Growth and poverty reduction in Uganda, 1992-2000: Panel data evidence[1]

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Abstract: To explore factors underlying growth and poverty reduction in Africa, as well as the magnitude of future challenges, we use micro level evidence from Uganda spanning the 1992-2000 period. Policy variables such as farmgate prices for agricultural exports, access to public goods such as health care, electricity, and infrastructure, as well as initial endowments of physical and human capital are found most important for growth and poverty reduction. Simulations confirm that policies to confront widening regional disparity are feasible but will require a sustained effort.

1. Introduction

Even though bringing about sustained growth in Africa remains a key challenge for development (Collier and Gunning, 1999), the empirical literature on economic growth has had difficulty coming to grips with the particular character of this continent. In virtually all cross-country growth regressions, the "Africa dummy", i.e. some unexplained factor that causes African economies to show significantly lower growth than the rest shows up uncomfortably large. Attempts to whittle down the size of this dummy (e.g. Freeman and Lindauer 1999, Gallup and Sachs 2000; Sachs and Warner 1997) by changing the way in which specific variables are constructed or by introducing variables relating to institutional, physio-geographic, and ethnic endowments have, in this context, had only some limited success. As a result, even though there are large differences in recent growth performance between African countries, a large part of "Africa's growth paradox" (Easterly and Levine 1997) persists. Using existing evidence to conclusions that are of relevance to and acceptable by policy makers will require to identify factors that have helped countries to increase growth and reduce poverty more specifically.

In this paper, we use data from a panel of about 1200 households that span the 1992-2000 period to explore determinants of economic growth and poverty reduction for Uganda,. Uganda shares many of the structural factors that are generally held responsible for low growth in an African context. It is ethnically very diverse, subject to tropical diseases such as malaria, does not have direct access to the ocean, and had to cope with a large onslaught of AIDS since the late 1980s. These obstacles notwithstanding, Uganda has, over the past decade, managed to achieve some of the highest growth rates in Africa. Analysis of the factors underlying this performance can help to better understand growth and poverty reduction in an African context, provide policy-relevant insights that go beyond what is know from the cross-country literature. By providing a better understanding of the character and magnitude of the challenges ahead, it can also help formulate policies that could address these challenges.

To do so, we proceed in three steps. First, we estimate determinants of economic growth at the household level, drawing on the insights gained in the cross-country literature. Second, we expand

this to a consideration of poverty reduction in an attempt not only to assess whether some policies have affected growth and poverty reduction differentially, but also to explore factors that have helped households to escape poverty during the period. Third, we use the estimates obtained for changes in poverty to perform simulations regarding the impact of different government policies. The analysis is based on a rich set of variables which includes initial household characteristics and endowments, access to infrastructure and health services, social capital and violence, as well as farmgate prices for the main agricultural outputs. Having such information at the household level allows us to address most of the issues that have been of interest to the cross-country literature in a way that is less subject to aggregation bias and unobserved heterogeneity while at the same time providing insights on the impact and magnitude of policies, public services, and asset endowments.

A first finding is that *price changes* for the country's main tradable product, coffee, were a major factor underlying overall economic growth. While this is not too surprising in view of the overwhelmingly rural nature of Uganda's economy, it is noteworthy that, according to our results, such price changes also had a significant and positive impact on the poor. The finding that liberalization of agricultural markets which results in increased prices for producers had a strong poverty-reducing effect is consistent with anecdotal evidence highlighting that there was considerable entry by small producers into the coffee industry. It suggests that barriers to entry into cash crop production have been relatively low and that small producers are able to respond to price signals. At the same time, the magnitude of the price responds highlights the dangers posed by sudden price decreases, and in particular the vulnerability of the poor in an agrarian economy that did not yet manage to meaningfully diversify its portfolio of cash crops beyond coffee. Efforts to improve producer prices in other crops such as cotton and measures to help enhance diversification at the farm and the marketing and agro-processing stages remain an important part of the agenda for sustained poverty reduction.

A second conclusion is that *initial endowments* of physical and human capital have greatly enhanced the scope for households' income growth, presumably by allowing households to better capitalize on the broad macro-economic changes undertaken during the period. This supports the hypothesis that physical assets and human capital are of greater importance in a liberalized economic environment. Simulations suggest that, through a combination of price increases and policies to enhance investment and access to assets, much of the structural disadvantage of the North and the East can be overcome.

Finally, access to key *public goods* such as electricity, infrastructure, education and health care, as well as maintenance of peace and order and the avoidance of civil strife have been critical determinants for households' ability to increase their income and reduce the risk of falling into poverty. We find that between 1992 and 2000, returns to physical and human capital have increased considerably, implying that households with higher initial endowments of those were able to improve their welfare. Policies to encourage asset accumulation and investment, in addition to measures that

could help provide public goods in an efficient and equitable manner has potential for improving the scope for future poverty reduction in Uganda.

The paper is structured as follows. Section two reviews the literature and the econometric specification to be applied. Section three describes the data and illustrates key changes in socio-economic variables in the aggregate as well as for poor and non-poor and different regions. It also provides a brief description of changes in inequality for both income and assets (in the cross section) and changes in poverty for the households included in the panel. Section four contains a discussion of the econometric evidence for changes in per capita expenditure as well as poverty. Section five concludes with a number of suggestions for policy and research.

2. Key questions and methodology

Determinants of growth and poverty reduction have been discussed in a large cross-country literature. In this section, we review some of the key methodological issues associated with the reliance on cross-country data in the literature and how use of household level data can potentially improve on this. We use this to motivate the choice of specific variables to be included in subsequent regressions.

2.1 Determinants of long-term growth: Lessons from the literature

Determinants of long-term income growth and, to a lesser degree, poverty reduction, have been explored in great detail by comparing across countries. Following the studies by Mankiw, et al. (1992) and Barro (1991), a large and rapidly expanding literature has tried to identify the relationship between initial endowments, government policies, and other factors, on growth. Starting with the variables suggested by standard neoclassical growth models, the range of factors considered has expanded rapidly to include measures related to institutional infrastructure, the distribution of opportunities and assets, and physio-geographic and natural characteristics of the country under concern. This was in parallel with a significant increase in the quality of some of the variables used for this purpose (e.g. on human capital endowments).[2] The insights from this literature have inspired thinking on economic development and policies that might be conducive to higher levels of more broadly based growth. At the same time, these contributions leave open a number of questions and issues (Durlauf and Rodrik 2001; Easterly 2001):

First, the limited number of country observations available and the open-endedness of the underlying model puts limits to the ability to more rigorously test the robustness of the underlying hypotheses and the parameters obtained. In view of the fact that many of the dependent variables are highly

[2] The reader is referred to Durlauf and Quah (1999) for a comprehensive overview of the "standard" growth models and to Aron (2000) for a discussion of the more specific institutional variables incorporated. Some of the more important variables relate to institutional issues and the rule of law (corruption in Mauro, democracy in Barro, civil liberties, instability, political rights, bureaucratic performance), initial mineral wealth and other endowments such as distance to the equator and land-lockedness (Sachs and Warner 1997), inequality, policy variables such as price distortions and levels, fertility (Barro 1999; Easterly and Levine 1997), government consumption, health (Sachs and Warner 1997), socio-economic variables such as religion, and war (Collier and Hoeffler 2001).

correlated among each other, this implies that any specific result may be highly dependent on the particular specification adopted. National level data also suffer from considerable aggregation bias which tends to lump together a large number of policy changes into a single dummy, thus making it difficult to identify the impact of specific measures in individual sectors (e.g. health or education). This is exacerbated by the fact that many of the variables chosen are at best imperfect representations of what the model intends to measure. Unobservable heterogeneity between and within countries compounds this problem (Brock and Durlauf, 2000).

Second, looking only at aggregate country-level data also make it more difficult to deal with issues of poverty and inequality in addition to growth and in an integrated framework. A number of contributions have pointed to the possibility that initial asset endowments are a critical determinant for future growth (Aghion et al. 1999; Bardhan et al. 1999). Testing this, together with the question whether policies aiming to increase growth will also help the poor (Dollar and Kraay 2000; Rodrik, 2000), is very difficult with existing cross-country data sets which are too noisy to make specific inferences on the issue (Deininger and Squire 1998; Banerjee and Duflo, 2000). Barring significant improvement in the data basis available, cross-country data and approaches will not allow to resolve this issue (Bourguignon 2000).

Finally, to the extent that differences in growth are "explained" with reference to immutable country-specific factors, the relevance of cross country evidence for actual policy formulation is limited. Although immutable country-specific factors such as the length of a country's coastline (or whether it is landlocked or not), its ethnic composition, and location in the tropics can "explain" significant part of the variation in growth rates observed across countries, the policy relevance of such a finding is limited. Exploiting the heterogeneity across individuals within a country would thus provide an opportunity to draw conclusions that are more meaningful from a policy perspective.

To overcome the limitations inherent in the cross-country literature and gain additional insights on issues of the behavioral relationships related to growth, poverty, and inequality, a number of authors have resorted to micro-level panel data. For example, Jalan and Ravallion (2001) use an annual panel covering four periods in six provinces in China to explore households' ways of consumption smoothing and risk coping. Glewwe and Grangolati (2000) explore a two period panel from Vietnam that spans 4 years to illustrate not only the regionally differentiated nature of growth but also to identify factors that helped households to escape poverty or that caused them to fall into poverty. Glewwe and Hall (1998) use similar panel data from Peru to explore how differences in initial endowments affected households' ability to deal with a macro-economic crisis. This illustrates that panel data analysis can provide interesting lessons to link micro-outcomes to macro phenomena especially if the information available spans policy changes at the macro-level such as liberalization of input or output prices, modification of subsidy schemes related to social services and education, or a large contraction due to balance of payment difficulties.

Although data for Africa have been more limited in the past, a number of recent panel data sets are allow utilized to analyze similar questions in this continent. Carter and May (2001) illustrate the differential impact of pre-existing differences on the ability to overcome pre-existing cleavages, and in particular the impact of initial asset endowments as a factor in allowing the previously disadvantaged population to make up for discrimination in the immediate post-apartheid period (i.e. 1993-1998). Dercon (2001) uses a shorter panel from Ethiopia to demonstrate the importance of price variables as well as exogenous shocks (rainfall) for the analysis of growth at the households level in Ethiopia.

Our analysis builds on these contributions and aims to apply them to the study of growth determinants in Uganda. We use data set from Uganda that spans not only a relatively long period (1992-2000) but also coincides with considerable changes in policy, in particular liberalization of agricultural trade in the early 1990s, a coffee price boom up to 1995/96, and the adoption of a program of Universal Primary Education in 1997. While there is little dispute that, over this period, Uganda has experienced a remarkable fall in aggregate poverty, the extent of poverty reduction and growth has been very diverse across regions. The contribution of different policy factors to this outcome, as well as the regional distribution of poverty reduction, are insufficiently understood. Use of the panel data allows us to minimize problems of measurement error and unobserved heterogeneity that would otherwise limit the comparability of data. At the same time they provide a rich set of policy relevant variables that allows to focus on specific policies that might have contributed to changes in households' expenditure as well as their poverty level. Before discussing the econometric specification, we describe the data and the variables included.

2.2 Data sources and variables

Our data come from two large scale Ugandan household surveys. The first one is the 1992 Integrated Household Survey, a comprehensive multi-purpose household survey based on a nationally representative sample of 9886 households. In addition to the standard socio-economic and expenditure information, this survey contains detailed information on economic activities for small-scale enterprises operated by the household in six sectors, namely crop and livestock farming, manufacturing, services, trade, and hotels. The second source of data is the 1999/2000 Uganda National Household Survey (UNHS), a nationally representative survey of 10,696 households fielded between August 1999 and September 2000. Even though it contains less detail on other enterprises, it includes a highly disaggregated account of agricultural production.[3] Both surveys were accompanied by an elaborate community module that allows to link households' use of social services to changes in the supply of such services at the community level. Moreover, the UNHS included a panel element of about 1,300 of the same households that were included in the 1992 survey. We use the panel, together with information on initial household characteristics, infrastructure, health, social capital, and output

prices, to make inferences on determinants of growth and poverty reduction at the household level. The justification for choosing specific variables, as well as some details regarding their construction, is explained below.

Physical and human capital assets: If credit market imperfections or other indivisibilities in investment imply that only households with a minimum level of assets can make investments that enable them to enhance the return to their labor (Birdsall et al. 1999)[4] or if changes in macro-policy such as liberalization result in a sudden increase of returns to existing assets, initial asset endowments will have a significant impact on changes in households' consumption and poverty, as well their ability to overcome shocks (Aghion et al. 1999). Inclusion of households' initial stock of physical assets, calculated based on retrospective information given in the 2000 survey,[5] allows to test to what extent ownership of higher initial endowments of physical capital has been associated with higher levels of growth or have enhanced households' ability to escape poverty.

Although cross-country regressions have in some cases had difficulty to obtain clear results,[6] numerous micro-economic studies confirm that, especially in situations where technology or other economic conditions change rapidly, human capital will have a key impact on growth (e.g. Rosenzweig 1998). In Uganda, analysis of the impact of education on subsequent growth is of particular interest to assess whether the recent emphasis on expanding access to education through government programs, especially the Universal Primary Education initiative (UPE), have targeted one of the critical factors for subsequent development. We use the mean number of school years completed in the household to represent the initial human capital endowment.

Infrastructure: A key lesson from the empirical literature on cross-country growth is the significance of infrastructure and "endowment" variables such as whether or not a country has access to the sea (Sachs and Warner 1998), the length of its coastline, or the presence of minerals that can be exploited. These estimates may be biased insofar as they capture other country-level fixed effects,[7] more careful construction of changes in the stock of infrastructure finds a smaller, though still significant impact (Canning 2000). Sub-regional studies find that government spending on infrastructure makes an important and highly significant contribution to poverty reduction (Fan et al. 2000). Two key

[3] For more detail on survey design see UBOS 1992 and 2000.
[4] An illustration for the latter would be investments to improve land or housing which will not be undertaken if the household is a tenant and does not own any of the assets in question.
[5] To measure assets in a comparable way, the 2000 survey asked for current as ell as past values of 12 categories of household assets including buildings, 9 types of livestock plus structures for livestock rearing, and 10 categories of enterprise land, tools, transport equipment, and other enterprise assets. The need to rely on retrospective information so arose because of deficiencies in the 1992 data. In-depth study of the extent to which there is mis-reporting or mis-recording of assets in the survey could provide important methodological and substantive insights but clearly exceeds the scope of this paper. As the survey asked households only about the relative level of asset ownership (did not one, somewhat less, much less, somewhat more, much more) as compared to the present, we imputed 1992 asset values by multiplying the value for each of the items with 0, 0.75, 0.5, 1.25, and 1.5, respectively).
[6] A number of ways to construct appropriate measures of countries' human capital stock have been discussed in the literature (see Barro and Lee, 2000). In many cases, however, coefficients in cross-country regressions turned out to be either insignificant or even negative (Forbes, 2000; Freeman 1999)
[7] One could think of many such variables. For example, the density of the road network, agro-climatic potential including variables such as soil quality and rainfall, as well as natural disease pressure and the availability of (public or private) preventive and curative infrastructure.

infrastructure assets in Uganda are availability of electricity and roads. To assess to what extent infrastructure access affects a household's growth opportunities, and one could thus make a case for government to increase provision of such infrastructure, we use the availability of electricity at the household level and infrastructure access as measured by the community-level distance to the municipality.

Health: While earlier literature paid scant attention to health issues, a number of recent studies have pointed out the importance of disease pressure, proxied initially by a "tropical dummy" and subsequently infant mortality or proxies for the incidence of malaria, as a possible constraint for economic growth especially in Africa (Gallup and Sachs 2000, Masters and Sachs 2001). While anecdotal evidence strongly supports this hypothesis, better measurement of the underlying phenomenon would be very desirable. We do so by using household level information on whether or not diseases were experienced in the initial period. Based on the finding that observed illness is strongly related to supply-side factors such as (non)-availability of doctors and medicines and quality of service (Deininger, 2001) this can reasonably taken to capture at least part of the supply side phenomena of interest and we use a dummy for observed illness to measure access to health services in the regression.

Social capital: Following the identification of ethnic diversity as a factor that is directly or indirectly responsible for much of Africa's "growth tragedy" (Easterly and Levine 1998), a wide range of social capital related variables have been constructed and included in country-level growth regressions (Aron, 2000). In our context, two types of such social capital variables are of interest. One affects primarily the cost of entering in and conducting economic transactions of all kinds (Fafchamps and Minten, 2000).This would include variables such as the density of the social network, presence of mutual trust, confidence in local institutions, and levels of ethnic diversity. A second set of variables related to conflict and civil strife can not only impede economic transactions but also cause direct damage and destruction of the economy's stock of human and physical capital (Collier 1999).[8] We use initial levels of ethnic diversity to proxy for the first and civil strife as indicators to proxy for the second. In view of Uganda's high level of ethnic diversity,[9] a variable to represent the former is constructed from community-level information on the share of the five most important ethnic groups in the community and normalized to fall between 0 and 1. To capture the incidence of civil conflict, we include a household level variable equaling one if, in 1992, the household's economic activity was affected by civil strife and zero otherwise, a variable that was obtained retrospectively (together with information on current exposure to civil strive) in the 1999/2000 survey.

Household data allow us to use more specific measures for each of the above. For example, landlocked nature and distance to the equator are factors that do not vary over time and are likely to proxy for other unobserved characteristics. These might include transport costs and.

[8] In fact, a strong and negative impact of civil strife on economic growth has recently been and which has recently received independent attention (Collier and Hoeffler, 2000). A more detailed analysis of this phenomenon is available in Deininger (2001).

[9] Clearly, with 51 recognized ethnic groups many of which can not understand each other's languages, ethnic differences continue to be a major determinant of social interaction in today's Uganda.

Output prices: One of the key features of recent policy reforms in Uganda as well as other African countries has been the elimination of taxes and other controls on prices for agricultural output, something that resulted in a significant increase in farmgate prices for coffee, Uganda's main export crop. To capture this price increase we use the change in regional median prices for coffee, the main marketable output, between 1992 and 2000. We also note that, even though, during the period under concern, changes in export taxation have been the driving force underlying the observed changes in output prices, producer prices and/or the profitability of agricultural production would be equally affected by improvements in road or marketing infrastructure that would reduce the margins involved in bringing output from producers to consumers or exporters. This is an area where the use of household level data is of particular relevance and further study could yield important additional insights.

2.3 Econometric specification

Let Y_{it} be per capita expenditure including home consumption of household i in period t and define the growth rate of this variable between t-1 and t (here taken to represent 1992 and 2000) as ΔY_i (i.e. $\Delta Y_i = Y_{it} - Y_{it-1}$). Then, the growth equation to be estimated regresses observed growth on a set of initial conditions, i.e.

$$(1)\ \Delta Y_i = \alpha + \beta \boldsymbol{X}_{it-1} + \gamma \boldsymbol{Z}_{it-1} + \varepsilon_i$$

where $\boldsymbol{X}_{it-1}$ is a vector of initial household level characteristics, including endowments with human and physical capital from the standard growth model as well as variables relating to health, gender, and household composition. $\boldsymbol{Z}_{it-1}$ denotes a vector of initial community-level variables including access to infrastructure, other public goods and "bads" (violence and ethnic fractionalization), price changes, and initial income and poverty levels at the community level (excluding household i) as explained above.[10] Note that use of changes in income will not necessarily eliminate household fixed effects but will result in more efficient estimates (Glewwe and Hall 1998).

In addition to examining the impact of initial conditions on households' income growth, we are interested in the effect of the same variables on changes in the level of poverty. To measure poverty, we use the poverty line constructed by Appleton (2000) and let ΔP^{α}_i be the change in the Foster-Greer-Thorbecke index P^{α} ($\alpha = 1, 2$) for household i between the two periods.[11] We can then define a reduced form regression similar to the one above for changes in poverty with right hand side variables defined analogously.

$$(2)\ \Delta P^{\alpha}_i = \alpha + \beta \boldsymbol{X}_{it-1} + \gamma \boldsymbol{Z}_{it-1} + \delta P^{\alpha}_{it-1} + \varepsilon_i$$

[10] Questions on community-level infrastructure access were asked retrospectively as well but revealed relatively little change over time, forcing us to use only initial conditions in the regression.

[11] As the poverty headcount (P0) is just a discrete representation of (continuous) changes in P1, we do not include it separately.

The right hand side variables are the same as those included in the growth equation discussed earlier. Since the dependent variable is the change in the level of poverty, it will help to identify variables (and thus policies) that are of particular relevance to poverty reduction. Comparing between the two regressions would thus potentially allow to identify policies that would have particular benefits for the poor, something that will be of relevance in discussing the results.

As a key purpose of the analysis is to identify changes in the incidence of poverty, we complement this evidence with a multinomial logit regression based on a variable ΔP_i which takes three values (-1, 0, and 1) for households who escaped poverty, remained in their previous status (either poor or non-poor), or fell into poverty, respectively. Using a set of right hand side variables that is similar to what was reported earlier, this multinomial logit regression can be specified as

$$(3)\ \Delta P_i = \alpha + \beta \mathbf{X}_{it-1} + \gamma \mathbf{Z}_{it-1} + \varepsilon_i$$

The advantage of this specification is that it allows to distinguish between factors that contribute to households falling into poverty and those that help them to escape the latter, an issue that needs not always to be symmetric. Moreover, it allows to conduct simulations that help to assess the impact of specific policy measures on the share of households falling into or escaping poverty.

3. Evidence on growth and inequality in Uganda

This section discusses data sources underlying the analysis together with a number of descriptive statistics regarding changes in income, assets, and poverty, as well as the distribution of income and assets in the overall sample. In the 1992-2000 period, economic growth in Uganda has been considerable and the per capita expenditure distribution in 2000 dominates the one in 1992. At the same time, the fact that relative disparities seem to have widened suggests that not everybody benefited equally from economic growth. To set the stage for this analysis, we briefly describe how the panel households differ from the overall sample and discuss changes in the level of poverty they experienced.

3.1 Changes in socio-economic characteristics

To illustrate the extent of changes between the two years as well as changes in the data included in our sample, table 1 presents descriptive statistics from the two cross sections. Information is provided for the total sample (columns 1 and 2) and for poor (columns 3 and 4) and non-poor households in both periods. Table 2 contains the same information disaggregated by region.

Occupation and sources of income: Information on the occupation of the household head indicates that Uganda continues to be being a predominantly rural society where the agricultural sector remains of paramount importance. With about 70% in both years, the large majority of Uganda's households draw their main livelihood from agriculture. In fact, the share of the poor who indicate to derive their

main livelihood from agriculture has increased, from 72% to 78%, pointing towards the danger of subsistence agriculture to develop into a refuge of poverty as well as the critical role of rural and agricultural growth to poverty reduction. About 27% of households were headed by females in 2000, as compared to 30% in 1992. While agriculture is a major source of income, the fact that about 46% of households had a non-farm enterprise indicates that Ugandan households rely on a diversified portfolio of income sources. At the same time, the large majority of these enterprises are of a very small scale, and only about 15% of those who have non-agricultural enterprises employed any hired labor. The fact that neither the share of households with non-farm enterprises nor the employment intensity of these enterprises appears to have expanded over time suggests that either high rates of enterprise startups were mirrored by equally high rates of mortality and disappearance of enterprises or that the observed income increases are mainly due to expansion of existing family-based enterprises.

Education: During the period under concern, one of the main pillars of Government policy has been the expansion of educational opportunities at the primary level through the program of Universal Primary Education. The relatively small overall decrease in the share of household heads without education (from 31% to 26%) suggests that it will take some time for this policy measure to have visible consequences. Still, the share of non-poor households whose head does not have any education has dropped dramatically, from 26% to 17%. Comparing this to the stagnation in the case of poor households (where the figures are 31% and 30%, respectively) could indicate that even a minimum level of education allowed households to escape poverty. It may suggest that education may indeed be an important determinant of the ability to escape poverty, something that will be explored in more detail in the regressions.

Asset accumulation: While descriptive data can not provide direct insights into the extent to which low asset endowments are a factor that contributes to poverty, they highlight two key facts. First, the degree of asset accumulation was not only very low but also differed markedly between poor and non-poor. With an average of 0.3% per annum, investment was virtually absent for the poor while the non-poor were able to accumulate assets at a rate of more than 4% per annum. The typical household's asset stock increased thus by only 2.7% per annum. Even though the figures obtained here may be affected by measurement error and the rate of investment at the household level will differ from overall increases in the economy's capital stock, this suggests that up to now the changed macro-economic environment has failed to elicit a meaningful investment response from the majority of households. As failure to increase the economy's capital stock may eventually undermine the scope for economic growth, this is an important policy issue which should be addressed with priority. A second observation of interest in this context is that the share of enterprise assets other than land remains quite limited. In both periods, land constituted more than 50% of the assets held by the mean household. Together with the fact that a significant share of the output increases (e.g. from perennials)

that could contribute to higher rural growth depend on land related investments, this implies that policies relating to land issues, for example those that aim to increase land access, transparency of land administration and transferability of land will have important implications for households' wealth.[12]

As housing is normally strongly correlated with wealth, information on housing conditions, in particular the change of such conditions over time, can provide a quick assessment of changes in income and wealth over time. The fact that the share of households with thatched roof has dropped considerably, from 61% to 42%, as well as reductions of the share of households with dirt floor (from 55% to 46%), suggests that, by this measure, there was indeed an improvement in overall living standards. Roofing, and to a lesser degree also flooring, have also improved markedly for the poor (from 61% to 47% and 56% to 51%, respectively). At the same time, and compared to the increase in households' own investment, provision of public infrastructure services seems to have expanded at a more modest pace. While availability of piped water increased, access to electricity has been stagnant and has actually decreased for the poor.

Health: Observed levels of sickness are affected by exposure to different sources of environmental risk and access to preventive and curative services. The data point towards an increase in the number of days lost to illness by the average household in the month immediately preceding the survey, from about 8 days in 1992 to 12 days in 2000. As the AIDS epidemic in Uganda is widely believed to have reached its peak by or before 1992, it is unlikely that an increase in AIDS-related illness underlies this phenomenon. A more likely reason is a worsening of access to health services that was associated with higher levels of cost recovery and absence of clear policy directives comparable to the UPE policy in the education sector. In 2000, almost two thirds of the incidents of sickness and an even greater share of the days lost were due to malaria.[13] The data also indicate that more than one fifth (23%) of the households experienced the death of a family member between 15 and 40 years of age during the period under concern, most of which are probably related to AIDS in some way. The potential for such a large share of deaths to have a broader economic impact on the survivors as well is illustrated by the fact that two out of every five households (42%) are host to at least one orphan child.

Ethnicity and civil strife: To measure the incidence of civil strife, theft, and inter-personal violence, the 2000 survey asked households whether they have been affected by any of these in 1992 or 2000. The variable allows to draw two conclusions of interest (table 1). First, instead of the decrease in the incidence of civil strife over time which one would expect in a "post-conflict" society, we find a marked increase in the number of households who report to be affected by such unrest, from 7% in

[12] This can also explain the heated discussion and the politically very sensitive and contentious nature of legal changes such as the passage of the 1999 Land Act.
[13] No information on the type of illness is available for 1992, precluding us from making a direct comparison of the incidence of different types of sickness between the two periods.

1992 to 15% in 2000, most of which is concentrated in the North and West of the country. Second, with an incidence of 15% in 2000, households unequivocally report civil strife as a more important source of economic damage than theft (10%) and personal violence (4%), the levels of which also have increased much less during the period under concern.

3.2 Changes in the distribution of income and assets

To explore to what extent such improvement in absolute levels of expenditure has translated into a narrowing of the *relative* disparities across regions as well as rural and urban sectors, we compare inequality in the distribution of per capita expenditure as well as household assets as measured by relative means and the Theil index as an indicator of inequality (table 3). Doing so points towards continuing importance of inter-regional disparities in terms of income but a slight narrowing of the dispersion in terms of assets: While, in 1992, the average household in the Central region spent 80% more per capita than the average household in the North, a net gain in the Center and a loss in the North implied that, in 2000, the mean household in the Center spent more than three times of the Northern one.[14] Also, despite the government's emphasis on a pro-rural policy, rural-urban disparities have widened. In 1992, rural inhabitants' expenditure amounted to about 87% of the mean (compared to 1.80 times by urban ones), a share which, in 2000, had dropped to 77% (as compared to 2.21). The widening of rural-urban and inter-regional disparities is confirmed by the decomposition of the Theil index of inequality which points to a small increase in within-group inequality but a significant increase in between group inequality. Emphasis on relative rather than absolute welfare could thus explain that, in participatory exercises, many households feel that their (relative) situation had failed to improve, even though mean income has increased for everybody thus providing a possible explanation for the fact that qualitative surveys found many households to be quite dissatisfied with their present situation as compared to earlier (UPPAP 2000, McGee 2000).

Although inequality of income and expenditure is important for subjective perceptions of welfare, households' ability to overcome long-term poverty may be more affected by levels of asset ownership. We note that, at the national level, as well as for rural and urban areas separately, the level of asset inequality prevailing in 1992 has been reduced, e.g. from 1.75 to 1.56 at the national level. As illustrated in table 3, there has been an insignificant increase in between-group inequality and a marked reduction in within-group inequality. This suggests that, during the period, asset-poor households have had the opportunity to catch up with their more wealthy neighbors. Notwithstanding, evidence as to the low overall level of such assets suggests that, in addition to adopting policies that would allow them to make productive use of such assets, it may also be useful to consider policies that would increase the overall level of investment. This conclusion is reinforced by the fact that, as illustrated in table 3, levels of asset inequality have decreased considerably in all of the regions under

concern suggesting that in the past increased investment opportunities did not contribute to widening inequality in the distribution of assets which may then lead to dualistic patterns of development. The finding that, at the same time, inequality in households' asset endowments has narrowed, suggests that growth opportunities have been relatively equitably shared and provides a motivation for the empirical investigation of this issue based on the household panel.

A graphical illustration of the extent to which overall per capita expenditure increased between 1992 and 2000 is provided in figure 1 which plots the cumulative density of the logarithm of this variable across households for the 1992 or the 2000 survey. It is clear from the figure that the second distribution dominates the former, i.e. that, if ranked by the distribution of income, households were unequivocally better off in the second than in the first period.[15] To illustrate, in 2000, less than 20% of households had a per capita income below 120 US $ (the middle point in the picture) while in 1992, about 35% of households had less than this amount available. Thus, in the aggregate, and in absolute terms, growth has made everybody better off.

3.3 Changes in income and poverty for panel households

From the analysis of the cross sectional surveys, we now move to the panel. It is well known that, to the extent that the pattern of attrition is non-random, inclusion of a panel component in a multi-purpose household survey will not necessarily yield a nationally representative sample even if the original survey was designed to be representative. As this danger increases with the amount of time elapsed between the two survey periods, it could be of particular relevance in our case. Running a probit regression where the probability of being included in the panel is a function of initial household characteristics suggests that, as one would intuitively expect, the probability of attrition decreases with household size and with education and assets. The results form such a regression, reported in appendix table one, indicate that having one additional household member decreases the marginal probability of being in the panel by 0.6 percentage points. Households who initially lived in urban areas or had access to electricity were significantly less likely to re-appear in the panel than are rural ones. Concerning the regional distribution of the sample, we note that panel households are disproportionately concentrated in central and western province and least likely to be encountered in the North as well as the East. While keeping these characteristics in mind will be useful in interpreting the results from subsequent descriptive statistics and regressions, we conclude that, even though descriptive data derived from the panel will not be representative of the population as a whole, use of the panel element to identify behavioral relationships is unlikely to impose unreasonable bias, as has been confirmed for other household surveys (Alderman et al. 2000).

[14] No regional price deflators were applied. However, to the extent that relative prices remained constant during the two periods, this will not affect the figures obtained. If, on the other hand, terms of trade shifted systematically against the North, our figures would be a lower bound on the true changes in household welfare. This is left for further investigation.

[15] This does not include the possibility that individual households' income decreased over the period, an issue for which panel data will be required.

Table 4, lines 1 and 2, provides descriptive evidence on growth in per capita income and expenditure for the panel households. We note that, even though Uganda has achieved high rates of growth by African standards, large differences across regions persist. While growth of consumption has been marked in the West, the Center, and the East, it was very limited in the North of the country. Similar large regional differences are found for growth of earned income. This is reflected in the changes observed in poverty rates to be discussed in more detail below. While poverty declined markedly in the Center, the East, and the West, the North was again lagging behind; in fact for the panel households included in our sample, the level of poverty remained completely stagnant.

The second half of table 4 identifies changes in the incidence of poverty for panel households. We note that, similar to what had been found for the cross section, poverty in the panel declined significantly, from 54% in 1992 to 36% in 2000. In addition, and slightly different from the cross sectional results, the panel also points towards continued high differences between regions. While poverty has almost halved in the Center (from 41% to 23%), it remained very high in the North where, insofar as panel households are concerned, no improvement can be detected. Poverty levels in the West and the East also showed a marked decrease, declining from about 58% to about 36%.

Disaggregation of changes in poverty for the panel households across regions and the urban and rural economy highlights that reductions in poverty were more pronounced in urban as compared to rural areas and also points towards a considerable lag in the rural North. Using the poverty headcount, we find that 42% of households emerged from poverty in urban areas, compared to only 25% in rural ones. Regional differences in the reduction of poverty are pronounced as well; in rural areas of the North and the East, only 22% and 18% of the panel households, respectively, emerged from poverty. In the same regions, 14% and 9% of previously non-poor panel households fell into poverty (a figure that is about 6% at the national average for both rural and urban areas). This may well explain that, despite a tremendous reduction of overall poverty levels, qualitative studies especially in these regions may find a sense of “things are not getting better”.

4. Determinants of growth and poverty reduction

This section provides estimates from regressions of household-level changes in per capita expenditure and the incidence of poverty on initial conditions, a multinomial logit regression for changes in poverty, and simulations of changes in poverty levels at the national and regional level that would, according to the results from this regression, be associated with specific policy initiatives. Results from the growth and poverty regressions point not only towards the overriding importance of initial endowments of physical and human capital as a determinant of growth and poverty reduction but also highlight the importance of policy variables. Access to electricity, initial health status, and changes in coffee prices all emerge as important determinants of income growth or poverty reduction and price

changes are found to have been particularly beneficial for the poor. Although it provides only a first crude approximation to the issue, the simulation that is based on these results suggests that policies to increase asset accumulation and improve the return to productive activities are not only the most likely to result in continued growth but, if applied in a regionally targeted fashion, also have the potential of reducing or even eliminating the stark inter-regional disparities that continue to characterize Uganda.

4.1 Determinants of income and expenditure growth

Results from estimating equation (1), i.e. the household level growth regression with the mean annualized rate of per capita income and expenditure growth as the dependent variables are reported in table 5. We find that households' initial endowments of physical as well as human capital clearly enhance subsequent growth, that in addition to household structure, government policies in the areas of infrastructure, health, and output prices have a significant impact, and that there is a strong convergence in income but divergence in physical and human capital assets,. Comparing the magnitude of both effects, we note that the latter are large enough to counteract any convergence effect.

Endowments: A first result of interest is the finding of strong convergence in income, but divergence in physical and human capital assets. As illustrated in table 5, the level of initial expenditure or income has a significant and negative effect on subsequent growth, implying that households with high levels of initial income or expenditures will, over time, regress towards the mean. Note, however, that the regression controls for other factors and that in particular other coefficients indicate that, once initial expenditure or income is controlled for, higher levels of assets put their owners on a permanently higher growth path. The magnitude of this effect is considerable - a difference of one standard deviation ion terms of initial assets would, according to the regression, translate in a difference of more than 2 percentage points in terms of growth of per capita expenditure and 3 percentage points in terms of income.

The importance of assets becomes even more pronounced if, in addition to physical capital, we consider endowments of human capital. Shifting households from the current median level of three years to having completed primary education (i.e. 6 years) would, according to the regression, result in an increase of 1.9 points in growth of consumption and 2.5 points in growth of income - a formidable change. Moreover, the results suggest that the impact of higher levels of education is convex, implying that further advancements in terms of subsequent secondary enrollment will yield even bigger benefits. This reinforces not only the emphasis on measures to promote investment but also suggests that the program of Universal Primary Education (UPE) which aims to eliminate the scope for drop-outs for financial reasons and thus gradually increase enrollment, is targeting one of the critical areas for the country's future development. Concerning other initial household

characteristics, we find that both income and expenditure of households who were female-headed in 1992 grew slower, by about 1 and 1.7 percentage points, respectively. Also, larger households (i.e. those with a higher number of members) grew slower than small ones, even in per capita terms.

Health: The importance of supply of curative and preventive health services is supported by an estimated strong impact of initial health conditions on growth. Regressions suggest that households who, in 1992, were afflicted by health problems, experienced growth of income or consumption that was 1.2 or 1.8 percentage points lower than those who had been free of such problems. To interpret this figure, note that local supply of health services is one of the most important determinants of ill health. A consistent policy to improve access to health services and thus reduce health-related losses of manpower, comparable to what has been implemented in the education sector, could thus have considerable benefit. At a broader level, and with malaria being responsible for more than 80% of all incidents of sickness, this supports the hypotheses, derived from cross-country evidence, that malaria can constitute an important impediment to African development (Gallup and Sachs 2000).

Infrastructure: Our regressions point towards a very pronounced effect associated with initial access to electricity at the village level. Households with such access saw their income and expenditure increase by 3.5 and 6 percentage points more than those who had to do without. To interpret this one should note that, even at the village level and in the initial period, access to electricity is not completely exogenous. To the extent that such supply had been directed towards areas with high potential return, the estimated coefficient would be biased upwards. However, in view of the exceedingly low level of coverage (with access standing at only 2% of panel households), one would still expect ample space for expansion before decreasing returns set in. [16] This conjecture is supported by the fact that local industrialists and investors have consistently mentioned limited access to and reliability of the electricity grid as one of the main impediments to future growth and investment and in many cases to invest considerable resources to establish their own generators (Svensson and Reinikka, 2001). In fact, with a rapidly expanding supply of more educated workers in the wake of UPE, supply of infrastructure could easily develop into a binding constraint that might, in the extreme, reduce the scope for generation of well-remunerated employment, something that could in turn also reduce the incentives to acquire education. At the same time, we do not find a significant impact of access to other infrastructure, something that can possibly explained as being due to high correlation of this variable with others that are already included in the regression (e.g. output prices).

Social capital and violence: The measure of ethnic fractionalization emerges as important and positive, in contrast to what one would expect from the cross-country literature where this variable is generally reported to be associated with lower growth. One explanation could be the scope for realizing synergies from ethnic diversity as long as these differences do not give rise to open

conflict.[17] Indeed, whether or not a household was affected by civil strife in the initial period is shown to have had a significant impact on growth of income but not expenditure. This remains true if, rather than postulating a linear effect, we allow for a possible non-linearity in the impact of this variable or use various cutoff values for "intermediate" levels of ethnic diversity as suggested by Collier et al. 2000. The magnitude of the coefficient is very large, suggesting a reduction of annual per capita income growth of 5 percentage points for households who have been affected by conflict. In view of the fact that this appears to be one of the first times to empirically demonstrate and quantify the negative impact of violence on economic performance at the household level, more research on this would be warranted.

Price policies: To test the impact of output price-related factors, we include the regional change in coffee prices as one of the independent variables.[18] Results suggest that changes in coffee prices have had a significant and quantitatively quite large impact on household income and welfare. This supports the importance which government attached to early liberalization of agricultural output prices in the process of liberalization. The large elasticity is in line with evidence of a significant movement of subsistence producers into coffee and other cash crops, suggesting that if the conditions are right and markets are available the smallholder sector is capable of a sustained supply response.

Critics often point out that, even though price changes may have a positive impact on the rural economy in the aggregate, they tend to leave out the poor who, due to barriers preventing them from entering the cash crop economy, will, at best, reap indirect benefits from such price changes, e.g. through labor markets. To explore the extent to which this is true in the case of Uganda, we interact coffee price changes with initial household asset endowments (columns 2 and 4). The negative and significant (at 10%) coefficient suggests that, contrary to this argument, price changes have been particularly beneficial to the poor, implying that entry barriers into cash crop production were low. Thus, in addition to contributing to higher incomes for existing producers, the price changes have spurred a significant supply response by the less well-off, thereby allowing the poor to make better use of their labor.

While concerns about a differential impact of cash crop price changes on the poor would thus appears to be ill-founded, price decreases could have a marked negative impact on Uganda's rural economy.[19] This is of special relevance in view of the fact that, with few alternative cash crops to coffee, options for risk diversification are severely limited. Although coffee prices were already well below their

[16] One might even argue that, at such a low level of coverage, political pressures to extend coverage may have been more important than economic ones – up to the extreme case where the coefficient in the regression is actually biased downwards. It is impossible for us to ascertain to what extent this has been true in Uganda.
[17] Note that violent conflict is included as a separate variable. Also note that ethnic diversity is greatest in urban areas - indeed, the index of ethnic fractionalization and an urban dummy are positively correlated ($\rho = 0.28$) although the introduction of such a dummy does not eliminate the significance of the fractionalization index.
[18] We use the coffee price as prices for other crops were difficult to recover from the original data. While it would be very desirable to complement this with a more detailed analysis of the agricultural supply response, the ability to conduct such an analysis may be constrained by the quality of the available data.
[19] Also note that coffee production is concentrated in some regions.

historical peak at the time of the survey, they have since declined even further. Avoiding the declines in producers' welfare that would be predicted by our regressions will require the development of options for crop and portfolio diversification by rural producers, by creating an environment for the development of marketing channels and processing infrastructure, in the country's different regions. Drops in coffee prices could have a distinctly negative impact on household welfare and would be particularly harmful for the poor whose vulnerability could be increased significantly.

To summarize, the results for growth of income and expenditure support not only the importance of policies, public services, and initial endowments with physical as well as human capital. The data on sickness suggest that better access to health services, and the associated lower levels of sickness, can reduce scope for future growth. The same is true for electricity and, to a lesser degree, road infrastructure. We confirm the importance of policies to increase prices of tradeables for economic growth as well as the fact that initial endowments have a strong impact on levels of income growth. The importance of the price variable is of particular interest in view of the fact that prices for other cash crops such as cotton have declined considerably. It suggests that measures to improve output prices and ensure availability of markets throughout the country could have significant impact at the regional level, especially in the Northern part of the country.

4.2 Poverty determinants

To explore to what extent the policy measures that are of relevance for enhancing growth would be at the same time help to reduce poverty, we re-estimate equation (2) with the change in the poverty gap and the squared poverty gap, respectively, as dependent variables. We then use the classification of households who escaped from or fell into poverty during the period to run a multinomial logit regression of changes in poverty status. The estimates obtained in this equation allow us to assess the impact of various policy interventions on the poverty headcount, thereby helping to quantify the magnitude of policy interventions needed to overcome the inter-regional discrepancies in poverty in Uganda.

Results from the regression of poverty levels on initial conditions (equation 2), reported in table 6, largely confirm the importance of the variables identified earlier.[20] Initial assets levels, both in terms of human capital and physical capital, are found to be of overriding importance. Households suffering from health problems in 1992 were characterized by higher levels of poverty in 2000, reinforcing the importance of an adequate supply of health services. The importance of public services is also illustrated by the signficiant and large coefficient on access to electricity and infrastructure, both of which were associated with significantly lower levels of poverty in the second period. Although being subject to civil strife in 1992 did not have any impact on poverty levels in 2000, the level of initial ethnic fractionalization had a significant poverty-decreasing impact, in line with what was observed

[20] It is easy to show that the coefficients for this equation with the initial level included will be the same as for the change. Also note that, because many of the dependent variables are censored, we use a tobit rather than a OLS framework.

earlier. While there was no indication that female headed households had higher poverty levels, contrary to their lower growth rates, higher household size was associated with higher levels of poverty. Finally, the scope for increases in agricultural productivity and market integration to reduce poverty is illustrated by the significant and large coefficient on the price of agricultural tradables. Although this should not come as a big surprise, in view of both the predominance of agriculture as a source of employment for Uganda's poor, and the relatively limited market integration of most rural producers, it illustrates the importance of the using productive policies as a means for poverty reduction in a subsistence economy. In view of the importance of agricultural prices for observed poverty levels, it is quite likely that the precipitous drop of prices for cotton, the main the main agricultural cash crop in the North, is one of the main reasons for the limited progress in poverty reduction that is observed in this region. The regression thus supports attention to market incentives in the productive sector.

As discussed earlier, the net reduction of poverty levels is composed of the number of households who escaped poverty minus those who fell into poverty. To explore the underlying dynamics, and in particular to distinguish whether there are specific factors that are more important for households falling into poverty and others that play a key role in helping it to escape from poverty, we run a multinomial logit regression with the dependent variables discussed earlier. Substantive conclusions do not change and many dependent variables such as education, household composition, and social capital, are estimated to be equally important for escaping poverty or (in their absence) falling into poverty. At the same time, it is of interest to observe differences in the magnitude of particular variables' estimated impact on the probability of escaping poverty or falling into poverty, respectively.

Two variables that are more significant for falling into poverty than the other way round are ill-health and electricity. The latter is likely to emerge because, in areas where electricity was available, there were significant indirect impacts (e.g. through higher demand for labor) that reduced households' probability of falling into poverty. The conclusion is that provision of public infrastructure can, by helping to cope with shocks and by indirectly increasing demand for labor, significantly reduce households' vulnerability. At the same time, while good health may not convey any particular advantage, ill-health will, especially in an environment where credit markets and access to other means of insurance are limited, throw a household into poverty. In this context, it is noteworthy that asset ownership, while also helping to escape poverty, can act as a strong buffer against descent into poverty.

4.3 The impact of policy changes on poverty

To illustrate the above results numerically and at the same time highlight the magnitude required for policy initiatives to tackle the inter-regional inequalities characterizing Uganda, table 8 reports results

of a number of counterfactual "policy experiments" where key policy parameters were changed to explore the potential impact the poverty levels observed in 2000. The baseline scenario, with the observed poverty headcount in 1992 as well as the headcount predicted by the regression for 2000, is presented in lines 1 and 2. In line with what was actually observed, the regression predicts a decrease in the national headcount from 54% to 37%, with marked differences across regions. Significant reductions in the Center (to 21%), the East (to 35%), and the West (to 39%) are accompanied by hardly any reduction in the North where 65% of households are predicted to still be below the poverty line in 2000.

The first policy experiment consists of a price change for the main tradable, coffee, that is 10% higher than what was actually observed. Compared to the baseline case, this results in a reduction of the national poverty headcount by about 6 percentage points, thus illustrating the high elasticity of poverty with respect to prices for agricultural output. The change is fairly evenly distributed across regions; overall it is predicted that 33% of households would escape poverty and 9.4% fall into poverty. This illustrates the potentially large benefits from liberalization of agricultural trade, a policy measure which in qualitative measures has also been shown to enjoy broad support among the population (UPPAP) and suggests that improvements in productivity and marketing conditions, as envisaged by the plan for the modernization of agriculture, will likely be a key element in the strategy to reduce poverty in Uganda.

As noted earlier, with a reliance on only one major cash crop, the economy also becomes highly vulnerable to shifts in output prices. This is illustrated by the second experiment which consists of a downward shift of coffee prices. Not surprisingly, in view of the linear character of the regression, we find that the poverty increases by slightly more than 6% in the aggregate. This is of particular relevance in view of the recent decrease in coffee prices, illustrating the need for a more diversified portfolio of cash crops the prices of which are not very highly correlated as a way of ensuring against the possibly pervasive negative impact of a negative price shock.

In view of the considerable variation in asset endowments across regions, the third counterfactual was an increase in the value of total (initial) assets owned to US $ 3,000 from an average in the panel of slightly about US $ 2,000. Note that, in view of the vast differences in initial asset endowments (which, in the panel, ranged from US $ 852 in the North and 1,212 in the East to US $ 2,245 in the West and 2,809 in the Center), this implies a far bigger change in percentage terms (i.e. more than tripling the initial asset endowment for dwellers of the North) for the regions that are least well-off. The impact, though modest in terms of overall poverty headcount figures (which decrease by only 10% from what had actually been observed in 2000) illustrates that increased levels of assets can have a big regional impact. The level of poverty in the North is predicted to decrease by more than 20 percentage points as compared to the baseline, with reductions of 13 points in the East, 10 points in the West, and 7 points in the East. This, together with the vast differences in poverty levels across

regions, suggests that region-specific policies might be needed to make a bigger dent in overall poverty and at the same time reduce the increasing disparity within regions that was confirmed by earlier figures.

To respond to the need of a regionally differentiated policy, the last two simulations provide evidence on the potential impact of regionally targeted increases in output prices and increases in asset endowments. Line 4 reports the result of a 50% increase in the price of the main tradable that is limited only to the East and the North. The results, in terms of the incidence of poverty, are clearly impressive; the incidence of poverty declines by about 26 percentage points in both regions and with a predicted level of poverty of only 9%, the East becomes the lowest in the whole country. Although poverty the North remains still high, with a headcount of 38%, it is now on par with the West. The assumption underlying this scenario is by no means unrealistic: Evidence from the household survey indicates that, in the 1992-2000 period, the national average price of cotton, the cash crop that had traditionally been cultivated in the North and East of the country, declined by 40% (Deininger, 2001). World cotton prices, by comparison, were stable or showed even slight increases during the same time.[21] Restoring cotton prices to their original level, together with some minor improvements in marketing costs due to improved infrastructure or technology could thus easily amount to the assumed price change. This suggests that the scenario, and the associated large decrease in poverty, is by no means unattainable, thus at the same time highlighting the importance of agricultural policy for poverty reduction.

The last simulation combines the scenario of a regionally limited price increase with a regionally limited increase of the asset endowment to US $ 3,000, something that has traditionally been attempted through policies providing regionally targeted investment incentives.[22] Results suggest that, with such a measure, the poverty headcount in the North would approach the levels (i.e. slightly above 20%) that are currently observed in the Center while poverty in the East would decline to 5%. Even though these extrapolations are of illustrative nature, they highlight the magnitude of the challenges to be confronted as well as the opportunities inherent in an activation of the productive sector of the rural economy.

5. Conclusion and policy implications

Inspired by the traditional cross-country literature, and using a similar set of variables, we analyze factors that have led to growth and poverty reduction for a panel of Ugandan households. Compared to cross-country regressions, we obtain more precisely estimated coefficients which in turn allow to draw conclusions that are of policy relevance in a number of ways.

[21] According to the FAO Trade data-base (www.fao.org), prices for the US as well as for Mali increased slightly, by 6% and 2%, respectively, between 1992/93 and 1998/99. Unfortunately, data for 2000 are not yet available.
[22] This is used just as an illustrative example.

Concerning price policy, our results are supportive of the strategy taken by the Government of Uganda but also illustrate emerging challenges. The importance of prices for agricultural tradables, as proxied by coffee, supports Uganda's emphasis on quick and decisive liberalization of output markets for agricultural produce in the early 1990s. The fact that such price changes have been particularly beneficial to the poor allows to dismiss the hypothesis that liberalization would be biased against the poor. The quantitatively large impact of output price changes on poverty reduction, especially in the North that was obtained in the simulations points towards the decline in cotton prices and the associated agricultural opportunities in the North as a possibly major reason for the continued high levels of poverty observed in this region. It also highlights the importance which the profitability of agricultural production, and in particular prices for agricultural output (including cotton and non-traditional export crops), are likely to play in any future strategy for growth and poverty reduction in Uganda.

In interpreting the significant impact of higher output prices, especially on the poor, one has to be cognizant of the fact that prices can go down as well as up and that, by implication, the poor would be particularly vulnerable to such decreases in output prices. While this does not eliminate the importance of higher producer prices, it highlights the importance of diversification of producers' crop portfolio and of other means to insure against price-related and other risks at the local and the economy-wide level. While an in-depth discussion of this issue is beyond the scope of this paper, it is clearly something that is of great relevance for the poor.

Even though we find convergence in income, households' initial asset endowment is a significant determinant of subsequent growth performance, and of even higher importance for poverty reduction. The large impact of households' initial endowments of assets and educational -for growth as well as poverty reduction- supports the emphasis on expanding opportunities for basic education through UPE as a basis for a sustained increase in the country's human capital base. At the same time, it highlights the danger of not being able to have sufficient physical capital assets, especially in light of a relatively low level of investment at the household level that is emerging from the survey. It suggests that, in addition to sound macro-economic policies and measures to increase overall levels of investment in the economy, specific and regionally targeted investments may be required to halt and eventually overcome the increasing divergence between the country's main regions which could, in an ethnically very diverse environment, give rise to social tension.

The importance attributed by our regressions to education as well as health-related variables is in sharp contrast to the weak and often indirect evidence from the cross-country literature. It illustrates that analysis of micro-data in one country has the potential of providing insights that go beyond what is revealed by aggregate regressions across countries. Together with the significance of access to other infrastructure such as electricity and the income-reducing impact of civil strife, our regressions illustrate that education needs to be complemented by access to other infrastructure to become fully

effective and that without a peaceful overall environment it will be difficult for the economy to thrive. Further efforts to enhance quality of service delivery and to reduce civil conflict are thus likely to have a large payoff. Unless sound policies are complemented by provision of the public goods needed for sustained income growth, the opportunities opened up by those policies may be utilized mainly by the more affluent and exacerbate pre-existing inequalities between urban and rural as well as different regions in the country. Ensuring the equality of opportunity needed to avoid such an outcome is an important challenge for the Government in the years ahead.

Although the above discussion provides an interesting illustration of the way in which relatively panels of household level data can be used for policy analysis, the reduced form estimates are only a very first attempt to address the associated issues. More work to identify the channels and mechanisms through which the different variables operate would be of great interest. Doing so would also provide an opportunity to address many methodological and substantive issues associated with the collection, interpretation, and analysis of panel data to which no clear answers exist at the moment. It is our hope that Uganda will be in the forefront of efforts trying to address these issues, thus leading to results that will be of broader relevance for the region.

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Table 1: Descriptive statistics for the whole population and poor and non-poor households, 1992 and 1999

	Total		Poor		Non-Poor	
	1992	2000	1992	2000	1992	2000
Occupation of head						
Agriculture	70%	69%	72%	78%	53%	53%
Other primary	3%	4%	3%	4%	6%	3%
Manufacturing & Trade	16%	14%	14%	9%	23%	22%
Services	12%	14%	11%	9%	18%	23%
Female headed household	30%	27%	29%	27%	33%	27%
Education of head						
Head has no education	31%	26%	31%	30%	26%	17%
Head has some primary education	27%	33%	26%	25%	35%	46%
Head has completed primary	15%	16%	14%	10%	24%	27%
Assets						
Total asset value (US $ equivalent)	2167	2670	1384	1419	3570	4914
Of which land	57%	51%	64%	56%	53%	48%
Housing materials and water						
Roof thatched	61%	42%	61%	47%	56%	33%
Dirt floor	55%	46%	56%	51%	43%	38%
Piped water	7%	11%	6%	5%	14%	21%
Flush toilet	2%	2%	2%	0%	4%	4%
Electricity in house	7%	7%	6%	2%	13%	17%
Use firewood	85%	84%	86%	92%	68%	68%
Enterprise activity and credit						
Has a non-farm enterprise	46%	45%	46%	42%	46%	51%
Credit from formal institution	15%	7%	15%	7%	18%	8%
Credit from informal institution	9%	10%	9%	9%	9%	11%
Other characteristics						
Sickness in the last month	52%	72%	53%	74%	42%	69%
Affected by civil strife	7%	10%	7%	10%	5%	9%

Source: Own computation based the 1999/2000 UNHS and the 1992 IHS

Table 2: Descriptive statistics by region, 1992 and 1999

	Central		East		North		West	
	1992	1999	1992	1999	1992	1999	1992	1999
Occupation of head								
Agriculture	55%	56%	74%	72%	85%	77%	74%	76%
Other primary	4%	4%	2%	2%	4%	6%	3%	3%
Manufacturing & Trade	26%	20%	12%	13%	3%	7%	13%	12%
Services	14%	20%	12%	13%	8%	10%	10%	10%
Female headed household	33%	29%	26%	24%	34%	35%	26%	22%
Education of head								
Head has no education	22%	17%	31%	25%	35%	36%	37%	29%
Head has some primary education	33%	41%	27%	32%	27%	24%	21%	31%
Head has completed primary	21%	23%	14%	16%	12%	11%	9%	12%
Assets								
Total asset value (US $ equivalent)	3691	4657	1518	1597	734	798	1974	2624
Of which land	57%	50%	62%	50%	30%	31%	61%	59%
Housing materials and water								
Roof thatched	35%	15%	65%	51%	91%	91%	64%	28%
Dirt floor	64%	55%	42%	32%	56%	38%	58%	58%
Piped water	12%	21%	5%	7%	2%	1%	6%	10%
Flush toilet	3%	2%	2%	2%	1%	0%	2%	1%
Electricity in house	15%	17%	4%	4%	1%	1%	2%	3%
Use firewood	71%	67%	87%	88%	93%	94%	93%	93%
Enterprise activity and credit								
Has a non-farm enterprise	56%	49%	48%	46%	33%	49%	42%	38%
Credit from formal institution	20%	6%	6%	9%	17%	5%	18%	10%
Credit from informal institution	14%	9%	4%	12%	9%	4%	8%	13%
Household characteristics								
Sickness in the last month	49%	64%	57%	84%	59%	77%	46%	68%
Affected by civil strife	2%	4%	8%	11%	13%	13%	5%	12%

Source: Own computation based the 1999/2000 UNHS and the 1992 IHS

Table 3: Measures for inequality of income and assets, Uganda 1992 and 1999

Inequality Measure		*Income inequality* 1992	*Income inequality* 1999	*Asset inequality* 1992	*Asset inequality* 1999
			Rural-urban disaggregation		
Relative mean	Rural	0.8694	0.7731	0.6735	0.6495
	Urban	1.7923	2.2153	2.9049	2.8796
Theil index	National	0.2828	0.3899	1.7545	1.5592
	Rural	0.2399	0.2532	1.4023	1.1294
	Urban	0.2375	0.3311	2.843	2.6076
Decomposition	Within group inequality	0.2393	0.2804	1.573	1.3617
	Between group ineq.	0.0435	0.1096	0.181	0.1975
			Regional disaggregation		
Relative mean	Center	1.3275	1.5199	1.7165	1.7504
	East	0.8717	0.8379	0.6222	0.6048
	North	0.7388	0.5104	0.3682	0.3129
	West	0.9367	0.8771	0.9830	0.9871
Theil index	Center	0.2732	0.3749	2.6058	1.9312
	East	0.2613	0.3044	1.3832	1.1542
	North	0.2540	0.2837	2.5757	1.2797
	West	0.2298	0.2285	1.3360	0.9852
Decomposition	Within group inequality	0.2579	0.3204	2.1041	1.3820
	Between group ineq.	0.0249	0.0695	0.1365	0.1772

Source: Own computation based the 1999/2000 UNHS and the 1992 IHS

Table 4: Changes in poverty and income measures, Uganda 19922000

	National	*Regional*			
		Center	East	North	West
Mean growth of per capita income	3.560	3.963	1.666	1.535	5.378
Mean growth of per capita expenditure	4.925	5.151	0.071	5.846	4.513
Poverty headcount in 1992	53.9%	41.1%	57.2%	66.3%	58.2%
Poverty headcount in 1999	36.3%	22.6%	36.3%	66.3%	35.4%
Change in headcount	-17.5%	-18.5%	-20.9%	0.0%	-22.8%
Share of households escaping poverty	29.2%	26.4%	34.3%	17.4%	34.1%
Share of households falling into poverty	11.7%	8.2%	13.4%	17.4%	11.3%

Source: Own computation based on 1313 panel households included in the 1999/2000 UNHS

Table 5: Determinants of changes in per capita expenditure and income, 1992-1999

	Growth of p.c. expenditure		*Growth of p.c. income*	
Assets in 1992 (log)	1.546***	4.068***	2.065***	6.390***
	(9.30)	(2.88)	(8.25)	(2.63)
Education (years)	-0.224	-0.243	-0.165	-0.209
	(1.16)	(1.25)	(0.51)	(0.65)
Education squared	0.070***	0.071***	0.086***	0.090***
	(4.19)	(4.29)	(2.99)	(3.15)
HH had health problems in 1992	-1.208***	-1.177***	-1.835***	-1.801***
	(2.96)	(2.89)	(2.92)	(2.88)
HH has electricity in 1992	6.012***	6.073***	3.560*	3.626*
	(5.03)	(5.07)	(1.74)	(1.79)
Change in coffee price	0.064***	0.171***	0.046***	0.228**
	(8.27)	(2.85)	(3.59)	(2.20)
Female headed household in 1992	-1.045**	-0.995**	-1.749**	-1.677**
	(2.28)	(2.17)	(2.24)	(2.14)
No of members age 6-14 in 1992	-0.941***	-0.926***	-0.571***	-0.543***
	(8.74)	(8.53)	(3.61)	(3.42)
No of members age 15-60 in 1992	-0.772***	-0.763***	-1.199***	-1.174***
	(4.30)	(4.18)	(5.48)	(5.26)
No of members age > 60 in 1992	-0.847**	-0.839**	-2.013***	-1.977***
	(2.31)	(2.30)	(3.36)	(3.30)
Dist. to municipality (10 kms)	-0.669	-0.709	1.338**	1.311**
	(1.42)	(1.50)	(2.05)	(2.00)
Ethnic fractionalization in 1992	1.981***	2.044***	3.274***	3.391***
	(3.18)	(3.27)	(3.31)	(3.41)
Affected by civil strife in 1992	-0.679	-0.746	-5.283***	-5.419***
	(0.81)	(0.88)	(3.81)	(3.92)
Initial assets *Δ coffee price		-0.008*		-0.014*
		(1.82)		(1.80)
Initial value of cons./income	-11.911***	-11.893***	-11.669***	-11.693***
	(33.93)	(33.95)	(30.98)	(31.11)
Constant	115.519***	81.908***	103.502***	46.426
	(24.19)	(4.21)	(18.11)	(1.41)
Observations	1222	1222	1165	1165
R-squared	0.53	0.53	0.53	0.53

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Determinants of poverty in 1999 (tobit regressions)

	Dependent variable			
	Poverty gap		Squared poverty gap	
Assets in 1992 (log)	-0.054***	-0.087***	-0.031***	-0.049***
	(6.80)	(10.34)	(7.27)	(10.72)
Education (years)	-0.013***	-0.023***	-0.007***	-0.012***
	(3.25)	(5.28)	(3.46)	(5.22)
HH had health problems in 1992	0.089***	0.046**	0.053***	0.031***
	(3.87)	(2.07)	(4.35)	(2.61)
HH has electricity in 1992	-0.204**	-0.203**	-0.109**	-0.112**
	(2.25)	(2.16)	(2.20)	(2.13)
Change in coffee price	-0.004***	-0.003***	-0.002***	-0.002***
	(10.48)	(6.95)	(11.44)	(7.76)
(Squared) poverty gap in 1992	0.246***	0.174***	0.168***	0.115***
	(5.34)	(3.91)	(4.69)	(3.29)
Female headed household in 1992		0.008		0.017
		(0.32)		(1.28)
No of members age 6-14 in 1992		0.037***		0.019***
		(6.83)		(6.37)
No of members age 15-60 in 1992		0.046***		0.026***
		(6.52)		(6.78)
No of members age > 60 in 1992		0.025		0.018*
		(1.30)		(1.78)
Dist. to municipality (10 kms)		0.055**		0.037***
		(2.50)		(3.14)
Ethnic fractionalization in 1992		-0.105***		-0.060***
		(3.19)		(3.34)
Affected by civil strife in 1992		0.055		0.033
		(1.45)		(1.59)
Constant	1.790***	1.748***	1.027***	0.992***
	(12.37)	(12.29)	(13.45)	(13.07)
Observations	1259	1222	1259	1222
Log-likelihood	-533.39	-457.67	-206.73	-139.29

Absolute value of t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Multinomial logit for of changes in poverty status between 1992 and 2000

	Probability of	
	Escaping poverty	Falling into poverty
Asset endowments in 1992 (log)	0.322***	-0.432***
	(5.09)	(5.67)
Mean education (years)	0.135***	-0.136***
	(3.86)	(3.55)
HH had health problems in 1992	0.169	0.428*
	(0.91)	(1.84)
HH had access to electricity in 1992	-0.801	-2.026**
	(0.61)	(2.24)
No of members age 6-14 in 1992	-0.241***	0.220***
	(5.25)	(4.25)
No of members age 15-60 in 1992	-0.204***	0.274***
	(3.27)	(4.28)
No of members age > 60 in 1992	-0.084	-0.067
	(0.55)	(0.36)
Dist. to municipality (10 kms)	-0.242	-0.010
	(1.35)	(0.04)
Ethnic fractionalization in 1992	1.215***	-1.147***
	(5.03)	(3.96)
Affected by civil strife in 1992	-0.400	0.032
	(1.29)	(0.08)
Change in coffee price	0.011***	-0.006**
	(4.90)	(2.21)
HH was poor in 1992	23.410***	-42.550
	(28.07)	(0.00)
No. of observations	1237	
Log-likelihood	-653.15	
Pseudo R^2	0.4314	

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Simulated impact of various policy interventions on the predicted poverty headcount

	Regions				*National*
	Center	East	North	West	
Baseline scenario					
Poverty headcount 1992	41.1%	57.2%	66.3%	58.2%	53.9%
Predicted headcount for 2000	21.3%	35.3%	64.5%	39.2%	36.9%
1. National level price changes (+10%)					
Share of people escaping poverty	31.9%	37.7%	22.4%	35.4%	32.8%
Share of people falling into poverty	6.8%	8.6%	15.7%	9.4%	9.4%
Predicted level of poverty	15.8%	28.4%	59.5%	32.1%	30.6%
2. National level price changes (+10%)					
Predicted level of poverty	28.1%	42.8%	69.2%	46.8%	43.7%
3. Overall increase in initial assets (to 3000 USD)					
Share of people escaping poverty	32.9%	41.4%	31.5%	36.7%	35.8%
Share of people falling into poverty	6.7%	7.1%	10.9%	8.5%	8.0%
Predicted level of poverty	14.7%	23.3%	45.6%	29.9%	26.2%
4. Region specific price increase					
Share of people escaping poverty	29.1%	50.4%	36.0%	31.3%	35.7%
Share of people falling into poverty	9.8%	1.8%	7.6%	12.1%	8.3%
Predicted level of poverty	21.6%	8.9%	37.8%	39.0%	26.6%
5. Region specific price plus initial asset increase					
Share of people escaping poverty	29.1%	53.7%	48.2%	31.3%	38.4%
Share of people falling into poverty	9.8%	1.0%	3.3%	12.1%	7.5%
Predicted level of poverty	21.6%	4.9%	21.2%	39.0%	23.1%

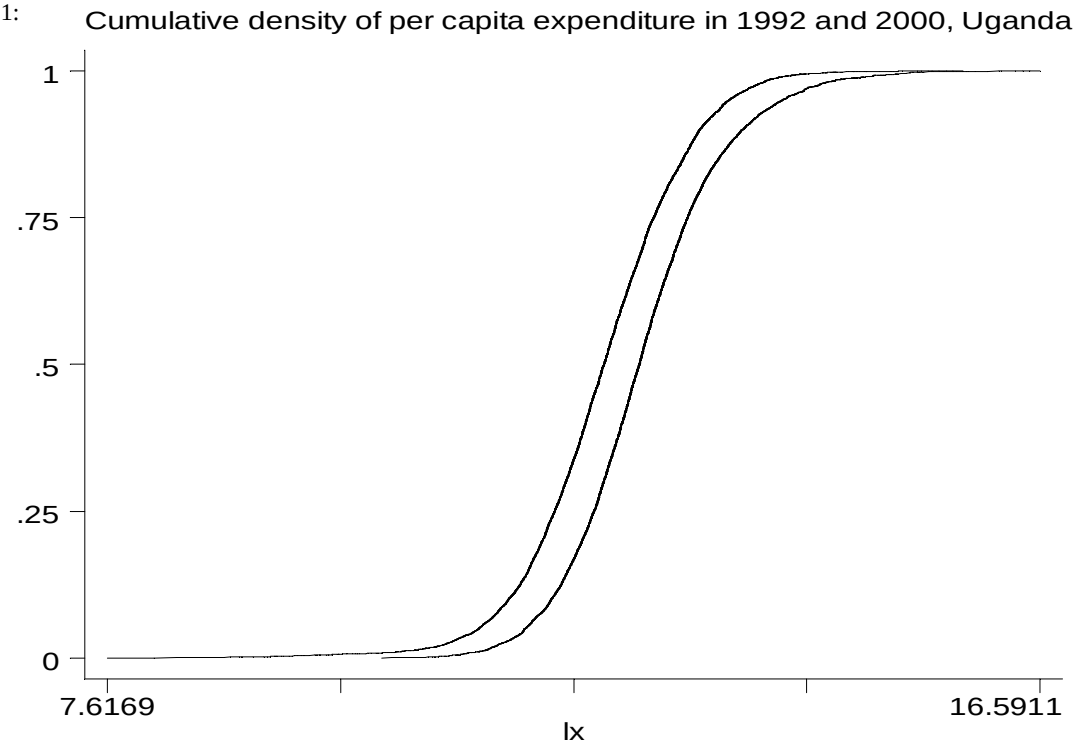
Appendix table 1: Probit selection equation for panel households

	Dependent variable: Household in panel
Household size	0.006***
	(3.01)
Education (years) in 1992	0.007**
	(2.54)
Education squared in 1992	0.000**
	(2.01)
Assets (log)	0.005***
	(4.85)
Female headed household in 1992	-0.001
	(0.08)
At least 1 member sick last month (1992)	-0.014*
	(1.72)
No of days lost to sickness	0.000
	(0.52)
HH has electricity in 1992	-0.059***
	(4.58)
No of members age 6-14 in 1992	0.002
	(0.59)
No of members age > 60 in 1992	0.009
	(1.40)
Urban community	-0.100***
	(12.21)
Eastern region	-0.030***
	(3.45)
Northern region	-0.055***
	(6.14)
Western region	0.004
	(0.42)
No. of observations	9923
Log-likelihood	-3724.39
Pseudo R^2	0.0650

Robust z-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: Estimation is based on the 1992 sample.

Figure 1:


Cumulative density of per capita expenditure in 1992 and 2000, Uganda
1
.75
.5
.25
0
7.6169
16.5911
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