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AN AFRICAN GROWTH MIRACLE? OR: WHAT DO ASSET INDICES TELL US ABOUT TRENDS IN ECONOMIC PERFORMANCE?

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Using changes in the possession of household assets over the past 20 years, several recent papers have argued that economic growth and poverty reduction in Africa was substantially better than suggested by national income data and income poverty statistics, which suffer from well-known weaknesses. We scrutinize these claims and first argue that trends in assets provide biased proxies for trends in incomes or consumption. In particular we show that the relationship between growth in assets and growth in incomes or consumption is extremely weak; instead, we find evidence of asset drift using macro and micro data, which is consistent with the claims we make about possible biases in the use of asset indices. As a result, we find no evidence supporting the claim of an African growth miracle that extends beyond what has been reported in official GDP/capita and consumption figures.

JEL Codes: O11, O12, O47

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1. INTRODUCTION

Until recently, the conventional wisdom on poverty and growth in Sub-Saharan Africa was that until the late 1990s, per capita economic growth in Sub-Saharan Africa had been zero on average, and negative in some countries, while only a few countries posted substantial positive per capita growth rates. As a result, absolute income poverty rates stagnated at very high levels (e.g., Chen and Ravallion, 2010) between 1980 and the early 2000s, ensuring that Sub-Saharan Africa has been by far the poorest continent, in per capita terms, since the 1990s. In recent years, things have changed somewhat for the better as growth rates in Sub-Saharan Africa have averaged around 5 percent since the early 2000s, leading

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(with population growth still above 2 percent per year), for the first time, to sustained per capita growth in the region.

There is some debate about the reasons for the recent improvements. Most notably, Miguel (2009) argues that improvements in political institutions and democratization, economic relationships with China (both through trade as well as Chinese direct investment), and rising commodity prices were the main drivers behind the recent economic improvements in Sub-Saharan Africa. He attributes very little importance to aid unless it was spend on programs to improve health or education. Miguel warns that positive development in Sub-Saharan Africa is still threatened by potential armed conflicts or the negative consequences of climate change, but in conclusion he states that "there is genuine hope today that Africa is on the path to real economic and political progress, and may finally catch up to the rest of the world economy." Other experts on Sub-Saharan Africa such as Collier, Glannester, and Weil among others, challenge some of Miguel's arguments or point out that he underestimates other potential risk factors for African development, such as high population growth. However, they agree that something has changed in Africa and that the continent is on a better path than it used to be (Miguel, 2009).

As a result of this recent improvement in growth rates, there has also been a noticeable reduction in poverty rates (Chen and Ravallion, 2010, 2012), but the level and pace of poverty reduction has remained disappointing, also due to the fact that higher growth appears to have been associated with rising inequality in many contexts. Thus despite these recent improvements, the general impression from available income and income poverty statistics is that Sub-Saharan Africa, on average, experienced decades of stagnation and regress between the mid-1970s and the late 1990s, from which it has only partly recovered.

At the same time, it is quite clear that GDP data derived from national accounts in many African countries are very weak. As is documented in detail in Jerven (2013), Devarajan (2013), and Young (2012), basic underlying data to construct national accounts are often missing or estimated, weights are outdated, and price information is missing or subject to poor quality, so that there are serious questions about the reliability of GDP estimates. "Small" changes such as rebasing the national accounts, as appeared in Ghana in 2010, or improving estimates for informal sector activities, as occurred in Mozambique, can lead to large changes in GDP. In the case of Ghana, GDP was revised upward by 60 percent. While the income poverty statistics are based on separate information (household surveys), there are also questions as to their reliability given the gap between consumption as measured in the surveys and consumption in the national accounts. This last point is a key driver of the results by Sala-i-Martin and Pinkovskiy (2010). They focus on income growth and income poverty in their analysis, but come to conclusions that are much more favorable than presented above. They estimate income distributions from aggregate statistics, for example GDP per capita and the Gini coefficient. They find that most African countries started a growth spurt already around 1995, which led to a tremendous decline in absolute income poverty. On average, both according to the $1 and $2 definition, poverty rates fell by around 10 percentage points between 1995 and 2006. The reduction of poverty happened broadly across all African countries and cannot be explained by the

performance of a small subset of large countries or geographic and historical characteristics. While these results are interesting, the numbers of Sala-i-Martin and Pinkovskiy should be interpreted with great caution for two reasons. First, the method does not allow attaching any level of significance to the estimates and is highly dependent on the rather crude and often inconsistent data available on income distribution (e.g., Grun and Klasen, 2008). Second, the approach taken only uses income distribution information but not mean incomes from the household surveys, which are taken from the national accounts instead. As there is a large, and in many cases, widening discrepancy between survey means and per capita incomes, this procedure delivers the much larger rate of absolute poverty reduction compared to the "official" World Bank figures (e.g., Chen and Ravallion, 2010, 2012), which rely entirely on survey data to estimate income poverty (and thus also use the survey means).[1] There is a large debate on this discrepancy as well as reliability of using per capita incomes as proxies for survey means, also in the context of other regions (e.g., Bhalla, 2004; Deaton and Kozel, 2005; Milanovic, 2005). While there are arguments for using per capita incomes as well as survey means, most of the studies suggest that particularly for the calculation of income poverty, using survey means might be more appropriate as most underestimation of incomes or expenditures in households is likely to be more concentrated among upper income groups. If that is the case, the survey incomes are likely to be appropriate for the assessment of income poverty; consequently, the pace of poverty reduction detected by Sala-i-Martin and Pinkovskiy might be substantially overestimated. Given that this debate now covers rather familiar ground that has been discussed intensively for some time, and given that this study is fundamentally based on the currently available official data, we will not dwell on this issue further here.

In the light of this uncertainty about Africa's economic performance and the many questions about data quality (especially of national accounts information), much effort has been going into improving the national account estimates in Africa, as is detailed in other contributions to this Special Issue (e.g., Devarajan, 2013). While extremely valuable, this is clearly a long-term project.

As a result, several scholars have tried to circumvent this problem of poor official data by the use of various proxy indicators for economic performance or income poverty. Maybe the most extreme version of this is to estimate GDP from outer space, using satellite maps of illumination at night to infer prosperity from this measure (e.g., Henderson *et al*., 2009, 2011). Based on satellite data of lights at night, they use lights growth to augment existing income growth measures. The lights data might be particularly important for improving estimates of economic growth in countries with poor national accounts data such as in Sub-Saharan Africa. The 43 Sub-Saharan African countries in the Penn World Tables 6.2 have data quality grades of C or D, implying a margin of error of 30 or 40 percent. The analysis of lights growth data suggest, however that official statistics neither overestimate nor underestimate growth consistently. In roughly half of the cases, the estimates of Henderson *et al*. are higher than the official statistics; in the other half

[1]For example, Chen and Ravallion (2012) find only a reduction of the poverty headcount in Africa in roughly the same time period of 3–7 percentage points, depending on the poverty line chosen.

of the cases they are lower. While this is an interesting approach to get a different reading of average economic performance, this approach has a number of own biases so that it is unclear what confidence to place on the point estimates of growth rates for individual countries, particularly since differences and changes in the type of economic activity might lead to different trends in light intensity.

A more down-to-earth approach has been followed by Alwyn Young (2012), who finds in a recent and much-noted contribution that economic growth and especially consumption growth has been much higher than official statistics suggest. Instead of a modest improvement in economic performance, Young talks about a veritable African Growth Miracle, with African per capita consumption growth equaling the level experienced in the more well-known miracle countries of South, East, and South-East Asia. Similarly, in an earlier set of methodologically related papers, Sahn and Stifel (2000, 2003) also found that poverty reduction and growth has been much faster than suggested using available GDP and income poverty statistics.

Sahn and Stifel (2000, 2003) and Young (2012) both use asset indices from Demographic and Health Surveys (DHS) as proxies for welfare. Using this, Sahn and Stifel (2000, 2003) find that asset indices point to much larger improvements than suggested from income poverty statistics. In fact, when expressing poverty in terms of asset ownership, poverty is also seen to have declined substantially already in the 1990s—much before the recently observed growth spurt in Africa. Young (2012) uses the same data source but a rather more complicated procedure to estimate (per capita) economic growth in Africa (see below). Also using the DHS to estimate household consumption consisting of (1) durable goods, (2) housing conditions, (3) children's nutrition and health, and (4) household time and family economics, he finds that household consumption (a proxy for per capita consumption) in Sub-Saharan Africa has been growing at an average annual rate between 3.2 and 3.8 percent since 1990. This is almost four times higher than the figures that are reported in international income statistics (e.g., the Penn World Tables) or the national accounts from individual countries. The results are, according to Young (2012), not driven by any of the product groups; for each of the product groups the growth rate in the DHS data is at least twice as high as the growth rate in the international macroeconomic statistics. As a result, Young suggests that the income statistics from Sub-Saharan Africa are deeply flawed and strongly underestimate income growth there. Using his approach, he can detect an "African growth miracle" from 1990 to 2004 with growth in real consumption not inferior to his non-Africa sample.[2]

These are just two specific examples of a much larger literature that has used asset indices as indicators of well-being. Following Filmer and Pritchett (2001) and Filmer and Scott (2008), many more studies now regularly use asset indices as indicators of well-being and we have done so ourselves in other work (e.g., Harttgen and Klasen, 2012; Harttgen and Vollmer, 2011). In fact, the DHS surveys now provide a pre-calculated asset index with the datasets available for download.

[2]His non-African sample includes countries from Latin America, and East, South, and Central Asia, including some of the fast-growing Asian economies (but excluding China, Korea, Malaysia, and Thailand).

There is an active literature that has considered the merits and problems of asset indices as indicators of consumption and material well-being (e.g., McKenzie, 2005; Stewart and Simelane, 2005; Stifel and Christiaensen, 2007; Howe *et al.*, 2009); most have found that asset indices are quite good proxies for consumption at a point in time. We agree with this literature, but argue that the use of asset indices to measure consumption levels across heterogeneous settings, and particularly to measure *trends* in consumption over time in heterogeneous settings, is deeply problematic and will lead to biased results.

More specifically, we argue that asset indices used as proxies for levels and trends in household consumption are subject to four biases. First, preferences for certain assets might rise over time as assets become more prevalent and part of "normal" living conditions. This might particularly relate to assets such as media and telecommunications equipment (e.g., TVs and telephones, including mobile phones). Second, changing relative prices can lead to a demand shift favoring some assets at the expense of other household expenditures. Again mobile phones are probably the best example of an asset whose relative price has declined dramatically over recent years. Third, assets are stocks rather than flows, so that it is already conceptually problematic to proxy a flow (consumption) with a stock (asset ownership). A useful flow measure to be derived from the stock of assets would be the services these assets provide on an annual basis. But this is rather hard to do in practice, as the DHS surveys do not record age and depreciation of assets and thus are a poor predictor of asset services. This might particularly be a problem if households are reluctant to dispose of older assets and thus one can observe an accumulation of assets with rising average age, which overestimates the rise in asset values over time; the relationship between asset accumulation and disposal might also differ between countries with low or high initial levels of assets, where the former may have lower disposal rates than the latter. Lastly, the provision of some assets (such as access to piped water and electricity) are in many poor countries a result of specific government policies to extend these services (often at highly subsidized rates). Thus while the possession of these assets might indeed be welfare enhancing and should be reflected in a broader (multidimensional) measure of well-being, it does not imply that availability of these publicly provided (or subsidized) assets should be considered as reliable proxy measures for actual household consumption.[3]

In this paper, we use information from DHS surveys of African and non-African countries from about 1990 to 2010 to assess the relevance of these criticisms in light of the findings by Young, and Sahn and Stifel. In particular, we will investigate to what extent the correlation between asset and income growth has indeed been different in Africa than elsewhere. Moreover, we will use micro income surveys from selected African and non-African countries to determine to

[3]Note that Young (2012) disagrees with the last point, suggesting that his measure of real consumption *should* reflect the positive impact of subsidized prices or government provision. But since this would clearly not be captured in a proper assessment of national accounts-based household consumption, a proxy indicator should not reflect this either. Of course, one could move towards an outcome-based welfare measure such as the new multidimensional poverty measure developed by OPHI and used by UNDP, for example, which reflects water, sanitation, and education access (UNDP, 2010), and this would clearly reflect subsidized or public provision. But if one wants to take that route, one can measure these items directly and there is no need to estimate a proxy for household consumption.

what extent there has been asset drift at fixed real income levels which might be related to the four concerns raised above.

Reproducing the starting point of the analyses of Young, and Sahn and Stifel, we find that there has indeed been considerable growth in asset ownership in African households, not dissimilar to the growth observed in households elsewhere. But we first note that inter-temporal data on asset holdings in Africa is only available for a non-random sample of countries, which have, according to GDP and GNI statistics, performed above average in the period under consideration. Related to this, we find that the mismatch between asset and income growth is quite sensitive to the time period chosen. At the same time, we find that the relationship between asset growth and per capita income growth is very weak in African and non-African countries (where the concerns about national accounts data might be less serious). More seriously, we find evidence of "asset drift," i.e. that assets accumulate at the household level even in the absence of income growth, suggesting that several of the biases discussed above might indeed be empirically relevant. As a result, we suggest that it is not reliable to estimate income or consumption growth (and income poverty) using asset indices and have therefore no reason to suspect that the "traditional" view of per capita growth and poverty reduction in Sub-Saharan Africa (pointing to stagnation and regress until the late 1990s, followed by moderate positive income growth and poverty reduction thereafter) is incorrect.

The paper is organized as follows. The next section briefly reviews the methodology by Young (2012) and Sahn and Stifel before it describes the construction of asset indices. Section 3 presents our empirical analysis, which is followed by a conclusion in Section 4.

2. Methodology

2.1. *Methods by Young, and Sahn and Stifel*

We will briefly discuss Young's methodology here to point out the key drivers of his results. Using DHS data from 1990–2006, Young first shows that the growth of assets over time in Africa, when normalized by the cross-sectional distribution of per capita incomes from the Penn World Tables (version 7.0), is much larger than measured improvements in per capita consumption using national accounts. This is true for a broad range of assets, including consumer durables and housing conditions, as well as some indicators of health and family economics, although it is important to note that improvements in housing conditions are much lower than when using the other indicators. In contrast, this discrepancy is much lower in non-African countries, where asset and consumption growth match up much better. In a second step, using educational achievements as a proxy for income (assuming a stable and constant rate of return[4]) and calculating the relationship between assets and education, he then estimates that the source of the discrepancy

[4]In one part of the analysis, the (micro-based) rate of return is estimated using available wage data, allowing the returns also to vary across countries; the reliability of these wage data are open to question as they are based on very few questions in the DHS to the female respondent.

is largely related to higher growth in income (proxied by assets) than a smaller cross-sectional variation. Thus his conclusion that consumption growth (as proxied by asset growth) has been much larger than per capita income data suggest, leads to his finding of the African growth miracle.

It is beyond the scope of this paper to review and comment on Young's paper in detail. While many aspects of the paper are extremely carefully derived and executed, some questions arise. First, the paper assumes a constant income elasticity of demand for the assets used. As discussed above, this might be problematic as this elasticity might particularly change over time and be affected by the "asset drift" arguments we raise above.[5] There are also serious questions to what extent educational attainment can be used as a proxy for income, given that much education depends on public policy, educational quality is highly uneven, and there are questions about whether the expansion of education in Africa has actually had much effect on lifting income growth rates. In this sense, the finding by Pritchett (2001) of a very low, zero, or even negative *macroeconomic* return to the educational expansion in Africa is particularly relevant; in Young (2012), it is assumed that this macroeconomic return is substantial (and can be derived from the estimated returns at the micro level, a point that Pritchett explicitly disputes). Lastly, it is not clear whether using educational attainment is well-suited to assist in the calculation of the standard deviation of incomes given the bounded nature of the indicator. Beyond these points, ultimately the paper's results are largely driven by the trends in asset ownership in Africa (compared to elsewhere) and this is what we will focus on in the analysis below.

Sahn and Stifel (2000) generate an asset index from the DHS data in order to investigate changes of income poverty in Africa between the late 1980s and the late 1990s. To compare asset poverty across countries, they pool the latest survey from each country to determine the asset weights. Then they go back to the national asset distributions and set the 25th (and 40th) percentile from the first survey of each country as the relative poverty line. They find that poverty declined in most countries during the 1990s, mostly due to improvements in rural areas. Sahn and Stifel conclude that their results on asset poverty are broadly consistent with other indicators of poverty and national economic attainment in terms of country rankings, and thus conclude that their analysis of trends in asset indices provide a vastly more positive picture of poverty reduction already in the 1990s when measured income poverty rates stagnated at high levels.[6] Also here, the key driver of the result is the growth in assets that is used as a proxy for income poverty, and thus it is critical to assess to what extent changes in asset holdings can proxy changes in incomes across space and time.

[5]Young tackles the question that the demand for some assets will have grown due to falling prices or increased preferences. He claims to tackle this by examining indices combining a broad range of asset-related indicators that should balance out such effects. This is, however, unlikely to tackle our "asset drift" arguments advanced above. Also, even the broad range of assets is unlikely to reflect the totality of consumption expenditures well.

[6]Sahn and Stifel (2003) evaluate the potential of the asset index as a measure of household economic welfare in greater detail. They find that the household ranking based on the asset index is less consistent with reported expenditures than a ranking based on predicted expenditures. However, the asset index predicts health and child nutrition with less measurement error than expenditures.

2.2. *Constructing an Asset Index*

We follow the approach of Filmer and Pritchett (2001) and Sahn and Stifel (2003) to construct an asset index. The main idea of this approach is to construct an aggregated one-dimensional index over the range of different dichotomous variables of household assets, capturing housing durables and information on the housing quality that indicate the material status (welfare) of the household:

$$A_i = b_1 a_{i1} + b_2 a_{i2} + \ldots + b_k a_{ik} \tag{1}$$

$$a_{ik} = \beta_k c_i + u_{ik} \tag{2}$$

for $i = 1, \ldots, N$ households and $k = 1, \ldots K$ household assets. A_i is the asset index, the a_{ik} refer to the respective asset of the household i recorded as dichotomous variables in the DHS data sets, and the b_k are the weights for each asset that are used to aggregate the indicators to a one-dimensional index. In the model, the ownership of an asset k of household i, identified by a_{ik}, is a linear function of an unobserved factor, which in our case is material welfare c_i. The relationship between the asset k in c_i is given by β_k plus a noise component u_{ik}, where both terms have to be estimated (Sahn and Stifel, 2000).[7]

For the estimation of the weights and for the aggregation of the index, we use a principal component analysis as proposed by Filmer and Pritchett (2001). The first principal component is our asset index.[8] Principal component analysis is a technique to identify those linear combinations from a set of variables that best capture the common information behind the variables. This means that we assume that household assets and housing characteristics explain the long-term wealth of a household measured by the maximum variance in the asset variables. The principal component analysis is structured by a set of equations where the asset variable is related to a set of latent factors:

$$\begin{aligned} \tilde{a}_{1i} &= v_{11} A_{1i} + v_{12} A_{2i} + \ldots + v_{1k} A_{ki} \\ &\cdots \\ \tilde{a}_{ki} &= v_{k1} A_{1i} + v_{k2} A_{2i} + \ldots + v_{kk} A_{ki} \end{aligned} \tag{3}$$

where the $\tilde{a}$ are the k asset indicators (the a's in equation (1)) normalized by their mean and their standard deviations; A are the k principal components and v are the weights that relate the principal components to the ownership of the asset (Filmer and Scott, 2008). After the weights v have been estimated, the inversion of the equation system (3) yields the following set of equations:

$$\begin{aligned} A_{1i} &= b_{11} \tilde{a}_{1i} + b_{21} \tilde{a}_{2i} + \ldots + b_{k1} \tilde{a}_{ki} \\ &\cdots \\ A_{ki} &= b_{1k} \tilde{a}_{1i} + b_{2k} \tilde{a}_{2i} + \ldots + b_{kk} \tilde{a}_{ki} \end{aligned} \tag{4}$$

[7]The model is based on the following assumptions: (i) households are distributed *iid*; (ii) $E(u_i|c_i) = 0$; and (iii) $V(u_i) = Diag\{\sigma_1^2, \ldots, \sigma_K^2\}$.

[8]An alternative way to estimate the weights for the assets to derive the aggregated index is a factor analysis employed, for example, by Sahn and Stifel (2000). However, the two estimation methods show very similar results.

The equation for the first principal component is the equation with the highest variance. The weights that are used to aggregate the asset variables into a one-dimensional index are given by the set (b_{11}, b_{21}, . . ., b_{k1}). The asset index is calculated for each individual, weighted by household size.

A possible issue that arises from using principal component analysis is that the resulting growth rates of the index might be influenced by the standardization of the index (achieved by subtracting the mean and dividing by the standard deviations of the asset in question). To address this, we use two other aggregation methods to calculate the asset index (for a detailed description, see Filmer and Scott, 2008). First, we simply sum all assets and housing characteristics of the household, what Filmer and Scott (2008) call the count index:

$$A_i = a_{1i} + a_{2i} + \ldots + a_{ki}.^{9} \tag{5}$$

For the second additional index, we also use the sum of the assets, but weigh each asset by the share of the population that does not own the asset. The index is called the share weighted average:

$$A_i = w_1 a_{1i} + w_2 a_{2i} + \ldots + w_k a_{ki}, \tag{6}$$

where the weights w_k are given by $w_k = \frac{1}{N}\sum_{i=1}^{N}(1 - a_{ki})$. Weighting the index takes into account that some assets are possessed by only very few households and, hence, are of particular importance for capturing material welfare of the household. Using these two additional indices, we can compare the growth rates of GDP per capita and consumption per capita with growth rates of the asset indices based on three different aggregation methods.[10]

3. Empirical Analysis

3.1. *Data*

To illustrate our approach we use 160 DHS data from 33 African and 34 non-African countries (see Online Appendix, Table A1). For 42 countries we have more than one survey, allowing us to calculate changes in asset indices. The DHS are undertaken by *Macro International Inc., Calverton, Maryland* (usually in cooperation with local authorities and funded by USAID) and started in 1984. They provide detailed information on child mortality, health, and fertility, as well as household assets (household incomes or expenditures are not included). To date, DHS data is available for 84 developing countries for several years—resulting in more than 240 large-scale household surveys. The data are self-weighted national surveys of women aged between 15 and 49. The average sample size is about 5,000 to 6,000 women; some surveys are even larger.

[9]In the count index, all assets are coded as dummy variables (1 = possession of the asset).

[10]One may clearly worry about the conceptual foundation of using principal component analysis in this context. Ideally, one would want to use prices as weights for different assets but these are not available. So this has to be seen as a purely empirical approach to find a reasonable proxy for welfare.

TABLE 1
SCORING FACTORS OF ASSET INDEX

Asset	Mean	SD	N	Total Sample Scoring Factor	First Year Scoring Factor	Latest Year Scoring Factor
Owns radio	0.579	0.494	1,927,621	0.395	0.342	0.235
Owns TV	0.441	0.496	1,932,150	0.826	0.810	0.754
Owns refrigerator	0.292	0.455	1,870,275	0.779	0.745	0.780
Owns bike	0.283	0.450	1,835,633	0.049	0.040	0.012
Owns car	0.117	0.321	1,803,855	0.270	0.232	0.150
Owns motorbike	0.078	0.268	1,841,863	0.424	0.369	0.378
Piped drinking water	0.335	0.472	1,939,267	0.618	0.563	0.474
Owns electricity	0.566	0.496	1,904,439	0.789	0.769	0.665
Owns phone	0.309	0.462	1,513,699	0.718	0.671	0.715
High quality of floor material	0.549	0.498	1,749,964	0.667	0.612	0.475
Flush toilet	0.357	0.479	1,885,949	0.714	0.663	0.708
Mean years education of adult household member	5.671	4.588	1,650,293	0.720	0.669	0.634
Percentage of the covariance explained by the first principal component				0.391	0.408	0.309
Eigenvalue of first principal component				4.691	4.141	3.704

Source: Demographic and Health Surveys; calculation by the authors.

The DHS include a household member module and an individual recode for women of reproductive age. The household member recode lists all members of the household. At the household level, the DHS provide information on basic demographics, education, and the possession of household assets. Although the DHS are not completely standardized across time and countries, the design and coding of variables (especially on assets and dwelling characteristics) are generally comparable.

We use the following variables to construct our asset indices: radio, TV, refrigerator, bike, motorized transport, capturing ownership of household durables and type of floor material, type of wall material, type of toilet, and type drinking water capturing the housing quality, and we calculate the asset indices separately for each country and period. Table 1 shows means of asset possession across the surveys and also presents the scoring factors (weights) to be used for the construction of asset indices. We use three approaches to generate the weights for the asset index in the principle component analysis (equation (4)). One uses the pooled sample of countries and years to generate weights. When using this approach, we can compare an individual country's performance in terms of levels and trends in assets with respect to this international and inter-temporal standard. One might worry, however, that such an approach glosses over changes in the importance of certain assets as proxies for income over time.[11] We therefore also generate weights using the first and last survey for each country. As can be

[11]For example, owning a radio might be more closely correlated with household wealth in the early parts of the survey than in the later ones where, arguably, a radio has lost importance as a medium of access to mass media (while the role of a TV might conversely have increased).

seen in Table 1, there are differences in weights when using these three procedures. While it is true that the scoring factors of most household assets have declined (with the exception of owning phones and having access to flush toilets), the differences in scoring factors are not very large and, as we find below, do not greatly affect our results. For the other two asset indices, the weights are either not an issue (sum index) or depend on each survey-year (equation (6)). In Table A1 of the Online Appendix we report descriptive statistics for every country–year observation, including the average value for each component of the asset index and GDP per capita.

We use DHS data to construct asset indices at the household level. The DHS data are available for more than 40 countries with at least two and up to four waves per country between 1990 and 2010. Further, we use data on real GDP per capita (chain index) from the Penn World Tables 7.0 as well as consumption per capita (calculated by using the real consumption share in the Penn World Tables with the GDP per capita measure).

In a second step, we approach the question of asset drift using micro data. The main motivation for doing this is to avoid the use of possibly problematic national accounts data. We therefore want to ask what the relationship between asset holding and real incomes looks like at the micro level, where we have arguably more confidence in the reliability of the income data used. To illustrate this with two examples for which reliable survey information is available, we use household survey data for Indonesia and Zambia. In particular, for Indonesia we use the (panel) Indonesian Family Life Survey (IFLS) for the periods 1993, 1997, 2000, and 2007; for Zambia, we use the (cross-section) Zambia Living Condition Monitoring Surveys for the periods 1996, 1998, 2004, and 2006. Using survey data for Zambia and Indonesia as examples, we ask whether possession of assets is increasing over time at different parts of the income distribution, holding real incomes constant. For example, if we keep the income level of the 25th percentile of households in Zambia in 1996 fixed in real terms, we ask whether households with that same real income in 2006 hold the same, fewer, or more assets. If they hold more assets, this would be evidence of asset drift, possibly related to the four issues discussed above. To the extent possible, we will also investigate whether we can say anything about the causes of observed asset drift.

3.2. *Results*

In Table 2 we compare the growth rate of the asset index and the growth rate of GDP per capita and consumption per capita for a variety of country samples and time periods. The DHS surveys are roughly available every five years, and the survey years differ by country. We thus calculate the average annual growth rate of the asset index and its components between two survey years. We do the same for GDP per capita and real consumption per capita. Here we take GDP per capita and consumption per capita that corresponds to the respective DHS survey years 1994–2010. We have growth rates of the asset index and of GDP (consumption) per capita for 42 county–year observations, 25 of which are for African countries.

We present a whole range of figures for comparison. On the asset index side, we present, as discussed above, the growth rate of the standardized asset index

TABLE 2

GDP Per Capita and Asset Index Growth by Region

	Baseline Estimate (%)	First Year (%)	Latest Year (%)	Count Index (%)	Weighted Average (%)
Total			42		
Asset index growth	1.715	1.721	1.753	3.305	1.880
Asset index growth (Young sample)	1.596	1.597	1.631	3.202	1.768
Real GDP per capita growth (DHS sample)[a]	3.307				
Real GDP per capita growth (DHS series, 1994–2010)[b]	2.921				
Real GDP per capita growth (low income countries)[c]	2.697				
Real GDP per capita growth (least developed countries)[c]	2.881				
Real consumption per capita growth (DHS sample)	2.770				
Africa (DHS Sample)			25 (Young sample: 21)		
Asset index growth	1.893	1.887	1.941	3.832	3.036
Asset index growth (Young sample)	1.712	1.694	1.756	3.747	3.054
Real GDP per capita growth	3.470				
Real GDP per capita growth (Sub-Saharan Africa)[c]	3.038				
Real consumption per capita growth	2.943				
Real consumption per capita growth (Young sample)	2.002				
Non-Africa (DHS sample)			17		
Asset indexgrowth	1.452	1.477	1.476	2.529	0.179
Real consumption per capita growth	2.515				
Real GDP per capita growth	3.069				

Notes:

[a]DHS sample: income data are matched to countries and years for which asset growth rates in the DHS were computable.

[b]DHS series: per capita income growth from 1994 and 2010 for all countries for which DHS data are available (including countries where we only have one DHS and regardless of whether the available DHS data cover this entire time period).

[c]Complete available series: data series between 1994 and 2010 from Penn World Tables 7.0.

Source: Demographic and Health Surveys; calculation by the authors.

using the pooled, the first, and the last year data for weights, as well as the growth rate of a simple count index, and a weighted average (with weights being the share of the population not owning an asset). We also consider a reduced sample which is identical to the one used by Young and which stops in 2006. For income growth, we consider income growth using exactly the years of the DHS sample, as well as the entire period of analysis (1994–2010), several subsamples, and we also consider per capita real consumption growth (as does Young) which should presumably be more closely related to asset growth.

The average annual growth rate of the asset index is 1.7 percent while the average annual growth rate of GDP per capita is about 3.3 percent, with real consumption growth being lower at 2.8 percent. It turns out that it does not make a big difference whether the weights for the asset index are based on the first survey, the last survey, or the full sample. In all cases, the average annual growth rate of the asset index is around 1.7 percent. It does, however, matter whether asset possession is standardized (as in the asset index) or simply counted. The procedure of using the standardized asset index has the advantage of making the assets more comparable with each other, but it reduces the impact of fast-growing assets where the standard deviation is rather large. Using the count index, which is closer to the type of measure used by Young (who examines the growth of individual assets), asset index growth is substantially higher at 3.3 percent. Moreover, Table 3 and Online Appendix Table A1 show for individual assets that some assets, particularly ownership of TV, car, and phones (including mobile phones), and flush toilets have grown very fast in many countries. Thus aggregation seems to matter and results will differ whether we interpret the growth of the standardized asset index (as, for example, done by Sahn and Stifel, 2000) or use the growth rates of individual assets (as done by Young) as a proxy for improvements in economic performance.

Using any version of the asset index, GDP per capita growth, and consumption growth, African countries have higher growth rates than non-African countries for the sample period. The growth rate of the asset index was about

TABLE 3
GROWTH OF ASSETS

Asset	Total (%)	Non-Africa (%)	Africa (%)
Radio	1.18	–0.56	2.82
TV	5.83	3.53	8.13
Refrigerator	3.51	3.28	3.73
Car	5.18	5.52	4.95
Motorbike	2.41	3.68	1.44
Piped drinking water	3.94	2.90	5.90
Bike	2.53	0.97	3.76
Electricity	2.93	2.40	3.41
Phone (landline and mobile)	22.74	14.89	31.47
High quality of floor material	1.11	3.28	0.90
Flush toilet	7.52	5.80	9.24
Years of education	1.77	1.85	1.69

Source: Demographic and Health Surveys; calculation by the authors.

1.9 percent in African countries while it was 1.5 percent in non-African countries. The results are even more dramatic when using the count index or the weighted average. Using the former, asset index growth is substantially higher in Africa than elsewhere (3.8 vs. 2.5 percent); even larger discrepancies arise when using the latter. The growth rate of GDP per capita (consumption per capita) is 3.5 percent for African countries (2.9 percent) and 3.1 percent (2.5 percent) for non-African countries in the sample period covered by the DHS.

At first glance, some of these figures seem surprising and also do not seem to fully reflect what we have said in the beginning about income growth in Africa versus elsewhere; they also do not match the stylized facts of Young (who particularly finds lower consumption per capita growth using the Penn World Tables and UN statistics in Africa than elsewhere). A few explanations are therefore necessary.

First, the data reflect that the DHS sample is biased toward economically more successful economies. The average growth rates for least developed countries, low-income countries, and all Sub-Saharan African countries (for which data are available) are about 0.5 percentage points lower than for the DHS sample. The important message from this is that the DHS, which also form the core of the analysis in the papers by Young, and Sahn and Stifel, present a selected sample of more successful African economies. This is not too surprising as countries that are in serious economic troubles, or even face civil conflict, are unlikely to be able to field a DHS.[12]

Second, Young's sample stops earlier and excludes surveys from 13 African DHS from 2007–09 (and one from 2006). As a result, Table 2 reflects more strongly the high growth rates of African countries between 2006 and 2009, leading to the high overall GDP and consumption growth rates. To show this, we restrict the African sample to the DHS included by Young and similarly restrict the consumption and GDP growth rates to that sample; the numbers change substantially again and yield interesting insights. When restricting the sample in this way, per capita consumption growth is now only about 2 percent (see "Young sample") while asset index growth is hardly affected. Although these results do not entirely match Young's data (for reasons that are not entirely clear), his stylized facts are now visible in Table 2. If we take the count index as being closest to his use of the asset index and compare it to real consumption growth in his sample, asset index growth in Africa is 3.75 percent, while measured consumption growth is only 2 percent; conversely, in the non-African sample, consumption growth is higher than in Africa (2.5 percent) while asset index growth is considerably lower (also at 2.5 percent). It also confirms Young's claim that the mismatch between asset and consumption growth is particular to Africa while the two match up well in the non-African sample. Thus, using the count index as a better measure of economic performance would lead to Young's claim of the African Growth Miracle that is visible in assets but goes unrecognized when using consumption per capita growth.

The comparison between the two sample periods in Table 2 generates another interesting finding: the fact that consumption growth is much lower in the shorter sample (2 percent instead of 3.5 percent) while asset index growth is hardly affected

[12]Of course, one may doubt the reliability of the GDP figures from these countries as well.

TABLE 4
Regression Results

Variables	(1) Asset Index Growth	(2) Asset Index Growth	(3) Asset Index Growth	(4) Asset Index Growth
Consumption p. c. growth	0.00255	–0.324	0.00674	–0.349
	(0.0989)	(0.301)	(0.102)	(0.313)
Sub-Sahara Africa (= 1)		–0.00492		–0.00205
		(0.0119)		(0.0147)
Growth rate Sub-Saharan Africa		0.364		0.380
		(0.319)		(0.326)
Asset index			–0.000390	0.000825
			(0.00160)	(0.00239)
Constant	0.0171***	0.0227**	0.0193*	0.0165
	(0.00504)	(0.0101)	(0.0103)	(0.0206)
Observations	42	42	42	42
R-squared	0.000	0.039	0.002	0.043

Notes: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.
Source: Demographic and Health Surveys; calculation by the authors.

(3.2 vs. 3.35 percent) already suggests that the link between the two is not terribly close. It would also be some first evidence consistent with asset drift in the sense that asset growth was high even in the periods when consumption growth was rather modest.

Lastly, one may also wonder why real per capita GDP growth (real per capita consumption growth) in the non-African sample is "only" 3 percent (2.5 percent) per year. Again, sample selection issues play a role. For one, China is excluded. Moreover, many of the fast-growing Asian economies (including Malaysia, Thailand, and Korea) are also not included. Lastly, note that these are all unweighted averages.

Since changes in asset indices are meant to provide a proxy for consumption growth, we now turn to the correlations between the growth rate of consumption per capita and the growth rate of the asset index. In Table 4 we report regression results with the average annual growth rate of the asset index as dependent variable. The independent variables include the annual growth rate of real consumption per capita (in a robustness check, growth of GDP per capita was also used and the results are very similar),[13] an Africa dummy, the level of the asset index, and the interaction of the Africa dummy with the growth rate of consumption per capita.[14] The last analysis is of particular relevance if one believes that poorly measured consumption data in Africa are leading to a lack of correlation between asset and consumption growth: we would then expect there to be a stronger correlation in the non-African sample (with better national accounts) than in the African sample. The first regression only includes the growth rate of

[13]Results are available on request.

[14]Note that we use the current level of the asset index and not the initial level. While the initial level would be more appropriate for a convergence regression, it has the downside that the time difference between two surveys is not identical across countries and years. Treating initial levels for four-year periods, five-year periods, and six-year periods equally would bias the result (more than taking current levels); but using initial levels does not change the results at all.

consumption per capita and a constant. The constant is significantly different from zero while the coefficient of consumption per capita is not. This means that the growth rates of the asset index and of consumption per capita are practically uncorrelated. Thus, the growth of the asset index is a bad predictor for the growth of consumption per capita and vice versa. The significant constant term would imply an asset drift in the sense of base growth of the asset index even without any growth of consumption. In the second regression we include a dummy for Africa and its interaction with consumption growth to test whether the relationship differs between Africa and elsewhere (a claim which would be consistent with Young's analysis). Both terms are insignificant; the constant term is still significant. This means that for both regions, asset index growth and consumption growth are hardly correlated. In the final two specifications we also include the level of the asset index. Now nothing is significant anymore, suggesting that we are unable to explain the growth of assets in any real way.

In Tables 5 and 6 we report results of similar regressions with the average annual growth rate of the components of the asset index as dependent variables: radio, TV, phone, electricity, fridge, car, motorbike, bike, floor material, toilet, and education. In Table 5 we only include the growth rate of consumption per capita; in Table 6 we also include an Africa dummy and its interaction with consumption growth.[15] In Table 5, the coefficient of the consumption growth rate is only significant and positive once (for growth of refrigerators), and all constant terms except for radio, bike, and floor material are significant and positive, suggesting asset drift for most assets that is largely uncorrelated with consumption growth. This is consistent with the notion that preferences and relative prices are shifting towards more modern assets (such as TVs, phones, and cars); it is also consistent with the notion that asset drift can be the result of public policies which might be responsible for the upward drift in electricity and sanitation access and education (both prominent development goals for many countries). Also in Table 6, the coefficient of the consumption growth rate is never significant and positive (but sometimes significant and negative). Neither the Africa dummy nor its interaction with growth of consumption per capita shows a significant coefficient in most regressions (the exceptions being education growth and TV growth, where the main effect is negative). The constant term is significant for TV, phone, electricity, car, and education. To sum up: there is no evidence for a correlation between the growth rate of consumption per capita and the growth rate of the components of the asset index. There is some evidence for an asset drift for most assets, i.e. there is a base growth of assets regardless of consumption growth, for most components of the asset index. This is particularly the case for radios, TV, telephones, electricity, refrigerator, cars, motorbikes, bikes, and education, although not always significantly so. The lack of correlation between asset growth and consumption growth is the same for African and non-African countries.

In conclusion, we find no evidence that asset index growth and consumption growth are closely correlated with each other, neither in African or elsewhere.

[15]Note that the number of country–year observations is larger than in Tables 2 and 4 because we only calculate the asset index if all components are available. The most limiting component is the telephone, with only 56 country-year observations for growth rates.

TABLE 5

REGRESSION RESULTS BY ASSETS

Variables	(1) Growth Radio	(2) Growth TV	(3) Growth Phone	(4) Growth Electricity	(5) Growth Fridge	(6) Growth Car	(7) Growth Motorbike	(8) Growth Bike	(9) Growth Floor Material	(10) Growth Toilet	(11) Growth Education
Consumption p. c. growth	0.0928 (0.137)	0.0589 (0.295)	0.671 (0.844)	0.117 (0.186)	0.426* (0.232)	–0.0678 (0.291)	0.327 (0.204)	0.122 (0.215)	0.176 (0.445)	0.258 (0.557)	–0.0767 (0.121)
Constant	0.00768 (0.00644)	0.0559*** (0.0138)	0.210*** (0.0403)	0.0286*** (0.00866)	0.0287** (0.0111)	0.0654*** (0.0144)	0.0181* (0.0100)	0.0170 (0.0103)	0.00782 (0.0210)	0.0692*** (0.0257)	0.0195*** (0.00562)
Observations	68	68	56	67	62	58	60	62	66	67	67
R-squared	0.007	0.001	0.012	0.006	0.053	0.001	0.043	0.005	0.002	0.003	0.006

Notes: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.
Source: Demographic and Health Surveys; calculation by the authors.

TABLE 6

REGRESSION RESULTS BY ASSETS AND REGION

Variables	(1) Growth Radio	(2) Growth TV	(3) Growth Phone	(4) Growth Electricity	(5) Growth Fridge	(6) Growth Car	(7) Growth Motorbike	(8) Growth Bike	(9) Growth Floor Material	(10) Growth Toilet	(11) Growth Education
Consumption p. c. growth	–0.521* (0.269)	–1.444** (0.641)	–0.484 (2.060)	–0.214 (0.447)	0.724 (0.559)	–0.568 (0.759)	0.542 (0.504)	0.0858 (0.519)	–0.185 (1.028)	0.968 (1.411)	–0.520* (0.276)
ssa		–0.00385 (0.0284)	0.131 (0.0859)	0.00230 (0.0192)	0.0230 (0.0253)	–0.0109 (0.0341)	–0.000519 (0.0233)	0.0331 (0.0226)	–0.0648 (0.0458)	0.0549 (0.0584)	–0.0204* (0.0122)
gr_ssa		1.826** (0.710)	1.187 (2.240)	0.394 (0.491)	–0.358 (0.615)	0.590 (0.824)	–0.261 (0.553)	0.0294 (0.568)	0.477 (1.139)	–0.864 (1.538)	0.547* (0.306)
Constant	0.00331 (0.00955)	0.0736*** (0.0227)	0.162** (0.0681)	0.0308* (0.0155)	0.0136 (0.0207)	0.0764** (0.0290)	0.0163 (0.0196)	–0.000606 (0.0185)	0.0433 (0.0364)	0.0345 (0.0473)	0.0341*** (0.00967)
Observations	68	68	56	67	62	58	60	62	66	67	67
R-squared	0.327	0.155	0.130	0.029	0.067	0.012	0.051	0.073	0.042	0.017	0.060

Notes: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.
Source: Demographic and Health Surveys; calculation by the authors.

Instead we find asset drift in both regions (especially for more modern assets such as TVs, phones, cars and assets where public action matters such as electricity access, sanitation access, and education) that is largely unaffected by trends in (measured) economic performance. Thus it appears doubtful that one can deduce trends in economic performance from examining trends in aggregate asset indices or growth of individual assets which seems to be affected more by changing preferences, relative prices, and public action than by economic performance. The fact that this lack of correlation obtains not only in Africa but also elsewhere suggests that poor national accounts data in Africa are unlikely to be the key driver of these results.

So far, our analyses were based on aggregate consumption data from the Penn World Tables, which are derived from national accounts information. We now turn to an analysis at the micro level with countries for which we have asset data and expenditure data. We do this exemplarily for two countries where we have several household surveys with good income and asset information available. As an African case, we use the country of Zambia from 1996 to 2006. Zambia is quite a typical country for Sub-Saharan Africa in the sense that official GDP data suggest that growth had been flat for much of the 1980s and 1990s and picked up significantly post-2000. The non-African country we choose is Indonesia, which represents a country where income growth has been substantial in the past two decades (though briefly interrupted by the financial crisis of 1998–99).

For Zambia we have cross-sectional survey data for 1996, 1998, 2004, and 2006. Assets in the asset index include motorbike, TV, video, radio, fridge, phone, sewing machine, stove, piped water, electricity, flush toilet, and education. The asset index is thus quite similar to the asset index in the previous analysis. For Indonesia we have panel survey data for 1993, 1997, 2000, and 2007. The asset index is somewhat different due to a different level of development. Here, assets include motorized vehicles, appliances, savings, jewelry, electricity, phone, piped water, flush toilet, fridge, number of rooms, and floor material. In Tables 7 and 8 we report descriptive statistics for all assets and survey years. A few points are worth noting. In Zambia, an economy that (is reported to have) shrunk until the early 2000s, after which substantial growth set in, possession of some assets has increased substantially, including phones, videos, TVs, and motorbikes. This growth already took place prior to the recent pick-up in growth, which is again consistent with asset drift arguments. For other assets including education and household access to electricity, water, and flush toilets, the trends are rather unclear. In Indonesia, an economy that has been growing strongly in the period (with the interruption of two years due to the Asian financial crisis), all kinds of assets seems to have grown substantially.

In Tables 9 and 10 we report the development of certain assets for constant levels of household expenditure. To this end we calculate the expenditure level at the 25th, 50th, and 75th percentile in the first survey (1993 for Indonesia and 1996 for Zambia). We then look at the assets of households that have similar levels of expenditure in the later surveys. Thus, we keep the real expenditure level constant and look at the asset development over time at these constant expenditure levels to determine whether there is evidence of asset drift. We will now go through the development of each asset. In Indonesia we observe a rather strong increase of

TABLE 7

Asset Means and Scoring Weights in Zambia

Asset	1996 Mean	1998 Mean	2004 Mean	2006 Mean	Total Sample Scoring Factor
Motorbike	0.018	0.058	0.051	0.059	0.389
TV	0.310	0.309	0.328	0.367	0.809
Video	0.079	0.099	0.165	0.176	0.694
Radio	0.606	0.603	0.594	0.630	0.437
Refrigerator	0.154	0.154	0.119	0.119	0.715
Phone	0.058	0.045	0.122	0.367	0.605
Sewing machine	0.170	0.153	0.093	0.071	0.339
Stove	0.269	0.260	0.228	0.237	0.834
Piped drinking water	0.528	0.457	0.388	0.383	0.644
Electricity	0.303	0.295	0.701	0.645	0.523
Flush toilet	0.313	0.276	0.242	0.245	0.763
Mean years education of adult household member	8.879	7.726	8.026	8.349	0.678
Percentage of the covariance explained by the first principal component					0.408
Eigenvalue of first principal component					4.897

Source: Zambia Living Condition Monitoring Surveys; calculation by the authors.

TABLE 8

Asset Means and Scoring Weights in Indonesia

Asset	1993 Mean	1997 Mean	2000 Mean	2007 Mean	Total Sample Scoring Factor
Owns motorized vehicle	0.329	0.467	0.433	0.567	0.499
Owns appliances (TV, radio, etc.)	0.738	0.765	0.769	0.871	0.593
Owns savings	0.235	0.248	0.291	0.261	0.440
Owns jewelry	0.498	0.580	0.607	0.546	0.417
Has electricity	0.695	0.847	0.904	0.962	0.593
Owns TV	na	0.566	0.574	0.742	0.710
Has piped drinking water	0.044	0.251	0.267	0.218	0.370
Has flush toilet	0.321	0.440	0.484	0.656	0.661
Owns refrigerator	0.000	0.119	0.146	0.282	0.525
Number of rooms	4.837	5.023	5.304	5.339	0.634
High quality of floor material	0.617	0.680	0.739	0.803	0.621
Percentage of the covariance explained by the first principal component					0.315
Eigenvalue of first principal component					3.462

Source: Indonesia Family Life Surveys (IFLS); calculation by the authors.

motorized vehicles over time at all three expenditure levels while it only increases at the highest expenditure level in Zambia. For electrical appliances there is an expenditure gradient in Indonesia, but within each expenditure group the numbers are fairly constant at a high level with only modest increases over time.[16] This

[16]Electrical appliances refer to the share of households possessing any of the following items: radio, tape recorder, sewing or washing machine; in 1993, TV and refrigerator are also included here, but are dropped from 1997 onwards. Thus this is a rather crude indicator and asset drift might not be visible here, because households with any of these assets might have increased the number and type of assets, and households who possessed a TV or refrigerator in 1993 are no longer considered in this question.

TABLE 9

ASSET GROWTH CONDITIONAL ON INITIAL EXPENDITURE LEVEL IN INDONESIA

	25th Percentile (of 1993 real household expenditure)				50th Percentile (of 1993 real household expenditure)				75th Percentile (of 1993 real household expenditure)			
Year	1993	1997	2000	2007	1993	1997	2000	2007	1993	1997	2000	2007
Owns motorized vehicle	0.268	0.354	0.354	0.375	0.337	0.412	0.425	0.478	0.394	0.458	0.419	0.541
Owns electrical appliances	0.602	0.506	0.640	0.639	0.707	0.662	0.704	0.767	0.794	0.766	0.798	0.866
Owns savings	0.112	0.063	0.077	0.043	0.171	0.125	0.166	0.095	0.295	0.184	0.188	0.166
Owns jewelry	0.397	0.463	0.428	0.370	0.439	0.515	0.521	0.403	0.562	0.578	0.584	0.533
Has electricity	0.517	0.680	0.813	0.856	0.658	0.788	0.866	0.939	0.786	0.878	0.873	0.964
Owns TV	na	0.266	0.303	0.483	na	0.368	0.446	0.596	na	0.560	0.571	0.733
Has piped drinking water	0.004	0.096	0.132	0.090	0.011	0.123	0.147	0.143	0.022	0.149	0.209	0.176
Has flush toilet	0.137	0.178	0.180	0.340	0.192	0.195	0.260	0.411	0.369	0.362	0.395	0.565
Owns refrigerator	na	0.010	0.007	0.043	na	0.003	0.010	0.045	na	0.028	0.070	0.137
Number of rooms	4.406	4.325	4.759	4.812	4.683	4.501	4.967	5.161	5.078	5.009	5.418	5.590
High quality of floor material	0.416	0.400	0.541	0.499	0.542	0.519	0.607	0.664	0.666	0.663	0.706	0.785

Source: Indonesia Family Life Surveys (IFLS); calculation by the authors. Note appliances measures whether households hold any of the following electrical appliances: radio, tape recorder, sewing or washing machine. In 1993, TV and refrigerator are additionally included in the question, but later excluded from this category and asked separately.

TABLE 10

Asset Growth Conditional on Initial Expenditure Level in Zambia

	25th Percentile (of 1996 real household expenditure)				50th Percentile (of 1996 real household expenditure)				75th Percentile (of 1996 real household expenditure)			
Year	1996	1998	2004	2006	1996	1998	2004	2006	1996	1998	2004	2006
Motorbike	0.013	0.006	0.005	0.004	0.020	0.024	0.012	0.014	0.009	0.025	0.030	0.041
TV	0.031	0.052	0.092	0.119	0.149	0.164	0.242	0.314	0.409	0.420	0.546	0.610
Video	0.002	0.004	0.017	0.018	0.012	0.012	0.069	0.066	0.055	0.076	0.224	0.286
Radio	0.353	0.365	0.496	0.557	0.510	0.561	0.603	0.652	0.672	0.731	0.716	0.750
Refrigerator	0.006	0.006	0.008	0.013	0.038	0.036	0.047	0.048	0.166	0.169	0.156	0.158
Phone	0.003	0.001	0.008	0.103	0.010	0.004	0.043	0.285	0.047	0.036	0.145	0.617
Sewing machine	0.072	0.063	0.045	0.027	0.106	0.098	0.068	0.064	0.178	0.172	0.111	0.090
Stove	0.015	0.015	0.024	0.026	0.083	0.086	0.115	0.125	0.339	0.327	0.340	0.415
Piped drinking water	0.149	0.136	0.205	0.169	0.330	0.308	0.302	0.290	0.628	0.571	0.513	0.503
Electricity	0.018	0.037	0.673	0.607	0.091	0.129	0.664	0.577	0.395	0.372	0.700	0.666
Flush toilet	0.034	0.057	0.049	0.054	0.142	0.133	0.128	0.140	0.377	0.331	0.351	0.353
Mean years education of adult household member	7.070	6.116	6.514	6.823	7.776	6.902	7.441	7.865	9.120	8.122	9.047	9.382

Source: Zambia Living Condition Monitoring Surveys; calculation by the authors.

is different in Zambia: there we see strong increases in TV, video, and radio ownership over time. In Indonesia, we similarly see a strong increase in TV ownership between 1997 and 2007. For electricity we observe increases from very low levels in both countries to almost universal coverage in Indonesia and coverage of about two thirds in Zambia. Particularly for Zambia there is practically no expenditure gradient for electricity visible. Electricity is a good example for asset development that is rather independent of expenditure development, and likely related to public action.

There is also massive asset drift for telephones in Zambia. In the first surveys hardly anyone owned a telephone, while in the last survey a sizeable fraction in Zambia owned a telephone. As we already noted for electricity, telephones also spread rather independently from expenditure development. For piped water and flush toilets the picture is very different. In Indonesia ownership of both assets increases strongly over time, and again we could conclude that the development of these assets is independent of expenditure development, and likely related to public action. In Zambia we do not see much improvement over time at a given expenditure level. The other assets are only available for one of the two countries and it is therefore difficult to compare their development.

To summarize, the general picture that emerges from this analysis is the following. First, there are some assets, which increase regardless of income levels and trends. This appears to be most clearly the case for phones (including mobile phones) and TVs. Here preferences and relative prices are surely important factors that affect this development, and they seem to operate as much in countries with low and high growth. Second, some aspects seem to be highly erratic and quite unconnected to income levels, including access to water and electricity as well as education. Clearly, this is more driven by public policy than by income levels or trends, preferences, or prices. Third, it would be interesting to study to what extent asset drift is due to low disposal rates so that households simply accumulate assets and dispose of them rarely; this is a particular problem since ideally we would want to estimate asset services (a flow measure) rather than asset possession (a stock). The surveys do not allow a full assessment of this issue but the Indonesia panel survey provides some information on this topic. In Table 11, we simply ask the question whether households added new assets, recorded no change in assets, or no longer report possession of these assets, presumably due to disposal of assets.[17] The table shows that asset accumulation rates are substantially higher than disposal rates. In particular, households appear to be reluctant to dispose of TVs, vehicles, and refrigerators, particularly in the last period. These low disposal rates suggest that it is likely there is great heterogeneity in asset services between households; those who bought assets in the more distant past might get much lower services from them than those who purchased them recently. This suggests that relatively low disposal rates are a part of the explanation for asset drift and particularly bias asset services between households.

[17]To be sure, some of those households that do report continued possession of an asset might have disposed of it and replaced it with a new one. So "disposal" could be underestimated here.

TABLE 11

Asset Accumulation and Disposal in Indonesia, 1993–2007

	Jewelry	Electrical Appliances	Vehicles	TV	Refrigerator
t2–t1 (1993–1997)					
Added (%)	0.23	0.14	0.24	na	na
No change of household without asset (%)	0.28	0.14	0.44	na	na
No change of household with asset (%)	0.35	0.62	0.23	na	na
Not available any more (%)	0.15	0.10	0.09	na	na
t3–t2 (2000–1997)					
Added (%)	0.18	0.10	0.14	0.11	0.06
No change of household without asset (%)	0.24	0.13	0.39	0.32	0.83
No change of household with asset (%)	0.42	0.69	0.31	0.49	0.09
Not available any more (%)	0.16	0.08	0.16	0.07	0.03
t4–t3 (2007–2000)					
Added (%)	0.15	0.15	0.25	0.25	0.19
No change of household without asset (%)	0.24	0.07	0.31	0.18	0.68
No change of household with asset (%)	0.39	0.72	0.34	0.52	0.10
Not available any more (%)	0.22	0.05	0.11	0.06	0.03

Source: Indonesia Family Life Surveys (IFLS); calculation by the authors.

Lastly, it is not entirely clear whether one can identify any asset in the two countries that would appear to proxy income well and not be affected by the biases mentioned above. Such an asset should have a strong income gradient (i.e., richer households are more likely to own it), and not change much over time for the same level of real incomes. Possible candidates might be the quality of the floor material, or the number of rooms in Indonesia and refrigerators in Zambia. Further research should examine this using more surveys from more countries.

4. Discussion and Conclusion

In this paper we have investigated to what extent one can use asset indices and the growth of these indices (or that of individual assets) as proxies for GDP and consumption growth. Motivated by studies by Sahn and Stifel, and Young, we ask the more general question whether asset indices, such as those that are provided and can readily be calculated using DHS data, are reliable proxy indicators of assessing changes in economic performance across space and time. This is of importance as a cross-validation of possibly poor income and income poverty statistics in Africa (and elsewhere). It is also of importance as asset growth rates have been used by these authors to suggest that Africa has been growing much faster than is reflected by income and income poverty statistics. Our most important conclusions are as follows. First, the evidence of high asset growth in Africa is partly based on the availability of DHS data from a selected sample of more successful African economies. This selected sample therefore overestimates economic performance in Africa. Second, aggregation matters. Using standardized asset indices versus our count indices significantly alters the results. Third, there is evidence of asset drift, both in Africa as well as elsewhere. This is particularly the case for more "modern" assets such as TVs, telephones (including mobile phones),

and the like. Using growth in these assets to proxy for income growth will overestimate economic performance; in fact, given the lack of any correlation, monitoring the growth of these assets will not provide any information on consumption growth. This evidence is present when using aggregate trends as well as when linking assets to real income levels using micro data. Fourth, and closely related, growth of assets and growth of consumption are hardly correlated at all, neither in Africa nor elsewhere. This is due to the combination of issues raised above, including the role of prices and preferences, public policy, and asset accumulation. Thus at this stage, it appears difficult to infer any clear statement that would link asset changes to per capita consumption or income changes. Consequently, we have no real basis for supporting the claim of an African economic growth and poverty reduction miracle. While we agree that there are serious problems with African GDP and poverty statistics, we cannot conclude from the analysis of asset changes that existing GDP and poverty statistics substantially underestimate true economic performance in Africa.[18]

Further research should try to examine more closely whether there are some assets which are closely linked to income and less prone to the biases mentioned above. For this, more analysis at the micro and macro level of the type produced here will be required. Second, we are currently unable to distinguish clearly among the various biases that render asset-based income proxies possibly unsuitable to study trends in incomes. While we provide some evidence that low disposal rates are part of the story, sorting out these biases (i.e., relative prices, preferences, public policy, and age and accumulation issues) is an important area for further investigation. Lastly, while these asset indices might not be suitable proxies for income and consumption trends, they might indeed be more useful as proxies for multidimensional well-being indicators. If interpreted in that sense, one may possibly argue that well-being in Africa has improved by more than suggested by income data. But if that was the aim of the exercise, one should try to identify assets that are particularly good proxies of well-being rather than looking for assets that proxy income well; this is similar to the agenda of the recently published Multidimensional Poverty Index by UNDP which derives a poverty measure based on the possession of selected assets (UNDP, 2010). Clearly, this is an agenda worth pursuing further.

Our paper also suggests that there are no easy shortcuts to bypass the current problems associated with poor national accounts and household survey statistics in Africa. While proxies offer tantalizing opportunities, we have shown that there are inadequate alternatives to addressing the tough challenge of improving national account and survey information in Africa. As shown in other papers in this Special Issue, these problems are well understood, the solutions are, in principle, available, and some countries have made good progress in implementing

[18]There is the question of how the larger mismatch between asset growth and consumption growth in Africa than elsewhere can be explained, an important aspect of the study by Young (2012). But note first that part of the mismatch is related to the sample used by Young. When considering our longest sample, the mismatch is only slightly larger in Africa than elsewhere. Second, since Africa started off with a lower asset base than most other regions, the higher growth of assets might simply be related to a catch-up effect on household assets.

them. The challenge now is to move forward on the agenda of implementing much-needed improvements on national accounts and survey information in African countries.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table A1: GDP Per Capita, Consumption, and Assets by Country and Year