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Education, Incomes and Poverty in Uganda in the 1990s

by

Simon Appleton

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Centre for Research in Economic Development and International Trade,
School of Economics,
University of Nottingham,
University Park,
Nottingham, NG7 2RD,
UNITED KINGDOM

Telephone (0115) 951 5620
Fax: (0115) 951 4159

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Simon Appleton

Centre for Research in Economic Development and International Trade, University of Nottingham

The Authors
Simon Appleton is Lecturer, School of Economics, University of Nottingham.

December 2001

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Abstract

This paper examines the relationship between poverty and education in Uganda in the 1990s. It shows how growth in living standards and poverty reduction during that period was fastest for more educated households. Income growth at the household level is disaggregated into earnings growth from three kinds of activity: farming, non-agricultural self-employment and wage employment. The direct productivity effects of education on earnings from each income source are estimated and found to have increased over time. The role of education in determining access to different sources of income is also assessed.

Outline
1. Introduction
2. Poverty Reduction and Economic Growth in Uganda 1992 to 1999/2000
3. Returns to Education – Conventional Approaches
4. Wider Estimates of Returns to Education
5. Summary and Conclusions

I. INTRODUCTION

Education in developing countries is often identified as a key area where public investment can lead to poverty reduction. We examine this issue in the context of Uganda, a country where poverty eradication is the overarching goal of public expenditure and education has become the largest component of government spending after the Universal Primary Education initiative of 1997[1]. We focus on microeconomic evidence, examining the extent to which poverty is associated with lack of education and the ways in which education raises household incomes. A key feature of the paper is to go beyond the standard estimates of rates of returns to education, which are based only on wage earnings. We look more generally at returns within a variety of income-generating activities and at how education affects which activities the household engages in. In doing so, we provide evidence on several hypotheses about the level of the rate of return to education, how it varies both across activities and over time.

It is commonly observed that there is a strong correlation between poverty and lack of education in Africa. However, it is sometimes questioned whether standard estimates of returns to education in Africa are in high. Together these perceptions imply a seeming contradiction. One possible hypothesis to explain this is that standard estimates of returns to education are based on wage differentials but education may bring benefits not just in raising the wages of those in employment, but also in giving people access to wage employment. To anticipate our findings, we find no contradiction in Uganda: there is a strong correlation between poverty and lack of education but standard estimates of returns to education are healthy. The effects of post-primary education on access to wage employment are quantitatively important, especially at the university level. However, at the secondary level, the positive income effects from this are offset by a corresponding loss of income from non-wage earnings. Primary education does not have large effects on income via access to wage employment but it does bring substantial income effects by increasing access to non-agricultural self-employment.

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1 Under the UPE initiative, fees for state primary schools are waived for four children from each household. Within year, the initiative led to a near doubling of the number of children enrolled in primary school. In order to deal with this dramatic expansion, the Education Sector Investment Plan of 1998-2003 envisaged a 50% increase in expenditures on primary school and a doubling of resources to secondary schools

Another common hypothesis about education is that it pays mainly in wage employment. Estimates of returns to education in agriculture are typically insignificant in Africa and even for developing countries in general, average substantially less than in wage employment (Appleton, 2000). There is less evidence for non-agricultural self-employment. If it were true that education was rewarded mainly in the wage employment, this might raise questions about its efficacy in reducing poverty since the poor in Africa are typically self-employed, whether in agriculture or other sectors. Such pessimism may be unwarranted. Although we do find lower returns to education in agriculture in Uganda, this result may be driven by an imperfect measure of labour input. Moreover, returns to schooling in non-agricultural self-employment generally match those in wage employment.

There has been considerable interest in changes in the rate of return to education. The conventional wisdom is that returns in developing countries have been sustained over time (Psacharopoulos, 1994). However, there is little evidence on this for Africa, where the combination of a massive post-Independence educational expansion and economic stagnation might be expected to lower rates of return. Few studies have looked at changes in returns to education in particular African countries over an extended period. Appleton, Bigsten and Kulundu (1999) looked at the effect of education on earnings of manufacturing workers in Kenya using data for 1978, 1986 and 1995. They find the Mincerian returns to primary education have fallen from 10% in 1978 to 2% in 1995; the returns to secondary schooling have fallen from 34% to 12%; the returns to university have not fallen and may have increased. Moll (1996) reports that returns to primary education for Africans in South Africa fell from 8% in 1960 to 3% in 1975. Thereafter, they remained fairly constant. Two studies covering much shorter periods of time have not observed falls. Krishnan, Selassie and Dercon (1998) find no significant changes in returns to education in Ethiopia in the period 1990-1997. Canagarajah and Mazumdar (1997) find a rise in the returns to education in Ghana, particularly post-primary, between 1987 and 1991. We cover the period from 1992 to 1999/2000, a time when Uganda enjoyed strong growth, still recovering from the disastrous economic mismanagement and civil conflict of the 1972-1986 period. The chaos of this earlier period had limited educational expansion and so educated labour was more scarce than in countries such as Kenya. Indeed, we find a marked rise in the returns to education.

A further issue we address is the pattern of returns to education across the sub-sectors – primary, secondary and tertiary. The conventional wisdom is that primary education has the highest return and university education the lowest (Psacharopoulos, 1994). However, this conclusion for Africa has been challenged based on a persuasive re-reading of the original studies on which it is based (Bennell, 1996). We find the conventional pattern of social returns in Uganda in 1992, although the absolute size of the returns for each sub-sector is greatly reduced from the widely cited averages provided by Psacharopoulos. By 1999/2000, the level of social returns to education in Uganda has risen to approach those high averages, with the exception of the return to secondary education.

The paper centres on the analysis of two official surveys, each of around 10000 households, gathered in 1992 and 1999/2000. The surveys are nationally representative except in so far as four districts had to be excluded because they were deemed insecure: Bundibugyo, Gulu, Kasese and Kitgum. In section two of the paper, we document how poverty in Uganda varies with education and how this relation has changed over time, from 1992 to 2000. Following Appleton (2001), we focus on poverty conceived in money metric terms, defining the poor as those whose consumption is below an absolute poverty line. In the third section of the paper, we estimate conventional earnings functions for wage employees and compute standard estimates of rates of return to education. In the fourth and final substantive part of the paper, we take a more holistic view, modelling the effect of education on earnings from agricultural and non-agricultural self-employment as well as the impact of education on access to income from these sources. Section four summarises and concludes.

II. POVERTY REDUCTION AND ECONOMIC GROWTH IN UGANDA 1992 TO 1999/2000

II.1 The Fall in Consumption-Based Poverty

Poverty appears to have fallen markedly in Uganda from 1992 to 1999/2000 when measured in terms of household private consumption[2]. Table 1 sets out poverty indicators estimated from the 1992 Integrated Household Survey and the 1999/2000 Ugandan National Household Survey. The data follows Appleton (2001) in comparing

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2 For brevity, we will subsequently refer to consumption-based poverty as simply "poverty".

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household private consumption per adult equivalent with a poverty line defined using the methods proposed by Ravallion and Bidani (1994)[3]. Overall, the proportion of Ugandans estimated to be living below this poverty line is estimated to have fallen from 56% in 1992 to 34% in 1999/2000. This fall in poverty was driven by strong economic growth. Mean real private consumption per adult equivalent rose at an annualised rate of 4.7% for the country as a whole. The distribution of consumption per adult equivalent worsened slightly during the period.

One possible reason for the slight worsening of the distribution of welfare was that more educated households, already better off, appear to have enjoyed higher growth than less educated ones. Table 1 shows this by decomposing these consumption-poverty indicators by the education of the household head for 1992 and 1999/2000[4]. In both years, unsurprisingly, poverty rates are lower for households with more educated heads. For example, in 1992, 66% of those living in households with uneducated heads were poor compared to 54% of those living in households whose heads had completed primary school and 24% of those in households headed by secondary school completers[5]. However, although the relation between poverty and education of the household is clear and statistically significant, it is notable that poverty is not confined to the uneducated. For example, in 1992, those in households with heads who had complete primary education or higher accounted for a third of the population and a quarter of the poor. Even amongst those living in households headed by university graduates, one in ten were categorised as poor. Education appears to reduce the risk of poverty but does not eliminate it.

Education has a stronger negative relation with poverty in 1999/2000 than in 1992. Consistent with this, educated households enjoyed faster growth and poverty reduction than uneducated ones. Nationally, the poverty headcount fell by 39% but for those in households with uneducated heads, the reduction was only 28%. The falls in the other poverty measures, the P1 and P2 indicators, were also steeper for the more educated.

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3 The poverty line derived in this way varies by location with urban areas are given a higher allowance for non-food needs. However, on average, the poverty line is equivalent to US$34 dollars (in PPP terms) per capita per month and so close to the "dollar a day" poverty line sometimes used for international comparisons.

4 It should be noted that these decompositions are bivariate and that education is correlated with other many other factors that may affect poverty, notably urban residence, age and sex of the household head.

5 The secondary school system has six years in Uganda (S1 to S6), with the first four being lower secondary and the last six being upper secondary. We define secondary completion as attaining S4 or higher.

The correlation between poverty reduction and education of the household head was monotonic across cycles of education. That is to say, the proportionate fall in poverty was largest for those with university educated heads, second largest for secondary educated heads and smallest for those in households with uneducated heads. The relation between with growth and education of the household head was also positive but not strictly monotonic. For those with uneducated household heads, mean consumption per adult equivalent grew by an average of 3.8% per annum. Those with primary completers as heads enjoyed 5.8% growth and those with secondary completers experienced 4.8% growth.

Due to past educational expansion and household demographics, the proportion living in households with uneducated heads fell from 28% in 1992 to 24% in 1999/2000. This accounts for some of the fall in overall poverty, as can be quantified using the decomposition of Ravallion and Huppi (1991). If P_{t1} is a poverty indicator for time t1, then:

$P_{t2}-P_{t1} = \Sigma (P_{it2}-P_{it1})n_{it1}$ intra-sectoral effects

$+ \Sigma (n_{it2}-n_{it1})P_{it1}$ inter-sectoral effects

$+ \Sigma(P_{it2}-P_{it1})(n_{it2} - n_{it1})$ interaction effects

where n_{it2} is the proportion of the population in educational category i at time t1 and P_{it1} is the poverty indicator for educational category i at time t1. The interaction effects tell us whether population shifted to educational categories where poverty was falling or not (if positive, as in the Ugandan case, people moved into sectors where poverty was falling). By this decomposition, the increase in the proportion of Ugandans living in better educated households (the total inter-sectoral effects) accounted for 4.5% of the overall reduction in the poverty head count. Beyond this, it is noteworthy that both educated and uneducated households contributed substantially to the poverty reduction.

The finding that households with more educated heads are less likely to be poor holds for both rural and urban areas (figures not reported but available upon request). However, variations in education lead to larger differentials in living standards in urban areas. For example, consider the ratio between the mean consumption per adult equivalent of households whose heads completed primary school and that of households

with uneducated heads. In 1992, the ratio was 142% in urban areas but only 118% in rural areas. By 1999/2000, the ratios had risen to 170% and 128% respectively.

Decompositions of consumption based poverty indicators can only tell us so much about the role of education in poverty reduction. In order to understand more, it is necessary to look at household incomes and examine the role of education in household income generation.

II.II   Growth in Household Earnings

Household earning rose broadly in line with consumption (Table 2 refers)[6]. The level of household earnings in both surveys is substantially below the level of consumption. This is partly because there are substantial unearned sources of household income – notably remittances. However, it may also reflect the common problem of households under-reporting income relative to consumption. For our purposes, what is important is that the rise in household earnings is commensurate with the rise in household consumption. At the median, real earnings per household rise by 58% compared to a 51% rise in consumption. At the mean, the rise in earnings is 82% compared to a 64% rise in consumption.

The growth of earnings was fairly broad-based. We categorise earnings into three sources: wage earnings, income from non-agricultural self-employment and agricultural enterprise income. Earnings from all three sources rose substantially between 1992 and 1999/2000. In 1992, agriculture accounted for just over a half of household earnings. The shares of both non-agricultural self-employment and wage employment were each just under a quarter. Mean agricultural incomes rose by 62% but non-agricultural incomes grew faster. The largest increase was in income from non-agricultural self-employment, which rose by 125%. Wage earnings rose by 82%. Although agricultural income grew rather less than non-agricultural income, the large share of household

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6 We exclude households that report earnings from a particular source but do not report any members working for such earnings. This exclusion produces a sub-sample of 9424 households from the 10696 surveyed in 1999/2000 and 9029 from the 9101 surveyed in 1992. All figures for 1992 exclude the four districts not surveyed in 1999/2000. The problem of a mismatch between the reporting of income and labour is much more severe in 1999/2000 and affected mainly self-employment, particularly non-farm self-employment. Without the exclusions, the rise over time in the proportion of households receiving non-farm self-employment income would be even more marked (reaching 41% in 1999/2000).

earnings that come from agriculture ensured that it accounted for the largest part – two-fifths - of the overall growth in mean earnings. However, almost as important was the growth in earnings from non-agricultural self-employment, which accounted for over a third (37%) of the overall rise in mean earnings. The increase in wage earnings accounts for under a quarter (23%).

Part of the reason for the exceptional rise in earnings from non-agricultural self-employment is that there was an increase in the proportion of households engaged in this activity, from 28% in 1992 to 34% in 1999/2000. On one accounting, this rise in the proportion of households engaged in non-farm self-employment explains over a third (36%) of the rise in the mean earnings from that source[7]. By contrast, there has been a substantial fall in the proportion of households obtaining income from wage employment, while the proportion receiving income from farming falls only slightly. The rise in the proportion obtaining income from non-agricultural self-employment just outweighs the fall in the proportion receiving wage income, so overall, the proportion of households obtaining earnings outside of agriculture rises slightly from 54% in 1992 to 56% in 1999/2000.

It is also interesting to look at mean earnings from a given source *for those who receive any income from that source*. We term these "conditional mean earnings" since they are mean earnings conditional on receiving some earnings from the relevant source. Conditional mean earnings from wage employment have increased the most, rising by 121% during the period. By contrast, conditional mean earnings from farming and non-agricultural self-employment rose by 68% and 80% respectively. This suggests that average wages have grown more than the return to labour within other kinds of income-generating activities.

These figures on earnings imply that it is important to look at the role of education in the determination of income from all three sources of earnings identified. Adopting a conventional focus on wage earnings alone will neglect over three-quarters of the overall growth in earnings. Moreover, as well as examining whether education is associated with higher productivity within a particular income generating activity, it is interesting

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[7] This can be seen if we use the actual conditional mean earnings for 1999/2000 but assume that the proportion of households receiving earnings from non-farm self-employment was the same as in 1992.

to examine whether it plays any role in increasing access to higher return activities. In particular, it is worthwhile analysing the marked increase in the proportion of households receiving earnings from non-agricultural self-employment.

III. RETURNS TO EDUCATION – CONVENTIONAL APPROACHES

III.I Wage Earnings Functions

The main means by which education is conventionally thought to bring economic private benefits is by raising earnings in wage employment. Table 3 presents information on earnings and education for 1992 and 1999/2000. As expected, mean wages are higher for more educated workers. In 1992, secondary school completers earned an average 89% more from wage employment than primary completers did. University graduates earned five times as much as primary completers. From the full sample, we estimate that real wages have risen by an annualised rate of 10% per year during the period. This is substantially more than the rise in mean consumption per adult equivalent. Workers of all educational attainment have seen strong real rises in earnings. The lowest growth in earnings (averaging around 5% per annum) is amongst "drop-outs": those who have incomplete primary or secondary schooling. Earnings growth for other groups is over nine percent, being strongest (13% growth per annum) for primary completers. From the simple descriptive statistics, there is no simple clear pattern of widening or narrowing educational differentials. However, since education is negatively correlated with age (and other variables), it may be that changes in returns to education are masked.

To explore this, we estimate standard Mincerian earnings functions. The dependent variable is the log of real annual earnings and the sample is those aged 15-59 who reported wage employment as their main economic activity[8]. The explanatory variables are controls for sex and age (as a quadratic), together with variables for years of primary schooling, years of secondary schooling and a dummy variable for university graduation. We also control for cluster fixed effects (for example, variations in the level of local demand for labour). The educational variables are statistically significant in both types of specification for both years. However, they are smaller in the cluster fixed effects models than in the OLS estimates and appear to be larger in 1999/2000 than in 1992. It

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8 The second survey does not provide data on hours worked.

is likely that education may proxy for some omitted factors, such as residence in an area with a high demand for labour.)[9].

Table 3 reports the Mincerian returns (coefficients on the education variables) from the earnings functions. Assuming that university attendance lasts three years, a year of attendance at university is predicted to raise earnings by more than a year of attendance at school. A year of secondary schooling seems more remunerative than a year of primary schooling in 1992 but the reverse is true in 1999/2000. The coefficients on all the education variables rise over time, but only the rise in returns to primary education is statistically significant at conventional levels[10].

We also estimated the earnings functions on separate sub-samples, disaggregating by sex, urban-rural location and public-private employment (results not reported in Tables but available upon request). Here we refer only to results where the educational coefficients differed significantly (at the 10% level) between the sub-samples. The only educational coefficient to differ significantly between the sexes was that on primary education in the 1999/2000 survey, which brought higher returns for women[11]. There were no significant urban-rural differences in the effects of education in either survey. The only educational coefficient to differ significantly between the public and private sectors was that on primary education in the 1999/2000 survey, where there were higher returns in public employment. In the same year, secondary and university education were less well rewarded in the public sector, with both differences being significant at the 11% level. This suggests that in 1999/2000, relative to the private sector, the public sector has tended to compress wage differentials, benefiting the less educated at the expense of the better educated. Gender differentials were also less marked in the public sector. Nonetheless, even in the private sector, there was a significant rise in the return to primary education between 1992 and 1999/2000.

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9 Cluster fixed effects remove biases from correlations between education and, for example, the strength of the demand for labour in a location. However, they may provide under-estimates of the benefits of education since they net out any effects education may have in encouraging migration to areas of high labour demand or in providing local externalities.

10 We test for significance by estimating the earnings function on a pooled sample from the two years with a dummy variable for year and a full set of interactions between this dummy and the other explanatory variables. The significance of the interaction terms provides a test of whether the coefficients on the explanatory variables have changed over time. The interaction term on primary education is significant at less than the 1% level. Those on secondary and university education are significant at the 13% level and 19% level respectively.

11 Tests of significance were performed by pooling the samples and including a full range of gender interactions.

We explore cohort effects by separating the sample according to the time workers are likely to have entered the labour market[12]. We define four cohorts – those entering the labour market after 1992; those entering after 1982; those entering after 1972 and those entering before 1973. In both surveys, older cohorts receive high returns to schooling, although this may reflect an age rather than a cohort effect. Comparing between the surveys, all cohorts appear to have enjoyed rises in the returns to education. For example, returns to education have more than doubled for the 1983-1992 cohort. The returns to education are also higher in 1999/2000 for those newly entered into the labour market than they were in 1992. This is particularly marked in the case of the returns to primary education but barely discernible for secondary education. Specifically, those entering the labour market between 1983 and 1992 received only a 4% wage premium per year of primary education in 1992. In 1999/2000, those entering the labour market after 1992 received a 13% wage premium per year of primary education.

III.II   Standard Rates of Return to Education

The coefficients on the earnings functions can be interpreted as rates of returns only on overly strong conditions – most notably, that the cost of education is foregone wages and that individuals live forever. In reality, there are direct pecuniary costs of education and the opportunity costs may be less than the wage, particularly for young children. Table 5 reports estimates of the current average pecuniary costs of education.

For the private pecuniary costs, we use the mean household expenditure (net of scholarships) per student as reported in the 1992 IHS. Comparing the figures on household spending per year with the mean wages reported in Table 3, we see that the direct cost of primary education averaged only 4% of an adult wage per year. Spending on secondary school students was seven times this figure. The figures for university students are only indicative, since few such students could be found in the survey samples (only 16 in 1992). However, it appears that households spent less per student at the university level than at the secondary school level. Unfortunately, we cannot directly observe how the private costs of education have changed since the 1999/2000 UNHS

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[12] We assume that individuals enrolled in school at age 8 and entered the labour market after completing their education.

does not disaggregate total household spending on education by student. One might expect private costs of education to have altered over time, both because private consumption has generally risen and also because of specific reforms in the financing of education. In particular, the UPE initiative of 1997 led to the abolition of tuition fees for many primary school students. Between the two surveys we have also seen the introduction of greater cost sharing into Makerere university (Court, 1999)[13]. To investigate this, we regressed total household spending on education on variables for the numbers primary, secondary and university students in each household (since the regression is descriptive, we estimate it using the population weights for the surveys). The coefficients on these independent variables for student numbers can be interpreted as the marginal private cost of schooling per student and are reported in Table 5 as estimated private costs. We estimate the changes in the private costs of education by the change in the marginal costs calculated from the regression. There appears to have been a fall in spending per primary student and a rise in spending per post-primary student, with a doubling of the cost of university attendance. We take these estimates of the change in private costs and apply them to the observed data on private costs in 1992 to infer the likely magnitude of private costs observed in 1999/2000.

For the pecuniary costs of education paid by the state (and donors), we use data on total public expenditure on education provided by the World Bank. Comparing 1991/92 with 1999, there has been a substantial increase in state spending per school student. At the primary level, spending per student has increased 130% despite official enrolments rising from 2.4m to 6.6m. At the secondary level, spending has increased by 200%. By contrast, public spending per university student has fallen by 30%. It should be noted that, although household spending per university student is estimated to have doubled during the period, this increase in private funding is not sufficient to offset the reduction in public spending.

We follow convention in assuming that the opportunity cost of post-primary education is foregone wages. However, this assumption is implausible for primary education and there is no consensus on a preferable assumption (Bennell, 1996). Time use data in the

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13 Court (1999) reports that in 1994, no students in Makerere were paying fees but by 1999, 70% were. Whereas before the government had provided all the funding for Makerere, by 1998/99, internally generated funds accounted for 31% of the total.

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IHS provides some insights here. Out of 10,459 children surveyed aged 7 to 14, only 52 worked for wages and had usable data on wage rates. It was more common for children to work on family enterprises (almost exclusively farms). Of those not in school, 38% performed such work and averaged 33 hours of such work a week. Of those in school, 22% worked and averaged 16 hours per week. A simple calculation, therefore, implies that the opportunity cost of attending school in this age range is on average around 9 hours per week, or a little over one fifth of a normal working week. If we assume that the productivity of child labour is the same as adult labour, then one estimate of the opportunity cost of primary school is that it is around fifth of an adult wage[14].

We combine these assumptions about the costs of education with estimates of the wage benefits of education based upon the earnings functions (Table 6 refers). In particular, we use the earnings functions to predict the expected earnings of individuals from age 15 to 59, on the assumption that they work in wage employment continuously after leaving education[15]. Using these costs and benefits, we compute the private rate of return that sets the net present value of education equal to zero. For the social rate of return, we also include the cost to the government of providing education, taking as the mean public expenditure per student.

For primary education, the private rate of return doubles from 15% in 1992 to 30% in 1999/2000. The private returns to post-primary education also rise substantially, almost doubling in the case of secondary school. There is little difference between the private and social returns to secondary education, since the direct cost of such education to the government is small relative to the assumed opportunity costs. For primary education, relatively low opportunity costs make the direct costs to the government more important. Nonetheless, the social return to primary education is estimated at 24% in 1999/2000. The allowance for public direct costs is most important for university education, lowering the return in 1999/2000 from a private rate of 24% down to a social rate of 13%. Overall, it appears that the social rate of return is highest for primary education,

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14 It is interesting to note an analysis of agricultural production functions estimated using the data (Angemi, 1999). Ordinary least squares estimates implied that adult labour is approximately 10 percent more productive than child labour. When instrumented for, child labour appears twice as productive as adult labour.

15 We assume that individuals enrol in primary school at age eight, the mean age of first enrolment in 1992, and that each grade of schooling takes one year (i.e. there is no grade repetition or temporary drops out of school).

followed by university and then secondary education. It is noteworthy that the fall in public spending per university student from 1992 to 1999/2000 has greatly increased the social return, from a scarcely profitable 3% to a healthy 13%.

The returns can be compared with the widely cited averages for sub-Saharan Africa computed by Psacharopoulos (1994) and revisited by Bennell (1996). These regional averages are based mainly on studies performed in the 1960s and 1970s. The difference between the two sets of figures is that Bennell excludes those studies he judges to have been based on inadequate data. Perhaps the most marked contrast is that the return to secondary education appears much lower in Uganda than the average rate of return commonly cited for the region. The estimates can also be compared with more recent figures for urban Kenya in 1993 (Appleton et al. 1999). The social rates of return to schooling (not university) in Uganda in 1992 are the same as those estimated for Kenya in 1993. University education was less profitable in Uganda by virtue of higher direct costs rather than lower estimated benefits[16]. We do not know if there has been a rise in the returns to education in Kenya in the 1990s similar to that in Uganda. Indeed, this seems unlikely given that the Kenyan economy has not enjoyed the strong growth of neighbouring Uganda. However, it is notable that the returns to education are estimated to have fallen in Kenya since 1978, particularly at the secondary level. This may help explain why the returns to secondary education are lower for Uganda than studies in the 1960s and 1970s imply for the region as a whole.

On balance, the returns to education in Uganda, as conventionally computed, do not appear low. At all levels, the social returns are estimated at over 10%. The relatively high return to primary education is reassuring given the large investment of public resources under the UPE initiative. Of course, as Hammer (1996) notes, such high returns do not imply that the government should be making the investment, anymore than a high return to widgets suggests that the government should enter the widget-making business. For example, it must be considered whether these investments in education might be realised under private finance in the absence of public subsidy. However, the large enrolment response to the 1997 UPE initiative does suggest that public subsidy has a strong effect on enrolment, perhaps due to credit constraints on

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16 A year of university graduation was estimated to raise earnings by 17% in Kenya in 1993 and 18% in Uganda in 1992.

poor households. The case for public subsidy also depends partly on the possible presence of externalities to education and equity issues, neither of which conventional estimates of the rate of return to education address directly. Nonetheless, if the government wishes to invest in education for reasons of equity, as a way of providing assets of value to the poor in the absence of direct transfers, these rates of return suggest that funding education may be an attractive form of redistribution.

IV. WIDER ESTIMATES OF RETURNS TO EDUCATION

IV.I Overall (Reduced Form) Effects of Education on Total Earnings

Above we considered how education affects the *wage* earnings for *individual* workers. However, most earnings in Uganda arise not from wage employment, but from household enterprises, whether farms or non-agricultural businesses. A simple reduced form method for exploring the wider role of education is therefore to model *total* earnings at the *household* level. Table 7 models the log of total household earnings as a function of the education of adult household members and other exogenous determinants of earnings. Adults are defined as those over the age of 15 who are not full-time students (students are unlikely to be contributing substantially to household earnings). We distinguish between three different levels of education. We measure primary and secondary schooling in terms of the average years of such schooling completed by adult household members. For university, our measure is the proportion of adults in the household who have completed university education (information on years spent at university is not provided in the surveys). The average age of the adults and the proportion that are women are included as controls. Other hypothesised determinants of earnings are measures of factors of production owned by the household: labour, land and capital. All three are entered in logarithmic form. Although the household's factors of production could be regarded as endogenous to income, they are treated as exogenous due to a lack of suitable instruments. The models are estimated with community-level fixed effects, to remove the average impact of community-level variables (such as soil condition or the level of local demand for labour) that are not controlled for.

The most striking feature of the reduced form models is the substantial rise over time in the coefficients on education, in contrast to the constant coefficients on the traditional factors of production. For example, if adults in the household average an extra year of

primary education, this raises household earnings by 8% in 1999/2000 compared to 5% in 1992. Averaging an extra year of secondary education raises household income by 13% in 1999/2000 compared to 10% in 1992. The rise in the coefficient on university education is even larger. If all household members had attended university, income would be 183% higher, *ceteris paribus*, in 1999/2000; in 1992, the corresponding figure is 54%[17]. The rise in earnings between the surveys does not seem to reflect an increased productivity of the endowments of capital, land and labour owned by the household. The coefficient on the log of labour in both surveys is around 0.6, indicating that doubling the number of adults in a household will reduce per capita earnings by a fifth. It is likely that both the capital and land variables were measured with considerable error, but nonetheless it is interesting that their coefficients remain constant over time[18].

We also controlled for two other characteristics of adult non-students in the household – their gender composition and their mean age. Households with a higher proportion of adults who are women earn less, *ceteris paribus*. This gender gap becomes larger over time. In 1992 an all women household would earn around 10% less, on average, than an all male one with similar education and other characteristics; in 1999/2000, this effect has grown to 14%. The average age of adults in the household has an inverse-U relation with earnings. In both equations, the relationship peaks when adults average 39 years of age.

By modelling the effect of education on total household earnings, we are aggregating effects on earnings within types of income generating activity (wage employment, farming and non-farm self-employment) together with any effects of education on income via activity choice. Such aggregation is useful if we want to obtain an overall estimate of the effect of education on household welfare. However, it is interesting to decompose this effect for several reasons. One reason for disaggregating is distributional – the poor are more reliant on earnings from farming and, to a lesser extent, non-farm self-employment. If all the effects of education came through wage employment, then it may do little for poverty reduction. A second reason for disaggregating is a concern that some of the impact of education on earnings may not reflect higher productivity. For

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17 For university attendance, we estimate the effect by using $\exp(\beta)-1$ where β is the coefficient on university attendance.

16

example, there may be credentialism: employers may pay educated workers more but merely for their credentials, not because they are more productive. Such credentialism is likely to be confined to wage employment, not farming or self-employment.

IV.II   How Education Affects Productivity Within Activities

Human capital theory assumes that education raises the productivity of labour in given income-generating activities. The simple Mincerian earnings function postulates that the log of wage earnings is a function of the worker's schooling, S, and other characteristics (such as age), X. Where there are L wage employees in the household, we could estimate a household level counterpart to an individual-level Mincerian earnings function:

$$E(\ln Y_k \mid Y_k > 0) = \beta_s S_k + \beta_l L_k + \beta_x X_k \qquad (1)$$

where $\ln Y_k$ is the log of household earnings from activity k (in this case, wage employment)[19]. The coefficients, β_k, on schooling are often interpreted as a measure of the increased productivity attributable to schooling.

We also estimate variants of (1) for household earnings from farming and from non-agricultural self-employment. In both cases, the dependent variable is derived from the answers to simple questions about annual household income earned from these activities[20]. For agricultural earnings, we add variables for the log of cultivable land and the log of agricultural capital to obtain a conventional Cobb-Douglas production function, augmented with human capital variables[21]. For non-agricultural self-employment a similar approach is used, although land is not included as a factor of production. Note that when modelling earnings from each of the three income sources,

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18 Capital was measured as the productive assets of the household, excluding land. The land variable refers to cultivable land owned by the household.

19 The reason for modelling wage earnings at the household rather than individual level is for comparability with models of earnings from household enterprises. Estimating the models at the individual level yields similar results for the effects of education.

20 These answers yield estimates of agricultural income that are similar to what can be constructed from more detailed information on the value of output net of monetary costs (e.g. for purchased inputs and hired labour). It has been argued that simple questions about earnings from self-employment can give better estimates than calculations based on detailed questions about sales and costs (Johnson, McKay and Round, 1990).

21 Variable inputs, such as seeds and fertilisers, are not included in the model since they are endogenous and we lack suitable instruments for them. Part of the effect of education may work via these inputs so it may be inappropriate to control for them when gauging the overall impact of education, see Appleton and Balihuta (1996).

labour is measured as the (log) number of adult non-students in the household who report the relevant type of income generation as either their main or secondary activity. This measure is rather crude, since it does not control for the amount of time allocated to the activity[22]. The education measures we use refer to the average education of the household labour engaged in the relevant income generating activity. Similarly our other controls for labour characteristics, X, refer to the average age and sex ratio of the workers.

The quantity of labour allocated to farming and its average characteristics – including education - are treated as endogenous, with instruments being the overall household stock of labour and its average characteristics. That is to say, we assume that the household's total endowments of labour and education are exogenous, but the allocation of this labour and education across activities is endogenous. Consequently, the first stage of the estimator is three equations:

$$E(S_k, L_k, X_k \mid Y_k > 0) = \alpha_{sj}S + \alpha_{Lj}L + \alpha_{xj}X \qquad (2)$$

where L is the number of all adults in the household, S is their average schooling and X their average other characteristic.

We allow for community-level fixed effects to remove the impact of any community-level factors that we have not controlled for which raise earnings by a given proportion.

Table 8 reports the results of the models for 1992 and 1999/2000. Returns to education generally increase over time but the pattern of change varies across with the level of education and the particular income generating activity concerned. At the primary level of education, the increase is only substantial for earnings from wage employment – the coefficient more than doubles from 7% to 16%. There is no appreciable change in the coefficient on primary schooling in the non-farm self-employment earnings function. In the agricultural earnings function, the coefficient rises from a relatively low 2.6% to 3.5%. The change in coefficients on secondary schooling in the agricultural earnings

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22 The 1992 survey allows estimates to be made of the number of hours per year each worker allocated to an
    activity. From this data, individuals who reported farming as their secondary activity allocated only 40%

function is more substantial: rising from zero in 1992 to 7% in 1999/2000[23]. By contrast, the increase in the coefficients on secondary schooling in the two off-farm earnings functions is modest – going from 9% in 1992 to 10-11% in 1999/2000. University attendance only has statistically significant effects on earnings from wage employment, where it almost doubles in size between the surveys.

The elasticities of earnings with respect to labour all increase between the two time periods. This implies an across the board increase in earnings per worker[24]. The returns to cultivable land and to capital fall slightly between the two surveys.

IV.III   How Education Affects Entry to Income Generating Activities
We noted that part of the growth in earnings in Uganda was attributable to increases in the proportion of households engaged in non-farm self-employment. Did education play any role in this? In this section we consider the extent to which households with differing levels of education engaged in different activities and what this implies for total household earnings. Where education leads to a change in total household earnings through the choice of income generating activities engaged in, we refer to this an entry effect of education.

More formally, let us define household expected earnings, E(Y), as:

$$E(Y) = \sum Pr(Y_k > 0).E(Y_k | Y_k > 0) \qquad k = a, n, w \qquad (3)$$

where Y_k is earnings from source k (a=agriculture; n = non-agricultural self-employment; w = wage employment).

The marginal effect of schooling, S, on total household earnings is thus:

$$dE(Y)/dS = \sum E(Y_k | Y_k > 0)\delta Pr(Y_k > 0)/\delta S + \sum Pr(Y_k > 0)\, dE(Y_k | Y_k > 0)/dS \qquad (4)$$

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time to farming as those who reported it as their main activity; for the two non-farm income generating activities, the relevant proportions were around 25%.

23 The coefficients on education may be underestimated due to our measuring labour in terms of workers rather than hours worked (see Appleton, 2001).

The first term on the right hand side is the sum of what we label the "entry effects" of education: those effects that come about through changing the probability of receiving earnings from different sources. The entry effects are the marginal effects of schooling on the probability of receiving earnings from particular income sources, $\delta P(Y_k>0)/\delta S$, weighted by conditional mean earnings from the source, $E(Y_k|Y_k>0)$.

We calculate the marginal effects from independent probits for the probability of a household engaging in a particular type of income generating activity – specifically, farming; non-farm self-employment and wage employment[25]. We hypothesise that the probability of engaging in a particular activity depends on the number of adult members, their education, age and sex, the education of the household head and the region in which the household lives. We do not include household holdings of land and other productive assets in the models, as these are endogenous with respect to the household engaging in a particular activity. Table 9 gives the full results for the probits. The effects of education on the probability of receiving income from a given source are quantified in the marginal effects given in Table 10.

The probits show that primary education increase the probability of receiving some earnings from non-agricultural self-employment. Post-primary education generally increases the likelihood of receiving some wage earnings, at the expense of receiving any earnings from either agricultural or non-agricultural self-employment. Table 10 also presents the "entry effect" of an extra year of schooling on earnings from activity k defined as:

$$\frac{\delta Pr(Y_k > 0).}{\delta S} \frac{E(Y_k | Y_k > 0)}{E(Y_k)} \qquad (5)$$

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[24] The number of household members engaged in each activity changes little, conditional on some members being engaged. There is a 5% increase in the average number of household members engaged in farming, but the average numbers in non-farm activities does not change.

[25] The use of independent probits is a simplification. An alternative approach would be to model activities jointly, for example, using a multinomial logit. Households could be modelled as falling into one of six categories: farm only, self-employment only, wage employment only, farm and non-farm self-employment, self-employment and wage employment, and engaging in all three types of activity. We use independent probits for simplicity because distinguishing between all six categories is not the focus of this paper.

For example, in 1992, an extra year of primary education for all household members reduces the probability of household receiving income from agriculture by 0.5 percentage points and this lowers total household earnings by 0.6%, *ceteris paribus*.

Looking at a particular income source in isolation makes the entry effects of education seem large. For example, an extra year of university education for all adult non-students strongly increases the likelihood of the household receiving wage earnings and *ceteris paribus*, this would raise household earnings by around a third. However, the effects on different income sources are often offsetting – for example, university education reduces the probability of receiving earnings from farming and non-farm self-employment. The effects on total earnings are also reported in Table 10. Here we can see, for example, that the net entry effects of having an extra year of university education are to raise household total earnings by 4% in 1992, falling to 2% in 1999/2000. The net entry effects of secondary schooling are not far from zero in both years. Although secondary schooling makes it more likely households will receive wage earnings this is broadly offset by corresponding reductions in the probability of receiving incomes from self-employment (agricultural and non-agricultural). Only in the case of primary education have the net entry effects increased over time. In 1992, the net entry effects imply that average an extra year of primary education raises earnings by 0.8%; by 1999/2000, this more than doubles to 1.8%. It is greater access to non-farm self-employment that drives this effect. Primary education has statistically insignificant effects (at the 5% level) on the probability of the household receiving wage earnings in both years. By contrast, the marginal effects of primary education on the probability of receiving non-agricultural self-employment earnings are statistically significant in both years and roughly double over time.

IV.IV   Decomposing the Overall Rise in Returns to Education

We can use equation (4) to decompose the overall rise in returns to education. The decomposition is firstly by type of income generating activity (in this case, wage employment, farming and non-farm self-employment). Within each type of activity, we can then distinguish between the direct productivity effects and the entry effects. In addition, there may be indirect of education on the earnings of those engaged in particular income generating activities if education alters the amount of labour allocated

to the activity or changes the characteristics of such labour (for example, its sex or age). These indirect effects are distinct from the entry effects, since they are conditional on the household receiving some earnings from the relevant activity. It is straightforward to calculate these indirect effects based on our two stage least squares estimates of the household earnings functions. In particular, we can use the first stage of our estimators (equation 2) to gauge the extent to which household education affects, for example, labour input.

The total effect of changing the average schooling of adults in the household on earnings from source k is given by:

$$\frac{\delta E(\ln Y_k \mid Y_k > 0)}{\delta S} = \beta_s \alpha_{ss} + \beta_L \alpha_{Ls} + \beta_X \alpha_{Xs} \qquad (6)$$

The right hand side of equation (6) shows how changing the average schooling of adults changes earnings from activity k through:

- *direct education effects*: i.e. by changing the schooling of adults allocated to work on activity k (the first term on the RHS);
- *labour input effects:* i.e. by changing the labour input into activity k (the second term on the RHS)
- *age/sex effects:* i.e. by changing the non-education characteristics, X, of the labour allocated to work on activity k (third term on the RHS of (5))

In practice, the earnings functions estimated are slightly more complex than equation (4) in that three types of education are distinguished (primary, secondary and university) along with two other characteristics of the workers (their age and sex).

Table 11 presents the combined indirect effects of education – those via labour input and changes in the age-sex mix of the workers. It also recaps on the results of the previous two sections, by presenting the direct productivity and entry effects. Results are presented in terms of the overall proportionate effect of education on expected earnings, vis:

$$\frac{\delta E(Y_k)/\delta S}{E(Y_k)} = \frac{E(Y_k \mid Y_k > 0)}{E(Y_k)} \cdot \frac{\delta \Pr(Y_k > 0)}{\delta S} + \frac{\delta E(\ln Y_k)}{\delta S} \qquad (7)$$

where the first term on the right hand side is the "entry effect" defined in equation (5) and the second term is that given in equation (6).

The results show that the direct effects of education on earnings from a particular source account for only a part of the overall effects. For example, under half the effect of secondary education on wage earnings in both years arises from direct increases in wages for employed workers. The remainder arises because secondary education increases the expected number of employed workers in a household. For university education, these effects are even more important whereas for primary schooling, it is only the direct effect on wage earnings that is of any size. However, when looking at total earnings, entry and labour input effects are often small. The indirect effects of education contribute less than one percentage point to the overall effects of education on total earnings. Positive entry and labour input effects of education on earnings from one source are frequently offset by corresponding negative effects on earnings from other sources. For example, although the indirect effects of post-primary education on wage earnings are positive, those on non-wage earnings are negative. Post-primary education either reduces the likelihood of receiving any non-wage earnings and/or reduces the amount of workers involved in such activities conditional on some such earnings being received. Indirect effects are most important at the university level, where the large effect of increased access to wage employment more than outweighs losses from reduced involvement in farming and non-farm self-employment. Indirect effects are also important for primary schooling in 1999/2000, in particular, the favourable effect of the probability of receiving earnings from non-farm self-employment. This entry effect, combined with a positive labour input effect, raises expected earnings from non-farm self-employment by a similar magnitude to the direct productivity effects. The direct productivity effects of an extra year of primary schooling for each household member imply a 7% increase in total household earnings in 1999/2000. Adding in the indirect effects of primary schooling raises this figure to 9%.

V. SUMMARY AND CONCLUSIONS

Household survey data imply a marked fall in consumption-based measures of poverty

in Uganda in the period 1992-2000. This reduction in poverty was driven by economic growth – if anything, the distribution of income worsened. Educated households benefited more from the growth and indeed this is one factor underlying the rise in income inequality. Growth appears to have been broad-based, with substantial increases in household earnings from all sources - wages, farming and non-farm self-employment. On account of its large initial income share, agriculture was the most important source of growth of earnings despite growing the most slowly. However, it was closely followed by earnings non-agricultural self-employment, which enjoyed the highest growth. A substantial part of this growth was driven by an increase the number of households engaging in non-farm self-employment.

According to human capital theory, education raises incomes by increasing the productivity of workers. These productivity effects have conventionally been estimated by looking at wage differentials. We estimated standard Mincerian wage earnings functions for 1992 and 1999/2000. In 1992, each year of schooling was associated with a 7-8% increase in wages, *ceteris paribus*; for university education, the corresponding figure was 18%. Wage differentials by education increased between 1992 and 1999/2000. The effect was particularly marked for primary schooling, with an extra year of schooling being associated with a 17% increase in wages. We used this information on the wage benefits to compute standard estimates of rates of return to education. We took estimates of the pecuniary costs of education and assumed that opportunity costs were the wage for post-primary education, but only a fifth of the wage for primary education. From these assumptions, standard private rates of return to education appear quite high: for example, 15% for primary education in 1992, doubling to 30% in 1999/2000. That education should be negatively correlated with poverty in Uganda is thus unsurprising – conventional estimates of rates of return appear high. Similarly, the greater fall in poverty for the more educated is to be expected given the rise in returns to education over time. Even after allowing for the public cost of funding education, rates of return appear attractive – the standard "social" rate of return to primary education in is estimated at 24% in 1999/2000. Post-primary education did not have a particularly high social return in 1992, but by 1999/2000, the return exceeds 10%.

A limitation of conventional estimates of returns to education is that they focus only on wage employment, when most Ugandan households depend more on earnings from self-

employment, both agricultural and non-agricultural. Simple reduced form functions for household total earnings confirm that there has been a substantial increase in the returns to education. The coefficients on variables for the number of years of primary and secondary schooling both increase by around 50%; the coefficient on university education more than doubles. However, to investigate further, we estimated the effects of education on total household earnings, distinguishing between those from agricultural self-employment, non-agricultural self-employment and wage employment. Part of the effect of education on total household earnings reflects direct increases in productivity such as those estimated from conventional wage earnings functions. In 1992, the returns to education in terms of household earnings from non-agricultural self-employment are very similar to those in terms of wages. Education appears less productive in agriculture, although this result does not hold if allowance is made for variations in hours worked. By 1999/2000, the productivity effects of education have risen in agriculture. Secondary education, in particular, now appears to have a return in agriculture and this explains a large part of the increase in the overall increase in returns to secondary schooling. The return to secondary schooling in non-farm self-employment keeps pace with that in wage employment. However, there is no rise in the returns to primary education in non-farm self-employment to match that in wage employment.

Education also has allocational effects – altering the probability of a household receiving different kinds of income and affecting how much labour is allocated to those income-generating activities it does engage in. affects the kind of income generating activity households engage in. Post-primary education increase the probability of a household receiving wage income but reduces the probability of receiving earnings from agricultural and non-agricultural self-employment. Primary education increases the probability of receiving income from non-agricultural self-employment and has weak effects elsewhere. Over time, these indirect effects of education become more important for primary schooling. In particular, households with primary educated households are more likely to have taken part in the expansion of non-agricultural enterprises between 1992 and 1999/2000. This effect, coupled with the large rise in the returns to primary education in wage employment, helps explain the rise in the overall returns to primary education in Uganda.

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Table 1: Poverty statistics by education of the household head

IHS						Contribution to:		
Education of head	population share	CPAE	P0	P1	P2	P0	P1	P2
national	100.00	6900	55.71	20.31	9.90	100.00	100.00	100.00
uneducated	28.18	5434	66.48	26.98	14.03	33.63	37.43	39.93
incomplete primary	38.77	6333	57.87	20.61	9.80	40.27	39.33	38.36
complete primary	16.04	6857	53.48	18.54	8.77	15.40	14.65	14.21
incomplete secondary	8.41	7796	47.50	14.44	6.33	7.17	5.98	5.38
complete secondary	7.96	12651	23.96	6.60	2.63	3.43	2.59	2.11
university	0.64	23470	9.76	0.79	0.08	0.11	0.03	0.01

UNHS						Contribution to:		
Education of head	population share	CPAE	P0	P1	P2	P0	P1	P2
national	100.00	9835	34.16	10.13	4.34	100.00	100.00	100.00
uneducated	24.11	7212	48.09	17.05	8.40	33.94	40.59	46.67
incomplete primary	38.01	8284	37.66	10.70	4.26	41.90	40.15	37.32
complete primary	18.92	10617	28.69	6.91	2.46	15.89	12.90	10.73
incomplete secondary	9.38	10964	20.04	4.91	1.73	5.50	4.54	3.75
complete secondary	8.58	17131	10.78	2.14	0.77	2.71	1.82	1.52
university	1.00	44015	2.33	0.06	0.00	0.07	0.01	0.00

CPAE = consumption per adult equivalent (1989 Uganda Shillings per month).

Table 2: Household earnings by source

	Mean	Proportion reporting some earnings from source	Conditional Mean	Median
IHS				
Consumption	304068			224986
Earnings	198362			128477
Agricultural	104650	0.832	125710	87860
Self-employed	47747	0.275	173414	69959
Wage	45965	0.330	139417	74074
Non-agriculture	93713	0.538	174241	80996
UNHS				
Consumption	498130			339374
Earnings	361065			202681
Agricultural	169727	0.805	210870	137534
Self-employed	107353	0.344	312131	111957
Wage	83984	0.272	308569	146917
Non-agriculture	191337	0.563	339905	128820

Means and medians are in 1989 shillings per household per year.

Table 3: descriptive statistics on education and wage earnings

Education of head	IHS 1992 Wage earnings	% workers	UNHS 1999/2000 Wage earnings	%workers
national	156248		341241	
uneducated	67178	11.2	138253	10.0
incomplete primary	107733	25.5	158360	25.1
complete primary	132320	23.4	345254	28.7
incomplete secondary	139805	8.4	214860	7.0
complete secondary	250283	28.5	496483	25.7
university	705561	3.0	1393239	3.5
Number of observations	3359			2486

(1989 Ush per worker per year)

Table 4: Mincerian returns to education over time

Survey	Cohort	Primary	Secondary	University
IHS 1992	1972 and earlier	8	15	17
	1973-1982	5	8	33
	1983-1992	4	5	9
	All cohorts	7	8	18
UNHS 1999/2000	1972 and earlier	22	18	39
	1973-1982	19	12	10
	1983-1992	14	10	22
	After 1992	13	6	25
	All cohorts	17	11	23

Assuming 3 years to complete university
Cohorts defined by the year when an individual is predicted to enter the labour force.

Table 5: Estimates of the pecuniary costs of schooling (1989 shillings per student per year)

	Primary	Secondary	University	Notes
Public				
1991/1992	3586	8787	552681	From World Bank (1993).
1999	10110	26406	386525	Figures on spending provided in personal communication by Carla Bernotonico of the World Bank. Student numbers taken from the Republic of Uganda (2000). University student numbers are for 1998
Private				
1992 observed	6326	44029	20681	From IHS 1992
1992 estimated marginal costs	4661	62527	137635	Estimated from a regression of household educational spending on student numbers using IHS and UNHS data
1999/2000 estimated marginal costs	4087	75445	261077	
1999/2000 inferred	5547	53125	39229	Updating 1992 observed costs by change in estimated marginal costs

Table 6: Standard estimates of rates of return to education

	1992 IHS		1999/2000 UNHS	
	Private	Social	Private	Social
Primary	15.2%	13.4%	30.2%	23.7%
Secondary	6.8%	6.4%	11.5%	10.5%
University	15.8%	2.7%	24.2%	13.4%

We assume that the opportunity cost of primary school is one-fifth of the adult wage and the opportunity cost of post-primary school is a full adult wage.
Direct private costs are assumed to be those reported in the IHS.
Benefits are those predicted by the earnings functions with community fixed effects.

Memo item: average rates of return for sub-Saharan Africa

	Psacharopoulos (1994)		Bennell (1996)	
	Private	Social	Private	Social
Primary	41	24	NA	15
Secondary	27	18	NA	24
University	28	11	NA	6

NA = not available

Memo item: rates of return for Kenya

	1978		1986		1993	
	Private	Social	Private	Social	Private	Social
Primary	24	13	22	13	25	13
Secondary (lower)	23	20	17	14	7	6
University	13	2	31	10	35	17

30

Table 7: Reduced form models of the log of total household earnings (with community fixed effects)

	1992		1999/2000	
	coefficients	t-ratios	coefficients	t-ratios
Household holdings of factors of production:				
Log capital	0.044	18.6 ***	0.046	11.33 ***
Log land	0.063	11.14 ***	0.063	12.97 ***
Log number of adult non-students	0.599	32.91 ***	0.596	27.04 ***
Average characteristics of adult non-students in household:				
Years of primary school	0.051	12.56 ***	0.078	16.38 ***
Years of secondary school	0.095	11.39 ***	0.133	12.51 ***
Proportion attended university	0.432	3.52 ***	1.040	6.54 ***
Age (years)	0.049	15.89 ***	0.034	9.82 ***
Age squared	-0.001	-17.58 ***	0.000	-11.56 ***
Proportion women	-0.099	-3.86 ***	-0.141	-4.23 ***
Mean community fixed effect	10.585		10.412	

*** = significance at the 1%, ** at the 5%, and * at the 10% level.

Table 8: Household earnings functions by sector

IHS 19992

	farm		self-employment		wage	
	Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio
Log of factors of production						
Labour	0.405	14.57 ***	1.191	8.15 ***	0.754	7.78 ***
Capital	0.126	18.76 ***	0.049	4.14 ***		
Land	0.356	20.99 ***				
Average characteristics of household members working in activity (predicted):						
Years of primary school	0.026	4.74 ***	0.065	5.69 ***	0.067	7.85 ***
Years of secondary school	0.000	-0.02	0.089	4.46 ***	0.086	7.36 ***
Proportion attended university	0.198	0.57	-0.103	-0.34	0.352	2.79 ***
Age (years)	0.035	8.67 ***	0.049	4.36 ***	0.042	5.05 ***
Age squared	0.000	-9.6 ***	-0.001	-4.59 ***	-0.001	-5.46 ***
Proportion women	0.153	4.03 ***	-0.153	-2 **	-0.266	-5.21 ***

UNHS 1999/2000

	farm		self-employment		wage	
	Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio
Labour	0.586	18.23 ***	1.291	7.58 ***	1.171	7.5 ***
Capital	0.108	14.28 ***	0.021	3.32 ***		
Land	0.182	16.72 ***				
Average characteristics of household members working in activity (predicted):						
Years of primary school	0.035	6.17 ***	0.068	5.5 ***	0.158	14.59 ***
Years of secondary school	0.069	4.42 ***	0.112	5.17 ***	0.100	6.56 ***
Proportion attended university	-0.468	-0.94	0.418	1.44	0.663	3.92 ***
Age (years)	0.037	8.6 ***	0.033	3.19 ***	0.088	7.94 ***
Age squared	0.000	-8.7 ***	0.000	-3.76 ***	-0.001	-7.95 ***
Proportion women	0.114	2.51 **	-0.404	-4.85 ***	-0.121	-1.75 *

Estimated with community-level fixed affects and instrumenting for labour input and its characteristics

The dependent variables are the logs of household earnings from the relevant source. The samples used are those households drawing any earnings from the relevant source.

Table 9A: Probit Models for Engaging in an Income-generating Activity, 1992

	Farming coefficient	t-ratio	Non-agricultural self-employment coefficient	t-ratio	Wage employment coefficient	t-ratio
Intercept	-1.460	71.83 ***	-0.980	48.05 ***	0.027	0.04
Log number of adult non-students	0.735	275.08 ***	0.205	37.32 ***	0.140	16.71 ***
Average characteristics of adult non-students in household:						
Years of primary school	-0.038	15.36 ***	0.053	47.79 ***	0.013	2.96 *
Years of secondary school	-0.161	77.95 ***	-0.076	24.60 ***	0.195	146.55 ***
Proportion attended university	-0.207	0.44	-0.214	0.82	0.789	4.48 **
Age (years)	0.018	5.18 **	0.023	12.51 ***	0.025	14.96 ***
Age squared	0.000	0.35	0.000	19.91 ***	0.000	24.02 ***
Proportion women	0.576	97.25 ***	0.300	36.79 ***	-0.773	238.65 ***
Regional dummy variables:						
Eastern urban	0.327	24.73 ***	0.230	14.23 ***	-0.065	1.05
Eastern rural	2.270	746.97 ***	-0.264	22.50 ***	-0.766	175.33 ***
Central rural	1.657	661.38 ***	-0.418	58.06 ***	-0.604	116.16 ***
Western urban	0.016	0.06	0.056	0.82	-0.134	4.34 **
Western rural	1.777	633.52 ***	-0.805	182.97 ***	-0.680	135.83 ***
Northern urban	0.423	35.30 ***	0.077	1.34	-0.057	0.67
Northern rural	1.969	624.73 ***	-0.483	66.21 ***	-0.879	205.82 ***
Education of parents of household head:						
Father incomplete primary	-0.038	0.66	0.055	2.28	0.005	0.02
Father complete primary	-0.071	1.25	-0.027	0.25	0.072	1.69
Father post-primary	-0.020	0.04	-0.124	1.87	0.107	1.26
Mother incomplete primary	0.065	1.57	0.027	0.40	-0.010	0.05
Mother complete primary	-0.365	13.44 ***	0.009	0.01	0.119	1.77
Mother post-primary	-0.143	0.43	-0.136	0.64	0.085	0.20

Table 9B: Probit Models for Engaging in an Income-generating Activity, 1999/2000

	Farming coefficient	t-ratio	Non-agricultural self-employment coefficient	t-ratio	Wage employment coefficient	t-ratio
Intercept	-2.456	181.13 ***	-0.601	18.07 ***	0.355	5.67
Log number of adult non-students	0.836	304.81 ***	0.219	41.15 ***	0.051	2.04
Average characteristics of adult non-students in household:						
Years of primary school	-0.001	0.01	0.082	120.77 ***	0.008	1.05
Years of secondary school	-0.097	22.43 ***	-0.077	22.23 ***	0.130	60.21
Proportion attended university	-0.811	5.70 **	-0.129	0.27	0.814	7.38
Age (years)	0.049	40.69 ***	0.007	1.19	0.010	2.30
Age squared	0.000	12.38 ***	0.000	10.71 ***	0.000	12.07
Proportion women	0.492	55.38 ***	0.365	44.55 ***	-0.951	274.68
Regional dummy variables:						
Eastern urban	0.002	0.06	0.024	13.14 ***	-0.009	2.03
Eastern rural	2.024	739.10 ***	-0.415	50.60 ***	-0.673	123.56
Central rural	1.851	756.00 ***	-0.548	95.12 ***	-0.710	149.45
Western urban	0.014	10.84 ***	0.002	0.44	-0.002	0.20
Western rural	2.137	769.95 ***	-0.717	147.54 ***	-0.680	127.58
Northern urban	-0.006	6.47 **	0.009	18.34 ***	0.000	0.04
Northern rural	2.015	557.92 ***	-0.284	19.86 ***	-0.750	123.49
Education of parents of household head:						
Father incomplete primary	0.074	1.08	0.161	10.80 ***	0.011	0.04
Father complete primary	0.017	0.03	0.079	1.31	-0.030	0.16
Father post-primary	-0.239	11.26 ***	0.081	2.11	0.082	2.02
Mother incomplete primary	-0.068	0.85	-0.009	0.03	0.016	0.08
Mother complete primary	-0.136	1.93	0.083	1.17	-0.026	0.10
Mother post-primary	-0.290	7.79 ***	-0.143	2.94 *	0.117	1.87

Table 10: The entry effects of education

	1992				1999/2000			
	agriculture	self-employment	wage employment	Total earnings	agriculture	self-employment	wage employment	Total earnings
Marginal effects on probability of receiving some income from the source:								
primary	-0.5	1.1	(0.3)		(0.0)	2.0	(0.2)	
secondary	-2.2	-1.5	4.3		-1.5	-1.9	2.6	
university	(-1.9)	-2.2	10.2		-9.5	-1.5	10.3	
Entry effects – proportionate rise in household earnings								
primary	-0.6%	3.9%	0.9%	0.8%	0.0%	5.4%	0.6%	1.7%
secondary	-2.7%	-5.5%	13.1%	0.3%	-1.9%	-5.1%	9.4%	-0.2%
university	-2.3%	-8.1%	31.0%	4.0%	-11.8%	-4.5%	38.0%	2.0%

For primary and secondary schooling, the effects are the marginal effects, $\delta P/\delta X = \beta P(1-P)$, in percentage terms where P is the weighted mean proportion obtaining income and β is the coefficient on education.

For university, the effect of attendance is calculated by the impact effect, $\Phi(Z)-\Phi(Z+\beta)$ where $Z=\Phi^{-1}(P)$. The table shows the effect of a year of university, where the impact effect is divided by three and the results are again expressed in percentage terms.

Terms in brackets denote effects that are statistically insignificant at the 5% level.

Table 11: Effects of an extra year of education on mean earnings from different sources

	1992				1999/2000			
	Agriculture	Self-employment	Wage employment	Total	Agriculture	Self-employment	Wage employment	Total
Primary								
Direct education	2.5%	6.4%	6.6%	4.4%	3.4%	6.4%	15.3%	7.1%
Entry effect	-0.6%	3.9%	0.9%	0.8%	0.0%	5.4%	0.6%	1.7%
Labour input +age/sex	-0.1%	0.6%	-0.5%	0.0%	0.1%	0.9%	-0.2%	0.2%
Total	1.9%	10.9%	7.0%	5.2%	3.5%	12.7%	15.6%	9.0%
Secondary								
Direct education	0.0%	8.9%	9.2%	4.3%	6.6%	11.3%	10.7%	8.9%
Entry effect	-2.7%	-5.5%	13.1%	0.3%	-1.9%	-5.1%	9.4%	-0.2%
Labour input +age/sex	-0.3%	1.5%	1.3%	0.5%	-1.0%	0.8%	1.7%	0.2%
Total	-3.0%	4.9%	23.6%	5.1%	3.7%	7.0%	21.8%	8.9%
University								
Direct education	6.9%	-2.1%	13.5%	6.3%	-12.8%	19.5%	24.5%	5.4%
Entry effect	-2.3%	-8.1%	31.0%	4.0%	-11.8%	-4.5%	38.0%	2.0%
Labour input +age/sex	-1.8%	1.5%	1.3%	-0.2%	-3.8%	-1.3%	9.3%	0.0%
Total	2.9%	-8.6%	45.9%	10.1%	-28.5%	13.7%	71.8%	7.4%

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