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PRODUCTION AND COST FUNCTIONS FOR HIGHER EDUCATION IN CAMEROON: THE CASE OF THE FORMER UNIVERSITY OF YAOUNDE .

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PRODUCTION AND COST FUNCTIONS FOR HIGHER EDUCATION IN CAMEROON:

THE CASE OF THE FORMER UNIVERSITY OF YAOUNDE .

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DEDICATION

This work is dedicated to the entire family of **AKO**, my parents: Papa **LUCAS KHAN** and Mama **FRANCISCA MESHI**, and more especially to the memory of my late grandmother Ma **MONICA NKENGFOR** who did not live long enough to see me become what she had wanted.

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ABSTRACT

This study sets out to assess the internal efficiency of higher education in Cameroon with particular reference to the former University of Yaounde. To do this, educational production and cost functions have been estimated. They try to identify the critical inputs which impinge on the production of higher education, and to determine the relative importance of these inputs in influencing the academic performance of students. We also attempt to determine the impact of the inputs on expenditure per student, and the optimum size of the institution. The cointegration methodology using the ordinary least squares regression technique is applied on time series data from 1971/72 to 1991/92. Linear and log-linear functional forms are used to estimate our relationships. Analyses are carried out first for the three faculties of the former University of Yaounde combined, and then, for each of the faculties separately, so as not to conceal variations within the faculties. The following results are obtained.

School environmental variables explain a greater proportion of the variation in student performance. Government expenditure per student, the student-teacher ratio, the number of teaching staff, and the number of students enrolled have a significant influence on the academic achievement of students. The relative importance of the inputs is not the same in the different faculties, but the number of academic staff appear to be the most effective school input. The number of students receiving scholarships has a negative effect on performance in all the faculties, despite being the most important item in total university expenditure.

Given that expenditure per student is an aggregate of many expenditure variables, the negative relationship with performance found in some faculties does not necessarily mean the ineffectiveness of increased government spending on higher education, but a poor allocation of expenses on the different items which comprise it - an element of efficiency.

The optimum size of enrolment in the faculties was found to be 11752, 7090, 8358, and 28334 in the FDSE, FLSH, FS and all the faculties combined, respectively. These fell below the maximum enrolments recorded by the 1991/92 academic year (the end of our study period), which was 15554, 8781, 9171, and 33506, respectively. This implied that all the faculties were experiencing diseconomies of scale. There was therefore need for restricting enrolment or decentralisation of the former University of Yaounde if efficiency was to be improved.

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GENERAL INTRODUCTION

Education is not only a basic human right, but also an essential component of social and economic development. The recognition of the role of educational investment in promoting economic growth actually dates back to the time of Adam Smith and the early classical economists, who emphasised the importance of investing in human skills (Psacharopoulos and Woodhall, 1995). Notwithstanding, they never advocated the idea that investment in education or human capital investment could be used to stimulate national economic growth. Economic growth during this time was attributed only to investment in physical capital. Economic theory related growth to capital and labour, assessed in quantitative terms.

After the second world war, economists became more interested in educational issues and elaborate investigations were carried out to examine the role of human skills in promoting rapid economic growth. These investigations clearly demonstrated the important role of human capital in accelerating economic growth. This influenced governments, planners, educators and international donor agencies to become interested in educational projects as a means of economic growth. For example, the first World Bank project on education was initiated in 1962 despite the fact that it had been providing financial and technical assistance for development since its establishment in 1944. Lockheed and Verspoor (1991,P.1) acknowledge that "education is a cornerstone of social and economic development ... it improves the productive capacity of society and their political, economic and scientific institutions."

After the 1960s, development policies in most countries - both developed and developing, reflected this recognition that human capital (in the same way as physical capital), was a productive investment. A significant proportion of national budgets were allocated for education and training. This was more so for most Sub-Saharan African countries just gaining independence.

In Cameroon for example, the educational budget increased from 6,010 to 50,540 million CFA francs between the fiscal years 1972/73 and 1983/84. On the average, about 10 percent of the national budget has been absorbed each year by the educational sector. These figures are underestimated since the former University Centres had autonomous budgets, and some professional schools which fell directly under particular ministries had their budgets attached to those of these ministries. During this very period, school enrolment (from primary to tertiary level) increased from 1,044,285 to 1,797,940 pupils and students (UNESCO, 1985). This represented an increase of about 72 percent over eleven years.

As regards the higher educational sub-sector, a lot of importance was accorded it after independence. Universities were expected to produce the skilled human resources necessary to manage the newly independent countries, to generate development-relevant research, and to provide community service. They had as predominant objective to train skilled leaders, managers, scientists and professionals in numbers sufficient to replace colonial masters to guide national development (Saint 1992). They were therefore viewed as key instruments of national development. In the words of an elderly African statesman -- Julius Nyerere (cited by Todaro 1977, p. 264), "the role of a University in a developing nation is to contribute, to give ideas, man power, and services for the furtherance of human equality, human dignity and human development."

If we examine Cameroon government expenditure on education for 1983 we realise that 41 percent was spent on primary education, 35 percent on secondary education and only 24 percent on tertiary education, meanwhile, if we examine in more details the amount spent by government per pupil and student, we discover that the unit cost of higher education by far exceeds that of primary and secondary education. The cost of educating a tertiary-level student is about sixty-eight times that of educating a primary school pupil[1]. Relatively therefore, the government sacrifices a lot in delivering higher education services in Cameroon.

[1] The data here is compiled from the World bank (1988; p.140-3). Tables A16 to A19.

1 A STATEMENT OF THE RESEARCH PROBLEM

Despite the enormous sacrifices made by the government of Cameroon in providing higher education and the colossal sums given as direct scholarships to students, the former University of Yaounde had been characterised by high rates of repetition and drop-out. In some faculties , less than 40 percent of students enrolled gained promotion into an upper class at the end of the academic year. Affa'a and Des Lierress (1991, p.43) report failure rates of 85 percent among the freshmen of the Faculty of Science of the former University of Yaounde. Saint (1992, p.92) equally reports that "to complete a three-year undergraduate programme, Cameroonian students require an average of 7.7 years in the arts, 8.9 years in law and economics, and 18.2 years in the sciences."

These high repetition and drop-out rates implied a substantial waste of material and human resources to the state - the principal provider of funds for higher education in Cameeroon, the University institution, and the student himself. Repetition involves an element of waste since repeaters stay in school longer than the normal duration of the cycle, thus increasing cost per graduate and leading to more crowded classrooms. Drop-out is also considered wasteful because investments have been made on students who fail to attain the graduate class[2] which is considered

[2] Some researchers like Eicher (1984,p.115) argue that drop-out is not a total wastage because the dropping out student has at least acquired some human capital. But in Cameroon, a university drop-out retains his pre-university status in the labour market.

an internal objective of the school. UNESCO (1985) in a study of the population of students awarded first degrees in July and September 1984 in the former University of Yaounde, concluded that because of repetition and dropout, a degree holder costed 39 percent more than normal - that is if the study duration of three years was respected. The World Bank (1988, p.143) gives the recurrent cost per student-year in Cameroon in 1983 as 3345 United States dollars. This is approximately the amount wasted per student-year repeated or by a drop-out after a year in school. Cost per graduate becomes extremely high for those who succeed to complete.

The government of Cameroon in a communiqué published by the National daily - Cameroon Tribune (1993,N°5305)[3] acknowledged the numerous problems faced by the University of Yaounde. The consequence of which were :"high rate of failure and insufficient internal returns" (p.1).

This rather poor performance led some people to question the efficiency with which resources were allocated in the production of higher learning in the faculties of the University of Yaounde. This became more relevant given the fact that budgetary allocations for the education sector , and for higher education in particular were declining in the face of the economic crisis hitting the country. As a consequence, the possibility of financing projects (educational projects inclusive) greatly declined. This meant that a

[3]The French language edition of Cameroon Tribune.

host of economic and social activities of the government had now to compete for the limited public financial resources. Education had to compete keenly with poverty alleviation, health and agricultural programmes among others. The decision maker therefore has as a major concern, the setting up of new priorities for the allocation of these scarce resources .

It now becomes evident that higher education has to do with reduced state funding. For example, the budget of the former University of Yaounde stood at 14977 million CFA francs in 1989/90, down from 16455 million CFA francs in the 1985/86 academic year. This represented a fall of more than 9 percent within nine years. During the very period enrolment increased by 79.73 percent, that is from 15258 in 1985/86 to 27423 in 1989/90. This has led us to reiterate the question of how efficiently resources have been allocated in the production of higher education in Cameroon since the creation of the University of Yaounde. Carnoy (1967, p.361) shares this when he writes that, "the problem in developing countries is that investment in education is not put within the context of allocating scarce resources optimally, they tend to superimpose educational investment decisions somewhat haphazardly on general development goals."

If this has been the case with higher education in Cameroon, then the high repetition and drop-out rates can be attributed to the poor allocation of school resources. This might not be surprising given that no study in Cameroon has ever addressed in a systematic manner the crucial questions as to how higher education is produced; what the strategic inputs in the production process are; how relatively effective they are; and how production has been in terms of output and cost.

All this prevailed, despite the fact that more than a quarter of the education budget has been made available to higher education in the last ten years. For example, nobody really knows the effect of scholarships on the academic performance of students. But their non-payment has often caused a lot of rioting and destruction in many universities in West and Central Africa: Cameroon, Gabon, Côte d'Ivoire, Benin, Niger, Senegal and many others.

This means that rational higher education policy could seriously be impeded in the absence of some vital set of knowledge concerning the issues raised above. A study of this nature seems urgent now, especially in the face of economic recession which has greatly reduced the financial resources of the state. In the education sector, higher education has to compete especially with primary education which has been proven by many studies to have, both a higher private and social rate of return than tertiary education as shown by Psacharopoulos and Woodhall (1985) in a review of such studies.

1.2 RESEARCH OBJECTIVES

Our main aim in this study is to attempt an examination of the internal efficiency of higher education in Cameroon, and more specifically in the former University of Yaounde. We will be guided through this process by the following specific objectives:

a) Identify the critical inputs (those subject to policy control) which influence students' academic performance. This will be done by specifying and estimating educational production functions- in which a series of inputs applicable to higher education in Cameroon will be matched against specified outputs.

b) Determine the relative importance of these inputs in affecting student performance. This will be done by calculating the beta coefficients of the regression parameters. In a system operating within financial constraints, priority need be established among the various inputs intervening in the educational production process.

c) Examine the impact the various school inputs had on expenditure per student in the university by estimating average cost functions. This will help indicate areas in which cost-savings can be realised without affecting the quality of education.

d) Examine the existence of economies or diseconomies of scale in university operation. This will enable us determine the shape of the average cost curve of university education in Cameroon from which a possible optimal size of university operation can be determined.

e) We also hope through this study to put at the disposal of policy makers an analytical and empirical base for policy formulation in the higher education sub-sector.

3 BASIC RESEARCH HYPOTHESES

The research objectives of examining the internal efficiency of educational production have generated the following hypotheses to be tested:

a) School environmental resources (policy controllable inputs) account for a greater variation of students' academic performance. This is because the influence of socio-economic status declines as we move up the academic ladder (Simmons and Alexander, 1978; p.348), and especially at the tertiary level in Cameroon where the economic background was not important before the suppression of scholarships.

b) The payment of scholarships to students has little or no effect on academic performance despite widespread scholarship-related crisis.

c) The inputs which account for a greater proportion of the variation in per student expenditure do not significantly influence student performance (output). This is a typical situation of misallocation of resources which we assume prevailed in the former University of Yaounde.

d) The average cost curve of higher educational operations in Cameroon obeys standard neo-classical theoretical constructs of being U-shaped. From the above, if the average cost curve is U-shaped, it follows that economies of scale were followed by diseconomies of scale as the level of operations increased.

4 THE SCOPE OF THE STUDY

Before January 1993, the University of Yaounde was made up of three Faculties and five Specialised schools (or 'Grandes Ecoles'). More will be discussed on these Specialised Schools in Chapter Three, which deals with the development of higher education in Cameroon.

This study, meant to investigate the efficiency of resource commitment in higher education in Cameroon, will focus mainly on the three Faculties of the former University of Yaounde. It is in these Faculties that the main problem and the motivation of this study: high rates of repetition and drop-out was very pronounced. These were really negligible in the other establishments of the of the former University of Yaounde. Also, the faculties had uniformized procedures in terms of admission and graduation, whereas in the professional schools, admission standards were not the same and the duration of studies varied. While it was six years in CUSS, it was three years in the other schools. This makes uniform analysis difficult. The faculties were: The Faculty of Law and Economics (F.D.S.E.), the Faculty of Letters and Social Sciences (F.L.S.H.), and The Faculty of Science (F.S.). This was their denomination before the January 1993 University Reforms.

These Faculties made up more than 75 percent (even 85 percent in some years) of higher education enrolment in Cameroon. Their proportion of enrolment can permit us to make inference about all of higher education without much risk of errors. We will treat all these faculties as a single entity and then further examine the production process in each faculty separately. This will enable us discern their peculiarities, which could be shadowed by the global or aggregate treatment. The aggregate data shows average values which tend to conceal variation within the faculties.

The 1993 University reforms profoundly reshaped the higher education institution in Cameroon, thereby transforming the production process. From a previously single university, six new ones were created. Because of these changes, we have decided to limit our analysis to the pre-reform period since the time series data for the post-reform period is not long enough to permit the use of multiple regression procedure adopted for this study. The time series data for this study stretches from 1962/1963 - one year after the former University of Yaounde started operations to 1991/92 - marking the end of academic year just before the implementation of the reforms of January 1993. Unfortunately, we have been able to obtain data related to financial transactions only from 1971/72 academic year. Our regression analysis therefore covers only the period from 1971/72 to 1991/92 academic years.

5 METHODOLOGY

5.1 *DATA COLLECTION*

Data for this study came principally from secondary sources. This was data kept by the university authorities over the years in the course of their administrative functions. Some variables had data as far back as from the creation of the university in 1961/62, while others (especially those related to finance) had information only as from the 1971/72 academic year. This has reduced our sample size considerably.

Data on student enrolment and the number of graduates has been obtained from the registrar's office in each of the faculties and from the Statistics Office of the University of Yaounde I. The Office of Statistics and the Academic Personnel Office provided us with data on the number of teaching staff. Data on the number of students who benefited from scholarship were collected form the Welfare Department while those on academic staff salary were sort from faculty budgets provided by the financial service attached to the University of Yaounde I. From the University Library, we collected data on the number of textbooks available each year. This excluded journals and other periodicals, because no effective record was kept of them over the years. It was therefore impossible to include them in a time-series study like this one. This was the very case with books in departmental libraries. Therefore, only the number of textbooks in the Central Library have been used as a variable in all the Faculties, and the

University as a whole. The fact that the library staff reported a high rate of book theft and damage, implies that the figures reported exceed the number of books which were actually in the central library. The Computer Centre and the Annual Reports of the different Faculties equally provided us with additional information on the variables.

To compute total public expenditure on the faculties, and hence expenditure per student, we obtained the following data from the budget service of the Financial Department of the University of Yaounde I for each faculty:

→ Personnel expenses: this included the salaries of both the academic and the non-academic staff;

→ Working expenses: departmental expenses (like book acquisition, running of the laboratory, other instruction-related material, field studies, seminars and research missions), and administrative expenses (like the acquisition of furniture and equipment, vehicle maintenance, organisation of examinations, receptions and ceremonies).

Total public expenditure was not only limited to the amount allocated to each faculty as its budget, but also include expenses of the central services or those jointly carried out for all the establishments of the former University of Yaounde (that is the three faculties and the five professional schools). We thus collected the following data related to the whole university:

→ Charges and obligations fixed by the law such as social contributions, insurance against accidents and property (library, laboratories, kitchen and others), and fees for adhesion to international university associations;

→ Personnel salaries and working expenses of the rectorate, the central library, the welfare department, and the computer centre. This included expenses on medical services, transportation, feeding, lodging, lighting, water, telephone, general repairs, book acquisition, furniture and materials, entertainment and ceremonies;

→ Expenses on scholarship to student; and

→ Research allowances to the academic staff.

Since the study focuses only on the three faculties of the former University of Yaounde, we had to share all these general expenses among the various establishments which made up the university. Our problem was then to find an appropriate allocation coefficient or ratio. The World Bank (1986, p.71) recommends that each overhead item should be looked at individually to determine the appropriate base for allocation.

The budget for scientific research was used to finance staff research projects, publications, and a fixed amount was also given to all members of the academic staff at the end of the academic year as a research premium. This fixed premium varied with the academic rank of each staff. To allocate this research budget among all the establishments of the former University of Yaounde, we have used as ratio the proportion of academic staff in each establishment. This is because the budget benefited the teachers directly. The ratio we have used might not be very appropriate given that part of this budget was awarded as a function of research projects and publications of staff members. The amount received by teachers in each faculty was therefore not only a function of their numbers. Dealing with a time series study like this one, it was not possible to obtain information on publications or research projects financed from the research budget over the study period. We therefore hope the coefficient we have used is the best alternative despite its shortcomings.

The respective shares of the scholarship budget to the various establishments were not available for all the years. From data for the available years, we realised that the three faculties received an average of 75.16 percent of the scholarship budgeted for the whole university. On the average, the F.D.S.E. received 39.92 percent, the F.L.S.H. had 15.17 percent, and the F.S. took 20.07 percent. We therefore used these percentages as our allocation coefficients for the rest of the years with no data.

We used the proportion of students in each establishment as the allocation coefficient for the remaining general expenses: library, welfare department and central services. Here we assumed that the amount for each establishment was proportional to the number of students enrolled, since most of these services benefited students directly.

5.2 DATA ANALYSIS

This is discussed in details in Chapter Three, where we treat it together with the model specification. Suffice it to say here that the method of data analysis is both qualitative and quantitative.

6 PLAN OF THE STUDY

The rest of the work is organised in two parts. Part One serves as background to the study and comprises Chapters One and Two. Chapter one is devoted to a review of human capital literature, specifically in the area of educational production and cost functions. Here we look at the methodological approach and the results obtained by previous empirical studies. Chapter Two on its part presents the higher education institution in Cameroon from the creation of the Cameroon National School of Administration in 1959 to the present day. It traces the historical background of higher education, its development to the University of Yaounde and its present structure resulting from the 1993 University reforms.

Part Two which deals with the theoretical and empirical aspects of the work is equally divided into two chapters. The specification, the estimation procedures, estimation problems and probable solutions of estimating the educational production and cost models are subject matters of Chapter Three. Chapter Four deals with the estimation of the production and cost models specified in Chapter Three. Here we attempt to identify and classify those variables that intervene in the production of higher education in Cameroon. The general conclusion is devoted to a summary of our findings and the policy suggestions emanating from the study.

PART ONE

BACKGROUND TO THE STUDY

To establish the base for this thesis, we make a review of the major works that have been undertaken in the domain of the production and cost of human capital. This is the subject of Chapter One. Chapter Two on its part traces the evolution of the higher education institution in Cameroon from its inception in 1959 to the 1993 University Reforms and the growth of private higher education. These two chapters, forming Part One of this work actually lay the background for our theoretical and empirical analysis in Part Two.

CHAPTER ONE

LITERATURE REVIEW

1.1 INTRODUCTION

The study of the efficiency of educational investment falls within the framework of human capital theory whose origin can be traced to the early development of political economy. The role of investment in human capital in promoting economic growth actually dates back to the time of Adam Smith and the early classical economists, who emphasised the importance of investing in human skills (Psacharopoulos and Woodhall, 1985). Human capital theory recognises education and training as investment in the same way it considers physical capital.

Human capital has three of the important characteristics of physical capital (Wonnacot and Wonnacot, 1986, p.28): Firstly, it increases the productive capacity of the economy, since a trained worker can produce more than an untrained one; secondly, it requires a willingness to wait during the schooling period when no goods or services are produced; and lastly, there are costs associated with the development and formation of human capital.

The above points are corroborated by Ricardo when he attributes the differences in workers' productivity and rewards to the level of acquired natural capacities. The acquired capacities result from more education. Education therefore becomes a means by which skills and abilities which raise productivity are produced. These skills must accordingly be rewarded (Tafah, 1989).

Despite this recognition, growth policy was still focused on physical capital accumulation prior to the Second World War. After the war, Japan and Germany recorded high growth rates despite the extensive destruction of their physical plant during the war. Economists then started rethinking the source of economic growth, since the rapid growth of these countries could not be attributed solely to the traditional factors of production: physical capital and labour. It was only then that they got involved in empirical works to establish the relationship between education and economic growth.

In the early 1960s; Shultz (1961) and Denison (1962) demonstrated that education contributed directly to the growth of national income by improving the skills and the productive capacity of the labour force. Denison used the growth accounting approach, based on the concept of the aggregate production function which links output (Y) to the input of physical capital (k) and labour (L). He assumed a linearly homogeneous function: $Y = f(K, L)$. Denison argued that if economic growth is due entirely to increases in physical capital and labour, then it should be possible to disaggregate the rate of growth of output into its capital and labour components. His attempt to explain the United State's economic growth between 1910 and 1960 in terms of increase in labour and physical capital immediately established, that there was a large residual that could not be explained in this way. An attempt was then made to discover how much of this residual was related to the effect of education on the quality of the labour force. Denison concluded that between 1930 and 1960; 23 percent of the rate of growth of output was due to the increased education of the labour force. Schultz on his part measured the contribution of education to economic growth in terms of the rate of return to human capital, which he compared with the rate of return to physical capital. He concluded (as did Denison) that a substantial proportion of the rate of growth of output in the United States was due to investment in education. Empirical works in developing counties (Ghana, Kenya, Nigeria, Malaysia, and the Republic of Korea), where the internal rate of return on human capital was compared with that of physical capital came out with the same conclusion as regards the importance of education in economic growth[1]

This conclusion led to an expansion of investment in human capital especially in developing countries with an aim of increasing the pace of economic development. Consequently, huge amounts of resources have been committed to education and training. This has prompted researchers to investigate the efficiency with which these investments have been carried out, this notwithstanding their effect on economic growth. The efficiency of educational investment is examined from two perspectives: internal and external efficiency.

[1] These empirical works are discussed by Psacharopoulos and Woodhall, 1985; and Haddad et al., 1990.

The external efficiency of an educational system is judged by how well schools prepare pupils and students for their roles in society, as indicated by the employment prospects and earnings of students. "Such measures depend on external criteria rather than results entirely within the school" as noted by Psacharopoulos and Woodhall (1985, p.205).

On the contrary, internal efficiency (our objective in this study) is concerned with the relationship between inputs and output within the educational system or within individual institutions. Output in this case is measured in relation to internal institutional goals rather than the wider objectives of society. Some other researchers (Cohn, 1968; Psacharopoulos, 1970; The World Bank, 1986; Tafah, 1989; and many more), examine internal efficiency from the cost angle. In this approach, they look at the major cost determinants of educational investment and the efficiency of expanding the system (especially in some developing countries where universal basic education is still negligible).

In the sections that follow, we will survey the empirical works which have been carried out in this domain. First, we will review studies which examine efficiency by establishing a relationship between educational inputs and output (educational production functions) and secondly those which look at efficiency from the cost angle (educational cost functions).

2.2 EDUCATIONAL PRODUCTION FUNCTIONS

The general form for this function has been specified by researchers in the field (Bowles, 1970; Summers and Wolfe, 1977; Simmons and Alexander, 1978; and Hanushek, 1979) as:

$$A = f(F, P, S, I),$$

Where A - denotes academic achievement;

F - represents family influences;

P - stands for peer influences;

S - refers to school environmental inputs; and

I - for innate or initial abilities.

There is hardly any quarrelling with this specification. Disagreement comes in when details about the definition and the measurement of variables and the form of the functional relationship are introduced. Simmons and Alexander (1978, pp. 142-3) note that "there is no established theory of learning to serve as a guide to either the correct form of the educational production function or *a priori* limits on its coefficients." And Hanushek (1979, p. 372) adds that "educational production functions have been estimated in a variety of forms, although most frequently variants of linear and quadratic models."

Linear models are estimated are estimated under the assumption that the various input are independent from each other and that their marginal products are constant. But for lack of a sound theoretical backing for this assumption, Hanushek (1979) opts for the estimation of logarithmic in addition to the linear models. Logarithmic models presuppose declining marginal products and also highlight the more or less joint nature of inputs into the educational production process (Umo 1980, p. 26).

Researchers have often experimented with various variants of both models to obtain those which satisfy econometric requirements. This has been the case of Cohn (1968), Umo (1980), Tafah (1989), and Tafah et al.(1990).

An aspect of the educational production function in which opinions differ among researchers is the measurement of educational output. To start with, The World Bank (cited by Psacharopoulos and Woodhall 1985, p. 207) makes a distinction between the output and the outcome of the educational system. Educational output, understood to mean student achievement (knowledge, skills, behaviour and attitudes) is measured by test scores or examination results. Output is used when measuring the internal efficiency of an educational system.

On the other hand, educational outcome is considered to be the external effects of educational output. That is the ability of students to be socially and economically productive. Outcome is used when we are assessing the external efficiency of the system. This does not concern us in this particular work.

As far as the measurement of educational output is concerned, many variables have been used. Some of which include attendance rates, drop-out and continuation rates, certification, cognitive scores and scores on standardised tests, research and non-cognitive tests designed to measure students' attitudes. This multitude of variables portray the difficulties involved in measuring educational output. None of these variables, can on its own really englobe all the aspects of educational production. As Bowen (1977, p. 22) puts it, "The outcomes[2] are numerous, complexly interrelated, often subtle, sometimes unintended, unstable over time, difficult to substantiate, sometimes negative, and judged differently by different observers."

This actually demonstrates the fact that there is no unanimity on any measure of the output of the educational system. Some researchers have attempted the use of more than one output measure in their studies (Perl 1973, and Brown and Saks 1975). Brown and Saks used the mean and the standard deviation of test scores as output measures in their study. They argued that the aim of the school authorities is to obtain the highest mean and the lowest variance possible, thus these were the most appropriate of educational output. But these are far from being the objectives of students (or their parents) who are interested in their individual scores and not the mean or standard deviation of scores.

The main problem hindering the frequent use of more than one output to measure educational achievement is the intercorrelation which exist among such variables. Perl (1973, p.159) explains that measuring the relationship between the inputs

[2]Bowen uses outcome and output synonymously.

and each output variable will be redundant if the intercorrelation is high. For this reason, many researchers have opted for a single variable to measure educational output, this notwithstanding its shortcomings (Cohn 1968, Summers and Wolfe 1977, Umo 1980, and Tafah 1989). The single, most used educational output measure as noted by Hanushek (1979, p. 355) is standardised test scores, but most of such studies have been carried out at the primary and secondary school levels.

At the tertiary level of education (our concern in this study), output is much more varied and interrelated to be measured by standardised test scores. Kerr (1979, p.991) expresses scepticism as he states that "postsecondary education has so much diverse patterns of study that competence tests are much more difficult to design and administer than at lower levels where the subject matter is much more uniform." This argument is corroborated by Hanushek (1986, p. 1155), as he points out that, "how effective test scores are in measuring the contribution of schooling to subsequent performance probably varies at different points of the schooling process. In postsecondary education, few people believe that test scores actually measure output."

Some researchers in developing countries who have not been able to obtain standardised test scores (perhaps because they are costly to design and administer) have preferred to use examination results to measure student performance. Tafah (1989) uses the official results of the First School Leaving Certificate and the

General Certificate of Education to measure the output of primary and secondary education in Cameroon respectively. In measuring the output of the educational production process in Nigerian universities, Umo (1980) used the number of degrees awarded or what he calls "the stock of terminal capital" (p. 26).

Educational production functions are also characterised by a lot of differences as regards the input variables used in the analysis. The general form of the function specified above regroups educational inputs into four broad categories: school environmental inputs (S), family background characteristics (F), peer group influences (p), and innate or initial abilities (I). There is little agreement as regards which elements of the major input components to be included in the production function. While researchers like Summers and Wolfe (1977) used elements of all the four broad inputs in their studies, Bowles (1970) used three (F, S, and I), Lockheed and Longford (1989) used two (F and S), Cohn (1968) focused only on (S), while Murnane et al. (1981) analysed only home environmental resources (F).

Among these input components, that representing school environmental resources (S) is very important because it regroups variables controlled by educational policy makers like teacher and school characteristics. Much attention has been given this variable in past studies because of its susceptibility of being altered within a given time by the school authorities to improve the production efficiency of the educational system. This is not the case with the other input components. Only very studies like that of Murnane (1981) do not include school environmental inputs in their analysis. Their study was aimed solely at examining the different socio-economic factors influencing academic achievement.

Concerning school environmental inputs, many variables have been used to describe them by different researchers. Heyneman and Loxley (1983) listed more than a hundred variables generated by the International Association for the Evaluation of Educational Achievement (I E A) in eighteen countries for assessing the educational production process. Others like Umo (1980) used only three variables in their study. Though researchers are not agreed on a particular set of school inputs which influence academic performance, a group of variables appear repeatedly in most of these studies. These include: teacher characteristics like experience, qualification, salary, verbal ability, sex and motivation, and school facilities like number of books, availability and use of library, enrolment, expenditure per student, curriculum content, building and laboratory facilities (Bowles 1970, Perl 1973, Simmons and Alexander 1978, Heyneman and Loxley 1983, Fuller 1986, Hanushek 1986, Lockheed and Longford 1989, and Tafah et al. 1990).

Hanushek (1979, p.363) concludes this problem of input specification by acknowledging that "there is little conceptual clarity, and the choice of inputs seems, sometimes explicitly, to be guided more by data availability rather than any notion of conceptual desirability."

This lack of unanimity or clarity in input and output measurement is also reflected by the controversial and apparently contradictory results of various empirical studies. The most controversial of these works was the study mandated by the Civil Rights Act of 1964 in the United States of America under the title: "Equality of Educational Opportunities."[3] The results of this study, published in 1966 and commonly called the "Coleman Report"[4] set the tone for subsequent investigations and have remained the most quoted and debated in the literature of educational production (Bowles and Levin, 1968a; and 1968b; Perl, 1973; Hanushek, 1979; and 1986; Lockheed and Longford, 1989).

The startling thing about the Coleman study was, firstly, the survey information covering over half a million students and more than 3000 schools. Secondly, it was this study which directed attention to the importance of the relationship between school inputs and student achievement. It also integrated for the first time, terms such as statistical significance, analysis of variance, production efficiency, multicollinearity, residual variation, estimation bias, and simultaneous equations (Hanushek 1979, p.352).

The principal conclusion of the Coleman Report, the most debatable in the literature, and that which interest us in this study

[3]Cited by Hanushek (1979, p.352)
[4]Because the study team was led by James S. Coleman.

is cited by Perl (1973, p.157): "The components of school expenditure have little, if any, impact on student performance. Consequently, investments in reduced class size, improved teacher quality, or improved school facilities are likely to have little effect on educational output."

This implied that schools had little to do with student performance and that on the contrary, non-school influences (like socio-economic background and the characteristics of fellow students) were more important in determining student performance. This conclusion had disturbing implications for any attempt to increase the efficiency of education by changing the combination of school environmental inputs. It attracted a lot of criticisms and further research to validate or invalidate these conclusions.

Some of the first critics of the Coleman Report were Bowles and Levin (1968a, 1968b). They (1968a) came out with different results re-analysing the Coleman data. They found a significant influence of some school variables on academic achievement : teacher verbal ability, teacher salaries and school facilities (adequate science laboratory) had a significant positive relationship with output. Their concern in the second paper (1986b) was the estimation procedure used by the Coleman team. The regression technique employed, they say, was fraught with the problem of multicollinearity. They suspected a high degree of collinearity between the school variables and the socio-economic status of the students. They proceeded by eliminating some of the less important variables from the regression equations to reduce this effect. The new equations again confirmed their earlier results as to the positive effects of the school environment on academic performance.

Still that year, Cohn (1968) estimated an educational production function for Iowa high school operations (in the United States of America) using incremental test scores as a measure of educational output. Cohn used exclusively school environmental inputs in his model and established a positive and significant relationship between median teacher salary, the number of assignments per teacher and incremental test scores. The other variables where either insignificant or had a wrong sign and the coefficients of determination (R^2) were very low. He attributed the poor performance of the model to intercorrelation among the variables and the fact that most educators may not regard increments in test scores as the single or most important measure of school quality.

Contrary to Cohn who used only school inputs in his production function, Perl (1973) added socio-economic variables and peer characteristics. His aim was to verify the conclusion of the Coleman Report using alternative statistical techniques applied to a different data set. His results showed a positive and significant relationship between the scores of an aptitude test and socio-economic variables. The proxy for peer characteristics had the expected sign but was not significant. Concerning school environmental inputs, the following variables were significant at the one percent level or even better : class size, starting salaries of teachers, increase teacher specialisation, teacher qualification, increase learning time and the number of books in the library. When these results are compared with those of the Coleman Report, we find to the contrary that students attending high expenditure schools performed generally better.

Summers and Wolfe (1977) used pupil-specific data in their study and complained that the use of school- or district-level averages was not appropriate for these types of studies. The result of their work showed that socio-economic and genetic factors, as well as school resources influenced academic performance. Many school variables were significant, and they wrote: "we find that many school inputs mattered, and that their impact varied considerably on different types of students" (p.647).

The growing optimism about the effectiveness of schools was again put to question by Jenck's (1972) very negative conclusions:[5] "The characteristics of a school's output depend largely on a single input, namely the characteristics of the entering children. Everything else, the school budget, its policies, the characteristics of the teachers - is either secondary or completely irrelevant."

[5]Jenck's conclusion is cited by Psacharopoulos and Woodhall (1985, p.217)

Simmons and Alexander (1978) came out with a similar conclusion after reviewing educational production studies in ten developing countries. Their conclusion was less severe than that of Jenck as they accepted that a few school inputs had an effect on student performance. They also concluded that school variables are less important at the primary and early secondary grades, their influence increases as the student proceeds the secondary cycle, and eventually they have a greater impact on performance (p.348).

Heyneman (1976), and Heyneman and Loxley (1983) dissipated this pessimism when they carried out a comparative study between developed and less developed countries. The study by Heyneman and Loxley (1983) involved twenty nine countries and their main preoccupation was the universal applicability of evidence from North America (with less than 5 per cent of the world's school population) to countries around the world with different characteristics. This study confirmed the result of the Heyneman (1976) study, using a wider sample. They came to the following conclusions:

The proportion of explained variance attributed to school environmental variables is 66 per cent on the average in the fifteen developing countries included in the survey, and thirty five per cent for the fourteen developed countries. Pre-school variables on their part, accounted for fifty six per cent of the explained variance in developed countries but only for thirty three per cent in developing countries. These results were further compounded by the highly significant negative relationship between the influence of school variables on achievement and the level of gross national product per capita. They then arrived at the conclusion that, " the poorer the country, the greater the impact of school and teacher quality on science achievement" (p.1180). Their results once more demonstrated the effectiveness of the school environment (at least in developing countries) and also stressed the non-universality of paradigms tested only in some parts of the world.

Of the studies reviewed so far, non has examined the production process at the higher education level. The literature at this level is relatively scanty, especially in the developing world. A study which has examined the production process in higher education in Africa by estimating a production function is that of Umo (1980). He used a set of inputs exclusively from the school environment to explain scholastic achievement proxied by the number of successful graduates in Nigerian universities. The results in both the linear and logarithmic scales showed that the inputs explained a substantial part of the variation in the number of graduates (between 89 and 96 per cent).

The only studies which have systematically investigated the internal efficiency of educational production in Cameroon are those of Tafah (1989) and Tafah et al. (1990). Tafah (1989) examined the production of secondary education in Cameroon using General Certificate of Education results as a measure of educational achievement. He used school variables and a proxy for socio-economic status (school location). One important aspect of this study was that, apart from a global view, Tafah disaggregated his results following school ownership (government, mission, and private individuals) so as to present a vivid insight into certain disparities that exist in the Cameroon secondary education system. His results showed that the number of teaching staff and the class size are significantly related to student performance in all the school types. Per student expenditure, non-teacher expenditures, and the existence of a high school are also significant. Average teacher salary, boarding facilities and teacher qualification are inconsistent in their effect on student performance. As regards the performance of the model, about 84 per cent of the total variation in performance is explained in some of the equations estimated. When only school inputs are used, about 80 per cent of the variation is explained. Tafah's study once more demonstrated how school environmental variables are important predictors of educational performance.

The other study in Cameroon by Tafah et al. (1990) identifies the variables affecting primary school performance. Apart from the number of female staff which is inconsistent, the remaining variables used in the primary school model significantly affected student performance. Unlike the secondary school study, the average teacher salary and school location significantly influenced performance at the primary school level. The performance of the model is reasonably good given that Tafah et al. Used cross-sectional data.

This review of educational production studies shows that more and more studies are affirming the effectiveness of the school environment in enhancing school performance. Though some doubts might still exist on the extent of this effectiveness, especially in developed countries (where non-school factors appear to be important), the evidence from developing countries is very much in favour of school environmental resources.

In this study, we limit ourselves only to school variables. This is not only because of lack of data for the other input categories, but also because there is evidence for their relevance especially in developing countries. Simmons and Alexander (1978) affirm that their effectiveness increases as we climb the academic ladder up to he higher education level, where they have a greater impact. We therefore hope to throw some light on the production of higher education in Cameroon with this approach.

The empirical studies reviewed so far only distinguish significant from insignificant inputs, but fails to tell us which of them is more important than the others in influencing educational achievement. But given the fact that educational institutions always operate with limited budgets, the educational decision-maker is certainly interested in the relativeness of those inputs over which he has control. One of our objectives in the study is to establish a priority among the inputs of higher education in Cameroon.

No matter the expected outcome of any educational investment, it will only be carried out if funds exist. This implies that the study of cost, as a constraint in the educational environment is also of great importance. We now examine some of the works which have been carried out in this domain.

2.3 EDUCATIONAL COST FUNCTIONS

As mentioned earlier, some authors have sort to examine the internal efficiency of the educational system on the basis of the cost of production. This has been done by estimating an educational cost function. In the words of Tafah (1989, p.149), "estimating educational cost functions is meant to examine to what extent resource combinations are best utilised to maximise the attainment of educational goals." This aspect of evaluating the internal efficiency of schools has not been much treated in the literature as has been the case with educational production functions. Those researchers who have estimated educational cost functions have had as objectives, the examination of the determinants of educational cost, the possibility of the existence of economies of scale in school expansion and the estimation of the optimum size of institutions.

The general form of the educational cost function often estimated has been given by The World Bank (1986, p.95) as follows:

$$AVC = f(S, X_1, X_2, --- X_n, Q, P_1, P_2, --- P_n)$$

Where AVC is the average cost,

S denotes the size of the educational institution under consideration,

$x_1 \ldots x_n$ stands for exogenous factors that may account for differences among the unit under study,

Q represents the quality of educational output, and

$p_1 \ldots p_n$ are the prices of the educational inputs.

What interest researchers most is the specification of the estimable function and the variables to be included. This leads us to the issue of the functional form of the educational cost function. The selection of the functional form for estimating the cost function is not self-evident. The World Bank (1986, p.96) notes that, "a large family of positive, homogenous, non-increasing, concave functions of input prices can be classified as cost functions, the choice of the cost function is quite arbitrary." Researchers have often tested several functional forms to see which best satisfies required criteria. Tafah (1989, p.185) justifies this procedure as he writes that "the estimation of alternative models enables us to discern the appropriate model as dictated by the various statistical tests. This is vital for an exploratory study."

Educational cost functions have therefore been estimated in the linear, quadratic and hyperbolic forms. In the linear model, average cost is regressed on the various cost elements (including school size) all introduced in a linear form. To examine the existence of economies of scale, and eventually diseconomies of scale, quadratic functions have also been estimated by squaring the size variable. They implicitly admit the existence of an optimal school size (in terms of enrolment) beyond which diseconomies set in. In the hyperbolic functional form, the inverse of enrolment is introduced as one of the regressors. With this formulation, an optimal school size is never attained as average cost continues to fall with increase school size. Average cost functions have also been estimated in both the linear and logarithmic forms. This enables us to see the essence of the additive and the multiplicative nature of the cost variables as well as deriving their elasticities directly from the logarithmic function (Cohn, 1968; Umo, 1980; and Tafah, 1989).

As regards the computation of educational costs, capital cost or outlays have often been left out and attention paid only to recurrent expenditure. The World Bank (1986) justifies this by the fact that capital expenditures occur too infrequently to adequately measure actual yearly capital costs, and reliable data on depreciation are hardly available. As concerns the consequences of the absence of capital cost in the model, it affirms that "when capital cost are not included, the estimated average cost functions can still be useful for evaluation of the efficiency in the use of the other inputs, labour, consumable materials, supplies, *etc.*"(p.95). In support of this position, Mingat and Tan (1988) note that "..., unless objective is to assess the cost of building additional school places, the analysis of unit costs is usually directed at recurrent expenditure." Riew (1966) equally corroborates this argument.

As far as empirical estimates of educational cost functions are concerned, one of the pioneer works in the field was that of Riew (1966). In his study, he estimated a parabolic cost function for Wisconian high schools. About 56 per cent of the variation in average per student operating expenditure was accounted for by the six variables, of which average teacher salary, enrolment, the square of enrolment and change in enrolment were statistically significant. Riew's results also showed the existence of significant economies of scale at the level of education he studied.

In the same line, Cohn (1968) estimated a long-run average cost function using the linear, the parabolic and the hyperbolic functional forms. The results clearly indicate the existence of economies of scale. The coefficient of enrolment squared was significantly positive, meaning that the long-run average cost curve is U-shaped. This implied that diseconomies of scale were likely appear if optimum school size was exceeded. Cohn also estimated the optimum school enrolment of 1470 and the lower and upper 95 per cent confidence limits of this optimum size at 1277 and 1663 respectively.

Umo (1980) used time-series data from Nigerian universities to estimate two variants of the cost function : the expenditure and scale functions. The expenditure function revealed that the number of academic staff had a cost-increasing effect on university expenditure, while the science-arts ratio and enrolment had a cost-decreasing effect. As regards the scale function, estimates revealed the existence of substantial economies of scale with respect to enrolment and the science-arts ratio.

Psacharopoulos (1970) on his part carried out an international study of the relationship between real cost per student and the enrolment ratio in institutions of higher learning in developing countries. To standardise the variables for the different countries, he divided the deflated cost by the per capita income of each country and used the enrolment ratio instead of enrolment. Psacharopoulos (p.29) concluded that "cross-country evidence points to the existence of substantial reduction in university cost as the student body increases." Psacharopoulos however cautioned that the documented fall in unit cost should not only be interpreted as reflecting returns to scale, but also as a fall in the quality of education provided by university institutions. He added that it will be incorrect to attribute the full cost reduction to returns to scale since some deterioration of quality might accompany rapid expansion. He, on the other hand admitted that it is extremely difficult to differentiate between quality changes and returns to scale in general economic theory.

The World Bank (1986), after investigating the structure of annual recurrent costs in Chinese universities also examined in details the relationship between the size of the institution and unit recurrent cost. The results revealed that the average cost function declined over the range of enrolment under consideration, implying the existence of economies of scale. The analysis also suggested that the curve continues to decline but at a declining rate meaning that diseconomies of scale will eventually arise.

The only educational cost function study in Cameroon has been carried out by Tafah (1989). He estimated cost functions for both the primary and the secondary school systems in Cameroon. The primary school study involved a sample of 258 schools and the following results were obtained: average teacher salary had a strong positive influence on per pupil expenditure, while school enrolment had a significant negative impact. He demonstrated that an increase in enrolment of one per cent will lead to a 0.22 per cent reduction in per pupil expenditure. He equally showed how primary school enrolment could be increased from an average of 481 pupils to an optimum of 1033 pupils without significantly jeopardising school quality. He predicts, for example that in a typical average primary school, increasing enrolment by one pupil could reduce per pupil expenditure by 110.5 francs (CFA).

As regards the secondary school estimates, Tafah worked on a sample of 119 schools and came out with the following results: average teacher salary and school enrolment had similar significant effects as in the primary school study. Other variables which had positively significant effects on expenditure per student were boarding facilities and the number of teachers, while school location and ethnicity had insignificant impacts. He calculated the optimum secondary school enrolment to be 2208 students up from an average of 756. Tafah (1989, p.222) predicted that schools with an average enrolment of 1000 students could increase to 2000 and save 12000 francs (CFA) per student.

Both the primary and secondary school estimates reveal that unit cost diminishes as we approach optimum enrolment. This implies that the average cost curve is U-shaped in both cases. Economies of scale will be followed by diseconomies of scale as optimum school enrolment is exceeded. But at both levels of education , average enrolment is still far below the optimum, thus there are possibilities of reaping economies of scale by expanding primary and secondary enrolment in Cameroon.

Most of the studies reviewed above have identified the teaching staff salary as the most significant determinant of school expenditure especially in developing counties. They equally demonstrate the existence of economies of scale in the school systems studied. We will push this analysis up to higher education in Cameroon. Apart from the usual variables included in cost functions, the amount of variation attributed to scholarship payments will also be examined.

2.4 CONCLUSION

This review of the literature on educational production reveals that the role of schools in influencing academic achievement is well established especially in developing countries. This is far from saying that there is unanimity, for controversy still arises as to the methodological approach to be followed. The cost studies on their part indicate that there is still room for the expansion of enrolment at declining unit cost, though care must be taken not to do this at the expense of educational quality. This is especially the case in the developing countries where the level of material inputs is rather low.

Focus is now gradually shifting from whether schools matter, to how investment in school inputs can enhance students' achievement. Issues of interest to researchers now, for example, are whether it is more teacher training or more textbooks which influence performance, and not whether teachers or textbooks do matter at all. That is how to improve the efficiency of educational production.

In this study therefore, we attempt to identify the critical inputs that impinge on the production of higher education in Cameroon and equally establish priorities among these inputs. Tafah (1989) did not carry his analysis to this level and also ignored the classification of inputs according to their order of importance in influencing achievement. We will equally carry to higher education the investigation of economies of scale treated at lower levels by Tafah (1989). We hope by this attempt to contribute our bit in the phase of the dearth of research in this area in Cameroon. Apart from Umo (1980) who used time series data to analyse the educational production process, all the other studies reviewed in this work use cross-sectional data. In our analysis we have equally used time series data and attempt an application of the concept of cointegration to educational data.

CHAPTER TWO

THE EVOLUTION OF HIGHER EDUCATION IN CAMEROON

2.1 INTRODUCTION

The expression "Higher Education" as used in this study designates the various types postsecondary educational institutions that train middle- and high-level personnel in degree, diploma and certificate granting programmes. We do not rely on the narrow notion restricted to traditional universities, but make an overview of other postsecondary institutions in the country. In the rest of this chapter, we go back to history and look at the beginning of formal education in Cameroon and how the colonialists failed to establish higher educational institutions despite enormous pressure from the United Nations, in section (2.2). In section (2.3), we examine how higher education actually started in Cameroon, and in section (2.4), we present the various institutions of higher learning which have existed in Cameroon before the 1993 University Reforms. The structure of university education in Cameroon after the reforms is presented in section (2.5), while section (2.6) is reserved for the conclusion.

2.2 A HISTORICAL PERSPECTIVE[1]

Formal western education is said to have been introduced in Cameroon in 1884 when Joseph Merrick of the London Baptist Missionary Society opened up the first school at Bimbia (now Fako in the south-west province) with an enrolment of sixty pupils. Alfred Saker opened the second school in June 1885 at Akwa town in Duala. From the creation of the first school to the

[1] Much of this section is written thanks to the works of Nfor-Gwei (1975) and Knowles (1978)

independence of Cameroon (a period of about seventy-six years), these missionary authorities expanded and developed educational facilities only at the primary school level.

Even under the thirty years of German annexation, educational facilities were further developed, but no secondary educational institutions were established. When Germany lost Cameroon at the end of the First World War, it was partitioned between France and Great Britain in accordance with the mandate of the League of Nations. After the war these countries continued to administer their various parts of Cameroon as United Nations trust territories until independence. France and Great Britain developed educational facilities both qualitatively and quantitatively during this period, but neither of them provided any local facilities for higher education. They instead offered scholarships for Cameroonians to study in their respective countries and in other colonies which had higher educational institutions (Senegal for French scholarships and Nigeria for British scholarships).

As far back as 1948, the various specialised agencies of the United Nations recommended that the administering authorities not only increase scholarships but also establish higher educational facilities in these countries. The United Nations Trusteeship Council, at its fifth session on July 19, 1949, unanimously adopted resolution 110(v), which called on France to pay particular attention to Cameroon's higher education needs and consider the establishment of university institutes or colleges there by 1952. France's response was negative despite continued pressure from United Nations specialised agencies. France maintained her position on the following grounds: lack of finances , equipment and an inadequate number of qualified students. She claimed that all this made "the establishment of a university in Cameroon at that time premature, inadvisable, and even unnecessary" (Knowles 1978, p.772).

Therefore, no higher educational institution existed in from the inception of western education in 1884 to the granting of independence in 1960. The Baptist Missionary Society's educational efforts ended at the primary level. German plans to carry education beyond the primary level were foiled by the outbreak of World War I. France and Great Britain carried education up to the post-primary level, but failed to establish any higher educational facilities despite the pressure from the United Nations. Cameroon's education needs therefore remained large unsatisfied during the pre-independence period.

2.3 THE BIRTH OF HIGHER EDUCATION IN CAMEROON.

A number of reasons favoured the setting of higher educational institutions in Cameroon. These included firstly, the fact that most Cameroonians sent abroad did not come back after their studies, thus leading to a very high rate of brain-drain (Nfor-Gwei, 1975). Secondly, studies in most European universities in which Cameroonians studied were not adapted to the specific needs of the country. Lastly, the number of qualified personnel needed by the country was so high, such that the reliance on foreign universities in the long-run was insufficient and a serious financial burden to the country. Even bilateral and multilateral aid could hardly cover the bills for the training of the number of qualified personnel needed by the country.

The granting by the French government of the status of a self-governing state to Cameroon by decree N°57-501 of April 16, 1957 also favoured the setting up of higher education institutions in the country. The Cameroon National School of Administration created in 1959, and which started functioning in 1961 (April) was the first higher education institution in Cameroon. It had as mission to train high level administrative personnel for the public service. A magistracy section was latter to be added in 1964 and to give it the present of 'ENAM' (Ecole Nationale d'Administration et de Magistrature).

The real foundation of university education in Cameroon was laid by presidential decree N°61-55 of April 25 1961, creatingthe National institute of university studies. This institute was established to offer pre-university courses in the arts, law and the sciences, and was to be expanded as technical possibilities permitted (article 2 of the 1961 decree). It was affiliated to the Toulouse University in France which provided curriculum guidance and the academic staff.

Another higher educational institution to be created was the Advanced Teachers Training College (ENS) for the training of secondary school teachers and primary school inspectors. It was created by decree N°61-186 of September 30, 1961, and went operational by November of that very year. It was under the supervision of UNESCO, since it was the fruit of an agreement it signed with the Cameroon government in June 1961. After the February 11, 1961 plebiscite during which the southern sector of British Cameroons had opted for reunification with "La Republique du Cameroon", it was necessary to adapt higher education in Cameroon to this new reality (the bi-cultural nature of the country). The government of Cameroon then sought the advice of UNESCO for the establishment of a Cameroon university. Following the study and recommendations of UNESCO, the Federal University of Cameroon was created to replace the National Institute of University Studies by decree N°62-DF-289 of 26 July 1962.

By the start of the 1962/63 academic year, the Federal University of Cameroon consisted of the following establishments: The Faculty of Law and Economics, The Faculty of Letters Social Sciences, and the Faculty of Science. The Advanced Teachers Training College (ENS) became part of the University in 1963. This was also the case of the Advanced School of Agriculture which started operating in January 1962. These establishments of the Federal University of Cameroon, added to the Cameroon National School of Administration and Magistracy and the Military School (EMIA) could be said to have formed the foundation of higher education in Cameroon.

It should also be noted that after the 1972 referendum which changed Cameroon from a federal to a united republic, the Federal University of Cameroon became simply known as the University of Yaounde by decree N°73-326 of June 23rd, 1973. The University of Yaounde as we shall see below, remained the nucleus of higher education in Cameroon until the 1993 university reforms.

2.4 INSTITUTIONS OF HIGHER LEARNING IN CAMEROON

As mentioned earlier, this study focuses only on higher education in Cameroon as it existed before the 1993 reforms. Section 2.5 will make a presentation of higher education as it is in Cameroon today. Prior to 1993, higher education in Cameroon was dominated by the University of Yaounde. The other higher educational institutions which existed can be grouped under the following categories: The University Centres, Institutions attached to ministerial departments, those with regional or international status, and those in the private sector.

2.4.1 THE FORMER UNIVERSITY OF YAOUNDE

As noted above, this institution came into existence by decree N°73-326 of June 23rd, 1973 to replace the Federal University of Cameroon. It received a greater majority of Cameroonians admitted into postsecondary education. It had alone, over the years enrolled an average of more than 75 per cent of all higher education students in the country- this went up to 95 per cent in some years (UNESCO 1985). The University of Yaounde was made of eight establishments: three faculties and five professional (or career-oriented) schools. We will examine each of them in turn, but with more emphasis on the faculties which are our main focus in this study.

3.4.1.1 The Faculties

The three faculties of the former University of Yaounde fulfilled the traditional functions of a university institution which involve instruction and research- that is intellectual training. Access into the faculties was opened to all students who successfully completed secondary education by obtaining the General Certificate of Education (advanced level) or the Baccaulauréat. The following were the faculties of the former University of Yaounde:

The Faculty of Law and Economics (F.D.S.E.),

The Faculty of Letters and Social Sciences (F.L.S.H.), and

The Faculty of Science (F.S).

The names of these faculties are indicative of the courses they offered. In the rest of this section, we will be examining the evolution and distribution of the following variables in the various faculties: student enrolment, the teaching staff, the student-teacher ratio, budgetary allocations, scholarship payment, graduate output, staff salary and expenditure per student. This comparative treatment will enable us appraise the distribution of inputs and output within the faculties.

A) Enrolment.

The three faculties constituted an average of about 80 per cent of the student population of the former University of Yaounde. The remaining 15 per cent was for the professional schools. This enrolment was not evenly distributed among the faculties. The FDSE singled out itself with an enrolment which very often exceeded that of the other two faculties brought together. Before the 1982/83 academic year, the FLSH was second in terms of student numbers, but this position was taken over by the FS after this period. Table 3.1 presents the absolute number of students enrolled, and the share of each faculty in total enrolment. Average enrolment for the faculties stood at 4323 (50.70%), 1947 (22.80%), and 2260 (26.50%) in the FDSE, FLSH and the FS respectively.

As regards the evolution of enrolment, the general trend was positive. It was 77, 38 and 33 in 1962/63, by 1991/92, it had increased to 15554, 8781 and 9171 in the FDSE , FLSH and the FS respectively as shown by Table 2.1. The total enrolment of 33506 for all the faculties represented 90 per cent of all students in the former University of Yaounde in 1991/92.

Table 2.1: Enrolment for selected years in the faculties.

Year	FDSE		FLSH		FLSH		All faculties
	ENT	As % of total	ENT	As % of total	ENT	As % of total	ENT
1962/63	77	52.03	38	25.68	33	22.30	148
1967/68	303	41.11	195	26.46	239	32.43	737
1972/73	1195	40.68	821	27.94	922	31.38	2938
1977/78	4053	54.50	1859	24.99	1526	20.51	7438
1982/83	5564	55.64	1870	18.70	2563	25.63	9997
1987/88	9333	52.26	3614	20.24	4893	27.40	17840
1990/91	13476	46.82	7331	25.45	7975	27.71	28782
1991/92	15554	46.42	8781	26.20	9171	27.37	33506

Ent = Enrolment.
Source: Statistics Office of the University of Yaounde I, Admissions Offices of the various faculties and UNESCO (1985).

B) The Academic Staff

The distribution of the academic staff among the faculties was not in favour of the FDSE. Despite its enrolment share of over 55 per cent, its academic staff hardly surpassed 25 per cent of the total for the faculties. For example, out of a total staff of 280 in the 1982/83 academic year, only 63 (22.5 per cent) were of the FDSE. The FS remained throughout the study period with the highest number of staff, followed by the FLSH. They had respectively 111 (39.64 percent), and 106 (37.86 per cent) teachers in the 1982/83 academic year. Table 2.2 shows the evolution and distribution of the academic staff in the various faculties.

Table 2.2 : The academic staff for selected years.

Year	FDSE		FLSH		FLSH		All faculties
	Staff	As % of total	Staff	As % of total	Staff	As % of total	Staff
1962/63	6	37.50	6	37.50	4	25..00	16
1967/68	14	21.00	24	35.82	29	43.28	67
1972/73	35	22.58	58	37.42	62	40.00	155
1977/78	38	16.24	100	42.74	96	41.02	234
1982/83	63	22.50	106	37.86	111	39.64	280
1987/88	83	22.31	130	34.95	159	42.74	372
1990/91	114	25.33	144	32.00	192	42.67	450
1991/92	121	24.54	152	30.83	220	44.68	493

Source : Statistics Office of the University of Yaounde I, Admissions Offices of the various faculties and UNESCO (1985).

The average percentage of teachers in the FDSE was the lowest at about 23.5 per cent, while the FS topped the list with 41 per cent. The FLSH was in the middle with about 35.50 per cent. Another characteristic of the academic staff was the presence of expatriates. As far back as 1962/63, the staff of sixteen in the whole university was expatriate. Their number increased to a maximum of eighty-three in 1973/74 and started declining to less than twenty in 1990/91. The few remaining were mostly in the FS and there was virtually non in the FDSE by the late 1980s. This decline in their numbers was due to the fact that qualified Cameroons were now available and took up most of the duties hitherto performed by expatriates.

C) The Student-Academic Staff Ratio

This variable approximates class size, and is obtained by dividing the number of students by the number of teachers in the faculty. Our discussions above revealed that despite having the greatest number of students on roll, the

FDSE had the least number of teachers. It thus had the highest student-teacher ratio among the faculties. From a minimum of 9.9 in 1963/94, it got to a frightening level of 128.5 students per teacher in 1991/92. The average for all the faculties that year was 68 while that for Sub-Saharan Africa in 1988 was 14.4 (Saint 1992, p.64). with such a high ratio, a hypothesis linking this to poor student performance in the faculty might be tenable

The situation in the FS and FLSH was a bit better, though far above the Sub-Saharan Africa average reported above. The maximum student-teacher ratio in the FS was 41 in 1991/92, while it was 57.8 for the FLSH in the same year. The lowest ratios in the FS can be attributed to the nature of studies which calls for a closer teacher-student relationship especially as regards laboratory practicals. The average ratios over our study period were 82.3, 24, and 22.9 in the FDSE, FLSH and FS respectively. Table 2.3 presents the student-teacher ratios in the various faculties .

Table 2.3 : student-teacher ratios for selected years.

Year	FDSE	FLSH	FS	ALL faculties
1962/63	12.8	6.3	8.2	9.3
1967/68	21.6	8.1	8.2	11.0
1972/73	34.1	14.2	14.9	19.0
1977/78	106.7	18.6	15.9	31.8
1982/83	88.3	17.6	23.1	35.7
1987/88	112.4	27.8	30.8	48.0
1990/91	116.2	51.6	41.5	64.0
1991/92	128.5	57.8	41.7	68.0

Source: Computed from Tables 2.1 and 2.2.

The rapid rise in the student-teacher ratio in all faculties as shown in Table 2.3 was due to the fact that the increase in student population was more than proportionate to that of the teaching staff. Elsewhere, such an increase in this ratio will be considered an efficiency gain since it means more students per teacher and a reduction of per student expenditure. But the case in the faculties of the former university of Yaounde was the plethoric student intakes with a consequence of over-crowded classrooms and lecture halls. This certainly had negative effects on the quality of education offered, thus compromising the gains in efficiency.

D) Graduate Output

The faculties of the former University of Yaounde awarded the following certificates : "Capacité, Licence, Maîtrise, Doctorat de 3ᵉ Cycle and Doctorat d'Etat". For lack of data, our discussion will focus only on the number of "licences" (first Degrees) awarded. The evolution of the number of "licences" awarded generally reflected the pattern of enrolment in the various faculties. As can be seen from Table 2.4, the number of awards in 1967/68 was 22, 17 and 5, and by 1991/92 this had increased to 1497, 895 and 811 in the FDSE, FLSH and FS respectively. For the faculties pooled together, this represented an absolute increase of 7180 percent over a twenty-five year period.

The distribution of graduate output among the faculties was not directly linked to enrolment as would have been expected. The FDSE which enrolled the highest number of students normally had the greatest number of graduates. The FLSH which had the least number of students came in the second position. The FS tailed the list despite the fact that it enrolled more students than the

FLSH. This was the result of the high repetition and drop-out rates in this faculty. The average number of degrees (Licences) awarded per year between 1966/67 and 1991/92 was 536 (50.42 percent); 334 (31.42 percent); and 193 (18.16 percent) in the FDSE, FLSH and FS respectively. This gave a yearly average of 1063 degrees in all the faculties. This was the average number swelling the labour market yearly from the faculties of the former University of Yaounde. Table 2.4 below shows the number of "Licences" awarded over some selected years, how they were distributed among the faculties and each faculty's share of the total..

Table 2.4: The number of 'Licences' awarded for selected years.

Year	FDSE		FLSH		FS		All faculties
	Licences	As % of total	Licences	As % of total	Licences	As % of total	Licences
1967/68	22	50.00	17	38.64	5	11.36	44
1972/73	58	21.40	156	57.56	57	21.03	271
1977/78	231	30.04	431	56.05	107	13.91	769
1982/83	603	52.52	369	32.14	176	15.34	1148
1987/88	905	50.22	522	28.97	375	20.81	1802
1990/91	1300	47.13	840	30.46	618	22.41	2758
1991/92	1497	46.74	895	27.94	811	25.32	3203

Source: Statistics Office of University of Yaounde I and the Admission Offices of the various Faculties.

E) Budget Allocations

Each of the eight establishments of the former University of Yaounde (including the three faculties) had a separate budgetary head. A separate budgetary head equally existed for services common to all these establishments: Central administration, welfare services, scholarship payments, research allowances and the central library. We examine here only the budgets made directly to the faculties - their direct budgetary allocations. These budgets constitute an important component of per student expenditure, a variable in our model. The direct budgetary allocations for the three faculties represented an average of only about 21 per cent of the budget of the former University of Yaounde. With this small budget, the faculties had to educate 85 per cent of the student population. The remaining 89 per cent of the university budget went to the central services, the professional schools and especially for scholarship payments.

The distribution of the direct budgetary allocations to the faculties, saw the FDSE always in the last position despite the very large ratio of students enrolled. This represented only an average of 24 per cent of the total budget to the faculties between 1971/72 and 1991/92. That of the FLSH was an average of 31 per cent within the same period, while the FS alone took about 45 per cent but with less than 30 per cent of total enrolment. This can be attributed to the number of academic and administrative staff employed and also to the quantity of laboratory equipment purchased. Tarpeh (1993, p.26) reports a similar trend in the University of Ghana, Legon, where the Faculties of Arts and Social Studies received an average of 41 per cent of the budget with 60 per cent of enrolment, while the Faculty of Science received 35 per cent of the budget with only 12 per cent of the students.

An increasing trend in the evolution of faculty budgets was noticed till 1986/87. These budgets fell in 1987/88, especially in the FLSH and the FS as a result of the fall in the national budget. Table 2.5 presents the budget for each faculty and the joint share of these faculties in the university budget .

Table 2.5: Budgets to the faculties for selected years (million CFAF).

Year	FDSE		FLSH		FS		ALL Faculties	
	Budget	As % of total	Budget	As % of total	Budget	As % of total	Budget	As % of U Y budget
1971/72	56	21.43	75	28.57	131	50.00	261	21.00
1975/76	145	21.76	190	28.48	332	49.76	667	20.23
1979/80	274	22.47	407	33.38	538	44.15	1218	25.74
1983/84	754	26.34	848	29.60	1262	44.06	2864	24.93
1987/88	871	26.51	996	30.32	1419	43.18	3287	21.97
1990/91	877	28.81	1022	33.55	1146	37.64	3045	16.61
1991/92	984	28.15	1169	33.43	1343	38.42	3497	17.73

N.B: U Y stands for the Former University of Yaounde
Source: The Office of Statistics and the Budget Department of the University of Yaounde I

F) Academic Staff Salary

In all the faculties, the academic staff salary was the most important item in the budget especially in the 1990s. For example, in 1990/91, teacher salaries consumed 90.44 percent of the budget of the FLSH. Over the study period, this faculty spent an average of 65 per cent of its budget on teacher salaries. This was followed by the FS which in 1990/91 used 86.58 per cent of the budget for salaries and the yearly average was about 54 percent. As regards the FDSE, it spent 35 per cent of its budget on teacher remuneration in 1971/72, but as the expatriate staff (paid by their home governments) reduced rapidly, and were replaced by nationals (paid from the faculty budget), the share of salaries in the budget rose quickly. This attained a maximum of 79.19

per cent in 1991/90, but the average was generally around 50 per cent, being the lowest among the faculties. The amounts paid as teacher remuneration and their share in the faculty budget are summarised in Table 2.6 below.

Table 2.6 : Academic staff salary for selected years (million CFA francs).

Year	FDSE		FLSH		FS	
	Licences	As % of total	Licences	As % of total	Licences	As % of total
1971/72	20	35.00	43	57.62	61	47.00
1975/76	50	34.16	119	62.46	180	54.20
1979/80	155	56.59	284	69.77	291	54.16
1983/84	434	57.49	543	64.01	480	38.06
1987/88	446	51.14	686	68.87	787	55.47
1990/91	684	78.01	924	90.44	992	86.58
1991/92	779	79.19	1052	90.02	1130	84.13

N B : F B = Faculty Budget.
Source: The Office of Statistics and the Budget Department of the University of Yaounde I.

G) Scholarship Payments

Scholarship payments were not included in the faculty budget, but treated at the level of the central administration for the benefit of students in all the eight establishments of the former University of Yaounde. These consumed an important part of the university budget. Its share even exceeded 50 per cent of the university budget in the 1990/91 academic year when it peaked 9296 million CFA francs, up from 5500 million CFA francs the previous year. It was from this year that the government was unable to provide the amount required, and consequently suppressed all scholarships. It should also be noted that while the attribution of scholarships in the faculties was selective, all students admitted into the professional schools were automatically accorded scholarships. The scholarship budget and the number of beneficiaries increased with enrolment until suppression in the 1990/91 school year as presented in Table 2.7.

Table 2.7 : Number of students awarded scholarships for selected years.

Year	FDSE		FLSH		FS		ALL Faculties	
	N° of students	As % of Ent	N° of students	As % of Ent	N° of students	As % of Ent	N° of students	As % of Ent
1971/72	442	53.51	485	82.20	455	81.12	1382	69.90
1975/76	1106	51.12	652	40.07	1154	74.50	2912	54.53
1979/80	2293	41.72	798	54.92	1301	97.89	4392	53.06
1983/84	2970	56.24	1270	65.80	1908	65.36	6148	60.69
1987/88	6705	71.84	2821	78.06	4407	90.07	13933	78.10
1990/91	7491	55.59	3592	49.00	5232	65.60	16315	55.68
1991/92	000	---	000	---	000	---	000	---

NB : Ent is the total number of students enrolled.
Source : Statistics Office and the Computer Centre of the University of Yaounde I.

As regards the distribution (in absolute terms) of scholarships to the different faculties, the FDSE topped the list very often. This was due to the high proportion of students enrolled. This was followed by the FS, then the FLSH. For example, out of a total of 16315 scholarship awards in 1990/91, the FDSE, FLSH and the FS had respectively 7491, 3592 and 5232 students as shown by Table 2.7 above. But when the number of awards is related to the number of students enrolled in each faculty, the FDSE then tails the list. The FS had the highest proportion of students on scholarship, followed by the FLSH. The average annual percentages were 79.09, 61.68 and 55.01 for the FS, FLSH and the FDSE respectively. For all the faculties combined, an average of 61.99

per cent of all students admitted were awarded scholarships. The bias in favour of the FS was an official policy to encourage studies in the scientific field. In chapter four, we shall attempt to establish the influence of scholarship awards on student performance.

H) Expenditure Per Student

The evolution of expenditure per student as shown by Table 2.8 below, was very erratic between 1972/72 and 1982/83. Within this period, increases and decreases alternated and no precise trend was discernible. It was only after 1983/84 that a clear trend of decreasing expenditure per student appeared in all the faculties. This trend continued till 1991/92 - the year with the least expenditure per student through out the study period. This was as a result of the suppression of scholarship payments to students that school year. This same trend is noticed when all the faculties are pooled together in the last column of Table 2.8.

The declining unit expenditure in the 1980s can be partly attributed to increasing student intakes, but a conclusion for the existence of economies of scale might seem premature here. This is postponed to chapter five where a more systematic approach will be used by estimating expenditure per student functions for all the faculties.

Table 2.8: Expenditure per student for selected years (CFAF)

Year	FDSE	FLSH	FS	All faculties
1971/72	442 275	378 131	542 492	451 570
1975/76	386 755	330 165	472 780	394 467
1979/80	257 083	546 122	744 232	386 026
1983/84	470 461	811 541	761 287	619 248
1987/88	328 007	515 253	524 565	419 849
1990/91	370 813	364 797	411 842	380 648
1991/92	199 907	272 387	287 604	242 906

Source: Computed from Tables 2.1, 2.5 and other expenditure data from the Statistics Office and Budget Department of the University of Yaounde I.

An examination of the variation of expenditure per student between the faculties shows that the FS had the highest per student expenditure for most of the period. The FLSH occupied this position for a few years in the 1980s due to the fact that total expenditure was spread over a small number of students. But the FS remained with the highest total expenditure throughout the study period. This was principally the result of huge faculty budget. Unit cost in the FS fluctuated between 871 thousands and 288 thousand CFA francs, while in the FLSH, it was between 812 and 272 thousand CFA francs. The FDSE had the lowest expenditure per student throughout our study period. It varied from a maximum of 470 to a minimum of 200 thousand CFA francs. This was the combined result of a small faculty budget and a high and rapidly rising enrolment. The average per student expenditure (between 1971/71 and 1991/92) stood at 575, 490 and 353 thousand francs in the FS, FLSH and the FDSE respectively. For the faculties brought together, the average was 428 thousand CFA francs.

The fall in expenditure per student witnessed in the last eight years before 1991/92, should normally have been considered an important efficiency gain. But the risk here is the effect this fall had on the quality of university education. This is more so because the fall was due to budget cuts and rising enrolments, than from any management efficiency. For example, the book acquisition budget (an accepted measure of educational quality) fell by more than 35 per cent between 1985/86 and 1991/92. After raising a similar argument, Saint (1992, p.91) notes that "during the 1980s, the combination of incremental budget belt-tightening and rising enrolments within African Universities produced a generally recognised deterioration in the quality of higher education across the continent".

We have attempted in this section to look at the way in which some variables were distributed among the faculties and also how these variables evolved with time. This was a prelude to Chapter Four which tries to assess the influence these variables had on the performance of students in the various faculties. In the section that follows, we briefly present the remaining establishments of the former University of Yaounde - the professional schools.

2.4.1.2 The Professional Schools

Apart from the three faculties, the former University of Yaounde also had five profession or career-oriented establishments or schools. Unlike the faculties which were involved with general instruction and research, these schools trained students for specific duties in the society like teaching, medicine, engineering, journalism and diplomacy. Where as admission into the faculties was opened to all secondary graduates, entry into the professional schools was very restrictive and through competitive examinations. Students were admitted as a function of government needs and were absorbed into the public service on graduation. These schools included the following:

A) The Advanced Teachers Training College (Ecole Normale Supérieure - E.N.S)

It was created by presidential decree N° 61-186 of 30th September 1961 and became operational in November of that very year. It has as mission to train teachers for general secondary education and teacher training colleges, orientation counsellors and the promotion of educational research. E.N.S operates on two campuses: a main campus in Yaounde and an annex in Bambili (principally for English-speaking students) in the North-West Province. Teachers are trained at the first and second cycles for junior and senior secondary schools respectively.

B) The University Teaching Hospital (Centre Universitaire des Sciences de la Santé - C.U.S.S).

This medical school was created by presidential decree N° 69-DF-256 of June 14, 1969 and started functioning that same year. It is specialised in the training of health personnel. Apart from training general medical doctors and specialists, it runs a special programme (CESSI - Cycle d'Enseignements supérieures en Soins Infirmiers) for the training of senior nurses. After the 1993 University Reforms, this school took up a new appellation - the Faculty of Medicine and Biomedical Sciences (F.M.S.B) and is attached to the University of Yaounde I as we shall see in section 3.5 below.

C) The National Polytechnic (Ecole Nationale Supérieure Polytechnique - E.N.S.P)

This school of engineering was created on the 24th of April 1971 as one of the establishments of the University of Yaounde. Courses were divided into two sections: a long of five years for the training of engineers (Ingénieur de Conception) and a short course of three years for training of Maintenance engineers (Ingénieur de Travaux). The latter course was suspended in 1989.

D) The Advanced School of Mass Communication (Ecole Supérieure des Sciences et Technique de l'Information et de Communication - E.S.S.T.I.C).

This journalism school was created by presidential decree N° 70-DF-211 of 15th May 1970 as the International Advanced School of Journalism of Yaounde. It started operating in November 16, 1970. It had as mission to train journalists and information technicians at three levels: Division I for information technicians; Division II for non-specialist journalists; and Division III for specialist journalists.

E) The International Relations Institute of Cameroon (IRIC).

The school was created by presidential decree N° 71-DF-195BIS of April 24, 1971 as the fruit of a co-operation accord signed between the governments of Cameroon and Switzerland in January 1963. It trained student diplomats and carried out research in the domain of International relations. Studies at IRIC are carried out at three levels: Diplomatic training - a nine-month course for personnel of Foreign Affairs Ministry; Professional 'maîtrise' -

a one-year course for holders of the first degree; and the doctorate - a two-year course for holders of the professional 'maîtrise' in International Relations.

Enrolment in the professional schools was only about 15 per cent of the total student population in the former University of Yaounde. The most populated among them was ENS with often more than 60 per cent of total enrolment in professional schools. This was followed by CUSS, ENSP, ESSTIC, and IRIC was always the last. For example, in 1991/92, enrolment was 2921 (74.16 per cent), 558 (14.28 per cent), 308 (7.88 per cent), 82 (2.10 per cent) and 38 (0.97 per cent) in ENS, CUSS, ENSP, ESSTIC and IRIC respectively. The disparity in enrolment in these schools was due to employment opportunities created by the government in the various sectors of the economy. For example, the high demand for secondary education meant a high derived demand for secondary education teachers. Government therefore admitted many students into ENS than any other professional schools because the educational sector needed more workers than the others

The distribution of the teaching staff followed a similar trend in absolute terms. Still in the 1991/92 academic year, the number of teachers were 143 (39.18 per cent), 122 (33.45 per cent), 82 (22.47 per cent), 10(2.75 per cent) and 8(2.19 per cent) in ENS, CUSS, ENSP, ESSTIC and IRIC respectively. The number of teachers in ESSTIC and IRIC remained low because these establishments used a high number of part-time teachers not included in our count of the academic staff.

Despite its many teachers, ENS had the highest number of students per teacher as a result of the high number of students enrolled. This got to a maximum of 20.4 students per teacher in 1991/92. The least student-teacher ratio in the professional schools was 3.4 recorded in 1976/77 in the ENSP. This represented an under -utilisation of the teaching staff. Table 3.9 shows the ratio for selected years for the professional schools of the former University of Yaounde. The average student-teacher ratios for these establishments were as follows: 11.7, 6.2, 4.6, 11.3, and 7.7 for ENS, CUSS, ENSP, ESSTIC and IRIC respectively. When all the professional schools are put together, the ratio fluctuates between 7.1 and 10.7. These ratios for selected years are equally presented in the last column of Table 2.9. The increase in the ratio in the latter years can be attributed to rising enrolment in ENS, as enrolment in the other professional schools was almost stagnant.

Table 2.9: Student-teacher ratios for selected years in the professional schools.

Year	ENS	CUSS	ENSP	ESSTIC	IRIC	ALL
1971/72	8.8	6.3	4.4	12.5	—	7.9
1975/76	15.9	6.9	4.4	14.3	18.3	9.4
1979/80	12.3	6.5	6.1	9.4	12.0	8.7
1983/84	12.8	5.7	5.2	9.1	5.0	8.7
1987/88	15.0	4.5	5.0	15.0	4.0	8.8
1991/92	20.4	4.6	3.8	8.2	4.8	10.7

Source: Admission Offices of the various establishments.

In terms of direct budget allocations to these professional schools, the teacher training college (ENS) always had the largest packet. Even when all the establishments of the University of Yaounde were considered, ENS was second only to the FS. The huge budget of ENS can be attributed to the fact that it operated on three separate campuses in the past: Yaounde, Bambili and Douala (though the Douala campus has been closed now). The budget of ENS also covered the running of the Government Bilingual Practising School in

Yaounde. ENS was followed by CUSS, ENSP and in decreasing order. IRIC, though part of the University of Yaounde, enjoyed financial autonomy, and its budget did not fall under that of the University of Yaounde. The budget allocations for 1989/90 were as follows: 1293, 815, 399 and 186 million CFA francs for ENS, CUSS, ENSP and ESSTIC respectively. As was the case with the faculties, an important part of these budgets was spent on personnel (academic) salaries and benefits. Usually this was more than 50 per cent, and at times as high as 65 per cent in the medical school.

The cost of educating a student in the professional schools was very high when compared with those in the faculties. The medical school had the highest cost per student, followed by ENSP, ENS and ESSTIC. Tafah (1989, p.53) gave the following cost per student for 1983/84: 2.45 million FCFA for CUSS; 2.13 million FCFA for ENSP; and 1.49 million FCFA for ENS. He calculated the comparative cost of educating students in the professional schools and the faculties in that same year and obtained the following results (p.54): the cost of training a student in CUSS was equivalent to educating six students in the FDSE, four in the FLSH and four in the FS. Equivalent figures for ENSP were five, three and three; and four, two and two for ENS. This strongly demonstrates the disparity in cost per student between the professional schools and the faculties.

This high per student cost in the professional schools was not only the result of large budgetary allocations, but to a large extent due to the small number of students enrolled by these professional schools. This means that efficiency gains (in terms of reduced unit cost) could be reaped if enrolment in these schools is increased, as this will not only reduce unit cost, but also increase class size. It should also be noted that these efficiency gains from increased enrolment can adversely affect the quality of education. A compromise is therefore necessary between increasing enrolment and falling educational quality.

It follows from our discussions above that in the former University of Yaounde, more human and financial resources were accorded the Professional Schools than the Faculties. This is evidenced from the very low student-teacher ratios and very high costs of educating students in these schools. The result was a very high success rates recorded by these establishments. Drop-out was almost non-existent and repetition very negligible. This strongly contrasted with the situation in the faculties where the success rate was less than 25 per cent in some classes and drop-out and repetition were common place.

2.4.2 THE UNIVERSITY CENTRES

After the University of Yaounde, the other main suppliers of higher education in Cameroon were a group of institutions officially called the University Centres. The creation of these institutions was a follow-up of the recommendations of the Council of Higher Education and Scientific and Technical Research of December 1974. The purpose of the university centres as outlined by article 3 of this decree was to provide education, conduct research and carry out production-oriented programmes for development. Another reason was to decongest the University of Yaounde, whose infrastructure was under enormous pressure. This was also a first step in the decentralisation of the University of Yaounde out of the capital city.

The University Centres functioned almost like the professional schools of the University of Yaounde. Students were trained for specific duties in the society, entrance was through a competitive examination and graduates were recruited into the public service from the beginning. Their campuses were located in the towns of

Buea, Douala, Dschang and Ngoundere. As we shall see in Section 3.5 below, these university centres were transformed into full-fledge universities by the 1993 university reforms.

2.4.2.1 The Dschang University Centre

This University Centre (now the University of Dschang) was specialised in agricultural related studies. It had as objective to cameroonise agriculture at the level of experts on the field, the management of para-public enterprises, rural animation, and also to encourage young graduates to establish as farmers instead of looking up only at the government for employment. The Dschang University Centre consisted of two establishments: National Advanced School of Agronomy ('Ecole Nationale Supérieure Agronomique' - ENSA) and the Institute of Agricultural Techniques ('Institut des Techniques Agricoles' -ITA). ENSA was created in 1973 to replace Advanced Federal School of Agriculture ('Ecole Fédérale Supérieure d'Agriculture - EFSA). It operated in Nkolbisson (in the neighbourhood of Yaounde) until 1985 when it was transferred to Dschang. ENSA admitted General Certificate of Education (Advanced Level) holders for a five-year course leading to the award of the Diploma of Agronomic Engineer. ITA on the other hand started operating in September 1977 with two cycles. Cycle A trained G.C.E - Advanced Level holders for the 'Diploma d'Ingenieur des Travaux Agricoles', while cycle B prepares 'probatoire' holders for the diploma of Agricultural Technicians, both after a three-year course.

2.4.2.2 The Douala University Centre.

This University Centre became functional as from 1979 with the principal objective of training business managers and teachers of technical secondary education. It functioned with two establishments: The Advanced Teachers Training School for Technical Education (Ecole Normale Supérieure d'Enseignement Technique -ENSET) and the Advanced School of Economics and Commerce (Ecole Supérieure des Sciences Economiques et Commerciales - ESSEC). ENSET had as duty to train technical secondary education teachers. Student teachers were admitted in two sections: that for administrative and economic techniques, and that for industrial techniques. The minimum requirement to sit for the entrance examination was the G.C.E - Advanced Level or Baccaulaureat in the technical or scientific fields. ESSEC on its part was a school for business management studies. Students specialised in either the techniques of management or in commercial techniques. Studies lasted for four years and were punctuated by field work in enterprises. It should also be noted that ESSEC succeeded the Institute for the Administration of Enterprises which existed formerly in Yaounde. This University Centre is now the university of Douala as we shall see latter in this chapter.

2.4.2.3 The Ngaoundere University Centre.

This institution became operational in 1982 with only one establishment: the National Advanced School of Food processing Industries (Ecole nationale Supérieure des Industries Agro-Alimentaire du Cameroon - ENSIAAC). ENSIAAC was specialised in the training of engineers and technicians in food processing like bakery, brewery food conservation and conditioning, and other domains. Due to the nature of its studies, it maintained very close links industries. ENSIAAC students visited these industries for the practical part of their studies, some industrialists also delivered part-time lectures related to the food transformation process in this institution. Students were admitted here through a competitive examination for holders of the G.C.E - Advanced Level or 'Baccaulauréat' in the sciences, for a three-year course. They were awarded the 'Diploma d'Ingenieur de Travaux en Agro-Alimentaire'. Students from the Faculty of Science of the former University of Yaounde were also admitted on completion of two years of study in the University. They underwent a three-year course and were awarded the 'Diploma d'Ingenieur de Conception en Agro- Alimentaire'. The Ngaoundere University Centre became the University of Ngaoundere with the reforms as we shall see latter.

2.4.2.4 The Buea University Centre.

This University Centre was the last among all those created in 1977 to become operational. It started functioning in 1985/86 with a single establishment: the Advanced School of Translators and Interpreters (ASTI). It was also initially supposed to accommodate the language course transferred from the University of Yaounde. ASTI admitted only first degree holders for a two-year course in translation and interpretation. Before the transformation of the Buea University Centre into the University of Buea, ASTI remained its only establishment though others had been previewed by the decree of creation.

2.4.3 HIGHER EDUCATIONAL INSTITUTIONS ATTACHED TO MINISTERIAL DEPARTMENTS.

Apart from the University of Yaounde and the University Centres, higher education in Cameroon is also provided by other institutions directly linked to particular ministries. They carry out professional training in specific fields and graduates are immediately absorbed into the public service. Recruitment into these institutions is through highly competitive examinations and only a few students are admitted. The numbers have been reducing further since government decided to cut down on employment in the public service. These institutions include the following:

a) The National School of Administration and Magistracy (ENAM)

This was the first educational institution created in Cameroon in 1959. It is placed under the authority of the Ministry of Public Service. ENAM trains administrative, financial, social and judicial personnel for the Public Service. It also retrains those already on the field and carries out research and documentation in the field of administration. ENAM now admits only candidates who have at least a first degree or civil servants of category 'B' with a working experience of at least five years. Studies last for two years.

b) The School of Post and Telecommunications (ENSPT).

This establishment was created in 1969 and placed under the auspices of the Ministry of Post and Telecommunications. It trains specialists for service in the Ministries of Post and Telecommunications, Armed Forces and Communication. It compromises two divisions: A technical division for telecommunications and an administrative and operation division for postal services. ENSPT now recruits students at three levels: holders of G.C.E - Ordinary Level (or its equivalents) for post and telecommunication agents; G.C.E - Advanced Level (or its equivalents) as post and telecommunication controllers; and first degree holders as post and telecommunication inspectors. It equally admits those already on the field for refresher courses.

C) The National School for Social Affairs Assistants (ENAAS).

It is attached to the ministry of Social and Women's Affairs. ENAAS was created in 1962 with the mission to train educators and social assistants. It has three cycles, but only cycle 'B2' admits postsecondary students. Courses here last for two years with the acquisition of the 'State Diploma for principal Assistants of Social Affairs' (Diplôme d'Etat d'Assistant Principal des Affaires Sociales). Apart from Cameroon government students, other non-governmental bodies and foreign governments also send students to the school. For quiet a number of years now, this school has not been admitting students, but has not been officially closed.

d) The Military Academy (EMIA)

This school is placed under the authority of the Ministry of Defence. It has as mission to train senior military officers for the army. Students are admitted at two levels for a two-year course: degree holders who graduate as Lieutenants in the army , and second year university students or military men who have obtained the G.C.E - Advanced level (or its equivalents), who graduate as Sub-lieutenants. EMIA also admits foreign students presented by their governments.

e) The National School of Public Works (ENSTP)

This school was created in 1970 and placed under the Ministry of Public Works and Equipment. It had as mission to supply senior staff for public works, urban development and the agricultural sector. ENSTP now admits only secondary education graduates for a three-year course qualifying as engineers, the other sections having been suspended. It offers courses in civil engineering, rural engineering, topography and urbanisation. An annex operates in Buea for the training of technical agents and technicians of a lower level.

f) The National School of Youths and Sports (INJS).

This was created in 1972 and became operational in 1974. INJS comprises two sections: Physical and sports education, and youth counselling and animation. There are also two cycles: cycle one admits secondary education graduates for a three-year course leading to the award of the diploma of youth counsellors and animation (Diplôme de Conseiller de Jeunesse et d'Animation) or the diploma of teachers of sports and physical education (Diplôme de Professeur d'Education Physique et Sportive). Cycle two admits either secondary graduates for a five-year course or degree holders for a two-year course. Graduates are awarded the diploma of principal youth counsellors and animation (Diplôme de conseiller Principal de Jeunesse et d'Animation) or the diploma of certified teachers of physical and sports education (Diplôme de Professeur Certifié d'Education Physique et Sportive). Graduates are employed by the Ministry of National Education for physical education teachers, and the Ministries of Agriculture and Social and Women's Affairs for counsellors and youth instructors.

g) The National Police Training School.

This school is attached to the Secretariat of Internal Security. It trains personnel for the police force. Students admitted range from G.C.E - Ordinary Level holders to degree holders. Graduates obtain ranks ranging from Police Inspectors to Police Commissioners.

2.4.4 HIGHER EDUCATIONAL INSTITUTIONS WITH REGIONAL OR INTERNATIONAL STATUS.

The geographical position of Cameroon on the African continent has attracted a number of regional and international professional training institutions into the country. Apart from professional training and retraining, these schools also carry out studies and research related to the programmes they offer. We now briefly examine these institutions.

a) The Institute for Demographic Studies (IFORD)

IFORD is the fruit of an accord signed between the Cameroon government and the United Nations Organisation (UN) in November 1971 on the recommendations of the UN's mission for demographic programmes in Africa. IFORD covers the needs of twenty-five French-speaking[2] African countries in providing specialists in population issues. It admits only first degree holders presented by their home governments for a single-cycle two-

[2] Its counterpart exist in Ghana - Regional institute for Population Studies (RIPS) for English-speaking Africa.

year course. Graduates are awarded the diploma of advanced specialised studies in demography (Diplôme d'Etudes Superiéures Specialisées en Demographie - DESSD). This establishment was attached to the University of Yaounde II after the 1993 University Reforms.

b) The International Insurance Institute (IIA).

IIA is an international professional institution created in 1972. It has as mission to train insurance technicians for twelve French-speaking West and Central African countries. It also carries out research and gives technical assistance to insurance companies. Today, admission into IIA is opened to citizens of the fourteen member-states of the inter-African Conference of Insurance Markets (Conference Inter-Africaine des Marchés d'Assurances - CIMA) and candidates are officially presented by their country of origin. These member-states also finance this institution. IIA trains four different categories of students: Insurance technicians, Higher insurance technicians, Senior insurance staff and Senior specialised insurance staff. It admits students with 'Probatoire', 'Baccaulauréat', 'Licence' and 'Maîtrise' or the next inferior diploma awarded by IIA (with working experience) for the various categories.

c) The Sub-Regional Institute of Statistics and Applied Economics (ISSEA).

This institute was created in 1961 as the International Centre for Statistical Training (CIFS) under the auspices of the UN and the Cameroon government. Presently, it belongs to, and is financed by member-states of the Customs Union for Central African States (UDEAC). ISSEA trains students in statistics and applied economics in three different cycles: the cycle for technical agents admits 'BEPC' holders for a nine-month course. The cycle for technical assistants enrols students with 'Baccaulauréat' for a two-year course, while the cycle for statistical engineers trains 'Baccaulauréat' holders for three or four years (depending on the grade scored in the entrance examination). ISSEA has trained students from about twenty-one African countries.

d) The Pan-African Development Institute (PDI).

There exist two of these institutes in Cameroon: One in Douala for francophone Central Africa, and the other in Buea for anglophone west Africa[3]. These schools are concerned with training, research and consultancy in development-related issues. The initiative to create such institutions came in 1964 among some African personalities concerned with decolonisation problems. The objective was to train Africans to efficiently replace departing expatriates after colonisation. Three study options are offered: regional development and planning, management of enterprises and co-operatives, and the training of trainers (only in the Douala institute).

2.4.5 HIGHER EDUCATIONAL INSTITUTIONS IN THE PRIVATE SECTOR.

We classify under this category all higher educational institutions not under the control of the government. The administration and finance of these institutions is in the hands of private individuals or non-governmental bodies. As for institutions belonging to non-governmental bodies, we can distinguish those owned by religious authorities in Cameroon. The most prominent here is the Central African Catholic University located on the outskirts of Yaounde. The nature of studies in this University is similar to that offered in any traditional

[3] The remaining two in Africa are in Ouagadougou (Burkina-Faso) for francophone West Africa, and in Kaboue (Zambia) for Southern Africa.

university institution. For the moment, studies are effective only in the arts and social sciences. Secondly, we have those religious institutions which are specialised only in theological teachings. They train priests and pastors who work for their various religious denominations. Here we can cite the Faculty of Protestant Theology in Yaounde, the Presbyterian seminary in Kumba, the Baptist Seminary in Ndu, and the major Seminaries of Nkolbisson and Bambili.

The other institutions in the private sector, we consider as higher education are those created and managed by individuals or groups as business enterprises with profit motives. In Cameroon, these are mostly limited to two-year postsecondary institutions which offer professional training leading to the award of an undergraduate diploma known as the "Brevet de Technical Superieur" (BTS). Some private institutions offering BTS courses in Cameroon include: 'Institut Samba Superieur' and 'Institut Siantou Superieur' in Yaounde, 'Ecole Superieure de Gestion' and 'Institut de Technologie de l'Information' in Douala, and the 'Groupe Tankou Enseignement Superieur' in Bafoussam and many others. Recently, two postsecondary institutions have been approved in Bamenda: the Nacho University of Cameroon and the Polytechnic of Bamenda.

'Institut Samba Superieur' deserves some attention here because of the ambitious projects of its management. It started operating in the 1992/93 academic year with only 105 students. In 199495, it enrolled 1333 students - the only number of places it could offer since the demand was much greater. This school presently offers BTS courses in nine disciplines including journalism, photography, home economics, marketing, business communication, hotel management, computer studies, accounting and management, and secretaryship. This institution charged a fee of about 195,000 CFAF (1995) which is far less than what is taken annually by the

Catholic University. It is however facing some difficulties, like the lack of well equipped laboratories and workshops, and the lack of qualified staff in some disciplines like photography. The proprietor intends to transform this institute into a full-fledge university and construction work is nearing completion on a permanent site.

In the face of rising demand for higher education (the combined effect of population growth and increased access to education), private higher educational institutions offer an alternative for expanding access without adding to government expenditure. Private universities are then expected to join as partners in the production of skilled human resources. The likely problem to be faced by the development of this sector is that private higher education is expensive to provide and consequently costly to attend. The more private higher education is job-oriented, the more students it will attract and this will equally help reduce the lost in foreign currency spent on studies out of the country.

Private institutions can be more efficient as they are more flexible in responding to changing demands from students and employers. But much care must be taken to see to it that some minimum quality is upheld in this private institutions. A supervisory authority or body can be created to take care of this, especially in situations where these schools award their own certificates. If accreditation is done by the Ministry of National Education (as is the case with

BTS), then supervision should be very limited or eliminated. In this way, private institutions can make a positive contribution to the country's human resource development.

2.5 UNIVERSITY EDUCATION IN CAMEROON AFTER THE 1993 UNIVERSITY REFORMS.

The President of the Republic in January 1993, signed a series of decrees greatly transforming the landscape of university education in Cameroon. These decrees have been compiled and published by the Ministry of Higher Education under the title "University Reforms in Cameroon" (La Reforme Universitaire au Cameroon). This document outlines four principal problems which confronted university education in Cameroon and which consequently motivated the 1993 reforms: a very low teacher-student ratio, low internal and external returns, the dominance of welfare services in the university budget and a demoralisation of the university community (p.10). In this section, our aim is to present the various university institutions in Cameroon after the reforms.

An important aspect of these reforms, which is of interest to us in this chapter was the decentralisation of university education in the country. An initial attempt was made in 1977 with the creation of four University Centres. These failed in decongesting the former University of Yaounde because they were highly specialised, entry was very selective and only a few courses were offered. The reforms started with decree N°92-74 of 13th April 1992, transforming the University Centres of Buea and Ngaoundere into full universities. The decentralisation was further expanded by decree N°93-026 of

19th January 1993, which created the universities of Douala, Dschang, Yaounde I and Yaounde II.

In the paragraphs that follow, we list the various establishments of the six universities now existing in Cameroon , as outlined by the presidential decrees of 1993. It should be noted that some of the establishments listed below are not yet operational but are provided for by the decrees organising the various university institutions.

2.5.1 THE UNIVERSITY OF NGOUNDERE.

The academic and the administrative organisation of this University is defined by decree N°93-028 of 19th January 1993. The establishments of this institution are outlined by article 107 of this decree as follows:

Faculties

-Faculty of Letters and Social Sciences

-Faculty of Law and Political Sciences

-Faculty of Economics and Management

-Faculty of Sciences

-Faculty of Education

Professional Schools (Les Grandes Ecoles).

-The Advanced school of Agro-Industrial Sciences

-The School of Geology and Mineral exploitation

-The School of Veterinary Science and Medicine

-The School of Chemical Engineering and Mineral Industry

-The University Institute of Technology

2.5.2 THE UNIVERSITY OF DSCHANG

Article 107 of decree N°93-029 of 19th January 1993 attributes the following establishments to the university of Dschang:

Faculties

-Faculty of Letters and Social Sciences

-Faculty of Law and Political Sciences

-Faculty of Science

-Faculty of Agronomy and Agricultural Science

Professional Schools

-The Fotso Victor University Institute of Technology (Bandjoun)

-The Institute of Fine Arts (Foumban)

2.5.3 THE UNIVERSITY OF DOUALA

The various establishments of this institution are outlined in article 107 of decree N°93-030 of 19th January 1995 as follows:

Faculties

-Faculty of Letters and Social Sciences

-Faculty of Law and Political Sciences

-Faculty of Industrial Engineering

-Faculty of Economics and Applied Management

-Faculty of Science

-Faculty of Medicines and Pharmaceutical Science

Professional Schools

-The University Institute of Technology

-The Advanced School of Economics and Commerce

-The Institute of Fine Arts

-The Institute of Fishery Science

2.5.4 THE UNIVERSITY OF BUEA

The University of Buea is organised by decree N°93-034 of 19th January 1993. Article 49 of this decree lists the establishments which constitute this institution as follows:

-The Faculty of Arts

-The Faculty of Education

-The Faculty of Sciences

-The Faculty of Health Science

-The Faculty of Engineering and Technology

-The Faculty of Agriculture and Veterinary Medicine

-The Faculty of Social and Management Studies

-The Advanced School of Translators and Interpreters

-The College of Technology

2.5.5 THE UNIVERSITY OF YAOUNDE I.

Article 107 of degree N°93-036 of 19th January 1993 enumerates the various establishments which make up this institution as follows:

Faculties

-The Faculty of Arts, Letters and Social Sciences

-The Faculty of Science

-The Faculty of Medicine and Biomedical Sciences

-The Faculty of Education

Professional Schools

-The National Advanced School of Engineering

-The Advanced Teachers' Training School

-The University Institute of Wood Technology

2.5.6 THE UNIVERSITY OF YAOUNDE II.

The establishments of this institution are listed in article 107 of decree N°93-037 of 29th January 1993 as follows:

Faculties

-The Faculty of Law and Political Science

-The Faculty of Economics and Management

Professional Schools

-The Advanced School of Mass Communication

-The International Relations Institute of Cameroon

-The Institute for Demographic Training and Research

The comment we can make on the decentralisation of higher education in Cameroon is that despite the continuous insistence on the professionalisation of studies in the Faculties, the Professional Schools continue to exist side-by-side the Faculties, and in some cases, a Faculty and a Professional School in the same University are expected to do virtually the same thing. For example, in the University of Yaounde I, we have the Faculty of Education and the Advanced Teachers' Training School (ENS) which are practically supposed to do about the same thing. This is the very case in the University of Buea where we have a Faculty of Engineering and Technology, and a College of Technology, and also in the University of Douala with the

Faculty of Economics and Applied Management and the School Economics and Commerce (ESSEC). Though all of these establishments are not yet functional in some of these Universities, their inclusion in the decree of creation implies that sooner or latter, they will become operational. It is our wish that the objectives of these establishments be clearly spelt out before they go operational. This will avoid duplication and the financial burden this would have entailed on the Universities concerned.

Another comment we can make on the structure of higher education in Cameroon emanating from the reforms concerns the creation of some particular establishments in almost all the universities. An example is the College or Institute of Technology which exists in five of the six universities. If all these colleges were to become operational, and given the limited financial resources of these universities, the quality of education offered might not be guaranteed. These colleges will be inadequately equipped and staffed, as scarce human and material resources will be spread widely among these schools. Enrolment from the start will be low, thus leading to low student-teacher ratios and high per student cost. In order to reap economies of scale and assure high standard of learning, just one or two of these colleges should be allowed to operate. The general objective therefore, should be to make universities specialise in particular disciplines so that responsibilities are shared and education produced more efficiently.

2.6 CONCLUSION

Following the discussions above, one can conclude that the development of higher education in Cameroon is virtually at the end of the initial phase which Saint (1992 p.3) describes as consisting of the creation and expansion of national systems of higher education and employing them to meet critical human resource needs in the public sector following independence. This phase started with the creation of the Cameroon School of Administration in 1959 and the National Institute of University Studies in 1961 - latter to become the University of Yaounde and the nucleus of higher education in Cameroon until decentralisation in 1993. Other more career-oriented institutions were also established by the government in addition to a number of regional schools located in Cameroon. A more recent phenomenon in the higher education sub-sector has been the creation of private institutions like the Catholic University of Central Africa and several two-year postsecondary establishments which prepare students for non-degree diplomas like the 'Brevet de Techniciens Supérieur' (BTS).

After this first phase of creation and expansion, the next phase now has to deal with issues concerning financing, efficiency, relevance and the quality of learning. These pre-occupations are necessary if higher educational institutions have to remain the principal source of skilled labour and technical knowledge needed to guide national development.

PART TWO:

THEORETICAL FRAMEWORK AND EMPIRICAL ANALYSIS

Part Two of this study presents the methods of analysing the data and the results from our estimations. We specify our production and cost function models, describe how they will be estimated, and how potential statistical problems will be solved in Chapter Three. While Chapter Four estimates and presents the results of the models specified in Chapter Three.

CHAPTER THREE

SPECIFICATION AND ESTIMATION PROCEDURES OF THE EDUCATIONAL PRODUCTION AND COST FUNCTIONS

3.1 THE EDUCATIONAL PRODUCTION FUNCTION

3.1.1 INTRODUCTION

The production of any good or service, for example, bread or medical care requires valuable resources, consisting of various kinds of labour, capital, land and entrepreneurial ability. Like all other producing entities, the management of educational institutions decides on the types and amounts of production, on the types and amounts of resources, and on the way these resources are to be organised. The educational production process can therefore be modelled by establishing a relationship between educational inputs and output. This relationship is known as the educational production function in studies of human capital formation. It is defined simply as a statistical relationship linking student outcomes to characteristics of the students, their families and other students in the school, as well as characteristics of their schools. This function is used to assess the internal efficiency of an educational system or institution. As noted by Bowles (1970, p.12), "in setting school policy and in long-range educational planning, knowledge of the educational production function is essential to efficient resource allocation." The educational production function as used in human capital theory is an adaptation of the neo-classical production function which we briefly present in the following section.

3.1.2 THE NEO-CLASSICAL PRODUCTION FUNCTION

The production function expresses the maximum amount of output capable of being produced by each and every set of specified input combinations in the existing state of technical knowledge. It can be presented in mathematical, graphical and tabular forms. Under neo-classical assumptions, the production function is a single-valued mapping from input space into output space in as much as the maximum attainable output for any stipulated set of inputs is unique (Ferguson, 1969). Two broad categories of production functions are distinguishable in production theory: fixed- and variable-proportions production functions.

A production process is said to be characterised by fixed proportions if, and only if, each level of output technologically requires a unique combination of inputs. In this case, only one combination of inputs can produce a specified output. This is frequently called a Leontief function. A fixed proportions production function can be represented as follows:

$$Q = Minimum(\frac{x_1}{\alpha_1}, \frac{x_2}{\alpha_2}, \ldots, \frac{x_n}{\alpha_n}) \qquad [3.1]$$

where Q is the maximum attainable output,

($x_1 \ldots x_n$) are the quantities of inputs,

($\alpha_1 \ldots \alpha_n$) denote constants, and

"Minimum" means that Q equals the smallest of the ratios (x_i/α_i).

At any observable production point[1] on the fixed-proportions production function, the following relation must hold:

[1] A production point is a point at which no input is redundant.

$$\frac{x_1}{\alpha_1} = \frac{x_2}{\alpha_2} = \cdots = \frac{x_n}{\alpha_n} \qquad [3.2]$$

If not, only the input with the lowest ratio will determine the level of output and a fraction of inputs with higher ratios will stay redundant.

The second category of production functions is that with variable proportions. Here, the same level of output can be produced by two or more combinations of inputs; in other words, one input can be substituted for the other continuously in such a way as to maintain a constant level of output. This is the essential technological feature of the variable-proportions production function. This second category ties in with one of the objectives of this study, which is to determine the relative importance of the various educational inputs in a bit to proposing a substitution of the less effective with the more effective inputs. The variable-proportions production function can be expressed as follows:

$$Q = f(x_1, x_2, \ldots, x_n) \qquad [3.3]$$

Where Q is the output and x_i the inputs.

A number of assumptions are made concerning this variable proportions production function[2].

a) It is everywhere continuous and well defined over the range of inputs yielding non-negative output. It thus admits continuous first and second order partial derivatives.

b) The inputs are assumed to be continuously variable - they are real variables defined over the non-negative domain of real numbers.

2 This analysis is abridged from Ferguson (1969, Chapter Four)

c) The production function is assumed unchanging, it is given and admits neither technological progress nor retrogression.

d) The inputs remain unchange in character and homogenous within themselves.

e) Finally, the behaviour of a single-product firm is assumed and a perfect competitive market for inputs and output.

Given the above assumptions, we can use the production function presented in equation [3.3] to obtain the marginal productivity (MP) of any given input. The MP of x_1 is the rate of change of total output in relation to the variation of its quantity - the partial derivative of equation [3.3] with respect to x_1.

$$MP_{x_1} = \frac{\partial Q}{\partial x_1} = \frac{\partial f(x_1, \cdots x_n)}{\partial (x_1)} \qquad [3.4]$$

We can in a similar way obtain the MP for any other input.

The above discussion deals only with the technical aspects of production theory in which economic magnitudes such as input and output prices are not introduced. We now take into consideration the much more important part of the theory which requires the use of economic criteria in the allocation of inputs. The assumptions outlined above regarding the continuous production function are retained here.

The economic criterion in this optimal input combination problem is that the largest output be produced for any stipulated expenditure upon resources. This problem, in other words, involves the maximisation of output subject to a given level of cost. It can be formulated as follows:

Maximise $$Q = f(x_1, x_2, \ldots, x_n) \qquad [3.5]$$

Subject to $$\bar{c} = \sum_{i=1}^{n} p_i x_i \qquad [3.6]$$

where p_i denotes input price and $\bar{c}$ is the constant stipulated level of cost. Q and x_i apply as above. To solve this problem, we first construct the Lagrange function:

$$L = f(x_1,...,x_n) - \lambda(\sum_{i=1}^{n} p_i x_i - \bar{c}) \qquad [3.7]$$

The first order conditions for a constrained maximum are that all partial derivatives of equation [3.7] equal zero. Performing the differentiation we obtain:

$$\left.\begin{aligned} \frac{\partial L}{\partial x_i} &= f_i - \lambda p_i = 0 \\ \frac{\partial L}{\partial \lambda} &= \sum_{i=1}^{n} p_i x_i - \bar{c} = 0 \end{aligned}\right\} \qquad [3.8]$$

f_i is the first partial derivative of the production function with respect to x_i. Expression [3.8] provides (n+1) equations to solve for (n+1) unknowns ($x_1,...,x_n$) in terms of the (n+1) parameters ($p_1,...,p_n$, $\bar{c}$).

Solving [3.8] we obtain:

$$\frac{f_1}{p_1} = \frac{f_2}{p_2} = \cdots = \frac{f_n}{p_n} \qquad [3.9]$$

This states that the optimal input combination is attained at the production point where the marginal productivity of the last franc spent on resources is the same in every use. That is, the marginal productivity of a franc's worth of any resource must equal the marginal productivity of a franc's worth of any other resource (Ferguson 1969, pp.132-3).

The above development of the neo-classical theory of production is based on very restrictive assumptions. These assumptions would hardly hold when confronted with the actual behaviour of a production unit and more especially when it concerns the production of education - the object of this particular study.

3.1.3 LIMITATIONS OF THE EDUCATIONAL PRODUCTION FUNCTION

Despite the fact that we view the educational establishment as a production entity - a process which involves the commitment of inputs to obtain an output, the realities of education differ considerably from the pedagogical assumptions of the production function outlined in standard neo-classical theory. Some of the peculiarities of educational production are as follows:

School administrators know very little about the production process and do not therefore, select or alter inputs with a view to optimising any well-defined function of school output. This is more so for higher education in Cameroon which was still of recent a state monopoly. The reason being that political and social considerations do not always tie with economic optimising decisions.

Secondly, the output of the education industry is multi-dimentional and produced simultaneously. The homogenous and single output assumptions are therefore violated. The output is both quantitative and qualitative, and measurement is not at all evident. Researchers in the field are not yet agreed on any measure(s) to be used to evaluate the activities of the educational system.

Thirdly, in education, unlike in other producing sectors, the decision-maker has no control over some of the inputs which intervene in the educational production process. He can control school environmental characteristics, but education is also influenced by family background variables and students' ability and initial level of learning which are out of his control. This makes efficient production very difficult.

Also, in education, inputs can not be selected as in a factory. There is yet no unanimity on any class of inputs and the methods of measurement to be used. The assumption of homogenous inputs is hardly tenable in educational production. No two teachers can be the same even if they have the same qualification and the same years of experience. In addition, the market for educational inputs is hardly perfect, especially in Cameroon, and more so in higher education where the government is almost the sole buyer - we have some sort of a monopsony market situation[3].

Furthermore the data set for educational production is rather imperfect: the collection of family background data from students or pupils is plagued by a lot of inaccuracy and many variables are omitted simply for lack of an appropriate measure, and the use of proxies implicitly admits the existence of measurement errors. In a critical remark regarding the specification of inputs in educational production function analysis, Hanushek (1979, p.363) noted that, "there is little conceptual clarity, and

[3] This was more evident with the recruitment of higher education teachers in Cameroon in the period of the former University of Yaounde.

the choice of inputs seems, sometimes explicitly, to be guided by data availability rather than any notion of conceptual desirability".

The above problems beset the direct application of a model such as the neo-classical production function to the educational production process. This implies that, if the prescription of equating the ratios of marginal productivity to prices over all inputs

$$\frac{MP_1}{p_1} = \frac{MP_2}{p_2} = \cdots = \frac{MP_n}{p_n} \qquad [3.10]$$

is applied to the input coefficients which emerge from an estimated educational production function, efficient allocation of resources will almost certainly not occur.

Despite all these limitations, many researchers have continued to estimate educational production functions to evaluate efficiency in human capital investments. They have had to compromise between what is conceptually desirable and the shortcomings inherent in the study of educational production functions. The objective in this sort of analysis is therefore to improve on the efficiency of resource allocation (reduce the gap between the ratios - MP_i/P_i) rather than achieve optimum resource allocation.

3.1.4 THE PRODUCTION FUNCTION FOR HIGHER EDUCATION IN CAMEROON

As we mentioned earlier in the introduction, the production of education requires valuable resources. The school organisation is seen as a firm which receives material inputs and transforms these resources into the production of educated individuals. The general form of the educational production function has been specified by some authors (Bowles 1970, Hanushek 1979, and Simmons and Alexander 1978) as follows:

$$A = f(F, S, P, I) \qquad [3.11]$$

Where,

A - denotes some measure of school output (such as academic achievement),

F - refers to the vector of family background characteristics,

S - is the vector of variables measuring school environmental inputs,

P - stands for vector of peer group characteristics, and

I - refers to vector of variables representing students' ability and the initial level of learning attained by the student prior to entry into the level of school in question.

The above specification which assumes availability of data on all the variables may not be very suitable in our case because of the reasons advanced above concerning the measurement of educational production function variables. For this study on the former University of Yaounde, we specify a model that we hope appropriately describes the production process. The assumption underlying this study is that the school authorities can identify the goods and services, or factors of production most likely to raise academic achievement, and then reallocate resources in favour of such factors. This implies that we shall place emphasis only on policy variables - those inputs which can be manipulated or controlled within a given time by the university authorities with the aim of improving the production efficiency of the educational system. Policy variables fall under the category of school environmental inputs (S).

3.1.4.1 The Statistical Models and Definition of Variables.

We specify the following implicit educational production function relating academic performance to school environmental resources for higher education in Cameroon.

$$L_t = f(NSS_t, TTS_t, TSS_t, XPS_t, STR_t, ENT_t)$$

Where,

L_t = Measure of academic achievement. This is proxied here by the number of first degrees ('Licences') awarded at time t.

PL_t = This is the percentage of all students awarded first degrees - a relative measure of performance in each faculty at time t.

ENT_t = The total number of students enrolled at time t.

TTS_t = Total number of the teaching staff at time t.

TSS_t = Real average salary of the teaching staff at time t.

STR_t = Student-teacher ratio at time t - a proxy for class size.

BSR_t = Book-student ratio - the number of library books per student at time t.

XPS_t = Expenditure per student at time t.

NSS_t = Number of students benefiting from scholarships at time t.

a_j and b_j are parameters to be estimated.

These are a set of parsimonious variables which we believe should depict the central issues in the production process. The production functions for higher education in Cameroon to be estimated are as follows:

$$P_1: \quad L_t = a_0 + a_1NSS_t + a_2TTS_t + a_3TSS_t + a_4XPS_t + a_5STR_t + \varepsilon_t \qquad [3.12]$$

$$P_2: \quad L_t = b_0 + b_1NSS_t + b_2TTS_t + b_3TSS_t + b_4XPS_t + b_5ENT_t + \varepsilon_t \qquad [3.13]$$

$$P_3: \quad logL_t = loga_0 + a_1logNSS_t + a_2logTTS_t + a_3logTSSt + a_4logXPS_t + a_5logSTR_t + \varepsilon_t \qquad [3.14]$$

$$P_4: \quad logL_t = logb_0 + b_1logNSS_t + b_2logTTS_t + b_3logTSS_t + b_4logXPS_t + b_5logENT_t + \varepsilon_t \qquad [3.15]$$

In order not to underrate faculties with smaller enrolments, we have also decided to use a relative measure of academic achievement (PL_t). Four additional equations will thus be estimated (P_5 to P_8), replacing L_t with PL_t.

Equations [3.12] and [3.13] are the linear functional forms in which academic achievement (L_t) is regressed on school environmental resources in a linear additive manner. Equation [3.13] differs from equation [3.12] in that STR is replaced by ENT. Equations [3.14] and [3.15] are the logarithmic transformations of equations [3.12] and [3.13] respectively. The explanations for each of these functional forms is given in section (3.3) together with the procedures for estimating these functions and the difficulties involved.

3.1.4.2 Description of Variables

Number of 'Licences' produced (L)

This variable represents the number of first decrees produced by the faculties of the former University of Yaounde, and is used here as a proxy for educational achievement. The acquirement of a university degree is the ultimate objective of any university student. This serves as a passport into the labour market at that given level. A university drop-out retains his pre-university status in the labour market. Furthermore, the Cameroon society places a high premium on credentials - the recognised worth of an individual. The acquisition of a university degree equally reflects the higher educational concerns of parents and even teachers. But university education also produces other ascriptive outcomes which are difficult to measure. The reliance on L_t is because this is easily measurable and data acquisition is equally easy.

Percentage Performance (PL)

In addition to the use of the absolute measure of output (L) as our dependent variable, a relative measure (PL) is also used. PL is the absolute number of degrees produced, expressed as a percentage of the number of students enrolled. Tafah (1989, p.140) argues that "the use of absolute number of successful candidates alone might underrate smaller schools which perform relatively well." He continues that the relative variable reduces all schools to the same measurement. Umo (1980, p.27), though not using it, recommends the use of output-enrolment ratio as a good measure of educational achievement where the wastage rate (repetition and drop-out) is high as was really the case in the faculties of the former University of Yaounde.

Our output measures (L and PL) might not effectively measure the amount of knowledge a student acquires at the tertiary level of education, but remain the most objective we can have, given our data set. Promotion to an upper class would have been a better measure since it takes care of the production process in the lower classes as well, but we could not obtain it for the period covered by our study. The number of students awarded degrees (that is, promotion from the final class) was believed to be the best alternative.

Enrolment (ENT)

Total enrolment is included as one of the inputs in our production function in an attempt to take into account the possibility that the scale of operations in the faculties affect the output of the educational process. An institution which is too large might pose administrative pedagogic problems and thus affect the performance of students as they follow lessons out of lecture theatres and strikes become very frequent.

Many authors have used this variable in their studies (as examples: Perl 1973; Simmons and Alexander 1978; Psacharopoulos and Woodhall 1985). Psacharopoulos and Woodhall (p.215) assert that "among the most important inputs into the educational process are the pupils or students themselves." Bowen (1977, p.13) equally notes that "students are not only the object of the educational process but also an important part of the environment in which instruction takes place." This variable has produced mix results in various studies. In a review of studies on educational production functions, Simmons and Alexander (1978) found a positive relationship between enrolment and educational achievement in two of the studies, and also a negative relationship in two others. Its behaviour therefore depends on the production process in any educational system or institution. Since we are trying to examine the production process in the faculties of the former University of Yaounde, we refrain from any prediction on the behaviour of ENT and wait for empirical evidence.

Total Number of Teaching Staff (TTS)

TTS is used in this study as a proxy for the quantity of teaching time actually supplied by members of the academic staff. The quantity of teaching time could have well been evaluated by the number of hours taught, but since it was not possible to reconstitute these hours in the faculties over the study period, we then used TTS as a proxy. It should also be noted that this variable has nothing to do with teacher quality since teachers of all grades or ranks have been included without distinction.

TTS is used on the assumption that all teachers supplied the same number of teaching hours per week. In reality, this varied a lot among staff members. Some taught for less than four hours a week while others taught for more than twelve hours. We hope the numbers of hours taught by part-time lecturers and post-graduate students will cover this gap since we have not included them as staff members.

Many researchers have used this variable (for example, Tafah 1989 and Umo 1980). In the words of Tafah (1989, p.141), "the actual number of teaching staff is a crucial input in any educational system and students' performance at any of the levels of education is critically dependent on the teachers." We postulate that the number of academic staff is performance enhancing and thus a significantly positive relationship between TTS and the number of degrees produced (L and PL) is expected.

Real Average Salary of the Teaching Staff (TSS)

TSS is used here as a quality index since it is a proxy for teacher experience (number of years in work) and qualification (level of education). Salary scales in Cameroon provide experience- and qualification-related increments. Both experience and qualification are acceptable measures of the quality of a teacher. Staff salary was the most important single expenditure item in the direct budgets of the faculties of the former University of Yaounde (representing more than sixty percent). Given that education is labour intensive, TSS should normally be high. Its size therefore warrants its inclusion in the model to see its influence on academic performance as well.

It is important to note that staff salary includes only that part of income from teaching (research allowances are excluded). Staff salary is measured in constant CFA francs so as to get rid of inflation and measure only the influence of the teachers' purchasing power on students' performance. We have used the consumer price index (CPI) to deflate the salaries. As a proxy for teacher quality, the real salary of the staff is expected to be productivity enhancing, and thus positively influence academic performance.

The Student-Teacher Ratio (STR)

STR is our proxy for class size and equally serves as a quality index. Simmons and Alexander (1978, p.353) describe it as "a traditionally important variable for the internal efficiency of schooling." STR is obtained by dividing the number of students by the number of teachers to obtain the number of students per teacher.

One can be tempted to link the high rate of failure to the large class sizes in the faculties of the former University of Yaounde. It is a bit hasty to draw a definite conclusion on the basis of this argument since the teaching methods employed and the curriculum might reduce the importance of class size as an indicator of over-use or under-use of teachers. We thus avoid any a priori prediction on the behaviour of STR and wait for an empirical investigation.

The Book-Student Ratio (BSR)

This variable measures the number of books available to each student. The importance of textbooks and scientific journals in a university environment need not be over-emphasised. The library is the foundation of a university's academic quality and research capability. Without access to recent developments world-wide through current books and journals, original research is rarely possible. Most of the research on the inputs into the educational process have found this variable positively significant in determining academic achievement. As Buchnan and others (cited by

Saint 1992, p.98) put it, "there is now a substantial body of research which demonstrates the importance of textbooks and supplementary materials in increasing student performance and academic achievement. Book provision is widely regarded as being the single most cost-effective factor in upgrading educational quality."

This abundant evidence has led some specialist to advocate the establishment of a minimum BSR as one of the parameters of educational quality. The outcry for the decline of the quality of education in Sub-Saharan Africa is blamed on the stagnating or even declining share of the book acquisition budget in the school budget (World Bank, 1988).

The use of these variable in our model assumes that students make good use of the books available. That is, a student with more books is exposed to more learning than that with less books. We however recognise the fact that the availability of study and reading space, the age distribution of the books and the book lending policy do really influence the effectiveness of books despite their numbers, and consequently their impact on performance. From the above assumptions, we hypothesise a positive relationship between the BSR and academic performance(L and PL). Our hypothesis is supported by the World Bank (1988, p.78) when it notes that "supplying libraries with multiple copies of textbooks as well as supplementary books and periodicals, is the highest priority."

Expenditure Per Student (XPS)

This variable measures recurrent government expenditure in the faculties of the former University of Yaounde. Capital expenditure is left out because it occurs very infrequently and thus can not determine the yearly output of the institution. Our aim here is to see how the government can use this variable in the short-run as a policy instrument to influence the output in university education. It therefore ignores the opportunity cost or forgone earnings by the students and the personal contribution of the student (or his family) to his studies. XPS is simply what the government spends to deliver the higher education service.

This variable has been widely used as an input in educational production function analysis. Results obtained have been very contradictory. While the World Bank (1988, p.34) notes that "low expenditure per student has certainly constrained educational achievement in Sub-Saharan Africa", Simmons and Alexander (1978, p.354) draw an opposite conclusion from a research review: "unit costs, particularly at the secondary and higher levels, could be significantly lowered without affecting performance." We are thus unable to forecast the behaviour of this variable in our model *a priori*.

Number of Students on Scholarship (NSS).

We include the number of students on scholarship as an independent variable in our model to assess the impact of bursaries on student performance. Expenditure on scholarship was the single most important expenditure item in the budget of the former University of

Yaounde. It took up more than 50 percent of the budget of the university in the 1990/91 academic year.

When the University of Yaounde was created, bursaries were given as a motivation to students. This was when enrolment was still low. Government needed skilled human resources to take over administrative and managerial functions hitherto in the hands of foreigners. As the years went by and enrolment increased, the situation changed from that of insufficient supply to that of insufficient demand of skilled manpower. The objectives of the award of scholarship were now no longer justified, but government continued payment, though now using a more selective criteria than from the start, when all students were on bursaries. Scholarships were discontinued in the 1990/91 academic year, not through a systematic study and conclusion that they had nothing to do with student performance, but because of government's inability to continue payment amidst frequent student strikes.

Due to its large share in the university budget, we therefore intend to establish a relationship between these bursaries and student performance. Given the extravagant manner in which students spent these scholarships, we do not expect any significant link between them and student performance.

3.2 THE EDUCATIONAL COST FUNCTION

3.2.1 INTRODUCTION

In view of the magnitude of resources committed to higher education and the rapid rise in these amounts, we thought it necessary to inquire into the causes responsible for their variation and into scale economies. An analysis of educational expenditure, we hope will offer another way of looking at the efficiency of resource use in an educational system. It will provide an empirical basis for understanding the financial characteristics of the system. Since any government operates under a budget constraint, educational cost or expenditure is a major item to be considered before any school investment decisions are made. Regardless of the nature and size of benefits, an educational project will not be implemented unless the funds exist. Therefore, cost scrutinisation and analysis of the resource burden associated with school operation and expansion are of primordial importance in educational decision making and planning. Our intention in this study is to examine the influence the various school inputs have on expenditure per student in higher education, and the existence of economies of scale in school expansion. Such an analysis, we hope can make it possible to detect areas in which cost-savings can be realised. This will take us further to determining the size of the institution which minimises cost.

3.2.2 THE NEO-CLASSICAL COST FUNCTION

The educational cost function (as the educational production function) is an adaptation of the neo-classical cost function. The assumptions made above concerning the production function equally apply here. Under neo-classical theory, the cost function is defined as the least cost combination of inputs in the production process. This least cost combination could allow us derive the long-run average cost function from the production function. This is demonstrated by Nicholson (1978, pp.224-5).

Given fixed input prices (p_i), the problem of the producer becomes that of choosing an input bundle (x_i) to minimise the cost of producing any feasible output. The solution to the cost minimisation problem determines the cost function. The total cost (TC) of production is given by:

$$TC = p_1x_1 + p_2x_2 + \ldots + p_nx_n \qquad [3.16]$$

the given output level is

$$Q = f(x_1, x_2, \ldots, x_n) \qquad [3.17].$$

Mathematically, the cost-minimising input choice is obtained by minimising equation [3.16] given equation [3.17]. Setting up the Lagrange expression we have:

$$L = p_1x_1 + p_2x_2 + \ldots + p_nx_n + \lambda\{Q_0 - f(x_1, x_2, \ldots, x_n)\} \qquad [3.18]$$

The first order conditions for a constrained minimum are given as:

$$\left.\begin{aligned} \frac{\partial L}{\partial x_1} &= p_1 - \lambda\frac{\partial f}{\partial x_1} = 0 \\ \frac{\partial L}{\partial x_2} &= p_2 - \lambda\frac{\partial f}{\partial x_2} = 0 \\ \frac{\partial L}{\partial x_n} &= p_n - \lambda\frac{\partial f}{\partial x_n} = 0 \end{aligned}\right\} \qquad [3.19]$$

$$\frac{\partial L}{\partial \lambda} = Q_0 - f(X_1, X_2, \ldots, X_n) = 0$$

Where $\frac{\partial f}{\partial x_i}$ is the marginal productivity of input x_i.

Solving this system of equations we obtain

$$\frac{\partial f/\partial x_1}{p_1} = \frac{\partial f/\partial x_2}{p_2} = \cdots = \frac{\partial f/\partial x_n}{p_n} \qquad [3.20]$$

Equation [3.20] means that the cost-minimising input choice is attained when the marginal productivity per franc spent is the same for all inputs used.

The result here is the same as that obtained for output maximisation in section (3.1) above. This is what Ferguson (1979, p.174) calls the duality theorem: " the marginal equivalencies defining economic efficiency are the same whether obtained by minimising the cost of producing a stipulated output or by maximising the output obtaining from a given expenditure upon resources".

Given neo-classical assumptions, and following the demonstrations above, a well-behaved production function should produce a U-shaped average cost function. But the specificities of educational production outlined in the previous section violate the standard neo-classical assumptions on production theory. This therefore precludes the attainment of optimality conditions in the educational industry. The consequences of this is the inability to derive the cost function directly from the production function in the educational sector. As Umo (1980, p.28) points out, "this problem has led economists to undertake a direct specification of the cost relationship for empirically investigating any issues of interest".

3.2.3 THE COST FUNCTION FOR HIGHER EDUCATION IN CAMEROON

The general form of the educational cost function often estimated by educational economists is given by the World Bank (1986, p.95) as follows:

$$AVC = f(S, x_1, x_2, ..., x_n, H, p_1, p_2, ..., p_n) \quad [3.21]$$

where,

AVC is the average cost,

S - denotes the size (enrolment) of the educational institution under consideration,

$x_1, ..., x_n$ - stand for exogenous factors,

H - represents the quality of educational output, and

$p_1, ..., p_n$ - are the prices of the educational inputs.

As mentioned above, we will be referring here to expenditure per student functions and not cost per student functions. Cost is a more broader expression which in addition to government expenditure also includes the opportunity cost of schooling and the student's own expenditure (or his parents) on education. The non-inclusion of these cost items is not only due to lack of data, but because of our intention to examine how the government or the university authorities can use their resources as a policy instrument. Our implicit expenditure per student function for higher education in Cameroon is as follows:

$$XPS_t = f(NSS_t, TTS_t, TSS_t, ENT_t) \quad [3.22]$$

where the variables are as defined in section (3.1) above.

The explicit expenditure per student functions to be estimated are as follows:

C_1: $XPS_t = a_0 + a_1NSS_t + a_2TTS_t + a_3TSS_t + a_4ENT_t + \varepsilon_t$ [3.23]

C_2: $XPS_t = b_0 + b_1NSS_t + b_2TTS_t + b_3TSS_t + b_4ENT_t + b_5(ENT_t)^2 + v_t$ [3.24]

C_3: $\log XPS_t = \log a_0 + a_1\log NSS_t + a_2\log TTS_t + a_3\log TSS_t + a_4\log ENT_t + \varepsilon_t$ [3.25]

Equation [3.23] expresses a linear relationship between XPS and the inputs in an additive form, while in equation [3.24], $(ENT)^2$ is added to obtain our quadratic expenditure per student function. Equation [3.25] expresses the same relationship in equation [3.23] in a log-linear form. The significance of these different functional forms will be discussed below in section (3.3) dealing with the methods of estimation.

Expenditure per student (XPS), is our dependent variable in this model. It measures the amount or sacrifice made by the government in educating students at the former University of Yaounde. Only government expenditures are taken into consideration so as to see how the government can re-allocate resources to improve on academic achievement once the crucial inputs are identified. Enrolment (ENT) is our size variable. It is essential in the determination of economies of scale. Micro-economic theory establishes that as the size of operations increases, unit cost tends to fall. From this we predict a negative relationship between XPS and ENT. $(ENT)^2$ is included on the assumption that economies of scale will eventually give rise to diseconomies of scale if the level of operations exceeds the optimum. We are therefore postulating that the expenditure per student curve will be U-shaped. This means that the coefficient of ENT will be negative, while that of $(ENT)^2$ positive. This will guarantee the existence of an optimum school size. Given that the payment of scholarship was the single biggest expenditure item in the budget of the former University of Yaounde, its inclusion as one of the variables explaining expenditure per student is to be expected. We thus expect the number of students receiving scholarships (NSS) to have a highly significant positive effect on XPS. The salary of the teaching staff constituted more than a half of the direct faculty budgets. Their strong influence on the faculty expenditure per student is therefore to be expected. Given that the number of academic staff (TTS) is expected to be a very determinant factor in student performance, a knowledge of their influence on per student expenditure might be important in deciding how this variable can be used to improve the efficiency of production. Following from Umo's (1980, p.33) result in Nigerian Universities, we expect TTS to have a significant effect on XPS.

3.3 METHODS OF ESTIMATION.

3.3.1 INTRODUCTION

The basic statistical tool used in this study is the ordinary least squares regression procedure. This is used to establish a relationship between the dependent and the independent variables as follows:

$$Y_t = b_0 + b_1X_{t1} + b_2X_{t2} + \ldots + b_nX_{tn} + \varepsilon_t \qquad [3.26]$$

where Y_t = the dependent variable at time t,

X_{tj} = independent variable j for the time t,

b_0 = the constant term,

b_j = the regression coefficient associated with independent variable j,

and

ε_t = the error term.

The use of the ordinary least squares method in estimating linear models relies on a number of assumptions. If the premise that the assumptions hold is violated, problems arise. These are the usual problems confronting single-equation estimation: multicollinearity, heteroskedasticity, autocorrelation (serial correlation), and nonstationarity (specific to time-series data). In this section, we discuss these problems and propose some solutions of dealing with them. We latter on describe how the regression coefficients will be used to determine the relative effectiveness of the inputs, and also present the functional forms to be estimated.

3.3.2 POTENTIAL STATISTICAL PROBLEMS AND PROPOSED SOLUTIONS.

Heteroskedasticity occurs when the null hypothesis of a common error variance (that is homoskedasticity) is rejected. The consequence of this is that ordinary least squares estimators become inefficient, though they remain unbiased. Our tests of significance are thus invalidated (Maddala, 1988; p.167). Despite the believe that heteroskedasticity does not usually occur in time-series data (Pindyck and Rubinfeld, 1991; p.127), we still thought it necessary to carry out some formal tests for the existence of heteroskedasticity to be sure our data set is no exception to this believe. We have used the White test for this purpose. It involves the following procedures:

- Regressing the square of residuals on the independent variables, that is

$$\hat{\mu}_i^2 = b_0 + b_1 x_{1t} +,\dots,+ b_n x_{nt} + v_t \qquad [3.27]$$

- and from this, we calculate the measure of the goodness of fit R^2.

The White Test is based on the fact that when there is homoskedasticity, the goodness of fit, times the sample size (N) follow a chi-square distribution with p degrees of freedom. That is, $NR^2 \to \chi^2_p$, with p degrees of freedom, where p is the number of regressors. If the test statistics is greater than the critical value from the χ^2-table, we reject the null hypothesis of homoskedasticity, and then correct for heteroskedasticity[4] We have used this White Test in our different data sets.

Serial correlation occurs when residuals corresponding to different observations are correlated. When this happens, the standard errors of ordinary least squares estimators are underestimated, thus R^2 as well as t and F statistics tend to be exaggerated. They are unbiased but not efficient. The Durbin-Watson (D-W) statistic is the most common test used for the detection of serial correlation. It involves testing the null hypothesis $\rho = 0$ (ρ is the serial correlation coefficient) for no serial correlation, against the presence of a first order autoregressive process-AR(1). The null hypothesis is not rejected if the D-W statistic is greater than d_u or is less than $(4-d_u)$, for the test of first order positive or negative serial correlation, respectively, where d_u is the upper bound of the statistic given by the D-W tables. In regressions where the null hypothesis is rejected, we will use quasi-differences to alter the linear model

[4] The White Test is described by Maddala (1988, p.163) and Pindyck and Rubinfeld (1991, p.136).

into one in which the errors are independent (Maddala 1988, p.194). This amounts to transforming the variables as follows:

$Y_t^* = Y_t - \rho Y_{t-1}$ and $X_t^* = X_t - \rho X_{t-1}$ where t=2,3,...,N.

We now run a regression of Y_t^* on X_t^* using the ordinary least squares procedure. But ρ (the serial correlation coefficient) is not known *a priori*, and we have to estimate it. One of the methods used to estimate ρ is the Cochrane-Orcutt iterative procedure. It involves a series of iterations, each of which produces a better estimate of ρ than the previous one. It uses the notion that ρ is a correlation coefficient associated with residuals of adjacent time periods. That is:

$$\hat{\mu}_t = \rho_1 \hat{\mu}_{t-1} + \varepsilon_t \qquad [3.28]$$

where $\hat{\mu}_t$ are serially correlated residuals from the original equation.

Ordinary least squares is used to estimate ρ in equation [3.27]. In the second stage, we use $\hat{\rho}_1$ to transform our data and run the regression using ordinary least squares. The residuals from this second regression are used to estimate ρ_2 as in equation [3.28] above. The process continues until the new estimate of ρ differ from the old one by less than 0.01 (Pindyck and Rubinfeld 1991, pp.141-2).

Multicollinearity is a situation where there is high intercorrelation among the explanatory variables. This makes it difficult to disentangle the separate effects of each of the independent variables on the dependent variable. Multicollinearity manifests itself very often through large standard errors and small t-ratios. But the variance-inflation factor (VIF - discussed by Maddala, 1988; p.227) is one of the measures used to detect the presence of multicollinearity. It is given by:

$$VIF_i = \frac{1}{1-R_i^2}$$

Where R_i^2 is the squared multiple regression coefficient between X_i and the other independent variables. The VIF can be interpreted as the ratio of the actual variance of the coefficient of X_i to what the variance of X_i would have been if X_i were not to be correlated with the other independent variables. High intercorrelation among the independent variables (that is high R_i^2) will lead to high values for VIF.

To complement our VIF results, we will calculate simple correlation coefficients for all our variables. While the VIF shows the level of correlation between the independent variables in a given equation, the simple correlation coefficient compares two independent variables at a time. It varies between 1 (for positive correlation) and -1 (for negative correlation). These extremes indicate perfect multicollinearity. A correlation coefficient nearer zero (from 1 and -1) indicates that multicollinearity is not so serious enough to affect the results of our regressions.

The fact that we are dealing with time-series data brings another problem. Very often time-series data present characteristics of nonstationarity. Perman (1989, p.18) poses the problem thus: "given that it is not, in general, admissible to use classical techniques for inference in models with nonstationary components, it seems sensible to 'remove' nonstationarity prior to estimation and testing". If the series are nonstationary, then we can not validly model the process via an equation with fixed coefficients that can be estimated from past data. This is because the structural relationship described by the equation is invariant over time (Pindyck and Rubinfeld, 1991; pp.443-4).

A stationary series has a constant mean and variance - this means that they are time-independent. The difference between a stationary and a nonstationary series can be illustrated in terms of a data generating process. Lets consider the first order autoregressive model:

$$y_t = \rho y_{t-1} + \varepsilon_t \qquad [3.29]$$

where ε_t is an independently normally distributed random variable, with zero mean and variance σ^2, and ρ is the autoregressive coefficient. We have a stationary series if $|\rho| < 1$, and If $|\rho| \geq 1$, the series is nonstationary.

The main consequence of nonstationarity is the presence of spurious regression which arises where known unrelated series are shown to be apparently correlated using the ordinary least squares estimator. This apparent correlation is due to the fact that the series are time-dependent and are dominated by their trend component. Another problem is that of inconsistent regressions, which results from running a regression involving stationary and nonstationary series. Here the value of the coefficient will not be constant because the nonstationary series will have a time-dependent mean. Adam (1993, p.28) notes that "if inference is to be valid and not time-dependent, then all the variables in a model must be of the same order of integration." The first step in time series modelling therefore, is to examine the time series characteristics of each of the variables in the data set.

Despite the problems involved with nonstationary series, their desirable property is that they can be differenced one or more times to attain stationarity. This leads us to the order of integration of a series. A series, y_t is said to be integrated of order d {denoted $y_t \sim I(d)$} if it attains stationarity after differencing d times. Or the series is said to have d unit roots. A stationary series is therefore integrated of order zero $\sim I(0)$. To know whether a series is stationary or nonstationary, we have to determine its order of integration. This entails carrying out what is commonly referred to as the Dickey-Fuller (D-F) unit roots test (Pindyck and Rubinfeld 1991, p.460; Maddala 1988, p.214). The test is applied thus. Suppose that Y_t which has been growing over time is described by the following equation:

$$y_t = \alpha + \beta T + \rho y_{t-1} + \lambda \Delta y_{t-1} + \varepsilon_t \qquad [3.30]$$

where T is the trend and $\Delta y_{t-1} = y_{t-1} - y_{t-2}$. Using ordinary least squares we first run the unrestricted regression

$$\Delta y_t = \alpha + \beta T + (\rho - 1) y_{t-1} + \lambda \Delta y_{t-1} \qquad [3.31]$$

and the restricted regression

$$\Delta y_t = \alpha + \lambda \Delta y_{t-1} \qquad [3.32]$$

then we calculate the F ratio to test whether the restrictions ($\beta = 0$ and $\rho = 1$) hold. The F ratio is given by:

$$F = \frac{(RSS_R - RSS_{UR})/q}{RSS_{UR}/(N-k)} \qquad [3.33]$$

where RSS_R and RSS_{UR} are the residual sums of squares in the restricted and unrestricted regressions, respectively. k is the number of estimated parameters in the unrestricted regression, q is the number of parameter restrictions and N is the number of observations.

The null hypothesis ($\beta = 0$ and $\rho = 1$) of nonstationarity is rejected if the F ratio is greater than the critical value from the D-F table at a chosen level of significance. If on the contrary the null hypothesis is not rejected, the series is differenced and the test carried out again. This continues until the series becomes stationary.

One of the drawbacks of this procedure of differencing is that it results in the loss of information about the long-run relationship between the variables and the loss of degrees of freedom. The concept of cointegration has recently been introduced as a solution to this problem[5]. Cointegration occurs when the linear combination of nonstationary series produces an I(0) series. Let y_t and x_t be nonstationary series, and the linear combination of the two, $z_t = x_t - \lambda y_t$ is stationary ~ I(0), then y_t and x_t are said to be cointegrated. One condition for cointegration is that the series in the cointegrating regression should be integrated to the same order (Perman,1989; p.19). To test whether the linear combination of y_t and x_t is cointegrated, we simply run the cointegrating regression

$$y_t = \alpha + \beta x_t + \varepsilon_t \qquad [3.34]$$

and test whether the residuals from this regression are stationary {I(0)}. The null hypothesis here is for noncointegration (that is for nonstationary residuals). The D-F unit roots test is still used in this case. Adam (1993, p.31) notes that "cointegration analysis provides a powerful discriminating test for spurious correlation: conducting cointegration analysis between apparently correlated I(1) series and finding cointegration validates the regression."

The other tests used in this study are the t and F distributions. The t distribution is used to test the hypothesis on the significance of the regression coefficients. That is, the null hypothesis that $b_i = 0$ (where b_i is the regression

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[5] See Adam (1992, pp.9-16; 1993, pp.25-29), Maddala (1988, pp.216-8) and Pindyck and Rubinfeld (1991, pp.465-8) for more on cointegration.

coefficient). The F distribution on the other hand is used to test the existence of a linear relationship between the dependent and independent variables. That is the overall significant of the regression model. It is the joint hypothesis that

$$b_1 = b_2 = \ldots = b_k = 0.$$

To measure the goodness of fit of our regression models, we used the adjusted R^2 ($\bar{R}^2$). It measures the proportion of the variation of the dependent variable explained by the independent variables while taking the degrees of freedom into consideration.

3.3.3 THE RELATIVE EFFECTIVENESS OF EDUCATIONAL INPUTS

One of our aims in this study is to establish a priority among the inputs into the higher educational production process in Cameroon so that the most important inputs are identified. Bowles and Levin (1968a, p.14) lend support to such a treatment as they note: "Given the fact that schools always operate with limited budgets, the educational decision-maker is presumably interested in the relative effectiveness of those inputs over which he has control". But the use of the regression coefficient (b_j) to measure the relative importance or effectiveness of the individual independent variables is misleading. This is because the regression coefficients are not standardised and simply indicate the expected change in the dependent variable for a unit change of the independent variable with which it is associated, while the influence of the other variables in the equation is statistically held constant. In this way, the regression coefficient (b_j) or the "metric weight" as Pascarella and Terenzini (1991, p.672) call it, can be changed by simply altering the unit of measurement of the variable to which it refers. The same variable will thus yield different regression coefficients just because the unit of measurement has been changed.

To obtain the standardised or what is often called the 'beta coefficient[6], we simply perform a linear regression in which each variable is 'normalised' by subtracting its mean and dividing by its estimated standard deviation (Pindyck and Rubinfeld 1991, p.85).

The normalised regression now looks like this:

$$\frac{Y_t - \bar{Y}}{s_y} = \beta_1 \frac{X_{t1} - \bar{X}_1}{s_{x_1}} + \beta_2 \frac{X_{t2} - \bar{X}_2}{s_{x_2}} + \ldots + \beta_k \frac{X_{tk} - \bar{X}_k}{s_{x_k}} + \varepsilon_t \qquad [3.35]$$

Where $\bar{Y}$ = mean of the dependent variable (Y_t)

$\bar{X}_j$ = mean of the independent variable (X_{tj})

s_y = standard deviation of Y_t

s_{x_j} = standard deviation of X_{tj}

β_j = standardised or beta coefficient

j = 1, . . .,k.

But since we have not normalised our variables, we have obtained our beta coefficient by using the following relationship (Goldberger 1964, p.197; Olayemi and Olayide 1981, p.178; Pindyck and Rubinfeld 1991, p.85):

$$\beta_j = b_j \frac{s_{x_j}}{s_y} \qquad [3.36]$$

Where b_j is the regression coefficient obtained from the unstandardised regression model, and the others apply as above.

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[6] A more detailed discussion of beta coefficients is provided by Goldberger (1964, pp.197-8); Olayemi and Olayide (1981, pp.177-8); Pascarrella and Terenzini (1991, pp.671-2); and Pindyck and Rubinfeld (1991, p.85).

The beta coefficients so obtained are independent for any unit of measure of their variables and indicate the expected standard deviation change in Y_t associated with one standard deviation change in X_{tj}, while all other variables are held constant. In short, the beta coefficients put all variables on the same scale, and thus provide a scale-free estimate of a variable's effect on the dependent variable. It is at this level that we used the relative magnitudes of the coefficients as an objective measure of the relative importance of the individual explanatory variables in our equations. Brown and Saks (1977) applied this to a study on the production of education and commended its performance.

3.3 4 THE FUNCTIONAL FORMS ESTIMATED

In the previous section, we specified the production and cost functions for higher education in Cameroon to be estimated in Chapter Five. These functions were specified in the linear, log-linear and quadratic (for the cost functions only) functional forms. This is because there is no agreed upon unique form for these functions. Mingat and Tan (1988, p.80) note that "since there is always uncertainty about the true form of the educational production function, it is advisable to fit alternative functions to the data and to test for the robustness of the results. One can have greater confidence in the results and in the conclusions to which they point if the relative impact of the three inputs remains more or less stable for alternative functional specifications." We then explain each of the functional forms used in this section.

The Linear Functional Form

In this functional form the variables are introduced into the equation in a linear additive manner. Both the production and cost functions have been estimated using this functional form. The linear additive function is estimated on the assumption that the inputs are independent from one another and that their marginal influences on the dependent variable are constant. The marginal influences are given by the partial derivatives of the dependent with respect to the independent variables as follows:

$$b_j = \delta Y_t / \delta X_{tj} \quad (j=1,2,\ldots,k).$$

The Quadratic Functional form

Only the expenditure per student function has been estimated using this functional form. Here, the size variable is squared and included additively among the regressors. The main aim here is to investigate the existence of scale economies in university operations. This quadratic function is also used to determine the optimum size of each faculty and the university as a whole. The procedure is carried out using the average cost as follows:

$$AC_t = b_0 + b_1 X_{t1} + b_2 X_{t1}^2 + \sum_{j=2}^{k} b_j X_{tj} + \varepsilon_t \qquad [3.37]$$

Where AC_t = Average cost;

X_{t1} = The size variable (student enrolment);

X_{tj}(j = 2,3...k) = The other regressors in the linear cost function.

The first derivative of equation [3.37] gives:

$$\frac{\partial AC}{\partial X_j} = b_1 + 2b_2 X_1 \qquad [3.38]$$

The first derivative equals zero at the optimum

$$\Rightarrow b_1 + 2b_2X_1 = 0 \quad \Rightarrow X_1^* = \frac{-b_1}{2b_2}$$

Where X_1^* is the optimum size[7].

The logarithmic Functional Form[8]

We have also estimated a non-linear function of the form:

$$Y_t = b_0 X_{t1}^{b_1} X_{t2}^{b_2} \ldots X_{tk}^{b_k} e^{\varepsilon_t} \qquad [3.39]$$

The ordinary least squares multiple regression analysis adopted for this study is not suitable for the estimation of equations like [3.38]. We have therefore proceeded by transforming the equation into a logarithmic linear function so as to facilitate the estimation of the regression coefficients. The logarithmic transformation is as follows:

$$\log Y_t = \log b_0 + b_1 \log X_{t1} + b_2 \log X_{t2} + \ldots + b_k \log X_{tk} + \varepsilon_t \qquad [3.40]$$

As can be seen from equation [3.40], the logarithmic transformation involves the constant term b_0, but not the regression coefficients b_j. This implies that if the usual assumptions of linear regression models are valid, then b_j will have the desirable properties of least square estimators. In this case, b_0 (the antilog. of $\log b_0$) is biased in small samples but asymptotically unbiased. The transformation does not affect the error term because it enters the equation exponentially and multiplicatively. This implies that the linear regression assumption of zero expected error term is not violated.

[7] Cohn (1968) and Tafah (1989) carried out similar analyses at lower levels of education.

[8] See Kelejia and Oates (1989, pp.108-10), Olayemi and Olayide (1981, pp.169-72), and Maddala (1988, pp.62-3) for more on logarithmic functions.

One of our main reasons for estimating the logarithmic function is because of one of its important characteristics. This is that the regression coefficients are also the elasticity coefficients. It is easily shown from equation [3.40] that:

$$b_j = \frac{\partial Y_t}{\partial X_{tj}} \frac{X_{tj}}{Y_t} \qquad [3.41]$$

This is the elasticity of Y_t with respect to X_{tj}, which is simply the regression coefficient of X_{tj}. These elasticities will be used to measure the effect of a one percent change of an independent variable on the dependent variable.

3.4 CONCLUSION

We started this chapter by briefly describing the neo-classical production and cost functions on which the educational production and cost functions impinge. We then brought out the particularities of educational production which preclude the direct application of the neo-classical framework to the education 'industry'. The production and cost functions often specified in educational studies by economists was then presented. The nature of higher education and data deficiencies prevented us from estimating the generally specified functions. The educational production and cost functions which we thought best described the situation of higher education in Cameroon were then specified and the measurement of the variables included was explained.

The second section of this chapter had to do with the methods of estimating the functions specified. The various problems faced with single-equation estimation using ordinary least squares and the difficulties involved with time-series data were brought out, and solutions to these problems were proposed. The application of the cointegration procedure was equally discussed. A brief explanation was also given to the choice of the functional forms that will be used in the study.

The results of the various estimations are presented and discussed in the next chapter.

CHAPTER FOUR

ESTIMATION AND RESULTS

4.1 INTRODUCTION

After specifying the empirical model and discussing the estimation procedures and problems in Chapter Three, we now focus our attention in this chapter on the estimation proper. The results are presented here for all the faculties of the former University of Yaounde taken as an entity, then further disaggregated into the individual faculties. The reason for this disaggragation is that the combined data might tend to conceal variations within the faculties. The results for all the faculties taken together are presented under 'ALL' in our tables, while FDSE is for the Faculty of Law and Economics; FLSH for the Faculty of Letters and Social Sciences; and FS for the Faculty of Sciences. The results for the combined data ('ALL') will enable us draw inference on higher education in Cameroon, since the three faculties together enrolled very often about 80 percent of higher education enrolment in Cameroon.

In the first section of this chapter, we will determine the order of integration of all the variables in our model by using the Dickey-Fuller unit roots test. This is necessary before our estimations, so as to avoid the problem of spurious and inconsistent regressions. Section II presents and discusses our estimates of the educational production functions. In the third section, we equally analyse the results of the educational cost functions, from which we will determine the optimum size (enrolment) of the faculties. The last section of this chapter is reserved for the conclusion.

4.2 UNIT ROOTS TEST

As we mentioned in Chapter Three, the first step in time-series modelling is to determine the time-series characteristics of each of the variables in the data set. This enables us to decide on the levels of each variable to be included in our models. The results of the unit root test are presented below for each of the faculties of the former University of Yaounde. Table 4.1 presents variables for our linear functional form, while in Table 4.2, the test is applied to the logarithms of each of the variables for the log-linear functional form.

Reading from Table 4.1, non of the variables was integrated of order zero - I(0). This implies that non of them was stationary in its level. Only two variables: TTS and TSS are I(1) in some of the faculties - implying that these variables became stationary after a first difference. Most of the remaining variables are integrated of order two. Only NSS (in the FDSE) and ENT^2 (in the FS) need to be differenced three times to achieve stationarity.

When the variables are transformed into logarithms as in Table 4.2, some of them become stationary in their levels. That is, they are integrated of order zero - I(0) without any differencing. This is the case with NSS (in the FDSE), TTS (in the FS and the pooled data) and L (for the pooled data). A few other variables are I(1), while most of them remain I(2) as in Table 5.1.

Table 4.1: The D-F[1] test for unit roots

Variables	FDSE		FLSH		FS		ALL	
L	09.26+	(2)[2]	06.21++	(1)	13.05*	(2)	08.44+	(2)
NSS	13.27*	(3)	13.10*	(2)	10.20+	(2)	10.99*	(2)
TTS	08.76+	(1)	07.79+	(1)	08.99+	(2)	11.39*	(1)
TSS	15.22*	(2)	11.70*	(1)	13.03*	(2)	12.64*	(2)
XPS	06.57++	(2)	07.16++	(2)	10.25+	(2)	06.00++	(2)
STR	07.70+	(2)	18.90*	(2)	09.18+	(2)	10.72*	(2)
ENT	10.83*	(2)	12.08*	(2)	07.20++	(2)	09.35+	(2)
$(ENT)^2$	08.15+	(2)	06.59++	(2)	15.03*	(3)	07.63+	(2)

Notes:

1 We have obtained the critical values for the D-F unit roots test from Pindyck and Rubinfeld (1991, Table 15.1, p.461).

* Significant at the 1 percent level--the critical value = 10.61

\+ Significant at the 5 percent level--the critical value = 07.24

++ Significant at the 10 percent level--the critical value = 05.91

2 The number in parentheses indicates the order of integration or the number of times the series must be differenced to achieve stationarity

Table 4.2: D-F test for unit roots (variables transformed into logarithms).

Variables	FDSE		FLSH		FS		ALL	
L	11.67^{*}	(2)	16.76^{*}	(2)	11.69^{*}	(2)	06.94^{++}	(0)
NSS	10.72^{*}	(0)	06.85^{++}	(1)	08.29^{+}	(1)	09.21^{+}	(1)
TTS	07.89^{+}	(1)	06.81^{++}	(1)	07.84^{+}	(0)	11.06^{*}	(0)
TSS	16.37^{*}	(2)	12.40^{*}	(2)	13.55^{*}	(1)	14.27^{*}	(2)
XPS	06.44^{++}	(2)	08.70^{+}	(2)	09.78^{*}	(2)	06.41^{++}	(3)
STR	07.25^{+}	(2)	10.26^{+}	(1)	09.64^{+}	(2)	12.76^{*}	(2)
ENT	10.54^{+}	(2)	08.72^{+}	(1)	06.43^{++}	(2)	12.31^{*}	(2)

See notes to Table 4.1

Both Tables 4.1 and 4.2 show that the null hypothesis of nonstationary series using the Dickey-Fuller unit root test was rejected at various levels of significance as indicated on the tables. This was to be expected as the differencing would have continued until stationarity achieved. This unit root test reveals that, as with most economic data, educational time series data can equally exhibit nonstationarity.

Before we present our regression results, some comments are necessary as regards some variables which do not feature in our regressions despite the fact that we mentioned them in our model specification. The first of this is our relative output measure (PL). It measures the percentage of students awarded first degrees each academic year. When we regressed school inputs on this variable, the results were quite unstable. Negative signs were alternating with positive signs for the same variable in the same faculty for different functional forms. Some of the results were unreasonable and really difficult to interpret. Tafah (1989, pp.202-3) faced similar difficulties when he tried to use the variable for his study on secondary education in Cameroon. Furthermore, things got worst when the adjusted coefficient of multiple determination ($\overline{R}^2$) was negative and the F-statistic less than one. Faced with this problems, we decided to completely abandon this relative measure of output and ran all our regression with he absolute output measure (L).

In the general introduction where we described the methods of data collection, we raised the problems we encountered measuring the book-student ratio: the non-availability of time-series data on the number of books in departmental libraries and on journals and other periodicals. This implied the measure we tried to use did not reflect the reality. Furthermore, the figures we got from the central library included many books which had been damaged and stolen. This increased the errors of measurement of this variable. These difficulties are to be blamed for the contradictory results produced by this variable. We even tried two separate measures of this variable: the number of books per student and the number of books available, but there was no improvement in the results. This led us to reluctantly exclude this variable from our regressions. Reluctantly, because of the central role the library is expected to play in a university milieu. The number of library books available has been proven by many studies (Saint,1992; The World Bank, 1988; Haddad, 1990 and others) to have a strong influence on academic performance, and we had expected this variable to account for a greater variation in our output measure.

4.3 REGRESSION RESULTS

4.3.1 THE EDUCATIONAL PRODUCTION FUNCTION

The results of our educational production function are presented in Tables 4.3 and 4.4 below. Table 4.3 shows the results of the linear function , while Table 4.4 gives the results of the log-linear function. In the latter functional form, the variables are transformed into logarithms so as to derive directly the elasticities of the output with respect to the inputs as discussed in Chapter Three. The results are presented for the three faculties as an entity under 'ALL', and separately for each faculty as mentioned in the introduction to this chapter. Each faculty in our Tables has two regressions :P_1 and P_2. P_2 is different from P_1 in that, STR has been replaced by ENT. The replacement has been carried out so as to see the direct effect of the size of enrolment on academic performance. This might throw some light on the law of diminishing returns. In discussing the results from our regression models, we take each variable individually, look at its behaviour in both the linear and the log-linear functional forms and for the various faculties.

Table 4.3: Educational Production Functions.

Variables	FDSE		FLSH		FS		ALL	
	P_1	P_2	P_1	P_2	P_1	P_2	P_1	P_2
NSS	-9.9E-4	-9.6E-3	-0.034$^+$	-0.024	-0.027*	-0.021$^+$	-0.029$^+$	-0.043$^+$
	(-0.051)	(-0.445)	(-2.527)	(-1.744)	(-3.827)	(-2.677)	(-2.701)	(-2.847)
TTS	1.193*	2.841*	7.126*	5.807*	0.488*	0.100	0.812*	0.852*
	(4.532)	(4.314)	(14.87)	(11.21)	(3.993)	(0.532)	(10.17)	(4.875)
TSS	0.033	0.027	-0.055*	-0.038*	-5.6E-3$^+$	-9.3E-4	0.028	-0.036
	(1.454)	(1.036)	(-7.275)	(-5.060)	(-2.197)	(-0.368)	(0.871)	(-0.878)
XPS	-2.850*	-2.667*	0.497$^+$	0.323^{++}	9.4E-05	3.9E-05	-2.505*	-1.954$^+$
	(-4.280)	(-3.526)	(2.428)	(1.970)	(0.639)	(0.264)	(-4.461)	(-2.481)
STR	-9.004*	—	16.533*	—	8.420$^+$	—	-38.736*	—
	(-4.351)		(5.063)		(2.711)		(-4.016)	
ENT	—	-0.194*	—	0.152*	—	0.075$^+$	—	-0.065^{++}
		(-3.459)		(6.092)		(2.416)		(-1.959)
$\bar{R}^2$	0.632	0.544	0.951	0.958	0.700	0.669	0.734	0.520
D-W	2.01*	1.98*	2.02*	2.04*	2.07*	2.23*	2.14*	2.19*
White	3.6*	1.8*	0.95*	2.66*	7.92*	4.68*	2.89*	8.5*
F	6.84*	5.06*	71.16*	82.34*	7.61*	6.71*	8.37*	3.89$^+$
D-F	8.908$^+$	6.891^{++}	8.130$^+$	8.831$^+$	9.013$^+$	9.259$^+$	4186*	1744*

Note: t-statistics are in parentheses.
* Significant at the 1 percent level.
$^+$ Significant at the 5 percent level.
$^{++}$ Significant at the 10 percent level.
P_2 is different from P_1 in that STR is replaced by ENT.

Table 4.4: Ordinary Least Squares estimates of the Educational Production Function (variables in logarithms)

Variables	FDSE		FLSH		FS		ALL	
	P_1	P_2	P_1	P_2	P_1	P_2	P_1	P_2
NSS	-3.2E-3	-3.2E-3	-0.022	0.015	0.338	0.096	-0.829^{+}	-0.830^{+}
	(-1.539)	(-1.540)	(-0.240)	(0.079)	(1.214)	(0.355)	(-3.102)	(-3.090)
TTS	0.229	1.349^{*}	1.299^{++}	1.396^{++}	0.414	-0.009	1.309^{*}	1.289^{*}
	(0.415)	(3.712)	(2.078)	(1.905)	(0.789)	(-1.188)	(38.35)	(43.58)
TSS	0.157	0.158	-0.317	-0.246	0.826^{+}	0.981^{+}	0.006	0.142^{+}
	(0.514)	(0.517)	(-0.846)	(-0.636)	(2.999)	(2.865)	(0.039)	(2.313)
XPS	-1.220^{+}	-1.221^{+}	-0.276	-0.311	0.104	0.110	-0.167	-0.190
	(-3.352)	(-3.354)	(-0.934)	(-1.113)	(0.392)	(0.544)	(-0.723)	(-1.303)
STR	-1.119^{+}	—	0.063	—	1.305^{*}	—	0.326	—
	(-3.060)		(0.288)		(7.314)		(1.093)	
ENT	—	-1.119^{+}	—	0.010	—	1.490^{*}	—	-0.167
		(-3.058)		(0.056)		(6.304)		(-0.938)
$\bar{R}^2$	0.791	0.791	0.583	0.580	0.502	0.369	0.947	0.955
D-W	2.19^{*}	2.19^{*}	2.04^{*}	2.03^{*}	2.03^{*}	2.10^{*}	2.19^{*}	1.99^{*}
F	8.58^{*}	8.58^{*}	5.74^{*}	5.69^{*}	3.52^{+}	2.25	42.46^{*}	64.31^{*}
D-F	—	—	6.187^{++}	6.017^{++}	—	—	—	—

Note: t-statistics are in parentheses.
* Significant at the 1 percent level.
$^{+}$ Significant at the 5 percent level.
$^{++}$ Significant at the 10 percent level.
P_2 is different from P_1 in that STR is replaced by ENT.

4.3.1.1 The Behaviour Of The Inputs

The Number of students on scholarship (NSS)

When data for all the faculties is pooled together ('ALL'), the coefficient of this variable is negative and significant at the 5 percent level in both P_1 and P_2 for the linear equations in Table 4.3. For the log-linear equations, this negative relationship is confirmed at the same level of significance for both equations in Table 4.4. Student performance is inelastic with respective to NSS. This indicates that a one percent increase in NSS will lead to a 0.829 and 0.830 percent fall in student performance (L) for P_1 and P_2 respectively.

In the FDSE, this variable had insignificant coefficients in both the linear and the log-linear functions. In the linear functions (Table 4.3), the sign of both P_1 and P_2 is negative. In the logarithm functions (Table 4.4), both signs were again negative, implying that the award of scholarships had a negative impact on the performance of students (though this effect was statistically insignificant). The elasticities from Table 4.4 indicate that a one percent increase in the number of students receiving scholarships, could reduce student performance by 0.003 percent (very inelastic). For the FDSE therefore, NSS was negative but nonsignificantly related to the number of first degrees awarded.

In the FLSH, the coefficient of NSS was negative in the two linear equations. It was even significant at the 5 percent level in P_1. When we examine the log-linear equations in Table 4.4, we see that the coefficient is negative in P_1 but becomes positive in P_2. Non of these is significant even at the 10 percent level. The partial elasticities are equally small in absolute values as was the case in the FDSE.

For the FS, the negative effect of NSS on performance is very significant for the two linear equations. It is significant at the one percent and 5 percent levels for equations P_1 and P_2, respectively. In the logarithmic functions, we found the contrary. Both NSS coefficients are positive but still none is significant. The logarithmic results show that a one percent increase in NSS will increase academic performance by 0.34 and 0.096 percent for P_1 and P_2, respectively.

Though this variable has a few perverse coefficients in its relationship with performance, the negative influence appears to be dominant. This negative coefficient is against our *a priori* expectation. We were expecting a nonsignificant, but not really a negative coefficient. NSS also remains inelastic in all the equations estimated. This negative relationship implies that the scholarships given to students instead prevented them from working hard to obtain their degrees. This might be understandable given that these allowances were seldom spent for the acquisition of learning aids like textbooks. The system of *'polycopes'*[1] made students to rely less on textbooks. There was therefore a tendency for students to spend this money on other things than academic : expensive dressing, household appliances (like musical sets) and even drinking among other social activities.

[1] These were the compiled notes of teachers sold to students. They contained almost all what the teacher taught for the whole year and will consequently bring in his examination

This results should therefore not be surprising. It suggests some degree of inefficiency in the allocation of resources in the former University of Yaounde. A lot of resources were being used on an input which was not performance enhancing. It is therefore in order to reallocate resources to more productive inputs so as to improve production efficiency. Scholarships were completely suppressed in the 1991/92 academic year as a result of government's inability to continue payment. Our regression results seem to lend support to this decision, but stop short of advocating for a complete suppression. Perhaps, a simple reduction of the number of students on scholarship or a change in the criteria for selecting winners in favour of meritorious candidates might have been a better solution. It might also be necessary to note here that the initial objective for the award scholarships was to encourage students to enrol in higher education, since government needed skilled human resources to take up administrative and managerial functions hitherto in the hands of expatriates. By 1991/92, this objective had long been defeated, as the situation had changed from that of insufficient supply to insufficient demand of skilled labour. This might have even been another justification for the suppression of scholarships.

The total number of teaching staff (TTS)

An aggregation of all the faculties produce very good results. In the linear functions in Table 4.3, all the coefficients are positive and significant at the 99 percent confidence level. This shows that the number of teachers in the university had a very significant and positive effect on the number of degrees awarded. In the log-linear functions, the coefficients remain positive and significant at the one percent level. The t-ratios for equation P_2 is as high as 43.578. This significant relationship is further corroborated by the elasticity of student performance with respective to this input. The elasticities indicate an increase of 1.31 and 1.29 percent in performance if TTS is increased by one percent.

When the data is disaggregated for all the faculties, the FDSE has very significant and positive coefficients for TTS in the linear equations. It has a 99 percent confidence level in both equations. In the log-linear forms, the positive relationship is confirmed. P_1 is not significant even at the 10 percent level but P_2 is significant at the one percent level. The elasticity of P_2 is 1.35 showing that the number of degrees produced was elastic with respect to this input. The coefficient of P_1 is inelastic.

In the FLSH, the positive effect of the number of teachers is even stronger than in the FDSE above. Both coefficients in the linear functional forms are highly significant at less than the one percent level (P_1 has a t-ratio of 14.873 - Table 4.3). In the log-linear functions, the coefficients are equally positive but significant only at the 10 percent level. The elasticities indicate that an increase in the number of teachers will lead to a more than proportionate increase in student performance. Elasticities are 1.30 and 1.40 for P_1 and P_2, respectively.

The strong results of the above faculties are weakened by those of the FS. Here, the coefficients in the linear functions are both positive, but only P_1 had a significant coefficient at the one percent level. As for the log-linear functions, the results are inconsistent in both equations. None of the coefficients is significant, and the coefficient in P_2 is even perverse. The elasticity of this negative coefficient was quite small (-0.01 in Table 4.4), while that for P_2 was 0.41. Performance was therefore inelastic with respect to TTS in this faculty. Given that the negative result is insignificant, and that one of the three remaining positive coefficients is significant at the one percent level, we can then conclude for a weak positive relationship between TTS and performance (L) in the FS.

We can therefore conclude that the number of teachers had a highly significant positive effect on the number of degrees awarded by the faculties of the former University of Yaounde. This is consistent with our *a priori* expectation. Student performance is elastic for all the faculties combined, and in the FDSE and the FLSH, but is inelastic in the FS. The results confirm those of Bowles (1970), Umo (1980) and Tafah (1989). Our results therefore confirm Bowles' (p.43) conclusion that "the teacher is the single most important school input". This conclusion implies that efficiency can be improved if more resources are shifted towards the employment of more teachers. Nothing is said here about the quality of these teachers (academic grade and experience) since we could not obtain time series data to include these variables in our model.

Real Salary of the Teaching Staff

This variable serves as a proxy for educational quality (teacher experience and qualification). For all the faculties pooled together, the real average salary of the teaching staff has a nonsignificant effect on student performance in both linear equations. The coefficients are inconsistent as P_1 is positive and P_2 is negative. When we examine the log-linear functions in

Table 4.4, we see that they both have positive signs, but only the coefficient of the second equation is significant at the 5 percent level. Both coefficients are inelastic. Given that the positive results dominate, we can conclude for a positive relationship between average real teacher salary and the number of first degrees awarded by the three faculties of the former University of Yaounde brought together.

In the FDSE, this variable has positive effects on the number of degrees awarded in the two linear functional forms, but non of them is significant. The very results are obtained from the log-linear functions. The elasticity associated with a one percent increase in TSS is 0.15 for both log-linear functions - P_1 and P_2 as shown in Table 4.4. The relationship between teacher salary and academic performance was thus positive, but nonsignificant in the FDSE.

The results in the FLSH are the opposite of what we have in the FDSE. In the linear functions, the coefficients of TSS are both negative and significant at the one percent level in both P_1 and P_2. Although not significant, the log-linear functions confirm the negative relationship between TSS and L. The elasticities in absolute terms are 0.32 and 0.25 for the two equations respectively.

In the FS, the results are inconsistent across the functional forms used. The linear functions show a negative association between TSS and L. P_1 is significant at the 5 percent level while P_2 is not significant. The log-linear functions on their part show a positive and significant relation in both P_1 and P_2 at the 5 percent level. The elasticities are 0.83 and 0.98 showing that L is inelastic with respect to TSS. The perverse results of this variable in this faculty make a definite conclusion difficult. The situation with the log-linear functions is further complicated by the fact that, the F-ratio for P_2 is not significant, implying that the coefficients are not significantly different from zero. Even with P_2 dropped, P_1 still presents two exactly opposite results.

The use of the teachers salary as a proxy for teacher experience and qualification was justified on the grounds that pay scales in Cameroon provide longevity- and qualification-related increments. The negative relationship in the FLSH merits some attention because this faculty had the highest mean average salary among all the faculties. This stood at 6.42 million CFAF, while the average for all the three faculties was 6.33 million CFAF. This implies that the FLSH had a high proportion of experienced and qualified staff. This boils down to the fact that these qualified and experienced teachers had a negative influence on the performance of students at the undergraduate level.

This might be attributed to the fact that this senior staff was not much involved with undergraduate courses, especially with tutorials where the influence of the teacher is expected to be very important, and our study deals only with the undergraduate cycle. Therefore, as salaries increased (a consequence of increased experience and qualification), teachers abandoned tutorials and subsequently took only a few courses or even non at the undergraduate level, thus the negative effect on student performance. This conclusion raises some questions about the use of teacher salary as a proxy for experience and qualification. Perhaps a general increase in the salary of the teaching staff which does not come about through experience and qualification will have a positive effect on student performance. Another probable explanation to this negative relationship could be that the longevity of teachers might be accompanied by diminishing performance. This is the depreciation of human capital. This implies here that experienced teachers become less productive after a certain age. Tuckman et al (1977) tested but did not fail to reject this hypothesis.

Expenditure per Student (XPS)

The pooled data exhibits a negative relationship between expenditure per student and student performance in the linear functional form. As shown on Table 4.3 the coefficient of XPS in P_1 is significant at the one percent level, while that of P_2 is significant at the 5 percent level. The log-linear form results, though not significant confirm the negative relationship between per student expenditure and academic performance. Their elasticities are respectively 0.17 and 0.19 for P_1 and P_2. The conclusion here rejects our initial prediction of a positive link between XPS and L.

In the FDSE, the behaviour of this variable is consistent across the different equations. In the linear functional form, the coefficients of both P_1 and P_2 are negatively significant at the one percent level. The results of the log-linear functions further reinforce the results of the linear form. Both coefficients are negative and significant at the 5 percent level. The negative relationship here is highly significant and thus rejects our *a priori* expectation of a positive association between per student expenditure and student performance as was the case with the aggregate data. The elasticities indicate that a one percent increase in XPS could reduce the performance of students by 1.22 percent as can be seen from Table 4.4.

The results in the FLSH are not as consistent as those in the FDSE for the different equations estimated. The linear form shows a positive and significant relationship between XPS and L. The coefficient P_1 is significant at the 5 percent level, while that of P_2 is significant at the 10 percent level. On the contrary, the log-linear form produces a negative link between the two variables. This relationship is weaken as non of the coefficients is significant. Since the negative coefficient are not significant, we may conclude for a positive relationship between XPS and L in the FLSH.

In the FS, the linear form results show a positive but nonsignificant association in both P_1 and P_2. This positive link is confirmed by the log-linear form whose results equally remain nonsignificant. The elasticities are equally very low: 0.10 and 0.11. In the FS therefore, there exist a positive and nonsignificant relationship between XPS and L.

Before any explanation of our results, it should be noted that XPS is an aggregate of several expenditure items: staff salary, scholarship payments, running cost of the faculty including teaching aids, book acquisition, lodging, feeding, and others. The problem here is to determine which expenditure item was responsible for the positive or negative relationship between L and XPS.

Given that scholarship payments constituted the single most important expenditure item in the recurrent budget of the former University of Yaounde and that this variable had a negative relationship with performance in all the faculties, we can hold it responsible for the negative association between L and XPS. Average teacher salary might have played a similar role in some faculties in which it had a negative impact on performance.

The negative relationship between L and XPS can therefore be attributed to inefficient allocation of resources since a lot of resources were being channelled to scholarship payments which had no positive impact on performance. Resources were not being used efficiently to achieve educational objectives. Efficiency could have been significantly improved if resources were shifted towards the recruitment of more teachers - a performance enhancing input as we have demonstrated above. Even in those faculties where the coefficient of XPS was positive, improvement in efficiency could still have been realised if the input mix was altered. This should be in favour of performance enhancing inputs.

The Student-Teacher Ratio (STR)

This ratio serves as a proxy for class size and is an indicator of the quality of education offered. When data for all the faculties is brought together, the linear functional form equations produces a negative and significant relation between L and STR at the one percent level. On the contrary, the log-linear form shows a nonsignificant and positive link between the two variables. This form indicates the elasticity with respect to STR to be 0.30. These two results are contradictory, but since the positive result is not statistically different from zero, we lean to the negative relationship.

In the FDSE, the linear form shows a highly significant and negative relationship between class size and student performance. It is significant at the one percent level. The log-linear form equally confirm this result at the 5 percent level. The partial elasticity indicates that a reduction of one percent in class size will increase performance by 1.12 percent.

The results in the FLSH produce a significant (at the one percent level) and positive relationship between STR and L. The results from the log-linear form, though not significant, confirm this positive relationship with an elasticity of 0.06. So while an increase in STR reduces performance in the FDSE, it instead increases performance in the FLSH.

For the FS, the results are similar to those in the FLSH. The linear function has a positive coefficient which is significant at the 5 percent level. The log-linear form is stronger with a positive and significant coefficient at the less than one percent level. The elasticity of 1.3 indicates that a change in this input will lead to a more than proportionate increase in student performance.

The above results show how difficult it is to draw a definite conclusion on the behaviour of this variable in the various faculties of the former University of Yaounde. While the pooled data and FDSE show a negative link, the FLSH and the FS present a positive relation between L and STR. More light can be thrown on this behaviour if we look at the average STRs in all the faculties. In the FLSH and FS, these were 24 (with a maximum of 58) and 23 (with a maximum of 42) respectively. While for the FDSE, we had 84 (with a maximum of 129), and for all the faculties combined we had 37 (with a maximum of 68). We can therefore conclude that class sizes as high as 24 increased performance, but when they went up to about 37, the effect on student performance was negative. This means that the FLSH and FS can improve on their efficiency by increasing on their class sizes, while the FDSE will do same if the class size is reduced. This may be suggesting that there exist an optimal class size which falls between 24 and 37.

Total Number of Students Enrolled (ENT)

This variable is included into the educational production function so as to see the direct effect of school size on the performance of students. That is to test the law of diminishing marginal productivity. The results of the pooled data show that the linear functional form produces a negative relationship which is significant only at the 10 percent level. This negative association is verified in the log-linear functional form, which is not significant. The coefficient in Table 4.4 is inelastic.

In the FDSE, the coefficient of enrolment is negative and very significant at the one percent level in the linear functional form. The log-linear form equally confirms this negative relationship but with a 5 percent significant level. The elasticity is 1.12 implying that an increase in enrolment will lead to a more than proportionate decrease in student performance.

In the FLSH, the linear form establishes a positive relationship between student performance and enrolment. This has a 99 percent confidence level. The results of the log-linear form are not significant , but maintain the sign of the linear form.

The functions for the FS have the same signs as those of the FLSH, but establish more significant relationships between L and ENT. The linear functional form has a positive coefficient which is significant at the 5 percent level, while the log-linear functional form has an equally positive coefficient which is significant at the one percent level. It has an elasticity of 1.49 meaning that enrolment was performance elastic in this faculty.

As was the case with STR, the coefficient of ENT in the FLSH and FS is positive, while that for the FDSE and the pooled data is negative. This shows that at the given levels of enrolment, there were increasing marginal productivities in the FLSH and the FS. The average enrolments in these faculties stood at 2695 (with a maximum of 8781) for the FLSH, and at 3132 (with a maximum of 9171) for the FS. Production efficiency in these faculties could have been improved with an increase intake of students.

The three faculties as a single entity were already facing a problem Schiller (1986, p.126) describes as that of "crowded facilities". That is the law of diminishing marginal returns which means that the marginal product of a variable input declines as more of it is employed with a given quantity of the other inputs. The university was therefore in this zone of diminishing returns, implying that any small increase in ENT will have had a negative effect on the number of degrees produced each year. This was the vary situation in the FDSE which constituted the bulk of enrolment in the three faculties brought together. Average enrolment in this faculty stood at 6 057 (with a maximum of 15 554) while for all the faculties brought together it was 11 885 (with a maximum of 33 506). A caution about these results is necessary here. Our analyses are based on the assumption that our regression coefficients are unbiased estimates of the marginal physical products. This might not be true given the specificities of educational production discussed in Chapter Three. Despite these shortcomings, they nevertheless throw some light on the consequences of unchecked student intakes.

We now examine the overall performance of our production function model by first looking at the measurement of the goodness of fit ($\overline{R}^2$) of our regressions. $\overline{R}^2$ measures the proportion of variation in the dependent variable explained by the independent variables. The eighth row of Table 4.3 shows the $\bar{R}^2$s for our linear production functions. They are all above 0.50, implying that in all our functions, more than 50 percent of the variation in the number of degrees produced is accounted for by the five independent variables in our model. This verifies one of our hypotheses that at the higher education level, school environmental resources are very important in determining student performance. In the FLSH for example, $\bar{R}^2$ is even above 0.95, showing that our regression equation actually explained most of the changes in the dependent variable.

Looking at our log-linear functions in Table 4.4, we see that the $\bar{R}^2$s are varied among the different faculties. Whereas it is as high as 0.95 for the pooled data, it is just 0.37 in the FS. The function in the FS with this low explanatory power even has an insignificant F-ratio. The low $\bar{R}^2$ is thus not surprising and that particular function is not statistically useful. Apart from the FS, the other $\bar{R}^2$s for our log-linear functions show that more than 58 percent of the variation in L is explained by the five independent variables included in the model. An easy mistake to make here will be to try to compare the $\bar{R}^2$s from the linear functions with those from the log-linear functions. This will be incorrect because $\bar{R}^2$ is the ratio of the explained variance to the total variance, and the variances of L and log(L), (that is the logarithm of L) are different (Maddala, 1988; p.177).

The unexplained part of the variation in the our dependent variable (1-$\bar{R}^2$), can be attributed to a number of reasons. Firstly, due to data limitations, not all the intended independent variables have been included: teacher qualification and experience , and more especially the number of library books per student. Even the use of proxies implicitly admits a measurement error. We are of the opinion that some of these variables would have played an important role in explaining part of the variation in L. Secondly, the use of the number of first degrees produced might not be the single or most important measure of the output of higher education. Perhaps a better measure (which we could not use because of data limitations) could have been the number of students promoted to an upper class each year (which includes the number of degrees produced each). The output measure we used told just part of the story. Thirdly, even the data we used was not reliable as some sources produced contradictory observations. Lastly, it is likely that the inclusion of only school environmental variables, and the exclusion of socio-economic status, students' initial ability, and peer influence has led to some information loss.

Despite all these problems, we think we have been able to identify some of the variables which impinge on the production of higher education in Cameroon, as was one of our objectives. Our $\bar{R}^2$s are higher than some in similar studies: Bowles (1970), Cohn (1968) and Perl (1973), some of which used more regressors than in this study. We have also tried to show the predominant role of school environmental factors in determining the output of higher education. This implies that the results have failed to reject our initial expectations.

The F-statistic reportedly on Tables 4.3 and 4.4 for the linear and log-linear functional forms respectively, is used to test for the existence of a linear relationship between the dependent and the independent variables. Our original sample size of 21 was at times reduced to 18 due to differencing and the correction for serial correlation. This meant that the critical value of the F-statistic varied as well. Their various levels of significance are indicated on Tables 4.3 and 4.4. Examining first the F-statistics for the linear functions from Table 4.3, we see that all of them are significant at the one percent level except P_2 for the aggregate function which is significant at the 5 percent level. Looking now at the log-linear functions in Table 4.4, all the F-statistics have a 99 percent confidence level with the exception of the FS. P_1 for the FS is significant at the 5 percent level, while P_2 is not significant at all. It is this same P_2 which had the lowest $\bar{R}^2$ (0.369) among all our equations. This might imply the rejection of the log-linear form in this faculty. Generally speaking, the F-statistics indicate the overall significance of the relationship between the dependent and the independent variables in our production function model.

Tables 4.3 and 4.4 also show the Durbin-Watson (D-W) statistics which is a test for the absence of first order autocorrelation. The null hypothesis of no serial correlation was rejected in all our functions, both linear and log-linear. We then used the Cochrane-Orcutt iterative procedure described in Chapter Three to correct for serial correlation. The results presented in Tables 4.3 and 4.4 show significant D-W statistics for all the equations. The level of significant of each D-W statistics is indicated against the statistic on the tables.

The White statistic equally presented in Table 4.3 is a test for common residual variances (that is homoskedasticity) against the alternative hypothesis of heteroskedasticity. From Table 4.3, the White statistics for all our equations is less than 15.1 (the one percent critical value). This implies that the null hypothesis of homoskedasticity is not rejected at the 99 percent confidence level. Very often, researchers solve the problem of heteroskedasticity by estimating their equations with log-transformed data (Maddala, 1988; p.161). Since heteroskedasticity is absent in our linear functions, we saw no need again to test for its existence in the log-linear function. That is why our log-linear functions in Table 4.4 do not carry the White statistic.

Tables 4.3 and 4.4 contain a row for the Dickey-Fuller statistic. It is used here to test for cointegration of the regression equation in cases where the series involved were not stationary. The test is similar to the unit roots test presented in Tables 4.1 and 4.2 above but is applied here to the residuals from the regression equation. They have the same critical values. An inspection of the D-F statistic on the last row of Table 4.3 reveals that the null hypothesis of noncointegration is rejected for all the equations estimated. The two equations for the pooled data fail to reject cointegration with a 99 percent confidence level, while P_2 in the FDSE does same but at the 90 percent level, and the remaining equations do same at the 95 percent level.

For the log-linear equations in Table 4.4, only the FLSH has the D-F statistic. The reason is that, in the other faculties, at least one series was stationary in its levels (that is without any differencing). And since we could not run a regression comprising both stationary and nonstationary series, we had to difference all nonstationary series to stationarity. With all the series now stationary, there was no need for a cointegration test. That is why the other faculties do not have any D-F statistic for the cointegration test.

The D-F statistics presented on Table 4.4 for the FLSH does not reject cointegration at the 90 percent confidence level.

As regards multicollinearity, variance-inflation factors (VIF) have been calculated for each of the equations estimated, and presented in Tables 4.5 and 4.6 for the linear and log-linear functions, respectively. For the linear functions in Table 4.5, the VIFs are generally around 2. One major problem with the use of VIF is the absence of a critical value. But before we differenced our series for nonstationarity, the VIFs we obtained were even as high as 100. The VIFs we now present show a remarkable improvement.

Table 4.5: Variance-Inflation Factors for the Educational Production Functions.

Variables	FDSE		FLSH		FS		ALL	
	P_1	P_2	P_1	P_2	P_1	P_2	P_1	P_2
NSS	1.75	1.79	1.06	1.09	1.37	1.15	1.49	1.32
TTS	0.17	0.54	1.32	2.04	0.70	2.22	0.21	0.43
TSS	1.39	1.32	0.69	0.83	0.18	0.20	1.43	1.05
XPS	2.33	2.70	2.17	1.82	2.50	2.63	1.82	1.64
STR	1.32	—	1.59	—	2.22	—	1.70	—
ENT	—	2.33	—	2.63	—	5.88	—	2.50

Note: The VIFs are computed using the formula given in section 3.3 of Chapter Three.

Table 4.6: Variance-Inflation Factors for Educational Production Functions (variables in logarithms).

Variables	FDSE		FLSH		FS		ALL	
	P_1	P_2	P_1	P_2	P_1	P_2	P_1	P_2
NSS	0.01	0.01	2.86	12.5	1.64	1.64	1.22	1.22
TTS	4.00	1.60	1.92	2.70	1.79	1.52	0.01	0.01
TSS	1.79	1.79	2.33	2.78	1.59	1.59	2.08	1.32
XPS	2.43	2.43	1.25	1.23	1.39	1.39	1.25	1.43
STR	3.13	_	4.17	_	2.27	_	1.72	_
ENT	_	1.85	_	8.33	_	2.27	_	3.57

Note: The VIFs are computed using the formula given in section 3.3 of Chapter Three.

4.3.1.2 The Relative Effectiveness Of Educational Inputs

In chapter Three, we described the procedure for standardising our regression coefficients so that their absolute values can indicate the relative importance or effectiveness of the various inputs in influencing output. This can then enable us to establish priorities among the inputs. This is necessary given that the educational decision-maker operates with a limited budget. Table 4.7 below presents these standardised (or beta) coefficients for the educational production function. They are obtained by multiplying the regression coefficient by the standard deviation of the independent variable, and dividing by the standard deviation of the dependent variable as described in Chapter Three. As the absolute value of these coefficients indicate the relative importance of those independent variables in influencing the dependent variable, this implies that in any attempt to improve the efficiency of production, priority should be given to those inputs with the highest beta coefficients (in absolute terms). The signs of these coefficients indicate the direction in which any change should be affected.

Table 4.7: Standardised (beta) Coefficients for the Educational Production Function.

Variables	FDSE	FLSH	FS	ALL
NSS	-0.009	-0.136	-0.634	-0.489
TTS	0.201	0.883	0.482	0.338
TSS	0.156	-0.307	-0.113	0.114
XPS	-0.838	0.169	0.146	-0.592
STR	-0.608	0.306	0.401	-0.351

Looking at Table 4.7, we realise that priority is not given to the same inputs in the different faculties. For example, when all the faculties are pooled together, top priority is given to the reduction of expenditure per student (XPS). This is the same priority obtained in the FDSE, but in the FLSH, it is an increase in the number of teachers (TTS) which is very important, while in the FS, the best way of increasing the number of degrees produced is to reduce the number of students receiving scholarship (NSS). Table 4.8 below classifies the independent variables in their order of importance in influencing the dependent variable in the various faculties. This classification is operated from Table 4.7 by arranging the beta coefficients by their order of magnitude.

Table 4.8: The Relative effectiveness of the Educational Inputs.

FDSE	FLSH	FS	ALL
-XPS	TTS	-NSS	-XPS
-STR	-TSS	+TTS	-NSS
+TTS	+STR	+STR	-STR
+TSS	+XPS	+XPS	+TTS
-NSS	-NSS	-TSS	+TSS

Note: The sign in front of the variables indicates the direction in which change should be made in order to improve efficiency or student performance.

4.3.2 THE EDUCATIONAL EXPENDITURE PER STUDENT FUNCTION

The regression results for the expenditure per student function are analysed in a similar way as with the production function. We first examine the behaviour of each of the variables in the different faculties, and then we discuss on the general performance of the regressions. This will then lead us to the conclusion. The results are presented in Tables 4.9 and 4.10. The first table shows the results of the linear expenditure per student functions (C_1 and C_2). C_2 is different from C_1 in that enrolment squared $(ENT)^2$ is added to it. It is therefore our parabolic expenditure per student function. Table 4.10 contains the results of our log-linear functional form.

Table 4.9: Expenditure per student Functions

Variables	FDSE		FLSH		FS		ALL	
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
NSS	0.014^{+}	0.024^{*}	0.002	0.043^{++}	0.006	0.036^{*}	0.009^{*}	0.019^{+}
	(2.345)	(3.492)	(0.131)	(1.920)	(0.453)	(3.802)	(3.191)	(3.153)
TTS	1.742	0.126	-1.262	-0.837	1.052	-0.043	0.093	2.862^{+}
	(1.041)	(0.079)	(-1.519)	(-1.201)	(0.671)	(-0.520)	(1.034)	(2.899)
TSS	0.020^{+}	0.017	0.023^{++}	0.020^{++}	0.007^{+}	0.010^{*}	0.002	0.025^{++}
	(2.195)	(1.746)	(1.912)	(2.099)	(2.183)	(3.369)	(0.344)	(2.076)
ENT	-0.026^{++}	-0.083^{+}	-0.027	-0.372^{*}	-0.141^{*}	-0.421^{*}	-0.021^{+}	-0.112^{+}
	(-1.993)	(-2.681)	(-0.675)	(-4.298)	(-4.138)	(-7.986)	(-2.204)	(-2.943)
$(ENT)^2$	_	$3.5E\text{-}6^{++}$	_	$2.6E\text{-}5^{*}$	_	$2.5E\text{-}5^{*}$	_	$2.0E\text{-}6^{+}$
		(1.995)		(3.618)		(4.782)		(2.793)
$\bar{R}^2$	0.448	0.525	0.380	0.624	0.489	0.785	0.482	0.532
D-W	1.73^{*}	1.86^{*}	1.78^{*}	2.20^{*}	2.08^{*}	1.91^{*}	2.28^{*}	1.93^{*}
White	0.19^{*}	2.72^{*}	2.88^{*}	9.76^{*}	3.04^{*}	2.52^{*}	7.56^{*}	4.48^{*}
F	5.88^{*}	3.95^{+}	3.6^{+}	4.56^{+}	5.31^{*}	11.31^{*}	4.16^{+}	3.85^{+}
D-F	6.061^{++}	6.089^{++}	6.322^{++}	735.44^{*}	7.464^{+}	6.651^{++}	6.787^{++}	7.675^{+}
ENT^{*}	_	11 752	_	7 090	_	8 358	_	28 334

Note: t-statistics are in parentheses.
* Significant at the 1 percent level.
\+ Significant at the 5 percent level.
++ Significant at the 10 percent level.
ENT^{*} is the optimum enrolment
C_2 is different from C_1 in that it has $(ENT)^2$ included.

Table 4.10: Educational Expenditure per student Functions (variables in logarithms)

Variables	FDSE	FLSH	FS	ALL
NSS	0.165^{+}	0.029	0.225^{+}	0.240
	(2.540)	(0.535)	(2.577)	(1.407)
TTS	-0.070	-0.049	0.002	8.9E-04
	(-0.663)	(-0.533)	(0.368)	(0.352)
TSS	0.679*	0.220^{+}	0.130	0.342^{+}
	(9.619)	(2.463)	(1.565)	(2.492)
ENT	-0.044	-0.592*	-0.896*	-0.275
	(-0.450)	(-7.079)	(-9.277)	(-0.942)
$\bar{R}^2$	0.910	0.770	0.769	0.566
D-W	2.07*	2.03*	1.76*	1.79*
F	29.43*	19.99*	14.30*	5.90*
D-F	—	9.943^{+}	—	—

Note: t-statistics are in parentheses.
* Significant at the 1 percent level.
$^{+}$ Significant at the 5 percent level.
$^{++}$ Significant at the 10 percent level.

4.3.2.1 The Behaviour of the Independent Variables

The Number of students on scholarship (NSS)

The coefficients of this variable when the data for all the faculties is pooled together (presented under 'ALL' in Tables 4.9 and 4.10) are all positive and significant. For the linear functional form equations, C_1 is significant at the one percent level, while C_2 is significant at the 5 percent level. In the log-linear form, the coefficient is positive but not significant.

In the FDSE the positive relationship with XPS is confirmed in all the function al forms. In the linear functional forms, as presented by Table 4.9, the coefficient of C_1 is significant at the one percent level, while that of C_2 is significant but at the 5 percent level. In the log-linear form in Table 4.10, the only equation estimated is significant at the 5 percent level but not performance-elastic. NSS therefore has a positive and significant relationship with XPS in the FDSE.

Concerning the FLSH, the linear form produced a positive and nonsignificant coefficient in C_1, but a positively significant (at 10 percent level) coefficient in C_2. The log-linear form gave an equally positive coefficient, but which is not significant. The relationship between NSS and XPS in the FLSH is positive but less significant than the case in the FDSE.

The FS shows consistently positive results in both functional forms. The coefficient of NSS in C_2 is positive and significant at the one percent level, while in C_1, it remains positive but is not significant. The log-linear result is positive and insignificant at the 5 percent level. The relationship in this faculty between the two variables is more significant than in the two previous faculties. Its coefficient is inelastic.

The behaviour of NSS in explaining the variation in XPS has the expected sign, but the result is not as significant as we had expected, given that scholarship payments was the single most important expenditure item in the budget of the former University of Yaounde. The partial elasticities in all the faculties indicate that a change in NSS will lead to a less than proportionate increase in expenditure per student. This result which is not as significant as expected might be explained by the fact that this variable was measured by the number of students awarded scholarships, instead of the actual amounts spent on scholarship payments. This measurement could not be used for lack of faculty disaggregated data.

The Total Number of the Teaching Staff (TTS)

When data for all the faculties is pooled together, the TTS coefficients in the linear functional forms are all positive. While the coefficient in C_1 is nonsignificant, that in C_2 is significant at the 5 percent level. The log-linear form also has a positive coefficient, but which remains nonsignificant.

In the FDSE, the linear functions both showed a positive and nonsignificant relationship between TTS and XPS. The log-linear form had a negative coefficient which was also not significant. No relationship can therefore be statistically established between the two variables since all the regression coefficients are not significant in this faculty.

The linear functions in the FLSH both establish negative and nonsignificant relationships between TTS and XPS. The negative and nonsignificant link is equally confirmed by the log-linear form. Therefore, as was the case with the FDSE, the coefficient of TTS is not significant in this faculty.

For the FS, both C_1 and C_2 in Table 4.9 have nonsignificant coefficients for TTS. The coefficient in C_1 is positive, while that in C_2 is negative. The log-linear form has a positive coefficient which is equally not significant.

This variable has not confirmed our *a priori* hypothesis of a significant relationship between the total number of teachers and per student expenditure. The relationship is positive but remains nonsignificant. The number of teachers could therefore be increased without any significant increase in expenditure per student. Cost-savings could therefore be realised in this way. In all the faculties, an increase in TTS will have a less than proportionate effect on per student expenditure.

Real Average Teaching Staff Salary (TSS)

For all the faculties combined, the linear functional form in Table 4.9 produce positive coefficients between TSS and XPS. Equations C_2 is significant at the 10 percent level, while C_1 is not significant at all. In the log-linear form, the coefficient of TSS is positive and very significant with a confidence level of more than 99 percent.

In the FDSE, the linear equations show a positive relationship between real average teacher salary and expenditure per student. The coefficient in C_1 is significant at the 5 percent level while that in C_2 is not significant. The log-linear function reinforces the positive relationship between these two variables with a very significant coefficient at the less than one percent level. It had an elasticity of 0.30. TSS therefore had a cost increasing effect on XPS in the FDSE.

For the FLSH the coefficients of both C_1 and C_2 are significant at the 10 percent level and are all positive. The log-linear function also had a positive coefficient but had a higher confidence level of 95 percent.

The relationship between TSS and XPS in this faculty was positive but not so significant.

In the FS, the coefficients of the linear functions are all positive and significant at the 5 percent and one percent levels for C_1 and C_2 respectively. The coefficient of TSS in the log-linear function is positive but not significant. We can still conclude for a significant positive link between expenditure per student and average teacher salary in the FS, given that the linear results are more significant.

The general conclusion which can be drawn on the behaviour of the average teacher salary is that it has a consistent positive effect in explaining the variation of expenditure per student in all the faculties and in all the functional forms. This confirms our initial hypothesis and the results of other studies: Cohn (1968), Riew (1966) and Tafah (1989). This is not surprising since teacher salaries were the second most important expenditure item in the budget of the former University of Yaounde, and education is generally a labour intensive industry with salaries being a very important cost determinant. The elasticities in all the faculties are less than one, implying expenditure per student is inelastic with respect to the average teacher salary.

Total Number of Students Enrolled (ENT).

This variable was used in our expenditure function to see the effect of rising enrolment on XPS. The sign of its coefficient will enable us to determine whether the establishment concerned exhibited economies or diseconomies of scale. When all the faculties are pooled together, a negative link is established between XPS and ENT in all the equations estimated. The coefficients of ENT in both C_1 and C_2 are significant at the 5 percent level, while that of the log-linear functional form in Table 4.10 is nonsignificant.

In the FDSE, the coefficient of ENT is very consistent in its sign, though the level of significance varies. In C_1 and C_2 of Table 4.9, this coefficient is negative and significant at the 10 percent and 5 percent levels, respectively. The negative relationship is confirmed by the log-linear function though with a nonsignificant relationship. There exist therefore a negative relationship between XPS and ENT in the FDSE as in the pooled data.

The negative relationship above is mirrored in the FLSH for the three equations estimated. The level of significant is equally varied. The coefficient in C_1 is not significant , but that in C_2 is significant at the one percent level. The coefficient in the log-linear function is equally significant at the one percent level. The relationship in this faculty is rather more significant.

The results in the FS are more robust than those above. The negative association is confirmed. The coefficients of both C_1 and C_2 are significant at the one percent level. This is the same result with the log-linear function. The relationship in this faculty is very significant.

The negative link established here between per student expenditure and school size in all the faculties confirms our *a priori* hypothesis of initial economies of scale in the operation of university education in Cameroon. Similar results in higher education have been found by Psacharopoulos (1980) and the World Bank (1986). The behaviour of $(ENT)^2$ enable us know how persistent these economies of scale were.

Enrolment Squared {$(ENT)^2$}

This variable was introduced into the expenditure per student function to enable us test whether economies of scale are subsequently followed by diseconomies of scale if enrolment continues to grow. As can be seen from Table 4.9, the coefficient of $(ENT)^2$ in the aggregate ('ALL') and the disaggregated equations are positive, thus confirming our initial expectations that diseconomies of scale did eventually set in as enrolment increased. All the coefficients are significant at the one percent level for the FLSH and the FS, 10 percent for the FDSE, and at 5 percent for all the faculties combined. C_2 is then a U-shaped expenditure per student function in all the faculties - implying the existence of an optimum enrolment size.

After examining the behaviour of the independent variables in explaining the variation in expenditure per student, we now turn our attention to the overall performance of the model. The measurements of the goodness of fit ($\overline{R}^2$) of our C_1 equations in Table 4.9 are all less than 0.50, implying that the four variables in the equations do not explain up to 50 percent of the variation in per student expenditure. In C_2, with the addition of enrolment squared, the proportion of the variance in XPS explained by the independent variables is everywhere greater than 50 percent. The $\overline{R}^2$ in the FS was as high as 0.785. This seems to be telling us that the correct specification of the expenditure per student function should be parabolic (that is with the square of the size variable included as one of the independent variables). The $\overline{R}^2$ of the log-linear functions in Table 4.10 equally show that a substantial part of the variation in the dependent variable is explained by the four independent variables. In the FDSE, these variables explained 91.03 percent of the variation in expenditure per student. Comparing the $\overline{R}^2$ from the linear function with that from the log-linear function is incorrect as we explained under the production function.

The unexplained part of the variation in XPS can be attributed to a number of reasons: the unreliability in some of our data points as some of our observations had contradictory information from different sources. Secondly, the data for expenditure were budget estimates and not the actual amounts spent. Thirdly, because of our inability to obtain faculty-level data, we instead used the number of students given scholarships which was not what we had conceived. Problems involved in specifying educational cost functions could also account for the low $\overline{R}^2$ in our equations. Given our parsimony in variable choice, our results are better than those obtained by Cohn (1968) and Riew (1966).

The F statistics is equally reported in Table 4.9 for the linear form equations and in Table 4.10. for the log-linear form equations. The C_1 equations in Table 4.9 have two F statistics which are significant at the one percent level (for the FDSE and the FS). The remaining once are all significant at the 5 percent level. For C_2, the F statistics are significant at the 5 percent level, with the exception of the FS whose F statistic is significant at the one percent level. The linear relationship is more significant in the log-linear functional forms. Here, all the F statistics have a 99 percent confidence level. The F test therefore fails to reject the existence of a linear relationship between expenditure per student and the variables included in the model, thus proving the overall statistical significance of our regression model.

The test for the absence of serial correlation is shown on our tables by the Durbin-Watson statistic. Table 4.9 shows the D-W statistic for our linear functional form. In the C_1 equations, all the D-W statistics are significant at the one percent level. This is the same thing with the C_2 equations. The results of the log-linear form in Table 4.10 also show a significant D-W statistic. For all the results of the expenditure per student functions, the hypothesis of zero autocorrelation was accepted in all the equations estimated at the one percent level of significant. It is perhaps important to note that this statistics only became significant in most of our equations after the Cochrane-Orcutt iterative procedure was used to correct for serial correlation.

The white statistic presented on Table 4.9 is a test against heteroskedasticity as described in Chapter Four. As the results show, the White statistic for all our equations (both C_1 and C_2) has accepted the null hypothesis of homoskedasticity at the 99 percent confidence level. The absence of heteroskedasticity in our linear model made it needless for us to carry out the test in the log-linear model. This is because log-transformation is often proposed as a solution to the heteroskedasticity problem. This explains why the log-linear functions in Table 4.10 do not have the White statistic.

The last but one row of Table 4.9 shows the Dickey-Fuller (D-F) statistic for the test of noncointegration for our linear functions. The critical values for this test are given as a note to Table 4.1 above. In all the equations estimated in Table 4.9, only C_2 in the FLSH rejects the null hypothesis of noncointegration at the one percent significant level. C_1 for the FS and C_2 for the pooled data reject the hypothesis at the 5 percent level, while the remaining equations of the linear functional form reject at the 10 percent level. Concerning the log-linear functional forms, only the FLSH has the D-F statistic for the same reasons explained under the educational production function above. The statistic for this faculty fails to reject cointegration with a 95 percent confidence level as can be read from the last row of Table 4.10. Our regressions are now void of spurious correlation and inference can be made from our results without risk of much errors.

As regards the multicollinearity test, the variance-inflation factors (VIF) for each of the equations estimated are shown in Tables 4.11 and 4.12 below. In Table 4.11, the VIFs for the linear functions are generally less than two, except for the Variables ENT and $(ENT)^2$ in the C_2 equations. This implies that when these two variables enter the function, the problem of multicollinearity becomes serious. This is but obvious given that one of the variables is just the square of the other, and they are bound to be collinear. In the C_1 equations, and without $(ENT)^2$, the VIF for ENT is small and falls in line with the other variables. The VIFs for the log-linear functions in Table 4.12 are equally low. These values show the low level of collinearity among our independent variables. Before these series were differenced, most of the VIFs were above 75. The ones we present here show some remarkable improvement.

Table 4.11: Variance-Inflation Factors for the Educational Expenditure Functions.

Variables	FDSE		FLSH		FS		ALL	
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
NSS	1.120	2.220	1.100	1.890	1.300	1.850	1.150	2.040
TTS	1.020	1.590	1.920	1.920	1.190	1.220	0.400	0.490
TSS	1.100	1.490	0.730	1.520	0.060	0.060	1.000	1.010
ENT	0.790	5.000	2.330	11.110	1.020	6.250	2.080	12.500
$(ENT)^2$	__	8.330	__	14.290	__	8.330	__	14.300

Note: The VIFs are computed using the formula given in section 3.3 of Chapter Three.

Table 4.12: Variance-Inflation Factors for the Educational Expenditure Functions (variables in logarithms).

Variables	FDSE	FLSH	FS	ALL
NSS	1.000	3.570	1.110	1.200
TTS	1.090	1.280	0.004	0.003
TSS	1.350	1.010	1.030	1.190
ENT	1.200	1.010	1.140	1.010

Note: The VIFs are computed using the formula given in section 3.3 of Chapter Three.

This case against multicollinearity is further supplemented by the simple correlation coefficients presented in Appendixes A and B. Appendix A presents the coefficients for the original data, while Appendix B shows coefficients for log-transformed data .

Each appendix has a matrix of simple correlation coefficients for each of the faculties. An inspection of the simple correlation coefficients indicates that most of them lie below 0.5. Only a few pair of variables have a coefficient which is greater than 0.5. One of these conspicuous pairs is ENT and $(ENT)^2$. Their coefficient is very high in all the faculties, indicating the obvious collinearity that should exist between them, since one is simply the square of the other. The correlation coefficient between ENT and STR is also high in most of the faculties, but this is not a problem because these two variables do not appear together in any of the regression equations. Apart from these cases, there is no consistent high coefficient between any two variables as indicated in Appendixes A and B.

4.3.2.1 The Optimum Enrolment

From Chapter Three, the optimum size of the school was shown to be $ENT^* = -b_1/2b_2$, where b_1 is the coefficient of ENT, and b_2 is the coefficient of $(ENT)^2$. Applying this formula to our C_2 equations in Table 4.9, we obtain the following optimum or least expenditure enrolments: 11 752, 7 090, 8 358 and 28 334 for the FDSE, FLSH, FS and for the pooled data, respectively. These optimum enrolments are less than the maximum enrolments recorded in each of these faculties over our study period. An examination of the data indicates that the optimum enrolment was exceeded only in the 1989/90 academic year for the FDSE, FLSH and for the three faculties combined. In the FS, actual enrolment went above optimum enrolment in 1990/91. This indicates that before this time, economies of scale were still being experienced.

By the 1991/92 academic year, all the faculties were experiencing diseconomies of scale as enrolment had exceeded the optimum level. They were now operating on the increasing portion of the average expenditure curve. This meant that any further increase in enrolment inevitably led to higher expenditure per student. This is a situation which Schiller (1986, p.277) describes as "cost inefficiency", and defines as "the amount by which average total costs exceed minimum average costs for any given level of output". From the cost angle, we can therefore conclude that, higher education in Cameroon showed some evidence of inefficiency, as the actual level of enrolment was not at the lowest possible cost.

Policies to improve efficiency could have included restricting enrolment to the optimum level or decentralising the university altogether. None of these policies was solely the responsibility of those running this institution. The automatic entry (upon graduation from secondary education) policy practised in the university was a state-taken decision for social reasons. This implied that the university authorities could not restrict enrolment for efficiency motives. There was therefore a trade-off between cost-savings from improved efficiency, and the social gains of supplying higher education to all willing Cameroonians. This implies that improving efficiency from the cost angle is not fully in the hands of those who manage these institutions, since not all variables are under their control. A selective admissions policy in higher education is preferable since graduate unemployment is high and some graduates end up doing jobs with no relationship to their higher education training. It can even be argued that the massive enrolments in higher education increase unemployment, since some of the graduates insist on 'white-collar' jobs with their 'big' certificates.

The second probable way of solving the inefficiency problem while meeting the social objective of supplying higher education to all those interested, is to decentralise the university institution. The initial investment would have been prohibitive, but if the decentralisation is on the campus of any of the University Centres, it would not be too costly since some basic infrastructure is already in place. This will enable the existing institutions to be on the decreasing portion of the average expenditure curve. Additional enrolment will now lead to efficiency improvements as expenditure per student will continue to fall.

This conclusion from our analysis seems to lend support to the decision taken by the Cameroon Government in 1993 to split up the former University of Yaounde. But our analysis fails to provide any clues to the extent of the decentralisation. Perhaps a decentralisation on two campuses will have been enough. This problem of rapidly rising enrolment is not unique to higher education in Cameroon as Saint (1992, p.112) notes that "managing the growing social demand for higher education is the biggest challenge faced by African university systems."

We now try to show the effect on expenditure per student of an increase in enrolment of one additional student from a given enrolment level. This marginal change is given by the first derivative of the parabolic (C_2 equations of Table 4.9) expenditure function as follows: $b_1 + 2b_2ENT$. Applying this to the various expenditure per student functions we have:

-112.2 + 2(0.00198ENT) for the pooled data.

-083.2 + 2(0.00354ENT) for the FDSE

-371.5 + 2(0.02620ENT) for the FLSH

-420.9 + 2(0.02518ENT) for the FS

Where ENT is the level of enrolment.

For example, with an enrolment of 1000 students in each of the faculties, an increase of one student will reduce expenditure per student by: 108.240CFAF for the pooled data; 76.120CFAF in the FDSE; 319.100CFAF in the FLSH; and 370.540CFAF in the FS. This is the situation shown in the first row of Table 4.13. We had earlier mentioned above that in situations of economies of scale, increases in enrolment lead to reductions in expenditure per student. But as enrolment increases towards the optimum size, these reductions would be progressively smaller until they are zero at the optimum. After the optimum, diseconomies of scale set in, and any additional enrolment leads to increasing expenditure per student. From the table, an increase of a single student above the optimum increases cost by 0.004, 0.016, 0.009, and 0.003CFAF, in the FDSE, FLSH, FS, and the pooled data, respectively. This increase in expenditure per student would be progressively larger as we move further from the optimum enrolments. Lets demonstrate this with the effect of an additional student on the maximum enrolments recorded by these faculties. For the FDSE with a maximum enrolment of 15554, one more student will increase average expenditure by 26.922CFAF.

Table 4.13: The Effect of Marginal Changes in Enrolment on Expenditure per Student (in CFA francs).

Level of enrolment	FDSE	FLSH	FS	ALL
1 000	-76.120	-319.100	-370.540	-108.240
4 000	-54.880	-161.900	-219.460	-96.360
7 000	-33.640	-4.700	-68.380	-84.480
7 090	-33.003	0.016	-63.848	-84.124
8 358	-24.032	66.459	0.009	-79.102
10 000	-12.400	152.500	82.700	-72.600
11 752	0.004	244.305	170.931	-65.662
13 000	8.840	309.700	233.780	-60.720
15 000	23.000	414.500	334.500	-52.800
20 000	58.000	676.500	586.300	-33.000
25 000	93.800	988.500	838.100	-13.200
28 000	115.040	1095.700	989.180	-1.320
28 334	117.405	1113.202	1006.000	0.003
30 000	129.200	1200.500	1089.900	6.600

Note: The negative signs indicate a fall in expenditure per student as enrolment increases towards the optimum. The sign changes when enrolment reaches the optimum level.

For the FLSH with a maximum enrolment of 8781, this will be 88.624CFAF; for the FS with a maximum enrolment of 9171, this will be 40.952CFAF; and for the pooled data with a maximum of 33506, the increase will be 20.484CFAF. These figures show the difference between a marginal change at the optimum and a marginal change at the level of enrolment which existed in the faculties in the 1991/92 academic year (the end of our study period). The difference between these figures gives us an idea of the extent of inefficiency which characterised production at the 1991/92 level of enrolment. For example, in the FDSE, there was an increase of 672950 percent in the cost of an additional student when enrolment was at the 1991/92 level instead of being at the optimum.

4.1 CONCLUSION

In this chapter, we have estimated the production and expenditure per student functions for higher education in Cameroon, with particular reference to the former University of Yaounde. Given that we are working with time-series data, we had first of all to determine the order of integration of each of the series before introducing them into the regression equations. With the educational production function, we have regressed the number of degrees produced (the proxy for educational achievement) on a series of policy controllable variables from the school environment. These input have been: the number of students on scholarship, the total number of teaching staff, the real average teacher salary, per student expenditure, the student-teacher ratio and the number of students enrolment. Another output measure: the percentage of students receiving first degrees, behaved poorly results and was dropped from our model. Equally, one of our input measures - the book/student ratio was abandoned because it held no observable relationship with dependent variable - probably a consequence of poor measurement. Given that the sheer size of the regression coefficient does not measure its relative importance in determining output, we have calculated standardised or beta coefficients to enable us assess the relative effectiveness of the inputs.

As regards the expenditure function, we have regressed expenditure per student on a number of inputs. This has enabled us to determine the variables responsible for the variation in average expenditure in the university. The inclusion of enrolment (ENT) as an independent variable has enabled us to determine the existence of economies of scale in school operations. The eventual appearance of diseconomies of scale has also been tested by adding the square of enrolment $(ENT)^2$ to the expenditure per student function. Through this, we have been able to determine the optimum size of enrolment and to analyse the efficiency of production on the bases of cost of production. In estimating both the educational production and the expenditure per student functions we have used two functional forms: the linear and the log-linear forms. The linear form shows the marginal effects of the independent variables on the dependent variable, while the log-linear form shows the elasticities of the independent variables with respect to the dependent variable. In the production function, the school inputs used explain a substantial part of the variation in the number of degrees produced as evidenced by the $\bar{R}^2$s. Meanwhile , the variation of expenditure per student was not well explained by the independent variables included in the model. In our models, we have also attempted an application of the concept of cointegration to educational data with encouraging results. Serial correlation; heteroskedasticity, and multicollinearity tests have all been carried out to determine the validity of our results.

We hope this chapter has been able to provide answers to our research objectives. This might not be with the robustness expected, because of the inconsistencies in some of our results. Despite this, we hope we have been able to throw some light on the process of producing higher education in Cameroon.

GENERAL CONCLUSION

We set out in this study with a general objective of examining the production process of higher education in Cameroon in the phase of the high repetition and drop-out rates witnessed, despite the enormous amount of resources committed by the government for the supply of higher education. The focus of the study was the three faculties of the former University of Yaounde in which repetition and drop-out were extremely high. Very often, not more than 25 per cent of students succeeded in their examinations. These were signs of inefficiency in the production of higher education which we sought to elucidate, and to suggest how efficiency could be improved.

1 SUMMARY OF FINDINGS

In order to assess the internal efficiency of the educational production process we specified educational production and cost functions for higher education in Cameroon. These were estimated in the linear and log-linear functional forms. The linear form gave us the marginal effects of the educational inputs on the output, while the log-linear form showed us how elastic output was with respect to the various educational inputs. Given that we were working with time-series data, we had to test our variables for nonstationarity. We applied the Dickey-Fuller unit roots test and the results revealed that most of our variables were nonstationary. This implied that we had either to difference our series to stationarity before running our regressions or run the regressions then test for cointegration. Both approaches were applied in different situations.

To estimate our educational production function, the output of the educational system in Cameroon was proxied by the number of first degrees produced each year. The need for the comparison of output in the various faculties (with different levels of enrolment) led us to another more relative measure of output: the percentage of students awarded first degrees. This was expected to reduce the faculties to the same level for easy comparison. But unfortunately, this output measure was dropped for producing contradictory and inconsistent results. We used a series of educational inputs exclusively from the school environment. These included: the number of students awarded scholarships (NSS), the number of academic staff (TTS), the average salaries of the teachers (TSS), expenditure per student (XPS), the student-teacher ratio (STR), and the number of students enrolled. A preliminary analysis of the data revealed the presence of serial correlation. To solve this problem, we transformed the data using the Cochrane-Orcutt iterative procedure which led to significant D-W statistics. Heteroskedasticity was not a problem as shown by the White test, and multicollinearity was seriously reduced when the data was differenced - as is shown by the variance-inflation factors and the simple correlation coefficients.

The ordinary least squares regression procedure yielded the following results:

The number of students receiving scholarship had a very significant negative impact on the performance of students when the data for the three faculties was pooled together. But when the faculties were considered individually, the impact was not all that so significant, but remained globally negative. The performance of students was inelastic with respect to changes in this input. This result shows that the award of scholarships was ineffective in influencing student performance. This can be attributed to the fact that most students did not use these scholarships for the acquisition of learning materials (like textbooks). They resorted to expensive dressing and sophisticated household appliances (like musical sets) and even drinking among other social activities. The ineffectiveness is more disturbing given that scholarship payments constituted the single most important expenditure item in the budget of the former University of Yaounde - taking very often more than a third of the budget. This implies that if a different input mix is adopted with resources shifted away from scholarship payments, efficiency could be improved.

The total number of teaching staff (TTS) was the most significant of our inputs in explaining the changes in the number of first degrees produced by the former University of Yaounde. This effectiveness was demonstrated when all the faculties were pooled together and even when they were analysed independently. Student performance was even elastic with respect to the number of teachers employed in the FDSE , FLSH and for the pooled data - implying that an increase in TTS will lead to a more than proportionate increase in student performance. This implied that some efficiency gains could be achieved if resources are reallocated in favour of more academic staff.

Average real teacher salary (TSS) used in this study as a proxy for teacher experience and qualification had generally a positive relationship with student performance. This was the case for all the faculties combined, and in the FDSE and the FS. This meant that an increase in the real salaries of teaching staff will be performance enhancing. The only exception was in the FLSH where the relationship was negative. This negative association might be explained by the fact that this faculty had the highest average real salary among all the faculties, implying it equally had the highest proportion of senior staff. A probable explanation is that, very often, the senior staff take courses mostly at the postgraduate level, thus the negative relationship between their numbers and the performance of students at the undergraduate level. This negative relationship between teachers' salaries and student performance could also be attributed to an element of diminishing performance (or the depreciation of human capital) of older members of staff.

Expenditure per student was found to affect student performance differently in the various faculties, but the negative relationship was highly significant. Since spending per student was an aggregation of all university expenditure items, the problem becomes that of determining which of them had a negative effect on student performance. One of our earlier conclusions was that, NSS, the main expenditure component, had a negative impact on performance. This might therefore explain the negative relationship between L and XPS. The negative influence of NSS on XPS was more than compensated in faculties in which the number of students on scholarship was not high.

The student-teacher ratio served as an indicator of the quality of education offered. This variable exerted a positive influence on student performance in the FLSH and the FS because the ratio was still relatively low. But in the FDSE and the pooled data with a very high STR, the influence was negative. It can therefore be concluded that the impact of the student-teacher ratio on student performance depends on its prevailing level, and that there exist an optimal student-teacher ratio.

The number of students enrolled (ENT) was included in the production function to assess the direct effect of school size on the number of degrees produced. The results showed that the level of enrolment was adversely affecting performance in the FDSE and also when the data for all faculties were pooled together, where average enrolment stood at 6057 and 11885. In the FLSH and the FS where enrolment was still relatively low (average of 2695 and 3132, respectively), the impact on performance was positive. The negative coefficients imply that at higher levels of enrolment, diminishing returns will be witnessed, and this had been the case in the FDSE with its huge student population.

We used standardised or beta coefficients to determine the relative importance of the various school inputs. The results show that the priority was not the same in the various faculties for improving production efficiency. This justified the decision for treating the faculties separately, for each had its specificities. Each faculty exhibited differences in terms of the input that influenced performance most. In the FDSE, a reduction in per student expenditure stood out first, while an increase in the number of teachers was the case in the FLSH. A reduction in the number of scholarships appeared to be the most important variable in the FS, but when all the faculties were pooled together, the most efficient action was to reduce expenditure per student.

The objective of the production function analysis was not to obtain an efficient input mix, but to determine the direction of change that can bring about an improvement in the efficiency of allocating resources in higher education. Our conclusions therefore, do not show the extent of the change in any input necessary for an efficient production of higher education, but just the direction of such a change for an improvement in efficiency.

In order to examine efficiency from the cost of producing education, we estimated an average cost function for all the faculties of the former University of Yaounde. The dependent variable - expenditure per student was a more narrow measure than average cost since it did not include the opportunity cost of studying and other expenses incurred by parents. Our independent variables were: the number of students awarded scholarships, the number of academic staff, the real average salary of teachers, the number of students enrolled and the square of enrolment. All the tests applied to the educational production function above were equally applied here with similar results.

The number of students receiving scholarship had a cost-increasing effect on expenditure per student, but this effect was not as significant as expected, since scholarships were the single most important expenditure item in the former University of Yaounde. This is explained by the fact that this variable was measured by the number of students on scholarship, instead of the actual amounts spent on scholarships.

The number of teachers employed showed no significant relationship with per student expenditure. Meanwhile, the average salary of teachers (a proxy for teacher experience and qualification) had a significant positive effect on the dependent variable. This was expected as education is a labour intensive industry, and teacher salaries are an important determinant of cost.

Enrolment had a significant negative effect on expenditure per student. This implied that the education of an additional student costed less than the previous student. This is an evidence of economies of scale. An attempt to see whether this function obeyed microeconomic theory was made by adding the square of enrolment $\{(ENT)^2\}$ as a regressor in our function to obtain a parabolic specification. This was proved right as $(ENT)^2$ had a positive coefficient meaning that the expenditure per student function was U-shaped. This indicated the existence of an optimum enrolment size. Economies of scale eventually gave way to diseconomies of scale when the optimum size of enrolment was exceeded.

This led us to calculate the optimum enrolment in each of the faculties. These were as follows: 11 752; 7 090; and 8 385 for the FDSE, FLSH and the FS, respectively. When data for all the faculties was brought together, optimum enrolment stood at 28 334. We noticed that these optimum enrolments were less than the maximum enrolments recorded in each of the faculties. All the faculties were therefore operating above the optimum size, thus experiencing diseconomies of scale. This is an indication of cost inefficiency in the production process, since operations were not taking place at the least possible expenditure per student. The results equally showed that the reductions in expenditure per student became progressively smaller as enrolment approached the optimum, and were zero at the optimum. Immediately after the optimum level, each additional enrolment led to a higher expenditure per student, and this grew at an increasing rate as we moved further away from the optimum. This was verified in all the faculties. Therefore to achieve cost efficiency, enrolment had to be reduced in all the faculties of the former University of Yaounde. This seems to give credence to the decentralisation policy adopted by government in the wake of the University Reforms of 1993.

An examination of the development of higher education in Cameroon has permitted us to bring out the major stages of its evolution. This started with the creation of the National School of Administration in 1959 and evolved to the decentralisation of the University of Yaounde in 1993. The government was almost the sole actor at this stage. The latest development has been the proliferation of private higher education institutions. These are mostly two-year career-oriented post-secondary institutions. This we said could be termed the end of the initial phase, which consisted of the creation and expansion of a system of higher education and using it to meet the critical human resource needs in the public sector after independence. The second phase has already started with the talk of professionalisation of university education and the creation of career-oriented postsecondary institutions in the private sector. This phase will have to deal with issues concerning financing, efficiency, relevance, and the quality of learning. These pre-occupations are necessary if higher educational institutions in Cameroon have to remain the principal source of skilled labour and technical know-how needed to guide national development.

Certain caveats are in order before presenting the policy suggestions of this study. In carrying out this work, we have encountered problems, some of which have already been noted before in our discussions. These include the use of proxies which implicitly admit measurement errors, lack of appropriate data for some of our variables, omission of some major categories of educational inputs (socio-economic status, students' ability and peer influence), aggregation of variables, and even the variable for educational output might not be the single measure of academic achievement at the level of tertiary education. Despite these short-comings, we hope we have shed some light on the issues raised in the work. As Hanoch (cited by Umo 1980, p.36) puts it, "....any empirical study is subject to such limitations. One should try and fill a few gaps at a time, keeping limitations in mind and interpreting the results accordingly. On the other hand, one should not over-emphasise the reservations and short-comings to the point of discarding meaningful and valuable information in the name of purity". With Hanoch's remarks in mind, we now present the policy implications emanating from our findings.

2 POLICY SUGGESTIONS

It should not be surprising that some of the implications of this study, resulting from our analysis will coincide with decisions which have already been implemented in the framework of the 1993 University Reforms. Here we start with the policy suggestions emanating from the production function analysis and then those from the cost analysis.

Our analysis suggest that a reduction in the number of students awarded scholarships will lead to an improvement in the academic performance of students. But we know that scholarships were suppressed in the 1991/92 academic year. This was not as a result of any systematic study and conclusion as to their ineffectiveness in enhancing students' learning, but because of the economic crisis, and government's inability to continue payment. If in the future (in the phase of a favourable economic environment) the government decides to offer scholarships to students again, the scholarship policy should clearly spelt out the criteria for award, with more emphasis on merits. It can further be suggested that such scholarships should not be in the form of direct financial awards to students, since they were not well utilised by students in the past. They could take the form of free rooms in the dormitory, book donations or even the payment of school fees for deserving students.

An increase in the number of teachers employed would significantly improve the efficiency of producing higher education in Cameroon. The number of teachers has always been affected by some lecturers who take up administrative and political duties, thus paying only partial attention to the faculty, if they do not completely abandon the campus. This reduces the amount of teacher time available to students. Very often, these are the most senior staff. This suggestion calls for more attention to be paid to the acute shortage of academic staff in the newly created universities. This has caused teachers to criss-cross from one university to another for teaching purposes. In this way, their effectiveness can be hardly guaranteed.

Concerning teacher salaries (proxy for teacher experience and qualification), an increase will improve the performance of students. The qualified and experienced teachers (that is those with high salaries) should be encouraged to teach more hours in the university. Increased salaries could make the higher education sub-sector more competitive vis-à-vis other sectors. This could reduce staff attrition or prevent teachers from seeking supplementary employment, thus paying little attention to their lectures.

Increasing government spending per student could enhance the academic performance of students. The most important issue here is not the level of spending *per se*, influencing the efficiency of the system, but the mix in educational spending. Therefore an increase in spending, complemented by a change in the spending mix could have a significant influence on the efficiency of producing higher education. That is a spending bias in favour of more effective school inputs and providing a conducive atmosphere for learning an d teaching.

Our results equally indicate that efficiency gains could be achieved if the student-teacher ratio in the FLSH and the FS is increased, while that in the FDSE as well as for the three faculties as a whole is reduced. But efficiency gains from increased student-teacher ratio can lead to a fall in the quality of education offered, as class sizes become too large. This implies that there is an efficiency/quality trade-off. Given that student-teacher ratios in Cameroon were already very high compared with other Sub-Saharan African countries, a further increase in this ratio will not be advisable. Efficiency gains from increased student-teacher ratios should therefore be judged against their negative effect on educational quality.

Increasing the number of students enrolled will increase the number of degrees produced in the FLSH and the FS. On the contrary, enrolment should be reduced to increase the number of degrees produced in the FDSE and in all the faculties brought together. But with the open access policy instituted by the government, the university administrator does not have the free hand to impose any intake ceilings in view of improving efficiency. For the need of efficient production, the government could leave access control to university administrators, who should then use competitive examinations to control student intakes which can be a major cause of declining educational quality. If on the other hand, the government wishes to continue with its policy of offering higher education to all willing Cameroonians, then its financing should be a function of the number of students enrolled, if quality is to be preserved.

From our beta coefficients, we have realised that educational inputs are not equally effective in influencing the performance of students.

And since higher education operates within financial constraints, priorities should be established if any intervention is envisaged.

Efficiency was also measured through the cost of producing higher education, and the following policy suggestions were arrived at:

A reduction in the number of students on scholarship appeared to have been an important cost-saving device in our results. However, the scholarship programme had bee cancelled, leading to some savings. Such savings in cost could be used to invest in more efficient inputs like the recruitment of more teachers.

Since average teacher salary is expenditure-increasing, and the absolute number of teachers employed shows no significant effect on expenditure per student, efficiency can be improved just by increasing the number of teachers recruited. This is because the number of teachers has a significant effect on educational output, but a nonsignificant effect on spending.

The optimum size of enrolment in all the faculties indicates that operations were taking place above the least expenditure per student - implying the existence of cost inefficiency. The newly created universities should try to avoid this problem of overcrowding. Admission policy should be defined in such a way that intake ceilings are established. In such a situation, excess demand could be dealt with by organising competitive examinations or using grades of secondary school leaving examinations to select students. This may not be in line with government policy of providing education to all those who are qualified, but this is the only way to reduce overcrowding and inefficiency in the future.

Still in the same line, the government should encourage the development of private higher educational institutions as a means of managing the cost of expanding enrolment. They can respond efficiently and flexibly to changing demand and increase educational opportunities with little or no additional public cost. For this to be successful, the government should establish an appropriate structure for the supervision and accreditation of private educational programmes so that they can make a positive contribution towards the country's human resource development.

There is need for an improvement of the quality and quantity of the statistical data base of the university and make this readily available to researchers on request. The data collected should cover domains such as student enrolment, graduate output at all levels, repetition and drop-out rates, grades and number of academic staff, number of non-academic staff, details of financial transactions, and others. This data should be broken down for specific departments, and systematically assembled at the end of each academic year. Such data will not only be of use to researchers, but should equally help university management evaluate their own operations.

Another policy suggestion which we mention here does not come directly from our analysis, but from an examination of the structure of universities created by the 1993 reforms. This has to do with the creation of some particular establishments in almost all the universities. An example is the Institute or College of Technology which exists in five of the six universities. Also, there seem to be a duplication of disciplines within the same university as we have in the University of Buea (an example), a Faculty of Engineering and Technology, and a College of Technology. If all these establishments were to become operational, resources will be over-stretched and efficient production will be difficult to obtain. The general objective should therefore be to make universities specialise in particular disciplines, so that responsibilities are shared and education produced more efficiently. It should be of vital importance for all of Cameroon's universities to work closely.

The policy suggestions of this study have been generalised despite its limitation only to the former University of Yaounde. Such generalisations are not out of place considering that the newly created universities were as a result of problems encountered by the former University of Yaounde. However, as a recommendation further studies, it is suggested that a study be undertaken in the future to analyse the performance or the production process of all the universities in Cameroon. This should also enable us to see to what extent the reforms have been effective, or how different or similar the production process is in these universities and the former University of Yaounde. Furthermore, since our analysis has been based on the internal efficiency of higher education in Cameroon, it is also suggested that a study on the external efficiency of higher education - that is assessing the performance of university graduates in the society - be carried out.

Appendix A

Matrices of Simple Correlation Coefficients for the Independent Variables.

Table A1: The FDSE

	NSS	TTS	TSS	XPS	STR	ENT	$(ENT)^2$
NSS	1.000						
TTS	-0.027	1.000					
TSS	-0.065	-0.388	1.000				
XPS	0.528	-0.065	0.340	1.000			
STR	0.027	-0.408	0.157	0.045	1.000		
ENT	-0.301	0.170	-0.074	-0.527	0.384	1.000	
$(ENT)^2$	-0.544	0.211	0.007	-0.412	0.250	0.881	1.000

Table A2: The FLSH

	NSS	TTS	TSS	XPS	STR	ENT	$(ENT)^2$
NSS	1.000						
TTS	-0.308	1.000					
TSS	-0.014	0.072	1.000				
XPS	0.182	-0.475	0.412	1.000			
STR	0.190	0.024	0.335	-0.253	1.000		
ENT	0.262	0.230	-0.044	-0.433	0.616	1.000	
$(ENT)^2$	-0.502	0.443	-0.125	-0.451	0.066	0.530	1.000

Table A3: The FS

	NSS	TTS	TSS	XPS	STR	ENT	$(ENT)^2$
NSS	1.000						
TTS	-0.490	1.000					
TSS	0.009	-0.531	1.000				
XPS	0.289	0.008	-0.078	1.000			
STR	0.178	-0.476	0.357	-0.376	1.000		
ENT	-0.309	0.301	0.006	-0.355	0.638	1.000	
$(ENT)^2$	-0.459	0.439	-0.009	-0.202	0.336	0.898	1.000

Table A4: All the Faculties Combined

	NSS	TTS	TSS	XPS	STR	ENT	$(ENT)^2$
NSS	1.000						
TTS	-0.350	1.000					
TSS	-0.001	-0.568	1.000				
XPS	0.476	-0.353	0.188	1.000			
STR	0.001	-0.304	0.336	-0.343	1.000		
ENT	-0.491	0.396	-0.081	-0.405	0.386	1.000	
$(ENT)^2$	-0.431	0.401	-0.300	-0.437	0.412	0.769	1.000

Appendix B

Matrices of Simple Correlation Coefficients for Independent Variables transformed into logarithms.

B1: The FDSE

	NSS	TTS	TSS	XPS	STR	ENT
NSS	1.000					
TTS	0.138	1.000				
TSS	0.168	-0.242	1.000			
XPS	0.123	-0.109	0.532	1.000		
STR	0.080	-0.529	0.269	-0.135	1.000	
ENT	0.041	0.201	-0.316	-0.678	0.544	1.000

Table B2: The FLSH

	NSS	TTS	TSS	XPS	STR	ENT
NSS	1.000					
TTS	-0.083	1.000				
TSS	-0.161	-0.696	1.000			
XPS	-0.066	-0.370	0.352	1.000		
STR	0.352	-0.396	0.386	-0.168	1.000	
ENT	0.297	0.295	-0.089	-0.444	0.760	1.000

Table B3: The FS

	NSS	TTS	TSS	XPS	STR	ENT
NSS	1.000					
TTS	-0.019	1.000				
TSS	0.009	-0.104	1.000			
XPS	-0.054	-0.075	-0.017	1.000		
STR	0.305	0.110	0.364	-0.437	1.000	
ENT	0.346	0.177	0.032	-0.371	0.828	1.000

Table B4: All Faculties Combined

	NSS	TTS	TSS	XPS	STR	ENT
NSS	1.000					
TTS	0.123	1.000				
TSS	0.368	0.043	1.000			
XPS	0.322	0.177	0.399	1.000		
STR	0.302	0.020	0.492	0.271	1.000	
ENT	-0.141	0.251	-0.059	-0.377	0.135	1.000

BIBLIOGRAPHY

TEXTBOOKS

Aguessy, Honorat. (1994). Unesco's Commitment to the Success of Higher Education in Africa. Dakar: BREDA-UNESCO.

Allen, G. R. (1974). The Graduate Students' Guide to Thesis and Dissertations: A Practical Manual for Writing and Research. Washington D.C: Jossey-Bass Publishers.

Blaug, Mark. (1974). L'Education et le Problème d'emploi dans les Pays en voie de developpement. Genéve: BIT.

Bowen, Howard. R. (1977). Investing in Learning: The Individual and Social Value of American Higher Education. Washington, D C: Jossey-Bass Publishers.

Bureau Regional d'Education en Afrique (BREDA). (1988). Special Programmes for the Improvement of Higher Education in Africa. Dakar: BREDA-UNESCO.

__________. (1994). Orientations Futures pour l'Enseignements Superièurs en Afrique. Dakar: BREDA-UNESCO.

Chateh, Peter N . and Jacques Negha. (1982). Aperçu Général sur la Bibliothéque Universitaire. Bibliothéque de l'Université de Yaounde.

Chuku, Dike. (1987). Resource Allocation in Education. Port Harcourt: Andisen Nigeria Ltd.

Cohn, Elchanan. (1979). The Economics of Education. Cambridge: Ballinger Publishing Company.

Coombs, H Philips and Jacques Hallak. (1987). Cost Analysis in Education: A Tool for Policy and Planning. EDI Series in Economic development. Baltimore: The John Hopkins University Press.

Cooper, Russel M. and Margaret B. Fisher. (1975). The Vision of the Contemporary University. A case Study of Expansion and Development in American Higher Education, 1950-1975. Tampa: University Press of Florida.

Deith, Kenneth. (1969). "Some Observations on the Allocation of Resources in Higher Education". In, Readings in the Economics of Education, edited by Bowman et al. Paris: UNESCO.

Dockrell, W. B. (1990). Evaluation Procedures used to Measure the Efficiency of Higher Education Systems and Institutions: The Netherlands. Paris: UNESCO.

Eze, Agom. (1983). Economics of Education: The Nigerian Experience. Oweri: New African Publishing Co. Ltd.

Ferguson, C E. (1975). The Neo-Classical Theory of Production and Distribution. London: Cambridge University Press.

Galabawa, J. C. J. (1993). Study on the Cost-effectiveness and Efficiency in African Universities: A Case of the University of Zambia. Accra: Association of African Universities.

Goldberger, Arthur S. (1964). Econometric Theory. New York: John Wiley and Sons Inc.

Guitton, Henri. (1959). Statistique et Econometrie. Paris: Dalloz.

Hallak, Jacques. (1990). Investing in the Future: Setting Educational Priorities in the Developing World. Paris: UNESCO and Pergamon Press.

Henderson, J. M. and R.E. Quandt. (1972). Microeconomie. Paris: Dunod.

Hungate, Thad L (1964). Management in Higher Education. New York: Bureau of Publication, Teachers' College, Columbia University.

Kelejian, Harry H. and Wallace E Oates. (1989). Introduction to Econometrics: Principles and Applications. New York: Harper and Row Publishers.

Kerr, Clark.(1991). The Great Transformation of Higher Education: 1960-1980. New York: State University of New York Press.

Knowles, Asa S (editor-in-chief). (1978). The International Encyclopaedia of Higher Education. Vol. 3. Washington: Jossey-Bass Publishers.

Koutsoyiannis, A (1987). Theory of Econometrics: An Introductory Exposition of Econometric Methods. London; ELBS/Macmillan.

Lockheed, Marlaine E. and Adrain M. Verspoor. (1991). Improving Primary Education in Developing Countries. Oxford: Oxford University Press.

Maddala, G. S. (1988). Introduction to Econometrics. New York: Macmillan Publishing Company.

Martin, Jean-Yves. (1980). "Social Differentiation and Regional Disparities: Educational Development in Cameroon". In, Regional Disparities in Educational Development: Diagnosis and Policies for Reduction, edited by Gabriel Canon and Ta Ngoc Chaû. Paris: UNESCO.

Mfoulou; Raphaël and Owono Mbida. (1992). Bibliographie des Diplômés de l'IFORD. Yaoundé: Institut de Formation et de Recherche Demographique.

Mingat, Alain and Jee-peng Tan. (1988). Analytical Tools for Sector Work in Education. Baltimore: The John Hopkins University Press.

Mirer, Thad W. (1988). Economic Statistics and Econometrics. New York: Macmillan Publishing Company.

Ngwe, Emmanuel and Etienne F. Kouton. (1993). Vingt Ans d'Initiation à la Recherche Demographique: Une Autre Facette de l'IFORD. Yaounde: Institut de Formation et de Recherche Demographique.

Nicholson, Walter. (1978). Microeconomic Theory: Basic Principles and Extentions. Illinois: The Dryden Press.

Olayemi, J. K. and S. O. Olayide (1981). Elements of Applied Econometrics. Ibadan: CARD.

Onwumechili, C. A. (1993). Study Group on the Cost-effectiveness and Efficiency in African Universities: A Case Study of the University of Gezira, Sudan. Accra: Association of African Universities.

Pascarella, Ernest T. and Patrick T. Terenzini. (1991). How College Affects Students: Findings and Insights from Twenty Years of Research. San Francisco: Jossey-Bass Publishers.

Pindyck, Robert S and Daniel S Rubinfeld. (1991). Econometric Models and Economic Forecasts. New York: McGraw-Hill, Inc.

Psacharopoulos, G and Maureen Woodhall. (1985). Education for Development: An Analysis of Investment Choices. New York: Oxford University Press.

Samuelson, P. A. (1975). Foundations of Economic Analysis. New York: Harvard University Press.

Schiller, R. Bradley. (1986). They Microeconomy Today. New York: Random House, Inc.

Seymour, Haris E .(1964). "General Problems in Education and Manpower. In, Economic Aspects of Higher Education", edited Haris Seymour. Paris: O.E.C.D.

Tarpeh, D. Nmah. (1993). Study on the Cost-effectiveness and Efficiency in African Universities: A Case Study of Université Nationale de Côte d'Ivoire (National University of Côte d'Ivoire). Accra: Association of African Universities.

Tarpeh, D. Nmah. (1993). Study on the Cost-effectiveness and Efficiency in African Universities: A Case Study of the University of Ghana, Legon. Accra: Association of African Universities.

Tarpeh, D. Nmah.(1994). Study on the Cost-effectiveness and Efficiency in African Universities-Phase II: An Overview. Accra: Association of African Universities.

Thirkette, G L (1981). Wheldon's Business Statistics and Statistical Method. London: Pitman Publishing Ltd.

Tibi, Claude. (1987). Les déterminants des Coûts: Une perspective Internationale. Paris: UNESCO.

Todaro, Michael P (1977). Economics for a Developing World. London: Longman.

UNESCO. (1985). Cameroun: Etudes sur l'Enseignement et la Formation. vols. I-VII. Paris.

Wagner, Leslie. (1980). "Cost and Effectiveness of Distance Learning at Post-Secondary Level". In, The Economies of New Educational Media, Vol. 2: Cost and Effectiveness. Paris: UNESCO.

Walton, Clarence C and Frederick de W Bolman. (1979). Disorder in Higher Education. New Jersey: Prentice-Hall, Inc.

Weisbrod, Burton A (1965). "Preventing High School Drop-Out". In, Measuring Benefits of Government Investments, edited by Robert Dorfman. Washington, D.C.: The BrookingsInstitution.

Wonnacott, Paul and Ronald Wonnacott.(1986). Economics. New York: McGraw-Hill Book Company.

World Bank. (1986). China: Management and Finance of Higher Education. Washington, D. C.

World Bank. (1988). Education in Sub-Saharan Africa: Policies for Adjustment, Revitalisation, and Expansion. Washington, D. C.

Zymelman, Manuel. (1973). Financing and Efficiency in Education: Reference for Administration and Policy-making. Boston: The Nimrod Press.

ARTICLES AND SPECIAL PAPERS

Adam, Christopher A. (1992). Recent Developments in Econometric Methods: An Application to the Demand for Money in Kenya. AERC Special Paper Fifteen. Oxford: Centre for the Study of African Economies.

Adam, Christopher S. (1993). Time Series Econometrics for Africa. Lecture Notes for a Technical Workshop run by African Economic Research Consortium. Nairobi (Kenya).

Affa'a, Félix-Marie and Thérèse Des Lierres. (1989). "Les Cause d'Echec à la Faculté des Sciences (Université de Yaoundé)". In, Echecs dans l'Enseignement Superieur: Essai d'une Thérapeutique au Niveau Africain. Séminaire de l'AIPU - Texts Published by Thérèse Des Lierres - Université du Québec (Canada).

Albrecht, Douglas and Adrain Ziderman. (1992). Funding Mechanisms for Higher Education: Financing for Stability, Efficiency, and Responsiveness. World Bank Discussion Papers. N° 153. Washington, D C.

Bowles, Samuel. (1970). "Towards an Educational Production Function". In, Education, Income and Human Capital, edited by Lee W Hansen. New York: National Bureau of economic Research.

Bowles, Samuel. and Henry M. Levin. (1968a). "The Determinants of Scholastic Achievement: An Appraisal of Recent Evidence". Journal of Human Resources. 3(1) 3-24.

__________ (1968b). "More on Multicollinearity and the Effectiveness of Schools". Journal of Human Resources. 3(3) 393-400.

Brown, Byron W. and Daniel H. Saks. (1975). "The Production and Distribution of Cognitive Skills Within Schools". Journal of Political Economy. 83 (3) 571-93.

Chizmar, F. John and Thomas A. Zak. (1983). "Modelling Multiple Output in Educational Functions". American Economic Review. 73 (2) 18-22.

Cohn, Elchanan. (1968). "Economies of Scale in Iowa High School Operations". Journal of Human Resources. 3 (4) 422-434.

Cuadra, Ernestor and Birger Fredrikson. (1992). Scope for Efficiency Gains Resulting from Reductions in Repetition and Dropout: A Simulation Exercise. PHREE Background Paper Series. N° PRHEE/92/55. Washington, D C: The World Bank.

Eicher, J C (1984). Educational Costing and Financing in Developing Countries. World Bank Staff Working Papers. N° 655. Washington, D C.

Fine, Jeffry C. (1990). A Strategy for Graduate Training in Economics for Africa. AERC Special Paper Nine. Nairobi: Initiatives Publishers.

Fuller, Bruce and Aklilu Hable. (1992). Adjusting Educational Policies: Conserving Resources While Raising School Quality. World Bank Discussion Papers. N° 132. Washington, D C.

Fuller, Bruce. (1986). Raising School Quality in Developing Countries: What Investments Boost Learning?. World Bank Discussion Papers. N° 2. Washington, D C.

Gounden, Nalla A M (1967). "Investment in Education in India". Journal of Human Resources. 2(3) 347-58.

Grabe, Sven. (1985). Evaluation Manual. Socio-Economic Studies 6. Paris: UNESCO.

Haddad, Wadi D. et al. (1990). Education and Development: Evidence for New Priorities. World Bank Discussion Papers. N° 95. Washington; D C.

Hanushek, Eric A. (1979). "Conceptual and Empirical Issues in the Estimation of Educational Production Functions". Journal of Human Resources. 14(3) 381-8.

__________ (1986). "The Economics of schooling: Production and Efficiency in Public Schools". Journal of Economic Literature. 24(September) 1141-77.

Heyneman, Stephen P. (1976). "Influences on Academic Achievement: A Comparison of Results from Uganda and more Industrialised Societies". Sociology of Education. 49(July) 200-11.

Heyneman, Stephen. P. and William A Loxley. (1983). "The effect of Primary School Quality on Academic Achievement Across Twenty-nine High- and Low-Income Countries". American Journal of Sociology. 88(6) 1162-94.

Kellaghan, Thomas and Vincent Greany. (1992). Using Examinations to Improve Education: A Study in Fourteen African Countries. World Bank Technical Papers. N° 165. Washington, D C.

Kelly, Michael J. (1991). Education in a Declining Economy: The Case of Zambia, 1975-1985. EDI Development Policy Case Series: Analytical Case Studies N° 8. Washington, D C: World Bank.

Lockheed, Marlaine E. and Nicholas T. Longford. (1989). A Multilevel Model of School Effectiveness in a Developing Country. World Bank Discussion Papers. N° 69. Washington, D C.

Murnane, Richard J. et al. (1981). "Home Resources and Children's Achievement". The Review of Economics and Statistics. 48(3) 369-77.

Nfor-Ngwei, Solomon. (1975). "Education in Cameroon: Western Pre-colonial and Colonial Antecedents and the Development of Higher Education". PhD Thesis. University of Michigan.

Okedara, J. T. (1975). "Cost-Benefit Analysis of Formal and Nonformal Education: A Case Study". The Nigerian Journal of Economics and Social Studies. 20(1) 89-110.

Perl, J. Lewis. (1973). "Family Background, Secondary School Expenditure, and Student Ability". Journal of Human Resources. 8(2) 156-80.

Perman, Roger. (1989). "Cointegration: An introduction to the Literature". Strathclyde Papers in Economics. N° 7.

Psacharopoulos, G. (1980). Higher Education in Developing Countries: A Cost-Benefit Analysis. World Bank Staff Working Papers. N° 440. Washington, D C.

Riew, John. (1966). "Economies of Scale in High School Operations". Review of Economics and Statistics. 48(3) 280-7.

Saint, William S. (1992). Universities in Africa: Strategies for Stabilisation and Revitalisation. World Bank Technical Papers. N° 194. Washington, D C.

Salmi, Jamil. (1991). The Higher Education Crisis in Developing Countries. PHREE Background Paper Series. N° PHREE/91/37. Washington, D C: World Bank.

Schiefelbein, Ernesto; Joseph P Farrel; and Manuel Sepuluela-Stuardo. (1985). The Influence of Schooling Resources in Chile: The Effect on Educational Achievement and Occupational and Attainment. World Bank Staff Working Papers. N° 530. Washington, D C.

Simmons, John and Leigh Alexander. (1977). "The Determinants of School Achievement in Developing Countries: A Review of the Research". Economic Development and Cultural Change. 26 341-57.

Summers, A. A. and B. L. Wolfe. (1977). "Do Schools Make a Difference?" American Economic Review. 67(4) 639-52.

Tafah, E. E. O. (1989). "The Economics of Educational Investment in Cameroon". PhD Thesis, University of Lagos.

Tafah, E. E. O. (1994). "An Economic Analysis of the Determinants of Primary School Expenditure in Cameroon". Journal of Third World Studies. XI(1).

Tafah, E. E. O., J. U. Umo; and T. E. Ubogo. (1990). "The Economics of Education: Evaluation of the Determinants of Primary School Performance in Cameroon". Zimbabwe Journal of Educational Research. 2(2) 93-110.

Tan, Jee-Peng; Kiong Hock Lee; and Alain Mingat. (1984). User Charges for Education: The Ability and Willingness to Pay in Malawi. World Bank Staff Working Papers. N° 661. Washington, D C.

Thobani, Mateen. (1983). Charging User Fees for Social Services: The Case of Education in Malawi. World Bank Staff Working Papers. N° 572. Washington, D C.

Thulstrup, Erik W. (1992). Improving the Quality of Research in Developing Country Universities. PHREE Background Paper Series. N° PHREE/92/52. Washington, D C: World Bank.

Tuckman, P. H. ; J. H. Gapinski; and R. P. Hagemann. (1977). "Faculty Skills and the Reward Structure in Academe: A Market Perspective". American Economic Review. 67(4) 692-702.

Umo, Joe U. (1980). "Production and Cost Functions for Higher Education in an LDC: The Nigerian Case". Manpower Journal. 16(1) 25-38.

Vandemoortele, Jan. (1991). Employment Issues in Sub-Saharan Africa. AERC Special Paper Fourteen. Nairobi: Initiatives Publishers.

Verspoor, Adrain. (1989). Pathways to Change: improving the Quality of Education in Developing Countries. World Bank Discussion Papers. N° 53. Washington, D C.

Wolff, Lawrence. (1984). Controlling the Cost of Education in East Africa: A Review of Data, Issues and Policies. World Bank Staff Working Papers. N° 702. Washington; D C.

Woodhall, Maureen. (1983). Student Loans as a Means of Financing Higher Education: Lessons from International Experience. World Bank Staff Working Papers. N° 599. Washington, D C.

Zymelman, Manuel. (1990). Science, Education, and Development in Sub-Saharan Africa. World Bank Technical Papers. N° 124. Washington; D C.

OFFICIAL DOCUMENTS

Centre Universitaire des Sciences de la Santé. Livret de l'Etudiant: Many years.

Ecole Normale Supérieure Polytechnique. Livret de l'Etudiant: Many years.

__________. Rapport d'Activités 74-75 et Bilan de Quatre Année d'Existence. Université de Yaounde

Ecole Supérieure des Sciences et Techniques de l'Information. Livret de l'Etudiant: Many years.

Faculté de Droit et des Sciences Economiques. Livret de l'Etudiant: Many years. Université Fédérale du Cameroun.

__________ Twentieth Anniversary: 1962-1982. The University of Yaounde.

Faculté des Lettres et Sciences Humaines. Liste des Licenciés de 1967 à 1976. Université de Yaounde.

__________. Livret de l'Etudiant: Many years. Université Fédérale du Cameroun.

Faculté des Sciences. Livret de l'Etudiant: Many years. Université Fédérale du Cameroun.

Institut International d'Assurance (IIA). (1975). Présentation de l'IIA de Yaounde. Numéro 0. Janvier.

Ministère de l'Enseignement Supérieur. (1993). La Reforme Universitaire au Cameroon. Yaounde.

Ministère de Plan et d'Aménagement du Territoire. (1983). Annuaire Statistique du Cameroun. Yaounde: Direction de la Statistique et de la Comptabilité Nationale.

Ministry of National Education. (1968) Annuaire Statistique 1967/68. Service de la Planification, de la Carte Scolaire et des Statistiques. Yaounde.

République Unie du Cameroun. (1982). Actes du Conseille l'Enseignement Superieur et de la Recherche Scientifique et Technique. Deuxième Session., 20-23 October. Yaounde.

The University of Yaounde. (1986). Student Handbook: Bilingual Edition. Yaounde.

Université de Yaounde. Statistiques sur les Etudiants de la Faculté des Sciences: Année Universitaires 1987/88 et 1988/89. Yaounde: Computer Center.

__________. Annuaire Statistique. Many years.

__________. Aperçu Général: 82-83. Service de Liaison et des Activités Culturelles.

__________. Document Techniques: Données sur les Etudiants de Université de Yaounde (1984-85). Yaounde: Centre de Calcul.

__________. Effectifs des Etudiants: Année Universitaire 1975/76. Yaounde.

__________. Institut des Relations Internationales du Cameroon: Livret de l'Etudiant. Yaounde: IRIC

__________. Liste Protocolaire: Many years. Yaounde: Service de Liaison et des Activités Culturelles.

__________. Résultats des Examens et Concours: Many years. Yaounde

__________. Statistiques sur les Etudiants de la Faculté des Sciences: Many years. Yaounde: The Computer Center.

__________. Statistiques sur les Etudiants de la Faculté de Droit et des Sciences Economiques: Année Universitaires 1987/88 et 1988/89. Yaounde: Computer Center.

__________. Statistiques sur les Etudiants de la Faculté des Lettres et Sciences Humaines: Année Universitaires 1987/88 et 1988/89. Yaounde: Computer Center.

Université Fédérale du Cameroun. Statistiques des Etudiants et Elèves Inscrits à l'Université Fédérale du Cameroun: Année Universitaires 1970-71; 1971-72; and 1972-73. Yaounde.

University Center for Health Sciences. Report of Activities 1978-80. University of Yaounde.

University Center for Health Sciences. Students' booklet: Many years. Yaounde