WU WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

EQUIS ACCREDITED AACSB ACCREDITED ASSOCIATION AMBA ACCREDITED

The dynamics of returns to education in Uganda: National and subnational Trends

Crespo Cuaresma, Jesus; Raggl, Anna

DOI:
10.57938/2032e5fd-754a-4ca4-bce6-a5e847a02980

Published: 01/02/2014

Document Version:
Publisher's PDF, also known as Version of record

Document License:
Unspecified

Link to publication

Citation for published version (APA):
Crespo Cuaresma, J., & Raggl, A. (2014). *The dynamics of returns to education in Uganda: National and subnational Trends*. WU Vienna University of Economics and Business. Department of Economics Working Paper Series No. 169 https://doi.org/10.57938/2032e5fd-754a-4ca4-bce6-a5e847a02980

Download date: 30. Apr 2025

Department of Economics
Working Paper No. 169

The dynamics of returns to education in Uganda: National and subnational trends

Jesus Crespo Cuaresma
Anna Raggl

February 2014

The dynamics of returns to education in Uganda: National and subnational trends*

Jesus Crespo Cuaresma†
Anna Raggl‡

Abstract

We assess empirically the changes in returns to education at the subnational level in Uganda using the Uganda National Household Surveys for 2002/2003 and 2005/2006. Our results indicate that average returns to schooling tended to converge across regions in the last decade. The overall trend in convergence of returns to schooling took place at all levels of educational attainment and this behaviour in returns to education is mostly driven by the dynamics of returns to schooling in urban areas. We analyse subnational convergence in returns to education and unveil deviant dynamics in Northern Uganda. We discuss the potential challenges to inclusive economic growth in Uganda which are implied by our results.

Keywords: Human capital, returns to education, regions, Uganda.

JEL Classifications: J24, R23, O55.

*We are particularly grateful to Rachel K. Sebudde and Innocent Mulindwa for very valuable comments and discussions in the course of the analysis and an anonymous referee, Michael Bleaney, Anton Dobronogov, Nyende Magidu, Sukhdeep Brar and officials at the Uganda Ministry of Education and Sports and Uganda Bureau of Statistics for helpful comments on earlier drafts of this study. The authors acknowledge funding from the Austrian Science Fund (FWF): Z171-G11.

†Department of Economics, Vienna University of Economics and Business (WU); World Population Program, International Institute of Applied Systems Analysis (IIASA); Wittgenstein Centre for Demography and Global Human Capital (WIC) and Austrian Institute for Economic Research (WIFO). Address: Augasse 2-6, 1090 Vienna (Austria). Email: jcrespo@wu.ac.at.

‡Research Institute for Human Capital and Development, Vienna University of Economics and Business (WU) and Wittgenstein Centre for Demography and Global Human Capital (WIC). Address: Augasse 2-6, 1090 Vienna (Austria). Email: araggl@wu.ac.at

1 Introduction

Universal Primary Education (UPE) has been one of the key instruments aimed at achieving sustainable development and poverty reduction in Uganda since it took effect in 1997. The launch of UPE implied the abolition of tuition fees an other charges related to primary education and resulted in a remarkable increase in enrollment rates for primary schooling. Existing empirical studies present evidence concerning the fact that UPE also increased the access of girls to primary education and reduced drop-outs related to school costs (Deininger, 2003). In 2006, Uganda was the first country to adopt Universal Secondary Education (USE) as a policy tool to further meet the demands for a better educated workforce.

Several studies have assessed empirically the effect that UPE had on enrolment and completion rates, but few authors analyse the changes in returns to schooling that have taken place since UPE is in place in Uganda. Kagundu and Pavlova (2007) estimate wage regressions in order to assess the gender wage gap in Uganda, and obtain returns to education using the 2002/03 Uganda National Household Survey. They conclude that returns to schooling tend to be lower for rural areas and very high for tertiary education, but their analysis lacks the evaluation of changes in such returns over time. A more thorough analysis of returns to schooling in Uganda is of particular interest since economic theory would predict that a strong policy commitment to UPE should have a strong effect on returns to schooling. In particular, the expansion of primary schooling should lower its return through the increase in supply of educated individuals, a phenomenon which was predicted for the case of Uganda already in studies at early stages of the launch of UPE (see Appleton, 2001).

In this piece of research we evaluate the development of returns to education to individuals in the wage sector for Uganda for the period 2002-2006. We exploit the information in two national household surveys (Uganda National Household Survey 2002/2003 and 2005/2006 – UNHS 2002/03 and UNHS 2005/06) to quantify the degree of heterogeneity in returns to education across regions in Uganda. Using estimates from Mincerian wage regressions, we assess the dynamics of returns to education across regions and educational attainment levels. The aim of the study is manifold. On the one hand, we present for the first time a thorough analysis of the dynamics of returns to schooling in Uganda for the period of time when UPE was being implemented. On the other hand, we evaluate potential challenges in education and labour market policy by comparing the changes in returns to schooling not only by educational attainment level, but also by subnational region. With such an analysis, trends of convergence in returns to schooling across and within regions of Uganda can be assessed and diverging behaviour in terms of return dynamics can be identified and used to formulate policy recommendations.

The specifications we estimate give evidence of nonlinear, convex returns to years of schooling in Uganda, a pattern that is shared by other African countries (see Bennell, 1996, and Söderbom et al., 2006). Our results indicate that the first decade of the 21st century has been marked by overall convergent dynamics in terms of returns to education across subnational regions in Uganda. When we disaggregate the results by educational

attainment, the convergence trend appears to be stronger in returns to primary schooling as compared to other schooling levels, as would be expected from the theoretical intuition presented above. Disaggregating by rural versus urban areas, we find that return convergence is lagging in rural areas. Northern Uganda, a region whose recent history is marked by conflict, presents deviant characteristics as compared to the rest of the country when it comes to return dynamics within subnational units. While, on top of inter-regional convergence, strong patterns of convergence of returns to schooling *within* other regions are the rule, this is not the case in Northern Uganda.

The paper is structured as follows. Section 2 presents stylized facts concerning education and wages in Uganda and descriptive statistics based on the data used in the study. Section 3 summarizes the estimates of the returns to education both at the national and the subnational level. Section 4 analyzes the dynamics of returns to schooling in Uganda for the period 2002-2006 at the subnational level. Section 5 formulates policy recommendations based on the results in the previous sections, concentrating on the results for Northern Uganda. Section 6 concludes.

2 Wages and education in Uganda: A first look at the data

Our main data source to assess the relationship between schooling and wage earnings is the Uganda National Household Survey (UNHS) (surveys corresponding to 2002/03 and 2005/06), conducted by the Uganda Bureau of Statistics. We concentrate here in the data for 2005/06 in order to expose the stylized facts concerning wages and employment in Uganda. The UNHS 2005/06 contains data for 7,400 households from all districts in Uganda and offers detailed information about education, labour market activities, demographic and economic characteristics of 42,808 individuals. For our analysis, we restrict our sample to the economically active working age population (age 14 – 65),[1] that is, we exclude individuals currently in school age.[2] Table 1 shows the allocation of the population to different economic activities, grouped by sex, area, region and education. Considering wage work, in 2005/06 28% of the economically active part of the population is engaged in the wage sector and are the object of our study. As one might expect, there are clear differences in wage sector participation across regions and between men and women. Most importantly, a simple comparison of sector participation across sectors by educational attainment points towards a strong relationship between education and participation in wage work: the higher the attained education, the higher the odds of participating in the wage sector. While only 25% of individuals with primary school attainment are employed persons receiving a salary, over 60% of those with post-secondary education or a university degree work for wages. This observation indicates that selection to the wage sector in Uganda is not random and that methods aimed at correcting for

[1]The use of this age group is admittedly arguable, Kagundu (2007), for instance, includes individuals up to age 80, justifying such a choice with the longer work life in rural areas due to domination of agricultural work.

[2]Table A1 in the Appendix shows descriptive statistics of all explanatory variables for the datasets used.

sample selection may be needed when obtaining estimates of returns to schooling.

Table 1 – Employment Status by Sex, Area, Region and Education in 2005/06, Age 14–65

	Employment Status					
	Unemployed	**Wage Worker**	**Self-employed**	**Agriculture**	**Total**	**Sample size**
	%	%	%	%	%	
Sex						
Male	10.6	40.5	11.9	37.0	100.0	6,659
Female	20.3	18.0	9.0	52.7	100.0	7,784
Area						
Rural	14.0	26.3	7.5	52.2	100.0	11,191
Urban	24.6	38.2	24.3	12.9	100.0	3,252
Region						
Central	14.7	28.2	11.7	45.3	100.0	3,263
East	14.5	20.7	6.4	58.3	100.0	3,763
North	22.4	33.6	13.0	31.0	100.0	3,162
West	9.9	27.8	6.5	55.8	100.0	3,626
Kampala	29.0	41.5	26.8	2.7	100.0	629
Education						
No Education	18.8	22.0	6.4	52.8	100.0	2,418
Some Primary	14.5	26.5	9.0	50.0	100.0	6,332
Primary	15.5	24.9	13.4	46.2	100.0	2,161
Post-Primary	7.4	65.7	9.3	17.6	100.0	372
Some Secondary	17.6	25.6	15.4	41.4	100.0	1,506
O-Level	16.2	33.7	15.5	34.6	100.0	763
A-Level	23.5	37.6	21.5	17.3	100.0	165
Post-Secondary	10.9	66.5	12.7	9.9	100.0	398
University	23.5	65.2	6.7	4.6	100.0	147
Total	15.8	28.3	10.4	45.4	100.0	14,443

Source: UNHS 2005/06, data weighted using survey weights

The dependent variable in our analysis, the logarithm of hourly wages, is based on the reported wages per time unit, excluding in-kind payments.[3] Figure 1 shows the distribution of (log) hourly wages from the UNHS 2005/06 for the total working age population, as well as male/female and rural/urban subsamples. Considerable differences between the subsamples of male and female employees are observable, as well as differences between rural and urban areas. Wages tend to vary more in the male and urban sample, while the distribution is much more concentrated and shifted toward lower values for females and employees in rural areas. To further get an idea of the distribution of wages across different subgroups, Table 2 shows the means of hourly wages by region of residence and

[3]In very rare cases, individuals reported two or three jobs. In order to get one hourly wage to work with, we used a simple average of the hourly wages. The results of our analysis are nevertheless robust to the exclusion of these individuals from the sample

educational attainment. The gap between male and female wages is present for all subnational regions and education levels. Furthermore, we observe considerably higher wages for individuals with higher educational attainment. Isolating and quantifying the effect of educational attainment on wages, as well as assessing the behaviour of such an effect across subnational regions and over time in Uganda is the main focus of this study.

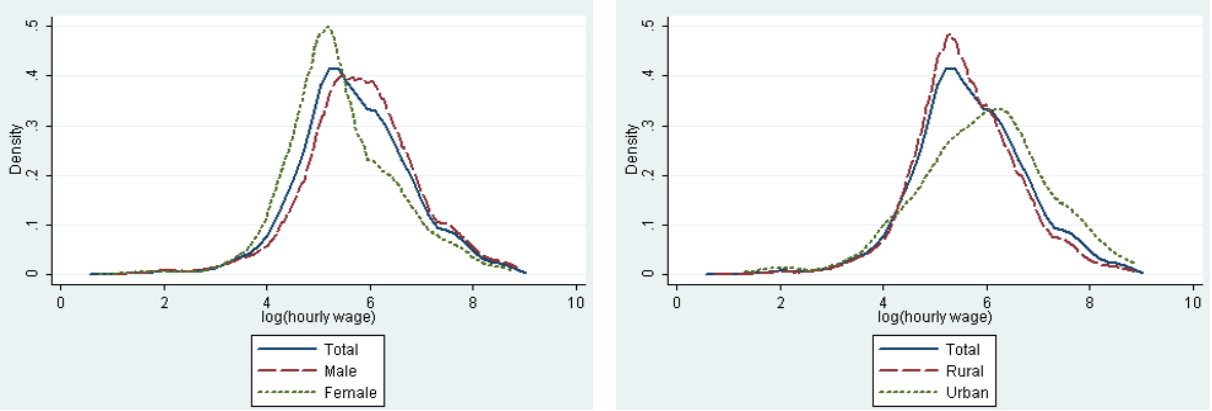


Figure 1 – Distribution of (log) hourly wage by sex and area, UNHS 2005/06

Table 3 shows the level of educational attainment of the working age population grouped by area and region. Mirroring the differences in wage earnings, notable differences between men and women and across regions in educational attainment can be observed in the sample. In order to understand the extent to which these differences can account for wage differentials, we turn to regression analysis in the next section and concentrate on the relationship between educational attainment and wages after controlling for other potential determinants of earnings.

3 Estimating returns to education in Uganda

3.1 The basic model

We estimate returns to education with the aid of standard Mincerian specifications (Mincer 1958, 1974) estimated using UNHS data for 2002/03 and 2005/06. Our most general specification relates wages to educational attainment after controlling for other determinants of earnings,

$$\ln w_i = \alpha + \psi(ed_i) + \sum_j \theta_j \mathbf{x}_{ji} + u_i, \tag{1}$$

where w_i denotes the hourly wage and ed_i is a variable measuring years of education of individual i. In all models, we control for individual, household, occupation, sector and regional characteristics using the set of variables given by $\{\mathbf{x}_j\}$ in (1). Different specifications of the relationship between educational attainment and earnings are assumed in the models we estimate. In the simplest case we assume $\psi(ed_i) = \beta ed_i$, so that the estimate of β refers to the average return corresponding to an extra year of education independently of the level of attainment at which such an increase takes place. We also

Table 2 – Hourly wages by area, region and education in 2005/06, Age 14–65

	Average hourly wages (Uganda Shillings)		
	Male	**Female**	**Total**
Area			
Rural	589.6	378.2	516.7
Urban	1,811.4	716.1	1,442.4
Region			
Central	987.1	668.6	900.1
East	880.4	511.1	756.5
North	922.9	357.4	679.9
West	493.0	308.9	431.8
Kampala	1,518.8	615.1	1,202.5
Education			
No Education	369.7	245.7	290.6
Some Primary	408.1	289.6	368.4
Primary	485.2	320.6	454.2
Post-Primary	2,549.6	1,262.1	2,085.8
Some Secondary	1,004.1	372.2	839.5
O-Level	1,312.2	755.5	1,173.1
A-Level	1,145.0	650.6	1,099.3
Post-Secondary	1,929.6	1,091.6	1,622.9
University	4,742.0	2,263.1	4,107.8
Total	877.4	455.6	732.7

Source: UNHS 2005/06, data weighted using survey weights

use specifications given by $\psi(ed_i) = \sum_{k=1}^{K} f_k(ed_i - \gamma_k)$, with

$$f_k(ed_i) = \begin{cases} \beta_k(ed_i - \gamma_k) & \text{if } \gamma_k < ed_i < \gamma_{k+1}, \\ 0 & \text{otherwise,} \end{cases} \quad (2)$$

with $\gamma_0 = 0$ and where different returns are assumed across attainment levels, which are defined by the threshold levels γ_k, $k = 1, \ldots, K$. This specification assumes K different attainment levels, each one with a cumulative duration of γ_k years. This specification allows for the estimation of different returns to education associated to years of primary, secondary and tertiary education. Finally, we also assume a more flexible link between years of education and wages, approximated by $\psi(ed_i) = \sum_g \beta_g I(ed_i = g)$, where $I(\cdot)$ is an indicator function, taking value one if the argument is true and zero otherwise and $g = 1, \ldots, G$ denotes each possible value for the years of education. This specification estimates returns to education for each individual year of schooling and thus does not impose a predetermined functional form between ed_i and $\ln w_i$. Several theoretical settings assume decreasing returns to education, which would materialize themselves in a concave partial relationship between years of education and wages, with primary schooling having the highest private returns. On the other hand, convex-shaped returns to schooling appear to be the rule in developing countries. The estimate of average returns to education may not be a sensible statistic to consider if strong differences in returns

Table 3 – Years of education: males and females by area and region in 2005/06, Age 14–65

	Average years of eucation		
	Male	**Female**	**Total**
Area			
Rural	5.9	4.1	4.9
Urban	8.4	7.1	7.7
Region			
Central	6.6	5.8	6.2
East	6.3	4.4	5.3
North	6.2	3.2	4.4
West	5.8	4.0	4.8
Kampala	8.8	8.2	8.4
Total	6.4	4.6	5.4

Source: UNHS 2005/06, data weighted using survey weights

across educational attainment levels or years of schooling are prevalent in the economy. Psacharopoulus (1994), for instance, reviews estimates of returns to schooling across the world and concludes that years of primary schooling tend to exhibit significant larger returns than higher education levels. This observation, however, has been contradicted by more recent estimates for African countries (see Bennell, 1996, for a seminal contribution and Söderbom et al., 2006, for recent estimates for Eastern Africa), which exhibit a convex pattern in the relationship between years of schooling and wages, after controlling for other determinants.

We analyze the geographical differences in returns to schooling by estimating our models for geographically defined subsamples, as well as for the full sample. Table 1 in the Appendix presents descriptive statistics for the explanatory variables used in the estimations. They include, apart from years of education, measures of experience, demographic characteristics of the individual and the household, as well as variables related to the area of residence and occupation and industry dummies. Tables 4 and 5 present the OLS estimates corresponding to the specification with $\psi(ed_i) = \beta ed_i$ for the two household surveys. The models are estimated using as the following covariates as extra control variables: employment status dummies, experience, experience squared, a gender dummy, dummies for civil status, a dummy for having attended a public school, a dummy for urban areas, household size, region dummies, industry dummies and occupation dummies.[4] We also reestimate the model by region in order to account for parameter heterogeneity across subnational territorial units. The estimates imply an average return to education in Uganda of roughly 7.2% in 2002/03 which decreases to 5.75% in 2005/06. These estimates hide a high degree of heterogeneity in terms of returns to schooling across regions, with larger returns in the Western region and Kampala in 2002/03 and in Northern and Eastern Uganda in 2005/06. With the exception of the Northern and Eastern region,

[4]Most of the parameter estimates for these controls are not reported in our tables but are available from the authors upon request.

returns to education tended to decrease in all regions for the period 2002-2006. Tables 6 and 7 present the p-values corresponding to the tests of equality of returns to education between pairs of regions in a given year (Table 6) and across periods (Table 7). The results of the pairwise tests indicate that the behaviour of returns to education in Kampala tends to differ significantly from that of the rest of the country. Concentrating on the size of the point estimates, the changes in returns over this period imply convergent dynamics in returns to education within the country, with larger decreases happening, on average, in regions with relatively high initial returns to schooling. Such an equalization trend in returns to education is backed by the test results presented in Table 6 and Table 7. While significant differences between the average returns to schooling in Kampala and most other regions of the country existed in 2002/03, these appear to have disappeared by 2005/06.

Table 4 – UNHS 2002/03: Wage Equation, OLS estimates by Regions, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Education	0.0723***	0.0581***	0.0521***	0.0603***	0.0741***	0.107***
	(0.00791)	(0.0145)	(0.0134)	(0.0177)	(0.0148)	(0.0202)
Experience	0.0301***	0.0426***	0.0177	-0.00788	0.0423***	-0.0242
	(0.00633)	(0.0111)	(0.0173)	(0.0128)	(0.0129)	(0.0232)
(Exp.squared)/1000	-0.318***	-0.575**	-0.198	0.181	-0.461*	1.419**
	(0.123)	(0.244)	(0.333)	(0.218)	(0.248)	(0.632)
Female	-0.159***	-0.373***	-0.0680	-0.0468	-0.163**	-0.210*
	(0.0475)	(0.122)	(0.0940)	(0.113)	(0.0695)	(0.125)
Married	0.150***	0.287***	0.217**	-0.0295	0.0699	0.0854
	(0.0475)	(0.0920)	(0.0930)	(0.137)	(0.0914)	(0.112)
Urban	0.194***	0.210**	0.253***	0.142	0.208***	
	(0.0445)	(0.0967)	(0.0830)	(0.0950)	(0.0639)	
Observations	2807	747	623	445	832	160
R^2	0.523	0.540	0.536	0.556	0.530	0.706

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size, region dummies, industry dummies and occupation dummies.

In Table 8 we consider model (1) with $\psi(ed_i) = \sum_{k=1}^{K} f_k(ed_i - \gamma_k)$, with $f_k(ed_i)$ given by (2), in order to capture such nonlinearities in the education/wage relationship induced by return heterogeneity across attainment levels. We define returns to education for primary education as the average return corresponding to one of the first 7 years of schooling, returns to secondary education as the average return per year corresponding to the following 6 years of schooling and returns to tertiary education as those corresponding to a subsequent year of education (the maximum value of the variable measuring years of education observed in our sample is 17). The results presented confirm the convex shape

Table 5 – UNHS 2005/06: Wage Equation, OLS estimates by Regions, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Education	0.0575***	0.0548***	0.0632***	0.0621***	0.0488***	0.0576***
	(0.00596)	(0.0139)	(0.0126)	(0.0117)	(0.0107)	(0.0186)
Experience	0.0364***	0.0504***	0.0178	0.0254***	0.0492***	0.0176
	(0.00528)	(0.0130)	(0.0110)	(0.00964)	(0.00917)	(0.0237)
(Exp.squared)/1000	-0.525***	-0.723***	-0.279	-0.387**	-0.709***	0.00607
	(0.0975)	(0.251)	(0.211)	(0.175)	(0.167)	(0.525)
Female	-0.149***	-0.253***	-0.143**	-0.139***	-0.106**	-0.179
	(0.0310)	(0.0808)	(0.0673)	(0.0532)	(0.0530)	(0.128)
Married	0.103***	0.0197	0.107	-0.00881	0.213***	0.134
	(0.0368)	(0.0775)	(0.0844)	(0.0743)	(0.0670)	(0.136)
Urban	0.0912*	0.181	0.108	0.0456	0.109	
	(0.0498)	(0.115)	(0.0789)	(0.0788)	(0.0750)	
Observations	3956	882	791	988	1045	250
R^2	0.373	0.310	0.378	0.295	0.412	0.532

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size, region dummies, industry dummies and occupation dummies.

Table 6 – Testing for differences in returns to education across regions (p-values)

Returns to education, 2002/03						**Returns to education, 2005/06**				
	Central	East	North	West	Kampala	Central	East	North	West	Kampala
Central		0.75	0.92	0.43	**0.04**		0.65	0.68	0.72	0.90
East			0.70	0.26	**0.02**			0.94	0.38	0.80
North				0.55	**0.08**				0.40	0.83
West					0.18					0.68

P-values of corresponding tests for (pairwise) equality of returns to education across regions for each national household survey. Figures in bold indicate significance at the 10% level.

found in the literature and display complex dynamics in the period 2002-2006. While returns to primary education increased on average during this period, they present relatively low levels in 2005/06.Returns to years of secondary and tertiary education tended to decrease on average during the period under study.[5]

The convex relationship between years of schooling and wage earnings which has been postulated for developing countries is present in our data, as can be seen in the estimates

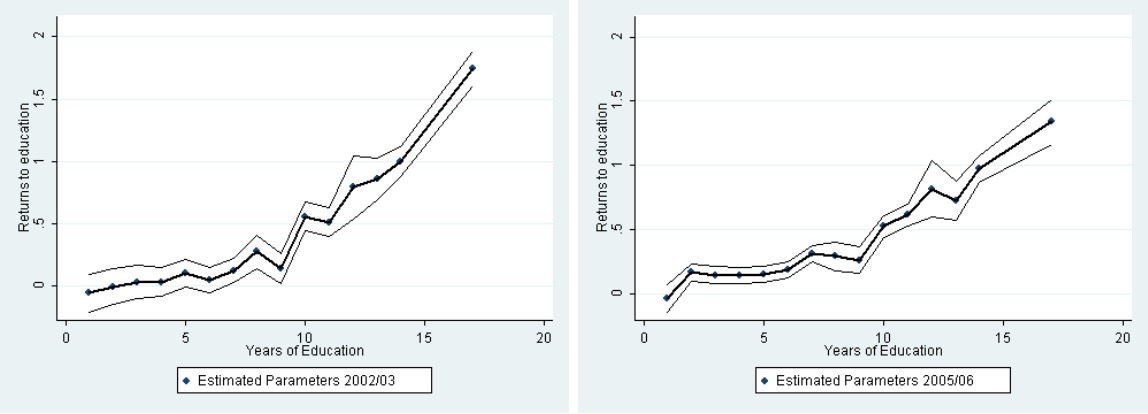
[5]Estimates by region can be found in the Appendix. Kampala actually presents the opposite development, with returns to primary schooling in 2005/06 which do not appear statistically significant. The estimate corresponding to the returns of secondary schooling in Central and Northern Uganda increased slightly and the dynamics of returns to tertiary education are relatively heterogeneous across regions.

Table 7 – Testing for differences in the returns across regions and across years (p-values)

Rows refer to UNHS 2002/03, columns to UNHS 2005/06					
	Central	East	North	West	Kampala
Central	0.87	0.78	0.82	0.82	0.82
East	0.88	0.54	0.57	0.84	0.80
North	0.80	0.89	0.93	0.57	0.91
West	0.34	0.57	0.52	0.16	0.48
Kampala	**0.03**	**0.06**	**0.05**	**0.01**	**0.07**

P-values of corresponding tests for (pairwise) equality of returns to education across regions and household surveys. Figures in bold indicate significance at the 10% level.

of the model with attainment-specific returns. We make the model more flexible by using the functional form implied by $\psi(ed_i) = \sum_g \beta_g I(ed_i = g)$. Figure 2 plots the estimated parameters for each year of schooling using the full sample for 2002/03 and 2005/06, together with the corresponding standard errors of the estimates. As expected, the shape of the estimates implies increasing returns to education. Furthermore, a flattening of the pattern of returns takes place in the period under consideration, with stronger reductions in returns at higher attainment levels.



(a) (b)

Figure 2 – Returns to education by years of education with corresponding standard errors: (a) UNHS 2002/03, (b) UNHS 2005/06

It should be noticed that, following most of the literature and with the aim of making our results comparable with other existing studies for Uganda (see Kagundu and Pavlova, 2007), we include sectoral and occupation dummies in all of our specifications of the wage equation. It could be argued that the returns to education should be measured based on models which do not contain sector and occupation dummies, so as to obtain returns that include information related to the effect that education has on the probability of being employed in better paid sectors or occupations. The average returns to schooling obtained from such models increase to approximately 10.7% for the UNHS 2002/03 dataset and 8.35% for the UNHS 2005/06. Notwithstanding this general increase in the estimates of the return to education, all the results presented above concerning the differences across

Table 8 – Wage Equation, OLS estimates by Regions, Age 14–65, UNHS 2002/03 and UNHS 2005/06

	UNHS 2002/03	UNHS 2005/06
Years of Primary	0.0143	0.0350***
	-0.0121	-0.00783
Years of Secondary	0.106***	0.0841***
	-0.0149	-0.014
Years of Tertiary	0.218***	0.151***
	-0.025	-0.0374
Experience	0.0299***	0.0374***
	-0.00612	-0.00529
(Exp.squared)/1000	-0.371***	-0.558***
	-0.119	-0.0982
Female	-0.169***	-0.172***
	-0.047	-0.0312
Married	0.153***	0.101***
	-0.0451	-0.0367
Urban	0.185***	0.0798
	-0.0439	-0.049
Observations	2807	3956
R^2	0.546	0.377

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size, region dummies, industry dummies and occupation dummies.

attainment levels and regions are qualitatively similar when this variant is employed.[6]

The widespread introduction of UPE may have also had effects on the returns to education across age groups in the Ugandan labour force. Comparing the sectoral distribution of employed individuals with (only) completed primary education by age in the 2002/3 and 2005/6 surveys does not support the view that wage employment has become more difficult for younger cohorts with primary education in the period under study. Approximately 15% of the employed individuals aged 14 to 24 with only completed primary education worked in the wage sector in 2002/03, while this figure increased to 31% in 2005/06. Since the period 2002-2006 has been characterized by high rates of GDP growth in the country, the expansion of the wage sector in these years may account for the developments. Estimates of the differences in returns to education across age groups do not reveal any remarkable differences for any of the available surveys.[7]

[6]Estimation results for these specifications can be found in the Appendix.

[7]Detailed results are available from the authors upon request.

3.2 Endogeneity and sample selection

The adequacy of OLS estimates of returns to education rests on the assumption of exogenous regressors in specification (1). The theoretical framework provided by human capital theory, however, implies that education should be treated as an endogenous variable. To the extent that the expected wage affects the individual decision of investment in human capital, estimates of returns to schooling obtained using OLS would be biased and estimation methods that explicitly account for the correlation between education measures and the error term in (1) should be preferred. This problem is further enlarged by the fact that both earnings and education may depend on unobservables (ability being a typical example) which correlate positively with the level of educational attainment. The direction of the endogeneity bias for the estimates of returns to schooling is not always straightforward. Considering innate ability, for example, one might intuitively think that an omission leads to an overestimation of returns to education, because more able individuals acquire more education and also have better earning opportunities in the job market. Griliches (1977) argues, however, that individuals with better abilities also have higher opportunity costs of schooling, and thus may have a rational incentive to invest less in schooling, which would suggests a downward bias in OLS estimates. Innate ability is not the only factor that has an impact on an individual's schooling decision. Differences in discount rates among individuals can also be a source for heterogeneity in investment in human capital (Lang, 1993). Ceteris paribus, high idiosyncratic discount rates when making decisions of investment in schooling would lead to lower educational attainment. This implies, that even individuals with the same abilities can exhibt different schooling choices due to differences in discount rates. Such differences in discount rates among individuals can originate in different tastes for schooling or in different family backgrounds. [8]

Several potential instruments have been proposed in the literature to be used in two-stage least squares (2SLS) estimation in order to correct for the endogeneity bias in returns to education estimates. Such covariates include family background and parents' education, as well as supply-side variables related to school access and infrastructure (distance to the closest school is a typical instrument in this context). Variables which approximate aspects of individual time preference have also been proposed as instruments of educational attainment in Mincerian wage regressions. In the context of proxying time preferences, measures of smoking habits are usually utilized as instruments. Evans and Montgomery (1994) argue that smoking behaviour is a good proxy for discount rates (see Fuchs, 1982 for an early reference) in the sense that individuals who smoke would tend to place a significantly higher weight to current utility as compared to future wants.[9]

A further source of estimation bias refers to the fact that our sample is limited, by construction of our research question, to wage earners. If we think of our sample as

[8] There is no agreement in the literature on whether an omission of a proxy for discount rates causes a bias and if so, whether it leads to an underestimation or to an overestimation of the true effect of schooling. For further readings see for example Dickson (2009). See also Harmon and Oosterbeek (2000) for a discussion on the case when both ability and discount rate biases occur at the same time.

[9] See Chevalier and Walker (2001) and Fersterer and Winter-Ebmer (2003) for recent studies using smoking behaviour as an instrument for educational choice in the framework of models aimed at estimating returns to schooling.

resembling an experiment, participation in the wage sector is not necessarily assigned randomly among the members of our population. On the contrary, particularly in developing economies, selection to the wage sector is related to variables affecting wages, as well as other potentially unobservable characteristics. Uganda is not an exception in this respect: according to the UNHS 2005/06, only 28% of the 14 – 65 year olds are engaged in wage work. The rest of the economically active part works in agriculture (45%), in another kind of self-employment (10%) or is unemployed (16%). Theoretically, the decision whether to work for wages or salaries depends on the individual's reservation wage, a variable we cannot observe. Thus, the problem of sample selection can be seen as an omitted variable bias, which in turn causes the variables included in our model which are correlated with the omitted variable(s) to be also correlated with the error term. This correlation induces a bias in our coefficient estimates, where the direction of the bias is not clear. Heckman (1976, 1979) proposes a two stage estimator that in a first step allows to approximate the omitted variable by modelling the probability of being in the wage sample (selection equation) and in a second step corrects for this selection in the original model. The empirical identification of the selection process implies that we require at least one variable that only affects the decision of whether to participate in the wage sector or not, but not the salary. When assessing the sample selection problem for Uganda, Kagundu (2007) uses the number of young children in the household, the ratio of ill persons in the household, non-labour income, age, education and for the rural subsample also the earnings from crop farming and the value of family assets as variables in the selection equation. In similar studies for other developing economies, Asadullah (2005) and Duraisamy (2002) use land holding and income from other sources different from labour to estimate the selection equation for Bangladesh and India, respectively.

We assess empirically the potential extent of such biases for our samples in 2002/03 and 2005/06 by reestimating our basic regressions using, alternatively, 2SLS and the Heckman procedure for sample selection. In our 2SLS estimation, in addition to the exogenous variables in (1), we use parental education (educational attainment level of the father) and smoking habits of the individual as instruments of educational attainment. On the other hand, in order to correct for sample selection, we apply Heckman's (1976, 1979) estimator with agricultural land ownership, the ratio of elderly individuals in the household and the ratio of sick family members as variables for identification of the selection equation. The estimated returns to schooling, for different specifications of $\psi(ed_i)$ and estimation methods, are presented in Tables 9 and 10.[10]

The results concerning average returns to education presented in the top panel of Tables 9 and 10 indicate that the sample selection bias is not quantitatively very relevant in our sample. In addition, the lack of significance of the inverse Mills ratio term indicates that from a statistical point of view there is no need to perform the correction for sample-selection. In both the UNHS 2002/03 and the UNHS 2005/06 the correction for sample selectivity increases returns to education minimally, but the change is not significant if the precision of the estimates is taken into account. The correction for selectivity in

[10]The results of the first stage regressions are presented in the Appendix. Although the variable which proxies smoking behaviour is not significant, the parent education covariates are significant and the standard Sargan test for identification indicates that the instruments are adequate.

Table 9 – UNHS 2002/03: OLS and Heckman estimates of Wage Equation, Age 14–65

	(1) OLS	(2) Heckman
Years of Education	0.0723***	0.083***
	(0.00791)	(0.01107)
Observations	2807	18966
R^2	0.523	–
Inverse Mills Ratio		0.030
		(0.1563)
Years of Primary	0.0143	0.0309***
	(0.0121)	(0.00818)
Years of Secondary	0.106***	0.0879***
	(0.0149)	(0.0175)
Years of Tertiary	0.218***	0.162***
	(0.0250)	(0.0322)
Observations	2807	18966
R^2	0.546	–
Inverse Mills Ratio		-0.153
		(0.1541)

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, experience, experience squared, a gender dummy, dummies for civil status, a dummy for having attended a public school, a dummy for urban areas, household size, region dummies, industry dummies and occupation dummies. Heckman estimates use agricultural land ownership, the ratio of elderly individuals in the household and the ratio of sick family members as variables for identification of the selection equation

the estimates for 2005/06 increase returns to education at all attainment levels, but the change is not at all sizable and indicate that the sample selection bias does not appear quantitatively important in this sample. The results for the UNHS 2002/03 by level of attainment present different patterns by educational attainment level: while returns to years of primary education practically double after the adjustment, accounting for sample selectivity leads to a reduction in returns for secondary and tertiary education. The relative increases in returns by level of attainment, however, still reproduce the convex pattern found using OLS estimation. For the UNHS 2002/03 data on smoking behaviour or parent education are not existing, so we constrain the 2SLS estimation to the sample from UNHS 2005/06. 2SLS estimation does lead to very strong increases in estimated average returns to education, which more than double from 5.75% to 13.3% by year of schooling. Since these results cannot be compared with similar estimates for the year 2002/03, we do not use these returns to schooling in further analysis, but note that additional research would be necessary to assess the distorsion of return estimates due to

Table 10 – UNHS 2005/06: OLS, Heckman and IV estimates of Wage Equation, Age 14–65

	(1) OLS	(2) Heckman	(3) 2SLS
Years of Education	0.0575***	0.0557***	0.125***
	(0.00596)	(0.00559)	(0.02828)
Observations	3956	14324	3940
R^2	0.373	–	0.348
Inverse Mills Ratio		-0.0705	
		(0.1068)	
Sargan test (p-value)			10.054 (0.122)
Durbin-Wu-Hausman test (p-value)			6.33 (0.012)
First stage F-test (p-value)			19.010 (0.000)
Years of Primary	0.0350***	0.0351***	
	(0.00783)	(0.00725)	
Years of Secondary	0.0841***	0.0805***	
	(0.0140)	(0.0135)	
Years of Tertiary	0.151***	0.1389***	
	(0.0374)	(0.0336)	
Observations	3956	14324	
R^2	0.377	–	
Inverse Mills Ratio		-0.0828	
		(0.1067)	

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, experience, experience squared, a gender dummy, dummies for civil status, a dummy for having attended a public school, a dummy for urban areas, household size, region dummies, industry dummies and occupation dummies. 2SLS estimates use parental education and smoking habits as instruments. Heckman estimates use agricultural land ownership, the ratio of elderly individuals in the household and the ratio of sick family members as variables for identification of the selection equation

endogeneity.[11]

The analysis hitherto has unveiled heterogeneous dynamics of returns to schooling in subnational Ugandan regions for the period 2002-2006. In the following section, we address the trends underlying such changes in returns to schooling and enlarge the analysis by considering differences in urban and rural zones, as well as the behaviour of returns within regions in the period under study.

[11]The results using instrumental variables are left unchanged if the Heckman procedure is applied to a model including fitted values of educational attainment from the first stage of the 2SLS method. These latter results are available from the authors upon request.

4 Returns to education: Subnational trends

In this section we analyze the trends which are implied by the dynamics of returns in different subnational regions of Uganda. We start by analyzing overall convergence trends of returns to schooling within the country. Panel (a) in Figure 3 depicts a scatterplot showing the average returns to schooling for each region estimated from the UNHS 2002/03 against the change in returns for the period 2002-2006 which is implied by the estimates obtained for the UNHS 2005/06. The correlation between these two variables reveals the degree of convergence/divergence existing in terms of returns to education among regions in Uganda. A negative correlation between initial returns and their consequent change indicates that regions with relatively high returns to education tended to reduce these in the subsequent period by more (or increase them by less) than regions with lower initial returns to schooling. Convergence of returns to schooling has thus taken place if such a negative correlation is observed, while divergence in returns is observed if a positive correlation prevails. The overall dynamics of returns to education within Uganda clearly point towards a convergence trend for the period 2002-2006. While the data in panel (a) of Figure 3 refers to the average returns to schooling, independently of the level of educational attainment to which they are attached, in panel (b) of Figure 3 we present the scatterplot for disaggregated returns by level of attainment (primary, secondary and tertiary education).[12]

The relative behaviour of returns to education across Ugandan regions for different attainment levels imply a fast speed of convergence for returns to schooling at the primary and secondary level, while the convergent dynamics of returns at the tertiary education level are relatively limited. Although returns to primary schooling tended to increase in this period, a result which may appear theoretically counterintuitive at first sight, it is at this level of attainment that the strongest trend of convergence in returns appears in 2002-2006. Significant differences in return changes for these years are visible if we differentiate between rural and urban areas (panel (c) and (d) in Figure 3, respectively). Two important results emerge from the comparison of rural and urban areas. Firstly, the patterns of convergence observed in the full sample seem to be driven by return changes in urban areas. It is only in this subsample that returns to education at all attainment levels present convergence, with tertiary education returns converging at a higher speed than those in the full sample (as measured by the slope of the regression line). Furthermore, the increase in returns to primary schooling found for the full sample is a characteristic which is only systematically present in the rural subsample, while such changes are only present in the Eastern region in urban areas.

If we interpret these developments between 2002 and 2006 under the light of potential different equilibria in labour markets, driven by different supply levels of workforce by educational attainment, the return increases in rural areas can be seen as a signal of partly unmet demand of educated individuals. Remarkable increases in returns to tertiary education are present in rural areas for Eastern and Northern Uganda. Despite this behaviour fitting in the overall trend of convergence across subnational regions in Uganda,

[12]The educational attainment specific estimates of returns to education by region are presented in the Appendix.

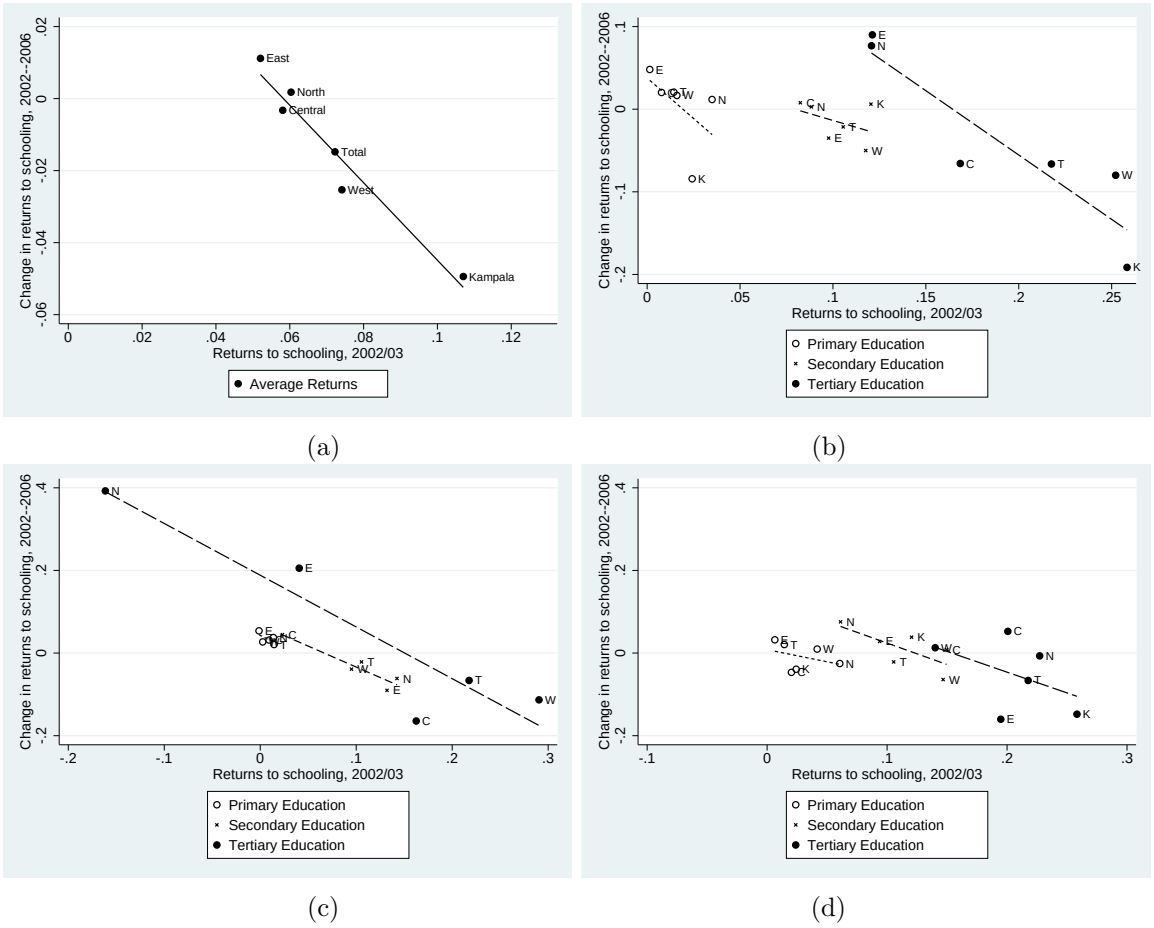


Figure 3 – Returns to schooling by attainment level, UNHS 2002/03, versus change in returns 2002-06: (a) average years of schooling, full sample; (b) average years of schooling by attainment level, full sample (c) average years of schooling by attainment level, rural subsample (d) average years of schooling by attainment level, urban subsample.

the increase in Northern Uganda deserves a more detailed analysis. The improvement in school enrollment and educational attainment in Uganda has not taken place in a homogeneous manner, and Northern Uganda has been lagging behind in education indicators (both in terms of quantity and quality indicators) due to the conflict and post-conflict situation in the region. While such a background would theoretically justify the existence of higher returns to schooling in Northern Uganda, there are several other factors that could shed more light in this phenomenon. First of all, at least partly, the effect may be education-supply driven. The lack of incentives for teachers to move to the Northern region has been often discussed in the academic literature on education policy in Uganda. The better salaries offered by humanitarian organizations in Northern Uganda, which at least partly explain the high returns to education observed in the region, have created alternative working opportunities for teachers who otherwise may have decided to stay in the public education system.

The convergence analysis undertaken hitherto studies convergence of returns across subnational regions in Uganda, but does not assess the dynamics of returns to schooling *within* regions. In spite of the fact that in some cases the parameters are estimated based on very small samples, we can obtain estimates of average returns to education at the district level, which would allow such an analysis. With the returns of education at the district level, we estimate the following model,

$$\Delta\hat{\beta}_{ij} = \gamma_{0j} + \gamma_{1j}\hat{\beta}_{0i} + \nu_i, \tag{3}$$

where the change in returns to schooling in district i of region j is regressed on the initial return to schooling of the district assuming parameters which are potentially different across regions. This specification allows us to differentiate convergence between and within regions through the use of region-specific fixed effects and region-specific speeds of convergence (measured through the parameters γ_{1j}) In Table 11 the results are presented for models with and without region-specific parameters. In the first column of Table 11, the estimate corresponding to the pooled data, without region-specific parameters, is presented. The result indicate a strong trend of convergence across districts, as would be expected from the previous results at the regional level. On average, returns to schooling also converged within regions, as can be observed from the estimates of the second column, which includes region-specific fixed effects. This specification assumes a common speed of convergence across regions, an assumption which is relaxed in the model presented in the third column of Table 11. In the model estimated in the third column of the table, we estimate region-specific speeds of within-convergence in returns to schooling. An F-test for equality of parameters for all regions strongly rejects the null hypothesis of equal speed of convergence across regions (the corresponding test statistic is 14.24, with a p-value of 0.00), but excluding the Northern region the test cannot reject equality of parameters across regions (the test statistic is 0.37, with a p-value of 0.69). Northern Uganda, thus, has a deviant behaviour in comparison with other regions not only in terms of overall, aggregated differences, but also in the pattern of change in returns to schooling within the region. Conflict-related displacement and infrastructure problems, coupled with the teacher-supply related arguments mentioned above, are factors that may help explain the slower path of convergence in returns to schooling in the north of Uganda.

Table 11 – Convergence regressions: district-level returns to schooling

	(1)	(2)	(3)
Initial return	-1.079***	-1.070***	-
	(0.141)	(0.155)	
Initial return, Central			-1.564***
			(0.319)
Initial return, East			-1.253***
			(0.177)
Initial return, North			-0.573***
			(0.052)
Initial return, West			-1.352***
			(0.147)
Observations	55	55	55
Region fixed-effects	No	Yes	Yes
Region-specific convergence speed	No	No	Yes
R^2	0.5848	0.5948	0.658

Dependent variable is the change in returns to schooling at the district level in Uganda between 2002/03 and 2005/06. Robust standard errors in parenthesis. *** stands for significance at the 1% level.

5 The geographical distribution of returns to schooling in Uganda: Lessons for education policy

One of the main objectives of UPE is to contribute to the elimination of disparities and inequalities in access to education. By assessing the differences in returns to schooling across subnational regions in Uganda, a dimension that has not been explored hitherto, we can evaluate *ex-post* measures of the success of education policy and identify problems in the fulfillment of the objectives related to education equality. In the framework of Growth Diagnostics (Hausmann et al., 2005), the estimation of returns to education plays a particularly important role in the assessment of potential constraints to economic growth. Differences in returns to schooling across regions which are not corrected over time act as price signals indicating mismatches which may hint to the existence of (regional) constraints to economic growth. The inter-regional dimension which has been highlighted in the study is particularly relevant in the paradigm of Inclusive Growth Analytics (see Ianchovichina and Lundström, 2009), which concentrates on the utilization of those agents which suffer exclusion from the growth process. The geographic dimension of inclusion is an important factor to take into account in such an analysis, and the results of our empirical study provide policymakers with useful information to evaluate the challenges being faced when implementing policies for inclusive growth.

Equalization of returns to schooling across subnational areas is the expected development if the forces of demand and supply of skilled individuals were acting symmetrically throughout the country. Our results indicate deviant developments in Northern Uganda, as well as in rural areas as compared to urban areas. The results concerning the differential behaviour of returns to schooling in Northern Uganda have to be put in the context of the post-conflict situation of the region. Problems in the provision of education in

Northern Uganda have been extensively documented (see for example Higgins, 2009) and the importance of designing education policy strategies aimed at solving the problem has been recognized by international organizations (UNICEF, 2007) and the Government of Uganda. From the side of demand of education services, poverty in Northern Uganda sets limits to school attendance in spite of the reduction in costs of education implied by the successful implementation of UPE policy. On the supply side, teachers do not tend to find sufficient incentives (both financial and in terms of quality of life) to move to Northern Uganda, partly due to the infrastructure problems in the region. The high rate of teacher absenteeism in the region can also be partly explained by this factor. Furthermore, the better salaries offered by humanitarian organizations in Northern Uganda reinforce such incentives to move away from the public education system. Ensuring the improvement of school infrastructure in Northern Uganda in terms of both new investments and renovation of existing structures is a key challenge that needs to be tackled to ensure catching up of the region with the rest of the country. Such a priority is recognized by the Government of Uganda (see Ministry of Education and Sports, 2008), although the budgetary effort which would be required to cover the short-term infrastructure costs in Northern Uganda (in particular in primary education) is deemed overwhelming. Although these measures concentrate on education policy from the supply-side, it should be noticed that the interaction of education policy with other demand-side policies is very relevant. From the side of the demand for education, despite the reduction of costs caused by the implementation of UPE and the expected further reduction implied by USE, widespread poverty in Northern Uganda leads numerous families not to have enough income as to finance the costs which are not covered by UPE policies, namely school materials and uniforms. Private contributions of parents to schools are also very limited in the region. Adjustments from both the demand and supply side appear thus important to reduce the gap in returns to education which is evident in the data.

To the extent that the quality of education plays a role in returns to schooling, their regional distribution and change over time is also related to qualitative differences in the provision of education. Public expenditure per pupil in Uganda has been historically much higher for urban as compared to rural areas, a factor which has been claimed responsible for the differences in performance in national examinations between pupils from rural schools as compared to those from schools in urban areas (see for instance Inter-Regional Inequality Facility, 2006). The differential dynamics of returns to schooling in rural and urban areas may be partly reflecting such differences in the skills acquired by locality. Policies aimed at reducing the financing gap between rural and urban areas would contribute to equalize returns of education across regions in Uganda and achieve inter-regional equity when it comes to benefiting from the private returns to schooling.

Measures related to education quality and infrastructure are presented in Table 12 for the different regions in Uganda. The pupil-to-teacher and pupil-to-classroom ratios for primary education appear much higher in the East and North region. Indicators for school infrastructure also tend to show deficiencies for the North region, which scores worse than all other parts of Uganda in terms of access to piped water and first aid facilities. Teacher absenteeism has been found to be strongly related to the quality of infrastructure in schools, as well as to the qualification of teachers, with those with a degree in edu-

Table 12 – Quality and constraint indicators by region

	Descriptive Statistics				
	Kampala	**Central**	**East**	**North**	**West**
Classroom situation^{+}					
Pupils/classroom ratio, primary	27	40	58	67	40
Pupils/classroom ratio, secondary	41	35	37	36	32
Pupils/teacher ratio, primary	39	56	85	97	52
Pupils/teacher ratio, secondary	19	18	20	21	19
Teachers by skill level*					
Graduate	9.9%	4.7%	3.1%	1.7%	3.3%
Grade V	30.8%	26.4%	28.0%	20.9%	24.2%
Grade III	59.0%	61.6%	66.3%	67.7%	69.5%
Untrained	0.4%	8.0%	3.5%	9.8%	4.0%
Teacher Shortage (1-(actual/needed))*					
Graduate	17.8%	50.4%	62.1%	70.6%	85.5%
Grade V	21.3%	45.2%	39.8%	49.4%	52.5%
Grade III	11.3%	19.9%	19.6%	28.3%	16.7%
Infrastructure of Schools*					
Piped water at school	42.5%	12.7%	6.4%	3.7%	8.7%
Water bore whole at school	–	11.7%	20.5%	26.9%	6.5%
Water bore whole outside school	3.3%	14.3%	21.6%	22.9%	4.5%
Library	42.4%	19.7%	4.4%	16.1%	15.8%
Seperate toiletts for teachers	98.3%	68.6%	51.6%	59.1%	75.1%
First Aid facilities	81.4%	41.9%	27.0%	20.3%	23.2%
Non attendance (6–12 year olds)*					
Never attended school	16.0%	14.6%	11.6%	20.3%	19.4%
Drop-outs (6–24 year olds)*					
Drop-out after P1	2.2%	3.0%	1.4%	7.3%	3.5%
Drop-out after P2	2.9%	6.2%	4.8%	8.0%	7.7%
Drop-out after P3	7.2%	8.5%	7.4%	10.5%	12.1%
Drop-out after P4	14.4%	10.2%	13.2%	16.2%	15.6%
Drop-out after P5	15.8%	17.2%	24.6%	20.7%	18.2%
Drop-out after P6	15.8%	23.0%	28.1%	19.6%	18.3%
Drop-out after P7	41.7%	31.9%	20.4%	17.6%	24.5%
Mean hourly wages of teachers (UGS)^{x}					
Teaching professionals	2629.0	1720.1	2117.2	1702.4	1807.5
Teaching associates	1252.1	986.1	970.5	912.4	817.4
Experienced non-professionals	440.6	993.6	625.9	857.2	733.9
All	1612.3	1097.7	1084.1	1053.6	1042.6

Sources:

*NSDS 2008

$^{+}$Ministry of Education and Sports, Republic of Uganda

^{x}UNHS 2005/06

cation being less likely to be absent from school during working hours (see Chaudhury et al., 2005). Both of these characteristics explain the high rates of teacher absenteeism which are reported in Northern region and which are often mentioned as obstacles to the effectiveness of investments in education expansion (see UN Office for the Coordination of Humanitarian Affairs, 2010).

The levels of student absenteeism and drop-outs in the first years of primary education are also highest in Northern Uganda, although the drop-out rate appears higher in other regions for subsequent years of primary education, peaking in a 41.7% drop-out for Kampala.[13] These problems, coupled with the relatively low wages of teachers in the Northern region (which fail to give a sufficient incentive signal for education professionals), indicate that focused policy actions need to be taken to improve the supply of education services in Northern Uganda. For the expansion of primary (and subsequently secondary) schooling to lead to inclusive paths of development within the country, the regional disequilibria unveiled in this study should be taken into account when designing further investments in school infrastructure and training of teachers.

6 Conclusions

Education policy plays a central role in the development strategy pursued by the Government of Uganda. Ten years after the start of UPE, the first steps of USE were taken in 2007 and the design of further policy steps is of particular importance since the experience of Uganda in terms of expansion of education expansion has recently gained a sort of exemplary status for other African countries.

Our study sheds light on the changes in returns to education at the subnational level in Uganda for the last decade. Our results indicate that the period 2002-2006 has been marked by overall convergence in returns to education across subnational regions in Uganda. The dynamics in returns to primary schooling indicate a rapid convergence path in the first part of the decade as compared to other schooling levels, a result which would be theoretically expected after the introduction of UPE. Convergence in returns to education, however, is lagging in rural areas and in particular in Northern Uganda. Patterns of strong convergence of returns to schooling *within* regions are present in all regions with the exception of Northern Uganda.

The analysis of returns to education and their change over time has become an important instrument to identify potential constraints to economic growth in the sense that disequilibria in the market for skilled labour may be detected through the analysis of its price (the returns to education) and its distribution both across subnational units and over time. A detailed analysis of the characteristics of the education sector in the regions of Uganda in connection to the changes in returns to schooling indicate that education quality and teacher absenteeism are particularly important explanatory factors regarding

[13] Uganda's primary schooling drop-out rate, 13.9%, is the highest in the region, compared to 3.2% in Tanzania and Kenya.

the different behaviour of returns to education in Northern Uganda.

References

[1] Appleton, S. (2001): What Can We Expect from Universal Primary Education?, in *Uganda's Recovery: The Role of Farms, Firms and Government.*, ed. by Collier, P. and R. Reinikka, World Bank Regional and Sectoral Studies.

[2] Asadullah, M. N. (2006): Returns to Education in Bangladesh, *Education Economics*, 14(4), 453–468.

[3] Bennell, P. (1996): Rates of Return to Education: Does the Conventional Pattern Prevail in sub-Saharan Africa?, *World Development*, 24(1), 183–199.

[4] Bird, K., and K. Higgins (2009): Conflict, Education and the Intergenerational Transmission of Poverty in Northern Uganda, Project Briefing, Overseas Devlopment Institute.

[5] Card, D. (1999): The Causal Effect of Education on Earnings, in *Handbook of Labor Economics*, ed. by O. Ashenfelter, and D. Card, vol. 3, chap. 30, pp. 1801–1863. Elsevier.

[6] Card, D. (2001): Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems, *Econometrica*, 69(5), 1127–1160.

[7] Chaudhury, N., Hammer, J., Kremer, M., Muralidharan, K., and Rogers, F. H. (2006): Missing in Action: Teacher and Health Worker Absence in Developing Countries, *Journal of Economic Perspectives*, 20(1), 91–116.

[8] Chevalier, A., and I. Walker (2001): Further Results on the Returns to Education in the UK, in *Education and Earnings in Europe: A Cross Country Analysis of Returns to Education*, ed. by C. Harmon, I. Walker and N. Westergaard-Nielsen. Edward-Elgar.

[9] Deininger, K. W. (2003): Does Cost of Schooling Affect Enrollment by the Poor? Universal Primary Education in Uganda, *Economics of Education Review*, 22(3), 291–305.

[10] Dickson, M. (2009): The Causal Effect of Education on Wages Revisited, *IZA Discussion Paper 4419*, Institute for the Study of Labour.

[11] Duraisamy, P. (2002): Changes in Returns to Education in India, 1983-94: by gender, age-cohort and location, *Economics of Education Review*, 21(6), 609–622.

[12] Evans, W. N., and E. Montgomery (1994): Education and Health: Where There's Smoke There's an Instrument, *NBER Working Papers 4949*, National Bureau of Economic Research.

[13] Fersterer, J., and R. Winter-Ebmer (2003): Smoking, Discount Rates, and Returns to Education, *Economics of Education Review*, 22(6), 561–566.

[14] Fuchs, V. R. (1982): Time Preference and Health: An Exploratory Study, *NBER Working Paper 539*, National Bureau of Economic Research.

[15] Griliches, Z. (1977): Estimating the Returns to Schooling: Some Econometric Problems, *Econometrica*, 45(1), 1–22.

[16] Harmon, C., and H. Oosterbeek (2000): The Returns to Education: A Review of Evidence, Issues and Defciencies in the Literature, CEE Discussion Papers 0005, Centre for the Economics of Education, LSE.

[17] Heckman, J. J. (1976): The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models, in *Annals of Economic and Social Measurement*, Volume 5, number 4, NBER Chapters, pp. 120–137. National Bureau of Economic Research.

[18] Heckman, J. J. (1979): Sample Selection Bias as a Specifcation Error, *Econometrica*, 47(1), 153–61.

[19] Ianchovichina, E., and S. Lundstrom (2009): Inclusive Growth Analytics: Framework and Application, Policy Research Working Paper Series 4851, The World Bank.

[20] Lang, K. (1993): Ability Bias, Discount Rate Bias and the Return to Education, Unpublished Discussion Paper, Boston University.

[21] Mincer, J. (1958): Investment in Human Capital and Personal Income Distribution, *The Journal of Political Economy*, 66(4), 281–302.

[22] Mincer, J. A. (1974): *Schooling, Experience, and Earnings*, Columbia University Press, New York.

[23] Psacharopoulos, G. (1994): Returns to Investment in Education: A Global Update, *World Development*, 22(9), 1325–1343.

[24] Söderbom, M., F. Teal, A.Wambugu, and G. Kahyarara (2006): The Dynamics of Returns to Education in Kenyan and Tanzanian Manufacturing, *Oxford Bulletin of Economics and Statistics*, 68(3), 261–288.

Appendix

Descriptive statistics

Table A 1 – Means and standard deviations of explanatory variables: Sample composed of employed working age population as used in OLS regressions, data weighted using survey weights

	UNHS 2002/03		UNHS 2005/06	
	Mean	**Std.D.**	**Mean**	**Std.D.**
Education				
Years of Education	7.558	4.521	6.198	4.225
Years of Primary	5.444	2.392	4.864	2.516
Years of Secondary	1.855	2.305	1.188	2.012
Years of Tertiary	0.260	0.814	0.145	0.615
Experience				
Experience	16.933	10.840	20.464	11.982
(Exp.squared)/1000	0.519	0.514	0.562	0.623
Demographic Characteristics				
Female	0.299	0.458	0.344	0.475
Married	0.567	0.496	0.644	0.479
Urban	0.388	0.487	0.228	0.420
Household Size	5.659	3.428	5.440	3.099
Central	0.258	0.437	0.233	0.423
East	0.164	0.371	0.170	0.376
North	0.134	0.340	0.229	0.420
West	0.272	0.445	0.268	0.443
Kampala	0.172	0.378	0.100	.300
Industry				
Agriculture/Fishing	0.202	0.401	0.475	0.499
Mining	0.031	0.173	–	–
Manufacturing	0.094	0.293	0.068	0.251
Construction	0.070	0.255	0.072	0.258
Sales	0.074	0.262	0.052	0.222
Hotel	0.032	0.177	0.019	0.136
Transportation	0.067	0.251	0.052	0.221
Financial	0.002	0.043	0.004	0.063
Real Estate, Renting	0.013	0.113	0.008	
Public Administration	0.057	0.232	0.030	
Social Service	0.271	0.445	0.184	0.387
Private Households	0.078	0.269	0.036	0.185
Extra-territorial organizations	0.003	0.052	0.001	
Others	0.005	0.073	–	–
Occupation				
Legislative	0.006	0.080	0.006	0.080
Professionals	0.087	0.281	0.030	0.171
Associate Professionals	0.160	0.366	0.106	
Clerks	0.032	0.177	0.015	0.120
Shop Worker	0.122	0.328	0.085	0.279
Agriculture/Fishery	0.071	0.248	0.045	0.207
Crafts	0.036	0.257	0.065	0.247
Blue Skilled	0.035	0.186	0.046	0.209
Elementary Occupation	0.420	0.494	0.602	0.490
Observations	2807		3956	

Source: UNHS 2002/03 and 2005/06

Estimation results: Subsamples by region and educational attainment levels

Table A 2 – UNHS 2002/03: Wage Equation, OLS estimates by Regions, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Primary	0.0143	0.00774	0.00142	0.0349	0.0160	0.0242
	(0.0121)	(0.0244)	(0.0212)	(0.0290)	(0.0216)	(0.0329)
Years of Secondary	0.106***	0.0824***	0.0977***	0.0883**	0.118***	0.120***
	(0.0149)	(0.0256)	(0.0245)	(0.0380)	(0.0279)	(0.0390)
Years of Tertiary	0.218***	0.169***	0.121**	0.121	0.252***	0.258***
	(0.0250)	(0.0414)	(0.0553)	(0.0990)	(0.0391)	(0.0644)
Experience	0.0299***	0.0402***	0.0177	-0.00804	0.0386***	-0.0205
	(0.00612)	(0.0110)	(0.0178)	(0.0126)	(0.0124)	(0.0214)
(Exp.squared)/1000	-0.371***	-0.564**	-0.244	0.171	-0.447*	1.287**
	(0.119)	(0.243)	(0.345)	(0.215)	(0.234)	(0.567)
Female	-0.169***	-0.354***	-0.0580	-0.0871	-0.180**	-0.146
	(0.0470)	(0.122)	(0.0951)	(0.124)	(0.0714)	(0.116)
Married	0.153***	0.310***	0.188**	-0.0422	0.0796	0.0891
	(0.0451)	(0.0910)	(0.0929)	(0.140)	(0.0882)	(0.106)
Urban	0.185***	0.208**	0.225***	0.137	0.187***	
	(0.0439)	(0.0963)	(0.0807)	(0.0947)	(0.0630)	
Observations	2807	747	623	445	832	160
R^2	0.546	0.551	0.549	0.560	0.563	0.727

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size, region dummies, industry dummies and occupation dummies.

Table A 3 – UNHS 2005/06: Wage Equation, OLS estimates by Regions, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Primary	0.0350***	0.0279	0.0495***	0.0466***	0.0327**	-0.0600*
	(0.00783)	(0.0204)	(0.0171)	(0.0149)	(0.0129)	(0.0363)
Years of Secondary	0.0841***	0.0902***	0.0627**	0.0912***	0.0676**	0.127***
	(0.0140)	(0.0285)	(0.0280)	(0.0281)	(0.0313)	(0.0353)
Years of Tertiary	0.151***	0.103	0.211***	0.197***	0.172**	0.0668
	(0.0374)	(0.0808)	(0.0469)	(0.0745)	(0.0709)	(0.0902)
Experience	0.0374***	0.0509***	0.0183*	0.0249***	0.0499***	0.0173
	(0.00529)	(0.0129)	(0.0111)	(0.00960)	(0.00914)	(0.0236)
(Exp.squared)/1000	-0.558***	-0.749***	-0.297	-0.389**	-0.738***	0.0478
	(0.0982)	(0.252)	(0.213)	(0.174)	(0.167)	(0.528)
Female	-0.172***	-0.261***	-0.155**	-0.164***	-0.118**	-0.149
	(0.0312)	(0.0802)	(0.0680)	(0.0549)	(0.0538)	(0.126)
Married	0.101***	0.0230	0.103	-0.00599	0.211***	0.152
	(0.0367)	(0.0768)	(0.0849)	(0.0735)	(0.0670)	(0.133)
Urban	0.0798	0.161	0.102	0.0441	0.0810	
	(0.0490)	(0.113)	(0.0792)	(0.0776)	(0.0748)	
Observations	3956	882	791	988	1045	250
R^2	0.377	0.313	0.383	0.299	0.416	0.552

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size, region dummies, industry dummies and occupation dummies.

Estimation results without sector and occupation controls: Subsamples by region

Table A 4 – UNHS 2002/03: Wage Equation, OLS estimates by Regions, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Education	0.107***	0.0939***	0.0780***	0.102***	0.101***	0.153***
	(0.00723)	(0.0145)	(0.0125)	(0.0191)	(0.0130)	(0.0164)
Experience	0.0405***	0.0507***	0.0213	0.000531	0.0517***	0.0127
	(0.00695)	(0.0130)	(0.0171)	(0.0139)	(0.0130)	(0.0229)
(Exp.squared)/1000	-0.471***	-0.689**	-0.302	0.0520	-0.587**	0.429
	(0.133)	(0.268)	(0.328)	(0.244)	(0.254)	(0.656)
Female	-0.242***	-0.416***	-0.134	-0.0989	-0.223***	-0.336***
	(0.0434)	(0.0857)	(0.0918)	(0.116)	(0.0688)	(0.116)
Married	0.177***	0.332***	0.292***	0.00247	0.114	0.115
	(0.0493)	(0.0929)	(0.102)	(0.130)	(0.0872)	(0.119)
Urban	0.134***	0.171*	0.150*	0.0517	0.190***	
	(0.0434)	(0.0903)	(0.0800)	(0.0893)	(0.0661)	
Observations	2825	751	627	446	841	160
R^2	0.459	0.438	0.465	0.441	0.485	0.621

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size and region dummies.

Table A 5 – UNHS 2005/06: Wage Equation, OLS estimates by Regions, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Education	0.0835***	0.0901***	0.0848***	0.0787***	0.0814***	0.101***
	(0.00552)	(0.0128)	(0.0111)	(0.0114)	(0.0102)	(0.0175)
Experience	0.0410***	0.0508***	0.0219*	0.0284***	0.0512***	0.0398*
	(0.00547)	(0.0136)	(0.0112)	(0.00981)	(0.00970)	(0.0237)
(Exp.squared)/1000	-0.572***	-0.674***	-0.329	-0.430**	-0.703***	-0.484
	(0.101)	(0.260)	(0.217)	(0.176)	(0.175)	(0.568)
Female	-0.208***	-0.315***	-0.160**	-0.142***	-0.147***	-0.436***
	(0.0323)	(0.0894)	(0.0624)	(0.0530)	(0.0549)	(0.125)
Married	0.158***	0.0675	0.187**	-0.00405	0.265***	0.141
	(0.0385)	(0.0888)	(0.0804)	(0.0732)	(0.0696)	(0.130)
Urban	0.0575	0.0856	-0.0471	0.0661	0.164**	
	(0.0486)	(0.116)	(0.0754)	(0.0750)	(0.0737)	
Observations	3992	888	797	998	1056	253
R^2	0.313	0.218	0.329	0.264	0.335	0.371

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size and region dummies.

Table A 6 – UNHS 2002/03: Wage Equation, OLS estimates by Regions and Attainment Level, Age 14–65

	(1) Pooled	(2) Central	(3) East	(4) North	(5) West	(6) Kampala
Years of Primary	0.0322**	0.0133	0.0250	0.0781**	0.0252	0.0634*
	(0.0130)	(0.0272)	(0.0222)	(0.0320)	(0.0229)	(0.0338)
Years of Secondary	0.147***	0.136***	0.121***	0.134***	0.162***	0.163***
	(0.0133)	(0.0231)	(0.0241)	(0.0464)	(0.0245)	(0.0318)
Years of Tertiary	0.235***	0.177***	0.128***	0.107	0.251***	0.262***
	(0.0268)	(0.0448)	(0.0461)	(0.115)	(0.0411)	(0.0620)
Experience	0.0392***	0.0457***	0.0208	0.00158	0.0471***	0.0180
	(0.00671)	(0.0130)	(0.0174)	(0.0141)	(0.0125)	(0.0212)
(Exp.squared)/1000	-0.521***	-0.677**	-0.352	0.0229	-0.555**	0.268
	(0.129)	(0.273)	(0.339)	(0.247)	(0.237)	(0.576)
Female	-0.279***	-0.400***	-0.150	-0.147	-0.274***	-0.343***
	(0.0435)	(0.0858)	(0.0926)	(0.135)	(0.0741)	(0.116)
Married	0.196***	0.380***	0.282***	-0.00263	0.133	0.136
	(0.0469)	(0.0917)	(0.101)	(0.132)	(0.0846)	(0.112)
Urban	0.149***	0.184**	0.144*	0.0494	0.207***	
	(0.0422)	(0.0888)	(0.0806)	(0.0867)	(0.0612)	
Observations	2825	751	627	446	841	160
R^2	0.492	0.459	0.481	0.445	0.528	0.646

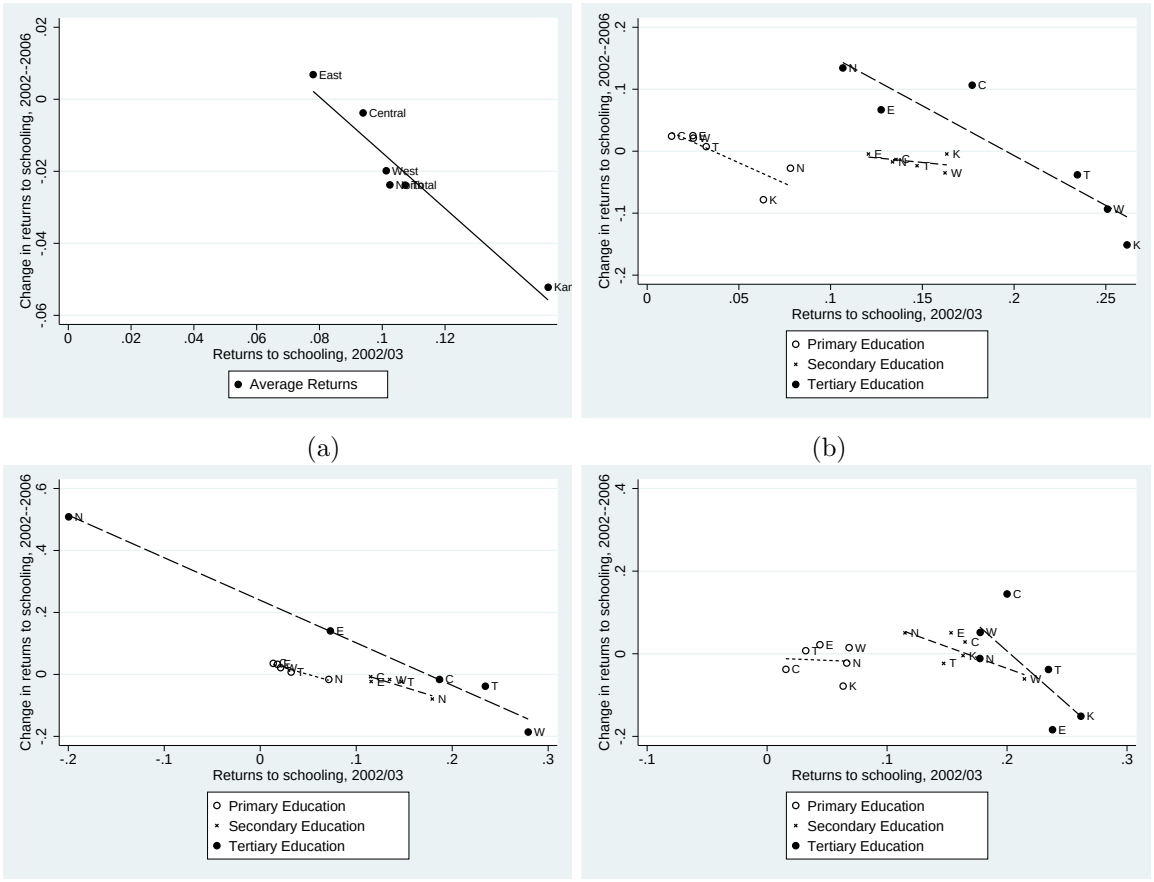
Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size and region dummies.

Table A 7 – UNHS 2005/06: Wage Equation, OLS estimates by Regions and Attainment Level, Age 14–65

Years of Primary	0.0396***	0.0375*	0.0501***	0.0506***	0.0462***	-0.0149
	(0.00820)	(0.0217)	(0.0173)	(0.0151)	(0.0141)	(0.0466)
Years of Secondary	0.124***	0.122***	0.116***	0.117***	0.127***	0.159***
	(0.0128)	(0.0272)	(0.0239)	(0.0273)	(0.0255)	(0.0385)
Years of Tertiary	0.196***	0.284***	0.194***	0.241***	0.157***	0.110
	(0.0308)	(0.0621)	(0.0373)	(0.0577)	(0.0547)	(0.0696)
Experience	0.0418***	0.0517***	0.0228**	0.0269***	0.0518***	0.0391*
	(0.00542)	(0.0132)	(0.0113)	(0.00972)	(0.00955)	(0.0235)
(Exp.squared)/1000	-0.622***	-0.739***	-0.375*	-0.426**	-0.744***	-0.442
	(0.101)	(0.258)	(0.217)	(0.175)	(0.173)	(0.568)
Female	-0.258***	-0.343***	-0.186***	-0.191***	-0.190***	-0.421***
	(0.0324)	(0.0871)	(0.0638)	(0.0557)	(0.0558)	(0.121)
Married	0.157***	0.0814	0.179**	0.00522	0.263***	0.172
	(0.0381)	(0.0869)	(0.0813)	(0.0718)	(0.0695)	(0.135)
Urban	0.0474	0.0653	-0.0498	0.0590	0.130*	
	(0.0473)	(0.112)	(0.0745)	(0.0732)	(0.0736)	
Observations	3992	888	797	998	1056	253
R^2	0.327	0.237	0.340	0.275	0.346	0.390

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Regression includes employment status dummies, a dummy for having attended a public school, household size and region dummies.

Dynamics of returns to education based on estimates from models without sector and occupation controls



(a) (b)

(c) (d)

Figure A 1 – Returns to schooling by attainment level, UNHS 2002/03, versus change in returns 2002-06: (a) average years of schooling, full sample; (b) average years of schooling by attainment level, full sample (c) average years of schooling by attainment level, rural subsample (d) average years of schooling by attainment level, urban subsample.

First stage results for 2SLS estimation

Table A 8 – UNHS 2005/06: First stage results for 2SLS estimation

Smoking	-0.145
	(0.114)
Father no education	-0.677***
	(0.131)
Father some primary	0.103
	(0.127)
Father completed primary	0.493***
	(0.141)
Father A-level	1.137***
	(0.324)
Father O-level	1.027***
	(0.195)
Father univeristy	1.519***
	(0.411)
Married	0.726***
	(0.099)
Urban	0.691***
	(0.114)
Household size	0.039***
	(0.014)
Observations	3940
R^2	0.635

Robust standard errors in parenthesis. * (**) [***] stands for significance at the 10% (5%) [1%] level. Dependent variable is years of schooling. Regional dummies included in the regression.