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Education and Wage in East and West Africa

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Abstract: This paper examines the extent to which levels of education of a wage employee account for wage difference in a selected sample of workers in Kenya, Tanzania, Uganda, Madagascar, Ghana, Niger, Guinea Conakry, Rwanda, Benin and Togo. The paper uses country specific factors to control for omitted variable bias. Using OLS and Control function estimates, the paper confirms significant wage difference accounted for by education attainment. Estimates of the models suggest a positive correlation between education and wages.The square term of schooling is highly significant indicating non-linearity of the returns to education, such that at higher levels of education the marginal returns to schooling is greater than the marginal returns to schooling at lower levels of education. The paper shows strong evidence that at primary level of education there is wage difference of 4.82 per cent due to one year of education, while middle school graduates have 6.3 per cent wage premium and so on. Country specific attributes have a positive influence on the extent of wage differences by country. Thus, it is likely that wage differences of education are a result of self-selectivity.

Keywords: *Education – Wage – OLS - Africa*
J.E.L. Classification: *C13 – I20 – J31*

Education et salaire en Afrique de l'Est et de l'Ouest

Résumé : Cette étude examine la relation entre les niveaux de l'éducation d'un salarié et les différences de salaire pour un échantillon de travailleurs sélectionné au Kenya, Tanzanie, Ouganda , Madagascar, Ghana, Niger, Guinée Conakry, Rwanda, Bénin et Togo. L'étude utilise des facteurs spécifiques à chaque pays pour contrôler le biais de variables omises. En utilisant la méthode des moindres carrés ordinaires et les estimations de la fonction de contrôle, l'étude confirme qu'il existe un écart salarial significatif représenté par le niveau d'éducation. Les estimations des modèles suggèrent une corrélation positive entre l'éducation et les salaires. Le carré de la variable niveau d'éducation est très significatif indiquant la non-linéarité des rendements de l'éducation, de telle sorte pour les niveaux les plus élevés de l'éducation les rendements marginaux de l'éducation sont supérieurs aux rendements marginaux de l'éducation pour des niveaux inférieurs. L'étude montre qu'au niveau de l'enseignement primaire il y a une forte différence de salaire de 4,82 pour cent en raison d'une année de plus d'études, tandis que les diplômés de collège ont 6,3 pour cent de prime salariale et ainsi de suite. L'article montre que les attributs spécifiques des pays ont une influence positive sur l'ampleur des différences de salaires par pays. Ainsi, il est probable que les différences de salaire par niveau d'éducation soient le résultat de l'auto sélection.

Mots Clés *: Education – Salaire – MCO - Afrique*
Classification J.E.L: *C13 – I20 – J31*

1. Introduction

This paper examines the extent to which schooling of wage employees in selected African economies can explain wage differences. In particular, it estimates the contribution of the education differences on observed wage differences for a set of wage employees. The estimate focuses on the effects on wage of education, by which is meant attending any formal education measured by years of completing education. The comparison of the effect of these various forms of learning allows the paper to address the question of whether the level of education attained can account for wage differences in African economies. The paper uses unique and rich data set that combines several African labour markets. This is unique as no previous study in this area had an opportunity of access to statistics from several countries at one level of analysis.

In almost all these countries major changes were introduced into the education system from time of independence during the 1960s till recent years of 2010. Given the span of age of workers in our data it is possible to assess if the returns to schooling for workers that went through the different schooling systems that have prevailed in the countries still hold. In assessing the returns to either education the issue that has received a lot of attention in the literature is whether education can be treated as exogenous. The data used here has information on country specific attributes and the fact that it aligns several countries together. These variables provide us with potential instruments for the education variable. Finally most of the estimates of returns to one year of education are outdated. They were conducted a few decades ago when economies had different dynamics altogether unlike now when many changes such as globalization have erupted

Empirical works for estimating returns to education have mostly used the standard wage equation developed by Mincer (1974). The wage equation assumes that the skills acquired by the worker through education and on the job training can be regarded as a stock of human capital, which influences the workers productivity by the same amount in all lines of production. In the absence of information on post schooling training that takes place while on the job, experience and tenure variables have been used as proxy for job training. Experience is represented as a quadratic term to capture the concavity of the earning profile (Ben-Porath, 1967). This has been through including job-training variables among the regressors in the earnings function. The traditional approach to estimate the relationship between schooling and job training has been to apply Ordinary Least Square in the earnings function.

Nonetheless, the OLS approach to earnings function estimates of the returns to schooling has faced persistent econometrics problem. The effects of omitted variable and measurement error in evaluating returns to schooling and training are among the problems of estimating returns to schooling cited in many previous studies (Card and Krueger (1996), Griliches (1977), Card (1995) and Ashenfelter and Zimmerman (1997), Chowdhury and Nickell (1985)). The major concern in applying OLS to estimate the Mincerian earnings function is that the disturbance term captures unobservable (omitted) individual effects that also might influence the schooling decision. Therefore, when we estimate returns to schooling, the precise measurement of the economic returns to schooling is plagued by difficulties in isolating the causal effect of schooling from the joint process of schooling and earnings. Hence, in assessing the returns to either education or training an issue that has received a lot of attention in the literature is whether education or training can be treated as exogenous. The estimation approach in this paper focuses on the analysis of the effect of schooling on the wage level. To assess this wage effect we estimate a wage function with the log of wage as a dependent variable.

2. **Theoretical and conceptual framework**

The theoretical framework for analysing the link between schooling, job training and earnings is based on human capital theory pioneered by Becker (1964), Becker and Chiswick (1966), Mincer (1974) and Ben-Porath (1967). In the models of Becker (1964), Mincer (1974) and Ben-Porath (1967) schooling increases earnings through raising human capital. A systematic conceptual framework to analyse the impact of on the job training in the labour market was first proposed by Becker, Gary (1962 and 1964). Becker's work identified two types of training, i.e. general and specific. According to Becker, general training is the type of training that once acquired is equally useful (that is it enhances productivity) in all other firms. Specific training is the type of training that enhances productivity only in the firm where it is acquired, and the value of training is lost once the worker leaves the firm. Hence earnings dispersion in human capital theory is due to the fact that skills differ across the labour force.

Some empirical works in the human capital literature have made an attempt to proxy for specific versus general training through analysing different effects of on the job-versus off the job training (Lynch, 1991, 1992), or by looking at the different effects of company versus school training (Loewenstein and Spletzer 1997), when analysing earnings or wage growth and mobility. Other authors have focused on examining the employers' willingness to invest in general training (Bishop and Kang 1996). It is apparent from recent literature that while a conceptual separation between general and specific training is a useful tool of

analysis, in reality much of job training is a mixture of general and specific training. Katz and Ziderman (1990) and Acemoglu and Pischke (1998a), pointed out that asymmetric information can mean that training that would otherwise be general is in effect specific. Despite the difficulty in categorizing training between general and specific, more availability of data with explicit information regarding job training has led to availability of evidence regarding the empirical relationship between training and earnings, the relationship between mobility and training and other aspects such as cost sharing in investment and determinants of training.

There are authors who have measured directly the effect of accumulating human capital through training (e.g., Lynch (1992), Barron, Black and Loewenstein (1989), Booth (1991), Lynch (1991), Gritz (1993), Krueger and Rouse (1998), Bartel (1995), Holzer et al (1993) and others.). Lynch (1992) analysed the effects of on the job-versus off the job training. In this study it was found that on the job training raises wages at the current employer but not at future employers. With regard to mobility Lynch found that individuals with on the job training are less likely to leave their current employer while individuals with off the job training are more likely to leave. Other studies have tested whether job training might be a form of investment in specific human capital that reduces workers' incentive to quit a job and firms' incentive to fire a worker. Among the authors that address this issue, Lynch (1991), Gritz (1993), and Parent (1999) find that company training reduces the probability of job separations for young workers. In contrast, Krueger and Rouse (1998) who focus on personnel files from two large U.S. companies, and Veum (1997) who uses a larger data set conclude that trainees are equally likely to quit as non-trainees.

Bartel (1995) analysed the link between training, wage growth and performance using evidence from company level information. A significant relationship between formal on-the-job training and the subjective performance ratings of professional employees is reported in this study. Other studies that have tested and confirmed a positive correlation between training and productivity include Barron et al. (1989), Holzer et al (1993), Bartel (1994) Koning (1994), Boon and ven der Eijken (1997) and others. Barron et al. (1989) reports a 3% rise in productivity being associated with 10% increase in training. In Hozler et al (1993), a faster growth in labor productivity is associated with receipt of training grants.

Apart from human capital theory, there are other models that explain the correlation between learning and earnings. In signalling models, first developed by Spence (1973), it is suggested that schooling acts as a signal or a filter for ability differences among workers that firms would wish to reward but cannot reward directly. In this model workers choose education not to increase their productivity, as in the human capital model, but to *signal* to employers their ability. It is

assumed that, ability differences may be positively correlated with length of schooling because, for example, more able persons; (1) receive a higher benefit from a given amount of schooling; (2) value future earnings more highly; (3) have lower costs of schooling in terms of lower time effort or (4) enjoy learning. According to Weiss (1988), from the firm's perspective these attributes are likely to be unobserved but valuable nonetheless, because they may enhance the return to on-the-job training within the firm and reduce the likelihood that such a worker quits or is absent or simply reduce monitoring costs.

Other explanations for the positive correlation between schooling/training and earnings are provided in the job matching theory, an incentive based theory (Lazear, 1981), and self-selection (Salop, 1976). According to Salop (1976), rising wage profiles may serve as a self-selection device to discourage potential movers from seeking employment. In Lazear, 1981, it is argued that using a more steeply rising age-earnings profile, a worker's incentive to shirk is reduced. For this reason, age-earnings profiles are upward sloping even if workers productivity does not vary over his life cycle.

There are a number of approaches that have been proposed to deal with problems of estimating OLS earnings function. The empirical studies in returns to schooling have exploited within-twins or within-siblings differences in wages and education and then apply fixed effects estimation technique that undertake data transformation to obtain the within groups or fixed effects estimators. The other approach to the econometrics problems of estimating OLS earnings function has been to find an instrument that is correlated with the true measure of schooling and uncorrelated with the unobservable fixed effects, to obtain a consistent estimator of the returns to schooling.

Although finding a suitable instrument is difficult, previous works in this area have argued that information on parental background variables, school quality, education policy and other family characteristics are potential controls for endogenous schooling (Card (1995) and Ashenfelter and Zimmerman (1997), Butcher and Case (1994), Card (1993)). In Card (1995) and Ashenfelter and Zimmerman (1997), parental education was used as an instrument for schooling. Other studies such as Butcher and Case (1994), report Instrumental Variable estimation results based on a sibling instrument. Card (1993) uses geographic proximity to a four-year college as an instrument for education. Studies that have attempted to correct the omitted variable bias using Instrumental Variable have mainly obtained coefficient estimates higher than what OLS estimates (Card 1993, 1995, Butcher and Case 1994, and Ashenfelter and Zimmerman 1997). Among the reasons advanced for such observation is the attenuation bias caused by the measurement error of schooling (Card 1999) and others). The other direct approach

to estimation problems of earnings function has been to separate effects of ability and schooling by including direct measure or proxy for ability in the earnings function. Studies that have utilized this approach have used aptitude test scores such as IQ to proxy for unobserved ability effects (see for example Griliches (1977), Knight and Sabot, 1990) and others). Griliches (1977) noted that while unobserved ability would tend to bias the OLS estimates of the return upwards, measurement error in the education variable would tend to bias estimates towards zero. He suggested that the biases might actually cancel out leaving OLS estimates a good guide to the true return to education. Devereux and Hart (2010) employ a regression discontinuity design allowing comparison of wages for the cohorts born just before and just after the law change. Using data from the General Household Survey (GHS), Devereux and Hart estimate a return to education for men of approximately 6 per cent for weekly earnings.

The other literature in this area suggest that identifying the *causal* effect of education on labour market and other outcomes is problematic given the endogeneity of schooling choice. Changes in compulsory schooling laws, which occurred in the UK in 1947 (when the school leaving age changed from 14 to 15) and 1973 (when it increased again to 16), are natural candidates for instruments and have been widely exploited (see Harmon and Walker, 1995, Devereux and Hart, 2010, Grenet, 2009, for earnings effects and Silles, 2009, Clark and Royer, 2010, for effects on health outcomes). More studies that provide details of estimating returns to education in recent years are found in literature (see for example, Anderberg, Dan and Yu Zhu. 2010, Black, Sandra E., Paul J. Devereux and Kjell G. Salvanes. 2008, Clark, Damon and Heather Royer. 2010, Crawford, Claire, Lorraine Dearden and Costas Meghir. 2010, Devereux, Paul J. and Wen Fan. 2011, Devereux, Paul J. and Robert A. Hart. 2010, Grenet, Julien. 2009, Harmon, Colm and Ian Walker. 1995, Silles, Mary. 2009 Thomson, Dave, Trevor Knight, Franz Buscha and Patrick Sturgis. 2010).

3. **Model specification**

In this section we specify the models to be estimated in analysing the schooling effect on wage profile. Before introducing the model estimated in this paper it is worthwhile noting that much of the empirical works in this area have based on the framework by Becker (1967) and Mincer (1974). In the traditional specification, returns to education are estimated as follows:

$$\log(y_i) = a + bS_i + cE_i + dE_i^2 + \varepsilon_i \quad (1)$$

Where y_i is average lifetime income S_i is years of completed education, E_i is experience, and ε_i is a statistical residual. The key assumption here is that agents maximize their life-time utility that depends on the average level of earnings over the lifecycle, denoted by y(S), and the disutility from education, h(S). This is specified as follows:

$$\max_{y,s} S(S_i, y_i) = \log(y_i) - h(S_i) \text{ s.t. } y_i = y(S_i)$$
$$\Leftrightarrow \max_{s} U(S_i) = \log(y(S_i)) - h(S_i) \quad (2)$$

Linearity in log earning implies that the optimal education choice does not depend on factors that raise earnings proportionally for all levels of education. $H(S_{i)}$ is creasing and convex in $S_{i.}$

The first-order condition of these maximization problems sets the marginal benefits of education equal to its marginal costs:

$$\frac{y'(S_i^*)}{y(S_i^*)} = h'(S_i^*) \quad (3)$$

Individual heterogeneity is introduced into this model by allowing marginal benefits and marginal costs to vary across individuals. Marginal benefits are assumed to be linear and decreasing in S_i where the intercept is individual-specific.

$$\frac{y'(S_i)}{y(S_i)} = b_i - k_1 S_i \quad (4)$$

By assumption, marginal costs are also linear in S_i and increasing. Heterogeneity enters again through the intercept term:

$$h'(S_t) = r_i + k_2 S_i \quad (5)$$

The optimal level of education derived from the first-order condition is:

$$S_i^* = \frac{b_i - r_i}{k_1 + k_2} \quad (6)$$

At the optimum, the marginal return to education of individual i is:

$$\beta_i = b_i - k_i S_i^* = b_i(1 - \frac{k_1}{k_i + k_2}) + r_i \frac{k_1}{k_1 + k_2} \quad (7)$$

It is easily derived that returns to education will differ across individuals unless one of the following two conditions is satisfied.

1. Marginal benefits are constant and equal for all (i.e. $b_i = \bar{b}$ *and* $k_1 = 0$) *or*

2. Marginal costs are constant and equal for all in (i.e. $r_i = \bar{r}$ and $k_2 = 0$).

By integrating equation 5, we can derive an econometric model that is very similar to the basic Mincer equation:

$$\log(y_i) = \partial_0 + \bar{b} S_i - \frac{1}{2} k_1 S_i^2 + a_i + (b_i - \bar{b}) S_i + \varepsilon_i \quad (8)$$

The important differences to Mincer's model are the individuals-specific intercept and slope terms that turn ten model into a random-coefficient model. The equation can be written in the form of deviations from means in the following way:

$$\log(y_i) = a_0 + \bar{b} S_i - \frac{1}{2} k_1 S_i^2 + a_i + (b_i - \bar{b}) S_i + \varepsilon_i$$

Where $a_i = \alpha_i - a_0$ with mean 0.

The basic specification in our empirical work is a modified version of equation 8:

$$\log(y_i) = \alpha + \beta_1 S_i + \beta_2 X_i S_i + \beta_3 S_i^2 + \gamma_1 E_i + \gamma_2 E_i^2 + \delta X_i + \varepsilon_i \quad (9)$$

Where S_i is years of education, E_i is working experience and X_i are other controls that will be described below. The interaction terms allow for heterogeneous slope coefficients. They contain only part of the control variables that enter directly. Therefore our empirical strategy is to estimate an wage function. For assessing the effect of schooling on wage levels, we specify a wage function that is augmented

with education variables, and use log of real wage as a dependent variable. The model for estimating the wage function is specified in equation 10 below:

3.1. The wage equation

$$\ln Y_{ij} = \beta_1 Age_{ij} + \beta_2 Age_{ij}^2 + \beta_3 Educ_i + \beta_4 Educ_i^2 + \beta_5 CI + \beta_6 CGDP + \mu_j \quad (10)$$

Where i, and j are subscripts of individual and establishment respectively,

LnY	is	log of real wage,
Age	is	the age of the worker
CI	is	country level of inflation
CGDP	is	Country level of Gross domestic product
Educ	is	years of education,
μ	is	the error term

The model specified above includes the squares of education and age that allow us to test the concavity of the age-earnings profile and the non-linearity of returns to education in our data.

3.2. Control function

As will be demonstrated later, this control function is a reduced form equation of determinants of education level in a given country. This is specified in equation 11 below

$$\ln ED_{ij} = \delta_1 POP_{ij} + \delta_2 ExpEd_{ij} + \delta_3 CGDP_{ij} + \eta_{ij} \quad (11)$$

Where i, j and t are subscripts of individual, firm and time respectively,

LnED	is	log of real wage,
POP	is	the country population
CGDP	is	Country level of Gross domestic product
η	is	the error term

3.3. Data and variables

The data used in this study is from the WageIndicator initiatives. This concept is owned by the independent, non-profit WageIndicator Foundation, established in 2003. The Foundation aims for transparency of the labour market by sharing and comparing wage data and labour conditions information. The Foundation operates national websites in some 70 countries. The WageIndicator Surveys aim to draw a random sample in a predefined set of occupations. This set of occupations includes skilled and unskilled occupations in all industries, for the list of occupations. The occupations are selected purposively to reflect the occupational structure, as reflected in the Labour Force Surveys in all these countries. Second, the occupations are selected to supplement the WageIndicatorweb-survey. During the fieldwork, in some cases it was easy to identify the respondent's occupation. In other cases, the respondents were asked their occupation. The supervisors and interviewers in each district are widely experienced in conducting Labour Force Surveys. The survey covers all districts in a country. The target number of respondents (2000) is distributed across all the districts. At the district level, the quota is distributed across the broad occupational categories. Respondents are then randomly selected by specially trained supervisors and interviewers to ensure every occupation is represented.

4. **Wage trends in the surveyed countries**

In this section, the paper described levels of wages and education in the surveyed countries of Benin, Kenya, Madagascar, Guinea Conakry, Niger, Togo, Senegal, Ghana and Tanzania. The discussion is hereby lined up below. The survey results indicate that median net hourly wage of the total sample in Benin is 214 Franc (CFA). The median has the advantage that it is not overly influenced by small numbers of high earners. Furthermore, employees with permanent contracts have by far the highest earnings (427 CFA), whereas workers without a contract (132 CFA) have the lowest earnings. At 231 Francs, employees on fixed term contracts earn just above average, whereas self-employed workers fall below it (189 CFA). With 166 CFA workers in firms with less than ten employees earn the lowest wages, whereas employees in firms of over a 100 employees earn the highest wages (463 CFA).

The results also shows that the lower on the informality-index, the lower the net hourly wages. Those on the lowest end of the scale earn only 144 CFA per hour; whereas those in the highest category earn wages far above that (median is 577 CFA). Men have higher wages compared to women, and with 171 CFA young workers have substantial lower wages than workers in the oldest age group (420

CFA). The results also show that working for small companies has a negative effect on wages. Workers with a higher occupational status earn more, as do people with more years of work experience and higher education. One in four self-employed workers earn less than CFA 100 per hour, as do 35% of the employees without contracts; in comparison, only 15% of fixed term employees and just 4% of workers with permanent contracts do. Two in three workers with tertiary education earn more than CFA 400 per hour, whereas 13% workers with primary education and 10% of those without education do so, indicating that education pays off. In Guinea the median net hourly wage of the total sample is 2887 Guinean Franc (FG), as results shows.

The relation between wages and education is less than clear cut. In Madagascar, the median net hourly wage of the total sample is 662 Ariary (MGA). Those on the lowest end of the scale earn only 328 MGA per hour; whereas those in the highest category earn wages far above that (median is 1443 MGA). Women have slightly higher wages compared to men, and at 529 MGA young workers have substantial lower wages than workers in the oldest age group (1151 MGA). The median net hourly wage of the total sample is 288.68 Niger Franc (CFA). In relation to Togo, the median net hourly wage of the total sample is 230.95 Togo Franc (CFA). Ghana analysis reveals that the median net hourly wage of the total sample is 2,35 GHS (Ghanaian Cedi). Senegal results are that the median net hourly wage of the total sample is 358.49 Senegal Franc (XOF). In Kenya, the median net hourly wage of the total sample is 33.67 Kenyan shilling. However, in the analysis the currencies are standardized in US dollar using the exchange rates indicated in annex1. The average wages in the selected countries is given in table 1.

At this juncture explanation about country selection is provided. The most straightforward explanation of country selection is the existence of data from wage surveys under Wage indicator. It is not easy in Africa to find a data set that combines series of countries in a survey that uses a similar questionnaire and collect same data. The most striking feature within this set is the fact that East African countries are combined with West African economies also with differences in languages. But as stated before the earnings function uses indexed variables that are comparable in all respects. Finally use of years of education allows estimates of the rate of returns to education that cannot be affected by currency difference as it ends up in searching differences of percentage. The interpretation ends up at the level of saying 1 year of education increases wage by say 5 percent and so on. There is usually a question of education sign. However, when a quadratic term like the one in the equation [9] is used, then education must have a negative sign while education squared will have a positive sign. The interpretation considers both coefficient estimates rather than one in isolation.

Table 1 Average wage in (US Dollars in the surveyed countries)

Country	Average Monthly Wage (US $)	Average Annual Wage (US $)
Benin	70	846
Kenya	63	755
Madagascar	48	580
Guinea	66	788
Niger	95	1141
Togo	76	909
Senegal	102	1227
Ghana	153	1835
Tanzania	56	672

Source: Computed using survey data of Wage indicator

5. Estimates of Returns to Education in the Selected Countries.

In the table 2 we present the regression results for wage equation that treat education as a continuous variable in years. For country comparison Kenya is used as a reference point. It will be recalled that the theory of human capital views education as the major sources of human capital accumulation that, in turn, have direct and positive effect on an individuals' life time wage. As column [1] of table 1 reveals, there is a positive correlation between education and wages in our sample. The square term of schooling is highly significant (at 1 per cent level) indicating non-linearity of the returns to education, implying that at higher levels of education the marginal returns to schooling is greater than the marginal returns to schooling at lower levels of education. Based on the coefficient of schooling and its square reported in this column we find strong evidence that the return to schooling increases monotonically with the level of schooling attained. The rate of returns to secondary school ordinary level if computed at 11 years is 10.5, while the return from one year of schooling for advanced level secondary that requires 13 years to complete is 13.3 per cent. The returns to schooling for higher education and other professional graduates are 17.5 and 16.1 respectively.

Table 2. Wage equation for estimating education effect of wage in anglo and francophone.

	OLS1	OLS2	OLS3
Years of Education	-0.049	-0.048	-0.036
	(4.44)***	(4.33)***	(3.19)***
Education Squared	0.007	0.007	0.005
	(12.96)***	(12.34)***	(8.84)***
Age		0.055	0.049
		(9.03)***	(8.02)***
Age squared/100		-0.052	-0.046
		(7.19)***	(6.59)***
Country level of inflation		0.049	0.041
		(1.17)	(1.01)
Country GDP		0.095	0.087
		(2.93)***	(2.71)***
Benin	-0.173	-0.157	-0.177
	(4.70)***	(4.23)***	(4.81)***
Madagascar	-0.142	-0.170	-0.204
	(3.09)***	(3.59)***	(4.37)***
Guinea Conakry	-0.008	0.012	-0.063
	(0.14)	(0.20)	(1.09)
Niger	0.010	0.002	0.011
	(0.25)	(0.05)	(0.27)
Togo	0.011	0.003	0.017
	(0.27)	(0.07)	(0.42)
Senegal	0.036	0.036	0.033
	(0.99)	(0.99)	(0.93)
Ghana	0.024	0.041	0.060
	(0.51)	(0.85)	(1.26)
Tanzania	0.001	0.013	0.040
	(0.07)	(0.30)	(0.90)
Observations	18,000	18,000	18,000
R-squared	0.23	0.24	0.26

Note: The dependent variable is the log of monthly real wage. Absolute values of t-statistics are in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent level is indicated by ***, ** and * respectively.

Nonetheless, our estimates in the first column reported do not control for other factors that might be picked up by the education coefficients. Therefore there is a question of how robust are our estimates or whether this wage effect of education operates through other individual characteristics as well as country specific features. For this reason, we stepwise add the control variables of individuals of age along with country specific characteristics of GDP per capita and inflation. As we move to the right hand side of the table 1, it is certainly clear that the wage effect of schooling in our data operate through other factors. For instance we find that the control for age of a worker which is a proxy for work experience and country features have substantial effect on the estimated size of the schooling coefficient. This may arise from the fact that the schooling coefficient might pick up the effect of other determinants of earnings.

6. *Control function estimates of the education effect on wages*

One of the problems of estimating the wage effect is omitted variable bias caused by endogeneity of education variable. In particular, due to endogeneity there is a possibility that some factors that affect education are omitted in the wage equation and yet correlated with the error term. When such case exists the estimated variables are said to be biased. We have so far approached the endogeneity by directly controlling for observed worker and country specific characteristics. In this section we tackle this endogeneity issue by estimating control function. By using the control function we can directly identify the correlation between the endogenous variable (schooling) and its unobserved determinants. We also predict a residual from education equation, which is used as an additional regressor in the earnings function. A significant parameter estimate of the residual means the unexplained variation of our endogeneous variable of schooling also affects variation in earnings. On the other hand if the parameter turns to be insignificant then we do not accept the hypothesis of endogeneity. The estimates also enable us to directly test for the linearity of the earnings function specification.

In Table 3 we present a variety of reduced-form regressions for years of completed education. The models in columns (1)-(3) add an increasing set of school type (a proxy for education attainment such as country expenditure on education, GDP and other factors.

TABLE 3. Reduced form regression of years of education on family background and school type[a]

	OLS+1	OLS2	OLS3
Country population size	3.012 (10.72)***	2.908 (10.52)***	2.422 (8.86)***
Country expenditure in Education	1.182 (3.62)***	0.976 (3.03)***	0.781 (2.48)**
National GDP	-0.07 (3.20)***	-0.053 (2.32)**	-0.050 (1.95)*
Observations	2333	2333	2333
R-squared	0.05	0.08	0.14

[a] The dependent variable in these regressions is the years of education. We use these estimates to obtain the control function estimates of education coefficients reported in table 2 We do so by obtaining the OLS residuals from the reduced form education equations. Significance at the 1 per cent, 5 per cent and 10 per cent level is indicated by *** , ** and * respectively

In table 4 we present earnings function results estimated by control function. In this specification, the residuals from the reduced-form regression of schooling are included in the earnings equation. The results in column [1] are OLS estimates of the wage equation. Still Kenya is used as a reference point. When we compare the OLS estimates with the control function estimates in column [2], we find that the wage effect of schooling is higher with the control function approach. However, the finding of higher coefficient estimates on schooling after control for endogeneity of schooling is well documented in the literature. As we pointed out earlier there are other possible reasons from empirical studies for this observation. Measurement errors in reported years of schooling is the main possible reason (see Card (2001).

The residual term is positive and significant at 1 percent. This suggests that the unexplained variation of schooling also affects variation in earnings. Therefore we reject the exogeneity of schooling. The test for exogeneity based on hausman test also confirms that we cannot accept the exogeneity at 5 percent. The test for the linearity of wage profile shows that we cannot accept the linear specification of the education earnings profile in our data. We still have strong evidence that we cannot accept exogeneity and linearity of the schooling earnings profile. The estimated coefficients are larger than what we observed in the OLS estimates after controlling for these factors. These results suggest that the estimated returns to schooling by OLS are downward biased. We still have strong evidence that earnings rise monotonically with the levels of education in our data.

Thus, we have strong support that education is positively correlated with earnings. Nonetheless, interpreting this finding as saying that the Mincerian returns to education rise with the education level is complicated. Insofar as the Mincerian returns reflect the social returns to education - and we discuss below how accurate a reflection they are of the social returns - they imply that higher levels of education generate higher increases in income than lower levels. Insofar as they reflect the private returns to education they provide information on the incentives faced by potential employees in acquiring formal education relative to acquiring training.

The other question is how and to what extent are our estimates comparable with the estimates reported in other developing countries, or other studies conducted in Tanzania. Psacharopoulos (1994) in a survey of 62 countries including 8 Sub-Saharan countries reports a positive effect of additional education. But the rate of returns to schooling reported in Psacharopoulos (1994), decreases with schooling level. This author found that primary school education had the highest returns (24%), followed by secondary education (18%) and lastly higher education (11%).

Table 4. Regression results of the estimates of earnings effect using control function and fixed effects within estimates.

	OLS	CF1	CF2
Years of Education	-0.061	-0.064	-0.045
	(4.00)***	(4.23)***	(2.89)***
Education squared	0.008	0.009	0.006
	(10.54)***	(10.36)***	(6.70)***
Age	0.054	0.058	0.053
	(6.20)***	(6.58)***	(6.08)***
Age squared	-0.001	-0.001	-0.001
	(4.82)***	(5.12)***	(4.92)***
Benin	-0.173	-0.157	-1.55
	(4.70)***	(4.23)***	(4.81)***
Madagascar	-0.142	-0.170	-0.204
	(3.09)***	(3.59)***	(4.37)***
Guinea Conakry	-0.008	0.012	-0.063
	(0.14)	(0.20)	(1.09)
Niger	0.010	0.002	0.011
	(0.25)	(0.05)	(0.27)
Togo	0.011	0.003	0.017
	(0.27)	(0.07)	(0.42)
Senegal	0.036	0.036	0.033
	(0.99)	(0.99)	(0.93)
Ghana	0.024	0.041	0.060
	(0.51)	(0.85)	(1.26)
Tanzania	0.001	0.013	0.040
	(0.07)	(0.30)	(0.90)
Control Variables			
Country Effects	YES	YES	YES
Test: Education earnings Profile linear (P-value)	0.000	0.000	0.000
Test: Exogeneity Hausman test (P-value)	0.462	0.197	
Observations	18,000	18,000	18,000
R-squared	0.23	0.24	0.27

Significance at the 1 per cent, 5 per cent and 10 per cent level is indicated by *** , ** and * respectively. All other variables are as defined before. CF is a control function. The instrument variables are country specific aspects.

This pattern is confirmed in a later update by Psacharopoulos and Ptrinos (2002). However, this concavity nature of the returns to schooling has limited empirical support from similar studies conducted in Africa. Appleton, Hoddinot and McKinnon (1996) show that there is a general pattern by which the returns to

education in Sub-Saharan Africa rise with its level. Also Schultz (2004) reports highest returns to education at the secondary and post-secondary levels in six African countries.

Knight and Sabot (1990) reported the convexity nature of the returns to schooling in East African countries including Tanzania. In estimating the human capital earnings function the authors found that secondary completers in Tanzania were paid 32 per cent more than the primary school completers, while in Kenya it was 61 per cent. Soderbom et. al (2004), in assessing changes in returns to education from 1980 to the late 1990s in Kenya and Tanzania provide strong evidence of increasing convexity of the returns to schooling during the 1990s in Tanzania. The Industrial Surveys of Africa group 1998 estimated the returns to schooling in Africa's Manufacturing Sector based on five African countries; the Cameroon, Ghana, Kenya, Zambia and Zimbabwe. The study found that the rate of return across the five countries was 9 per cent. The returns were non- linear rising from 3 per cent for primary to 14 per cent for secondary completers and 43 per cent for university graduates.

The rates of returns to schooling reported in this paper are comparable with the rates of returns reported in other studies.

7. **Summary and Conclusions**

This paper set out to examine the extent to which levels of education of a wage employee account for wage difference in a selected sample of workers in Kenya, Tanzania, Uganda, Madagascar, Ghana, Niger, Guinea Conakry, Rwanda, Benin and Togo. The paper used country specific factors to control for omitted variable bias. Using OLS and Control function estimates, the paper confirms significant wage difference accounted for by education attainment. The results reported in this paper shed some light in the debate on whether there are systematic evidences of the wage effect from education attainment. Our results have strongly indicated that formal education in the surveyed firms is more rewarding than both, the vocational education and on the job training. In particular we have shown that the returns to schooling increases monotonically with the level of schooling attained. The estimated rates of returns to schooling for primary school completed were 4.82 per cent, while middle school graduates had 6.3 per cent earnings premium. This marginal rate of returns increases up to 17.5 if the same worker would have a higher education qualification. Estimates of the models suggest a positive correlation between education and wages.

The square term of schooling is highly significant (at 1 per cent level) indicating non-linearity of the returns to education, implying that at higher levels of education the marginal returns to schooling is greater than the marginal returns to schooling at lower levels of education. Control for country specific reveals that the country specific attributes have a positive influence on the extent of wage differences by country. The OLS estimates indicated a positive effect of job training attended in the past. A worker attended any job training in the past was estimated to gain about 9 per cent more of earnings. But the estimates based on fixed effects within estimators indicated that, controlling for firm fixed effects on job training attended currently is negatively correlated with earnings, which was insignificant in OLS estimates became significant. Hence the fixed effects regressions suggest that the job training impact on earnings is influenced by the time invariant firm specific characteristics. Specifically, workers with job training are in high paying firms, so the earnings premium captured by OLS reflects the firm specific characteristics.

Based on these results we don't have support for the previous findings that the rates of returns to vocational education are higher than the rates of returns to general education. This low returns to job training might partly be due to the following reasons: If employers regard formal certificates mainly from more educated workers as important signal of ability, they may regard other skills derived from job training or even work experience as less important when recruiting or rewarding employees. The other possible explanation of this difference explained was that, when job training programs fail to complement to schooling. We concluded that it is more rewarding for individuals to invest more on general education in our data.

The summary of median net hourly wage results indicate that in Benin wage is 214 Franc (CFA), Guinea Conakry is 2887 Guinean Franc (FG), Madagascar is 662 Ariary (MGA), Niger is 288.68 Niger Franc (CFA), Togo is 230.95 Togo Franc (CFA), Ghana is 2,35 GHS (Ghanaian Cedi). Senegal is 358.49 Senegal Franc (XOF), In Kenya is 33.67 Kenyan shilling. The findings suggest that wage differences in these African economies are partly explained by education differences, but strongly influenced by country specific. Thus, it is likely that wage differences of education are a result of self selectivity such that highly paid educated wage employees might be self selected into high paying countries. Major conclusion of the paper is that there is significant effect of education in explaining wage differences in the countries surveyed but such effect work through country specific effect.

Annex 1

Rate of Currencies in the Countries covered.

S/N	Country	Currency	Dollar
1.	Benin	485.71 XOF	1 USD (source: IMF)
2.	Kenya	85.5 ksh	1 USD
3.	Madagascar (Malagasy Ariary , MDG)	2,189.96 MGA	1 USD
4.	Guinea	7030.01 GNF	1 USD (source: IMF)
5.	Niger	485.53442 XOF	1 USD
6.	Togo	485.71 XOF	1 USD (source: IMF)
7.	Senegal	485.71 XOF	1 USD (source: IMF)
8.	Ghana	2.033 GHS (cedi)	1USD
9.	Tanzania	1605.14 Tsh	1 USD

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