

Estimating Private Returns to Higher Educational Quality in South Africa: A Structural Equation Model (SEM) Approach

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ABSTRACT: *The aim of this study was to estimate private returns to higher educational quality based on the human capital model. Non-random sampling approach was used to collect data from participants using a standardized questionnaire. Using the Structural Equation Modelling (SEM) approach in STATA 12, the standardized estimates show that both higher educational attainment and college quality have significant effects on earnings; while educational attainment further significantly influences employability success. Correspondingly, employability success and earnings demonstrate significant endogenous positive effects on educational attainment. The model's reduced form estimates indicate that grade point average and college quality have significant positive effects on educational attainment, employability success and earnings.*

KEYWORDS: *higher education, quality, Structural Equation Model (SEM)*

I. INTRODUCTION

The subject of private returns to higher educational quality remains as a multidimensional concept in the realm of human capital investment. At macro level, quality higher education equips individuals with better skills and knowledge that stimulate economic growth (Quang, 2012). From the labour market perspective, quality higher education increases individuals' opportunities for employment. To create a competitive knowledge economy through quality education, the government has a great role to play with regards to implementation of quality assurance monitoring systems that regulate academic institutions' functions and processes.

In South Africa, the Higher Education Act (1997) provides for quality assurance and quality promotion in higher education. Section 5(1)(c) of the Act mandates the Council on Higher Education (CHE), through the Higher Education Quality Committee (HEQC) to promote and audit quality in higher education institutions. In respect of qualifications framework, the Higher Education Qualifications Framework (HEQF) ensures that all new academic programmes submitted to the HEQC for accreditation have to be HEQF compliant (Government Gazette No. 34883, 2011:54). Section 7(2) of the Higher Education Act (1997) requires the CHE/HEQC as the accredited ETQA to perform quality promotion and quality assurance functions within the requirements of section 5(1)(a)(ii)(bb) of the South African Qualifications Authority (SAQA) Act (1995). To ensure recognition of qualifications, section 5(3)(c) of the National Qualification Framework (NQF) Act (2008) requires qualifications to be of acceptable quality; while the HEQF provides common parameters and criteria for qualifications design and comparability of such qualifications across the system (Government Gazette No. 34883, 2011:56).

The rest of this paper is organised as follows: Section 2 provides literature and theoretical framework on the private return to higher educational quality based on the human capital theory. Section 3 specifies the econometric framework for empirical analysis. Section 4 presents and analyses the results; while Section 5 provides concluding remarks and recommendations.

II. LITERATURE AND THEORETICAL FRAMEWORK

Based on the human capital theory, investment in quality higher education is an effective instrument for acquiring knowledge and capabilities that enhance individuals' productive capacities (Ehrenberg & Smith, 2006). A rational individual's decision to seek quality education therefore borrows from the objective to maximize education utility expected in form of higher life cycle earnings (Checchi, 2006). Paulsen & Toutkoushian (2006b) propose that individuals behave rationally only if their choices of resource allocation between education and consumption on other goods occur in ways that maximize their utility subject to their distinct preferences.

Following the random utility theory, a rational individual spends on education if the expected level of utility from educational attainment exceeds utility from consumption on other goods. The decision making process functions as a comparison of utility values given by:

$$u_{ic} \equiv v(p_c, y_i, \varepsilon_{ic}) \quad \text{----- (1)}$$

where: u_{ic} denotes the utility value attained by individual i in college education (c), depending on price (p_c) and individual income (y_i). The parameter ε_{ic} is the error term that varies over alternatives and individuals. Provided the error term is additive, a rational individual chooses the alternative c (college education) over alternative g (other goods) if:

$$u(p_c, y_i) + \varepsilon_{ic} \geq u(p_g, y_i) + \varepsilon_{ig} \quad \text{----- (2)}$$

where: $u(\bullet)$ is the deterministic component and ε_{ig} is the stochastic component of the utility function $v(\bullet)$.

Proceeding from equation (2), higher education is deemed profitable if the present discounted value of its benefits exceeds the present discounted value of its direct costs plus the consumption forgone during the period of college education (Paulsen & Toutkoushian, 2008).

$$\sum_{t=\phi}^T \frac{E_t^U - E_t^{HS}}{(1+i)^t} > \sum_{t=1}^{\phi} \frac{C_t}{(1+i)^t} + \sum_{t=1}^{\phi} \frac{E_t^{HS}}{(1+i)^t} \quad \text{----- (3)}$$

$$\sum_{t=\phi}^T \frac{E_t^U - E_t^{HS}}{(1+r)^t} = \sum_{t=1}^{\phi} \frac{C_t}{(1+r)^t} + \sum_{t=1}^{\phi} \frac{E_t^{HS}}{(1+r)^t} \quad \text{----- (4)}$$

The symbol i in equation (1) represents the market interest rate used to discount the value of future streams costs and benefits; r in equation (2) denotes the internal rate of return on investment, which equals the interest rate that equates the present discounted value of the benefits of university education; $(E^U - E_t^{HS})$ represents the earnings differential between college and high school education; C_t denotes direct cost of education and ϕ is some value.

III. ECONOMETRIC METHODOLOGY

3.1 Introduction

This section presents the econometric framework applied for analysis in this study.

3.1 Data

The analysis collected data from two levels; individual level and academic institution level. Non-probability sampling was used to collect data on participants' profiles using a standardized questionnaire. The data covered educational attainment, grade point average (GPA), employment status, earnings and college quality. From the total 250 questionnaires distributed, 95.2% were returned fully completed. Data on college quality was collected based on graduates' perceived quality of colleges' infrastructure, curricula; research and assessment practices.

3.2 Estimation Technique

The structural equation model was used to estimate both structural parameters and reduced form estimates of the systems of equations examining the private returns to quality higher education. The systems of equations were given as:

$$\begin{aligned} y_1 &= \alpha_0 + \alpha_1 y_3 + \varepsilon_1 \\ y_2 &= \beta_0 + \beta_1 y_3 + \beta_2 x_1 + \varepsilon_2 \\ y_3 &= y_1 + y_2 + x_2 \end{aligned} \quad \text{----- (1)}$$

where: y_1 denotes employability success; y_2 represents earnings; y_3 symbolizes educational attainment; x_1 represents college quality; x_2 symbolizes grade point average (GPA). Variables y_1 , y_2 and y_3 are endogenous variables; while x_1 and x_2 are predetermined variables. Representing structural parameters by β 's in respect of endogenous variables; γ 's are attached to predetermined variables; while the endogenous and exogenous variables are represented by y 's and x 's; respectively.

Using the conventional notation (ignoring constant intercepts), the structural system reduces to:

$$\begin{aligned} y_1 &= \beta_{13} y_3 + \varepsilon_1 \\ y_2 &= \beta_{23} y_3 + \gamma_{21} x_1 + \varepsilon_2 \\ y_3 &= y_1 + y_2 + x_2 \end{aligned} \quad \text{----- (2)}$$

Transferring observable variables to the LHS, the standardized structural parameters become:

$$\begin{aligned} y_1 + 0y_2 - \beta_{13}y_3 + 0x_1 + 0x_2 &= \varepsilon_1 \\ 0y_1 + y_2 - \beta_{23}y_3 - \gamma_{21}x_1 + 0x_2 &= \varepsilon_2 \\ -y_1 - y_2 + y_3 + 0x_1 - x_2 &= 0 \end{aligned} \quad \text{----- (3)}$$

System (3) yields the matrix for the standardized structural coefficients:

$$\begin{bmatrix} 1 & 0 & -\beta_{13} & 0 & 0 \\ 0 & 1 & -\beta_{23} & \gamma_{21} & 0 \\ -1 & -1 & 1 & 0 & -1 \end{bmatrix} \quad \text{----- (4)}$$

To obtain the reduced form model, the structural system of endogenous variables was solved in terms predetermined variables, structural parameters and disturbances:

$$\begin{aligned} y_1 &= \frac{\alpha_1 \beta_1}{1 - \alpha_1 - \beta_1} x_1 + \frac{\alpha_1}{1 - \alpha_1 - \beta_1} x_2 + \frac{\varepsilon_1 + \alpha_1 \varepsilon_2 - \beta_1 \varepsilon_1}{1 - \alpha_1 - \beta_1} \\ y_2 &= \frac{\beta_2 (1 - \alpha_1)}{1 - \alpha_1 - \beta_1} x_1 + \frac{\beta_1}{1 - \alpha_1 - \beta_1} x_2 + \frac{\varepsilon_2 + \beta_1 \varepsilon_1 - \alpha_1 \varepsilon_2}{1 - \alpha_1 - \beta_1} \\ y_3 &= \frac{\beta_2}{1 - \alpha_1 - \beta_1} x_1 + \frac{1}{1 - \alpha_1 - \beta_1} x_2 + \frac{\varepsilon_1 + \varepsilon_2}{1 - \alpha_1 - \beta_1} \end{aligned} \quad \text{----- (5)}$$

Denoting the reduced form structural parameters by π 's yields:

$$\begin{array}{ll}
 \pi_{11} = \frac{\alpha_1 \beta_2}{1 - \alpha_1 - \beta_1} & \pi_{12} = \frac{\alpha_1}{1 - \alpha_1 - \beta_1} \\
 \pi_{21} = \frac{\beta_2 (1 - \alpha_1)}{1 - \alpha_1 - \beta_1} & \pi_{22} = \frac{\beta_1}{1 - \alpha_1 - \beta_1} \\
 \pi_{31} = \frac{\beta_2}{1 - \alpha_1 - \beta_1} & \pi_{32} = \frac{1}{1 - \alpha_1 - \beta_1}
 \end{array} \quad (6)$$

Substituting π 's into the system (6) provides the reduced form model as:

$$\begin{array}{l}
 y_1 = \pi_{11}x_1 + \pi_{12}x_2 + v_1 \\
 y_2 = \pi_{21}x_1 + \pi_{22}x_2 + v_2 \\
 y_3 = \pi_{31}x_1 + \pi_{32}x_2 + v_3
 \end{array} \quad (7)$$

where: the π 's represent the reduced-form coefficients.

The above computational operations confirm existence of a definite relationship between the structural parameters and the reduced form parameters.

IV. RESULTS AND DISCUSSION

4.1. Table 1: SEM Estimates Results

Standardized	Coeff.	Std. Err.	z	P > z	[95% Conf. Int.]	
Employability success← Educational attainment _cons	.888498 .4122706	.1681721 .6874131	6.65 0.60	0.000 0.549	.788887 1.75957	1.04811 .935034
Earnings← Educational attainment College quality _cons	.5927281 .1688674 .7278803	.0699101 .0502374 .2678005	8.48 3.36 2.72	0.000 0.001 0.007	.455706 .070403 .203001	.729749 .267331 1.25276
Educational attainment← Employability success Earnings GPA _cons	.9128010 .4083399 .6667775 3.752604	.34283 .1514423 .1748657 .8973497	2.95 2.70 3.81 4.18	0.003 0.007 0.000 0.000	.681961 .111518 .324047 1.99383	.938093 .705161 1.00951 5.51137

Holding other factors constant, the model's standardized estimates show that educational attainment has statistically significant positive effects on employability success and earnings. Approximately 88.84% of employability success and 59.27% of earnings are significantly and positively influenced by higher educational attainment. Moreover, nearly 16.88% of earnings are significantly influenced by college quality. Likewise, about 91.28% of higher educational attainment is positively influenced by employability success; while earnings and GPA positively and significantly influence educational attainment by nearly 40.83% and 66.67%; respectively.

4.2. Table 2: Reduced Form Model Estimates Results

Standardized	Coeff.	Std. Err.	z	P > z	[95% Conf. Int.]	
Employability success←						
College quality	.1393981	.0585039	2.38	0.017	.024732	.254063
GPA	.3965977	.526652	7.53	0.000	.293375	.499819
_cons	1.849866	.3230433	5.73	0.000	1.21671	2.48302
Earnings←						
College quality	.2742223	.0546995	5.01	0.000	.167013	.381431
GPA	.3573410	.0525556	6.80	0.000	.254333	.460348
_cons	1.212899	.2989916	4.06	0.000	.626886	1.79891
Educational attainment←						
College quality	.2411688	.0563774	4.28	0.000	.130671	.351666
GPA	.3495429	.0537080	6.51	0.000	.244277	.454808
_cons	1.663102	.3168853	5.25	0.000	1.04201	2.28418

Comparative to college quality, the reduced form model estimates show that GPA has relatively more pronounced significant positive effects on educational attainment, employability success and earnings. Approximately 39.65% of employability success, 35.73% of earnings and 34.95% of educational attainment are significantly and positively influenced by GPA. Correspondingly, nearly 13.93% of employability success, 27.42% of earnings and 24.11% of educational attainment are significantly and positively influenced by college quality.

V. CONCLUSION AND RECOMMENDATIONS

This section provides concluding remarks and recommendations for further studies.

5.1 Conclusion

The objective of this study was to estimate the private returns to quality higher education based on the human capital theory. Using the SEM approach, the standardized estimates indicate that educational attainment has a significant positive influence on both individual employability success and earnings; demonstrating a relatively higher significant effect on earnings. Consistent with the findings by Thomas (2003) and Zhang (2004), college quality has a significant positive effect on earnings. Furthermore, the result that GPA average positively influences higher educational attainment is also consistent with the findings by Zhang (2004). The reduced form model estimates of the predetermined variables show that college quality has significant positive impacts on educational attainment (Zhang, 2004), employability success and earnings. Similarly, GPA demonstrates significant positive effects on employability success (Hostetler, 2012), earnings and educational attainment.

5.2 Recommendations

Given the significant positive effects associated with college quality on employability success, earnings and educational attainment, higher academic institutions should work effectively towards improving their educational service provision in terms of infrastructure, academic programmes curricula, research and innovation; and assessment practices. Improvements in such components can enhance both student learning and recognition of the attained academic qualification. From the government side, the bodies mandated with the responsibility to ensure quality assurance, promote and audit quality should consistently strengthen their quality enhancement and monitoring systems to ensure that academic infrastructure, curricula alignment with labour market needs, teaching for learning; assessment practices and educational qualifications comparatively meet international standards.

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