Real Wages and Returns to Human Capital in Kenya Manufacturing firms*

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Abstract

This paper studies how real wages and wage returns to human capital in Kenya manufacturing firms changed, using cross-section data sets from a survey conducted in 1993, 1994, 1995, and 2000. A quantile regression technique is used to examine how the impact of human capital varies across the conditional wage distribution. The study found that between 1993 and 2000, the real wage, standardized for observable human capital characteristics increased, while returns to education appear to have been stable. Returns to education are highest for workers educated to advanced levels of education at all quartiles. Moreover, workers at the extreme top of the wage distribution have the highest returns to education while workers at the extreme bottom of the wage distribution have the lowest returns to education. This suggests that at each level of education, unmeasured factors compliment schooling in wage determination. Other dimensions of human capital such as tenure in current firm and worker's age are also significantly correlated with wages.

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1. Introduction

The aim of this study is to examine real wages and private wage returns to human capital in Kenya manufacturing firms during the 1990's.[1] This is important to know because it provides insights into how the manufacturing labor market operates and rewards skills. First, the study estimates returns to human capital and examines whether they are identical across the wage distribution. Second, it examines how real wages and returns to human capital changed in the 1990's and whether the changes, if any, were identical for all workers..

During the 1990's, the Kenya economy did not perform well.[2] The growth in real GDP was below 2.5% in six out of nine years between 1991 and 1999. The rates of growth in agriculture and manufacturing were poor. For example, in five of the years the latter recorded rates of growth below 2% while in the former, some years had rates of growth below zero. Formal wage employment expanded very slowly and many labor market participants have had to turn to informal sector employment (excluding small-scale farming) which statistics show expanded by close to 250% in the 1990's. In the early part of the 1990's, government instituted some economic reforms including, removal of price controls, freeing the foreign exchange rate, and other trade and financial sector reforms in early 1990's. The reforms and the poor state of the economy are likely to have had an impact on the performance of manufacturing firms, and by extension, wages and employment patterns.

Returns to human capital may have changed in this period not only due to economic changes but also due to continued expansion in supply of educated labor. While there is substantial empirical evidence that human capital and wages are positively correlated, different studies report different sizes and patterns of private wage returns to human capital (see Shultz, 1988; Psacharopoulos 1994; and Appleton, 1996 for surveys). Moreover, as Pritchett (2001) noted the little available evidence on changes in returns to human capital suggests that returns may increase, decrease, or remain stable over time.[3] In Kenya, Manda (1997) and Appleton, Bigsten and Manda (1999) reported that returns to schooling for urban manufacturing workers declined between 1978 and 1995 particularly for secondary graduates.

This paper considers what happened to real wages and private wage returns to human capital during the whole of the 1990's. It focuses not only on the average wage earner but also on

[1] The role of human capital in development was given impetus by the work of Shultz (1961, 1975) and the World Bank (2000) emphasizes investment in human capital as a way to reduce poverty.
[2] Table 1 presents some economic and education indicators for the 1990's
[3] At aggregate level, Pritchett (2001) reported that increase in schooling had little impact on growth in output per worker. Temple (2001) concluded that evidence on the impact of schooling on output growth is still uncertain.

workers at different quartiles of the wage distribution. Adopting the human capital model of wage determination, four cross-section data sets (1993, 1994, 1995 and 2000) drawn from a panel survey of Kenya manufacturing firms are used to estimate OLS and quantile earnings functions. The latter is not a standard technique in the literature on returns to schooling in developing countries. It is used in this paper because it provides a detailed decription of the wage structure. In particular, it helps in assessing whether real wage changes and changes in returns to human capital occurred for a particular segment of workers or for all workers. From a theoretical perspective, Card (1995) laid out a model which predicts that workers who faced different marginal costs and benefits in schooling may have different returns to schooling.[4] Quantile earnings functions are useful to illustrate the heterogeneity in workers.

The remainder of the paper is divided into 6 sections. Section 2 lays out the main issues in the literature on returns to education in developing countries. Section 3 contains a brief review of measurement of returns to schooling. The data are described in Section 4 and Section 5 presents the empirical model. In section 6 estimation results are presented and the paper concludes in Section 7.

2. Research Issues

This section reviews the main points of debate in the literature on returns to schooling in developing countries and Sub-Sahara Africa in particular. To start with, the survey of returns to schooling (Psacharopoulos, 1994) documented an aggregate pattern where returns to schooling are (i) higher in private sector employment than in public sector employment; (ii) highest at primary level and lowest at tertiary level.[5]; (iii) higher in developing countries especially in Africa, than in developed countries; and (iv) higher for women than men.

However, Bennell (1996) argued that the above pattern is unlikely in SSA because the estimates surveyed came from studies based on diverse methods, data quality, and countries that differ in size and records of economic performance. He proposed that, it is better to search for patterns in returns to schooling at country level. A survey of Mincerian returns to schooling (Appleton et al, 1996) for several SSA countries showed that returns to schooling rise with schooling. Recent estimates of returns to schooling (e.g Bigsten et al, 2000; Mwabu and Shultz, 2000; and Jones, 2001) report a similar result.

[4] Bushnisky (1994, 1998), Mwabu and Shultz (1996), Nielsen and Rosholm (2001), and Machado and Mata (2001) are examples of studies where changes in wage structure, educational returns, public-private wage differential, and wage inequality are studied using this approach.

[5] Private returns to primary schooling are 41%; returns to secondary and tertiary schooling are 27 and 28% respectively. Social returns are 24 % for primary schooling, 18% for secondary, and 11% for tertiary schooling.

A major source of skepticism about estimates of returns to schooling is that observed wage differences between workers may fully or partly reflect differences in ability and not productivity differences due to schooling. So if worker ability is omitted the estimates may be biased. But available empirical evidence does not appear to support this. Knight and Sabot (1990) and Glewwe (1996) included proxies for workers' ability in earnings functions and found little or no direct effect of ability on earnings. Other studies tested whether omission of family background biased estimated returns to schooling (e.g Lam and Schoeni, 1993). They reported that standard estimates maybe biased upwards. Similarly Behrman and Birdsall (1983) reported that omission of school quality measures injected an upward bias.

More direct effect of schooling on productivity has been estimated in farm production functions (e.g Pinckney and Kimuyu, 1995; Appleton and Balihuta, 1996) and manufacturing production functions. Using both earnings functions and production functions, Bigsten et al, (2000) reported positive wage returns to human capital in manufacturing sectors of five African countries. However, the returns to human capital were lower than the returns to physical capital. Jones (2001) used data from Ghanaian manufacturing sector and reported that more educated workers were more productive than less educated workers. Moreover, firms appeared to pay wages consistent with productivity differentials.[6]

Another source of skepticism about standard estimates of returns to schooling is that they are largely based on samples of wage earners. One question from this is whether returns to schooling estimated in wage employment are a good guide to returns to schooling in other forms of employment. Appleton (2001) reported that returns to education in farming, wage employment, and self-employment were remarkably close in Uganda. Moreover, wage benefits exclude externalities and direct consumption benefits which as noted by Shultz (1988) are important. External benefits are difficult to measure but Appleton and Balihuta (1996) and Weir and Knight (2000) have did this and reported that education of neighboring farmers had positive impact on individual farm output in Uganda and Ethiopia respectively.

Estimation of returns to schooling assumes that the increment in wages from additional schooling is constant over time. This may not be the case. Moll (1996) reported that in South Africa, return to primary schooling for Africans declined between 1960 and 1975 but stabilized thereafter. Return to secondary schooling remained strong in this period. Canagarajah and Thomas (1997) find that, private rate of return to secondary and post-

[6] This appears to support, at least in Ghanaian manufacturing, a key hypothesis of the competitive labor market model; that wages equal marginal product.

secondary schooling in Ghana rose in 1987-1991, while Krishnan, Sellassie and Dercon (1998) reported that labor market reforms had little impact on returns to schooling in urban Ethiopia in 1990-1997. But as pointed out earlier, Appleton, Bigsten and Manda (1999) reported that Mincerian returns to secondary schooling in Kenya declined between 1978 and 1995 while returns to university schooling did not decline.

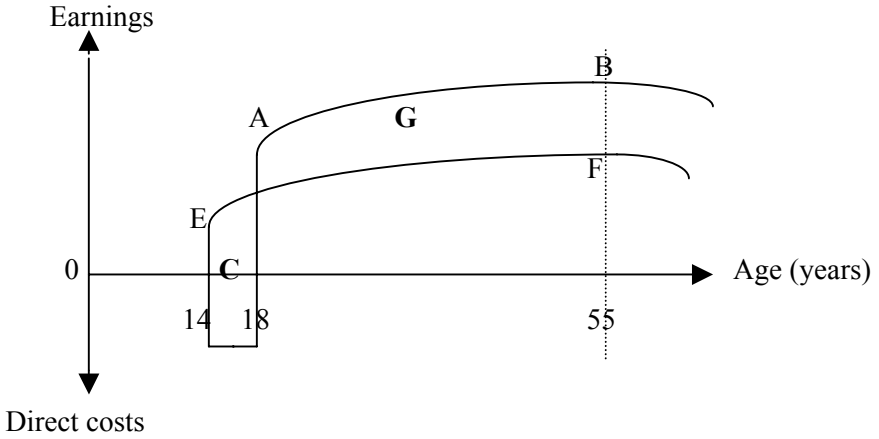
A recent line of research examines returns to schooling for workers at several points on the wage distribution (e.g Bushnisky, 1994). The main finding is that the return to schooling is not identical across the wage distribution and changes in returns to schooling may differ across the distribution too. Little research of this nature is available from Africa. The exception is Mwabu and Shultz (1996) study of returns to schooling in South Africa and Nielsen and Rosholm (2001) study of the public-private sector wage gap in Zambia. This approach gives a more detailed characterization of the earnings structure.

This study does not consider all the issues outlined above. It focuses on standard estimates of returns to schooling with the aim of testing whether any change occurred and whether returns to schooling are identical for low wage and high-wage workers. Before moving on to the empirical work the next section sets out two methods of estimating returns to human capital.

3. Measurement of Returns to Human Capital

The human capital model is the basis for measurement of returns to schooling. The idea is that schooling is acquired at a cost but it enhances a worker's productivity. To assess investments in human capital, costs and benefits maybe compared (Psacharopoulos, 1995). Figure 1 depicts the age-earnings profiles of two workers.

Figure 1: Age-earnings profiles



One worker studied up to primary level and the other studied up to secondary level. Assume the primary graduate entered the labor market at the age of 14 years the age-earnings profile may look like EF. The secondary graduate entered the labor market at the age of 18 years. The cost (*C*) of 4 years of study beyond primary school has two components: direct cost and opportunity cost (foregone earnings). The age earnings profile may look like AB. The gain from secondary schooling is *G*. The labor market earnings are assumed to rise with age at first and then decline due to diminishing returns.

The return to human capital is the discount rate that would equalize the sum of present discounted stream of schooling costs, to the sum of present discounted stream of wage benefits. In this illustration, the rate of return to secondary schooling would be the discount rate (r_s) that satisfies the expression in (1).

$$\sum_{t=1}^{37} \frac{(w_s - w_p)}{(1+r_s)} = \sum_{t=1}^{4} \frac{(w_p + c_s)}{(1+r_s)} \tag{1}$$

where w_s is the earnings of a secondary graduate and w_p is the earnings of a primary graduate. The difference $(w_s - w_p)$ is the gain labeled *G* in Figure 1, which the graduate will receive for 37 years. It is obtained after incurring a cost $(w_p + c_s)$ during 4 years of secondary schooling.

The second, and more widely used method is the human capital earnings function. The simple schooling version is due to Becker and Chiswick (1966) while Mincer (1974) introduced work experience into the model. The basic Mincerian model relates logarithm of earnings (*ln wage*) to years of schooling completed (*sch*) by a worker, years of labor market experience (*exp*), and years of labor market experience squared. The squared term accounts for the curvature depicted in Figure 1. The basic earnings function can be written as

$$\ln wage = f(sch, \exp, \exp^2) \tag{2a}$$

The schooling coefficient is interpreted as an estimate of Mincerian rate of return to schooling. It is assumed to be constant across different levels of schooling. To estimate returns to education at different points of the schooling distribution, the basic model is extended. Following Willis (1986) the earnings function is specified with years of schooling completed entered as a quadratic.

$$\ln wage = f(sch, sch^2, \exp, \exp^2) \tag{2b}$$

The return to a small increment in schooling in this model is the partial derivative with respect to schooling evaluated at a given point on the schooling distribution.

A different and more flexible formulation of the human capital earnings function breaks up the total years of schooling into years spent at each level of schooling. That is

$$\ln wage = f(prim, \sec, post, \exp, \exp^2) \qquad 2c$$

where *prim* is the years of primary school, *sec* is the years of secondary school, and *post* is the years of post secondary school. This will yield returns to education within a given level.

The Mincerian returns to schooling from the earnings functions above would equal private returns to schooling if (i) the cost of schooling is opportunity cost of the student's time, that is, earnings foregone when attending school.[7]; (ii) earnings differentials reflect productivity differentials; (iii) individuals live for ever and (iv) the increment in earnings is constant overtime. The latter assumption is relaxed later so as to test whether returns to schooling changed during the 1990's.

In the following empirical analysis, earnings functions (2b) and (2c) are employed to allow estimation of returns to different dimensions of human capital (schooling, years of tenure and labor market experience).

4. Empirical Specification

Previous estimates of returns to human capital in Kenya and other African countries are largely based on the standard method, that is OLS estimates of the earnings function. This provides estimates of the mean effects of wage determinants. For example, in the basic earnings function, OLS estimates would indicate whether wages of the average worker are significantly affected by schooling conditional on experience and the square of experience. However, workers have different unobserved productive characteristics (motivation, innate ability, physical strength).

When these are omitted from the earnings function, the effect of observed worker characteristics such as schooling may differ across the wage distribution. Moreover, Card (1995) noted that returns to schooling may differ across workers due to unobserved ability

[7] The foregone earnings for a particular level of schooling are the earnings of schooling level immediately below.

differences, that is, workers face different marginal rate of return to schooling. Returns may also differ workers faced different marginal costs of schooling or access to funds for schooling investments. This paper tests whether the effects of human capital differ for lower, middle, and high-wage workers. It also tests whether changes in real wage and changes in returns to human capital differ across the wage distribution.

A simple version for the human capital earnings function is adopted and estimated using the quantile regression estimator introduced by Koeneker and Basset (1978). Earnings functions are estimated at three quartiles of the conditional earnings distribution: lower quartile (25th percentile), median (50th percentile), and upper quartile (75th percentile). With a larger data set log wage functions can be estimated at more quartiles (e.g Bushnisky, 1994, 1998). Earnings functions are also estimated using OLS. This permits comparison between the two sets of estimates.

The schooling coefficient estimate at the lower quartile show the schooling effect for workers at the lowest 25% of the wage distribution. Estimates at the median show the schooling effect for workers at the middle and estimates at the upper quartile show schooling effect for workers in the to top 25% of the wage distribution. Thus as noted by Deaton (1997) the quantile regression technique allows a more detailed analysis of the conditional distribution of the dependent variable, in this case, log wage. One can compare returns to human capital of medium wageworkers with returns to human capital of high-wage workers.

Following Bushnisky (1994, 1998), the quantile regression model of the earnings function can be specified as follows:

$$\ln wi = x_i^{'}\beta_\theta + u_{\theta_i} \tag{3a}$$

$$Quant_\theta(\ln w_i \mid x_i) = x_i^{'}\beta_\theta; Quant_\theta(u_{\theta_i} \mid x_i) = 0 \tag{3b}$$

where w is the real hourly wage for worker i and x is a vector of explanatory variables. $i = 1,\ldots\ldots,n,$ where n is the number of workers in the sample. The explanatory variables in vector x are as follows. The gender of the worker measured as a dummy variable that takes the value of one if the worker is a man and zero if the worker is a woman. Age and age squared are included as proxies for labor market experience and labor market experience squared respectively. Schooling is measured in years of schooling completed.

Tenure in current firm is also included in the specification. Long tenure lengths may foster learning such that workers acquire firm-specific human capital. As a result they may become more productive and according to human capital theory wages would rise with tenure. A set of dummy variables for urban centers (Mombasa, Nakuru, and Eldoret) is also included. Each dummy variable takes a value of one if the particular firm is located in the particular urban center and zero otherwise. The benchmark is workers in firms located in the capital, Nairobi.

The parameter vector is denoted by β_θ and $Quant_\theta(lnw_i|x_i)$ is the θth sample quantile of lnw given x_i. The parameter vector is the solution to the minimization of the sum of absolute deviations residuals from any quantile of log of earnings across workers. For example when $\theta = 0.50$, this is the median regression or least absolute deviation (LAD) estimator. For equation (3a) the problem can be written as

$$Min\left\{\sum_{i:y_i\geq x_i\beta}\theta\,|\ln w_i - x_i\beta_\theta| + \sum_{i:y_i<x_i\beta_\theta}(1-\theta)\,|\ln w_i - x_i\beta_\theta|\right\} \qquad (4)$$

The solution to equation (4) is obtained by setting up a linear programming problem for the full sample and then linear programming algorithms are used to obtain the solution. Simultaneous quantile regressions are estimated so that it is possible to conduct tests of various restrictions across quantiles of the wage function.

The estimation procedure used takes the following sequence. First, earnings functions are estimated on a pooled sample across survey waves and including three time dummy variables for waves 2, 3, and 4. This specification facilitates a test of whether real wages changed with observable worker characteristics controlled for. Second, each wage determinant in the model is interacted with each time dummy variable. In this specification, the effect of each wage determinant is allowed to vary across the survey waves. In particular, it permits testing of whether returns to human capital changed between 1993 and 2000 by examining the significance of the coefficients of the interaction between each human capital variable and dummy variable for survey wave 4.[8]

5. Data and Sample Statistics

The data used are from a panel survey of Kenya manufacturing firms. The first three waves (1993, 1994, and 1995) were collected under the World Bank's Regional Program on

[8] An alternative procedure would be to estimate separate earnings functions for each survey wave.

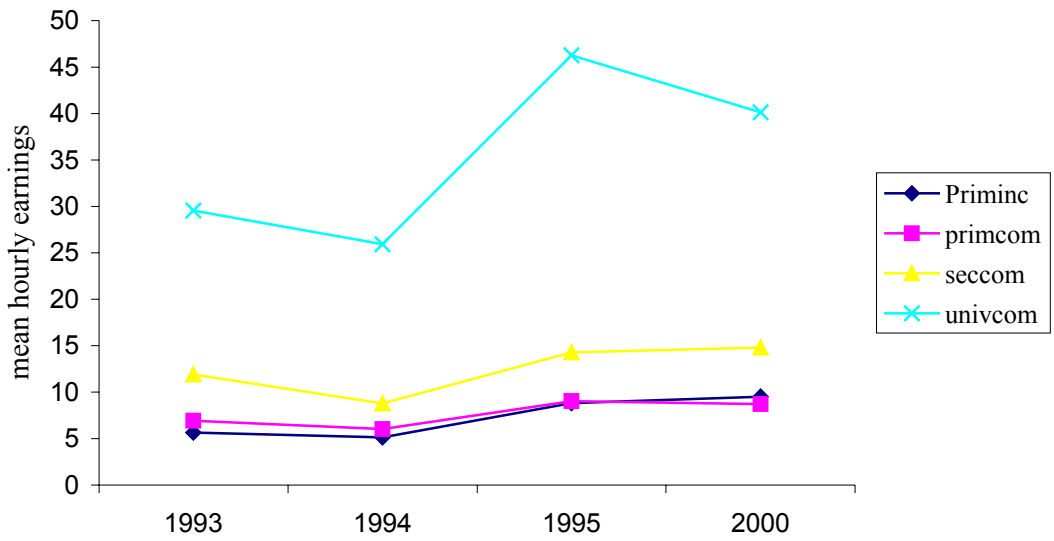
Enterprise Development (RPED). Nine countries (Burundi, Camerron, Cote d' Ivoire, Ghana, Kenya, Rwanda, Tanzania, Zambia, and Zimbabwe) were covered by the RPED. The Kenya RPED survey was funded by SIDA and conducted by researchers from the Department of Economics, Gothenburg University and Department of Economics, Nairobi University. The sampled firms are located in the capital, Nairobi and three other urban centres (Mombasa, Nakuru, and Eldoret). For a complete description of the Kenya survey see Bigsten and Kimuyu (2001). Many studies and several theses have been based on these data. In 2000, the United Nations Industrial Development Organization (UNIDO) funded a fourth survey wave in Kenya. This followed as much as possible the same firms that were in the first three survey waves. It was conducted by the Center for the Study of African Economies (CSAE), Oxford University in collaboration with the Department of Economics, Gothenburg University, and the Federation of Kenya Employers (FKE).

In each wave of data collection, a sample of workers in the firm visited were interviewed. Up to 10 workers were interviewed from each firm. Each was asked a set of questions about their wages, non-wage benefits, tenure in current firm, and individual characteristics such as age and schooling attainment among others. The total number of workers used in this paper is 4092 (1100 in wave 1, 1060 in wave 2, 964 in wave 3, and 968 in wave 4). Table 2 presents descriptive statistics of the sample of Kenya manufacturing workers pooled across the four waves, and by individual wave. The average age for the pooled sample is 34 years and does not go above 35 years in the four waves. The average tenure length in current firm is approximately 8 years which suggests low turnover of workers. In all waves over 50% of the workers interviewed work in firms located in the capital, Nairobi. Another feature of the data is that male workers constitute over 80% of each sample.

The mean years of schooling increased from 8.8 years in 1993 to 9.6 years in 2000. This is probably because retiring workers have less schooling while new entrants have more schooling. Moreover, although most workers are primary graduates the proportion that is secondary graduates is not far below. In wave 4 the proportion of secondary graduates outstripped that of primary graduates. Further, the proportion of workers without schooling and primary dropouts declined while that of university graduates increased slightly in wave 4.

Table 3, presents the distribution of hourly earnings by schooling and the mean hourly earnings are plotted in Figure 2.

Figure 2: Mean hourly earnings 1993-2000

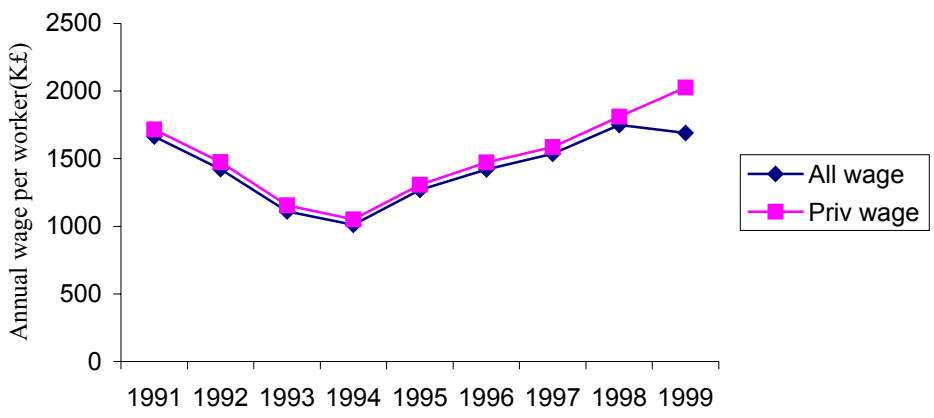


Note: Priminc: primary not complete, primcom: primary complete, seccom: secondary complete, univcom: university complete

The mean hourly wage grew by about 7% per year on average. Table 3 and Figure 2 show that the wage growth occurred for all workers regardless of schooling level. But the percentage increases differ. Also, the more educated received higher wages in each survey. Table 3 also gives a preliminary view of the relationship between schooling and the distribution of earnings. First, there is a positive relation between schooling and earnings at the 0.25, 0.50, and 0.75 quantiles of the earnings distribution. Second, the higher the level of schooling the larger is the earnings gap across quantiles. Third, the earnings differences across quantiles appear to change over time.

To place the above change in wages in context, they can be compared with other data. First, recall from Table 1 that on average, real private consumption demand rose by 3% per year between 1993 and 1999. This is about half of the increase in the unstandardized wage. Table 4, presents the annual wage per worker calculated from published data. This is plotted in Figure 3. The annual wage per worker in private manufacturing (Priv wage) rose by an average of 10% per year while the wage per worker in the whole manufacturing sector (All wage) grew by approximately 7% per year on average.

Figure 3: Manufacturing sector wage per worker



In Figure 4, the employment figures in Table 4 are plotted. In private manufacturing sector employment grew at an average rate of 3% per year compared to 2% for the whole manufacturing sector. Thus it appears that wage growth between 1991 and 1999 exceeded employment growth. The figures also illustrate that the wage growth picked up by the sample of firms in the survey is not limited to those firms.

Figure 4: Manufacturing employment, 1991-1999

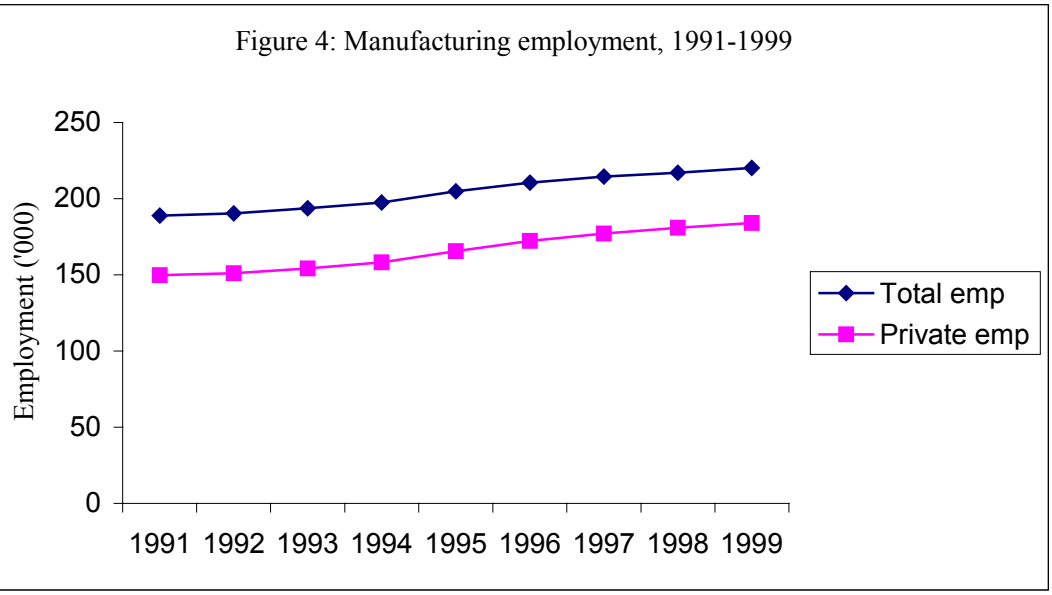


Table 5 presents firm level wage and labor productivity measures. The wage per worker grew considerably across the four survey rounds and the average labor productivity measured by output per worker appears to have increased. But the increase was small and far below the increase in average wage per worker. On average, employment declined less than 2% per year, much lower than the rise in average wage.

To summarize, calculations from published data and from the sample of firms appear to be in agreement that real wage growth occurred between 1993 and 2000. In the next section earnings functions are estimated with controls for human capital (age, tenure, and schooling) among other variables. It is then possible to derive the standardized change in earnings and to see how this differs from the change discussed here.

6. Estimation Results

In this section, results from the estimation procedure outlined in section 4 are presented. To begin with, earnings function estimates based on the pooled sample are presented. This is followed by earnings function estimates with interaction terms between wage determinants and time dummy variables to assess changes in returns to human capital.[9]

6.1. Real Wages and Returns to Human capital

Table 6 presents coefficient estimates of OLS and quantile earnings functions estimated on data pooled across the survey waves. The earnings function is estimated at first quartile, median, and third quartile. The pooled regression imposes the restriction that returns to worker characteristics are the same across the survey waves. But time effects are allowed for by including dummy variables for survey waves, with survey wave 1 as the benchmark.

In the top panel, the earnings function estimates reported are based on a model with education entered as a quadratic. The results suggest that men in the manufacturing firms earn significantly more than women at the three quartiles. The differential is most pronounced at the first quartile. The firm location coefficients suggest that workers in firms located outside the capital, Nairobi, have significantly lower wages.

Now we consider changes in real wage across the survey waves. These are derived from the coefficient estimates on survey wave dummies.[10] The implied change in mean real hourly wage is 38% across the waves, which translates to a simple average wage growth of about 5% per year. The corresponding wage growth at the median is about the same. A joint F-test rejected the null hypothesis of equality among coefficients of time dummies across

[9] The focus is on total returns to human capital. So a simple specification of the earnings function consistent with the human capital model is estimated. A number of education dependent variables such as occupation, firm size, sectors, and type of firm as regards ownership are not included. This is not to say that they do not affect wages.
[10] Calculated following Halvorsen and Palmquist (1980) as 100*(expb-1). b is the dummy coefficient estimate.

quantiles.[11] Hence the change appears to be the same across quantiles. The wage growth estimated from the earnings function is lower than the wage growth calculated from raw earnings data (7%) in Table 3. It suggests that part of the wage increase in raw data can be attributed to changing composition of workers in the characteristics included in the earnings functions.[12] It appears that the wage growth between 1993 and 2000 is larger than that between 1993 and 1995. In the latter period, Bigsten et. al. (2000) reported that real manufacturing wages rose by 21% in Kenya but fell in the other four countries in the cross-country study.

Turning to human capital variables (age, tenure, and schooling), it can be observed that they have coefficient estimates with expected signs. Age effects are statistically significant and the age-earnings profile is concave. The coefficient estimate of tenure in current firm is also statistically significant and uniform in size across the three quantiles. The tenure effect may suggest that seniority wages or reward to firm-specific human capital is important in Kenya manufacturing firms.

At the bottom of the top panel in Table 6, the estimated returns to schooling are presented. The return to a small increment in schooling is given by (Willis, 1986, page 532)

$$\frac{\partial Quant_{\theta}(\ln w \mid x)}{\partial s} = \beta_{s} + 2\beta_{s^2} s \qquad (5)$$

In this paper, the derivative is evaluated at 6, 10, and 14 years of schooling. It is also evaluated at the average years of schooling. The pattern is identical across quantiles. The Mincerian returns to schooling are higher for workers educated to more advanced levels. The returns are also highest for workers at the 75th percentile. In particular, for those with 6 years of schooling, the returns range from 0.03 at the first quartile to 0.06 at the third quartile. The standard estimate (OLS) is 0.05. For workers with 10 years of schooling, returns vary from 0.09 at the first quartile to 0.16 at the third quartile. The standard estimate is 0.13. Returns at 14 years of schooling are high, ranging from 0.15 at the first quartile to 0.27 at the third quartile. A joint F-test rejected the null hypothesis of equality of schooling coefficients across quantiles at 1% significance level. [13] The estimates from the standard method are of similar

[11] The F (6, 4079)-statistic is 1.06 in earnings function in top panel of Table 6 and F (6, 4078)-statistic is 1.24 in earnings function in bottom panel of Table 6.
[12] An earnings function was estimated on a sub-sample of workers excluding firms that entered the panel in 2000. The implied change in wages is similar to the one derived in the full sample.
[13] The F (4, 4079) statistic for the test is 28.42.

order of magnitude as those estimated by Bigsten et. al (2000). This suggests and results coming shortly seem to confirm that returns to schooling in the 1990's are quite stable.

The bottom panel of Table 6 presents estimates based on earnings function (2c), that is, the one with a spline in years of schooling. The total years of schooling are divided into years of primary (S_p), secondary (S_s), and post-secondary education (S_t) (e.g. Moll, 1996).

$$S_p = \begin{cases} x, 0 \le x \le 7 \\ 7, x > 7 \end{cases}$$

$$S_s = \begin{cases} 0, x \le 7 \\ x - 7, 7 < x \le 13 \\ 6, x > 13 \end{cases} \qquad (5)$$

$$S_t = \begin{cases} 0, x < 13 \\ x - 13, x \ge 13 \end{cases}$$

where x now denotes years of schooling completed. The schooling effect now varies across the schooling categories but is uniform within each level. As in the earlier specification, returns to schooling rise with schooling level and are highest at the 75th percentile. In particular, for workers with schooling less than or equal to 7 years the return ranges from 0.02 at the 25th percentile to 0.04 at the third quartile while the OLS return is 0.03. For those with 8 to 13 years of education the return ranges from 0.06 at the lower quantile to 0.13 at the upper quantile and the OLS return is 0.11. Returns to schooling above 13 years are over 0.30 across the three quantiles. The null hypothesis of equal schooling coefficients across quantiles may be rejected at the 1% significance level.[14]

The returns to primary schooling appear small while those at higher levels appear large. But recall from section 3 that these are Mincerian returns to schooling. The underlying assumption is that the cost of schooling is opportunity cost, that is, direct private costs are equal to zero. Consequently, Mincerian returns to schooling may overstate private returns to schooling for workers with higher level of schooling if direct private costs as a share of total costs are low. For workers with primary level of schooling Mincerian returns to schooling may understate private returns. This is because primary school children do not forego wages for the full

[14] The F (6,4078) statistic for the test is 39.07.

length of their primary schooling and if they work they do not earn a wage equivalent to the wage an adult without schooling would earn.

6.2. Change in Returns to Human Capital

This section tests whether the wage structure for manufacturing workers shifted during the 1990's. In particular, it tests whether returns to human capital changed. The log wage equation is estimated on a pooled sample from the four survey waves with survey wave dummies and interactions between each explanatory variable and each survey wave dummy. The coefficient estimates are presented in Tables 7 and 8. Since the F-tests reject the null hypothesis of equality in coefficients of interaction variables, this implies that the wage structure as a whole may have shifted between 1993 and 2000.[15] But the interaction effects between schooling and wave 4 dummy are generally not statistically significant. This suggests that returns to schooling changed little in this period.

This finding is difficult to compare with previous studies (see Table 9) because of differences in data, time periods, and estimated models. However, taken together they provide a picture of the trend in returns to human capital in Kenya. Milne and Neizert (1994) used urban labor force survey data and reported that between 1978 and 1986 the return to primary schooling fell while returns to secondary schooling increased. Appleton, Bigsten, and Manda (1999) estimated earnings functions on the 1978 and 1986 urban labor force surveys and on the 1995 wave of the RPED survey. They reported that the returns to primary schooling fell from 0.10 in 1978 to 0.02 in 1995 and returns to secondary schooling fell from 0.34 to 0.13. Returns to university education did not fall. Thus when taken in isolation, the results in this paper are in contrast with the results for earlier periods in Kenya. But taken together, the studies point to declining returns to education at primary and secondary levels.

The experience from outside Kenya is mixed. Moll (1996) reported that returns to primary schooling for Africans fell from 0.08 in 1965 to 0.03 in 1975. For colored and Asians, returns fell from 0.16 to 0.12. But returns to secondary schooling remained stable. In Ghana Canagarajah and Thomas (1997) reported that the return to a year of schooling rose from 0.03 to 0.07. Returns to post-primary school rose and became compressed between 1987 and 1991.

A study from Zambia (Nielsen and Rosholm, 2001) reported that between 1991 and 1996, the public-private sector wage gap grew in favour of low educated workers at the lowest quantile

[15] The F (30, 4052) statistic is 20.02 from OLS regression in Table 7. In Table 8 F (33, 4048) statistic is 17.61.

of the wage distribution. At the upper part of the distribution, the gap decreases sharply for highly educated workers. Returns to education though greater in the private sector varied across quantiles. A widely cited study (Bushnisky, 1994) reported that returns to schooling in the USA were higher for the top deciles of the wage distribution in the 1960's and early 1970's, but fell and converged across quantiles in the second half of the 1970's. In the 1980's, returns to schooling rose sharply especially at upper quantiles.

7. Summary and Conclusion

This paper set out to assess whether real manufacturing wages in Kenya changed during the 1990's and also whether returns to human capital changed for workers at different points on the wage distribution. It uses the standard procedure (OLS) of estimating returns to human capital but also deviates and uses a quantile regression technique to characterize the wage structure in more detail. There are four main findings from the analysis.

First, the results suggest that there was real wage growth between 1993 and 2000. The wage growth was identical across quantiles of the log wage distribution. Meanwhile, published data show that formal sector employment grew sluggishly and there was a huge expansion in informal sector employment. It might be expected that the pressure from these trends would hold down wages. However, apart from the human capital model on which the study is based, there may be other explanations for real wage growth. Institutional characteristics of the labor market such as unions may affect wages. Indeed, Manda, Bigsten, and Mwabu (2001) reported that manufacturing workers have a union wage premia of 12%. Soderbom and Teal (2001) reported that manufacturing firms in Ghana appear to share rents with their workers while in Cote d' Ivoire, Azam and Ris (2001) reported that firms seem to pay efficiency wages. These models may apply to the Kenya manufacturing labor market.

The second finding is that, the number of years a worker has been in the current firm, the number of years of schooling, and age, significantly affect earnings. In particular, wage returns to schooling are non-linear at the three quartiles considered, which means that workers educated to higher levels have higher returns to schooling. The low returns at lower levels may reflect the dwindling prospects of entering formal wage employment for educated Kenyans especially primary and secondary school graduates. The large expansion in informal sector employment may partly reflect the decreased opportunities and may suggest that measures have to be taken to enhance returns to education in the productive activities in which primary and secondary school graduates are mainly engaged in.

The third finding of this study is that private wage returns to schooling rise with quantiles at all levels of education. That is, returns are highest for high-wage workers (those in the third quartile of the log wage distribution). Within the human capital model, one possible conclusion is that unobserved productive factors due to individual ability or due to quality of schooling and training received might account for the higher returns at the upper quantile. Harmon, Oosterbeek, and Walker (2000) report a similar finding for the UK. In contrast, Mwabu and Shultz (1996) reported that at higher level of education returns decrease by deciles for Black South Africans but increase by deciles for White South Africans. Bushnisky (1994, 1998) reported that in the USA the pattern of returns to schooling across quantiles differed by experience groups.

The fourth result is that private wage returns to schooling in 2000 appear to be similar to those in 1993. This suggests that returns to schooling were quite stable in the 1990's. The lack of rising returns suggests that the impact of the large expansion in relative supply of educated labor in the 1970's and 1980's (see Knight and Sabot, 1990) is still being felt. Moreover, a comparison with estimates of returns to schooling for manufacturing workers in the 1970's and 1980´s (Appleton, Bigsten, and Manda, 1999) suggests that returns to schooling in Kenya manufacturing firms in the 1990's are lower than in the 1970's. Policy makers may need to consider carefully, measures to increase demand for educated labor in manufacturing (and in other economic sectors) if the increasing and more educated labor force is to derive substantial returns to schooling. Otherwise, if parents consider returns to schooling to be relatively low, they may be discouraged from making adequate investments in the schooling of their children.

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Table 1: Selected economic and schooling indicators for Kenya, 1991-1999

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Economic indicators									
GDP growth (%)	2.1	0.5	0.2	3.0	4.8	4.6	2.4	1.8	1.4
Inflation rate (%)	19.6	27.3	46.0	28.8	1.6	9.0	11.2	6.6	3.5
Real private consumption	5119	5020	3953	3525	4409	4311	4739	4873	4804
Population growth (%)	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	-
Population size (millions)	22.7	23.4	24.0	24.8	25.2	26.3	27.1	27.9	28.7
Formal sector (000)	1442	1462	1475	1505	1557	1619	1647	1665	1674
Informal sector (000)	1063	1238	1467	1792	2241	2644	2987	3354	3739
Manufacturing growth (%)	3.8	1.2	1.8	1.9	3.9	3.7	1.9	1.4	2.4
Agricultural growth (%)	-1.1	-3.7	-4.1	2.8	4.8	4.4	1.2	1.5	1.2
Schooling indicators									
Primary level (millions)	5.46	5.56	5.43	5.56	5.54	5.60	5.68	5.92	5.87
Secondary level (millions)	0.61	0.63	0.52	0.62	0.63	0.66	0.69	0.70	0.64
University level (millions)	0.039	0.042	0.040	0.040	0.040	0.037	0.040	0.044	0.042
Polytechnics (millions)	0.009	0.009	0.009	0.011	0.008	0.009	0.009	0.009	0.010
Techn.Institutes (millions)	0.007	0.008	0.008	0.008	0.008	0.010	0.009	0.008	0.010

Source: Economic surveys, various issues.

Table 2: Sample statistics (std deviations for continuous variables in brackets)

Variables	Pooled	1993	1994	1995	2000
Male worker	0.85	0.89	0.85	0.85	0.82
Age	33.86	34.54	32.78	33.30	34.76
	(8.95)	(8.86)	(8.55)	(8.80)	(9.44)
Tenure (in years)	7.87	8.10	7.26	7.58	8.53
	(7.12)	(7.06)	(6.71)	(7.03)	(7.63)
Schooling (in years)	9.10	8.84	8.79	9.18	9.60
	(2.86)	(2.95)	(2.88)	(2.90)	(2.61)
No schooling	0.004	0.007	0.004	0.001	0.003
Primary dropout	0.13	0.16	0.15	0.13	0.08
Primary graduate	0.43	0.45	0.43	0.44	0.39
Secondary graduate	0.41	0.38	0.39	0.39	0.49
University graduate	0.02	0.01	0.01	0.03	0.04
Works in Nairobi	0.64	0.68	0.66	0.65	0.57
Works in Mombasa	0.17	0.13	0.15	0.15	0.23
Works in Nakuru	0.10	0.10	0.10	0.11	0.08
Works in Eldoret	0.09	0.09	0.09	0.09	0.12
Real Hourly Earnings	10.34	8.77	7.26	12.31	13.02
	(14.50)	(10.57)	(8.02)	(20.62)	(14.46)
Ln (Real hourly Earnings)	2.00	1.88	1.72	2.18	2.24
	(0.72)	(0.68)	(0.65)	(0.67)	(0.75)
Round 1	0.27				
Round 2	0.24				
Round 3	0.26				
Round 4	0.24				
Number of observations	4092	1100	1060	964	968

Table 3: Distribution of hourly earnings (Kenya shillings) by worker's schooling

Schooling level/survey round	N	Mean	P25	Median	P75
Primary dropouts					
Round 1	175	5.66	3.84	5.04	6.55
Round 2	149	5.13	3.55	4.33	5.71
Round 3	135	8.82	5.66	7.68	9.30
Round 4	76	9.52	5.50	7.92	9.86
Primary graduates					
Round 1	491	6.94	4.09	5.18	7.42
Round 2	418	6.04	3.42	4.54	7.07
Round 3	471	9.03	5.61	7.54	9.88
Round 4	378	8.71	4.95	7.06	9.41
Secondary graduates					
Round 1	417	11.88	4.77	7.44	13.91
Round 2	379	8.78	3.98	6.08	9.73
Round 3	418	14.26	6.45	8.92	13.53
Round 4	471	14.78	6.27	10.07	17.56
University graduates					
Round 1	9	29.54	17.90	30.69	43.16
Round 2	14	25.94	12.39	21.09	30.77
Round 3	35	46.27	14.52	31.61	65.78
Round 4	40	40.14	21.11	30.52	52.91

Source: Calculated from sample data; N is number of observations; P shows percentile

Table 4: Annual Wages and Employment in Kenya manufacturing, 1991-1999

Year	Private employment (000)	Wage per worker Private mfg (K£)	Total employment (000)	Wage per worker Whole mfg (K£)
1991	149.80	1717.36	188.9	1664.08
1992	151.00	1474.83	190.3	1422.57
1993	154.30	1155.54	193.6	1109.24
1994	158.20	1051.07	197.5	1011.55
1995	165.50	1306.47	204.8	1269.77
1996	172.30	1471.39	210.5	1421.32
1997	177.10	1587.35	214.5	1536.21
1998	180.80	1811.50	217.1	1748.54
1999	184.00	2026.14	220.1	1691.16

Note: Nominal wages deflated with CPI (1990=100) series in IMF CD-ROM data. Mfg stands for manufacturing

Table 5: Firm Level Annual Wages and Employment

	Number of employees (Firm size)	Output per worker (Kenya shillings)	Annual wage per worker (Kenya shillings)
Round 1			
N	210	210	210
Mean	122	338,004	13,233
Median	28	161,988	10,244
SD	388	513,547	11,800
Round 2			
N	203	203	203
Mean	82	516,936	16,901
Median	21	182,222	10,709
SD	219	1,282,426	53,493
Round 3			
N	200	200	200
Mean	94	526,510	26,052
Median	21	224,613	13,431
SD	249	1,054,409	69,166
Round 4a			
N	198	198	198
Mean	111	444,992	26,196
Median	29	166,920	14,694
SD	230	799,948	53,127
Round 4b			
N	82	82	82
Mean	106	328,666	21,949
Median	35	190,586	14,463
SD	253	354,471	23,550

Notes: N is the number of firms. Round 4a indicates statistics when all firms are considered while Round 4b indicates statistics excluding firms that entered the panel in 2000.

Table 6: Pooled Earnings Function estimates

	OLS		θ=0.25		θ=0.50		θ=0.75	
Earnings function (2b)								
Male	0.06*	[2.39]	0.11*	[3.40]	0.07***	[1.83]	0.06*	[2.68]
Age	0.056*	[8.23]	0.047*	[6.90]	0.044*	[6.38]	0.05*	[6.46]
Age^2	-0.0005*	[5.53]	-0.0005*	[4.73]	-0.0004*	[4.13]	-0.0004*	[3.66]
Schooling (in years)	-0.081*	[6.07]	-0.062*	[4.05]	-0.104*	[5.19]	-0.101*	[4.77]
$Schooling^2$	0.0105*	[13.35]	0.0075*	[7.71]	0.0115*	[10.62]	0.0131*	[9.89]
Tenure (in years)	0.01*	[4.86]	0.01*	[4.63]	0.01*	[3.94]	0.01*	[2.95]
Works in Mombasa	-0.17*	[7.13]	-0.13*	[5.30]	-0.14*	[5.96]	-0.16*	[5.12]
Works in Nakuru	-0.49*	[19.08]	-0.43*	[12.88]	-0.47*	[11.30]	-0.49*	[11.15]
Works in Eldoret	-0.41*	[14.06]	-0.36*	[18.30]	-0.39*	[16.05]	-0.41*	[8.32]
Round 2	-0.01*	[3.97]	-0.11*	[4.26]	-0.09*	[3.67]	-0.10*	[3.23]
Round 3	0.32*	[13.43]	0.37*	[14.32]	0.34*	[15.27]	0.31*	[9.55]
Round 4	0.32*	[12.57]	0.32*	[13.65]	0.30*	[14.77]	0.30*	[11.00]
Constant	0.35*	[2.66]	0.29*	[2.24]	0.67*	[4.73]	0.68*	[4.18]
Return to schooling								
Schooling=6	0.05		0.03		0.03		0.06	
Schooling=10	0.13		0.09		0.13		0.16	
Schooling =14	0.21		0.15		0.22		0.27	
Average years of schooling	0.11		0.07		0.10		0.13	
Adjusted R-square#	0.41		0.23		0.24		0.27	
Number of observations	4092							
Earnings function (2c)								
Male	0.06**	[2.16]	0.14*	[5.04]	0.07***	[1.76]	0.04	[0.92]
Age	0.058*	[8.48]	0.048*	[5.95]	0.05*	[6.69]	0.056*	[6.39]
Age^2	-0.0005*	[5.77]	-0.0005*	[4.54]	-0.0004*	[4.53]	-0.0005*	[4.06]
Schooling≤7	0.03*	[3.80]	0.02*	[3.14]	0.03*	[3.34]	0.04*	[2.43]
7<Schooling ≤13	0.11*	[20.99]	0.06*	[15.95]	0.10*	[20.88]	0.13*	[19.55]
Schooling>13	0.30’	[12.20]	0.33*	[7.43]	0.33*	[16.47]	0.37*	[7.88]
Tenure (in years)	0.01*	[4.75]	0.01*	[4.59]	0.01*	[3.44]	0.01*	[3.39]
Works in Mombasa	-0.17*	[7.31]	-0.13*	[4.16]	-0.14’	[6.48]	-0.19*	[6.69]
Works in Nakuru	-0.49*	[18.82	-0.44*	[14.09]	-0.46*	[17.83]	-0.50*	[15.40]
Works in Eldoret	-0.41*	[14.08]	-0.37*	[17.41]	-0.39*	[11.50]	-0.42*	[9.00]
Round 2	-0.10*	[4.18]	-0.12*	[7.00]	-0.10*	[3.22]	-0.11*	[3.21]
Round 3	0.31*	[13.08]	0.35*	[13.35]	0.34*	[10.99]	0.29*	[9.89]
Round 4	0.31*	[12.14]	0.31*	[10.97]	0.29*	[12.05]	0.27*	[9.35]
Constant	0.07	[0.56]	0.11	[0.73]	0.22***	[1.83]	0.32***	[1.70]
Adjusted R-square#	0.41		0.23		0.24		0.26	
Number of observations	4092							

Notes: The dependent variable is log of hourly earnings. Significance at 1%, 5%, and 10% is indicated by “*”, “**”, and “***” respectively. # For quantile regression the R-square refers to Pseudo R-square. Absolute t-statistics are in []. OLS t-statistics are based on heteroskedastic consistent standard errors. Quantile regression t-statistics are derived from standard errors estimated using bootstrap resampling.

Table 7: Earnings Function Estimates with interaction variables

Variable	OLS		θ=0.25		θ=0.50		θ=0.75	
Male	0.08	[1.39]	0.21**	[2.06]	0.06	[0.82]	0.04	[0.56]
Age	0.05*	[3.94]	0.045*	[3.14]	0.037	[1.59]	0.05**	[2.31]
Age2	-0.0004**	[2.11]	-0.004**	[2.24]	-0.0002	[0.74]	-0.0003	[0.97]
Schooling	-0.058*	[2.82]	-0.036**	[2.24]	-0.048***	[1.83]	-0.032	[0.83]
Schooling^2	0.01*	[7.79]	0.0058*	[5.10]	0.0090*	[5.79]	0.0099*	[4.69]
Tenure	0.00	[0.58]	0.00	[0.86]	0.00	[0.41]	0.00	[0.24]
Mombasa	-0.21*	[5.02]	-0.07***	[1.65]	-0.14*	[2.97]	-0.24*	[3.06]
Nakuru	-0.39*	[8.39]	-0.26*	[5.47]	-0.31*	[8.61]	-0.49*	[11.54]
Eldoret	-0.40*	[7.01]	-0.35*	[7.94]	-0.40*	[5.77]	-0.39*	[3.61]
Round2	0.07	[0.18]	0.59	[1.41]	-0.01	[0.02]	0.23	[0.35]
Round3	0.82**	[2.13]	0.75***	[1.71]	0.70	[1.48]	1.00**	[2.06]
Round4	0.42	[1.13]	0.66	[1.44]	0.14	[0.26]	0.45	[0.65]
Round2 . Male	-0.04	[0.57]	-0.14	[1.14]	-0.02	[0.16]	0.04	[0.38]
Round3 . Male	0.03	[0.44]	-0.06	[0.49]	0.05	[0.50]	0.01	[0.12]
Round4 . Male	-0.06	[0.83]	-0.15	[1.22]	-0.01	[0.12]	0.03	[0.37]
Round2 . Age	0.01	[0.37]	-0.03	[1.38]	0.02	[0.75]	0.00	[0.04]
Round3 . Age	0.01	[0.37]	0.01	[0.50]	0.02	[0.79]	0.01	[0.32]
Round4 . Age	-0.01	[0.26]	0.01	[0.33]	0.01	[0.28]	-0.01	[0.44]
Round2 . Age^2	0.00	[0.88]	0.00	[1.23]	0.00	[1.11]	0.00	[0.26]
Round3 . Age^2	0.00	[0.96]	0.00	[1.02]	0.00	[1.34]	0.00	[0.99]
Round4 . Age^2	0.00	[0.01]	0.00	[0.63]	0.00	[0.24]	0.00	[0.34]
Round2 . Schooling	-0.01	[0.21]	-0.03	[0.74]	-0.06	[1.27]	-0.03	[0.56]
Round3 . Schooling	-0.08**	[2.20]	-0.06	[1.33]	-0.10***	[1.93]	-0.12	[1.61]
Round4 . Schooling	-0.02	[0.47]	-0.10*	[2.59]	-0.02	[0.51]	-0.03	[0.38]
Round2 . Schooling^2	0.00	[0.47]	0.00	[0.66]	0.00	[0.82]	0.00	[0.10]
Round3 . Schooling^2	0.00	[1.12]	0.00	[0.88]	0.00	[1.14]	0.00	[0.90]
Round4 . Schooling^2	0.00	[0.77]	0.01*	[3.07]	0.00	[0.59]	0.00	[0.61]
Round2 . Tenure	0.01***	[1.91]	0.01	[1.36]	0.01	[1.21]	0.01	[1.14]
Round3 . Tenure	0.01	[1.50]	0.00	[0.95]	0.01	[1.41]	0.02**	[2.03]
Round4 . Tenure	0.01*	[2.56]	0.01*	[2.51]	0.01	[1.25]	0.01	[1.54]
Round2 . Mombasa	-0.04	[0.54]	-0.11**	[2.06]	-0.10***	[1.66]	-0.01	[0.13]
Round3 . Mombasa	-0.03	[0.55]	-0.16*	[2.84]	-0.11***	[1.69]	0.01	[0.16]
Round4 . Mombasa	0.17*	[2.73]	0.06	[1.07]	0.12***	[1.68]	0.18***	[1.84]
Round2 . Nakuru	-0.12***	[1.73]	-0.14*	[2.24]	-0.24*	[3.96]	-0.07	[0.78]
Round3 . Nakuru	-0.07	[0.93]	-0.23*	[3.17]	-0.13**	[2.21]	0.06	[0.76]
Round4 . Nakuru	-0.30*	[4.06]	-0.37*	[4.45]	-0.38*	[6.53]	-0.20***	[1.85]
Round2 . Eldoret	0.03	[0.35]	0.07	[0.92]	0.04	[0.42]	-0.02	[0.15]
Round3 . Eldoret	0.03	[0.29]	-0.02	[0.53]	0.01	[0.13]	0.02	[0.17]
Round4 . Eldoret	-0.08	[0.98]	-0.01	[0.13]	-0.10	[1.09]	-0.17	[1.17]
Constant	0.22	[0.85]	0.13	[0.37]	0.50	[1.11]	0.46	[1.01]
Adj. R-square$^{\#}$	0.43		0.24		0.26		0.28	
Number of observations	4092							

Notes: The dependent variable is log of hourly earnings. Significance at 1%, 5%, and 10% is indicated by "*", "**", and "***" respectively. # For quantile regression the R-square refers to Pseudo R-square. Absolute t-statistics are in []. OLS t-statistics are based on heteroskedastic consistent standard errors. Quantile regression t-statistics are derived from standard errors estimated using bootstrap resampling.

Table 8: Earnings Function Estimates with interaction variables

	OLS		θ=0.25		θ=0.50		θ=0.75	
Male	0.07	[1.25]	0.22*	[3.89]	0.06	[1.41]	0.00	[0.04]
Age	0.05*	[4.06]	0.05*	[3.50]	0.04*	[2.40]	0.04*	[2.87]
Age2	-0.0004**	[2.28]	-0.0005*	[2.82]	-0.0003	[1.27]	-0.0002	[1.16]
Schooling≤7	0.05*	[4.30]	0.03*	[3.49]	0.04*	[4.69]	0.07*	[6.08]
7<Schooling ≤13	0.12*	[12.44]	0.06*	[5.99]	0.11*	[11.70]	0.14*	[11.47]
Schooling>13	0.39*	[6.76]	0.46*	[4.26]	0.46*	[3.39]	0.38*	[3.21]
Tenure	0.00	[0.73]	0.00	[0.87]	0.00	[0.98]	0.00	[0.58]
Mombasa	-0.22*	[5.25]	-0.10**	[2.26]	-0.17*	[3.20]	-0.26*	[3.07]
Nakuru	-0.39*	[8.41]	-0.29*	[5.68]	-0.33*	[4.67]	-0.47*	[7.97]
Eldoret	-0.40*	[6.96]	-0.35*	[5.66]	-0.40*	[10.03]	-0.39*	[3.89]
Round 2	0.09	[0.26]	0.57	[1.25]	-0.12	[0.32]	0.44	[0.77]
Round 3	0.67***	[1.77]	0.72	[1.37]	0.31	[0.59]	0.74***	[1.81]
Round 4	0.47	[1.30]	0.43	[1.20]	-0.02	[0.06]	0.69	[1.01]
Round2 . Male	-0.04	[0.54]	-0.16**	[2.14]	-0.02	[0.21]	0.05	[0.57]
Round3 . Male	0.03	[0.37]	-0.06	[0.73]	0.04	[0.68]	0.04	[0.43]
Round4 . Male	-0.05	[0.71]	-0.17*	[2.34]	-0.02	[0.27]	0.08	[0.92]
Round2 . Age	0.01	[0.33]	-0.03	[1.18]	0.02	[1.11]	-0.01	[0.30]
Round3 . Age	0.01	[0.40]	0.00	[0.12]	0.03	[1.04]	0.01	[0.62]
Round4 . Age	-0.01	[0.25]	0.01	[0.52]	0.01	[0.69]	-0.01	[0.42]
Round2 . Age^2	0.00	[0.78]	0.00	[1.21]	0.00	[1.43]	0.00	[0.01]
Round3 . Age^2	0.00	[0.96]	0.00	[0.39]	0.00	[1.49]	0.00	[1.54]
Round4 . Age^2	0.00	[0.07]	0.00	[0.68]	0.00	[0.49]	0.00	[0.32]
Round2 . Schooling≤7	-0.02	[1.11]	-0.02	[0.67]	-0.04	[1.58]	-0.04**	[2.26]
Round3 . Schooling≤7	-0.05**	[2.21]	-0.03	[1.09]	-0.04	[1.27]	-0.07*	[3.15]
Round4 . Schooling≤7	-0.02	[1.08]	-0.02	[0.94]	-0.01	[0.49]	-0.06**	[2.02]
Round2 . 7<Schooling ≤13	-0.02	[1.49]	0.01	[0.90]	-0.02	[1.25]	-0.04***	[1.73]
Round3 . 7<Schooling ≤13	-0.04*	[2.99]	-0.01	[0.70]	-0.04*	[4.67]	-0.06*	[3.31]
Round4 . 7<Schooling ≤13	0.03***	[1.84]	0.02	[1.54]	0.02	[1.06]	0.05***	[1.93]
Round2 . Schooling>13	-0.15	[1.62]	-0.19	[1.33]	-0.13	[0.87]	-0.04	[0.31]
Round3 . Schooling>13	-0.07	[0.93]	-0.26*	[2.40]	-0.12	[0.84]	0.10	[0.67]
Round4 . Schooling>13	-0.10	[1.50]	-0.11	[0.90]	-0.16	[1.06]	-0.12	[0.84]
Round2 . Tenure	0.01***	[1.71]	0.01	[0.97]	0.01	[1.09]	0.01***	[1.72]
Round3 . Tenure	0.01	[1.42]	0.00	[0.90]	0.00	[0.93]	0.02*	[3.09]
Round4 . Tenure	0.01*	[2.36]	0.01***	[1.70]	0.01	[1.01]	0.01***	[1.83]
Round2 . Mombasa	-0.03	[0.50]	-0.09	[1.09]	-0.07	[0.63]	-0.02	[0.21]
Round3 . Mombasa	-0.03	[0.44]	-0.11***	[1.81]	-0.09	[1.20]	0.02	[0.18]
Round4 . Mombasa	0.18*	[2.89]	0.10	[1.45]	0.15*	[2.37]	0.24*	[2.86]
Round2 . Nakuru	-0.12***	[1.81]	-0.13***	[1.84]	-0.22*	[2.48]	-0.12**	[2.13]
Round3 . Nakuru	-0.04	[0.60]	-0.17	[1.54]	-0.13	[1.37]	0.06	[0.43]
Round4 . Nakuru	-0.29*	[3.97]	-0.35*	[4.12]	-0.36*	[4.04]	-0.23*	[2.57]
Round2 . Eldoret	0.03	[0.35]	0.07	[0.85]	0.04	[0.67]	-0.08	[0.57]
Round3 . Eldoret	0.03	[0.37]	-0.03	[0.41]	0.00	[0.07]	0.03	[0.23]
Round4 . Eldoret	-0.08	[1.01]	-0.04	[0.53]	-0.10	[1.12]	-0.14	[1.12]
Constant	-0.05	[0.19]	-0.08	[0.28]	0.32	[1.10]	0.33	[0.98]
Adj. R-square#	0.42		0.24		0.26		0.28	
Number of observations	4092							

Notes: The dependent variable is log of hourly earnings. Significance at 1%, 5%, and 10% is indicated by "*", "**", and "***" respectively. # For quantile regression the R-square refers to Pseudo R-square. Absolute t-statistics are in []. OLS t-statistics are based on heteroskedastic consistent standard errors. Quantile regression t-statistics are derived from standard errors estimated using bootstrap resampling.

Table 9: Returns to Schooling From Other Studies in Kenya

Study	Data	Primary	Secondary	University
Bigsten et al (2000)[a]	RPED: 1993-95	4	12	22*
Milne & Neizert (1994)[b]	ULFS:1978	9	11	-
	ULFS:1986	7	16	-
Appleton, Bigsten & Manda (1999)[c]	ULFS:1978	10	34	61
	ULFS:1986	5	16	20
	RPED:1995	2	12	69
Manda (1997)[d]	ULFS:1978	18	56	-
	ULFS:1986	13	37	-
	RPED: 1993-95	5	13	53

Notes

RPED: Regional Program on Enterprise Development

ULFS: Urban Labor force Survey

(a) Part of a cross-country study of five African countries. The dependent variable is ln (monthly earnings). Regressors include schooling, schooling squared, age, age squared, tenure, tenure squared, and male dummy. Based on manufacturing workers. Evaluated at 6, 10, and 14 years

(b) The dependent variable is ln (hourly earnings). Regressors included are schooling, schooling squared, age, age squared, female dummy, location dummies, and occupation dummies. The schooling effect reported is for a worker aged 30 years.

(c) The dependent variable is ln (monthly earnings). The regressors include schooling dummies, potential experience, a second and third order polynomial in potential experience, male dummy, and location dummy variables. Only returns to schooling for manufacturing workers are shown in this Table.

(d) Dependent variable is ln(hourly earnings). Age, age squared, vocational training dummy, occupation dummies, and location dummies are included in separate earnings equations for each schooling level.

* Computed from the estimated model with schooling set to 16 years.