

Heterogeneity in Returns to Schooling in Cameroon: An Estimation Approach Considering Selection and Endogeneity Bias

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Abstract

The aim of this study is to show that the rate of the returns to education is not uniform, and that some people benefit most and others least from their education on the labour market. Using data from a survey on employment and the informal sector, the study provides evidence of the heterogeneity of the returns to education in Cameroon. By controlling for any selection bias attributable to endogenous choices of the employment sector in the school-to-work transition and the potential endogeneity of the education variable related to the individual unobserved heterogeneity, we used the ordinary least squares with robust standard errors and the quantile regression technique to estimate the Mincer earnings function. This estimation procedure based on the control function is suitable because of the robustness of the instruments used. Overall, the study found that the average rate of the returns of an additional year of education was 7.1%. The results of the quantile regression model showed that the returns to education differed according to the earnings quantile considered: they were highest for the highest-paid workers and lowest for the middle-income ones. In addition, the individual unobserved heterogeneity was observed to decrease the returns to education. The Wald test for the equality of coefficients significantly confirmed the heterogeneity of the returns to education by quantile. The study's findings have many socioeconomic policy implications.

Key words: *Returns to education; Endogeneity; Selection terms; Instruments; Quantile regression.*

JEL classification: *I26; J20; J30.*

1. Introduction

Over the past three decades, the economics of education has seen a renewal of issues relating, in particular, to schooling returns. Thanks to microeconomic development, empirical studies of the returns to education have increased manifold in various fields. In this connection, studies on economic growth have addressed the issue of the role of education in productivity and economic growth (Charlot, 1997; Hugon, 2005). Researchers who have studied inequality and poverty have sought to understand how investing in education can improve the incomes of the poor (Arestoff and Sgard, 2012). On the other hand, studies that have analysed the issue of optimal distribution of resources have made it possible to determine the expected returns on investment in education, that is, the wage benefits which people can gain on the labour market as a result of their schooling. For both individuals and society, returns to education remain at the centre of discussion in economic literature.

Private returns to education have been researched in several African countries (Schultz, 2004). While there is no doubt about the positive relationship between education and wages, the question of whether education affects people differently has been given comparatively little attention.¹ From a methodological viewpoint, the majority of studies reported in the literature have focused on average modelling (Arestoff, 2001; Nga Ndjoko et al, 2011). They have been much criticized because this approach provides essential but limited information (D'Haultfœuille and Givord, 2014). That is because an average income does not provide information on the more or less unequal distribution of income within a population. For example, an additional year of education benefits some people more than others on the labour market. Due to the complementarity between people's education and their ability, the returns to education will differ in the distribution of wages. If, for example, the most able people earn more, this could be explained by the high returns at the top of the wage scale. That is why an estimate to average opens to criticism when outliers or censored data are taken into account. For various reasons, numerous studies have revealed the heterogeneous effects of education on wages in a number of African countries (Mwabu and Schultz, 1996; Girma and Kedir, 2005; Fasih et al, 2012; Baye, 2015; Kavuma et al, 2015).

In the human capital theory, education is considered an investment in a durable consumer good (Lemelin, 1998), which improves workers' productive capacities (Schultz, 1961). On the assumption that remuneration is equal to marginal productivity,

the neoclassical analysis of the rate of returns to education ignores unemployment problems and refers almost exclusively to the prevailing wage rate on the labour market (Lemelin and Otis, 1978). In reality, the labour market does not adjust instantly; it is affected by the existence, if not the persistence, of situations of surplus or shortage (imperfection) which determine the private returns to education (Schultz, 2004). In a shortage situation, skill underutilization leads to the devaluation of human capital (Njifen, 2018). Indeed, when underutilized workers work fewer hours than they would like to, they will earn less. Furthermore, in developing countries, markets are not only imperfect, but the nature of employment contracts also significantly influences the relationship between human capital endowment and remuneration. The existence of a wide informal sector which significantly contributes to job creation greatly influences the effect of education on wages. Some authors have shown that the returns to education in the formal sector are higher than those in the informal sector (Pradhan and van Soest, 1997).

Based on certain stylized facts, it is necessary to carry out a case study on heterogeneity in the private returns to education in the Cameroonian context. Firstly, the level of underemployment and the expansion of the informal sector are likely to generate low-paid jobs. Indeed, in Cameroon, informal jobs represent 91% of the total jobs and the rate of underemployment is around 70%. Secondly, a combination of population growth and the transition to free primary education in 2001 has led to a massive increase in the total numbers of children in school. Net primary and secondary school enrolment rates increased from 66% and 14% in 1980 to 92% and 44% in 2015, respectively.² Lastly, the country's level and efficiency of education spending is not adequate to ensure educational quality. Non-salary expenditure on school supplies and facilities represents only 15-20% of the total education expenditure (Banque Mondiale [World Bank], 2017). At the same time, the proportion of primary school teachers paid by parents increased from 25% in 2009 to 38% in 2016. In addition, the reforms that became necessary following a significant increase in the number of students over the past three decades have led to an increase in the number of universities and private higher education institutions. Regardless of the number of jobs available, the number of graduates per year has been increasing dramatically.³ Against this backdrop of a decline in employability, where the poverty rate was around 37.5% in 2015 and the vulnerable employment rate was 73.6% in 2010, it is only fitting to ask whether an additional year of schooling produces the same benefits for all employees on the labour market. Otherwise, who benefits most from the returns to education?

The aim of the present study is to analyse heterogeneity in private returns to education using an estimation approach in the presence of selection and endogeneity bias. More specifically, it seeks to show that: (i) the frequency of (un)occupied labour force from another household in the vicinity determines the participation of an individual as wage-worker on the labour market; (ii) the frequency of wage-workers in another household determines the choice of employment sector; (iii) the average level of education per household in the residence area of individuals is a determining factor in the demand for education; (iv) education benefits the highest-paid more

than the lowest-paid employees and the education endogeneity bias related to the individual unobserved heterogeneity significantly decreases the returns to education. While issues related to profitability of education have been widely studied, the present study is the first to take into account double selection in the participation to labour market. It is equally the first to use a “non-self-cluster mean” as potential instrument in the identification process of the specified econometric model.

The use of this type of instrument is of proven relevance. The “non-self-cluster mean” variables, although rarely used in the literature, are suitable instruments to the extent that, by definition, they are not correlated with the error term and are strongly correlated with the instrumented variable (Handa, 1996). They are values corresponding to a given (instrumented) endogenous variable, calculated as an average for all the other households in a community, that is, without the score of the reference household. Theoretically, such community-level variables, unlike the individual-level ones, generally satisfy the exclusion and orthogonality conditions of a good instrument. For each regression analysis carried out, namely regarding the selection model, the multinomial probit of employment sector choice and the function of education demand, a non-self-cluster mean will be computed.

The rest of this paper is organized around four sections. Section 2 reviews the theoretical and empirical literature on the returns to schooling. Section 3 presents the study’s methodology, comprising the sources of data, the econometric approach and the estimation technique. Section 4 presents research findings. Section 5 concludes and offers economic policy recommendations.

2. Literature review

The theory of investment in human capital gave rise to a wealth of empirical work measuring the effect of education on earnings and, hence, the rate of returns to education. This rate is based on the assumption that education is a market production commodity. Since productivity is not easy to measure, it is hypothesized that remuneration is equal to marginal productivity. In perfect competition, individual's wage is determined by his/her marginal productivity. This section reviews the theoretical insights into the interpretation of the correlation between education and income before presenting some previous empirical studies.

Theoretical interpretation of correlation between education and income

The correlation between education and income, which is the basis for calculating the rate of returns to education, is essentially based on the relationship between education and labour (Lemelin, 1984). Various interpretations of this relationship can be organized around two main headings (Blaug, 1971; Lemelin, 1998): an economic approach and a non-economic approach (based on sociological and psychological interpretations).

- **The economic approach**

The economic approach focuses on the supply-and-demand principle to assess the rate of returns to education. In the rationale of this approach, the most educated earn more because the demand for their services is greater and the supply smaller. So, the approach is based on the idea of imperfect competition and is essentially premised on three things: a) remuneration is done at marginal productivity in value, b) education increases productivity through improving knowledge, and c) education has a cost. According to the proponents of this economic interpretation, workers are heterogeneous and education increases productivity. The contribution of education to productivity is manifested in two ways: first, education transmits knowledge, skills and abilities that improve performance at work; second, school is considered as the place where particular skills are acquired which prepares someone for the exercise of a profession. The demand for highly educated workers,

as determined by their marginal productivity, is greater than the demand for less educated ones. In addition, the supply-side argument recognizes that education has a cost and that this cost can only be incurred if education provides the best working conditions. The most educated will offer their services only for a higher pay rate, and conversely, if the pay rate is low, they will work less. Human capital theory (Mincer, 1974; Becker, 1975), which stresses the education-productivity-earnings causal chain, fits well into the argument that the education system enables people to acquire productive skills.

- **The non-economic approach**

Outside the economic approach, there are many authors who have argued that education is only a selection mechanism making it possible to reserve the best jobs for the elite. They have compared it to a tournament where everyone is invited to participate but where not everyone has the same chance of winning. This point of view is cast within the twin perspective – sociological and psychological – which rests on the assumption that education does not directly improve workers' productivity.

For the proponents of the sociological interpretation, the correlation between education and income stems from elements that are character-related, that is elements of an affective or moral nature transmitted by the school as the main place of socialization and adaptation to group life (Baudelot and Establet, 1971). In other words, school is a place where teamwork skills and, hence, a sense of competition, are developed to varying degrees. These skills enable an individual to live better with others, especially in impersonal and hierarchical organizations. Therefore, schooling is an opportunity to acquire all the qualities that are useful for employment.

According to the psychological interpretation, the role of education varies. In most cases, its main role is not to develop new skills or attitudes, but to identify talent, which reduces the cost of acquiring worker productivity information. Among authors that subscribe to this psychological interpretation are Arrow (1973), Spence (1973) and Thurow (1975). The relationship between education and income could reflect an acquired effect of productive knowledge and/or a signal effect of skills, in accordance with Arrow's (1973) filter theory and Spence's (1973) signalling theory. According to these theoretical strands, the main function of school is not to train but to classify and select individuals. In Spence's signalling model, educational investment is as much a selection instrument as it is an instrument for acquiring human capital. Education is just a signal. It is used at the same time by the employer in search of information on workers' skills and productivity (screening) and by workers themselves to signal their productivity (signalling). Employers thus determine the wage distribution depending on education levels. In light of such a distribution, the employee chooses the optimal level of investment which maximizes his/her discounted future earnings. For both Spence (1973) and Arrow (1973), education is not fundamentally productive; nevertheless, at the balance level, wages increase with education.

Within the framework of the job-competition model developed by Thurow (1975), the market adjusts itself through employment, not wages; productivity is therefore linked to the workplace. Under the assumption of competition between candidates for good jobs, the candidates for a job vacancy will form a queue in which the most educated will rank first. In a situation where employment is rationed, people will no longer afford to weigh between the returns to education and the investment made in education before they can accept the job. They will each have to submit a higher degree certificate than that of their competitors. In this case, only the most educated candidate will get the job, while the others will lose out on it because of their lower level of education. In this rationale, the role of education is to serve as an indicator of the ability to take advantage of job training.

Review of empirical studies

There is an abundant literature on the returns to education with reference to various countries, regardless of their level of development (Becker, 1964; Psacharopoulos and Woodhall, 1985; Murphy and Welch, 1992; Schultz, 2000; Acemoglu, 2002; Heckman et al, 2006; Oreopoulos, 2006; Psacharopoulos and Patrinos, 2018). There has been an exponential increase in contribution on this topic, particularly concerning African countries. For example, in a multi-country study, Psacharopoulos (1994) showed that primary education was more profitable both economically and socially than secondary and tertiary education, especially in poor countries. In sub-Saharan Africa, for example, the returns to education for one year of schooling was, on average, 41.3% for primary education, 26.6% for secondary education and 27.8% for higher education.

Table 1: Overview of returns to education

Region	Rate of private returns			Rate of social returns		
	Primary	Secondary	Higher	Primary	Secondary	Higher
OECD	21.7	12.4	12.3	14.4	10.2	8.9
Africa	41.3	26.6	27.8	24.3	18.2	11.2
Overall	29.1	18.1	20.3	18.4	19.1	10.9

Source: Psacharopoulos (1994).

Psacharopoulos' (1994) conclusions are consistent with pioneering work, notably that by Becker (1964), who noted a downward trend in the rates of returns to education as one went higher in educational attainment in the United States. The same results, according to which the private returns to education in sub-Saharan Africa were positive but decreasing, were later confirmed by numerous authors, among them Psacharopoulos and Patrinos (2004). However, there are also studies which report an upward trend in the rates of returns to education as one goes higher in level of education. Schultz (2003), for example, analysed data from six African countries and found that the private returns to education increased with the level of education and

tended to be higher at the secondary and post-secondary school levels than at the primary school level. For its part, and in the case of Nigeria, Aromolaran's (2002) study showed that hourly wage rates increased by about 2.5% and 2.4% for each year of primary education, by about 3.9% and 4.4% for each year of secondary education, and by 10% and 12% for each year of post-secondary education, for men and women, respectively. These findings were corroborated by Okuwa(2004), who found that workers' average wages increased with their level of education.

In the same perspective, other authors have estimated the effect of an additional year of schooling on the wage scale. In the case of South Africa, for example, Mwabu and Schultz (1996) found that the returns to tertiary education for whites increased significantly in the wage scale, from 9% to 18%; while they hardly increased for blacks. In the case of Ethiopia, Girma and Kedir (2005), after controlling for endogeneity by instrumenting the parents' education level variable, found that education was more beneficial for the poor: the returns to education for a year of education in the lowest earnings quantile (1st decile) were twice as high as those in the highest quantile (9th decile). In the case of Uganda, Kavuma et al (2015) analysed the heterogeneous returns to education for both salaried employees and self-employed. Using quantile regression models, they found, among other things, that the returns to education decreased with the quantile for both types of workers.

In the case of Cameroon, Tafah-Edokat (1998) is one of the first researchers to have observed that the average returns to education were positive and higher at the primary school level, then at the secondary level, and, last, at the tertiary level. According to this author, emphasis should be placed on investing in primary education and ensuring that those wishing to pursue higher education bear a higher share of the cost of education. However, this study modelled the average effect on public sector data only. Such a restriction constitutes a significant simplification of the labour market reality. Later, several other authors (see Bigsten et al, 2000; Amin and Awung, 2005; Ewoudou and Vencatachellum, 2006) also attempted to analyse the returns to education in similar contexts. However, these studies suffer from numerous shortcomings (Zamo-Akono and Tsafack Nanfosso, 2013). First, for some of them, there is the issue of the representativeness of samples they used. For example, Bigsten et al (2000) used a sample of workers from 170 firms in the manufacturing sector but were unable to provide information on the returns to education in the case of non-manufacturing sectors, whether these were formal or informal. Second, there is the non-taking into account of characteristics of the labour market structure (homogeneous or heterogeneous)(Bigsten et al, 2000; Amin and Awung, 2005). More recently, Baye (2015) assessed the effect of education on wage quantiles from two combined employment databases (for 2005 and for 2010). Although this study dealt with both the average and heterogeneous effect of education, it does not seem to have resolved issues related to selection and endogeneity of education.

It is clear that most of the research on the returns to education in Cameroon has been limited to formal sector workers, ignoring the informal sector in which returns

are assumed to be very low. However, Nga Ndjoko et al (2011) showed that the private returns to education were positive and high in the formal sector while they were negative in the informal sector. Nguetse Tegoum (2012) reported a positive effect of education on the informal sector employees' incomes: the benefits of completing basic education (enabling one to be awarded a primary school certificate) were estimated at 20% in the informal non-agricultural sector and 28% in the informal agricultural sector. A study by Zamo-Akono and Tsafack Nanfosso (2013) analysed the heterogeneity of returns to education according to segments of the labour market in Cameroon. Even though this study corrected the selection bias, it did not take into account the potential endogeneity problems of certain variables, notably education. Overall, while so many studies have been done, many of them are characterized by weaknesses that are likely to bring the reliability of their results into question.

Compared to the literature reviewed above, the present study innovates in several aspects, notably from a methodological point of view: indeed, it is one of the few studies, if not the first one, to control for a double selection bias in the participation to the labour market. To this effect, it estimates a bivariate probit in order to take into account two potential sources of bias: the choice to be occupied or otherwise and the choice to be wage-employed or not. These choices are not made randomly. For example, wage earnings can only be observed among people who are employed and, in particular, those in salaried employment. The present study also deals with the endogeneity of the choice of employment sector since this variable seems to be one of the channels through which education affects wages. Then, it deals with the potential endogeneity bias of the education variable. While dealing with all these endogeneity problems, the study has generated a specific instrument that is very rarely used in economic literature: the non-self-cluster mean. Instruments of this type unquestionably meet the orthogonality and exclusion conditions of a good instrument.

3. Methodological framework

To ascertain the returns to schooling, we use the quantitative analysis tools. The purpose of this section is to highlight data sources and econometric approach.

Data sources

The data used in the present study come from the national survey on employment and informal sector carried out in 2010 by the National Institute of Statistics.⁴ This survey is a national statistical operation carried out in two phases. The first stage concerns the data collection on working conditions, distribution of wages, employment details and demographic profile of households members while the second provides information on informal units⁵ identified during the first one. The sampling frame used comes from the cartography work done for the third national population and housing census in 2005. This survey was aimed to grasp the activity situations of labour force⁶ in the three main sectors of employment (public, private and informal sectors). Geographically, this national survey provides information on census areas, regions and residence area of individuals.

From a descriptive point of view, the database provides comprehensive information of around 38,599 individuals 50.23% of whom are women and 49.77% men; 41.3% of individuals in database belonged to the working population, 3.08% of whom were unemployed (ILO definition), and 1.32% discouraged workers, while 58% were inactive population. In terms of location area, 57% resided in urban areas and 43% in rural ones. About the allocation into the sectors of employment, 35% of them were employed in the informal sector while 3.11% were in the formal private sector and 3.2% in the public sector. According to age group, 21,490 of individuals were young people (under 35 years old) and 12,820 were adults (35 years and above). Descriptive statistics revealed that 71% of workers were salaried and some were in double employment. The average monthly earnings generated by the main and/or secondary employment amounted to XAF 75,215.

Table 2: Distribution of monthly earnings by quantile

Number of observations	Percentile	Earnings
7,470	10th (D1)	23,022.03
7,470	25th (Q1)	30,000
7,470	50th (Q2)	43,000
7,470	75th (Q3)	99,000
7,470	90th (D9)	154,900
Interquartile ratio (Q3/Q1)	3.301	
Interdecile ratio (D9/D1)	6.72	

Source: authors calculation.

Table 2 shows the percentile points of the monthly earnings distribution. The percentile monthly earning or wage is the monthly earning value which delineates the lowest p% of all the employees concerned, where p can be any integer value from 1 to 99. In the table above, the monthly earning value that delineates the lowest 25% of employees considered as lowest paid employees was XAF 30,000 while the earning value that delineates the upper 10% of employees considered as highest paid workers was XAF 154,900. The median monthly pay for employees was XAF 43,000; thus, 50% of employees earned less than XAF 43,000. The interquartile ratio shows that the 10% highest paid employees earned about 6.7 times the earnings of the 10% lowest paid.

Specification of the econometric model

To assess the private return to schooling, we adopt the methodological framework proposed by Mincer (1974). It is based on a simplified version of an optimal accumulation model of human capital over the life cycle (Ben-Porath, 1967; Becker, 1967). This function enables us to implicitly examine the impact of investment in education on individual productivity, with wages being considered the best indicator of productivity⁷ (Card, 2001; Psacharopoulos and Patrinos, 2004; Girma and Kedir, 2005; Baye, 2015). It is a linear semi-logarithmic function relating the logarithm of earnings to years of education and professional experience (Mincer 1974).

The specification of the structural equation used is the following:

$$lnW = \alpha_0 + \alpha_1 Ed + \alpha_2 Exp + \sum_{k=3}^4 \alpha_k T_k + \sum_{k=5}^m \alpha_k X_k + \varepsilon \tag{1}$$

In this equation, *lnW* represents the logarithm of monthly earnings. In fact, the manner of which income is defined can affect results. For some authors, using labour income is the best way to define it even if education increases productivity in several sectors of employment (Lemelin, 1998). *Ed* represents the number of years

spent in school, Exp the number of years of experience (i.e the difference between age and years of schooling, which begins at age 6) while T_k is a vector of variables containing three employment sectors (public, private and informal). X_k is a vector of explanatory variables other than those above mentioned (age, age-squared and sex). α_k represents the vector of parameters to be estimated; α_0 is the constant, α_1 measures the return to schooling, while ε is the error term representing the unobserved variables.

The estimation of earnings function (Equation 1) by the ordinary least squares (OLS) method most often leads to fallacious results (Gronau, 1979) due to many econometric problems, including sample selection bias and endogeneity bias. For example, wages that are perceived but are lower than reservation wages are not observed; therefore, analysis of earnings is potentially affected by a non-random selection of individuals on the labour market. The dependent variable, namely earnings, can only be measured if an individual effectively participates in the labour market. Thus, the differences between the characteristics of the active and the non-active population can be the source of selection bias resulting from the non-random sample selection in the estimation process (Kavuma et al, 2015).

In order to take into account this double selection bias, the present study will use Heckman's (1979) two-step method, which is the most commonly used in the literature. At step 1, it will use a bivariate probit that will allow us to simultaneously estimate two probabilities related to labour force participation in the labour market. Technically, the use of this model makes it possible to control for this double selection bias. After the estimation, the correction term called the "Inverse Mills ratio" will be computed and then introduced into the earnings model as an additional regressor (Kingdon and Soderbom, 2007; Rankin et al, 2010; Leyaro et al, 2012). Following Tunali (1983) and Yavuzoglu et al (2008), the reduced form equations of participation in the labour market (both in the broad and strict sense) are specified as follows:

$$Y_1^* = \beta_{01} + \sum_{k=1}^m \beta_{1k} Z_k + \mu_1 \quad (2)$$

$$Y_2^* = \beta_{02} + \sum_{k=1}^m \beta_{2k} Z_k + \mu_2 \quad (3)$$

In this equation, Y_1^* and Y_2^* are latent variables which influence the probability of being employed and that of being a salaried employee. These two variables depend on the same characteristics, Z_k , but their influence can differ between these two types of participation (β_{1k} is a priori different from β_{2k}). Z_k represents the vector of

the following explanatory variables: age group, living in an urban area, matrimonial situation being male, national language, education level, being a Muslim, and number of children in the household. The correct identification of this model is ensured by the addition of an instrumental variable, according to Maddala (1983). As instrument, the present study will use a “non-self-cluster proportion”, which represents the number of labour market participants per household excluding the individual’s household in his/her area of residence.

However, since Y_1^* and Y_2^* are latent variables, they cannot be observed. Only the following dichotomous variables can be represented:

$$Y_1 = \begin{cases} 1 & Y_1^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

$$Y_2 = \begin{cases} 1 & Y_2^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (5)$$

where, $Y_1 = 1$ when the individual is active on the labour market and $Y_1 = 0$, otherwise, and $Y_2 = 1$ in the case of salaried workers and $Y_2 = 0$, otherwise.

Assuming that the error terms μ_1 and μ_2 can be correlated, two cases can be distinguished: $\rho_{\mu_1\mu_2} = 0$ and $\rho_{\mu_1\mu_2} \neq 0$, where ρ represents the coefficient of correlation. If μ_1 and μ_2 are correlated, estimating the two probabilities from a bivariate probit will enable us to calculate a correction term which will then be included as an additional explanatory variable in the earnings function in order to control for the endogenous selection of the labour market.

In the earnings function, education (Ed) and employment sector (T) are potentially endogenous. People generally decide to look for jobs in the public, private or informal sector. Choosing from these employment sectors is probably not a random process (Baye, 2015). Ignoring these econometric problems results in biased estimators of Ordinary Least Squares (OLS). The probability of choosing the sector of employment $j = 1, 2$ and 3 (for public, private, and informal, respectively) takes the following form:

$$\Pr(S = j | j = 3; Z) = \Phi \left(\beta_0 + \sum_{h=1}^n \beta_h Z'_h + \sum_{h=n+1}^{n'} \beta_h Z'_h \right) \quad (6)$$

where, S is a multiple employment sector choice indicator and informal sector is considered as the reference modality; Z'_h is the vector of explanatory variables

including n exogenous covariates and $(n' - n)$ instrumental variables which influence choices of employment sectors but do not directly affect wage earnings. Those are sex, living in an urban area, family situation, number of children in the household, job search channel or strategy, type of school attended, level of educational certificate, and age group. To these variables will be added a “non-self-cluster proportion” as an instrumental variable in order to identify the model. This instrument represents the number of employees per household working in three employment sectors excluding the individual’s household in his/her residence area. Interactions between individuals and their near environment create imitative effects on individual behaviours. For example, the fact that an individual sees a member of neighbouring household working in a given sector is likely to motivate his/her behaviour. β_h indicates the vector of parameters to be estimated. The multinomial probit model is used to estimate the probabilities of choosing the employment sector (Equation 6). After estimating, we predict a probit index, probit density function and cumulative probit density function for each outcome. Dividing the probability density functions by the respective cumulative density functions generates corresponding inverse Mills ratios (λ_k). Then, the inverse of Mills ratio for each outcome will be used as additional explanatory variables that render employment sectors in the earnings function exogenous.

In model (1), education variable is potentially endogenous. Indeed, schooling is influenced by skills, social background and quality of education. If all these variables directly affect income (complementarity), then attributing all the differences in earnings to education leads to overestimation of the rate of returns to education (Welland, 1980). Furthermore, schooling is affected by measurement problems when only the number of years of education is considered (Griliches, 1977). Yet, when a variable is incorrectly measured, its effect is usually underestimated. That is why worker’s abilities are captured by the error term which is systematically correlated with both years of education and earnings (Card, 2001). Most of the studies that deal with this problem have used the instrumental variables method (Kerr and Quinn, 2010; Rankin et al, 2010; Leyaro et al, 2012). The equation of the reduced form representing the demand for education can be specified as follows:

$$Ed = \gamma_0 + \sum_{i=1}^k \gamma_i C_i + \sum_{i=k+1}^n \gamma_i C_i + v \quad (7)$$

In Equation 7, Ed represents the years of education, C_i is the vector of explanatory variables including the following k exogenous variables: sex, religion, type of school attended, number of years of father’s education, and reasons for studies abandonment, and $(n-k)$ instrumental variables which directly influence education level without affecting earnings. The “non-self-cluster mean education” is the only instrument in the model. It represents the average level of education for the other

members of households in the individual's residence area. According to "Veblen effect", people tend to imitate the behaviour of others, that is of those in their vicinity (neighbours, friends and other members of society). By using this instrument, we want to show that investment in education by other members of society has a positive ripple effect on individual schooling⁸. After estimating the model (7), the error term will be predicted and introduced as additional explanatory variable into the earnings function. Taking all the previous into account, the function of control can be specified as follows:

$$\ln W = \psi_0 + \psi_1 Ed + \psi_2 Exp + \sum_{k=3}^4 \psi_k T_k + \sum_{k=5}^m \psi_k X_k + \sum_{k=m+1}^{m+3} \psi_k \lambda_k + \varphi \hat{v} + \varepsilon \quad (8)$$

In this equation, $\ln W$ represents the logarithm of monthly wage earnings, Ed the number of years of education, Exp vocational experience, T_k the employment sectors (informal, public and private), and X_k the vector of explanatory variables, namely age, age-squared and sex. ψ_k is the vector of parameters to be estimated, while λ_k is the vector of correction terms from the bivariate probit and multinomial probit models. The coefficients associated with these different correction terms capture the correlation between the error terms in the estimation of selection processes with that of wages. \hat{v} is the estimated residual of reduced form of education equation (Equation 7), while ε is the error term. Estimating this earnings function thus enables us to obtain unbiased estimators.

• The estimation method

Model (8) specified above, is an overall measure of the average returns for an additional year of education. However, returns may be heterogeneous along the income distribution. Such heterogeneity has implications for the role of education in reducing inequality and for the policy implications for investment in education. The present study's aim is to analyse the differentiated effect of education on earnings quantiles. As part of this analysis, the conditional returns for five quantiles corresponding to the 10th, 25th, 50th, 75th, and 90th percentiles will be estimated. The choice of these quantiles is based on a rationale of social categorization of employees. In this connection, 10th and 25th percentiles reflect the conditions of workers considered poor and vulnerable, respectively; i.e the 10% of employees who earn less than XAF 23,000 and the 25% of employees who earn less than the minimum wage (conventionally fixed at XAF 36,270). The 90th percentile represents the highest paid employees. Authors have used the quantile method in a study on United States (Buchinsky, 2001), in those of African countries in general (Mwabu and Schultz, 1996; Girma and Kedir, 2005; Wambugu, 2002), and in that of Cameroon in

particular (Baye, 2015). After estimating, the weight of each variable in the sample will be computed, which will enable us to generalize the estimated coefficients to entire population. This technique makes it possible to obtain unbiased estimates, given the fact that not all individuals in a population have the same probability of being selected into the sample.

4. Presentation of the results

This section presents different results of the estimation process of augmented Mincer earnings function. It highlights determinants of labour market participation, factors determining the probabilities of choosing employment sector and the determinants of education demand, and then presents the evaluation findings of returns to education.

Determinants of labour market participation

From table 3 on results of the selection model estimation, many observations can be made. First, the correlation coefficient between error terms of the two equations was found to be positive (0.2789) and significant: it is statistically different from 0 at the 1% threshold. It confirms the fact that the probability to participate in the labour market is potentially determined simultaneously with the probability of being in a salaried job. This means that people with a higher probability of being both active than the probability explained by their observable characteristics are more likely to hold salaried jobs. It underscores the relevance of using biprobit model to control for selection bias. Table 3 shows the determinants of the probability of being active (Equation I) and of the probability of being in paid employment (Equation II). From an analysis of the observed marginal effects, many observations can be made.

It can be observed that living as a couple or being married significantly increased the probability of participating in the labour market as a salaried worker by 13.1%, compared to being single. One can imagine that family responsibilities within households push spouses to seek paid employment. However, being widowed or divorced decreased this probability by 3.2%. Logically, the residence area affects an individual's status on the labour market: living in an urban area negatively affects both the probability of being active and that in paid employment. Economic theory suggests that people location in urban areas can be a source of spatial concentration of inactive and unemployed workers. Despite job supply, which is relatively high in urban areas, job competition is intense, which means that the probability of a job seeker to find a well-paid job is very low.

Table 3: Results of the biprobit selection model estimation

Dependent variable	Equation I		Equation II		Marginal effects after biprobit	
	Coefficient	z-values	Coefficient	z-values	Marginal effects	z-values
Being married	0.54643***	18.84	0.1164***	3.98	0.13156***	13.61
Being widowed or divorced	0.02568	0.52	-0.1437***	-2.69	-0.03218*	-1.89
Living in an urban area	-0.2172***	-10.53	-0.2203***	-10.21	-0.09781***	-13.40
Being male	-0.2739***	-14.24	0.3085***	15.21	0.02127***	3.15
National language	-0.0346	-0.75	0.1117***	2.24	0.02004	1.27
Primary school level	-0.00712	-0.32	0.1048***	4.49	0.02469***	3.12
Secondary school level 1	0.1053***	3.12	0.01631	0.45	0.02433**	2.06
Secondary school level 2	0.00647	0.16	0.0098	0.25	0.00372	0.29
Higher education	0.02160	0.39	0.19132***	3.22	0.05095**	2.67
Being a Muslim	-0.03392	-1.36	-0.0480*	-1.82	-0.01861**	-2.12
Number of children in the household	-0.0615***	-2.68	-0.3434***	-14.24	-0.98139***	-12.18
Aged between 25 and 35 years	0.2865***	10.38	0.9148***	32.45	0.2691***	30.12
Aged 35 years and above	-0.1447***	-4.61	1.0563***	31.77	0.1885***	17.84
Non-self cluster work	1.3269***	16.59	2.650***	30.34	-1.3685***	-46.90
Constant	-0.7006***	-13.40	-2.650***	-36.10		
/athrho	0.2789***	22.30				
Rho	0.27896					
	Number of observations= 21,546 Wald chi2 (28)= 6,013.85 Prob. > chi2 = 0.0000 (***) , (**), (*): significant at (1%), (5%), (10%), respectively.					

Source: Authors computation via stata software.

The marginal effect of the probability for a male to participate in the labour market as a salaried worker was found to be 2.12% higher than that of a female. It is likely that women integrate the labour market early but suffer forms of discrimination in access to salaried jobs. In addition, people in the 25-35 age group and those who are at least 35 years old were relatively more likely to participate in the labour market. Ceteris paribus, being in these age groups was found to increase their likelihood of participation by 26.9% and 18.8%, respectively. In addition, being a Muslim significantly reduced, by around 1.8%, the likelihood of being employed. This observation is consistent with

that made by Ekamena Ntsama et al (2014), who reported that owing to the influence of ancestral and traditional beliefs in Cameroon, Muslim religion reduced chances of women to participate in the labour market by 9.27%. The education level was found to play a decisive role: compared to the illiterate, primary school education improved the probability of being employed by 2.46%, while (junior) secondary education improved it by 2.43%. The higher education level was a major asset: it increased the probability of participating in the labour market as a salaried worker by 5.09%. In other words, the more educated the individual was, the greater the likelihood of him/her being in salaried employment. Education level thus appears to be a factor in redressing injustices and persistent inequalities on the labour market.

The marginal effect of the number of children in charge of household head was found to be negative on the probability of being in salaried employment: a child in the household reduced this probability by 98%. Explanation for this can be found in feminist labour economics theory which suggests that women from households with heavy household responsibilities (e.g., several young children or many family members in charge) are expected to have very little time left to take part in economic activity. They are instead expected to be in self-employment. On the other hand, the fact that a household member is a salaried employee could also influence occupational choices of those close to him/her. A one-unit increase in the number of employed people in a potential employee's environment was found to significantly decrease his/her probability of participating in the labour market as a salaried employee by around 136%. The presence of a significant number of working people in the individual's residence area was found to be an obstacle to his/her participation in the labour market.

Multinomial probit estimates of determinants of employment sector choices

Table 4 presents the marginal effects from multinomial probit estimates. In this model, the informal sector is considered the reference modality. Overall, the difference observed between coefficients confirms the hypothesis of heterogeneity of different sectors on the labour market. First, results indicate that education level significantly influences the choice of employment sector: the marginal effect is positive. This means that the probability of choosing public or private sector increases with one's education level relative to informal sector choice. This result is an indication of the role played by education in allocation of formal jobs. The return of schooling is more likely in the formal sector than in the informal one. There is, therefore, a need to strengthen the formal sector and to encourage the formalization of informal sector so as to absorb a growing number of graduates in the country.

The number of children living in a household is found to significantly reduce the probability of seeking employment in the private sector: the marginal effect of the number of children on this probability is about -6%. In other words, when there is a new child in the household, the probability of working in the formal private sector decreases by 6%. On the other hand, it positively influences the choice of public

sector relative to informal sector, with a marginal effect of 11.4%. This differentiated effect can be justified by the rigorous management of human resources in the private sector. Because the private sector aims to maximize profit, it is likely to reduce the social security charges related to children to a minimum and, similarly, not likely to tolerate absences and delays at work, which sometimes are due to the fact that the employee had to take care of her children. This is not the case in public sector, where the management of human resources is flexible.

The type of school attended by the job seeker is found to influence the choice of the formal employment sector. Having attended a confessional school increases the probability of working in the private sector by 7.6% and that of working in the public sector by 9.2% relative to informal sector. For its part, having attended a secular private school increased the probability of working in the private sector by 8% and in the public sector by 10.17%. The public sector, by virtue of it being secular in essence, absorbs people from both confessional schools and secular private schools without any discrimination.

Table 4: Determinants of allocations to alternative sectors of employment

Variables	Private sector		Public sector	
	Marginal effects	z-values	Marginal effects	z-values
Living in an urban area	0.02590***	5.33	0.0159*	1.94
Strategy of formal employment	0.0957***	5.30	0.1897**	1.96
Being male	0.04024***	9.05	0.02107***	3.28
Number of children in the household	-0.0626***	-10.01	0.11492***	11.10
Having attended a denominational school	0.07603***	17.1	0.0925***	15.8
Having attended a secular private school	0.0801***	17.4	0.1017***	16.06
Being aged between 25 and 35 years	0.08684***	22.4	0.0931***	22.2
Being aged 35 and above	0.11367***	34.1	0.1127	26.7
Primary school level	0.07430***	24.9	0.0728***	20.6
Secondary school level 1	0.11144***	18.7	0.1302***	16.7
Secondary school level 2	0.16636***	18.6	0.1612***	15.7
Higher education level	0.20155***	13.2	0.2665***	14.5
Non-self-cluster employment	-0.04523***	-6.85	-0.0856***	-2.70
Pr (employment sector == 2)	0.08886			
Pr (employment sector== 3)			0.09210	
	Pr (employment sector== 1)= 0.81902; number of observations = 13,171 Wald chi2 (26) = 3,470.33 Prob. > chi2= 0.0000; reference modality= informal sector; (***), (**), (*): significance of 1%, 5%, and 10%, respectively.			

Source: Authors computation via stata software

Gender is found to significantly influence the choice of formal sector employment relative to informal sector: being male affects the probability of working in the private sector by 4% and in the public sector by 2.1%. Despite institutional laws that guarantee equality for all without discrimination on the basis of gender, gender-based inequality in access to employment still exists in the formal sector. However, beyond this type of discrimination that could be invoked, it may be that women make a deliberate choice not to work in order to have enough time to take care of their young children. In this connection, some previous studies, like that by Njike Njikam et al (2005), have shown that more women than men are in self-employment or are employed in precarious jobs in Cameroon. In terms of age, people over 25 years old were more likely to work in the formal private sector than those below 25 years. This seems logical since vocational experience, which is positively correlated with age, is often required as a condition for getting employed in this sector. It should also be noted that recruitment methods used in this sector are very selective and require qualifications, which young people under 25 years may not yet have. In relation to the public sector, being over 35 years had no significant effect on being employed, while being in the 25-34 age group increases the likelihood of being employed in this sector. In Cameroon, the regulatory system set the age limit for competing in the public service at 32 years. Thus, beyond the age of 35 years old, chances of getting employment in the public sector are nil. The residence area is found to have a differentiated effect on the choice of the employment sector: living in an urban area increases the probability of seeking employment in the private sector by 2.5% and in the public sector by 1.5% relative to informal sector. In urban areas, educated people are more inclined to seek salaried employment.

In addition, strategies used to formally seek employment are found to positively determine job distribution by sector: strategies such as using public employment services, competing for an open position or responding to a call for applications increases chances of working in the formal private sector by 9.5% and in the public sector by 18.9% relative to informal sector. In a country where corruption level is not negligible, this result seems surprising, given the predominance of social capital (informal job-seeking strategy) which characterizes the school-to-work transition of young people in the country. According to the National Institute of Statistics, more than one in two workers on the job market go through private networks to look for a job.

Finally, the variable “non-self-cluster employment” is found to have a significant effect on job distribution by sector. Indeed, when the number of individuals in salaried jobs by cluster increased by one, the probability of being employed in the private sector decreased by 4.5%, and by 8.5% in the public sector relative to informal sector. Moreover, the predicted probability of success if one sought employment was 9.2% in the public sector and 8.8% in the private one.

Determinants of the demand for education

Table 5 presents the determinants of the demand for education. The first observation is that being male is found to make someone go for higher studies than being female: indeed, being male was found to significantly extend the number of years of education, by about 12.2%. This reflects the persistence of gender-based inequality in access to education in the country, which tended to worsen due to geographical disparities in access to schooling. Young people dwelling in urban areas had more years of education than those living in rural areas: the marginal effect of living in an urban area was 65% compared to living in a rural area. That is why heads of households should promote girls' education, while the government should strive to improve the educational environment and quality in rural areas.

Table 5: Results of model estimate of the education demand

Dependent variable: log (years of schooling)		
Explanatory variables	Coefficients	t-values
Constant	0.74060	42.19
Being male	0.122417*	1.70
Being a Muslim	-0.163051	-1.58
Living in an urban area	0.6514214***	8.15
Having attended a denominational school	-0.0901677	-0.87
Having attended a secular private school	0.327977***	3.08
Number of years of education for the father	0.012271*	1.90
Schooling stopped because of failure at school	-2.229619***	-10.98
Schooling stopped because of financial difficulties	-1.864704***	-10.17
Schooling stopped because of pregnancy	-1.732851***	-8.66
Non-self-cluster mean education	0.054924***	4.16
Number of observations= CFAF 10,388 (10.10336) = 144.38 Prob> F = 0.0000 R-squared = 0.5809 (***), (**), (*): significance level at 1%, 5% and 10%, respectively.		

Source: Authors computation via stata software.

Furthermore, father's education influences positively the number of years of his child's education: a one-year increase in the father's education significantly improves the duration of his child's education by 1.2%. As the saying goes, "like father, like son", children's future life is strongly determined by their family and social background. It is difficult for a farmer's son to change social class, because in his primary socialization he will have been taught by his father, throughout his youth, how to be a farmer so that he could inherit his land. In general, a child identifies with the parent of the same sex, observes the parent's behaviour and imitates it, from which he/she will build his/her own personality. School plays a role in this social reproduction. Both economic and sociological literature has reported much evidence of the positive impact of the

parents' education on their child's cognitive development, on the quality of education they receive and on their educational success (Bourdieu and Passeron, 1970). Thus, the learning environment that educated parents can offer to their children has an impact on the latter's education level.

Several reasons can prevent a young person from continuing his/her studies. Failure at school, for example, greatly affects the duration of education by around 222%. The financial difficulties facing households are among the causes of school dropouts among young people. They reduce the duration of education by 186%. Pregnancy has a significant effect on school dropouts as well: being pregnant contributes to reducing the education duration by about 173%. Decision makers should take into consideration all these school-dropout-related factors.

Finally, the variable "non-self-cluster mean education", used as an instrument in the model has a significantly positive effect on education. When the average level of education per cluster increases by one, education duration tends to increase significantly by 5.4%. This result can indeed be attributed to peer pressure (Benabou, 1993) to the extent that the neighbours' behaviour influences a person's own behaviour. This has to do with the fact that education makes individuals adjust to society's dominant values and, in return, the latter cause social transformation through the transmission of new values which tend to spread across the entire society. In this respect, the education level of individual's neighbourhood members is a determining factor in his/her own socialization at school. A comparison with what happens in the prisoner's dilemma game, where all individuals adopt their own behaviour, will help us understand the development of mass education and the extension of education duration in the economy.

Returns to education and determinants of earnings

Table 6 presents results of the determinants of earnings in Cameroon. The first column presents the results of OLS estimates while selection-corrected quantile regressions are presented in columns 2-6. The overall significance of the model was satisfied at the 1% threshold. The R-squared value shows that around 78.54% of earnings were explained by the variables used in the model. The next five columns show the respective rates of returns to education by earnings quantiles. The coefficient associated with the constant can be considered as the quantile of employees representing the reference modality. It was found to be significantly positive, which reflects the fact that employees with this profile do not suffer loss of income on the labour market. In addition, the correlation coefficient between the error terms of the selection and earnings equations was significant and statistically different from zero (1% threshold). This confirms the existence of selection effects and justifies the taking into account of labour market participation selectivity-corrected in the structural wage equation.

Theoretically, age-earnings profiles are concave (Lemelin, 1998): they have an inverted U shape. That is, earnings are not constant but vary with age, increasing first

quickly, and then more slowly, before reaching a peak and eventually decreasing. The present study's results show that, on average and per quantile, earnings, at a given age, increase as a result of human capital accumulation. On average, this rate was 1.2%. In the distribution of earnings by quantile, the effect of age was observed only for middle-income (median) workers. At the top and at the bottom of the earnings distribution, coefficients associated with age were not statistically different from zero. However, earnings profiles were concave. At a given age-squared, earnings followed a downward trend. Theoretically, the increase in earnings in relation to age reaches the maximum when employees are in their forties or their fifties. Table 6 shows that, at a given age-squared, earnings decrease at an average rate of 1.1% and in the earnings distribution by quantile, the median earnings decrease at a rate of 2.6%. Overall, returns to education were more apparent among the less young workers.

According to Mincer (1974), the age-earnings profile is only supposed to reflect the increase in productivity caused by other investments. Thus, capital investment goes far beyond education. Its effect on earnings is assessed by considering years of experience on the labour market. Table 6 shows that work experience significantly influences earnings. Overall, the returns to education from one year of experience on the labour market were approximately 25.1%. In the structure of earnings per quantile, the effect of experience was greater at the median level: at a given level of experience, earnings increase at the rate of 25.8% for workers at the middle-income level. Lower rates were observed in the first quartile and in the third quartile: 19.2% and 9.9%, respectively. The marginal effect of a year of experience was 22.03% in the first decile and 18.7% in the 9th decile. The rates of returns to education from work experience were uneven in the earnings profile by quantile.

The gender gap is an issue that has been abundantly addressed in the literature on economic discrimination. The fact that it has persisted as a topical issue despite the considerable progress made in this area is worrying from the viewpoint of pay equity. Overall, Table 6 shows that men's earnings were, on average, significantly different from women's: men earn on average 9.6% more than women. This result seems evident for various reasons. First, women hardly get involved in multiple jobs on the labour market. Second, previous studies, such as that by Njike Njikam et al (2005), have already pointed to income disparities between men and women in the unprotected segments of the labour market in Cameroon. These disparities are linked to the lack of a real regulatory system able of limiting disparities that do not compensate for discriminatory earnings-related practices in those segments. Ekamena Ntsama (2014) also reported that the estimated average monthly salary for men was higher than that for women, with a difference of 4.9%. In the earnings distribution, differences in earnings were found to be significant for all considered quantiles. The earnings gap rose from 5.9% to 12.2% between first decile and first quartile, and then it went on a downward trend: 8.4% at the median level and 6.7% in the ninth decile. This means that differences in earnings were less significant at the bottom (first decile) and at the top (ninth decile) of the distribution; in other words, among the lowest-paid and the highest-paid workers.

Table 6: Identification of the determinants of earnings

Dependent variable: log (monthly earnings)						
Explanatory variables	Overall	1st decile (10th%ile)	1st quartile (25th%ile)	2nd quartile (50th%ile)	3rd quartile (75th%ile)	9th decile (90th%ile)
Years of education	0.07139***	0.02531	0.06851***	0.04904***	0.07998***	0.09682***
(t-value)	(3.56)	(1.03)	(6.54)	(4.29)	(3.35)	(0.91)
Work experience	0.2518***	0.22035***	0.19227***	0.25838***	0.09972	0.18752
(t-value)	(4.40)	(4.84)	(3.79)	(8.21)	(1.29)	(1.40)
Age	0.01202***	0.01336	0.00438	0.03015***	0.01425	0.00921
(t-value)	(4.20)	(1.12)	(0.57)	(3.17)	(0.67)	(0.33)
Age-squared	-0.01101*	-0.01741	-0.00603	-0.02680***	-0.02135	-0.001584
(t-value)	(-1.70)	(-1.46)	(-0.79)	(-3.21)	(-1.14)	(-1.2)
Male	0.09665***	0.05984***	0.12215***	0.08450***	0.10622	0.067208
(t-value)	(4.07)	(3.09)	(6.37)	(3.78)	(3.04)	(1.38)
Public sector	0.38009***	0.38103***	0.390211***	0.52214***	0.37682***	0.24838***
(t-value)	(6.32)	(4.83)	(4.53)	(5.32)	(3.89)	(3.17)
Formal private sector	0.31364***	0.24617***	0.21767***	0.32636***	0.34925***	0.370108***
(t-value)	(7.59)	(6.79)	(3.56)	(6.70)	(5.11)	(4.17)
Mills selection	0.19863***	0.07590	0.01665**	0.01092**	0.014675*	0.027378
(t-value)	(3.21)	(1.56)	(2.23)	(2.14)	(1.91)	(1.58)
Mills public sector	-0.15949***	-0.6526**	-0.4835**	-0.21459***	-0.27398***	-0.32027***
(t-value)	(-4.37)	(-2.33)	(-2.21)	(-5.82)	(-7.47)	(-5.22)
Mills private sector	-0.11911***	-0.12084***	-0.14457***	-0.13438***	-0.12346***	-0.10289***
(t-value)	(-6.50)	(-5.16)	(-9.80)	(-8.03)	(-6.01)	(-5.89)
Predicted residual (t-value)	-0.04247***	-0.01843	-0.03762***	-0.04076***	0.02939*	-0.6397***
	(-4.89)	(-1.33)	(-4.28)	(-5.51)	(1.62)	(-3.79)
Education*residual	-0.07313	-0.04232**	-0.07058***	-0.06657***	-0.06939***	-0.08983***
(t-value)	(-8.97)	(-2.31)	(-8.60)	(-8.15)	(-4.92)	(-5.14)
Constant	5.4151	4.2476***	4.5362***	6.07708	6.3031***	7.42071***
(t-value)	(10.69)	(5.68)	(6.91)	(14.02)	(12.62)	(11.00)

Source: Computed by authors using the Stata software.

Table 6 also reveals that sectors of employment influence earnings profiles. Overall, returns to education from the formal sector (private and public) are significantly higher than those from the informal sector. Being employed in the public sector increases earnings by 38.0% while being employed in the formal private sector increases them by 31.36%. In the earnings distribution by quantile, earnings profile in the public sector had an inverted-U shape: the rate of returns to education first increased from 38.1% in the first decile to 52.2% at the median (maximum) level, and then gradually decreases from 37.6% in the third quartile to 24.8% in the ninth decile. Thus, in the public sector, middle-level workers benefited more in terms of earnings. In the private sector, rates of returns to schooling gradually increase from bottom (1st decile) to

top (9th decile) of earnings distribution, from 24.6% to 37.01%, respectively. At the median level, the rate is 32.6%. The highest-paid workers, that is, those at the top of earnings distribution, enjoyed the highest returns. However, this result differs from that obtained by Baye (2015), who reported that rates of returns decrease from the bottom to the top of earnings distribution. Overall, these results confirm one of the psychological approach theses, according to which returns to education in relation to earnings should be greater in non-competitive sectors, such as the public sector.

Overall, the correlation between education and earnings is found to be positive for both estimates done using the overall model and earnings quantiles. The average rate of returns for an additional year of education was 7.1%, a finding consistent with that made by Belzil and Hansen (2002). These authors reported that the average returns to education varied between 5% and 15% depending on countries and the used methodology. But the average of these two rates is slightly higher than the rate of 5.6% reported by Baye (2015), but it is lower than the 8.8% reported by Zamo-Akono and Tsafack Nanfosso (2013). However, homogeneity rules out the assumption of differentiation in the rate of the private returns to education. In other words, the average rate of returns to education masks disparities between social categories, namely low-income earners (poor workers), middle-income earners, and high-income earners (rich workers).

Table 6 reports the differentiated returns to education in the earnings distribution. The rate of returns to education increases from the bottom up; it is 6.8% in the first quartile (25thile): in other words, this is the rate of returns to education for an additional year of education among the 25% employees earning less than XAF 30,000. The return for an additional year of education among middle-income workers, that is those earning XAF 43,000, is 4.9%, while that for the third quartile (75thile), that is the 25% of those earning above XAF 99,000, is 7.9%. Consequently, between the first quartile (25thile) and the third quartile (75thile), the rate of returns to education increases, from 6.8% to 7.9%, respectively. And between the first quartile (25thile) and the ninth decile (90thile), the rate also rises, from 6.8% to 9.6%, respectively. These reported differentiated effects are consistent with those found by Baye (2015). They stress the fact that returns to education tend to increase as one goes up on the wage scale. Furthermore, they are consistent with studies carried out in other contexts, notably by Lemieux (2006), Boudarbat and Pray (2011), which observed that the income inequality seemed to narrow at the bottom of wage distribution and to widen significantly at the top of distribution. However, education does not seem to be profitable for employees at the bottom (1st decile) of earnings distribution: it is not found to be significantly profitable for the 10% employees earning less than XAF 23,000.

Furthermore, the significance of the predicted residuals of education confirms the endogenous nature of education variable in the earnings equation: ability and other skills that are not observed, although strongly correlated with education, generate unobserved heterogeneity, which significantly and negatively influence earnings. This is revealed by both overall and quantile analysis. Therefore, controlling for the endogeneity bias of education is pertinent. To assess the effect of individual

unobserved heterogeneity on returns to education, the present study used, in its model, a variable that captured the interaction between education and predicted residuals was introduced in the structural wage equation. Overall, this individual unobserved heterogeneity reduces returns to education by about 7.3%. It exerts a greater effect on returns to education between the first and the ninth decile: this effect goes from -4.2% to -8.9%. At the median level, the presence of unobserved heterogeneity significantly reduces returns to education by 6.65%. The following section presents results of the homogeneity test of returns to education.

Results of the test of homogeneity in returns to education

Table 7 presents the results of the equal test of slopes done using the Wald test. The null hypothesis is equality of coefficients associated to education variable for different earnings quantiles. The quantile regression estimators are not the same as those obtained by the OLS; they have robustness properties which make them more appropriate. According to Variyam et al (2002), quantile estimates can capture the slope coefficients at different points in the distribution. This feature is particularly useful if the underlying data has heteroscedasticity. To examine this characteristic, the present study tested the hypothesis of equality of slope coefficients derived from various conditional quantiles.

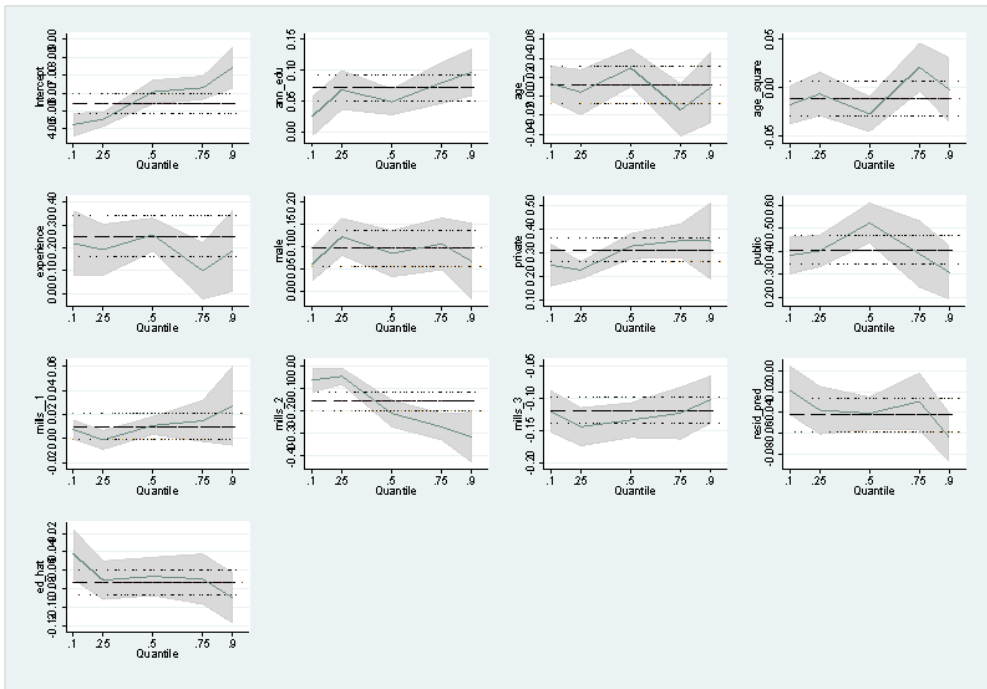
Table 7: Results of heterogeneity test in slope coefficients

Null hypothesis	Test statistic	Decision
(1) [q10] edu - [q25] edu = 0 (2) [q10] edu - [q50] edu = 0 (3) [q10] edu - [q75] edu = 0 (4) [q10] edu - [q90] edu = 0	F(4, 1825) = 6.49 Prob > F = 0.0000	Reject the null hypothesis of equality in slope coefficients
(1) [q25] edu - [q50] edu = 0 (2) [q25] edu - [q75] edu = 0 (3) [q25] edu - [q90] edu = 0	F(3, 1825) = 8.64 Prob > F = 0.0000	Reject the null hypothesis of equality in slope coefficients
(1) [q50] edu - [q75] edu = 0 (2) [q50] edu - [q90] edu = 0	F(2, 1825) = 12.91 Prob > F = 0.0000	Reject the null hypothesis of equality in slope coefficients

Source: Computed by the authors using the Stata software.

Table 7 presents the Wald test statistics of null hypothesis that coefficients associated to education in the quantile estimates are equal. The value of F leads to the rejection of this null hypothesis at the 1% level of significance (*Prob. > F = 0.000*). This test therefore confirms the hypothesis of heterogeneity in the returns to education. Figure 1 shows for each variable, in diagram form, the comparative effect of quantile estimates with the OLS estimator along a confidence interval.

Figure 1: Comparative effect of estimations of returns to education



Source: Authors, using Stata software.

In Figure 1, the horizontal lines represent the OLS coefficients; these are constant on the X-axis. Confidence intervals appear as dotted lines in each graph. Quantile coefficients are compared with the OLS coefficients observed for the mean. It is enough to compare the position of the curve corresponding to the quantile estimation with that of the OLS to have an idea of their heterogeneous nature. For example, coefficients associated with the education variable are much lower than the OLS coefficients from the first decile to the median level (second quartile). From the third quartile, coefficients of the quantile estimates are higher than the OLS ones. It is thus clear that the highest-paid workers (the rich) are those who benefit most from education.

5. Conclusion and policy implications

The aim of this study was to analyse the heterogeneity of the returns to education in Cameroon. To achieve it, an approach consisting in estimating both the average rate and the quantile rate of returns to additional year of education is used. Specifically, the ordinary least squares estimator. Usually, this technique is riddled with many econometric problems, in particular the potential endogeneity of the education variable in the wage equation and the possible selection bias attributable, not only to participation in the labour market, but also to the endogenous choice of the employment sector. To control for such limitations, the study estimated an earnings model augmented with selectivity and endogeneity-corrected terms. In particular, the quantile-regression-model estimates are associated with robustness properties which make the obtained results very pertinent. The unobserved heterogeneity effect on returns to education was also measured and a post-estimation Wald test was done to confirm the heterogeneous nature of returns to education in Cameroon.

Overall, the study found that there was a positive correlation between years of education and monthly earnings. The average rate of returns to an additional year of education was 7.1%. However, this result masks disparities in returns to education across social categories: low-income earners (poor workers), middle-income earners and high-income earners (rich workers). Quantile analysis revealed differentiated effects of education in the earnings distribution. The rate of returns to education was found to increase from the bottom to the top. It was found to be 6.8% in the first quartile (25thile). Likewise, the rate of returns to an additional year of education for the middle-income workers, that is those with median earnings, was 4.9%. It was 7.9% in the third quartile (75thile). Clearly, between the first quartile (25thile) and the third (75thile), the rate increased, from 6.8% to 7.9%. And between the first quartile (25thile) and the ninth decile (90thile), the rate of returns also rose, from 6.8% to 9.6%. However, education was not found to be profitable for employees at the bottom (1st decile) of the earnings distribution. The highest-paid workers benefited most from their investment in education. Further, the individual unobserved heterogeneity significantly reduced returns to schooling.

In terms of policy implications, the results from the quantile analysis are quite relevant. With the returns to education being positive, families can make an efficient investment in the human capital of their children to maximize their wealth. It follows, therefore, that there is still a need to focus public investment on the poor.

To reduce household poverty, it is necessary to reduce inequality in access to education. On average, the poorest households educate their children only up to the primary school level, while the wealthiest families can afford to do so up to higher education. Developing educational policies and setting up incentives should enable low-income families to invest in the education of their children even at higher levels. As part of the policies aimed at promoting education and, therefore, improving earnings on the labour market, greater emphasis should be placed on both measures for combating gender inequalities in terms of education duration and those for combating geographical disparities (urban vs rural) in access to education. In other words, decision makers should strive to improve the educational environment and education in rural areas and, above all, to encourage girls' education. In addition, they should prioritize the fight against poverty with a view to improving household living conditions, given the fact that the learning environment that educated parents can offer to their children affects the latter's educational level. Finally, education helps individuals to adjust to the dominant values of society. In return, these lead to social transformation through the transmission of new societal values.

The second implication concerns the labour market functioning. Education is not valued among the lowest-paid workers, most of whom will be found in the informal employment sector, where the level of education is not valued, and where returns to education are lower than in the private sector and the public sector. Improving the profitability of education in the labour market requires the formalization of the informal sector, which is predominant in Cameroon's economy (around 91%).

Notes

1. See Wang (2013).
2. Source: UNESCO Institute for Statistics.
3. Njifen's (2018) study reports that, in the higher education sector, the number of students had risen from 213 in 1962 to 244,233 in 2011. This dramatic increase in numbers led to university graduation of 21,737 students in 2005, 32,025 in 2008, and 53,138 in 2011.
4. National Institute of Statistics is the structure mandated to build up statistical database in Cameroon.
5. The concept of informal sector adopted here for this survey is that used for the 1993 national accounting system (which is a set of international standards aimed at establishing a framework for the production of statistics for national accounts). The distinction between activity sectors depends on the nature of the firm, according to criteria related to issues of administrative registration and formal accounting procedures.
6. According to international recommendations, the working-age population is all individuals aged 15 and above.
7. Assuming that salaried employees are remunerated to their marginal productivity and that this increases with the level of education, the theory of human capital (Mincer, 1974; Becker, 1975) offers a methodology that enables us to measure the increase in individual incomes gained from a year of additional schooling.
8. Several types of instruments have been used in the literature: the trimester of birth (in Angrist and Krueger, 2001), early tobacco consumption (Evans and Montgomery, 1994), the parents' income or education level (Usitalo, 1999; Harmon and Walker, 2000; Girma and Kedir, 2005), the school reform affecting the school-leaving age (Dickson, 2009), and the development of compulsory education (Brunello et al, 2013).

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