

***WAGE RETURNS TO EDUCATION BY GENDER: A COMPARATIVE
ANALYSIS BY EDUCATIONAL LEVEL IN SENEGAL***

**RENDEMENT SALARIAL DE L'ÉDUCATION SELON LE GENRE :
UNE ANALYSE COMPARATIVE PAR NIVEAU D'ÉDUCATION
AU SÉNÉGAL**

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Abstract

The purpose of this paper is to assess the return to education of different levels by gender in Senegal. In order to correct the potential existence of selection bias, Heckman's two-step approach will be used. Data from the 2015 ENES are used for econometric estimation. The first stage of Heckman shows that education levels play a key role in gender-specific labour market participation. For the second stage of Heckman, the results show that the return of education is higher at the higher level. This paper shows that when selection bias is corrected, the return of the higher level exceeds 20% for both men and women. The policy recommendation from this paper are the need to keep girls up to the university level and initiatives to fight against stereotypes about people with disabilities.

Key words: Return to education, Gender, Heckman approach

JEL Classification: I24, I26, J16, J24

Résumé

L'objectif de ce papier est d'évaluer le rendement de l'éducation de différents niveaux selon le genre au Sénégal. Afin de corriger l'existence potentielle de biais de sélection, l'approche en deux étapes de Heckman sera utilisée. Les données de l'ENES 2015 sont utilisées pour l'estimation économétrique.

La première étape d'Heckman montre que les niveaux d'éducation jouent un rôle clé dans la participation au marché du travail en fonction du sexe. Pour la deuxième étape de Heckman, les résultats montrent que le rendement de l'éducation est plus élevé au niveau supérieur. Cet article montre que lorsque le biais de sélection est corrigé, le rendement du niveau supérieur dépasse 20% pour les hommes et les femmes. Les recommandations politiques de cet article sont la nécessité de maintenir les filles jusqu'au niveau universitaire et les initiatives pour lutter contre les stéréotypes sur les personnes handicapées.

Mots clés : Retour de l'éducation, Genre, Approche Heckman

1. Introduction

In developing countries, education is seen as the key to accessing better jobs in the labour market and increasing incomes. However, in sub-Saharan Africa, the rise in unemployment is characterised by the relatively large share of educated people (Kuépié et al, 2013). This refers to the existence of a gap between education level, insertion opportunities and wage level.

More than elsewhere in Africa, the situation described above is particularly acute in the context of Senegal, where the importance of education is demonstrated by the significant share it occupies in the state budget and household expenditure. Education is 70% financed by the state, followed by households (15.55%) and in financial terms, almost 22.7% of the overall budget of the Senegalese state (ANSD, 2016). Thus, education is an investment for the individual himself, but also for the community (Psacharopoulos and Patrinos, 2018). At the individual level, the private return to education corresponds to the additional earnings that the individual expects as a result of additional years of study (Diagne and Diène, 2011).

In the literature, education as human capital is considered an important investment in that it enhances opportunities for insertion, increases the productivity of individuals and thus their wage levels (Kane, 2014; Kuépié et al, 2013). However, in the Senegalese labour market, the relationship between education levels, labour market participation and wage levels is of great concern by gender. Unlike sex, which is related to biological differences, gender describes the socially constructed differences on which individuals' roles in society are based (Reskin and Bielby, 2005).

Education seems to play a rather mixed role when analysing the gender characteristics of labour market participants and the unemployment situation. Out of 10 employed persons, all 6 had to attend school. However, it is found that 38% of the employed have never attended school, with women being

more represented than men (45.1% versus 35.3%) (RGPHAE, 2013). These findings on the profile of the employed give a relative indication of the low quality of the employed labour force and a possible preponderance of informal activities and therefore precarious jobs. An analysis focusing on levels of education shows that unemployment is more prevalent among those with primary and middle school education, 35.5% and 24.4% respectively. However, almost 16.3% of unemployed people have a higher level of education (ENES, 2015).

Human capital theory considers that women's lower earnings are due, in large part, to the difficulty of combining high human capital investment with specialisation in housework. According to Becker (1985), responsibility for childcare and household tasks prevents women's wage income from increasing more rapidly. In Senegal, the median wage increases with the level of education. Either earnings are low for lower levels and increase as the level of completed education increases. Workers with no formal education earn on average 153 FCFA per hour, while university graduates earn 866 FCFA per hour (Tidjens et al., 2012). However, there are gender-based wage disparities. Indeed, men earn more than women, 711 CFA francs per hour compared to 643 CFA francs (Tidjens et al., 2012).

In view of the above, the objective of this paper is to assess the wage performance of different levels of education by gender. In order to correct for the potential existence of selection bias, Heckman's two-stage approach will be used.

The rest of this paper is structured in different sections. Section 2 presents the literature review on private returns to education by gender. Section 3 provides the methodology adopted for the analysis by educational cycle. Section 4 presents the econometric estimation results and section 5 concludes the paper.

2. Private returns to education, an empirical review of the literature

The rate of return is one of the statistics that accounts for the net benefit, if any, of an investment. It is the rate of interest that equates the present value of the costs and benefits of an investment. In educational economics, the wage return to education is the additional earnings from an additional year (or cycle) of study. This is measured by the private rate of return. Studies that have compared the levels of private returns to education across several countries show that rates of return to investment in educational human capital are higher in developing countries (Psacharopoulos and Patrinos, 2018).

In the context of Senegal, Diagne et al (2003) measures the profitability of household investment in education or private return by applying the internal rate of return method to the 1995 ESAM data. With an average rate of return of 24.5% above the benchmark rate of return of 10%, the study shows

that education is a profitable investment. Indeed, based on the hypothesis that differences in individuals' income are attributable to their level of education, the analyses of the external return to education by Diagne et al (2003) are carried out in relation to the situation of school leavers on the labour market. In this framework, the levels of education and the wages offered are considered as relatively correct indicators of the capacity of the education system to adapt to the requirements of the labour market.

For Diagne et al (2003), education is a profitable investment for individuals at each level of education compared to the lower level of education. Thus, the private rate of return is higher in primary education (46%) and lower in secondary education (11%) just below the tertiary level (13%). Thus, with the exception of the higher level compared to secondary, the profitability of education decreases with education levels as suggested by the global developing country analyses of Psacharopoulos and Patrinos (2018). This result of private returns to higher education at other levels of education can be explained in part by an increase in the costs of education across education levels.

The study by Diagne et al (2003) is special in that it takes into account the sensitivity of the private return on investment in education following one year of repetition per education cycle. Overall, extending the duration of individuals' studies by an average of one year can reduce the private return by 15 points for primary education, 12 points for middle education, 4 points for secondary education and 10 points for tertiary education. However, this study does not provide the private return to education by gender.

In response to the findings of low school enrolment at the national level, Kazianga (2004) examines the private returns to education in Burkina Faso. Estimates of the wage equations using the Mincer approach show that returns differ between men and women and between the private and public sectors. The study corrects for selectivity biases related to participation in a wage employment sector using the two-stage approach of Heckman (1979). In this study, education is treated as a decision to invest in human capital, hence the analysis of this private investment using the internal rate of return. Thus, without taking into account the choice between the private and public sectors, the private returns to education in Burkina Faso are 9% for both men and women at the primary level; 16% for women and 14.3% for men at the secondary level and finally 18.1% and 23.4% respectively for the higher level. The analyses show that the rates of return increase with the level of education. The study by Kazianga (2004) sheds light on the strong influence of the sample selection bias on the estimation of returns to education. Indeed, the failure to take into account both the selection for participation in the wage employment sector and the choice of employment sector could bias the estimates.

Several initial analyses using the Mincer equation establish that the relationship between education and wage gains is concave, i.e. returns tend to decrease with increasing education levels. In this framework, the lowest levels of education have the largest comparative returns to higher levels (Psacharopoulos and Patrinos, 2018).

However, in the literature, analyses show that the returns to primary education may be lower than those to post-primary education. This indicates a possible convex profile of the relationship between education and income in the labour market. Such results are contrary to the basic model of human capital accumulation, in which the marginal return to education is assumed to be at best constant or even decreasing.

Kavuma et al (2015) analyse differences in the marginal private returns to education for 'wage' and 'own account' workers in Uganda, using Mincerian structuring with pooled data regression models. They find similar marginal private returns to an additional year of study between wage earners and own-account workers. Indeed, an additional year of education is associated, in both types of employment, with a 16% wage improvement. In other words, education leads to an increase in income for workers. This indicates a similarity in worker productivity in the two sectors and supports human capital theory more than signal theory. Indeed, the effects of education for own-account workers can only be related to the effects of human capital on productivity, since there is no possibility of information asymmetry in the case of self-employment.

Despite the similarity in returns to education for both employment sectors, Kavuma et al (2015) show that women's earnings supplements are lower than men's in both employment sectors. However, they find that marginal returns between two successive education levels are convex for employed workers. Furthermore, Kavuma et al (2015) find low returns to primary education and this is more problematic for own-account workers. This undermines the impact of primary education on individuals' productivity and employability, resulting in lower levels of earnings. In contrast, secondary education provides high returns to self-employment and higher education provides high returns to wage employment. A fundamental result of the analysis by Kavuma et al (2015) is that the marginal private returns to education decline as an inverse function of quantile levels of the wage distribution. This suggests that individuals in the lower levels of the wage distribution have the highest levels of marginal private returns to education.

Kuépié and Nordman (2006), in their analysis of the links between educational performance, labour market integration and the private economic return to education, measure the effect of educational capital through a linear function. This model allows the marginal return to education to vary from one

cycle to another. Econometric analyses of data collected from 3,000 Congolese households show that the returns to education are convex. This translates into the fact that the last years of high school and higher education are more profitable, whereas the primary level presents the lowest returns. This convexity extends to the informal sector where education is also an important determinant of earnings. These convex marginal returns reveal that education has an increasing impact on earnings. Indeed, from a theoretical point of view, the convexity of the earnings function implies that the cost of education tends to rise faster than the marginal return or that a very large number would obtain the maximum level of education.

Sackey (2008) examines the private returns to education in Ghana over the period 1992 to 1999. Applying the ordinary least squares method on household living standards survey data, they find that the private returns to tertiary education increase more significantly for both men and women in the labour market. For the female labour force, between 1992 and 1999, the return to further study at secondary level increased from 7.3% to 12.3% respectively. While in higher education, the return to an additional year of study increased from 11.4% to 18.4%. For the male labour force, the return to an additional year of secondary education decreased from 7% to 6%, while the return to an additional year of higher education improved from 13% to 19% between these two dates. The author also shows that, on average, the increases in rates of return to tertiary education coincide with periods of similar trends in school attendance for children of both sexes.

Montenegro and Patrinos (2014) examined data from 139 countries with a total of 819 household surveys over the period 1980 to 2013 to estimate the private returns to education and potential experience. The analyses show that SSA has the highest private rate of return of 12.4% significantly above the world average of 9.7%. Furthermore, their results show that returns to education are higher for women than for men. This conclusion holds true not only when considering the returns to an additional year of study, but also for the three levels of education examined. Their analyses show that higher education gives the highest returns and secondary education the lowest. Overall, the rate of return to an additional year of study is 10%. However, when considering men separately the return to an additional year of study is 9.6%, while for women alone it is 11.7%.

The estimation of the wage return to human capital factors may suffer from sample selectivity bias. Since only the income of those who are employed is observed, then the unemployed and the non-employed are not included in the estimates. In other words, the results only reflect the rate of return to education of one segment of the population, the employed. Heckman (1979) developed a two-stage statistical method to correct for this non-random sample selection bias often used in the estimation of

returns to education. The objective of this method is to use all available information to provide an efficient evaluation of the parameters of the regression (Heckman, 1979).

3. Methodology

3.1. Basic model

A separate specification of the Mincer wage equations for men and women. Recall that this Mincer equation represents the relationship between income gains and investments in human capital.

Thus, consider the following wage equations for men (h) and women (f) who work:

$$W_h = \beta_h X_h + \varepsilon_h \quad (1)$$

$$W_f = \beta_f X_f + \varepsilon_f \quad (2)$$

With W representing the wage vector set in logarithmic form, which refers to the fact that we measure the effect on the wage of a change in the variables of the vector of worker characteristics X (including education, work experience, marital status, etc.), β is the vector of coefficients and ε is the error term.

The selection bias problem occurs when the labour market participation decision is correlated with the wage or some other explanatory factors. In his study, Heckman (1979) shows that this sample selection problem could be understood as a specification error where a variable is omitted when constructing the wage equation. Heckman's procedure requires estimating in a first step a logistic regression to find out whether a person participates in the labour market explained by a vector of individual-specific characteristics and to calculate on this basis the "Mill ratio" for each individual.

Thus, the first step in Heckman's approach is to determine the probability of a person participating in labour market activities. Being active or not in the labour market is expressed as:

$$y_g = \alpha_g Z_g + \varepsilon_g \begin{cases} = 1 & \text{Actif} \\ = 0 & \text{sinon} \end{cases} \quad (1)$$

With Z the factors of individual and family characteristics of individuals i in group g = (male, female), the probability of participating in the labour market is written as follows:

$$\Pr(y_h > 0) = \Pr(\varepsilon_h > -\alpha_h Z_{ih}) = \Phi(\alpha_h Z_{ih}) \quad (2)$$

The inverse of the "Mill's ratio" is provided by:

$$\lambda_i = \frac{\phi(Z_i)}{1 - \Phi(Z_i)} \quad (3)$$

With $\phi(\cdot)$ is the normal density function; $\Phi(\cdot)$ is the normal distribution function. It is this inverse of the Mills ratio (λ_i) that is added as an estimator to the income equation and subsequently the parameters can be estimated by ordinary least squares.

For the second step of the Heckman procedure, starting from equations (1) and (2), the inverse of the Mills ratio is introduced. Thus, the Mincer gain equations with selection bias correction are expressed as follows:

$$W_h = \beta_h X_h + \rho_h \lambda_m + \varepsilon_m \quad (4)$$

$$W_f = \beta_f X_f + \rho_f \lambda_f + \varepsilon_f \quad (5)$$

With β the wage return of the associated X factors, λ the inverse of the Mill ratio and ρ the associated coefficients that allow to assess whether or not the selection effect exists.

3.2. Empirical estimation

Our empirical specification is in line with Mincer's (1974) income function analyses which are based on human capital theories. A semi-log wage equation approach is used and specified as follows:

$$\begin{aligned} Lsalaire_g = & cte + \beta_{1g} Urban_g + \beta_{2g} Head_hh_g + \beta_{3g} Married_g + \beta_{5g} Age_g + \beta_{6g} Agesq_g \\ & + \beta_{4g} Education_g + \beta_{7g} Training_g + \beta_{8g} Disability_g + \beta_{9g} Union_g \\ & + \beta_{11g} Contract_g + \beta_{11g} Selectivity_g + \varepsilon_g \end{aligned}$$

With g the two groups concerned (male or female), the $\beta_{i(=1...9)}$ being the coefficients associated with the variables determining the wages of individuals. Estimates will be made separately for men and women for the determination of the wage return to human capital factors.

In this paper, the returns to education are calculated using the following method:

$$\begin{aligned} r_{Primary/no_Education} &= \frac{\beta_{primary}}{S_{primary}} * 100 \\ r_{Secondary1/Primary} &= \frac{(\beta_{Secondary1} - \beta_{primary})}{(S_{Secondary1} - S_{primary})} * 100 \\ r_{Secondary2/Secondary1} &= \frac{(\beta_{Secondary2} - \beta_{Secondary1})}{(S_{Secondary2} - S_{Secondary1})} * 100 \\ r_{Higher/Secondary2} &= \frac{(\beta_{Higher} - \beta_{Secondary2})}{(S_{Higher} - S_{Secondary2})} * 100 \end{aligned}$$

Where $r_{i/j}$ the wage return of cycle i compared to cycle j and S is the expected cumulative duration of the education cycle.

In the context of this study: $S_{Primary} = 6$; $S_{Secondary1} = 10$; $S_{Secondary2} = 13$; $S_{Higher} = 16^1$.

3.3. Data

The database used for econometric estimation purposes is the 2015 Senegal National Employment Survey (ENES). This survey is conducted nationwide and is limited to individuals aged 10 years and over. Among other things, this survey aimed to assess the effectiveness of policies put in place to combat unemployment, but also those related to improving the living conditions of workers. The implementation of this survey was based on a sample of 6000 households. In order to cover the whole

¹ The choice is made for the Bachelor's degree (Bac+3) which is the first higher education degree in the LMD system in Senegal

country, the sample was drawn from 426 census districts, 282 of which were in urban areas and 144 in rural areas. Our sample includes individuals aged between 15 and 60 years (in completed years).

The logarithmic form of the monthly wage (Lwage) will be used as the dependent variable. For the purpose of the analyses, explanatory variables related to the social characteristics of individuals and those that may be related to human capital factors were retained. It should be noted that a variable linked to selectivity corresponding to the inverse of the Mills ratio will be generated from the labour market participation equation and integrated as an explanatory variable in the gender wage equations. This consideration of the possibility of selection bias for both men and women will allow us to judge the importance of the decision to participate in the labour market on wage levels.

4. Results and Discussion

In the context of the analysis of the probability of participating in the labour market, the logit estimation is associated with the determination of the marginal effects for each of the explanatory variables retained. The estimator used is the maximum likelihood. This step is also the first step of the Heckman approach to take into account the selection bias in the wage equation.

In the context of the analyses of the factors that determine the level of wages, we have incorporated the potential role of the selection bias. The incorporation of this bias from the participation equation as an explanatory variable in the wage equation is the second step of the Heckman model.

The results show that education plays an important role in determining the wage level. For example, the rate of return to primary education is 5.18% for men and 6.68% for women. For this level of education, this corresponds to the additional wage gain for those with primary education compared to those without. The rate of return to the middle cycle is 7.52% for men and 6.78% for women. This corresponds to the wage increment for those who reached the junior cycle compared to those who stopped at the primary cycle.

For the secondary level, the wage return is 10.23% for men against 7.9% for women. This refers to the wage gain expectation for individuals with secondary education compared to those with middle school education.

It is worth noting that the wage return to education is highest for both men and women at the higher level. In fact, the wage supplement when they have the higher level is 35.43% and for women it is 29.63%. In other words, the higher the level of education, the higher the salary, which proves the increasing return to education. This result reflects the usefulness of investments in educational human capital in determining the levels of wages in the labour market. In fact, in formal jobs this requires a

certain level of skill and education can be used as a measure of individual productivity. Thus, even though uneducated people are also present in the labour market as employed persons, educated people earn more wages that reward their higher productivity. This wage return corresponds to the private return associated with the investment in education since the contribution of the individual's education to his or her society or externality effect (social return) is not taken into account.

Tableau 1 : Wage returns to education by gender in Senegal

Niveau	Men	Women
Primary/No_education	5.18%	6.68%
Secondary1/Primary	7.52%	6.78%
Secondaire2/secondary1	10.23%	7.9%
Higher/Secondary2	35.43%	29.63%

Source : Author (details of coefficients in appendice)

Living in an urban area increases men's wages by 51% and women's wages by almost 61%. In other words, both men and women benefit quite considerably from working in urban areas. In relation to the status of head of household, this increases women's wages by 11%, while for men the increase in wages linked to this status is around 19%. When we look at the situation of married people, men have a 34% increase in salary, while women have an 8% increase in salary.

As for age, used as a proxy for potential experience, we find that wages for both men and women increase with age, but there should be a slight decrease in its role on wages after a certain level. Indeed, experience provides a 4% increase in salary for men and 3.9% for women. When we take its quadratic form to assess its evolution or the marginal contribution of a year of experience, we note that there is almost no decrease, of 0.03%. For vocational training, it provides a wage increase of almost 11% for men and almost 13% for women. The results show that people with disabilities earn less than those without disabilities. In fact, having a physical disability reduces the salary level for men by 8.4% and by almost 37% for women.

Being a union member increases wages in the labour market. In fact, membership of a workers' union provides a 4% increase for men and 3.4% for women. Workers who belong to trade unions, for the most part, work in sectors where wages are better regulated and this may give them some advantage. When we look at job stability, we find that individuals with an open-ended contract earn significantly

more than workers without such a contract. Indeed, for men, those with an open-ended contract earn 71% more than those without, and for women, having an open-ended contract should provide a 76% wage gain.

The second part of Heckman's approach reveals that corrections to the selectivity of the sample are necessary. Indeed, the selectivity or inverse of the Mills ratio is significantly different from zero. The negative effect indicates that unobservable factors, captured by the error terms, which affect labour market participation are associated with lower wage gains for both men and women.

5. Conclusion

Differences in the labour market have long been a focus of economic analysis. In particular, gender mainstreaming in the labour market also remains a current issue. The objective of this paper was to assess the gender-specific wage returns to education in Senegal.

Using data from ENES (2015), estimates from the dichotomous model, Heckman's first step, allowed for selection bias correction in the wage equation for the determination of the wage return to productive characteristics (Heckman's second step). In relation to the wage return, the results showed the earnings premium for men and women for the different levels of education. The results show that the returns to primary education are higher for women while the levels of returns to middle school are quite similar. On the other hand, wage returns at the secondary and tertiary levels are in favour of men with a difference of 2 and 5 percentage points respectively.

In view of the results obtained, a number of recommendations can be made. Given that the wage return to education is higher at the tertiary level, it is important to encourage girls in particular to continue their education to tertiary level. In addition, there is a need to strengthen human capital through training and to combat stereotypes of people with disabilities.

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