times as likely to occur as its non-occurrence (failure).
- when $\exp(\beta_i) = 1$ then there exist a 50% chance of the event occurring with a one unit change in the independent variable X_i .
- when $\exp(\beta_i) < 1$ then one unit change in X_i leads to an event being less likely to occur.

Hypothesis about the β_i 's.

The test statistic W for testing $H_0: \beta_i = 0$ (i.e., X_i has no significant effect on the log-odds ratio) against $H_1: \beta_i \neq 0$ (i.e., X_i has a significant effect on the log-odds

ratio) is given by $W = \left(\frac{\beta_i}{SE(\beta_i)}\right)^2$ and has a chi-square

distribution on one degree of freedom. $SE(\beta_i)$ is the standard error of β_i .

Description of variables: The explanatory variables used in the model are shown in Table 1.

RESULTS AND DISCUSSION

Estimates for the binomial poverty models shown in Table 2 indicate that household size, ecological zone, locality and age of household head are significant ($p < 0.05$) determinants of poverty for all the years under consideration. However, 'consulted', 'occupation of head not Agric' and 'ever attended school' are significant ($p < 0.05$) determinants of poverty for the years 1998/99 and 2005/06. The variable 'can write in English', which wasn't considered in 1991/92, was also found to be a

Table1: Description of explanatory variables used in modeling poverty

X_1	Hhszie	Household size
X_2	Age y	Age head
X_3	Sex	(Male = 1, Female = 2)
X_4	Ez	Ecological zone
X_5	Locality	Accra = 1, Urban = 2, Rural = 3
X_6	Consulted	Consulted health personnel: Yes = 1, No = 2
X_7	Sch ever	Ever attended school: Yes = 1, No = 2
X_8	HAgric	Occupation of head is not Agric: Yes = 1, No = 2
X_9	HLitt	Can write in English (head):Yes = 1, No = 2
Y	Poverty status	poor (0), Non-poor (1), Total consumption expenditure

Table 2: Estimated results of Binomial Logit Model of determinants of Household standard of living 1991/92, 1998/99 and 2005/06

Characteristic	1991/92		1998/99		2005/06	
	Odds ratio Exp (β)	Sig.	Odds ratio Exp (β)	Sig.	Odds ratio Exp (β)	Sig.
Hhszie	0.2914	0.0000	0.35610	0.0000	0.761	0.000
Ecological zone						
Coastal (1)	1.7862	0.0000	3.11380	0.0000	3.943	0.000
Forest (2)	1.5644	0.0000	3.40650	0.0000	3.711	0.000
Locality 3						
Accra (1)	4.6081	0.0000	18.0513	0.0000	1.65	0.001
Urban (2)	5.1466	0.0000	2.37680	0.0000	3.854	0.000
HAge (y)	1.2803	0.0484	0.82310	0.0000	0.993	0.001
Consult (1)	0.8785	0.0975	1.32990	0.0037	1.227	0.014
Sexhead (1)	1.0541	0.5753	1.12830	0.0908	1.131	0.108
Schever (1)	1.1209	0.4976	1.59990	0.0000	1.788	0.000
HAgric (1)	0.8767	0.3581	0.67190	0.0000	0.592	0.000
Literate head(1)	-	-	2.66760	0.0000	0.779	0.004

significant determinant of poverty status for both 1998/99 and 2005/06. In all the models, sex of head of household was insignificant. The Table 2 is an extract from Appendices B, C and D.

From the results in the Table 2 the following general deductions can be made for all the years under consideration:

Households with larger size are more likely to be poorer than those with smaller size. However, according to Kakwani (1989), in some instances larger households tend to have higher incomes because such households probably have on the average a greater number of people in the workforce. His assertion may be true in the urban areas where job availability is comparably better than in the rural areas where majority are subsistence farmers with large families.

Households in the savannah zones are poorer compared to those in coastal and forest zones; a confirmation of the results from the report of the GLSS (1995) citing the largest poverty incidence of 72% for the rural savannah. As indicated by the odds ratios in the table above for all the years, the forest zone which has most of the economic commodities in the country (cocoa, oil palm, minerals, rubber and timber) is the second poorest zone after the savannah zone. The coastal zone is the least poor and this might be as a result of the service sector in this zone, which has improved their standard of living as compared to the other zones.

Rural households are mostly poorer than households in the other localities. This goes to buttress the findings by

Ewusi (1987), that incomes in rural Ghana are generally lower than incomes in the urban areas. For all the years considered, with the exception of 1998/99 which recorded unexpectedly different result, Accra is in general the second poorest followed by the urban locality.

Households whose heads did not consult health personnel when sick are poorer than those whose heads consulted. This may be due to lack of funds for paying for such consultation which in turn leads to longer periods of recovery from illnesses and injuries; and hence lower productivity.

Households with illiterate heads are more likely to be poor than those with literate heads. This is as expected because majority of households with illiterate heads are mostly found in the rural areas where poverty is at its peak in most African countries, Ewusi (1987).

Households whose primary occupation is agriculture are poorer than those with different primary occupations. This deduction is as expected because majority of the households in the rural area have agriculture as their primary occupation (Ewusi, 1987).

Trend analysis of determinants of poverty: As observed from Table 2, for every additional member, the odds of being non-poor increases as the years progress. The odd ratios are respectively, 0.29, 0.36 and 0.76. This is an indication that households with large families are getting less poor over the years.

The ecological zone is another determinant of poverty and as such the odds ratio for those living in the coastal

zone for the three consecutive rounds are 1.79, 3.11 and 3.94, respectively whilst in the forest zone, the odd ratios are 1.56, 3.41 and 3.71 for 1991/92, 1998/99 and 2005/06, respectively. This is an indication that households in the savannah zone are almost four times poorer than those living in the coastal and forest zones in 2005/06. The results also show that households in the savannah zone are becoming poorer and poorer every year.

The trend is almost the same in the case of the localities. In 1991/92, households living in Accra and other urban areas were almost five times better than those in the rural areas. However, subsequent years recorded a slight decrease in the odds ratio. Even though rural households still remain the poorest among the three localities there had been an improvement probably due to government interventions (rural electrification, soft loan, pipe borne water, and so on.) over the past years. In 1998/99 Accra recorded an odd ratio of 18.1. This was as a result of a massive urban/rural migration into the city of Accra.

The odds ratio for households who did not consult health personnel when sick had decline from 1.3 in 1998/99 to 1.2 in 2005/06. This is an indication that there had been an improvement in their standard of living. The introduction of the health insurance scheme and the establishment of clinics in most of the district capitals may be the explanation for this phenomenon.

The results also show that household whose heads cannot read or write had increased from 0.6 in 1998/99 to 0.7 in 2005/06. Thus households whose heads cannot read or write are becoming poorer and poorer marginally. This proves that majority of heads of households do not see the need to attend adult education programmes to improve their standard of living.

Household heads whose primary occupation is agriculture had improved from 1998/99 to 2005/06. The ratios are 0.7 and 0.6, respectively, even though it was not significant in 1991/92. This may be attributed to government policy on agriculture which resulted in mass spraying of cocoa farms, distribution of free fertilizer to farmers and provision of tractors and many other interventions.

According to Ravallion (2003), growth incidence curve is one approach to answer the question of whether the poorest households are really benefiting from the accelerated economic growth being enjoyed by Ghana since the early 1990s.

These curves graph the growth rates in consumption at various points of the distribution of consumption, starting from the poorest on the left of the horizontal axis to the richest (non-poor) on the right GSS, (2007).

As shown in Fig. 3, the growth rates in consumption have been significantly higher in the upper part of the population, especially in the 1990s. From 1998/99 to 2005/06, while the upper hierarchy of the population benefited largely from the consumption, however, the

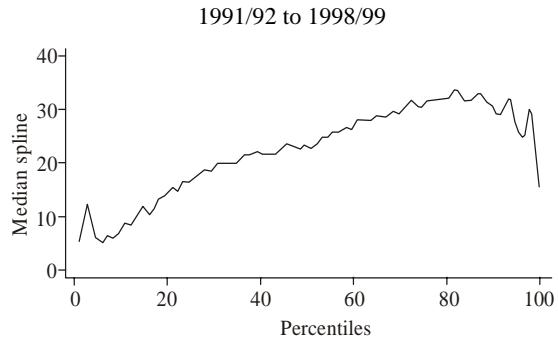


Fig. 3a: Growth incidence curves, national level, (Computed from the Ghana living standards Survey, 1991/92, 1988/99 and 2005/06)

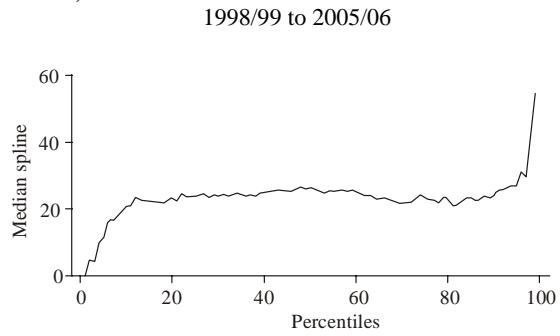


Fig. 3b: Growth incidence curves, national level, (Computed from the Ghana living standards survey, 1991/92, 1988/99 and 2005/06)

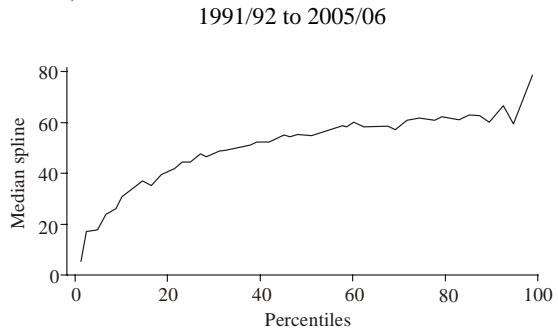


Fig. 3c: Growth incidence curves, national level, (Computed from the Ghana living standards survey, 1991/92, 1988/99 and 2005/06)

very poor had lower benefit than the rest of the population. The pattern of gains was equitable for a fairly large segment of the population since the growth incidence curve is flat from the second decile to the ninth decile.

CONCLUSION

In Ghana a high proportion of those in the poor income group are found in the rural areas. In addition, there are groups of households within the rural and urban areas who have relatively low standards of living compared to the households in the other localities. These

low income groups include households with poorly educated heads, those with large household sizes, households with illiterate heads and households whose primary occupation is agriculture.

Although households with large sizes, those whose heads have agriculture as primary occupation and those who did not consult health personnel when sick are relatively poorer, their living standards improved

marginally over the years. However, households in the savanna zone and those with illiterate heads became poorer and poorer over the years.

In summary, poverty reduction has benefited from very favourable economic growth in the last fifteen years. However, the decline in poverty would have been even better if it had not been offset by increasing inequality, particularly since 1998/99, GSS (2007).

Appendix A:

a: GDP by sector at constant 1993 Price, 1999-2000

	Sector (%)		
Year	Agriculture	Services	Industry
1995	36.3	28.1	24.9
1996	36.5	28.0	24.9
1997	36.6	28.7	25.4
1998	36.7	29.0	25.1
1999	36.5	29.2	25.2
2000	36.0	29.7	25.2

State of the Ghanaian Economy in 2000, ISSER.

b: GDP by sector at constant 1993 Price, 2001-2006

	Sector (%)		
Year	Agriculture	Services	Industry
2001	35.9	29.9	24.9
2002	35.8	30.0	24.9
2003	36.1	29.8	24.9
2004	36.7	29.5	24.7
2005	37.0	29.4	24.7
2006	37.3	37.5	25.3

State of the Ghanaian Economy in 2005, ISSER.

Appendix B: The following are the results of logistic regression analysis for the three consecutive rounds

Estimated results of Binomial Logit Model of determinants of household standard of living (1991/92)

Characteristic	Logit coefficient β	S.E.	Wald	d.f.	Sig.	Exp(β)
Hhsizze	-1.2332	0.0602	419.2629	1	0.0000	0.2914
Ez						
Ez (1)	0.5801	0.1231	22.2009	1	0.0000	1.7862
Ez (2)	0.4475	0.1020	19.2637	1	0.0000	1.5644
Loc 3			250.2004	2	0.0000	
Loc 3 (1)	1.5278	0.1994	58.7247	1	0.0000	4.6081
Loc 3 (2)	1.6283	0.1102	220.9928	1	0.0000	5.1466
Consult (1)	0.2471	0.1252	3.8957	1	0.0484	1.2803
HAge (y)	-0.1296	0.0782	2.7467	1	0.0975	0.8785
Sexhead (1)	0.0527	0.0941	0.3139	1	0.5753	1.0541
Schever (1)	0.1141	0.1683	0.4601	1	0.4976	1.1209
HAgrie (1)	-0.1316	0.1432	0.8446	1	0.3581	0.8767

Computed from the Ghana living standards survey 1991/1992

Appendix C:

Estimated results of binomial logit model of determinants of household standard of living 1998/99

Characteristic	Logit coefficient β	S.E.	Wald	d.f.	Sig.	Exp(β)
Hhsizze	-1.0326	0.0465	494.1587	1	0.0000	0.3561
Ecological zone			238.9943	2	0.0000	
Coastal (1)	1.1358	0.0940	146.0469	1	0.0000	3.1138
Forest (2)	1.2257	0.0822	222.5567	1	0.0000	3.4065
Locality 3						
Accra (1)	2.8932	0.2530	130.8044	1	0.0000	18.0513
Urban (2)	0.8658	0.0786	121.2057	1	0.0000	2.3768
HAge (y)	-0.1947	0.0425	20.9329	1	0.0000	0.8231
Consult (1)	0.2851	0.0981	8.4406	1	0.0037	1.3299
Sexhead (1)	0.1207	0.0714	2.8597	1	0.0908	1.1283
Schever (1)	0.4700	0.0778	36.5285	1	0.0000	1.5999
HAgrie (1)	-0.3976	0.0654	36.9241	1	0.0000	0.6719
Literate head(1)	0.9812	0.0697	198.2412	1	0.0000	2.6676

Computed from the Ghana living standards survey 1998/1999

Appendix D:

Estimated results of binomial logit model of determinants of household standard of living 2005/06

Characteristic	Logit coefficient β	S.E.	Wald	d.f.	Sig.	Exp(β)
Hhsizze	-0.273	0.013	473.751	1	0.0000	0.761
Ecological zone		376.903	2	0		
Coastal (1)	1.372	0.100	187.893	1	0.0000	3.943
Forest (2)	1.311	0.074	314.699	1	0.0000	3.711
Locality 3		229.606	2	0		
Accra (1)	0.501	0.152	10.877	1	0.0010	1.650
Urban (2)	1.349	0.089	228.466	1	0.0000	3.854

Appendix D: Continued

HAge (y)	- 0.007	0.002	10.447	1	0.0010	0.993
Consult (1)	0.205	0.083	6.037	1	0.0140	1.227
Sexhead (1)	0.124	0.077	2.582	1	0.1080	1.131
Schever (1)	0.581	0.077	57.207	1	0.0000	1.788
HAgrie (1)	- 0.524	0.086	37.178	1	0.0000	0.592
Literate head(1)	- 0.250	0.088	8.132	1	0.0040	0.779

Computed from the Ghana living standards survey 2005/2006

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