CHAPTER ONE
INTRODUCTION

1.1 Overview

This study is concerned with the economics of education. Based upon the definitions of economics and education, Cohn (1972) defined economics of education as a study of how men and society choose, with or without the use of money, to employ scarce productive resources to produce various types of training, the development of knowledge, skill, mind, character, etc – especially by formal schooling – over time and distribute them, now and in the future, among various people and groups in society.

Hence, the economics of education is concerned with the process by which education is produced, the distribution of education among competing groups and individuals and the question regarding how much should be spent by society on educational activities, and what types of educational activities should be selected or decided.

Specifically, our analysis focuses on the educational production functions. From the microeconomic theory, a production set is described as all combinations of inputs and outputs which comprise a feasible method of production. The boundary of this set is known as the production function and represents the maximum level of output attainable from a given level of inputs. Studies of educational production functions, also referred to as input-output analysis, examine the relationship among the different inputs into the educational process and outcome of the process. Statistical techniques may be used to evaluate the functioning of educational institutions or schools, and to examine the
possibilities for increased efficiency. Therefore, it should be emphasized the allocation of resources in education.

Studies included under the rubric educational production functions are generally statistical analyses relating observed student outcomes to characteristics of the students, their families, and other students in the school, as well as characteristics of schools. Most frequently, student outcomes are measured by various standardized test scores, although attitudes, continuation rate, and attendance patterns have also been analyzed. These studies also diverge considerably in terms of the actual measured inputs; in terms of the level of aggregation of both dependent and independent variables (e.g. individual student, school average, or district average observations); and in term of the precise statistical methods. Given such differences, the conclusion of the various studies appears to be very different-and often apparently contradictory (Hanushek, 1979).

Trying to accurately ascertain the direction and magnitude of any links between educational inputs and the school outputs is an important research question that has potentially significant ramifications for education policy. There has been considerable research addressing this question. However, most educational production functions specify only one output. Introducing multiple outputs into the production function raises interesting theoretical and empirical issues.

Which model most closely corresponds to the teaching and learning environment depends on the degree to which the outputs share the same inputs. Referring to the concept of "input exhaustion" introduced by the Brown and Saks (1980), it indicates the extent to which an increase in input applied to one output reduces the amount of that input available to produce other outputs. Complete input exhaustion occurs when outputs
are independently produced (i.e., zero input sharing). Each output has a separate production process. If, however, using an input to produce one output does not reduce its availability for producing other outputs, then the input is shared and the outputs are jointly produced by a single production process. Thus, the extent of input exhaustion indicates the degree of jointness in production.

As suggested by Chizmar and Zak (1983), a single production function embodying both outputs is more appropriate because of the absent of more detailed data on the allocation of inputs between educations. Then, neither ordinary least squares (OLS) nor two-stage least squares (2SLS) is appropriate, because, for both techniques, a single equation can have only one dependent variable. Thus, the goal of this study is to accurately appraise the key findings and methodological shortcomings of this work using Canonical Correlation Analysis, with the intention of providing a pointer on the jointness of production in educational outputs. This method is superior to the other methods because it is able handle multiple dependent variables and multiple independent variables in a single equation.

In this study, we investigate the joint educational production in Malaysia using mathematics and science scores for lower secondary school students. The importance of mathematics and science in our endeavors to raise living standards, clean up the environment and grow the economy is understood at the higher levels of Malaysian national education system.

Mathematics and science education in primary and secondary schools are the most important factor in the promotion of science capacity building of any country. It enables countries to build an indigenous science base on solid foundation, to transfer and
absorb the scientific knowledge being generated globally and utilize it within the country for the betterment of the people. Hence, mathematics and science education have been emphasized from as early as primary stage till the university level. Besides that, using mathematics and science test scores as the output measures helps in discovering the relationship between mathematics and science achievement through marginal rate of transformation.

In addition, we are interested in analyzing the performance of mathematics and science between rural and urban schools. There has seen a gap in educational achievement between schools and students in rural and urban areas. Rural areas are among the poorest in the country, where rural schools face more difficulties to deliver primary and secondary school educational services in geographically isolated areas.

Student performance in rural areas with the same range of educational facilities provided as their urban peers can be different due to various reasons including family background. In attempting to study these differences, we are estimating two different production functions for each school location and analyzing its input-output relationship with marginal analysis. However, policy makers should realized the importance of paying attention to the needs of rural schools.

1.2 Education Reforms In Malaysia

Education is the largest single industry in Malaysia. In 2001, it employed more than 279,853 teaching manpowers, involving nearly 5.1 million pupils in all levels of formal primary and secondary education. The Malaysian Educational Statistics (2000)
reported that the total educational expenditure accounts for about 20% of the total
government expenditure during 1990s.

Education has always been regarded as a vital factor in achieving the general
aims of society and there is growing concern about educational quality. In recent years,
the Malaysian government has implemented various education policies to improve the
performance of students to compete in the international market place, such as upgrades
the level of educational attainment of teachers, spends increasing expenditure on
educational purposes such as RM200 million tuition voucher scheme (Refer to Surat
Pekeliling Ikhtisas Bil.1/2004), and teaching science and mathematics in English
recently. Hence, it is important to measure existing educational performance of
Malaysian schools and understand its input-output relationship for designing policies
with respect to such varying issues.

The Government of Malaysia, in its economic program for 1996 to 2000 (Seventh
Malaysia Plan), has placed special priority on improving the quality of its science
programs and the numbers of students in the science streams. Additional emphasis will
be placed on continuing to improve the quality of and access to schools in underserved
areas. This would include, expanding the hostel program for students from rural areas,
amalgamating small schools, providing incentives for teacher training, and encouraging
private sector activity in education.

In a detailed framework, a sponsored study of secondary education by Asian
Development Bank (ADB), has classified the approaches to improving secondary
education according to whether they are primarily aimed at improving equity and access,
internal efficiency, quality, or external efficiency (NIER, 1995). It is sometimes difficult
to determine precisely which of these four domains a particular policy objective is directed. Almost any initiative to improve secondary education will need to take simultaneous account of equity issues, the efficient use of resources, the quality of student learning, and the extent to which wider economic and social needs are being met. Nevertheless, this ADB framework provides a useful reminder of the range of policy issues that need to be considered.

As noted in the introductory section, education is often viewed by economists as a problem of resource allocation. At the policy level, choices are required between education and a variety of other programs which compete for tax revenue and within the school system, administrators and teachers must choose between a variety of options for effecting educational outcomes (Levin, 1988 and 1989; Monk, 1981). Available options for improving student achievement (i.e., reduced class size, higher teacher salaries, before/after school programs, computer aided instruction, etc) have both different costs for implementation and different impacts on achievement within the schools.

1.2.1 Rural-Urban Difference in Education

The gaps in school achievement between rural and urban schools are well documented. They are large and have been persistent; this is well known and widely accepted. There are concerns that differences are growing between urban and rural areas, in terms of access and quality. In Eighth Malaysia Plan (2001-2005), efforts to reduce the performance gap between rural and urban schools were continued through the upgrading of teaching and learning facilities and placement of more trained teachers in rural schools. Continuous professional development of teachers in rural schools was also undertaken through the state educational resource centres and the teacher activity centres.
A sponsored study by World Bank in 1995 (Refer to http://www.worldbank.org/eapsocial/countries/malay/educ1.htm) found that, in Malaysia, only 20 percent of rural students received excellent grades in English, compared to over 40 percent of urban students. Similarly, only 35 percent of rural students performed well in mathematics, compared to 48 percent of urban students. Rural students often have many more obstacles to overcome than urban students, such as longer traveling distances and constantly changing and inexperienced teaching staff. Although efforts have been made to remedy these problems, by building more schools in rural areas, hostels for rural students, or teacher residences, the difficulties remain.

Recently, pupils in standard four, five and six from poor families in rural schools and certain poor urban schools would get tuition after school either in Malay, English, Science or Mathematics subjects. It would benefit 500,000 students who would get RM10 vouchers to pay for extra tuition, conducted by their teachers. The teachers decide the subjects the pupils are weak in, and hand out the relevant vouchers. The teachers would not be forced to do the extra classes, but they would be paid for running the tuition classes. Extra classes explicitly mean extra instructional time students spend in school. Therefore, there is a need to find out the influence of instructional time on academic achievement of rural and urban schools to ensure on its suitability.

Instead, reducing the difference in rural-urban performance gap is a long-term project that requires a full understanding of the relationship between community education levels and student performance. The rural-urban gap is not related to differences in rural and urban schools because, for the most part, rural and urban schools are much the same (Cartwright and Allen, 2002).
1.3 Objectives of the Study

With reference to Section 1.1 and Section 1.2, we know that it is important to sort out how the effectiveness of the education resources in schools contributes to its performance.

Thus, the main objectives of this study are:

1. To examine how school and environmental inputs into the educational production process affected student achievement in Mathematics and Science in Malaysian schools.

2. To analyze the joint production function of the educational outcomes in Malaysian schools using the Canonical Correlation Analysis.

3. To create a better understanding of the differences in rural and urban school's performance by investigating the rural-urban disparities in academic achievement. Separate production function will be estimated in order to disclose their performance differences.

4. To reveal the relationship between school outputs and educational inputs nationally and at rural-urban level. We will demonstrate marginal analysis by calculating the marginal rate of transformation between outputs, marginal elasticity of output with respect to input, marginal product, and marginal rates of substitution between inputs for Malaysian educational process.

5. To provide more effective tools and instruments to improve our educational system and school performance in the joint production situation.
1.4 *Significance of the Study*

The study is expected to produce a comprehensive report on the national academic achievement and disparity in rural-urban schools' performance at the secondary levels of education in the country. It will also suggest the suitability of several selected determinants in education for considerations by educators, policy makers and planners. Moreover, it is believed that the analysis will have spill-over benefits for a proper and realistic management of the envisaged reforms in the system of education of the country.

1.5 *Organization of the Study*

To be concise and coherent, the report describing this study contains seven chapters that discuss several elements within their own respective scope.

Chapter One presents an introduction to the study, specifies the research objectives and the organization of this study. Chapter Two provides a review of the related literature.

The theory of educational production function and joint production function are summarized in Chapter Three. Chapter Four contains data sources and a detailed description of the methodology used in the study.

The results of the applied economic analysis of simple regression and multivariate analysis for national level and rural-urban level are presented in Chapter
Five and Chapter Six, respectively. Finally, Chapter Seven presents the summary of the findings, conclusion and recommendation.