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Marketable Wealth in a Poor African Country

Using an index of consumer durables to investigate wealth accumulation by households in Ghana

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Abstract

The study uses an asset index of consumer durables to track changes in household wealth in Ghana during the recent period of strong growth. Using the Ghana Living Standards Survey of 1998 that contains both wealth data and consumer durable data, the authors demonstrate that the asset index approximate marketable wealth adequately. Although asset index estimates of wealth cannot match the precision of wealth surveys, this approach can provide useful information on marketable wealth in countries where more appropriate sources are not available. The asset index analysis with the three demographic and health surveys for 1993, 1998 and 2003 suggests that the solid economic growth seen over this period has been accompanied by a strong rise in the average asset index scores.

Keywords: wealth, Ghana, asset index
JEL classification: E21, O55

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1 Introduction

Accumulated wealth is clearly important for the survival and advancement of poor households. Although wealth is traditionally associated with the upper end of the income distribution, it may play a more pivotal role in the lives of the poor. Recent empirical and theoretical analysis have shown that drawing on wealth can help keep poor households afloat after an income or expenditure shock. Udry (1995), for instance, demonstrated that farmers in northern Nigeria appear to smooth consumption through dissaving after negative income shocks.[1] Accumulated wealth can create a buffer for the most vulnerable.

Wealth may also provide access to income generating opportunities. For instance, the theoretical work of Aghion and Bolton (1997) suggests that households with little accumulated wealth may find it difficult to acquire capital to fund an income generating venture. Due to their lack of wealth, are not able to have a large financial stake in the proposed income generating venture. This can cause incentive problems, making the project more risky and hence also more expensive to fund. In some cases these incentive problems may make projects prohibitively expensive, thus shutting off a possible escape out of poverty.

For the reasons cited above, wealth may significantly enhance a household's prospects of exiting poverty. However, a high proportion of the poor in Africa has no or extremely low levels of marketable wealth (Rogg 2006). For many African households it is difficult to save. Low and variable income makes it hard to save in at least two ways. Firstly, in African countries where many households struggle to survive, there is often little opportunity to build up a buffer. Most households also face a further obstacle: finding a liquid and safe store of value. Due to the high overheads and institutional inefficiencies associated with banking in these countries, few African households have access to financial products and banking services. Informal community savings schemes are suboptimal because they do not provide a safe value store for households, as households in the same community are often exposed to similar (covariate) risks. Non-financial assets may present an alternative saving form, but it comes with its own risks. These assets can easily be expropriated through theft and, in the case of livestock, also drought and are hence not secure stores of value (Collier and Gunning 1999a). In addition, assets often require investments that are large relative to the household's income, which makes it more difficult to use assets to 'smooth' income.

[1] Although there is controversy regarding the extent of the smoothing, it is a well-established finding in the literature that a there is a substantial amount of smoothing that occurs and that smoothing is often achieved via the sale of assets. See Rosenzweig and Wolpin (1993) and Fafchamps et al. (1998) on the sale of livestock following an income shock.

In an attempt to learn more about these processes, this study examines the accumulation of marketable wealth in an African country. The focus is on marketable wealth because the welfare improving mechanisms of wealth for poor and vulnerable families described in the paragraphs above are reliant on liquid stores of value.

Constructing estimates of the marketable wealth of households in developing countries is far from straightforward. As far as the authors know there are no wealth surveys for developing countries and regular household surveys do not traditionally gather sufficient information to track the wide variety of savings forms found in developing countries, including financial assets such as pension funds, bonds and shares as well as non-financial assets such as land, livestock and housing. There are also problems with the reliability of data on financial assets reported in surveys. It is difficult to obtain reliable financial information from poor households due to the long recall periods and often also inadequate levels of numeracy and literacy.

Due to these deficiencies in existing data sources and approaches, this study investigates the merits of an alternative approach that can be applied to any representative household survey containing information on consumer durables. The approach uses data on the ownership of a number of non-financial assets to construct an index to approximate accumulated wealth holdings. It has been established that questions regarding the ownership of non-financial assets are more reliable than self-reported valuations of the respondent's financial assets. Although admittedly less than ideal in many respects,[2] this method may provide a way to study wealth in developing countries where there are no wealth surveys available.

The proposed index of consumer durables appears to be an appropriate approach here given the study's focus on marketable wealth. Wolff (2000) defined marketable wealth as a store of value that can be readily converted to cash. Due to the peculiarities and complexities of savings behaviour in African countries, consumer durables are expected to represent a large proportion of marketable wealth for the 'representative' individual. Wolff's definition (2000) of marketable wealth excludes consumer durables, but the application of this term to consumer durables can be justified in this context.[3] As

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[2] The shortcomings of the approach are investigated in Section 3 of this study.

[3] Additionally, there is little indication that houses and land are necessarily better stores of value than durable assets. According to the Ghana Living Standards Survey (GLSS) 1998, the median depreciation rate for land is positive (indicating appreciation in terms of the median) and ranks top of a list of 24 household assets, but land has the second highest variation in the depreciation rate. Housing ranks seventh highest in terms of median depreciation (performing worse than cameras, cars, motorcycles, air conditioners, shares and also, land) and has the fourth highest variation in their rate of depreciation. Shares and motorcycles both have reasonably high variation of their depreciation rates, but air conditioners, cars and cameras have considerably lower variation of their depreciation rates. The calculated depreciation is based on the self-reported (recalled actual) purchase prices and the self-assessed current market worth of assets. Adjustments were made for inflation.

discussed earlier, for many households in African countries it is difficult to find investments that are liquid and safe stores of value. While consumer durables are admittedly not as liquid as savings or stocks, it may as a rule be 'more readily converted to cash' than assets such as land and houses. For instance, Collier and Gunning (1999b: 7) claim that 'most land in Africa is still not readily marketable'. They argue that land titling schemes have not improved marketability of land as much as hoped. Aryeetey (2004) reports that in the rural areas of Ghana 53 per cent of households did not own their farmland and 40 per cent of those households who did, did not have title deeds for the land.[4] Evidence presented by Torche and Spilerman (2006) regarding the misreporting and misinterpretation of questions regarding house ownership in Latin American countries may make it reasonable to assume that a large proportion of house ownership captured in surveys should not be regarded as marketable wealth.[5]

When using a household survey to study wealth, it is important to bear in mind that household survey samples are designed to adequately represent the country's population, not the country's wealth. Due to the high concentration of wealth at the upper end of the distribution, it has been shown that household surveys are likely to under-represent total wealth and the extent of inequality in its distribution (Davies and Shorrocks 2005). This is not a central concern for this study as the emphasis here falls not on assessing total wealth or investigating the inequality of wealth or changes in wealth levels, but rather on identifying patterns in wealth accumulation and drivers of wealth accumulation.

The authors choose to apply this method to Ghana because it is viewed as an interesting case for examining wealth accumulation in the light of the stable growth and the increase in the general levels of education experienced in recent years. Since 1990 per capita growth rates have been consistently positive and since the mid 1990s these have been reasonably stable around 2 to 3 per cent (Institute of Statistical, Social and Economic Research 2005). The average number of years of education had increased by 27 per cent between 1991 and 1998, rising from 4.5 to 5.7 years (Teal 2001). According to Teal (ibid.) this period was also marked by an improvement in the incidence of poverty. In 1988 the headcount poverty rate was 53 per cent. By 1991 it had declined to

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[4] The low incidence of use of land as a guarantee for loans and houses can be interpreted as providing further support for this view. Udry (1995) finds that in Nigeria land was used as guarantee for loans in only 3 per cent of cases. According to the GLSS 1998 only 1.4 per cent of the 2,662 loans tracked in the survey used land as collateral. Housing was used as a guarantee for only 0.2 per cent of these loans. Most of the loans had no guarantee, but 4.4 per cent of these loans were backed by 'other' unspecified assets. This may suggest that the limited use of housing and land as collateral is due not merely to the informal nature of the market for loans, but may also be because these assets are not considered to be marketable forms of wealth.

[5] There is also some evidence of this in the GLSS 1998. Almost 20 per cent of those that report owning a house in the module on household assets claim to not own a house elsewhere in the survey. The survey asked no more detailed questions regarding house ownership.

48 per cent, and by 1998 it had fallen to 45 per cent.[6] Teal (ibid.) reports that income inequality increased over this period. In 1988 the Gini coefficient for Ghana was 0.42 and it remained stable at this level in 1991, and then rose to 0.46 in 1998.[7]

Ghana is also an appropriate choice because it appears to typify household wealth accumulation in African countries in many ways. Due to the dominant role of agriculture in the economy,[8] most households are exposed (either directly or indirectly) to the high levels of uncertainty associated with agricultural production. There are few safe and liquid stores of value available to the largely rural population.[9] Access to formal sector financial services is remarkably low in Ghana.[10] Housing and land account for 47.7 per cent and 31.3 per cent of total wealth respectively,[11] but due to complex ownership arrangements and claims, thin markets and the 'lumpiness' of these assets, housing and land can often not be used to smooth consumption and are frequently not accepted as collateral (Collier and Gunning 1999b). For instance, Aryeetey (2004) reports that in 1993 only 21.2 per cent of farm-owning households held the right to sell their farms. The country is in many ways a typical African country. According to 1999 estimates the poverty head count ratio in Ghana was 44.8 per cent, just slightly lower than the 45.7 per cent ratio for sub-Saharan Africa (World Bank 2006). According to the Penn World Tables, Ghana's GDP per capita was US$1,349 in 2000, higher than the population weighted average GDP per capita for the continent of US$1,006 (Heston et al. 2002). The country is well-endowed with natural resources and its main exports are gold, timber, and cocoa (Central Intelligence Agency 2006). Poverty is highly concentrated in rural areas: according to 1998 estimates 49.5 per cent of rural residents were classified as poor, while only 18.6 per cent of urban residents were poor (World Bank 2006).[12]

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6 The poverty trends are consistent with the findings of Booysen et al. (2006). The study uses demographic and health surveys to construct welfare indices for a number of African countries for 1988, 1993 and 1998. In contrast to what Teal (2001) reports, they detect a decline in inequality for Ghana over the period.

7 For this calculation Teal (2001) uses the GLSS, applying the Ghana Statistical Service's 2000 estimate of the poverty line.

8 It is an economy dominated by agriculture, even more so than the average African country. In 2005 agriculture was responsible for 60 per cent of employment and represented 37 per cent of GDP (World Bank 2006).

9 In 2003, 54.6 per cent of the population resided in rural areas (World Bank 2006).

10 The market penetration of banks in this country is extremely low, even by African standards. On average, claims on the private sector by deposit money banks and other financial institutions constituted barely more than 3 per cent of GDP between 1980-95, according to Demirgüç-Kunt and Levine (2001). This is much lower than the African median of 15 per cent and considerably lower than the OECD average of 78 per cent.

11 According to the GLSS 1998 estimates. Note that the wealth measure did not include livestock.

12 These poverty head count ratios were calculated using a national poverty line estimated by the World Bank.

The next section of the study considers the datasets available for this analysis. Following this section, the advantages and disadvantages of the asset index approach are outlined in Section 3. Section 4 discusses results based on the asset index, while Section 5 assesses how well the asset index fares as an approximation of marketable wealth (using an alternative data source with information on both). In the two subsequent sections the asset index is used to examine life-cycle patterns in wealth accumulation and to consider the determinants of wealth.

2 Data

There are four main data sources available for Ghana that could be used for this analysis: the Population Censuses, the Core Welfare Indicators Surveys, the Ghana Living Standards Surveys (GLSS), and the Demographic and Health Surveys (DHS). The first two data sources have obvious deficiencies. There are no recent population censuses and the Core Welfare Indicators Survey is not detailed enough. This leaves the GLSS and DHS. The GLSS tracks a long list of assets, but its surveys are more dated than the DHS series and do not allow us to observe the full impact of the high growth and the recent increase in education levels on wealth accumulation. The last GLSS was conducted in 1998 and the three preceding surveys were in 1991, 1987 and 1988. The last DHS was in 2003 and there are also DHS available for 2002, 1998, 1993 and 1988.

As the name suggests, the DHS are focused on issues affecting health and demography, including data on marriage, fertility, family planning, reproductive health, child health, and HIV/AIDS (Rutstein and Rojas 2003). These surveys are available for 75 developing countries and in most of these countries there have been more than one survey. The surveys were initiated by USAID and although it has little information of a financial or economic nature, it contains questions on ownership of a range of durable household assets that can be used to construct an indicator of wealth. The surveys usually contain a women's questionnaire and a household questionnaire. The women's questionnaire is almost entirely devoted to issues regarding fertility and women's health. The household module of the survey is used to identify eligible candidates for the women's questionnaire. It collects information on the age, sex and education level of each household member and their relationship to the head of the household. It also asks questions regarding the dwelling, including the source of water, type of toilet facilities, the dwelling's floor, roof and walls and ownership of various consumer goods. In some cases, especially more recent surveys, there is also a men's questionnaire. It is shorter than the women's questionnaire and asks men about reproduction, contraception and gender roles.

The DHS series may appear to be an unorthodox choice of data source for the questions we intend to examine, but the surveys have a number of strengths that make them particularly attractive for a comparison of asset indices over time. The standardization of a number of sections of the survey enhances the comparability across time for

variables in sections. Due to the continuity associated with a large, centrally coordinated programme of surveys, one would also expect the survey samples of the DHS series to be more comparable across years than the samples of household survey samples designed by national statistical offices.

The sampling for the DHS is stratified according to region and rural-urban residence. Households were defined as individuals who live in the same dwelling and eat together. The data cleaning and imputations procedures are outlined by Croft (no date). Three nationally representative DHS were selected for this analysis: 1993, 1998 and 2003. Appendix A provides more information about the samples of each of these surveys. The 1988 DHS was excluded from this analysis because the samples of the pre-1990 surveys were not comparable to those from the post-1990 surveys.[13] There are ten private assets for which each of these surveys track ownership.

3 Constructing an asset index

Asset indices are widely used to construct welfare measures for poverty analysis. The World Bank (2003) reports that there is generally a significant, but modest correspondence between these indices and monetary measures of welfare, ranging between 0.20 and 0.40. Asset indices often include a wider range of indicators than what may be suggested by the name, including ownership of assets, quality of housing and access to public services. In the development literature there are two competing motivations for using this approach. According to the first approach it is assumed that the correspondence between the index and the welfare measures is strong enough that asset indices can mimic the more traditional monetary measures of welfare in cases where a survey contains no income or expenditure data. The work of Sahn and Stifel (2000) provides an example of this approach. Conversely, others advocate the use of the asset index approach not because of the correspondence between the asset index and monetary measures of welfare, but because of discrepancies (for example, Asselin 2002). According to this view, asset indices are used to construct a broader measure of welfare, incorporating more dimensions of deprivation and wellbeing than are included in conventional monetary measures.

This study examines whether this approach can also be used to compile an index to approximate wealth. For this purpose we deliberately select a set of indicators that are

[13] Prior to 1990, questions about asset ownership and housing characteristics were part of the individual questionnaire. After 1990 these questions were moved to the household questionnaire. Comparability between pre-1990 and post-1990 surveys is a problem because in the older surveys only individuals older than 15 and younger than 50 were selected for individual interviews, therefore not all households were represented in the individual module. In the case of Ghana, comparability across 1990 is substantially worse than for other countries, because only males who were husbands or partners of females older than 15 or younger than 50 were interviewed in 1988. Consequently, only 73 per cent of sampled households were represented in the individual interviews.

likely to be correlated with personal wealth. Section 5 investigates how closely the constructed index resembles wealth.

There is a wide array of techniques available to calculate the weights for the assets in the index. Although the principal component approach (PCA) is widely used for the construction of indices in the development economics literature, multiple correspondence analysis is a more appropriate technique for these asset ownership variables. PCA was essentially designed for continuous variables, as it assumes a normal distribution of indicator variables. In contrast, multiple correspondence analysis (MCA) makes fewer assumptions about the underlying distributions of indicator variables and is more suited to discrete or categorical variables. Hence, the authors opt for MCA rather than PCA.

Asselin (2002: 14) describes the calculation of a composite poverty indicator using MCA as a four-stage process. First, one constructs an indicator matrix (of ones and zeros) that shows the asset ownership of each household. The households, for example, are displayed as rows, and each asset is represented by the inclusion of a column for each possible (mutually exclusive and exhaustive) ownership category of that asset. In other words, each categorical asset ownership variable is reduced to a set of binary indicators. In this way, every household will indicate a '1' in exactly one of each asset's set of columns or categories, and a '0' in every other column. Second, the profiles of the households relative to the categories of asset ownership are calculated. The row profiles of a matrix are the rows of that matrix, each divided by its row sum. Third, MCA is applied to the original indicator matrix, and provides a set of category-weights from the first dimension or factorial axis of the analysis results. Fourth, these MCA category-weights are applied to the profile matrix. A household's MCA composite indicator score is calculated by adding up all of that unit's weighted responses. The calculation of the household's asset index score can be represented as follows:

$$MCAi = Ri1W1 + Ri2W2 + \ldots + RijWj + \ldots + RiJWJ \qquad (1)$$

where $MCAi$ is the ith household's composite wealth indicator score
Rij is the response of household i to category j and
Wj is the MCA weight for dimension one applied to category j

In using the asset indices to consider the evolution of marketable wealth over time, it is also necessary to construct asset indices that are comparable over time. There are two possibilities that would enable comparison over time. On the one hand, the asset index can be constructed using pooled weights obtained from the application of MCA to all three surveys or the index can be based on baseline weights obtained from an analysis of the first period survey. We opted for the latter. To ensure comparability across time, only variables that appear in all three surveys and were coded from similarly phrased questions were included in the analysis.

4 Estimating wealth using an asset index

Table 1 lists the weights assigned to each of the assets using the MCA approach. There are nine binary household level consumer durables; i.e., radio, television, refrigerator, bicycle, motorcycle, car, horse and cart, video recorder and tractor. In addition, there is also a categorical indicator on the type of flooring with four options (smart floor,[14] cement floor, earth floor and other). While it is unlikely that any of these items would be purchased primarily as investments, Aryeetey (2004) argues it makes sense for less affluent households to invest in productive assets that may have a dual role for the household. On average consumer durables represent 91 per cent of marketable wealth (excluding livestock holdings) in Ghana.[15] Also, consumer durables are expected to have a positive and significant relationship with other forms of marketable wealth because households may reveal information regarding their risk profile, demand for savings and wealth holdings in their acquisition of specific consumer durables.[16]

The first dimension of the index accounts for 0.969 of the total inertia in the data. In other words, almost all of the variation in household asset ownership can be summarised by the first dimension of the MCA. This provides adequate justification for use of only the first dimension from the MCA in the weighting of the survey responses when calculating the asset index scores.

In line with intuition, Table 1 shows that possession of any of the nine binary assets would increase a household's asset index score (although in the case of bicycle ownership, only barely). In most cases there is an asymmetry between the gain associated with ownership and the loss associated with not owning the asset. For instance, owning a horse and cart will increase the index score of a household by 0.3, but there is little cost to not owning a horse and cart. While ownership of this asset may be associated with a higher value of this latent variable, the lack of ownership is not necessarily associated with a lower value of this latent variable. There are only two assets, namely radio and television where the loss in the index score associated with non-ownership exceeds 0.1. If the latent variable that this asset index is approximating is assumed to be wealth, this would mean that for the remainder of the consumer durables,[17] not owning a particular asset does not appear to be a good predictor of wealth deprivation.

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14 'Smart' floors generally are carpeted, wooden or tiled floors.

15 Based on our own calculations from GLSS 1998.

16 According to the GLSS the correlation coefficient between consumer durables and non-consumer durable forms of wealth is highly significant and positive (0.23).

17 The term 'consumer durables' is not traditionally applied to the flooring categories listed here. Although mud or cement floors may have a relatively long life, they can hardly be regarded as manufactured goods. However, these two categories can be interpreted as representing the decision not to purchase other categories of flooring that could be classified as manufactured goods (tiles for instance).

Table 1: Weights assigned to assets by MCA

Asset	Loss in asset index score associated with not owning this asset	Gain in asset index score associated with owning this asset	Increase in score associated with ownership
Bicycle	-0.009	0.045	0.054
Horse and cart	-0.001	0.300	0.301
Radio	-0.171	0.247	0.418
Tractor	-0.001	0.670	0.671
Motorcycle	-0.009	0.757	0.766
Television	-0.115	0.764	0.879
Refrigerator	-0.095	0.949	1.044
Car	-0.034	1.252	1.286
Video recorder	-0.035	1.518	1.553
Mutually exclusive flooring options			Increase in score for each floor option relative to earth floor
Earth floor		-0.188	
Cement floor		-0.095	0.093
Other floor		0.114	0.302
Smart floor		0.545	0.733

Source: Authors' calculations using Ghana DHS 1993.

Generally there also seems to be some correlation between the weight assigned to the ownership of the asset and the cost of acquiring the asset. The pattern is, however, not consistent. The weight associated with ownership of a video recorder is more than double that of the weight of tractor ownership. This may be because in such an index this variable may represent far more than merely ownership of a video recorder. A video recorder is strongly associated with a high position on the scale of this latent variable. If the latent variable is presumed to be wealth, then it may for instance be that ownership of video recorders is highly correlated with large wealth holdings and ownership of other, more expensive assets so that this variable can effectively be used to identify the most affluent households among our sample.

Table 2 displays mean asset ownership per asset quintile for each of the assets. An increase in the index score is often associated with a rise in the number of assets, but this does not hold true in all cases. The floor material variable is an obvious exception. In most other cases the likelihood of ownership generally increases monotonically as one progresses from the bottom towards the top of the asset index distribution. Bicycles and horse carts are exceptions and appear to be inferior goods that are traded in when households become sufficiently wealthy. However, this interpretation does not fully explain the peculiar distribution patterns of bicycles across asset quintiles. Bicycle ownership is quite low in the first and second quintile and then dips in the third quintile, peaks in quintile 4 and then it again drops off in quintile 5.

Table 2 provides evidence of a hierarchy or ladder of assets: the households in the bottom asset quintile tend to have a cement or earth floor and a small proportion also own a bicycle. None of the households in the bottom quintile possesses any of the other eight assets in the index. All households in the quintile second from the bottom have bicycles and cement floors. Households in the third quintile are the first to report ownership of other floors, horse and carts and radios. Ownership of smart floors, televisions, motorcycles, refrigerators, tractors and cars start appearing in the second quintile from the top. Ownership of video recorders is restricted to the top quintile of households only.

Table 2: Asset prevalence by asset quintile

	Asset quintiles			
	1 and 2	3	4	5
Bicycle	0.122	0.084	0.444	0.211
Radio	0.000	0.992	0.789	0.942
Horse and cart	0.000	0.003	0.015	0.007
Television	0.000	0.000	0.184	0.841
Motor cycle	0.000	0.000	0.025	0.051
Refrigerator	0.000	0.000	0.019	0.697
Car	0.000	0.000	0.005	0.183
Tractor	0.000	0.000	0.003	0.006
Video recorder	0.000	0.000	0.000	0.293
Earth floor	0.219	0.232	0.015	0.004
Cement floor	0.800	0.764	0.589	0.350
Other floor	0.000	0.004	0.006	0.004
Smart floor	0.000	0.000	0.390	0.643

Note: Due to crowding of observations at the bottom of the distribution, the first and second quintiles represented 36.8 per cent and 3.6 per cent respectively of the total sample. These two quintiles were consequently merged.

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

It appears that the index has difficulty distinguishing the relative wealth of observations at the bottom end of the distribution. Figure 1 depicts the cumulative density function for the asset index pooled across the three surveys, showing much crowding in the left-hand side of the curve, with more than 70 per cent of observations squashed in between -0.7 and 0, a space that represents less than one-tenth of the full range of the index. This crowding at the bottom end of the distribution could merely reflect how difficult it is for poor households to acquire assets. Alternatively, it could be a symptom of censoring due to shortcomings in the set of assets available (i.e., that the list does not include enough of the assets that the very poor invest in).

Figure 1: Cumulative density curve for asset index

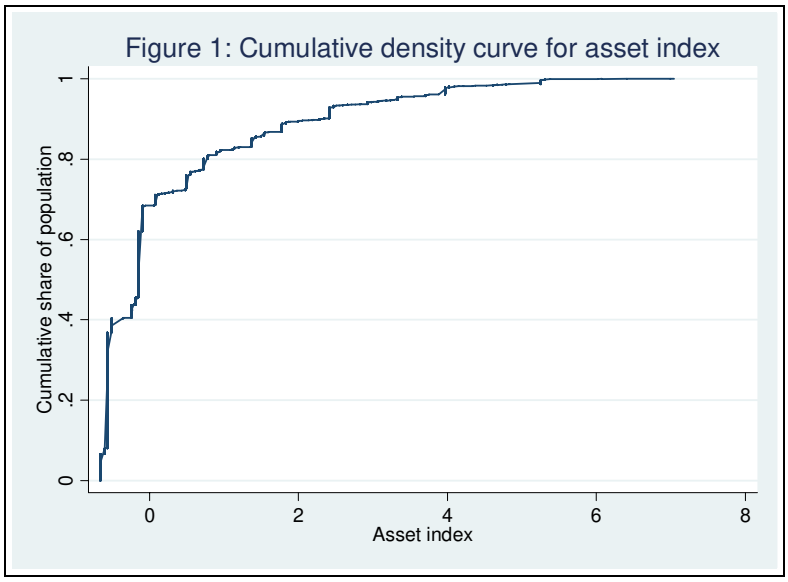

Table 3: List of assets associate with bottom 10 index values

Asset index score	List of assets	Frequency	Percentage of total (weighted)	Cumulative percentage (weighted)
-0.658	Earth floor, no other assets	1,309	6.69	6.69
-0.604	Bicycle, earth floor	378	1.38	8.07
-0.565	Cement floor	4,915	28.76	36.83
-0.511	Bicycle, cement floor	768	3.56	40.40
-0.357	Earth floor, horse and cart	3	0.01	40.41
-0.356	Other floor	13	0.07	40.48
-0.303	Bicycle, earth floor, horse and cart	2	0.00	40.49
-0.302	Bicycle, other floor	5	0.03	40.51
-0.264	Cement floor, horse and cart	4	0.02	40.53
-0.240	Bicycle, cement floor, horse and cart	597	3.24	43.77

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

Table 3 illustrates the index's failure to distinguish different levels of wealth deprivation in more detail. The index has 215 unique values, but the bottom 44 per cent of the households in this pooled sample attained 10 different index values only. This is in contrast with the top 10 values that account for only 0.14 per cent of the sample.[18] There are 47 unique values for the asset index that occur in the top 5 per cent of the distribution, ranging from 3.33 to 7.05. In principle censoring may occur on both ends of the asset index, but in this case it appears to be a much larger concern at the bottom end of the distribution. The analysis shows that the restricted number of assets in our

[18] Table B in the Appendix provides more detail on the list of assets owned by the households who attained the 10 highest index values.

index is clearly a deficiency. However, given the varied nature of the assets in this index, we are confident that the index will be able to pick up many of the more pronounced patterns of variation in wealth accumulation. The next section is devoted to examining this assumption.

5 Assessing the accuracy of the asset index as an approximation of wealth

To measure how well the constructed asset index approximate wealth, an asset index similar to the one compiled with the DHS data is estimated using the GLSS of 1998 and then compared to an estimate of wealth from the same survey. According to the GLSS 1998 user guide, the main objective of this survey was to gather information on individual wages, household income and household expenditure (Ghana Statistical Service, no date). The survey sample is stratified according to ecological zones and rural and urban location. The survey covers 5,998 households. The definition of households is similar to that employed in the DHS: all individuals who slept in the same house and ate their meals together for 9 of the past 12 months were regarded as members of the same household.

The GLSS dataset is well-suited to testing the adequacy of the asset index constructed in the DHS. The survey tracks ownership for an expanded list of household assets including land and houses and also financial assets such as shares. The survey asks respondents to estimate the resale value of each of these assets. It includes a separate module on savings. Furthermore, the GLSS also contains all of the 10 assets used to construct the asset index in the DHS. There are, however, some caveats that should be noted. Firstly, because of the implementation of baseline weights, the 1998 version of the DHS asset index uses weights estimated based on the 1993 DHS data. Additionally, the definitions and coverage of the assets used for compiling the GLSS asset index differ somewhat from those used for constructing the DHS index.[19] These differences between the indices are considered slight enough to regard the GLSS version of the asset index as a near replica of the index compiled with DHS data.

Although far from exhaustive, the 1998 GLSS contains a considerably more comprehensive list of assets than the DHS. This will allow us to estimate a second index based on a considerably longer list of assets, including amongst other things ownership of land, housing and also shares. This expanded asset index can be used to investigate to

[19] The GLSS asks only agricultural households regarding the ownership of tractors. The question regarding the ownership of a cart or trailer is restricted to agricultural households and business owners. Some of the asset classifications deviate from those employed in the DHS. In the GLSS horse and cart is not listed as a separate category. The only available comparable category is cart and trailer. Refrigerator is also not specified separately as a category, but only occurs in a pairing with freezer. The video category is broadened to video equipment in the GLSS. Also, the earth floor category is coupled with mud floors and the concrete or cement floors are paired together. Lastly, the categories given to describe the type of floor of the dwelling in the GLSS do not include smart floors.

which extent discrepancies between the wealth variable and the parsimonious asset index (akin to the index estimated with the DHS data) is attributable to problems with the asset index approach or problems relating to the small number of assets.

The 1998 GLSS contains ample information on wealth, which enables the calculation of a reasonable proxy for household wealth. An estimate of total household wealth is derived by adding the respondent's savings and the sum of the estimated resale values of assets owned (including consumer durables, farming equipment, land, houses and shares). Table C in the Appendix provides more detail on the construction of the wealth variable. A measure for marketable wealth is calculated by excluding land and houses, assets that are often inherited or passed down rather than bought and which the owner may frequently not have the right to sell.

The most notable omissions in these estimates of wealth are livestock and debt. The survey does not contain sufficient information about these variables to allow the estimation of livestock holdings or outstanding debt. It contains information on whether or not any household member had debt and the amount of the initial debt, but no information that allow the calculation of the outstanding amount of debt. In the case of livestock, there is information about livestock 'flows' (livestock raised, bought and sold), but not on livestock 'stocks'. Survey information regarding the distribution and prevalence of household debt indicates that wealthy households are more likely to have debt. The proportion of households that incur debt is much higher among the richest wealth quintile (0.49) than among the poorest wealth quintile (0.33). Although it is conceivable that livestock wealth may be correlated with the value of farming equipment, there is no way to test such a premise with the data available

To simplify the evaluation of the tests performed here, the wealth variables are assumed to provide a more accurate representation of household wealth than the asset index and a closer correspondence to these wealth variables is interpreted as evidence that the asset index is approximating wealth better. However, due to the reliability concerns regarding responses to questions about savings and the resale estimates and the omission of livestock holdings and debt, it would be naïve to assume that wealth estimates based on these numbers will accurately represent the wealth of households in the survey sample. There is ample reason to suspect that the measurement error of the wealth and also the marketable wealth variable may be high. If it is assumed that the measurement error of the wealth variables is 'noise' and independent of the measurement error of the asset indices, then the correlation coefficients reported here may underestimate the actual correlations.

The correlations between the parsimonious asset index and the marketable wealth variable (reported in Table 4) are modest, but positive and highly significant.[20] To investigate whether performance may be improved by increasing the number of assets, an expanded asset index is estimated including 15 additional assets listed in household assets and durable goods module of the 1998 GLSS.[21] Surprisingly, the correlation coefficient between the extended asset index and the marketable wealth measure is somewhat lower than that for the more parsimonious asset index.

Table 4: Correlation coefficients for a range of variables (GLSS 1998)

	Basic index	Expanded index	Total wealth	Marketable wealth	Income
Basic index	1.00	0.90	0.34	0.34	0.23
Expanded index	0.90	1.00	0.27	0.31	0.26
Total wealth	0.34	0.27	1.00	0.27	0.12
Marketable wealth	0.34	0.31	0.27	1.00	0.11
Income	0.23	0.26	0.12	0.11	1.00

Note: All correlation coefficients reported here are significant at the 1 per cent level

Source: Authors' calculations using GLSS 1998.

The positive and highly significant correlation coefficient between the basic index and marketable wealth variable supports the interpretation of this index as a measure of marketable wealth. The basic index's correlation with marketable wealth is virtually identical to the correlation with total wealth, but alternative measures of fit suggest that a narrower interpretation of the index as representing marketable wealth rather than total wealth may be more appropriate. There is a higher degree of overlap in terms of the allocation of households to quintiles (based on their rank) between the basic asset index and marketable wealth than between the basic index and the total wealth variable. Also, the wealth by age curves for the basic index have a closer resemblance to the curves for the marketable wealth variable than to those for total wealth. According to the asset index variable, the wealth-age curve is flat for households with heads without any secondary education. This is in contrast to the low, but steady gradient of wealth increase over age that the total wealth variable shows for this group. If land and homes are excluded from the wealth variable, the slope of the wealth asset curve for the households with less educated household heads disappears. The possibility of interpreting the index more generally as an approximation of welfare was also investigated, but there is little support for such an argument. The correspondence with per capita household income is considerably lower than that reported for wealth. Much

[20] As mentioned, the World Bank (2003) documents correlation coefficients for income indices range between 0.20 and 0.40. If it is assumed that the range would be similar for wealth indices, this index would be placed just towards the upper end of such a range.

[21] See Table C in the Appendix for more details on what assets the module listed.

of the observed correlation between income and the asset index may be mediated via the strong relationship between income and wealth.

The next two sections use the basic asset index constructed with the DHS data to investigate patterns and determinants of wealth accumulation. As argued in the previous section, we opt to use the DHS rather than the GLSS because the GLSS last available survey is in 1998 (versus 2003 for DHS) and does not allow us to study the full effect of the recent growth and increase in education. Also, the DHS series has a reputation for cross-survey comparability.

The next section examines the accumulation of marketable wealth using the basic asset index constructed with the DHS data. The analysis is rooted in the literature on savings behaviour. Models of savings behaviour are considered to be applicable to questions surrounding the accumulation of marketable wealth because the concept of marketable wealth as defined here only includes assets that are normally acquired via market transactions and seldom obtained by claim or received via inheritance or as a gift. To avoid unnecessary verbosity, 'wealth' is often substituted for 'marketable wealth' from this point forward.

6 The accumulation of wealth over the life-cycle

There is disagreement regarding the extent to which developed country savings models are relevant to developing country settings. Deaton (1990: 61-96) argues that the popular life-cycle model pioneered by Modigliani and Brumberg (1954: 388-436) may not be suitable to describe wealth accumulation over the life-cycle of households in developing countries. According to the life-cycle model, an individual or household's patterns of saving and dissaving will be determined by their life stage. Households accumulate savings during the productive part of their lives to ensure that they have sufficient resources to consume in the unproductive phase of their lives. Age is consequently viewed as a key determinant of savings behaviour. Deaton (1990) claims that savings behaviour in developing countries cannot be modeled accurately using this traditional theory. According to him the assumptions of the model are unrealistic in the context of developing countries.

In developing countries there are more multi-generational extended family networks and members of these networks may not need to save for retirement. The extended family structure can provide benefits resembling an old age pension: providing for unproductive individuals (some of these presumably the individual's children) during one's productive life stage can be seen as buying provision for oneself for the subsequent unproductive life stage (assuming that children and other relatives reciprocate).

The high levels of uncertainty that poor individuals face (due to amongst other things to the unpredictable character of agricultural income) and the presence of borrowing constraints further reduce the usefulness of this model in poorer countries. The life-cycle model assumes that savings behaviour is to a large extent driven by the independence motive, an aim that may be less significant in poor, large, multi-generational households. Deaton (1990) suggests that due to borrowing constraint and the high levels of uncertainty that households in developing countries often face, the precautionary motive may be the most important reason for saving. In many cases poor households save to build up a 'buffer' to shield them against unforeseen or unavoidable income shocks.

Is the life-cycle model expected to hold in Ghana's case? There is ample evidence of uncertainties plaguing agricultural households in rural Ghana (Doss 2001) and there is tentative support for claims that many households may be credit constrained (Aryeetey 2004). Additionally, many authors have highlighted the importance of extended family ties and kinship networks in Ghana (La Ferrara 2003; Aryeetey 2004).[22] Deaton's criticism against the life-cycle model will thus be applicable in Ghana's case. If Deaton's criticism is valid, the wealth-over-age curve will exhibit no hump. However, even if this were the case, one would still expect some correlation between age and wealth because an older household head has had a longer period over which to accumulate funds. These predictions are explored by graphing the relationship between wealth and the age of the household head using Lowess smoothing graphs. Lowess smoothing graphs are drawn using locally weighted regressions of the asset index score on the age of the household head for the pooled sample of survey observations. The smoothing occurs because the aggregate asset index score is derived by using all households within a specified span, not just those at the specific point (household head age).[23]

Separate curves are mapped based on the highest level of education achieved by household heads.[24] This is partly an attempt to control for the variation in the level of

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[22] It was also possible to detect multi-generational families based on the information given about each respondent's relationship to the household head. According to these rather crude estimates roughly 18 per cent of the households in the sample contain more than one generation of adults. Given the geographical basis of the definition of the household in this survey (people who eat and live together), these numbers tell us little about the extent and reach of the individual's obligations towards his or her relatives. According to the pooled version of the three DHS samples, the average household size is 3.9 and the average number of adults is 1.9—both much lower than the sub-Saharan African averages of 5.3 and 2.5 respectively estimated by Bongaarts (2001).

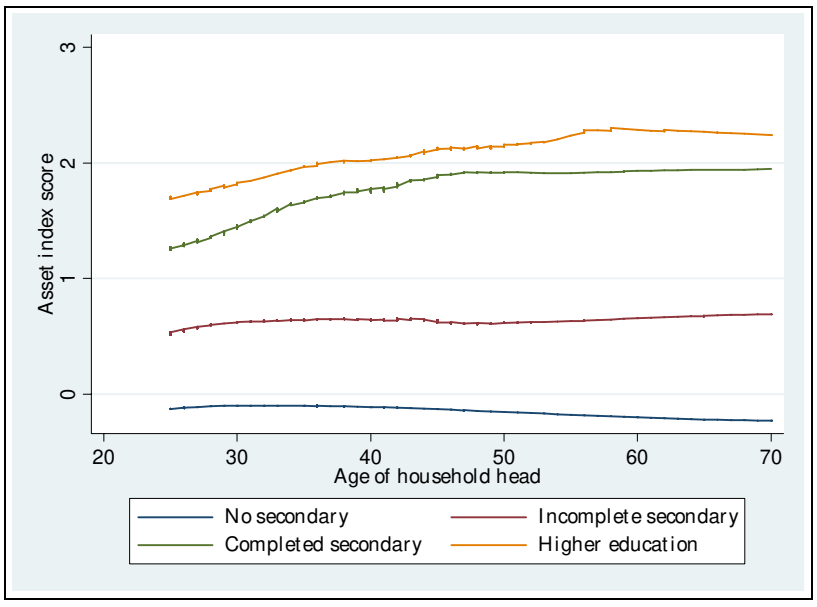
[23] According to the Stata manual the central point receives the highest weight and points further away receive lower weight, with weight depending on the distance from the central point. The process is repeated for every point in data.

[24] The education level variables are here interpreted as representing permanent income. According to Friedman's (1957) permanent income hypothesis, individual's savings decisions are mainly driven by their perceived long-term income. Individuals distinguish between permanent (long-term) and transitory (short-term) changes in their income level and alter their consumption habits only when they believe that their permanent income has changed.

permanent income. King and Dicks-Mireaux (1982) claim that failure to control for permanent income may be a reason why many studies examining the wealth-age relationship do not detect a hump shape curve. The mapping of separate curves for different education levels of household heads may also help to address one of Shorrocks' (1975) criticisms of the use of cross-sectional data for life-cycle analysis, namely that it does not take into account that survival is not a random selection mechanism. According to Shorrocks, the wealthy may be expected to live longer and thus it is expected that they will be overrepresented in cross-sectional data. By analysing the relationship between wealth and age by education group we may moderate this selection bias to some extent. It will help control for some of the changes in the 'representative individual' that occur over generations (Shorrocks 1975: 160).

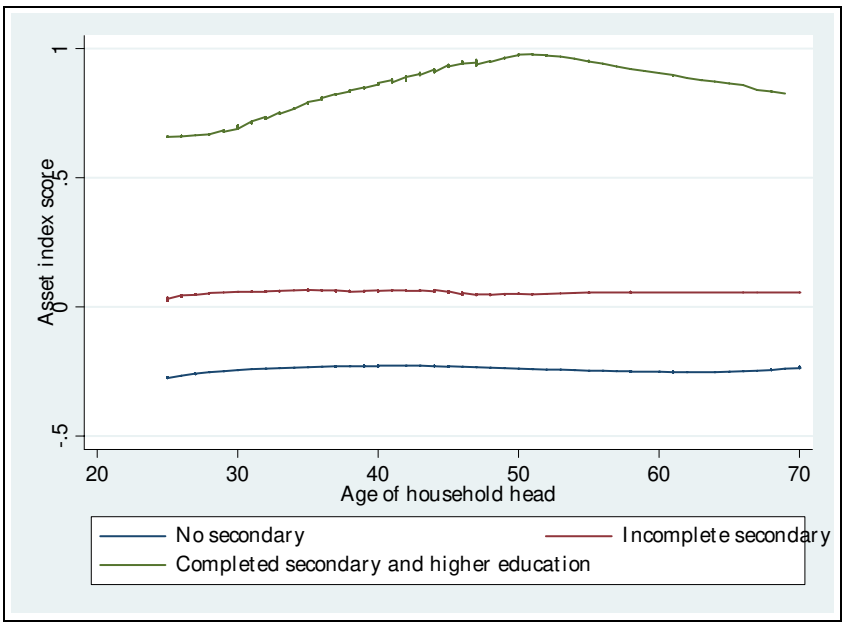
Figure 2 depicts the age-over-wealth curves for four different household head education levels (using averages across the three surveys). There are no signs of a hump in any of the curves. The wealth-over-age curves are flat for all households with household heads without completed secondary education. The curves of households with households heads with completed secondary education increase with the household heads' age, but there is no evidence of dissaving. There are at least three possible explanations for the lack of a hump. It may indicate that it is frequently not necessary for Ghanaian families to dissave as the head advances in age because there is an extended family structure to look after them. Alternatively, the household may not be able to dissave because of the unpredictability of the future and their inability to borrow. A third option may be that Ghanaians continue to work for much longer than individuals in developed countries. The GLSS 1998 suggests that a substantial portion of Ghanaians older than 60 may continue to work. Only 31 per cent of the survey's sample of 1,556 individuals older than 60 years was not working or receiving income. Twenty per cent of those older than 60 reported that they continue to earn an income.

Figure 2: Asset index versus age of household head per educational level of household head



The graph also shows that there are large differences in both the level and the slope of the curves for the four educational levels. The flat curves for household heads without completed secondary education provide evidence that little wealth accumulation occurs over time in such households. The upwards slope of the curves for household heads with completed secondary school signify that wealth accumulation does take place in these households. The literature would suggest that there would be a strong relationship between education and wealth, mediated mainly through earnings. It is hence not surprising that the wealth-over-age curve for higher education lies above that for completed secondary school. The flat wealth-over-age curves for households with heads who had either incomplete or no secondary schooling may suggest that a certain level of education is a required to enable an individual to earn sufficient income to facilitate saving. Encouragingly, the analysis shows that in rural areas there are also strong growth in asset holdings with age for households with heads that have completed secondary education (Figure 3).[25] In rural areas there is some evidence of a lower asset index score for households with heads that are older than 50 years. This could be due to dissaving during later life stages or cross-generational differences in income and living standards.[26]

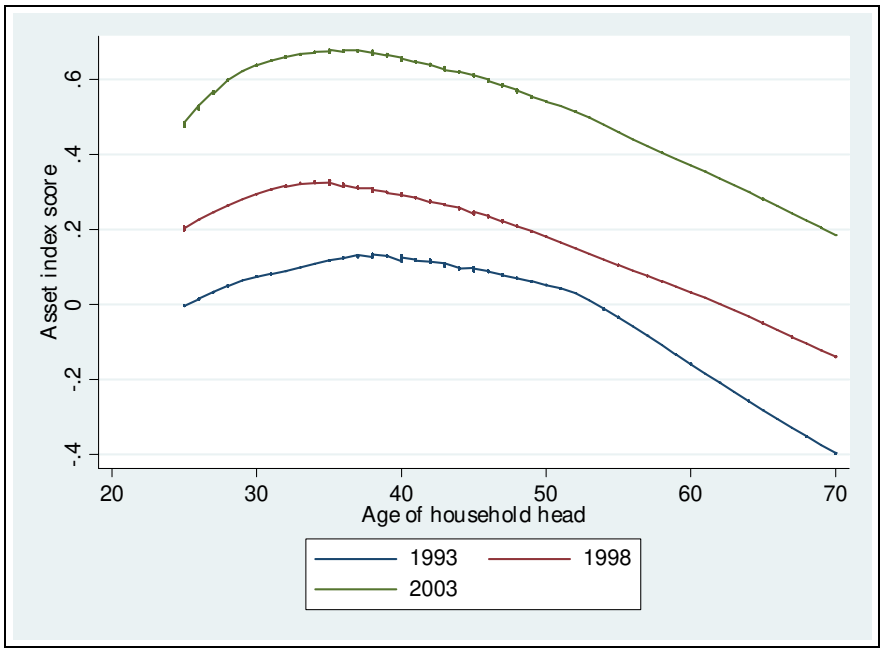
Figure 3: Asset index versus age of household head per educational level of household head for rural households



[25] The two top education categories were merged here because of low cell sizes.

[26] Section F in the Appendix considers the changes in the incidence of ownership of individual assets with the age of the household head.

Figure 4: Asset index for household head per survey



All the analysis to date has been on the pooled version of the survey data. However, it is clear that this makes it difficult to distinguish the effects of age from the impact of factors associated with a specific survey period such as the economic climate. The noticeably sharper right hand tail for the 1993 curve shown in Figure 4 indicates that dramatic shifts have occurred over the survey period. Part of what is observed here could be attributed to the reduction in poverty and increases in educational attainment witnessed towards the end of the 1990s. As mentioned in the introduction, Teal (2001) estimates that the average Ghanaian level of education rose by 27 per cent during the 1990s while poverty fell from 53 per cent in 1988 to 45 per cent in 1998.[27]

Table 5 provides average asset index scores per birth cohort for each survey period. It is clear that there is an improvement over time in the index scores of each of these household head cohorts. For the last two survey periods, asset scores are noticeably higher for the younger cohorts, but in the first survey period, the pattern is more ambiguous. The negative relationship between the asset index and the age of the household head in the last two surveys may be due to a missing control variable. The DHS data shows that younger cohorts tend to be more educated. When the same table is compiled for each education level, this trend disappears.

[27] For this calculation Teal uses the GLSS, applying the Ghana Statistical Service's 2000 estimate of the poverty line. Table D in the Appendix shows the increase in education levels over the survey years for the DHS.

Table 5: Average asset index per household head cohort, 1993-2003

Age in 1993	1993	1998	2003
26-30	0.31	0.37	0.70
31-35	0.17	0.43	0.71
36-40	0.09	0.34	0.63
41-45	0.26	0.22	0.51
46-50	0.19	0.20	0.51
51-55	-0.02	0.17	0.31
56 – 60	-0.13	-0.03	0.41

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

The observed rise in asset scores per cohort over survey periods could be due to either higher savings (as ratio of income) or improved economic conditions. Given the substantial size of these jumps (compared to other variation patterns in the index) it is unlikely that the higher asset scores can be attributed solely to the former. The rise in average cohort asset scores across survey periods is detected for all education groups.[28]

The preceding non-parametric analysis showed that age appears to be an important determinant of wealth, but it also revealed the complexity of distinguishing differences in taste or other generational variations from accumulation over the life-cycle. The next section turns to regression analysis in an attempt to control for more of the influences on households' pattern of wealth accumulation.

7 Explaining differences in household's levels of wealth

In constructing an empirical model, the authors take the traditional life-cycle model as a starting point and incorporate modifications proposed by the empirical literature on wealth. Several authors, including Wolff (1981), White (1978) and Steckel (1990), have proposed that life-cycle variables should be supplemented with earnings proxies from a Mincerian human capital model.[29] Indicator variables on educational level (primary, secondary, completed secondary, higher) are used to represent the influence of education. This will allow for non-linearities, which may be useful for capturing threshold effects (e.g. having level of education required to allows the household to earn

[28] The general trend appears to be robust for all education groups, although there are exceptions. In many cases the deviations from the trend may be due to small cell sizes.

[29] Information on occupation is excluded so that the education coefficient will capture the full effect of any changes in the returns to education. The exclusion of variables on occupation could introduce omitted variable bias, but tests with the GLSS 1998 data set indicate that the impact may not be vast. The omission of occupation variable causes a slight upward bias in the coefficients of the education variables. The size of this bias suggested by the tests with GLSS 1998 is presumed to be accurate, then any possible omitted variable bias will be of a considerably smaller magnitude than the trend in coefficients between years. Additionally, there is little reason to suspect that the omitted variable bias would fluctuate wildly between years.

a living that facilitates saving). Household size and the gender of the household head are added to the model as additional controls. The following model is thus estimated:

$$w = \beta_0 + \beta_1 a + \beta_2 a^2 + \beta_3 e + \beta_4 u + \beta_5 n + \beta_6 g \quad (2)$$

where w is the household's accumulated wealth, a is the head of the household's age, e is the education of the household head, u is the urban-rural indicator, n is the household size, g is the gender of the household head, the β-terms are the coefficients. If this model is viewed as the sum of a series of fixed period savings models, then it becomes evident that in the above specification age has a dual role: it may determine how much is saved (or dissaved) in each period and over how many periods these savings are accumulated.

Table 6 shows the coefficient estimates for separate regressions for each of the three surveys. The regressions were estimated with provision for the effects of the sampling structure (strata, clusters). There is a considerable amount of stability in coefficients across the survey periods. The main exception is the age variable and its squared value, which are insignificant in the regression for the 1998 survey. The two age variables are also not jointly significant. Apart from this result, there are few surprises: both of the age variables are significant in both other surveys, with the coefficient on the linear term having a positive sign and the quadratic term's coefficient carrying a negative sign. However, the net effect of age is minor, which is surprising given the various reasons to expect a substantial positive impact. This may be because of the overwhelming influence of education, which has a large, significant, positive impact. It is predicted that in 1998 an individual with higher education will score 1.593 points more on the asset index than someone with no education, a gap that on the asset index scale is equivalent to the gain realised by owning a video recorder or alternatively, a motorcycle and a television.

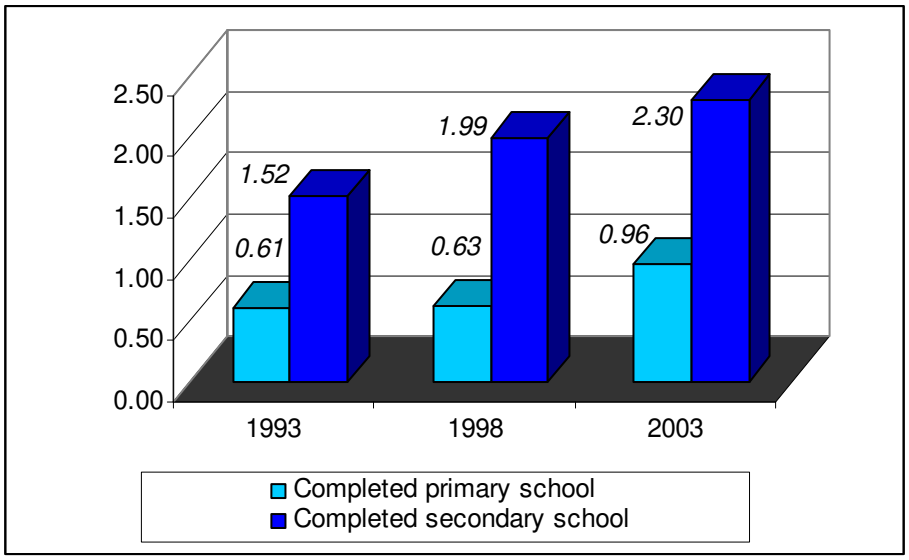
Table 6: Regressions comparing determinants of asset holdings across surveys

	1993	1998	2003
Some primary education	0.061**	0.099**	0.109**
Completed primary education	0.342***	0.439***	0.580***
Completed secondary education	1.149***	1.463***	1.470***
Higher education	1.733***	1.587***	1.965***
Household size	0.030***	0.044***	0.045***
Urban	0.756***	0.852***	1.039***
Age of household head	0.020***	0.004	0.020***
Squared age of household head	0.0002***	0.00003	0.0002***
Male household head	0.178***	0.202***	0.216***
Constant	-1.190***	-0.842***	-1.147***
R-squared	0.352	0.331	0.323
Overall significance (Prob>F)	0.000	0.000	0.000
Observations	5779	5878	6160

Note: ***indicates significance at the 1 per cent level, **at the 5 per cent level, *at the 10 per cent level.

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

Figure 5: Secondary schooling's influence, 1993-2003



The coefficient on household size is significant and positive, but small. Urban residency has a positive impact that is large, except for 2003. Having a male household head also appears to provide a significant benefit for asset accumulation, although its impact is not substantial.

The results from the pooled regression[30] (with dummies and interaction effects for 1998 and 2003 with 1993 as the reference or base period) allow the detection of shifts over time in the structural relationships (see Appendix Table E). The effect of higher education and male household heads has remained remarkably stable across the three periods. Due to data imperfections, we only identify changes in coefficients as trends when they are observed for both periods. There is evidence of a growing premium on completed secondary education and increase in the urban advantage. Figure 5 illustrates this effect by comparing predicted index scores for household heads with completed primary schooling with those for heads with completed secondary schooling over the three survey periods. In all cases the household is presumed to be a five-person urban household with a 50 year old male household head. The table shows a general upward trend in asset ownership between 1993 and 2003, accompanied by a widening asset score gap between household heads with secondary schooling and those without, especially between 1993 and 1998.

[30] Note that the pooled regression did not constrain the residual variances to be equal.

7 Conclusion

This study has demonstrated that asset indices can mimic marketable wealth reasonably well. Although asset indices based on household surveys cannot match the precision of wealth surveys, this approach can provide useful information on marketable wealth in countries where more appropriate sources are not available.

In line with the predictions of Deaton, the Lowess curves of wealth over age provide little evidence in support of the life cycle model. There is no sign of dissaving in later life for any of the groups. Households with less educated household heads have a flat wealth over age curve. Given the interpretation of education as a proxy for permanent income, these flat curves may suggest that there is a threshold level of income required for wealth accumulation. Households with household heads with secondary education have wealth curves that rise with age.

Education level has a considerable impact on wealth accumulation, presumably working via income. The exploratory analysis with the Lowess curves of wealth over age indicates a clear separation in the level of the asset index based on the household head's education level. The education level variables have large and highly significant coefficients in the regression results. The regressions also show that education's influence on wealth appears to have increased over time. It is encouraging to find such large positive benefits to investment in education in a country where a considerable share of work occurs outside of the formal sector.

There has been a strong increase in the average asset index scores over this period. Although the analysis here is not rigorous enough to be conclusive, there is evidence that this increase could be associated with improved economic conditions and the higher levels of education.

Appendix

Table A.A: Sampling frame for three Ghanaian demographic and health surveys

	Sample (n)		
Year	households	females	males
1993	5 822	4 562	1 302
1998	6 003	4 843	1 546
2003	6 251	5 691	5 015

Source: www.measuredhs.com.

Table A.B: List of assets associated with bottom 10 index values

Asset index score	List of assets	Frequency	Percentage of total (weighted)
5.381	Cement floor, radio, TV, refrigerator, motorcycle, car, video	2	0.02
5.435	Cement floor, radio, TV, refrigerator, motorcycle, bicycle, car, video	2	0.01
5.736	Cement floor, radio, TV, refrigerator, motorcycle, bicycle, car, video, horse and cart	2	0.01
5.980	Smart floor, radio, TV, refrigerator, bicycle, car, video, tractor	2	0.01
6.021	Smart floor, radio, TV, refrigerator, motorcycle, car, video	4	0.02
6.075	Smart floor, radio, TV, refrigerator, bicycle, motorcycle, car, video	7	0.04
6.407	Cement floor, radio, TV, refrigerator, bicycle, motorcycle, car, video, tractor, horse and cart	1	0.00
6.746	Smart floor, radio, TV, refrigerator, bicycle, motorcycle, car, video, tractor	1	0.01
6.993	Smart floor, radio, TV, refrigerator, motorcycle, car, video, tractor, horse and cart	1	0.01
7.047	Smart floor, radio, tv, refrigerator, bicycle, motorcycle, car, video, tractor, horse and cart	1	0.01

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

Table A.C: Variables included in calculating total wealth, GLSS 1998

Asset type	Valuation and ownership claim	Survey question to identify ownership and assess value of asset	List of assets included (where applicable)
Savings	Self-reported current value of savings owned by household members	Section 12C (Savings and Susu): Does any member of the household have a savings account in cedis or participate in Susu? What is the current value of these savings?	
Shares	Self-reported current value of shares owned by household members	Section 12B (Assets and durable consumer goods): Does any member of the household own […]?, For how much could you sell […] now?	
House(s)	Self-assessed resale value of house(s) owned by household members	Section 12B (Assets and durable consumer goods): Does any member of the household own […]?, For how much could you sell […] now?	
Land	Self-assessed resale value of land owned by household members	Section 12B (Assets and durable consumer goods): Does any member of the household own […]?, For how much could you sell […] now? Section 8B (Plot details): Is the farm owned by the household? If yes, does the household have the right to sell the farm or use it as collateral or security? If the farm were to be sold now, how much would it be worth? Question about land included in section about non-farm enterprise assets.	
Consumer durables	Self-assessed resale value of consumer durables owned by household members	Section 12B (Assets and durable consumer goods): Does any member of the household own […]?, For how much could you sell […] now?	Furniture, sewing machine, stove, refrigerator/freezer, air conditioner, fan, radio, radio cassette player, record layer, 3-in-one radio cassette record player, video equipment, washing machine, television, camera, electric iron, bicycle, motorcycle, car, boat, canoe, outboard motor.

Farming equipment	Self-reported resale value of farming equipment owned by household members	Section 8A (Agriculture assets, land, livestock and equipment): Does any member of the household own any […] now? How many? What would be the value of the […] if it were sold now?	Tractor, plough, trailer/cart, other animal drawn equipment, other tractor drawn equipment, sprayer, outboard motor, canoe, net, safety equipment, other.
Non-farm enterprise assets	Self-reported resale value of non-farm enterprise assets attributed to household in same share as income from non-farm enterprise	Section 10A (Basic characteristics of non-farm enterprises): Does the income of this enterprise belong entirely to you and this household? If no, what percentage of the income of this enterprise goes to you and this household? Section 10 C (Assets of enterprise): Does this enterprise own […]? How much would you be able to sell […] today?	Buildings, machinery/equipment, tools, bicycle, carts, cars, boats, other vehicles, other.

Note: To avoid double counting, answers on questions about the same asset type from different modules of the survey were compared. If the household reported owning the same asset in two different questionnaires, the option or options with lower estimated resale values were eliminated.

Source: GLSS 1998.

Table A.D: Education levels per survey year

Surveys	No education	Some primary schooling	Completed primary schooling	Completed secondary schooling	Higher education
1993	0.402	0.086	0.438	0.034	0.040
1998	0.340	0.097	0.458	0.047	0.057
2003	0.348	0.094	0.444	0.059	0.054

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

Table A.E: Regression showing determinants of asset holdings in pooled sample, 1993-2003

Variable	Coefficient
1998	0.286**
2003	0.037
Primary education	0.242***
Some secondary education	0.672***
Completed secondary education	1.152***
Tertiary education	1.737***
Primary education*1998	-0.138***
Some secondary education*1998	-0.203***
Completed secondary education*1998	0.317***
Tertiary education*1998	-0.144*
Primary education*2003	-0.106*
Some secondary education*2003	-0.055
Completed secondary education*2003	0.321***
Tertiary education*2003	0.233**
Household size	0.030***
Household size*1998	0.014**
Household size*2003	0.015**
Urban	0.743***
Urban*1998	0.099***
Urban*2003	0.288***
Age of household head	0.018***
Age of household head*1998	-0.013**
Age of household head*2003	0.0004
Squared age of household head	-0.0002***
Squared age of household head*1998	0.0001**
Squared age of household head*2003	0.000003
Male	0.180***
Male*1998	0.014
Male*2003	0.035
Constant	-1.139***
Overall significance (Prob > chi2)	0.0000
Observations	17 834

Note: ***indicates significance at the 1 per cent level, **at the 5 per cent level, *at the 10 per cent level.

Source: Authors' calculations using Ghana DHS 1993, 1998, 2003.

Are the asset-age Lowess smoothing graphs for the individual assets similar to that for the asset index? Figures A.F1-F13 contains pooled asset-age Lowess smoothing graphs for each of the 10 assets in the index, by the education level of the head of household. The asset-age curves for high prevalence, relatively liquid assets such as television, car and refrigerator more or less resemble that of the index. The erratic patterns of the curves for assets with low prevalence of ownership (such as for instance tractor and horse and cart) are disregarded because cell sizes turn very small and patterns become unreliable and unstable when assets with low prevalence of ownership are analysed according to a number of subcategories (e.g., age and education level).

The age-asset curves for bicycle ownership are peculiar. An obvious explanation would be that it is an inferior good. However, the education groups with the highest incidence of bicycle ownership are those where the head has higher education and those where the head has no secondary education. These patterns remain even when the curves are analysed separately for urban and rural residents. The polarized incidence of bicycle ownership may reflect the different reasons for ownership: in poor households where the head has no education, bicycles may be used for adult transport, while they may be used primarily for leisure or to transport children in more affluent households where the household head is more educated. The bicycle ownership curves decline sharply with age. This trend may be due to a combination of factors including the physical intensity of utilising the asset, changing tastes over time and dissaving. These complex patterns and relationships of this asset may have contributed to the low weight assigned to this variable in the index.

The results reported earlier confirmed theories proposing that there may be a threshold household income level that is required for saving and the analysis suggested that this threshold household income level could be approximated by the household head's education level. For this reason it may be worthwhile to study asset accumulation among households with heads that have completed secondary education more closely. The slopes of the asset-age curves of widely held and relatively liquid assets such as televisions, refrigerators, cars and video recorders are most likely attributable to asset accumulation over the life cycle. In other cases where assets are more difficult to exchange or upgrade, such as cement floors, changing tastes across generations may be a more plausible explanation of the sloped curves.

Figure A.F1: Television ownership versus age of household head by education level of household head

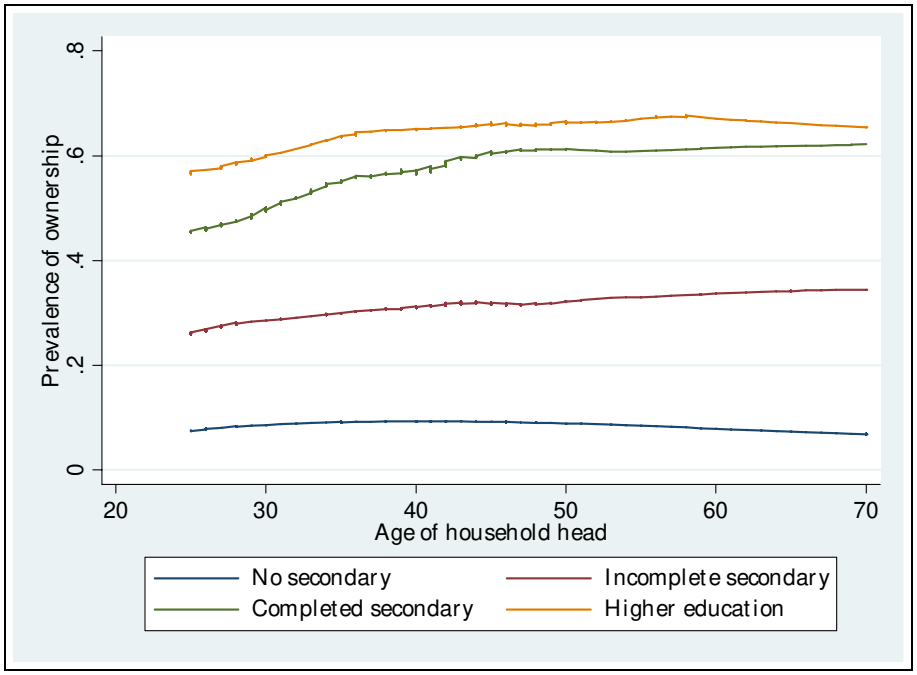


Figure A.F2: Car ownership versus age of household head by education level of household head

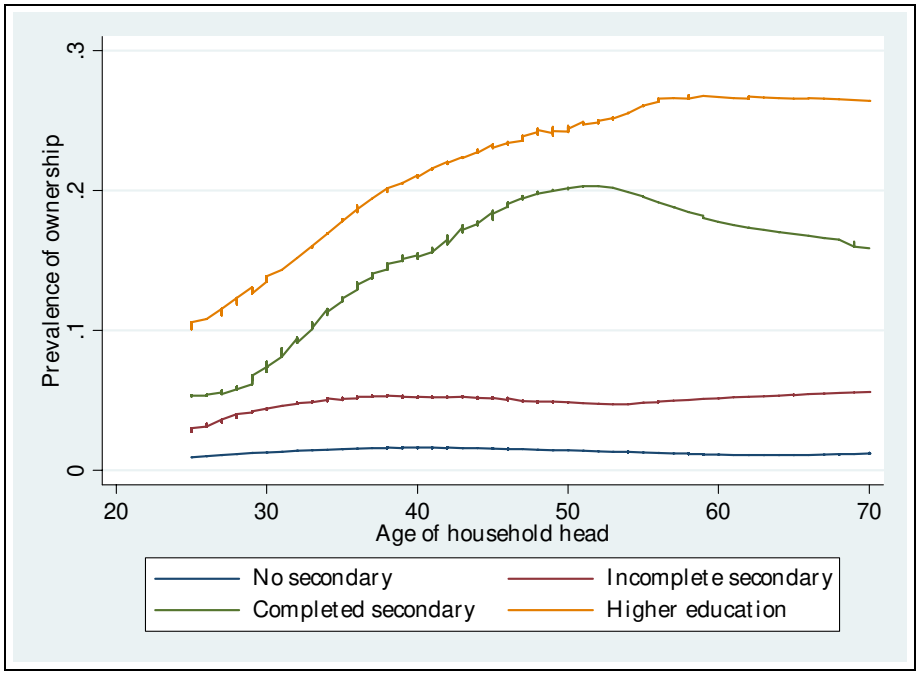


Figure A.F3: Motorcycle ownership versus age of household head by education level of household head

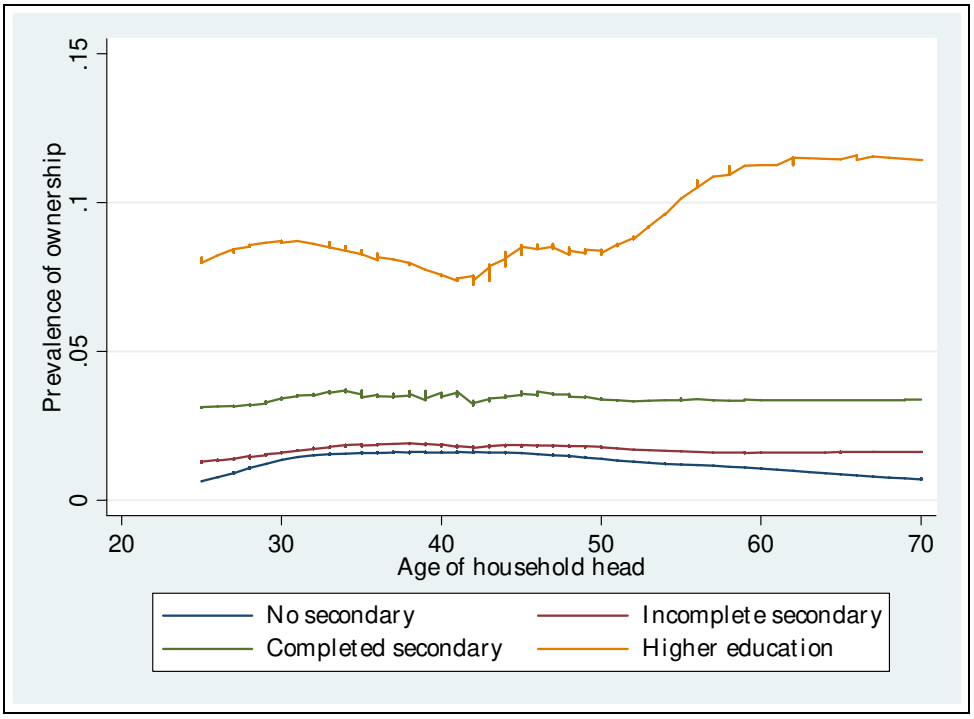


Figure A.F4: Video recorder ownership versus age of household head by education level of household head

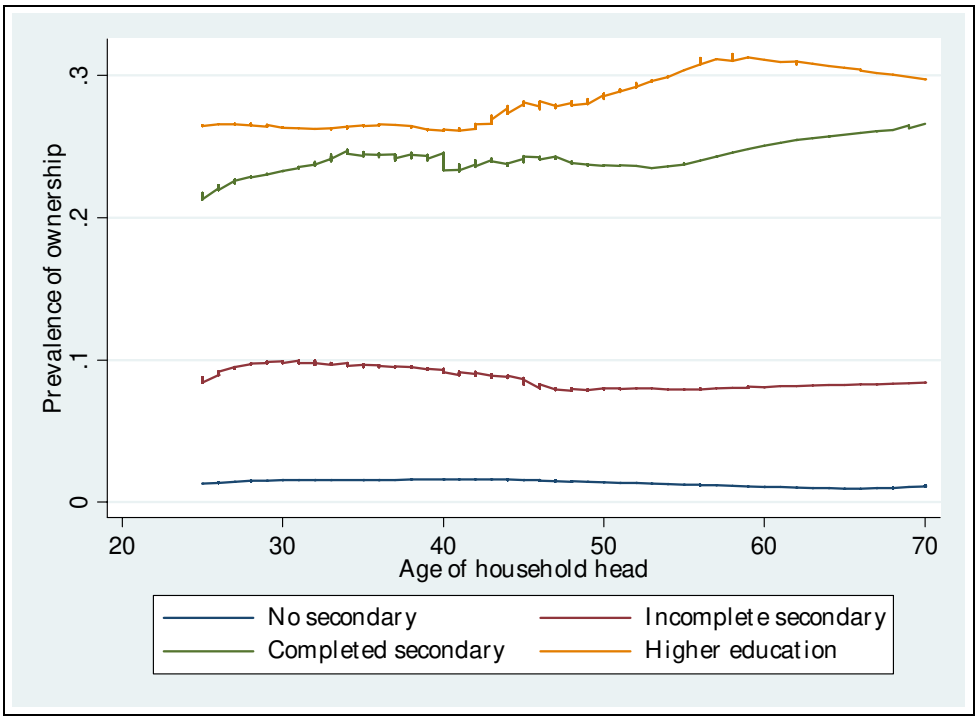


Figure A.F5: Bicycle ownership versus age of household head by education level of household head

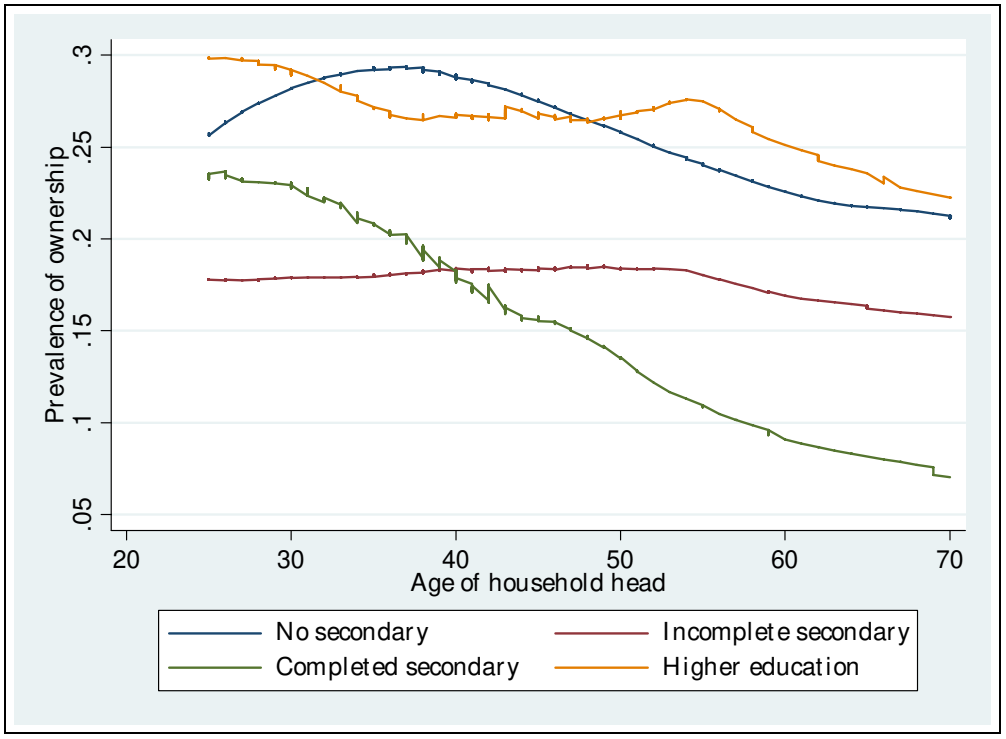


Figure A.F6: Horse and cart ownership versus age of household head by education level of household head

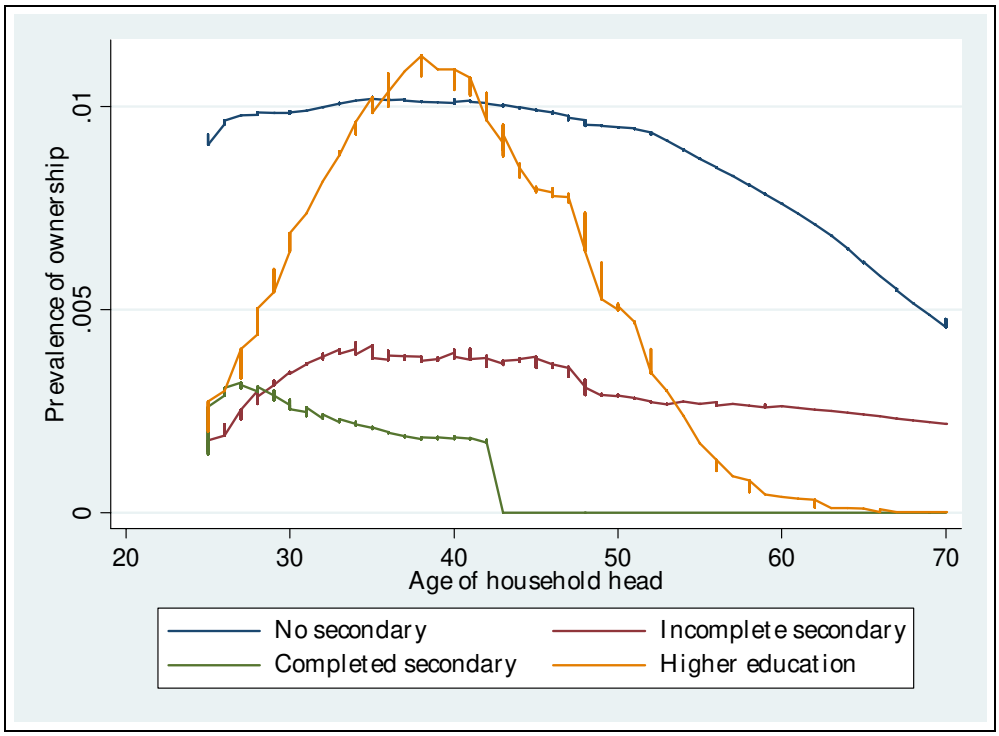


Figure A.F7: Radio ownership versus age of household head by education level of household head

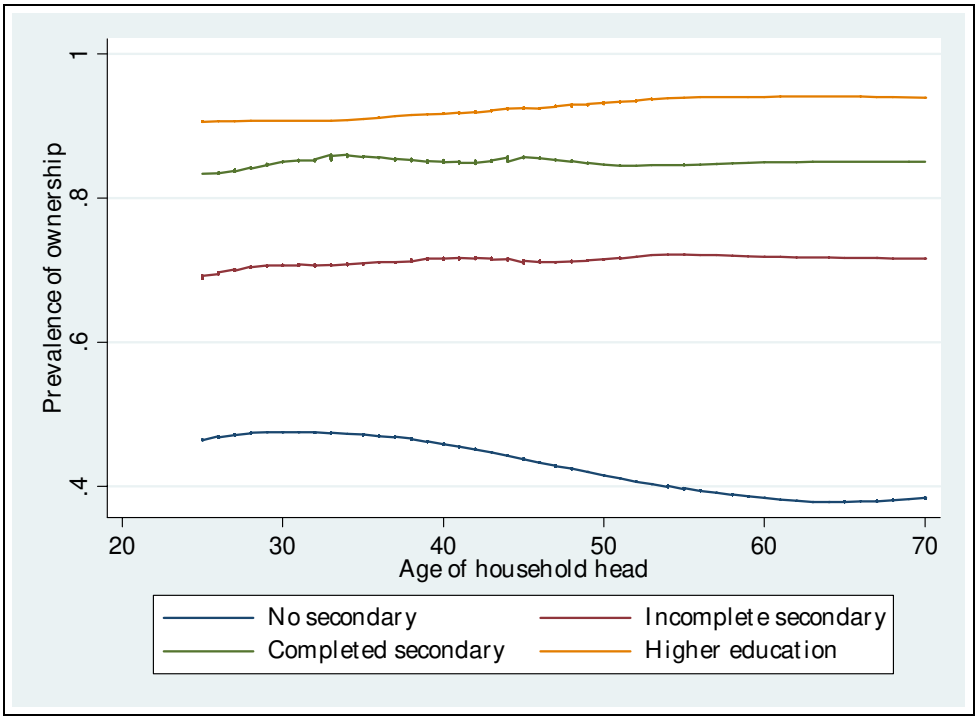


Figure A.F8: Refrigerator ownership versus age of household head by education level of household head

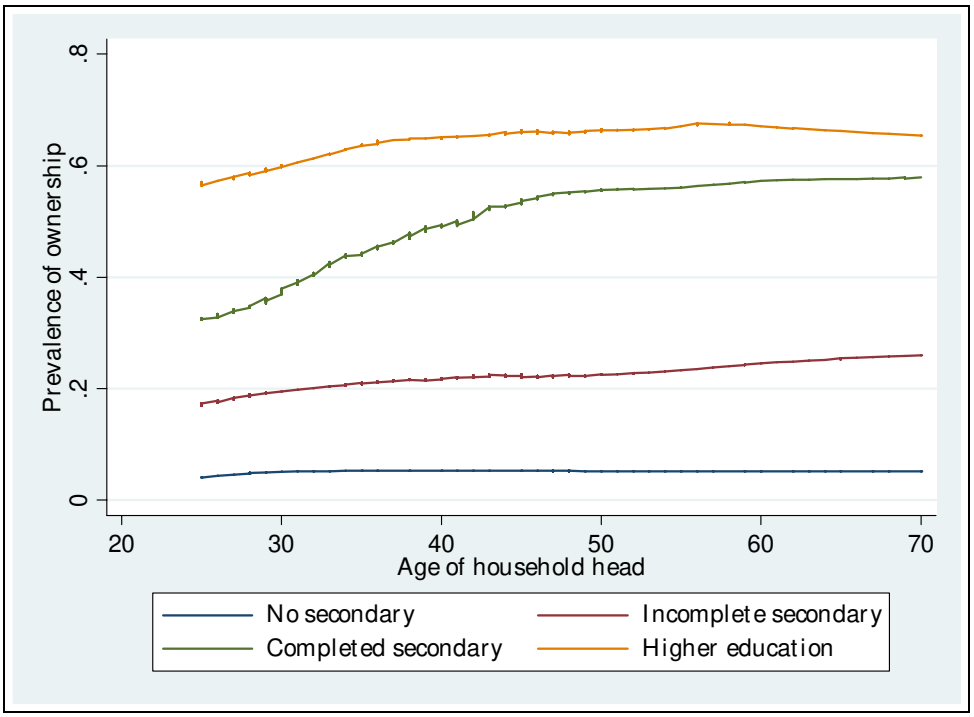


Figure A.F9: Tractor ownership versus age of household head by education level of household head

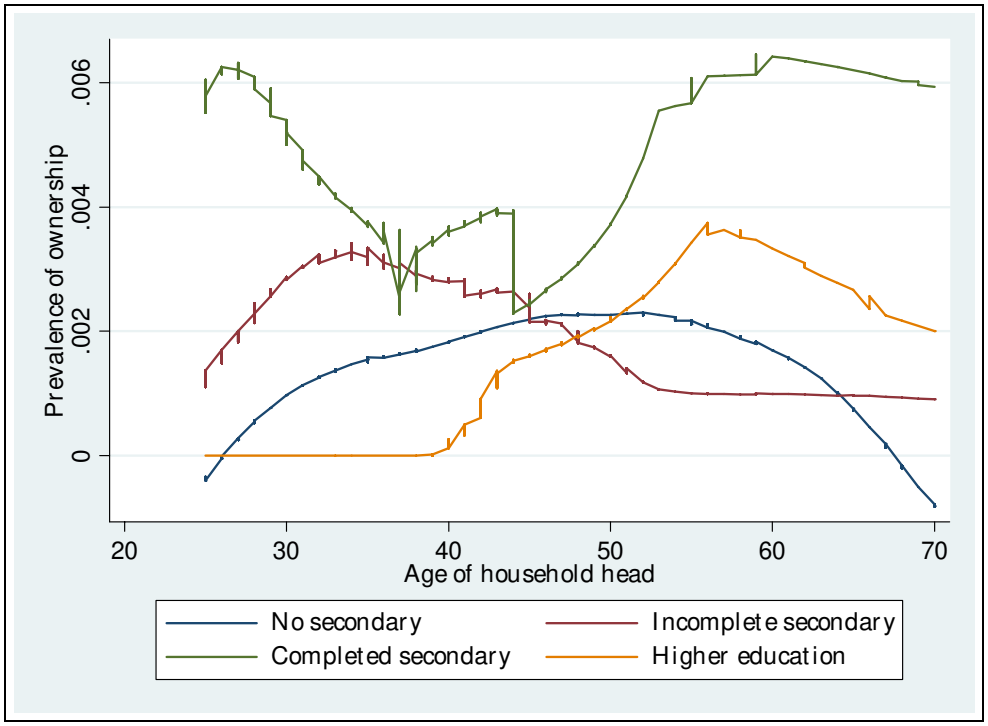


Figure A.F10: Cement floor versus age of household head by education level of household head

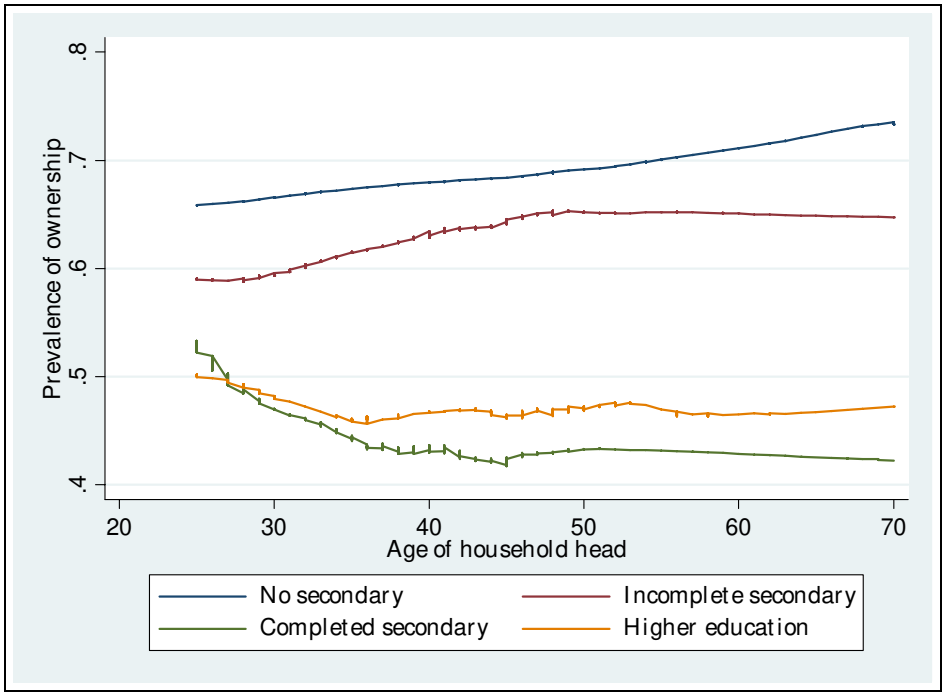


Figure A.F11: Earth floor versus age of household head by education level of household head

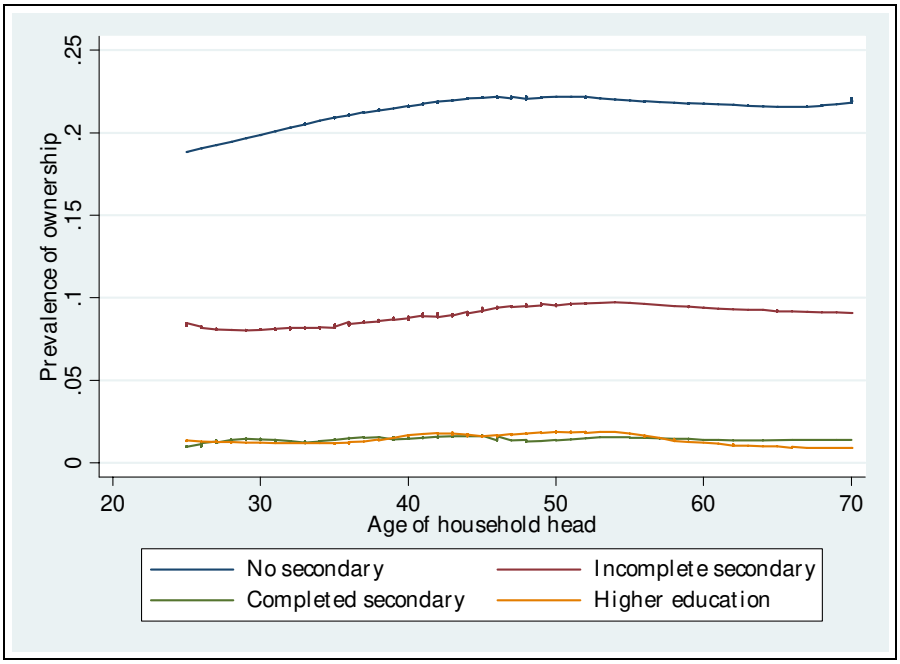


Figure A.F12: Smart floor versus age of household head by education level of household head

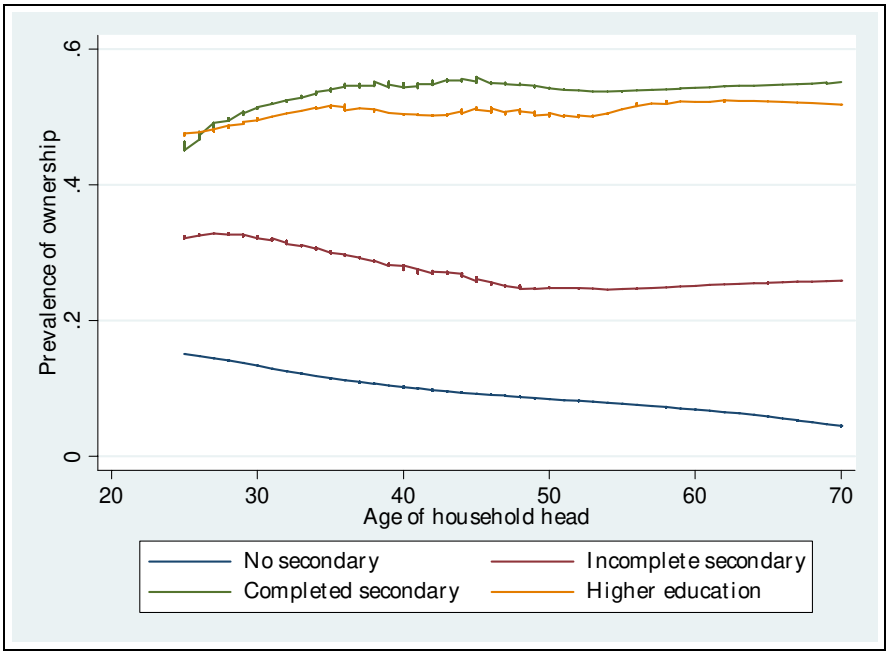
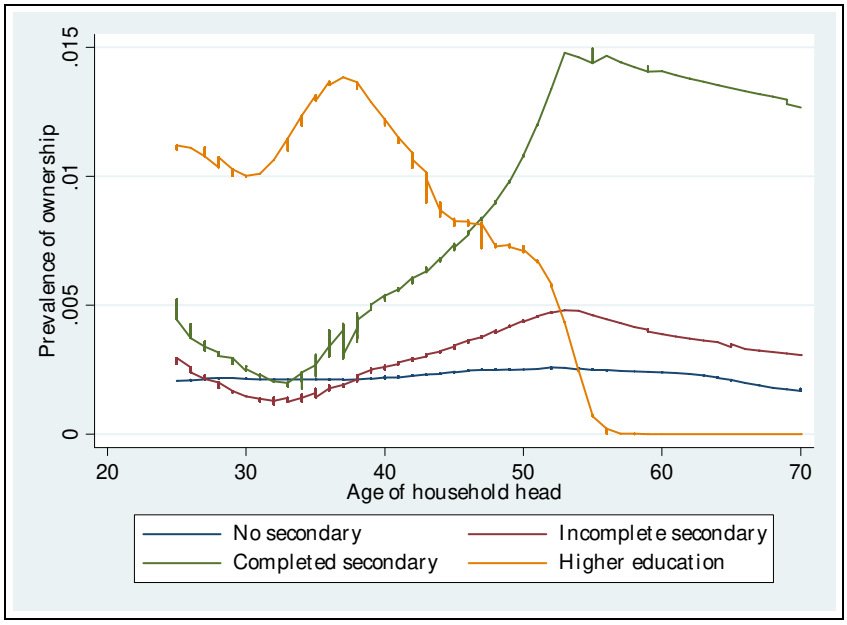


Figure A.F13: Other floor versus age of household head by education level of household head



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