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GRADUATE COLLEGE

THE DEMAND FOR HIGHER EDUCATION: A CASE STUDY OF TAIWAN, 1950-1969

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

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1972

THE DEMAND FOR HIGHER EDUCATION:

A CASE STUDY OF TAIWAN, 1950-1969

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CHAPTER I

INTRODUCTION

The purpose of this study is to examine the factors that influenced the demand for higher education in Taiwan during the period of 1950-1969. More specifically, since the demand for higher education in Taiwan increased sharply during this period and at the same time the economy of Taiwan experienced substantial economic development (see Appendix I, Table 18), an attempt will be made to look into the probable cause and effect relationships between economic development and the demand for higher education in Taiwan.

Methodologically, the study endeavors to combine theory with empiricism and quantification. The statistical data for the study are primarily derived from official publications and documents of the government of Taiwan. These include the following: Taiwan Statistical Data Book, National Income of the Republic of China, Educational Statistics of Taiwan, Statistical Abstract of the Republic of China, Educational Statistics of the Republic of China, A List of Public and Private Colleges and Universities, Central Daily News, Monthly Statistics, Economic Constructions in Connection with the Educational

Investment and the Demand for and Supply of Manpower. A number of files kept in governmental offices were also used. Whenever available the Chinese version of the above documents was used because it is generally felt that it is more reliable than the English version which tends to contain exaggeration of economic happenings.

Chapter II views the demand for higher education in historical perspective. In this regard the idea that education is a factor contributing to economic development is reviewed from the point of view of a number of pre-classical, classical, and contemporary economists.

In Chapter III the demand for higher education in Taiwan, 1950-1969, is analyzed. Particular attention is given to the factors affecting the development of higher education in Taiwan. An attempt to measure and estimate the demand for higher education in Taiwan is also made.

The effectiveness of the attempt to measure the demand for higher education in Taiwan is limited by a number of considerations. Chapter IV presents some of these limitations and offers an interpretation and appraisal.

Finally, Chapter V is a summary of the findings and conclusions of the study.

CHAPTER II

A BRIEF HISTORICAL BACKGROUND ON THE STUDY OF DEMAND FOR EDUCATION

Many people attribute the recent emphasis on the economics of education to the work done by Professor Schultz in the early 1960's.[1] His work was primarily concerned with issues related to investment, on the job training, health, and migration, which he considered important in propelling the growth of an economy. However, the idea that education can contribute to the betterment of the state of the economy was by no means new. Nevertheless, it was Professor Schultz who not only rekindled the discussion on the subject but also made extensive contributions to this area of study. In this connection, it is interesting to note that Professor Hellner refers to this emphasis as a "revival of interest."[2] and Blaug names Schultz the "father" on the concept of human

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[1]Especially the article he delivered in the AEA presidential address in 1961, "Investment in Human Capital," American Economic Review, March, 1961, pp. 1-17.

[2]OECD, Policy Conference on Economic Growth and Investment in Education (Paris, 1962), p. 30.

capital.[3] This chapter will be devoted to the examination of various economic writings as they relate to the demand for education.

A. Pre-Classical Economists

Almost all the economists and social philosopners before Adam Smith recognized the fact that education was not only indispensable in the training and development of the mind but also productive in the promotion of national wealth. Plato realized that education, which helps develop a man's innate tendencies, is productive in terms of economic wealth.[4] His most distinguished pupil, Aristotle, shared his view. So did such pre-classical economists as Hume, Mun, Locke, Petty, and Hales.[5] But, none of them seem to have delved into the problem of demand for education.

B. The Classical Economists

Adam Smith distinguished labor into skilled labor and common labor. The wages of skilled laborers are generally higher than those of common laborers because of the cost involved in the education of laborers in acquiring the

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[3]M. Blaug, Economics of Education; A Selected Annotated Bibliography (England: Pergamon Press, 1966), p. 12.

[4]George F. Kneller, Education and Economic Thought (New York: John Wiley & Sons, Inc., 1968), pp. 12-14.

[5]E. A. J. Johnson, Predecessors of Adam Smith (New York: Augustus M. Kelley, 1965), pp. 259-77.

"extraordinary dexterity and skill."[6] An educated man can be compared to an expensive machine; just as a machine yields profit during the process of production, the work which a man learns to perform must yield "over and above the usual wages of common labor--at least the ordinary profits of an equally valuable capital."[7] In his Chapter on the Division of Stock, he made the point even clearer by stating that:

> the acquisition of such talents, by the maintenance of the acquirer during his education, study or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person --the improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labor, and which, though it costs a certain expense, repays that expense with a profit.[8]

It goes without saying that in Smith's mind education, which improves the skill and ability of a worker, is undoubtedly productive in the sense that, just like a machine, it entails cost and yields profit. The acquired skill and ability of the worker should be treated as a type of capital.

Despite the fact that educational services, like national defense, public roads, and communication, are public goods and that the expense of education can be, without any injustice defrayed from the general revenue of the whole society, Smith preferred private schools supported mainly by

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[6]Adam Smith, Wealth of Nations, ed. C. J. Bullock (New York: P. F. Collier & Son Co., 1960), pp. 102-103.

[7]Ibid., p. 103.

[8]Ibid., p. 219.

profits and wages. Profits could be called the wages of accumulated labor, and wages, the profits of "the proprietors of a machine called man, exclusive of a sum to replace the wear and tear of the machine, or which is the same thing, supply the place of the old and decayed laborers with new ones."[12] As a result of this consideration, the expense of education was looked upon as something analogous to an investment in instruments, which does pay off in the long run. He said:

> The harvest of education may be late, but in the end it can hardly fail to be luxuriant. And it will amply reward the efforts of those who are not discouraged.[13]

In addition, he supposed that ignorance is probably the most formidable obstacle to the progress of society and improvement of the state of the poor, and that education, which attempts to eliminate this ignorance, will serve as a means of "providing for the permanent improvement of the poor" in the sense that it will "supply them, not with a temporary stimulus, but with a permanent energy."[14]

Senior was probably the one among the English Classical economists who discussed in the most extensive manner the

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[12]Quoted from Edwin Cannan, A History of the Theories of Production in English Political Economy from 1776 to 1848 (New York: Augustus M. Kelley, 1967), p. 166.

[13]J. R. McCulloch, A Treatise on the Circumstances Which Determine the Rate of Wages and the Condition of the Labouring Classes (London: G. Routledge & Co., 1854), p. 115.

[14]Ibid., p. 115.

economics of education. He also recognized the fact that education is productive both mentally and physically and that the expense of education should be regarded as an investment rather than as a consumption.

> Strictly speaking, it is not an expense. The money so employed is much more than repaid by the superiority in diligence, in skill, in economy, in health--in short, in all the qualities which fit men to produce and to preserve wealth, of an educated over an uneducated community.[15]

Yet, unfortunately, the demand for education is very weak because many people, especially those uneducated, do not realize the worth of education; they "do not feel in themselves the want of moral or intellectual training nor perceive that it is wanted by their children."[16] Only those who are well educated consider education for their children important and necessary. Following this line of reasoning, he advocated compulsory education for all classes. In his discussion of the Factory Act, he proposed that education be enforced as a preliminary to employment, that is, "no child shall be admitted to a factory till it can read, or allowed to work full time until it can read and write fluently."[17] In addition, government should, with the exception of higher

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[15] Ibid., pp. 328-29.

[16] Ibid., p. 339.

[17] Nassau W. Senior, "Letters on the Factory Act, As it Affects the Cotton Manufacture," Selected Writings on Economics; A Volume of Pamphlets 1827-1852 (New York: Augustus M. Kelley, 1966), p. 22.

and secondary education, provide schools as well as teachers not so much because parents cannot afford to pay for the expenses of education but because they cannot afford foregoing children's wages income.[18] Senior was aware of the fact that the demand for education was, to a great extent, determined by family income as well as the parents' attitude toward education. Generally speaking, the educated and/or rich parents are likely to demand more education for their children than do the uneducated and/or poor parents who tend to neglect their children's education either because of selfishness or ignorance of the advantages of education. In the case of selfishness, the immediate interests of parents and the permanent interests of children are in many respects opposed:

> In England there is unhappily among the working classes much less desire for education, and those immediately above them are often opposed to their receiving it. They think that it takes laboring children off their work.[19]

This again may well justify governmental intervention.

These views were also shared by J. S. Mill who asserted that:

> parental power is as susceptible of abuse as any other power, and is, as a matter of fact, constantly abused. If laws do not succeed in preventing parents from brutally ill-treating, and even from murdering their children, far less ought it to be presumed that the interests of children will never be sacrificed, in

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[18]Nassau W. Senior, Industrial Efficiency and Social Economy, ed. S. Leon Levy (New York: Henry Holt and Company), Vol. II, pp. 335-37.

[19]Ibid., p. 343.

> more commonplace and less revolting ways, to the selfishness or the ignorance of their parents.[20] --Education, therefore, is one of those things which it is admissible in principle that a government should provide for the people.[21]

Another reason that education cannot be left in the hands of parents is that the demand for education is not identical with the demand for a commodity. In the purchase of a commodity, consumers are in general the best judges of the commodity for themselves, as far as their tastes and interests are concerned. But they may not be true of education and medicine. In the case of medicine, parents may not be able to select the right medicine for their children even though they are willing to pay for it. The same analogy can be applied to education. Parents who are presumed to be aware of the best interests of their children may turn out to be most incompetent if no assistance is available.[22] Again, governmental intervention becomes indispensable because this is the case in which the interest and judgment of consumers are not a sufficient security for the goodness of commodity.[23]

In spite of the fact that Mill favored the intervention of government in education, he suggested that the intervention should be limited to the areas of establishing schools, giving them financial support, and making elementary

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[20]John S. Mill, Principles of Political Economy (New York: The Colonial Press, 1899). Vol. II, pp. 458-59.

[21]Ibid., p. 455.

[22]Ibid., p. 455.

[23]Ibid., p. 457.

education compulsory. Government should not exert its influence to such an extent that it virtually monopolizes the education of either lower or higher branches. To have a monopoly over the education of people is to be despotic, that is, to deprive people of their freedom of mind.[24]

Like Senior, Mill was fully aware of the fact that both the family income and the parents' educational background play a role of considerable importance in determining the demand for education. In other words, these two factors will greatly influence the extent to which education in general is demanded. As regards the particular field of study, Mill pointed out that the parental occupation could be a very influential factor in determining the demand for education along a particular line; he said that children were likely to follow their parents to enter the same line of specialization simply because no parent would like to demand education for his children which will lead to an occupation widely different in character from his own;

> the liberal professions are mostly supplied by sons of either the professional or idle classes; the more highly skilled manual employments are filled up from the sons of skilled artisans or the class of tradesmen who rank with them; the lower classes of skilled employments are in a similar case; and unskilled labourers, with occasional exceptions, remain from father to son in their pristine condition.[25]

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[24]Ibid.

[25]Quoted from Alfred Marshall's Principles of Economics, 8th edition; (London: MacMillan & Co., 1930), p. 218.

Undoubtedly, Mill attributed this transition of occupation from father to son to the direct influence of parental authority. He failed, at this point, to realize that there exists, as is usually the case, reciprocal relationship between generations in which one is easily influenced by the other. To put it somewhat differently, the fact that children tend to follow their parents with respect to the choice of field may also be attributed to the indirect socioeconomic environment in the home rather than to the direct influence of the authority of parents.

Yet, in contrast to Senior, Mill did not treat educational outlays as an investment whose primary objective was to better future return, even though he was deeply aware that educated people made higher income than the uneducated, ordinary laborers.[26] In his view, education is more a way of training and developing the decency of human minds and social morality than a means of promoting material well-being. It follows that higher education in Mill's view should not be oriented toward professional training.

Among the classical economists, Robert Lowe was probably the one who agreed with Adam Smith in almost every respect concerning the economics of education. Like Smith, he was extremely in favor of private schools and of applying the market mechanism in the operation of educational institutions.

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[26]John S. Mill, Principles of Political Economy (New York: The Colonial Press, 1899), Vol. I, p. 106.

As regards the demand for education, it should be left in the hands of parents because no parent is, in his view, so selfish or evil as to abuse his children. Parents may not be the best judges, but they are always for the best interests of their children; they may be wrong in demanding a particular line of education for their children, but that is, at most, because of their imperfect knowledge.[27]

Being concerned with the laboring class, Marx said nothing about higher education. To him, education meant elementary education for the working people. In the discussion of the Factory Act, he mentioned that education for workers was of primary importance because it provided them with the inner ability adaptable for the newer and more creative modes of production, thereby making possible the enhancement of productivity. Hence, the demand for education should be made compulsory. In addition, he said that to keep children in school all day long would entail waste and ineffi ciency. To avoid these defects and to increase the efficiency of schooling, education must be comprised of not only class instruction but productive work and gymnastics as well, so as to spread school hours over a variety of activities.[28] In sum, Marx showed no interest in the demand for higher education. To him, again, education meant compulsory elementary education.

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[27]Robert Lowe, Middle Class Education: Endowment or Free Trade? (England, 1968), pp. 7-10.

[28]Karl Marx, Capital (New York: Random House, Inc., 1906), pp. 526-56.

Like Smith, McCulloch, and Senior, Marshall viewed education as "an important means towards the production of material wealth" in that it first stimulates a worker's mental activity; i.e., it "fosters in him a habit of wise inquisitiveness; it makes him more intelligent, more ready, more trustworthy in his ordinary work," and then it increases indirectly the production of material wealth.[29] Since education promotes material production, the expenditures on education should be regarded ad an investment rather than as a consumtion. According to Marshall, education, especially higher education for genius, though incurring costs, will pay off in the long run.[30]

Furthermore, he asserted that the demand for education was generally influenced by several factors. First is family income. Parents of middle-and upper-income classes are more likely to demand education for their children than the lower income family because the latter can hardly acknowledge "a distant event as of nearly the same importance as if it were close at hand (discounting the future at a low rate of interest)."[31] Secondly, with respect to the demand for a particular field of study, two things stand out: (1) it is to a great extent determined by parental occupation because "parents generally bring up their children to occupations in

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[29]Marshall, Ibid., p. 211.

[30]Ibid., p. 216.

[31]Ibid., p. 217.

their own grades, and therefore the total supply of labor in any grade in one generation is in a great measure determined by the number in that grade in the preceding generation."[32] (2) It is determined by the level of earnings of a particular occupation to which education leads. If the average earning of one occupation rises relative to that of the others, demand for that particular line of education will increase rapidly, or to put it somewhat differently, the demand for education with respect to field of choice, or what is the same thing, the supply of a particular line of labor in the future is dependent on the current demand for that labor. This is simply because, in demanding education for their children, parents tend to "assume without a further thought that the condition of each trade in their own time sufficiently indicates what it will be in the future."[33]

In addition, like Mill, Senior, Chadwick and other classical English economists, Marshall advocated state support for the education of the poor, on the ground that the demand for education on the part of the poor, if left alone, will not be adequate because of high opportunity costs involved in getting the necessary education.[34] All of these seem to

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[32] Ibid., p. 217.

[33] Ibid., p. 571

[34] Ibid., p. 719.

suggest that Marshall's study in this regard was little more than repetition of the previous studies made by other economists regardless of the fact that his works were more extensive, systematic, and mathematical.

C. Recent Views on the Demand for Higher Education

Among the 792 articles and books listed in Blaug's Bibliography of the 'economics of education,' very few deal in detail with the problem of the demand for higher education. A great number of studies are concerned with the contribution of education to economic growth, including extensive studies on the methods of measuring the effects of education on productivity increase, capital formation, and income growth such as those put out by Denison, Bowman, Schultz, Weisbrod, Mincer, Becker, Mushkin, and Vaizey. Others such as those by Tinbergen, Bos, Harbison, Harris, Platt, and Parnes etc.[35] are interested in educational planning inclusive of the financing of the public as well as the private school, manpower forecasting, and the optimal allocation and utilization of resources. It is surprising that very little attention has been focused on the study of the demand for education, especially higher education. This section will be devoted to a review of the works done by a number of economists in this regard in recent years.

Seymour Harris treats students seeking higher education

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[35]M. Blaug, Economics of Education; A Selected Annotated Bibliography (England: Pergamon Press, 1966).

as customers and colleges and universities as institutions offering educational services for sale. The buying activities of customers are more or less restricted in the sense that each customer must present, in addition to such pecuniary costs as tuition and fees, a high school diploma and must meet certain requirements such as pass an examination or maintain a specified grade-point average, before the purchase of educational services can be made. As a result, many potential buyers are excluded from the market.[36] Besides, since the tuition and fees that students pay are considerably less than the full cost of providing educational services, the institutions of higher education do not engage in price competition as most of the firms do in an oligopolistic or monopolistically competitive market, but they are to attract the most qualified students. In case that there arises financial difficulty, it is not, as is often the case with profit-making business organizations, because of weak demand but because of either inflation or difficulty in absorbing more qualified students or both.[37]

Like Harris, Benson approaches the problem from the micro perspective. He treats education as both a consumer good and a producer's good. Treating it as a consumer good, Benson applies to education the theory of consumer behavior in which the marginal utility derived from education diminishes

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[36]Seymour E. Harris, "Economics of Higher Education," American Economic Review (June, 1953), pp. 344-57.

[37]Ibid.

as more hours are devoted to schooling within a short period of time. But, in the long run the demand for education as a consumer good is different from the demand for a commodity because the more education the members of a household receive, the more highly they will value schooling. Benson called this "a case of supply creating its own demand."[38] It appears that, in applying the theory of consumer demand to education, he failed to see the fact that there is nothing inconsistent between the demand for education of an individual and of a household as compared with the demand for a commodity. As an individual, a consumer tends to maximize his satisfaction by equalizing the marginal utility per dollar of various commodities. By the same token, to maximize satisfaction, a highly educated person in the family is likely to demand more education for the other members of his family who are less educated. The implication here is that the demand is largely determined by family environment or the accumulated educational stock, with no reference whatsoever to the supply condition.

Benson regards educational services as an intangible product the need for which buyers have no way of controlling. It is a sort of public good whose supply is indivisible. "One does not buy another ten dollars' worth of education: the choice is typically whether to spend several hundred or

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[38]Charles S. Benson, The Economics of Public Education (Boston: Houghton Mifflin Co., 1961), p. 80.

several thousand more."[39] Moreover, he adds that price changes in goods complementary to education are generally negligible so that they tend to have no effect on the amount of education demanded.[40] In other words, the cross elasticity of demand for education can be presumed to be very low with respect to almost any commodity. Besides, since there is no close substitute available in the market, the price elasticity of demand must also be very low. As to the income elasticity of demand, Benson presumed that it must have been positive in the United States because "the households of this country have experienced an upward shift in occupational status: there are fewer households in the laborer classification and more in the various white-collar groups. The head of a typical household presumably would want his sons to have at least as good jobs as he himself holds. The upward mobility in occupational status implies a demand for more years of schooling for the young people."[41] Then he made an even bolder assumption by stating that in the United States the income elasticity of demand for education could be greater than one for the middle-income families and between zero and one for both the upper-and-lower-income ones. From this, he concluded that at any rate education is a superior good. These, of course, are merely hypothetical. Whether they

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[39] Ibid., p. 92.

[40] Ibid.,

[41] Ibid.

coincide with reality is questionable unless some kind of statistical evidence is at hand.

As a consumer good, the demand for education is also subject to demonstration effect; that is, a household or community is apt to spend more money on educational purpose if it is located in an area surrounded by other households or communities with a higher level of educational attainment. This is nothing but previously mentioned point that the demand for education is correlated with socio-economic environment in the home and in the community.

In the home environment, parental occupation plays a role of considerable importance. In speaking of higher education, J. Vaizey presents some evidence to confirm this hypothesis. He said that in the United States "forty per cent of children of fathers in professional and semi-professional jobs who graduated from high school in 1954 successfully completed college, compared with eleven per cent of children of farmers."[42]

In addition to home environment, Gary Becker introduces another factor into the picture by asserting that able persons have more incentive to go on to college. And this can easily be proved by the fact that I.Q. and grades of entering college students are much higher than those of all

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[42]John Vaizey, The Economics of Education (New York: The Free Press of Glencoe Inc., 1962), p. 120.

high school graduates.[43] On this ground, education and ability are complementary rather than substitute with respect to earnings. He also presents a formula to measure the degree of complementariness.[44]

Speaking of the quality of college students, Vaizey argues that there is "no good evidence that college students of past decades have all come from the highest ability levels. On the contrary, there is evidence that increases in enrollment have been spread over a wide range of ability."[45] The fact that college students are composed of people with a wide range of ability does not, in any manner, disprove the assertion set forth by Becker that in general able people demand more education than do less able people unless college students can be classified on the basis of their I.Q. into several different categories and unless the number of college students with high I.Q. as a percentage of the total number of high school graduates in the same I.Q. category is less than the percentage of that in the other category.

To testify that the intellectual capacity of students is closely associated with the demand for higher education, H. Correa presented D. Wolfle's study in which people were

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[43]Gary Becker, "Underinvestment in College Education," American Economic Review: Paper and Processing, May, 1960, p. 353.

[44]Ibid., p. 352.

[45]Vaizey, Ibid., p. 120.

classified into 27 different categories of intellectual capacity, measured by means of Army General Classification Test (AGCT). It was shown that in 1949 less than one per cent of students with 72 AGCT or less entered college while more than sixty per cent of students with 148 AGCT ore more went on to college.[46]

Correa is probably the first economist in recent years to have made an extensive study on the problem of the demand for higher education. He said that the problem of determining the demand can be approached from two distinct perspectives: namely, micro and macro points of view. Macroeconomically speaking, the size and the structure of population by age and by sex are the most influential factors determining the demand. Microeconomically speaking, there are three major determinants: buyers' preference, income, and the price of education. Buyers' preference is composed of intellectual capacity, vocation, parental influence, and other motivations.[47] In fact, some of these factors that Correa designates as microeconomic determinants may well be regarded as macroeconomic ones as well, provided that they are measured in aggregate or average.

One thing needing to be pointed out is that, in contrast to Marshall's proposition that the current demand for a

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[46]H. Correa, The Economics of Human Resources (Amsterdam: North-Holland Publishing Company, 1967), p. 63, Table VII4-1.

[47]Ibid., pp. 59-61.

particular line of education is closely associated with the current earning of that occupation to which education has led, Correa found a lack of close relationship between the number of students seeking education in a particular field and the earning from that specialization even if a five-year time lag were taken into account.[48] This, of course, does not constitute a sufficient condition to reject Marshall's proposition simply because the number of students to be admitted to a special subject is generally restricted in the U. S. or in any other country. In other words, the supply of education is quite inelastic. To the extent that this is so, it is questionable whether the use of percentage of population enrolled can, as suggested by Correa, truly reveal the demand situation.

Turning back to the problem of the field of choice, Correa asserted that persons with high I. Q. tend to be specialized in certain fields, especially in the professional ones. But, unfortunately, there is a lack of evidence why this is so. One possible explanation Correa gives is that the professional makes a larger income than the non-professional worker. Consequently, in order to make a larger income, able persons tend to seek professional education. This type of reasoning is completely in line with the proposition set forth by Becker that ability and education are complementary rather than substitute to each other.

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[48] Ibid., p. 84.

In estimating the educational requirements for economic development, Tinbergen and Bos set up a system of equations including one demand function for labor with higher education.[49] The demand function they set forth was essentially derived from a production function in which the volume of production was assumed to be linearly related to the labor force with a particular level of education, which can be used to forecast the required manpower stock with higher education on the basis of per capita income and the number of both high school and college students (the number of people with college education being composed of those engaging in production as well as those teaching at secondary and college levels). Some economists are inclined to consider this equation a demand function for education. They fail to realize that the demand for labor of a particular educational level is not the same as the demand for education per se. Consequently, this equation tells nothing about the demand for higher education.

In fact, whether the forecast manpower requirements can be met depends upon the supply of it which, in turn, depends on the present effective demand for education. In particular, the present demand for a particular line of education suffices to indicate the future supply of manpower of

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[49]Tinbergen and Bos, "A Planning Model for the Educational Requirements of Economic Development," Econometric Models of Education (Paris: OECD, 1965), pp. 21-22.

the same kind. It follows that the supply of manpower can be controlled if the present demand for education can be controlled. Svennilson asserted that this is undoubtedly possible.[50] In the discussion of the problem of scientific and technical manpower shortage, he indicated that the problem can be solved through the implementation of appropriate government policy designed to induce more students into the various fields where graduates are badly needed. Tyler proposed that there were three ways by which more students can be induced to elect a scientific career: (1) providing the necessary motivation through improvement in the quality of science and mathematics curricula and teaching in high schools, (2) offering attractive salaries, and (3) encouraging public discussions of the national need for more scientists and engineers.[51] Surprisingly, he rejected the notion that intellectual capacity bears an important relation to the demand for higher education. But, he admitted that the family background of students does have some connection with the choice of field. Yet, in influencing the choice of field, family background is more likely to affect intellectual self-confidence than intellectual ability.[52]

Seymour E. Harris defines the demand for higher education

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[50]OECD, Higher Education and the Demand for Scientific Manpower in the United States (Paris, 1963), p. 79.

[51]Ibid., pp. 84-85.

[52]Ibid.

as "a desire to participate in higher education and the ability to be able to pay the costs of this education.[53] On this basis, students who seek higher education but are incapable of entering college or unable to afford the expenses will not constitute effective demand for higher education. To measure the effective demand, Harris takes the number of students enrolled as a percentage of the population.[54] This, of course, is deceptive in that it is a ratio rather than an absolute quantity, and if both population and the number of enrollees increase proportionately, the ratio remains unchanged, yet, in fact, the demand for college places has increased. In this connection, Conger seems to have made a more appropriate explanation in line with the concept of demand. In the projection of college and university enrollment, he estimated the demand for college education by means of the number of potential applicants for college places.[55] Three methods were employed in his projections, and the results differed widely depending on the method used. But, one thing is clear: that is, very little of the enrollment increase in recent years can be explained by population growth alone.[56] There

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[53]Seymour E. Harris, "The Demand for Higher Education," Economic Aspects of Higher Education (Paris: OECD, 1964), p. 25.

[54]Ibid., p. 25.

[55]Louis H. Conger, Jr., "College and University Enrollment: Projections," Economics of Higher Education, ed., Selma J. Mushkin (Washington D. D.: U. S. Dept. of HEW, Office of Education, 1962), pp. 3-4.

[56]Ibid., pp. 4-7.

must have been some other factors which could possibly explain better the sharp rise in the demand for higher education in the United States in recent years.

In response to this need, Brazer and David made an extensive study on the social and economic determinants of the demand for education, and found, on the basis of the survey taken in 1960, that the sharp rise in the demand for higher education can be attributed to a number of causal factors such as the increase in real family income, urbanization, and an increase in the demand for manpower with higher education due to technological progress.[57] In addition, he set up a model showing how the educational attainments are transmitted from one generation to another. Of all the factors affecting the educational attainment of children, the educational background of family head ranks first, explaining approximately fourteen per cent of the variation in children's education. Other factors such as difference in education of heads and wives, occupation, the number of children, migration, N-achievement, past peak earning, and religious preference all have more or less impact on children's demand for the educational attainment.[58]

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[57]Harvey E. Brazer and Martin David, "Social and Economic Determinants of the Demand for Education," Economics of Higher Education, ed., Selma J. Mushkin (Washington D. C.: The Dept. of HEW, Office of Education, 1962), pp. 21-22.

[58]Ibid., p. 27, Table 2.

Harvey Galper suggested that a new factor--the size of the armed forces, which has frequently been neglected--must be taken into consideration in the analysis of the demand for education. Presumably, the growth of armed forces has a negative effect on the number of students seeking college education since some people might go on to college if they were not interrupted by military service. He suggested that the number of students entering college is "a positive function of real family income and a negative function of the rate of growth of the army."[59] The functional relationship can be written as: $N_t/HSG_{t-1} = a + bY_{t-1} + cA_t/A_{t-1}$ Here, N designates the number of students seeking college education; Y, income; A, the size of armed forces; and HSG, the number of high school graduates with t indicating time period. But, since veterans have the benefit of attending college on the GI bill, thereby reducing their costs of education, discharge will increase college enrollments. This additional factor can be taken into consideration by adding one new element D (discharge) to the above equation, which now becomes: $N_t = aHSG_{t-1} + bY_{t-1}HSG_{t-1} + cA_tHSG_t + dD_{t-1}$. The net effect after D's being taken into account was still negative for the period of 1925-65. Therefore, Galper concluded that the increase in real family income and decrease in armed forces tend to increase

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[59]Harvey Galper, "A Short-Run Demand Function for Higher Education in the United States," Journal of Policital Economy Vol. LXXVII, No. 5 (September/October, 1969), p. 768.

the demand for college education, or vice versa.[60]

Assuming that the members of the armed forces are similar to those who are institutionized or immobilized for reasons of health, Campbell and Siegel excluded altogether armed forces from the estimate of demand. Like Galper, they measured demand by means of enrollment ratio, i.e., the ratio of undergraduate enrollment to people in the 18-24 year age group who possess high school diplomas, but, unlike Galper, excluding those who are in the armed forces.[61] Others who take enrollment as a measure of demand are Correa,[62] Blaug,[63] Linnemann,[64] and Friedman and Kuznets.[65]

Recently, Schultz criticized the use of the number of students enrolled as a measure of demand by saying that "the concept of demand implies price and quantity,"[66] and that the

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[60]Ibid., pp. 771-73.

[61]Robert Campbell & Barry N. Siegel, "The Demand for Higher Education in the United States, 1919-1964," American Economic Review, Vol. LVII, No. 3 (June, 1967), pp. 482-94.

[62]Correa, pp. 56-89.

[63]M. Blaug, "An Economic Interpretation of the Private Demand for Education," Economica (May, 1966), pp. 166-82.

[64]Hans Linnemann, "An Attempt at Forcasting the Demand for Higher Education in the Netherlands," Europe's Future Consumption (Amsterdam: North-Holland Publishing Company, 1964), pp. 288-303.

[65]Friedman and Kuznets, Income From Independent Professional Practice (Washington D. C.: National Bureau of Economic Research), Publication No. 45. See also Correa, loc cit, pp. 83-86.

[66]T. Schultz, "Resources for Higher Education: An Economist's View," Journal of Political Economy, 76 (January/February--November/December, 1968), pp. 327-47.

number of enrollees does not give reliable information on the demand for higher education because it is nothing but a naive exponential population projection. As an alternative to enrollment figures, he prefers measuring demand by means of expenditures on education. Using resource costs allocated to education as a measure of demand, Schultz estimated the income elasticity of demand for all levels of education in the United States for the period 1900-1956.[67] Besides, Hirsch also estimated the income elasticity of demand for public, primary, and secondary education in the United States for 1900-1958 and the cross-section income elasticity for the St. Louis City-County area.[68] Others who also take expenditure as a measure of demand are Benson,[69] Becker,[70] Mincer,[71]

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[67]T. Schultz, "Education and Economic Growth," Social Forces Influencing American Education, ed., Nelson B. Henry (Chicago: National Society for the Study of Education, 1961), pp. 46-88.

[68]Werner W. Hirsch, "The Income Elasticity of Public Education," Price Theory in Action 2nd ed.; ed. Donald S. Watson (Boston: Houghton Mifflin Co., 1969), pp. 55-57. According to his calculation, the cross-section income elasticity of demand for education for the St. Louis area was 0.58, which was considerably less than that for fire protection (10.1), police protection (0.98), and such consumer's goods as air conditioners, automobiles, golf supplies, and speedboats. Hirsch attributed this to people's attitude toward education and the proportional property and sales tax system.

[69]Bebson, Ibid.

[70]Gary S. Becker, "Investment in Human Capital: A Theoretical Analysis," Journal of Political Economy, Vol. LXX, Supplement, No. 5, Part 2 (October, 1962), pp. 9-49.

[71]Jacob Mincer, "On the Job Training: Costs, Returns, and Some Implication," Journal of Political Economy, Vol. LXX, Supplement, No. 5, Part 2 (October, 1962), pp. 50-80.

Deitch,[72] Oniki,[73] and Pauly.[74] Whether expenditure can unbiasedly reveal the extend of demand is still doubtful, for education as a commodity is heterogeneous in terms of quality; more money spent on education does not necessarily mean great intensity of demand, if the price of education differs from one institution to the other, and the high price does not correspond to high quality. In aggregate, expenditure can at best indicate resource allocation.

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[72]Kenneth M. Deitch, An Econometric Analysis of the Demand for American Public Education in the 1960's, with a Statement of the General Economic Case for Public Education, unpublished Ph.D. dissertation, 1966, Harvard University. In his study, the current expenditure per pupil in average daily attendance was used as a measure of demand, and it was fitted into a model purport to explain the interstate difference in expenditures for both the public elementary and secondary schools.

[73]Hajimi Oniki, A Theoretical Study on the Demand for Education, unpublished Ph.D. dissertation, Stanford University, 1968. In his study a purely theoretical micro model of the demand for education was constructed to see how an individual allocates his time and money to educational purposes in response to outside disturbances, so as to attain the optimum situation in terms of individual welfare. Although the application of his model to the empirical problem is of doubtful worth due to the unrealistic assumption made in the model, it does provide a thorough theoretical insight into the problem of determining individual demand behavior.

[74]Mark V. Pauly, "Mixed Public and Private Finance of Education: Efficiency and Feasibility," American Economic Review, Vol. LVII, No. 1 (March, 1967), pp. 120-130.

CHAPTER III

THE DEMAND FOR HIGHER EDUCATION IN TAIWAN: A CASE STUDY, 1950-1969

A. General Background

Since 1949, when the Chinese Communists took over the mainland China and the Nationalists fled to Taiwan, a tremendous change has taken place in almost every respect on the island. Among the changes, the development of higher education has been one of the most noticeable phenomena and has been a frequently discussed subject among politicians, economists, and educators as well as among sociologists. In 1945, when the island was first restored to the Nationalist Chinese from the hands of the Japanese, there were only four institutions of higher learning.[75] All were publicly supported. Private colleges and universities had not come into being prior to 1945 due to the suppressive colonial policy adopted by the Japanese government in Taiwan. In addition, students of native origin, with very few exceptions, were barred from entering law school or pursuing the social sciences.

[75]Namely, National Taiwan University, Provincial Normal College, Provincial Engineering College, and Provincial Agriculture College.

As a result of this restriction, there was an abundant supply of technical personnel such as agricultural technicians, engineers, and medical doctors coupled with a severe shortage of administrators and politicians immediately after World War II.

To see how higher education has developed during the past two decades, it is necessary to portray, first of all, the rate of increase in the number of institutions of higher learning. The number of colleges and universities, including junior colleges, rose from four with an enrollment of only 2,022 students in 1945 to eighty-six with more than 160,000 students in 1969, a more than sixteenfold increase in the number of institutions and a nearly seventyninefold increase in the number of students enrolled during the past two decades. Or, to put it differently, there has been an average increase of almost four institutions and seven thousand students per year. Of the basic factors featuring this dramatic change was the expansion and establishment of private colleges and universities. Among the eighty-six institutions existing in 1969, fifty-five were private as compared to none in 1945. Accompanying this rapid development was the sharp increase in the number of faculty, non-teaching staff members, and classes as well as in government appropriations for higher education (see Appendix I, Table 1). Briefly, from 1950 to 1968, the number of faculty members increased by almost 800 per cent; the number of classes by nearly 1,600 per cent; and the government spending on higher education, deflated by the wholesale

price index based on 1961 prices, increased by more than 700 per cent while the number of students and institutions, if measured on the basis of 1950 figures, rose by 2,318 per cent and 1,128 per cent, respectively. Undoubtedly, these are figures far exceeding those of many other developed as well as underdeveloped nations in the world today, as is shown in Appendix I, Table 2.

It is interesting or perhaps imperative to see what were the basic driving factors that caused such a remarkable development in higher education. During the same period, the island's population also increased tremendously from 7,554,399 in 1950 to 13,045,827 in 1968, an increase of nearly one hundred per cent. But the number of college and university students went up by more than twenty-two fold. As a result, the student-population ratio rose sharply over the past years (Appendix I, Table 3). In other words, the rate of growth in the number of students was greater than the rate of population growth. This suggests that the demand for higher education in Taiwan cannot be attributed to the demographical factor alone. Rather, other causes must be sought before the true picture can be revealed.

B. Factors Affecting the Demand for Higher Education in Taiwan

1. The Number of High-School Graduates (HSG)

Since the purchase of college education requires, in addition to the pecuniary transaction, some kind of effort

and qualification, e.g., high school diploma, high-school graduates become the only potential buyers of college educational services. In Taiwan, the number of HSG rose significantly from 6,454 in 1953 to 39,308 in 1968, which, if expressed in terms of percentage change, shows an increase of more than five hundred per cent, much greater than that of population growth. Moreover, for the same period under study the number of people seeking college education as a percentage of population increased despite the fact that the number of people in the college age group (20-24) as a percentage of total population declined (Appendix I, Table 5). This seems to suggest that the demand for high-school education in Taiwan is a derived demand deriving from the demand for college education. At any rate, the number of HSG can be considered a factor affecting the demand for higher education.

2. Per Capita Income

A second factor is income. Similar to the purchase of goods for which pecuniary payments are required, the purchase of education requires the disbursement of money income, unless it is free. To the extent that it is not free and higher education usually is not, income will presumably play a role of importance in the purchase of it. Speaking from the micro point of view, one would buy more education as his income rises. But, what precisely is meant by more education? More expensive? Of better quality? Or of longer duration?

Since one cannot register more than once at a time, the purchase of education will remain practically unchanged as his income rises, if he has already registered. Of course, if he decides to seek college education after the rise in income, then demand does increase with income. Following this line of reasoning, one sees that the changes in demand at the micro level are not a matter of "more" or "less," but a question of "have" or "have not." Theoretically, there could, for each individual, be a critical level of income where one shifts from "have" to "have not" or vice versa. Any change in income without crossing or reaching that critical point will cause no change in the individual demand. Since individuals are heterogeneous in nature, the critical level of income that affects the demand tends to vary with individuals. Consequently, it is impossible to formulate a demand function applicable to all individuals. It is for this reason that in this study the impact of a change in income on the demand for higher education will be examined from the macro point of view.

To measure income in aggregate terms, per capita income is chosen because (1) it is an average figure which takes population change into account, (2) it is the best yardstick to gauge aggregately how well-off people in general are.

In Taiwan, per capita income measured in terms of current dollars increased from NT$1,275 in 1951 to NT$10,305 in 1969. If measured in terms of constant dollars based on the 1964 price index, it increased from NT$3,728 to NT$8,709

during the same period (Appendix I, Table 6).

3. Price of Higher Education

The price of higher education is simply the private cost of receiving higher education, which includes not only explicit costs such as tuition, fees, and expenditures on books, but also implicit costs such as income forgone while staying at school. Because data on the implicit cost are inaccessible, tuition and fees paid by college students on the yearly basis is taken as the measure of price of higher education in Taiwan in this study. Since tuition and fees charged by educational institutions in Taiwan vary from one institution to another, especially between privately owned and tax-supported institutions, an average will be computed as an estimate of the annual private cost of education.

The average private cost of higher education in Taiwan, measured in current dollars, went up from NT$302 in 1953 to NT$5,363 in 1968, exclusive of expenditures on room, board, books, and transportation (Appendix I, Table 9). If deflated by price indexes based upon 1961 price, it went up from NT$576 to NT$4,627 during the same period, showing an almost eightfold increase during the past sixteen years. In spite of this sharp rise in costs, the number of people seeking college education, as stated earlier, increased by more than sixfold. On the basis of these observations alone, it is difficult to reason, as it is suggested by economic theory, that the price (cost) of education and the demand for education

are inversely related. Presumably, there are a number of propositions with which this peculiar situation can be justified. In the first place, it could be that the price of higher education has no direct connection with the demand for higher education simply because the cost is such a small sum that it accounts for a small fraction of the annual family budget, and that changes in the cost of higher education exert no influence on the purchase of it. Secondly, it could be that the strong demand actually causes a rise in the price (cost) of higher education, but not vice versa. Thirdly, it could be that the price of higher education did have a negative effect on demand, but the negative effect was more than offset by other factors producing positive effects, e.g., the rising per capita income, the favorable demonstration effect, urbanization, and the sharp increase in the number of people eligible for undertaking college education, etc., and that the demand for higher education would have been greater than it was, had the price of higher education not risen so sharply.

However, a brief examination of the above propositions suggests that the price of higher education is unlikely to be negligible, for the price of higher education in Taiwan accounted for a quarter of to more than half of per capita income prior to 1968 (compare Table 6 with Table 9 in Appendix I). This, needless to say, cannot be termed small, nor can it be laid aside. Likewise, the second proposition is

equally unacceptable, for, insofar as the cost of education does involve a considerable sum of money, the rise in price, though induced by a strong demand, will pose a feed-back negative effect on the demand for it in the year following, if not in the same year. As regards the third proposition, it is impossible, at this moment, to tell whether it is true unless some sort of empirical verification is made (the verification will be made in the later section of this chapter).

Furthermore, scholarships which purport to reduce the cost of receiving high education must, in theory, be subtracted from tuition and fees paid by students while interest payments on student loans, which are part of educational outlays, must be added to it. Yet, for the following reasons neither of them will be taken into consideration in the estimation of the private cost of higher education: (1) Although the empirical data are not inacessible, the amount of scholarships has practically been trivial in relation to the aggregate private cost and can be discarded without causing any significant variation in the price of higher education. The same holds true of interest payments on student loans. In fact, student loans were virtually nonexistent a few years ago. (2) After all, even these negligible sums of scholarships and interest payments will offset each other, thus in aggregate producing neither positive nor negative effect on the price of higher education.

4. Psychological and Other Factors

A number of psychological factors will also be considered. In the first place, since many people are subject to a "demonstration effect" in the purchase of a commodity, especially a consumer good, the percentage of population having college education will be used to detect this effect. The basic reasoning behind this proposition is that in most instances the existence of highly educated people (educational stock) is likely to contribute a kind of environment or atmosphere in favor of higher education. This will be especially true when college graduates tend to be in a high income bracket and/or are held in high esteem by the public because of their status in the government, business, or educational institutions. The sentiment in favor of higher education may be compounded if the economy is such that there is an increasing need for people with higher education. It may be argued that youngsters are more exposed to home environment than to the society as a whole, that the parental attainment and occupations are more important than the entire educational stock in the society, and that the number of people in the 40-60 age group having college education as a percentage of total population must be substituted for the percentage of population having college education. After some pondering of this alternative variable, it is abandoned for the following considerations: (1) It is felt that a study of the impact of the parental educational background and occupations on

higher education can be done more satisfactorily by means of cross-section rather than time-series analysis. (2) The empirical data available on individual households are too fragmentary and inadequate to make possible a complete and reliable analysis.

The percentage of the population having higher education includes both the college student and college graduate. College drop-outs are not taken into account because they constitute a very small fraction of the total number of students (Appendix I, Table 7).

In the second place, to see whether the degree of industrialization and urbanization of a society have any effect on the psychology of people's attitude toward higher education, the percentage of non-agricultural population will be considered.

The fundamental assumption underlying this approach is the fact that industrialization generally results in an increasing demand for people with high skills, wisdom, and more knowledge, which in turn will lead to an increasing demand for higher education. In the economic jargon, the demand for higher education is in a sense a derived demand resulting from the demand for highly skilled, educated manpower. Consequently, it may be expected that industrialization, which discriminately favors the educated over the uneducated or less educated, will generate an incentive on the part of students to demand more education.

Furthermore, people engaged in industry and commerce are likely to dwell in or near the urban areas where competition for the better-paid jobs is keen and easily felt. As a result, city-dwellers tend to realize better than farmers the necessity and importance of higher education. It is for this reason that the percentage of non-agricultural population is taken into consideration.

In effect, there are a host of other factors which may also exert some degree of influence on the demand for more education. Examples are the acceptance ratio (defined as the number of students to be accepted by the institutions of higher education as a percentage of the total number of applicants), N-Achieving motive, intellectual capacity, and the like.[76] In particular, those who have strong incentive to excell themselves in their careers and those who are intellectually capable of pursuing higher education tend to desire more education. Unfortunately, these factors, being psychological in nature, are hard to quantify and are often neglected in economic analysis.

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[76]It is true that some sociologists have made attempts to estimate the level of N-Achievement for various countries in the past based on government documents, children's stories, poems, literature, folk songs, and the like, but the estimations they did were basically on a long-run basis covering at least half a century or even several hundred years. Granted that N-Achievement can be measured over a short-period of time, its yearly variation will be too trivial to have any significant weight in this study in which all variables are measured on an annual basis.

C. Measurement of the Demand for Higher Education in Taiwan

There are a number of ways in which the demand for education can be measured quantitatively. Some economists chose government expenditures on education as a measure of demand, while others preferred enrollment data--either the absolute number of students enrolled or the relative enrollment ratio, that is, the number of students per thousand inhabitants--to any other information. However, strictly speaking, government expenditures reflect nothing but the allocation of public resources, or, to say the most, the extent to which the public sector of the economy is willing to support education. The enrollment data could possibly be regarded as a measure adequately indicating the true demand provided that the availability of college places is in no way limited. In the United States where one can, without much difficulty, go on to college as long as one has a high-school diploma and is financially capable of attending college, the demand for higher education may well be expressed in terms of enrollment. But in Taiwan where the number of people who are willing and financially able to receive higher education has long been far greater than the number of those who receive it, it is doubtful whether enrollment data can satisfactorily indicate demand. In short, the demand for higher education must be measured in terms other than the enrollment data.

Then what is the best measure of demand that can give accurate information on the number of people who are willing

and financially able to seek higher education? Would it be the number of applications filed by high-school graduates? But what if one files more than one application within the same year? Presumably, it will be extremely cumbersome to detect the duplication. It is for this reason the economists have had no choice but to use enrollment figures.

Fortunately, this difficulty can easily be resolved in the case of Taiwan where college admissions are controlled and consolidated by the so-called "Joint Colleges Entrance Examination" system (JCEE) which was established and which has been in effect since 1954. According to this system, high school graduates are required to take a college entrance examination, irrespective of the fields of study in which they intend to concentrate, and the results are to be graded and evaluated by the members of a central organization designated as the "Joint Entrance Examination Committee," which then determines the minimum requirements of eligibility and allots those who have been accepted to various schools on the basis of the test results and the students' choices of schools and fields. The examination is held only once a year, and all of the colleges and universities, including junior colleges, both public and private, must join legally as members of the system without exception. It follows that each student seeking a college education can register and take the entrance examination only once a year and that each individual school has no choice as to what kind of students

it would like to have. The committee takes care of everything, from the grading of the tests to the distribution of students. The only right that each individual school has is to determine and report to the committee before the examination is held the number of students it wants to accept in various fields of study. Of course, a system like this has merits as well as demerits which are beyond the scope of this study. What is important at this point is the fact that, since no student can take the entrance examination more than once a year, the number of students taking the joint college entrance examination can serve satisfactorily as a measure of the demand for higher education.

At this juncture, a few words pertaining to the distinction between the undergraduate and graduate studies seem necessary. As indicated above, the number of students taking college entrance examinations can very well signal the degree of the demand for higher education, specifically, the demand for undergraduate studies. Presumably, it is conceivable that the method of estimation of the demand for undergraduate studies can be extended to the demand for graduate studies by simply taking the number of undergraduates participating in the graduate entrance examination as a measure of demand. Unfortunately, this proposition does not hold true for the demand for graduate studies. For (1) the graduate entrance examination which is required of anyone seeking graduate studies is not held jointly by all the institutions concerned,

but rather it is held individually; so each student can take the examination more than once; (2) there are only a small number of graduate schools on the island, and both the number of those taking examinations and of those who are accepted are quite small and hence negligible; and (3) for reasons to be discussed in the next chapter, most undergraduates prefer going abroad for their advanced studies; so the number of people taking the "Examination for Study Abroad" has increased sharply over the past years.

Because of the aforementioned peculiar situation, the number of people taking the graduate entrance examination will not, in this study, be used as a measure of the demand for graduate studies, nor can we add this to the number of people taking the Examination for Study Abroad (designated as EFSA hereafter) as an estimate of the total demand for graduate studies, both at home and abroad, for there is no reason to believe that one who takes the one examination will not take the other. In fact, these two examinations have been and are held separately at different dates, and those who are eligible to take one examination are also eligible to take the other. Consequently, there is only one way left in which the demand for graduate studies can be measured quantitatively, that is, to substitute the number of people taking the EFSA for the number of people taking the Graduate Entrance Examination (GEE). To be more specific, the demand for graduate education at home must to some extent be ignored.

D. Theoretical Framework

As a first approximation, consider higher education a commodity displayed in the market for sale, for which the demand is, disregarding the qualifications required, subject to the buyers' income and the price of education. To put it somewhat differently, the demand for higher education is a function of the price of higher education and the buyers' income, ceteris paribus.

Mathematically:

$$Y_u(t) = f\{X_1(t),\ X_2(t)\} \qquad (3.5.1)$$

where $Y_u(t)$ denotes the demand for college education, or, in the case of Taiwan, the number of people taking the JCEE in year t. $X_1(t)$ designates the average tuition and fees charged by institutions of higher learning in year t, and $X_2(t)$, per capita income in year t.

Judging from the fact that a complex reality depicted by multi-dimensions is rarely of a simple linearity, it seems appropriate to postulate the relationship between $Y_u(t)$, $X_1(t)$, and $X_2(t)$ in the following form:

$$Y_U(t) = AX_1^{a_1}(t)\ X_2^{a_2}(t)\ u(t) \qquad (3.5.2)$$

where A, a_1, and a_2 are all constant terms and u(t), a disturbance term in year t. To estimate the elasticity coefficient of demand, first of all, take logarithms for both sides of the equation:

$$\log Y_u(t) = \log A + a_1 \log X_1(t) + a_2 \log X_2(t) + \log u(t) \qquad (3.5.3)$$

Or, $$Y'_u(t) = A' + a_1 X'_1(t) + a_2 X'_2(t) + u'(t) \qquad (3.5.3)'$$

where the prime denotes logarithms. Taking logarithms will certainly draw some conveniences in that it not only simplifies the mathematical calculation by transforming the power function into linear form but also indicates the elasticity of demand directly from the equation <u>per se</u> once the equation is estimated.

Taking first differences, equation (3.5.3)' becomes:

$$\Delta Y'_u(t) = a_1 \Delta X'_1(t) + a_2 \Delta X'_2(t) + \Delta u'(t) \qquad (3.5.4)$$

Since $\sum \Delta u'(t) = 0$, equation (3.5.4) has normal equation as follows:

$$\sum \left[\Delta Y'_u(t)\right]\left[\Delta X'_1(t)\right] = a_1 \sum \left[\Delta X'_1(t)\right]^2 + a_2 \sum \left[\Delta X'_2(t)\right]\left[\Delta X'_1(t)\right]$$

$$\sum \left[\Delta Y'_u(t)\right]\left[\Delta X'_2(t)\right] = a_1 \sum \left[\Delta X'_2(t)\right]\left[\Delta X'_1(t)\right] + a_2 \sum \left[\Delta X'_2(t)\right]^2$$

Set $x = \Delta Y'_u(t)$ $\quad y = \Delta X'_1(t)$ $\quad z = \Delta X'_2(t)$

then, both the price and income elasticity of demand can be easily obtained. Of course, the elasticities so obtained assume that they remain unchanged throughout the entire period. If the percentage of population having college education (X_3) is taken into account, equation (3.5.2) becomes:

$$Y_u(t) = B X_1^{a_1}(t)\, X_2^{a_2}(t)\, X_3^{a_3}(t)\, u(t) \qquad (3.5.6)$$

Again, B and a_3 are constant terms and u(t) is a disturbance term. It goes without saying that u(t) in the above equation is different from the disturbance term postulated in equation (3.5.2). However, for simplicity's sake, the same symbol is used here.

The number of persons having college educations is cumulative over time, and so is the size of population. Insofar as the former increases at a faster pace than the latter, $X_3(t)$ will increase gradually. Assuming that $X_3(t)$ increases at a rate of m, then:

$$X_3(t) = X_3(t-1)\ (1 + m)$$

so,
$$X_3'(t) = X_3'(t - 1) + (1 + m)' \qquad (3.5.7)$$

Again, the prime indicates logarithms. Next, taking logarithms for both sides of the equation (3.5.6), we have:

$$Y_u'(t) = B' + a_1X_1'(t) + a_2X_2'(t) + a_3X_3'(t) + u'(t) \qquad (3.5.8)$$

Taking first differences, equation (3.5.8) becomes:

$$\Delta Y_u'(t) = a_1\Delta X_1'(t) + a_2\Delta X_2'(t) + a_3\Delta X_3'(t) + \Delta u'(t) \qquad (3.5.9)$$

$$\begin{aligned}\text{Since } a_3\Delta X_3'(t) &= a_3\left[X_3'(t) - X_3'(t - 1)\right] \\ &= a_3\left[X_3'(t - 1)\ (1 + m) - X_3'(t - 1)\right] \\ &= a_3\left[X_3'(t - 1) + (1 + m)' - X_3'(t - 1)\right] \\ &= a_3(1 + m)' \qquad (3.5.10)\end{aligned}$$

Substituting (3.5.10) for $a_3\ X_3'(t)$ in equation (3.5.9), we have:

$$\Delta Y_u'(t) = a_1 \Delta X_1'(t) + a_2 \Delta X_2'(t) + a_3(1 + m)' + \Delta u'(t) \qquad (3.5.11)$$

Since m can be obtained from empirical observations and a_3 can be estimated, $a_3(1 + m)'$ is a constant. Set $a_3(1 + m) = M$, equation (3.5.11) can be written as

$$\Delta Y_u'(t) = M + a_1 \Delta X_1'(t) + a_2 \Delta X_2'(t) + \Delta u'(t) \qquad (3.5.12)$$

Here, a_1 and a_2 give the price and income elasticity of demand respectively, having taken into account the demonstration effect.

Analogously, the same reasoning can be followed and applied to a situation involving more variables. To illustrate, let $X_4(t)$, $X_5(t)$, and $X_6(t)$ signify the number of HSG, the percentage of non-agricultural population, and the acceptance ratio in year t respectively, and n, q, and r, their respective rates of change over time.

Then:

$$\begin{aligned} X_4(t) &= X_4(t - 1)\ (1 + n) \\ X_5(t) &= X_5(t - 1)\ (1 + q) \\ X_6(t) &= X_6(t - 1)\ (1 + r) \end{aligned} \qquad (3.5.13)$$

Taking these three additional variables into account, equation (3.5.6) can be extended to the following form:

$$Y_u(t) = CX_1^{a_1}(t)\ X_2^{a_2}(t)\ X_3^{a_3}(t)\ X_4^{a_4}(t)\ X_5^{a_5}(t)\ X_6^{a_6}(t)\ u(t) \qquad (3.5.14)$$

Again, C, a_1, a_2, a_3, a_4, a_5, and a_6 are constant parameters. Upon taking logarithms, the above function can be transformed into a linear form, that is:

$$\begin{aligned} Y'_u(t) = C' &+ a_1X'_1(t) + a_2X'_2(t) + a_3X'_3(t) \\ &+ a_4X'_4(t) + a_5X'_5(t) + a_6X'_6(t) \\ &+ u'(t) \end{aligned} \tag{3.5.15}$$

Taking first differences and substituting equation (3.5.13) for the respective corresponding terms in equation (3.5.15), we have:

$$\begin{aligned} \Delta Y'_u(t) &= a_1\Delta X'_1(t) + a_2\Delta X'_2(t) + a_3\Delta X'_3(t) \\ &\quad + a_4\Delta X'_4(t) + a_5\Delta X'_5(t) + a_6\Delta X'_6(t) \\ &\quad + \Delta u'(t) \\ &= a_1\Delta X'_1(t) + a_2\Delta X'_2(t) + a_3\Delta X'_3(t) \\ &\quad + a_4\left[X'_4(t) - X'_4(t-1)\right] + a_5\left[X'_5(t)\right. \\ &\quad \left. - X'_5(t-1)\right] + a_6\left[X'_6(t) - X'_6(t-1)\right] \\ &\quad + \Delta u'(t) \\ &= L + a_4\left[X'_4(t-1)\ (1+n) - X'_4(t-1)\right] \\ &\quad + a_5\left[X'_5(t-1)\ (1+q) - X'_5(t-1)\right] \\ &\quad + a_6\left|X'_6(t-1)\ (1+r) - X'_6(t-1)\right| \\ &\quad + \Delta u'(t) \\ &= L + a_4(1+n)' + a_5(1+q)' \\ &\quad + a_6(1\ \Delta\ r)' + \Delta u'(t) \end{aligned} \tag{3.5.16}$$

where $L = a_1\Delta X'_1(t) + a_2\Delta X'_2(t) + a_3\Delta X'_3(t)$, which can be expressed in the form of a three-variable linear function like equation (3.5.12). Now, set

$$a_4(1+n)' + a_5(1+q)' + a_6(1+r)' + Q$$

Q is a constant. Then, equation (3.5.16) may be transformed into:

$$\Delta Y'_u(t) = W + a_1 \Delta X'_1(t) + a_2 \Delta X'_2(t) + a_3 \Delta X'_3(t) + \Delta u'(t) \qquad (3.5.17)$$

where W = Q + M. W is a constant. a_1 and a_2 measure respectively the price and income elasticity of demand. Equation (3.5.15) will serve as a basic demand function for college education in Taiwan to be estimated in the next section.

E. The Estimation of Demand Function

The estimation of equation (3.5.15) yields (see Appendix II):

$$Y'_u = -3.0541 + \underset{(0.176114)}{0.17632X'_1} + \underset{(0.57663)}{0.30343X'_2} - \underset{(0.44366)}{0.60712X'_3} + \underset{(0.43756)}{0.61557X'_4} + \underset{(2.33479)}{1.3568X'_5} + \underset{(0.33325)}{0.57765X'_6} \qquad (3.6.2)$$

The figures in parentheses beneath the estimates of regression coefficients are standard error of estimates. The multiple correlation coefficient is 0.9928 and the coefficient of determination is 0.9857, which clearly suggest that the fit of logarithmic form to the data is quite good. The F value so derived is 103.3395, which is significantly greater than $F_{0.01(6,9)} = 5.8$, the critical value of F with 6 and 9 degree of freedom at one per cent level of significance. It is inconceivable at this point that the coefficient of X_1 has turned

out to be positive. It may be that the influences of other variables have more than offset that of X_1 to such an extent that the price (cost) of receiving higher education became completely negligible. The fact that the coefficient of X_3 is negative implies that people are subject to an adverse demonstration effect. This can be true if there is an over-supply of college graduates that the economy cannot absorb and, if as a result, either the employment prospect of college graduates is dim or the pecuniary return to college education is not noticeably higher than that to the secondary education; then college education becomes a project not worth undertaking. In fact, if one examines the steps through which the variables are added, he will find that X_2 alone is responsible for nearly ninety-seven per cent of the variation in Y_u, that is to say, the addition of X_1, X_5, X_3, X_4, and X_6 have practically contributed very little to the betterment of the fit of equation and, as a consequence, can be discarded (see Appendix II, Part A). The discard of all other variables leads to:

$$Y'_u(t) = -0.45722 + 1.32661X'_2 \qquad (3.6.3)$$
$$(0.06564)$$

The F value is 408.401 which is again significantly greater than $F_{0.01(1,14)} = 8.86$. Equation (6.3.3) yields an income elasticity of demand of more than unity, indicating that people in general demand more education when their income (in current dollars) rises. Undoubtedly, higher education is

a normal good although it is not certain whether it can be called a superior good. After all, higher education is not a necessity to many people; buyers tend to be sensitive to a change in income. To see whether buyers are subject to the money illusion, a regression on the real per capita income (in constant dollars based on 1964 price index) is performed for comparison, which yields $R^2 = 0.9409$. It is also highly significant. Thus, it makes little difference whether per capita income is measured in current or constant dollars in the testing of the educational market in Taiwan. In other words, buyers in general are not subject to money illusion in the purchase of higher education.

It may be argued that the sharp increase in the number of people seeking college education over the past years was nothing but a trend. To test the validity of this proposition, a third variable: time, was incorporated into the equation involving only X_1 and X_2, the two independent variables most highly correlated with Y_u in the correlation matrix (see Appendix II, Part B). Besides, to remove the trend generally inbred in time series data, a first difference regression equation was derived, which yields: $R^2 = 0.992$. Again, income alone accounts for more than ninety-eight per cent of the variation in Y_u as shown in Appendix II, Part C, a result that is consistent with what has been asserted.

As regards the demand for graduate education abroad, the estimate leads to the following result:

$$Y_g'(t) = 28.63164 - 7.82854X_3' - 27.9895X_5'$$
$$(2.4892) \quad (15.01427)$$
$$+ 1.03629X_7' + 3.25871X_8' - 0.29772X_9'$$
$$(0.25175) \quad (0.75852) \quad (0.65415)$$
$$+ 2.37228X_{11}' + 0.49265X_{12}' \qquad (3.6.4)$$
$$(3.26268) \quad (0.60389)$$

where Y_g represents the number of people seeking graduate studies abroad, i.e., the number of students taking EFSA. X_7, X_8, X_9, X_{11}, and X_{12} denote respectively the number of people left for graduate education abroad, the number of college graduates, the growth of real GNP, real per capita income, and the number of people returned from abroad. The standard error of estimate of Y_g is 0.15439, and the coefficient of determination $R^2 = 0.9345$. F value is 16.3013 which is significantly greater than the corresponding value at one per cent level ($F_{o.ol(7,8)} = 6.19$).

An examination of the above equation reveals that with the exception of X_7 and X_8 the estimates of coefficients of independent variables are very poor in that the standard error of estimates are exceedingly high. To see whether income bears closely on the number of people desiring to go abroad, X_{11} and X_9 are dropped from the equation. The coefficient of determination so obtained is 0.9298 which is still very significant. In other words, the elimination of income figure produces no perceptible impact on the demand for graduate studies abroad. In theory, an increase in income will

cause an increase in the demand for higher education if higher education is looked upon as a consumer good. However, an increase in income may also exert an adverse effect on graduate education if it does reduce the need or desire of doing advanced studies abroad especially for those who have emigration in mind. Many who are the potential emigrants will probably choose to stay in the home country if the economy prospers and the standard of living rises; besides, since emigration always involves uncertainty, the investment in studying abroad becomes less attractive when the home environment improves. In this connection, it is not certain whether the positive and negative effect associated with the increase in income have offset each other that they appear negligible in the equation. Next, X_7 and X_{12} are deleted to see if the demand for studying abroad is subject to "demonstration effect." The coefficient of determination is 0.7733, much lower than what we had when X_7 and X_{12} were included. The standard error of estimate increases from 0.1429 to 0.25689. It seems to suggest that the number of people seeking graduate studies abroad has been influenced by the outflow and reflux of students over the past years. In fact, X_7 alone explains seventy-five per cent of the variation in Y_g, reflecting the fact that the outflow is more influential than the reflux, (Appendix II, Part D). The coefficient for X_8 has been consistently positive and stable throughout this analysis, indicating the fact that college graduates are the potential buyers of graduate

education abroad. The coefficients of X_3 and X_5 are consistently negative, especially that of X_5 whose magnitude is undoubtedly large, seeming to signify that as the economy becomes more industrialized fewer people are willing to leave the country. In conclusion, the demand for education abroad is mostly affected by the positive demonstration effect and the state of economy.

CHAPTER IV

QUALIFICATIONS ON THE MEASUREMENT OF THE DEMAND FOR HIGHER EDUCATION IN TAIWAN: AN INTERPRETATION AND APPRAISAL

The analysis set forth in the preceding chapter involves a number of weaknesses that need to be clarified. The first of these concerns the specifics of the functional form and the process by which variables are selected. As is commonly recognized, the direct application of economic theory to the problem of higher education is a newly developed subject for which a firm theoretical foundation is still lacking. Due to this lack of theoretical foundation and to the complex nature of education, it is uncertain at the outset what factors must be considered and what can be discarded in determining the demand for higher education. Hence, the variables selected were taken from those suggested by a number of economists (see Chapter II). But, not all relevant variables can be included, especially those which are psychological in nature and unquantifiable. Secondly, the sample size is so small that the estimation based upon such a small number of observations may yeild unsatisfactory results that are

difficult to interpret. This is especially true of time-series data. Unfortunately, it is impossible at this stage to enlarge the sample size, for this work deals only with the period of time after the Nationalists retreated to Taiwan. Thirdly, it should be pointed out that this work is a short-run static analysis, for no consideration is given to the changing relationship among variables. Finally, throughout the process of this analysis, intercorrelation among variables has actually posed a problem of considerable difficulty. Since most of the variables have shown a steady upward shift, it is expected that the inclusion of one variable in the equation is apt to draw behind it the partial effects of other variables not being tested. The complete separation of them is impossible.

However restrictive the study may seem, it must be added that this study does furnish some valuable insights into the problem of higher education in Taiwan, which may well serve as guidelines for government policy if an appropriate interpretation of the results is made. Estimation techniques provide little help unless they are accompanied by appropriate interpretations of the results. This will be the objective of the following sections.

A. Undergraduate Education

The demand for higher education in Taiwan is influenced by a host of factors; some are economic in nature, while others

are not. In the preceding chapter it has been shown that income is the most crucial factor affecting the demand for higher education in that per capita income alone explains approximately ninety-five per cent of the variation in the number of people seeking undergraduate education. The coefficient of X_2 has been consistently positive throughout this study, indicating that the rise in per capita income does induce more people to search for college places.[77] The fact that income is the most influential factor also suggests that undergraduate education in Taiwan is more a consumer good than an investment good. As a consequence, there is a lack of link between the desire to pursue a particular line of specialization and the job market. Most people select their fields of study on the basis of interest rather than on the future employment prospects.[78] For this reason, the demand for a particular field of education is not closely geared to the demand for labor in that particular specialization; as a result, oversupply frequently occurs. For example, in 1960's there were many fields in which labor was redundant. There was a surplus of secondary and college teachers, accountants and financial analysts, economists, mechanical electrical, civil, and chemical engineers and technicians,

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[77]Those who were financially unable to attend college generally went to short-term vocational school. See Henry R. McCusker, Jr., Education and Development Menlo Park, California: Stanford Research Institute, SRI Project No. IMU-4027, 1963, Table B-27.

[78]Stanford Research Institute, Ibid., Table B-7.

etc.;[79] yet the demand for those fields of study showed no sign of decline.[80] In this sense, the demand for undergraduate education can hardly be regarded as a demand derived from the expectation of higher future income from the specialization in a particular line of education, mainly because in many instances the personal connection with the employer is more decisive than the field of study in the obtaining of employment so that the application of what one learns in school becomes secondary.[81] According to a survey made by the Stanford Research Institute in 1962, a range of four per cent to as high as 100 per cent of the college and university graduates were not working in their fields of education.[82] This implies that the demand for undergraduate education is not market oriented. In particular, high school graduates are interested only in getting into colleges and universities without being much concerned with the field of specialization and the future market situation. This strong quest for getting

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[79]Stanford Research Institute, Ibid., Table X, Xi, XII XIII, and XIV.

[80]Council for International Cooperation and Development, Economic Constructions in Connection with the Educational Investment and the Demand for and Supply of Manpower, Taipei: Executive Yuan, The Republic of China, 1969, pp. 62-63.

[81]In 1969, only 27.56 per cent of those high school graduates who were employed were able to obtain employment without personal connection. See Reports on the Prospect of Youth Failing in the JCEE, Taipei: Executive Yuan, ROC, 1970, p. 48.

[82]Stanford Research Institute, Ibid., p. 117.

into college can, aside from the rising income, be explained in terms other than those of economic consideration. For one thing, the educated have been held in high esteem in the traditional Chinese society for thousands of years. Only those who are highly educated can be men of status, trusted and respected. Consequently, there has been a strong commitment to education throughout the island. Elementary school pupils are eager to get into the secondary school, while secondary school students are struggling toward getting a college education. "Promotionism"--that is, focusing the classroom work on passing the entrance examination in order to be able to move on the next level of schooling--prevails, and education becomes an end itself. And since the number of people desiring higher education has been and will probably continue to be much larger than the educational facilities can accomodate, a stringent entrance examination has to be imposed to eliminate some of them. It follows that to pass the JCEE and become a college student is a great honor which will contribute to the enhancement of personal as well as family prestige. Such a keen competition will certainly result in the fact that passing the JCEE becomes more important than anything else regardless of the future income one may expect from specializing in a particular line of education. It is also due to this strong desire for higher education that the price has not become an important factor deterring demand. The coefficients of X_1 in the various equations posted are all positive, which

definitely is a wrong sign, indicating that the price of higher education in Taiwan has not constituted a barrier to those desiring to go on to college, not because the tuition and fees are relatively low in comparison to household income, but because other factors producing intensive demand have overshadowed the negative effect of price. As a result, the buyers become insensitive to price changes. In the United States where price does affect demand, raising tuition will cause the demand for education to fall.[83] Conversely, the availability of financial aid in the form of loans, fellowships, and assistantships will stimulate demand; so will the lowering of interest rates on student loans. Yet, this is not so in Taiwan. For one thing, the number and amount of scholarships are very limited, and student loans have been virtually nonexistent. It was not until 1969 that the government started to encourage commercial banks to make loans for the purpose of schooling. It must be concluded that the price of higher education constitutes not so much a barrier to the demand for it. The real barrier is, perhaps, the students' intellectual capacity; for, as was already mentioned, each applicant has to undergo a stringent written examination. Those who are of low intellectual capacity or who believe themselves to be so tend to be hesitant to take

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[83]Robert Campbell and Barry Siegal, "The Demand for Higher Education in the United States, 1919-1964," American Economic Review, Vol. LVII, No. 3, June, 1967.

the JCEE even though they possess high-school diplomas and are financially capable of paying for the cost of higher education, especially when they come to know that the number of applicants to be accepted will be very small in relation to the number of applicants.

The intensive desire for higher education can also be understood from the fact that the drop-out rate is very low. The average for the period 1962-1968 was 3.86 per cent (see Appendix I, Table 7). Unlike in the United States where many people have only part of a college education, nearly all of the college students in Taiwan, once admitted, complete their four-year education without interruption. Several reasons can be added to support this assertion. First, there are few flunk-outs, as has already been revealed in the low rate of drop-out. Secondly, the job prospects for persons with only secondary education and some college are not so promising as to draw college students out of school, implying that the opportunity cost in the form of income forgone on the part of college students is also low (Appendix I, Table 13). Thirdly, all college students are granted indiscriminately the privilege of deferrment from military service until graduation. And since the ROTC program is compulsory in the college curriculum, college graduates are entitled to become officers serving only one year in the armed forces upon graduation. On the other hand, both the high-school graduates and college drop-outs can serve only as NCO of whom two or

three years service are required. In this connection, one point deserves comment; that is, unlike in the United States where the size of armed forces is inversely related to the demand for higher education, as was proposed by Galper and Dunn,[84] the size of armed forces produces no noticeable effect on the demand for higher education in Taiwan. As a matter of fact, those who join the military academy are mostly those who fail in the JCEE.[85] In principle, the size of the armed forces is more of an effect than of a cause of the demand for higher education.

Now, let us return to the price issue. The fact that demand is perfectly inelastic with respect to price changes can be made even more obvious if price is measured in relative terms, i.e., the ratio of the amount of tuition and fees to per capita income in current dollars. The reason for using this alternative measurement is simple: the use of price figures in absolute terms with no reference to the income situation tends to be misleading in case price and income do not change in the same proportion. In particular, demand will increase as price rises, and the price elasticity of demand will become erroneously positive if the increase in income

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[84]Harvey Galper and Robert M. Dunn, Jr., "A Short-Run Demand Function for Higher Education in the United States," Journal of Political Economy, (September/October, 1969) pp. 765-77.

[85]Appriximately 1.73 per cent of those failing in the JCEE entered military academies in 1969. For detail, see Appendix I, Table 14.

is very large in relation to the rise in the price. To avoid this complication, a comparison between price and income seems indispensable. According to the data collected, the tuition and fees paid by students accounted for 13.6 per cent of per capita income in 1953, 14.1 per cent in 1954, and more than 50 per cent in 1968. Education became more and more costly in both absolute and relative terms as time went on, but the demand for it still showed a steady increase over the past two decades. In this sense, education for some people is seemingly a necessity for which there is no close substitute, and it can also be a superior good in the sense that the purchase of educational services will certainly reduce income spent on other items (Appendix I, Table 12).

An argument against the proposition of strong demand can be advanced by stating that population increases alone will suffice to explain the phenomenon of rising demand when demand is measured by means of the number of people taking the JCEE. Unfortunately, this assertion cannot be considered valid and applied here for the simple reason that the number of youngsters aged 20-24 did not increase as significantly as the rise in demand and that the percentage of the total population in the 20-24 age group actually declined throughout the period under study (see Appendix I, Table 5.)

On the other hand, the availability of educational services measured in terms of the total number of students accepted by the institutions of higher education as a whole,

though increasing as the price rises, has not increased sufficiently to meet the rising number of applicants over the past years. In economic jargon, the price elasticity of supply is low (0.28). This low elasticity, needless to say, is to be expected, for price generally does not play a decisive role in the determination of the amount of educational services to be offered. Basically, the amount of educational services offered is largely restricted by the capacity of such existing facilities as classrooms, teaching equipment, library, faculty, and administrative personnel, which can be expanded only if more funds are channelled into them. In fact, government expenditures for higher education has increased remarkably both in money terms and in terms of relative percentage. In money terms, it rose from NT$141,007,000 in 1959 to NT$962,180,000 in 1968. In relative terms, government expenditures for higher education rose from 11.13 per cent of the total educational budget to 15.78 per cent during the same period. If measured as a percentage of gross national product for the same year, it rose from 0.27 per cent to 0.57 per cent, showing approximately a threefold increase over a period of ten years (see Appendix I, Table 8.) Even so, the excess demand still persists. This again will certainly lead to the conclusion that the supply of higher education in Taiwan is still insufficient.

The insufficiency of supply in the educational market will bring about a problem involving social costs. In particular,

it has caused frustration in a great many youngsters who could possible become productive workers provided that appropriate higher education were available. The social cost entailed will become even larger when those who are barred from entering into colleges are unable to obtain employment. According to the survey done by the Council for Guiding Youth of the Executive Yuan in 1969, 20.78 per cent (2,917) of those failing in the JCEE did not know where to go or what to do; 77.65 per cent (10,899) expressed the wish to retake the examination in the coming year. Of all of those who failed in the JCEE only 3,055 persons (21.76 per cent) were able to secure employment. The remaining persons were either drafted or entered military academies or high schools which trained students for the sole purpose of passing the JCEE in the coming year.[86] In sum, almost 80 per cent of the high-school graduates who failed in the JCEE were out of work for a period of one full year (see Appendix I, Table 13.) This is no doubt a great loss to the economy. To avoid this loss, measures must be taken on the part of government to enhance supply by encouraging the establishment of private institutions and in the meantime by diverting more resources into higher education even at the expense of other projects. The diversion of resources from other ventures is justifiable on the ground

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[86]Council for Guiding Youth, Reports on the Prospect of Youth Failing in the JCEE. Taipai: Executive Yuan, ROC, 1970, p. 52.

that higher education in Taiwan is, as mentioned earlier, reckoned as a superior good by the private sector, and for this government should follow suit.

In the theoretical framework, the problem of excess demand or short supply can generally be solved by curtailing demand or stimulating supply or both. In practice, things must be weighed against the possible advantages and disadvantages so that the less effective or less advantageous measure can be discarded in favor of the one which appears to be more effective or more advantageous. In our example here, to restrict demand is apparently unwise or even disastrous. It follows that the only way to solve the problem is to increase supply.

B. Graduate Education and Brain-Drain or Over-Flow

Unlike the demand for undergraduate education where a closed economy has been implicitly assumed, the problem of the demand for graduate education cannot be approached without letting the economy open to the outside world. The relaxation of this assumption is necessary because the establishment of graduate schools and the emphasis on their programs was a matter of recent emergence in Taiwan. For a great many college graduates (undergraduates), pursuing graduate studies means going abroad, especially to such economically advanced countries as the United States, Canada, Japan, and the countries of Western Europe. In 1950, there were 216 college graduates

who went abroad for graduate studies, including 132 males and 84 females. In 1968, the figure soared to 2,711, of whom 1,727 were male and 984 female. The number of persons who went abroad for graduate studies during 1950-1968 is categorized according to sex and fields of study in Appendix I, Table 16. Among them, the male engineers make up the largest component, followed by the social and natural scientists. The fact that engineering and science students are more likely than students in other fields to pursue graduate studies abroad is because engineering and sciences as disciplines, especially natural sciences, have greater generality and more universal applicability than other professions; besides, advanced study in these fields requires better facility and more stimulating coworkers and environment, which only the rich, advanced countries can provide. Moreover, for those who have financial difficulty or the intention of staying in the country of destination, the information on the financial aid and job market is more perfect in these fields than in others. No wonder Grubel and Scott asserted that "scientists and engineers are from six to twelve times as likely to emigrate--as people in other professions."[87] Now, if the data is categorized on the basis of the country of destination in which the Chinese students do their graduate

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[87]Herbert B. Grubel and Anthony D. Scott, "The International Flow of Human Capital," American Economic Review (May, 1966), p. 269.

studies, the United States appears to be the one attracting the bulk of students as tabulated in Appendix I, Table 16.

To see the extent of demand for graduate education abroad, it seems necessary to make a comparison between the number of college graduates and the number of people taking the EFSA in the same year. The ratio of the latter to the former has been strikingly high during the past two decades. Overall, it ranges from 11.6 per cent in 1953 to as high as 99.7 per cent in 1961 as shown in Appendix I, Table 10.

Among those who left for graduate education abroad, a great bulk of them did not return after the completion of graduate education. If compared with the number who left, the number who returned comprise approximately 6 per cent on the average. In other words, 94 per cent of them elected to stay abroad. Graduate studies undoubtedly became a stepping stone toward emigration. Since most of those who did not return elected to remain in the United States, special attention will be given below to the Chinese students' demand for graduate education in the United States.

To the extent that the demand for graduate education becomes a demand for emigration, education is no longer a blending of consumption and investment, but rather a pure investment to which the principle of cost-benefit analysis becomes relevant and applicable. In particular, the expected income in the United States and the costs of making income will play a role of considerable importance in the determination

of demand. In the aggregate, the number of persons taking the EFSA will rise if the present value of the average expected income of all Chinese students electing to remain in the United States is greater than that of the average cost of making income. Symbolically, it can be written in the following functional form in which demand is a function of both income and cost:

$$Y_g = f\left(\frac{\sum_{j=1}^{k}\sum_{f=1}^{n}\frac{R_{jf}}{(1+r_d)^f}\Big/k}{\sum_{j=1}^{k} C_j / k}\right) \qquad (4.2.1)$$

where j = 1,2,3,---- k, denoting the number of students remaining in the United States, t = 1,2,3,---- n, the number of years working in the United States. R_{jf} denotes the expected income of an individual j in year f; C_j, the present value of the cost of making the income of an individual j; and r_d, the market rate of interest in the United States.

Conceivably, whether demand will increase, decrease, or remain unchanged depends upon whether equation (4.2.1) is greater than, smaller than, or equal to unity (without taking account of any psychic factor.)

Furthermore, since the cost of making an income abroad is comprised of not only the cost of receiving graduate education abroad but also the income forgone in Taiwan and the cost of transportation, the decision to emigrate in the name of graduate study can be further analysed by means of a cost-

benefit comparison here.

Let

C_{je} = the total cost of graduate education abroad of an individual j, including tuition, fees, room, board, books, etc. e = 1,2, ---m, signifying the number of years of studying abroad.

C_p = one way transportation cost from home country to the receiving country.

R_e = the domestic income forgone while studying abroad. e = 1,2, ---- m

R_jq = the domestic lifetime income of an individual j choosing to stay in the homeland until retirement. Here, q = 1,2, ---- m, m + 1, m + 2, ---- n, denoting the number of years a person works in the home country after completing his undergraduate education. $n > m$

R_{jf} = the future income stream abroad of an individual j. Here, f = m, m + 1, m + 2, ---- n, assuming that an individual remains abroad working until retirement.

then,

$$C_j = \frac{\sum_{e=1}^{m} C_{je}}{(1 + r_d)^e} + C_p + \frac{\sum_{q=1}^{n} R_{jq}}{(1 + r_h)^q} \qquad (4.2.2)$$

where $n > m$

r_d and r_h being the rates of interest in the country of destination and of origin respectively. In a purely competitive international factor market, r_d tends to be equal to r_h, which of course is unlikely to be the case in reality. Substituting equation (4.2.2) for C_j in equation (4.2.1) we have

$$Y_g = f\left(\frac{\sum_{j=1}^{k}\sum_{f=1}^{n}\frac{R_{jf}}{(1+r_d)^f}}{\sum_{j=1}^{k}\left(\frac{\sum_{e=1}^{m}C_{je}}{(1+r_d)^e} + C_p + \frac{\sum_{q=1}^{n}R_{jq}}{(1+r_h)^q}\right)}\right)$$

$$= f\left(\frac{\sum_{j=1}^{k}\sum_{f=1}^{n}\frac{R_{jf}}{(1+r_d)^f}}{\sum_{j=1}^{k}\frac{\sum_{e=1}^{m}C_{je}}{(1+r_d)^e} + C_p + \frac{\sum_{q=1}^{n}R_{jq}}{(1+r_h)^q}}\right) \qquad (4.2.3)$$

In other words, whether the demand for graduate education will increase, remain the same, or decrease depends upon whether the numerator is greater than, equal to, or smaller than the denominator. Since in general term $\sum_{j=1}^{k}\sum_{f=1}^{n}\frac{R_{jf}}{(1+r_d)^f}$ has been and will probably continue to be greater than $\frac{\sum_{j=1}^{k}\sum_{q=1}^{n}R_{jq}}{(1+r_h)^q}$ for a long time to come, C_p is so trivial that it can be neglected from the long-run point of view and that $\sum_{j=1}^{k}\frac{\sum_{e=1}^{m}C_{je}}{(1+r_d)^e}$ is also likely to be small in relation to $\sum_{j=1}^{k}\sum_{f=1}^{n}\frac{R_{jf}}{(1+r_d)^f}$; the chances are that the demand for graduate studies in the United States is very likely to continue

to rise unless more stringent restrictions are imposed. In case that financial aids in the form of scholarships are available, $\frac{\sum_{e=1}^{m} C_{je}}{(1 + r_d)^e}$ can be reduced substantially or even to zero, or it may become negative if the amount of scholarships is greater than C_{je}; as a result, $\sum_{j=1}^{k} \frac{\sum_{e=1}^{m} C_{je}}{(1 + r_d)^e}$ will be reduced by a considerable amount. Let S_{ib} designate the amount of the scholarship received or to be received by an individual i (i = 1,2. ---) for b years, equation (4.2.3) can be modified as

$$Y_g = f \frac{\sum_{j=1}^{k} \sum_{f=1}^{n} \frac{R_{jf}}{(1 + r_d)^f}}{\sum_{j=1}^{k} \frac{\sum_{e=1}^{m}}{(1 + r_d)^e} - \sum_{i=1}^{\lambda} S_{ib} + kC_p + \frac{\sum_{j=1}^{k} \sum_{q=1}^{n} R_{jq}}{(1 + r_h)^q}}$$

here, $\lambda < k$ and $b \leq e$ (2.4.4)

Of course, if education is financed through bank loans which require interest payments, the amount of the interest must be added to the denominator. Yet, in fact, the interest item may well be dropped, for th chances of Chinese students' getting loans either from the banks in the home country or from the United States are slim.

Presumably, $\sum_{j=1}^{k} \frac{\sum_{e=1}^{m} C_{je}}{(1+ r_d)^e} - \sum_{i=1} S_{ib}$ tends to be smaller for students of engineering and science than for

people of other disciplines because of the fact that $\sum_{l=1}^{\lambda} S_{ib}$ is more likely to be large in the case of graduate education. kC_p is negligible in terms of lifetime earnings. Then the whole equation (2.4.4) boils down to the problem of comparing $\sum_{j=1}^{k}\sum_{f=1}^{n} \frac{R_{jf}}{(1+r_d)^f}$ with $\frac{\sum_{j=1}^{k}\sum_{q=1}^{n} R_{jq}}{(1+r_h)^q}$. The problem of emigration in the form of seeking graduate education becomes a problem of wage differential between the more developed country and the less developed one, or in economic jargon, a disequilibrium of international factor market. In this connection, the outflow of the highly educated is always advantageous from the individual point of view as long as such a differential exists. Consequently, the establishment of graduate schools in Taiwan will not help reverse the trend, for those who are presently in or who have graduated from the graduate school in Taiwan will also leave the country in the pursuit of higher income if the barrier to migration is weak. In fact, few people are willing to undertake graduate education at home or to remain in the homeland upon completing graduate education. Presumably, the rate of return to graduate education is very low both in pecuniary and in psychic terms. For one thing, people with advanced degrees do not necessarily earn more than those with only undergraduate

degrees.[88] Furthermore, the higher the degree a person holds, the narrower will be his job market, for the graduate-degree holders can, in most instances, work only for the government or for academic institutions whose pecuniary renumeration are generally lower than those of other employers. The private enterprises, whose salary scales are comparatively high, are not in great need of the graduate-degree holders no matter how large the firms may be.[89] The practice in many corporations in the United States of having conspicuous consumption by hiring M.S's or Ph.D.'s and paying more than their marginal product because of the snob-value of graduate degrees is almost non-existent in Taiwan. Secondly, the history of graduate programs in Taiwan is short so that the academic environment and facilities are still inadequate for advanced research. In turn, this appears to contribute toward the skeptical view of Taiwan's society about the market value of the newly offered graduate degrees. In general home-made

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[88]College and university professors do not earn more than new college graduates holding Baccalaureate degrees and working for corporations and banks. For instance, the average monthly salary scale for an associate professor in 1969-70 was NT$2,510.00. If a housing allowance and rations in kind were added, total compensation amounted approximately NT$3,000.00 or a little more, which was no higher than the salaries of new corporations or bank employees with only Baccaulaureate degrees. See Educational Abstract, Taipei: MOE, ROC, 1970, p. 25.

[89]According to a survey made in April of 1970 by the Ministry of Education of the Republic of China, only 60 out of the 1,454 job openings for highly educated personnel were in private institutions or corporations.

degrees are considered less valuable than foreign-made ones. This view accounts for the trend that the majority of undergraduates prefer to undertake graduate studies abroad, especially in the United States. In the academic year of 1960-61, Chinese students in the United States, mostly from Taiwan, accounted for 10.0 per cent of the total foreign students enrolled in the U ted States colleges and universities, ranking second only to students from Canada (Appendix I, Table 17.) In effect, studying in the United States has become a fashion in Taiwan. The more people leave for graduate studies, the more others tend to follow suit. "Demonstration effect" plays a decisive role in inducing more people to desert the island. The coefficient of X_7 in the equation of the demand for graduate education indicates the existence of this situation.

Whether or not this outflow of the educated manpower is a "brain drain" deserves elaboration. Presumably, the "brain drain" which drains the highly skilled persons out of an economy, will cause frictional costs before others can be retrained to replace those who left the country, thereby reducing the total output. To put it somewhat differently, the "brain drain" will impede the growth of productivity because of the bottlenecks created by the flight of the highly skilled, thus reducing the income of those who remained behind, if income does correspond to the marginal product. Apparently, this has not been the case in Taiwan. Judging from the fact that both

the productivity[90] and the income have risen remarkably during the past two decades, it is hard to justify the assertion that the "brain drain" has actually impeded the growth of the economy. In effect, it is debatable whether a "brain drain" has taken place, for there is no reliable data to show that those who remained in the home country are intellectually inferior to those who stayed abroad. For one thing, people who are professionally successful at home tend to be hesitant to part with what they have already achieved in order to leave for a new environment where they might be confronted by risk and uncertainty.

To the extent that the departure of college graduates causes no decrease in general productivity, it is doubtful that "brain drain" is the appropriate term to describe the outflow of the educated manpower in Taiwan. A different expression such as "spillover" or "overflow" could well be more appropriate, as Baldwin has suggested:

> During the past decade, emigration has been rising quite significantly, in South Korea, Taiwan, and the Philippines. But there is little evidence that these losses have any significant effect on economic growth; indeed, among LDCs Taiwan and South Korea have been noted for their high growth rates. --Asian brain drain is an overflow, not a drain.[91]

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[90]Using 1952 as a base year, the index of industrial productivity in Taiwan rose to 322.1 and that of agricultural productivity to 175.8 in 1966. See Taiwan Statistical Data Book, Ibid., p. 33 & 53.

[91]George B. Baldwin, "Brain Drain Or Overflow," Foreign Affairs, Vol, 48, No. 2, January, 1970, p. 364.

This is mainly because the economy cannot absorb students as fast as they graduate. For example, in 1962 the rate of unemployment was 13 per cent for college graduates and 30 per cent for vocational school graduates.[92] To the extent that this situation prevails, the flight of the educated manpower may, to some degree, relieve or mitigate against the population pressure on the existing productive capacity, thereby moving backward along the diminishing marginal product curve.

In this connection, it seems that the outflow of the educated is not as detrimental to the economy as it was imagined, at least in the short run. In effect, the growth of an economy requires smooth coordination between physical and human capital. The redundancy of one will create a bottleneck on the part of the other in the short one. In the case of Taiwan, the growth in educated manpower has already reached its saturation pointwith respect to the existing physical counterpart so that the absorbing capacity of the economy becomes one of the major concern. Of course, the absorbing capacity can expand as the economy grows.[93] Thus, what cannot be absorbed at present may be absorbed in the future as the economy develops to a certain stage. But, assuming that men are rational beings always seeking to

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[92]Henry McCusker, Jr., Education and Development, Ibid.

[93]The absorbing capacity depends on the number of job positions created and the number of college graduates seeking employment each year.

maximize self-interest, it is impossible to expect them to stay in the homeland until they are fully absorbed. In the preceding chapter, it was shown that X_{12} was closely associated with X_5, implying that people's willingness to stay in the homeland was geared to the stage of development, especially the degree of industrialization of the homeland.

The proponents of the "brain drain" thesis tend to regard the outflow of manpower as a loss to the home country equal to the amount of educational outlays plus the cost of rearing children.[94] They tend to place emphasis on the supply of educated manpower with no regard to the demand for it, i.e., the absorbing capacity of the economy. Besides, the cost of rearing children is something that parents have to bear once the children are bo n regardless of whether the children later stay at home or migrate. The cost of education will not be a loss if technological externality in the form of free scientific knowledge is greater than the return on domestic research projects and if the amount of remittances received more than makes up the amount of taxes that the government could collect from those emigrants if they choose to remain at home.[95] Furthermore, the short-run adjustment cost incurred

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[94]M. J. Bowman and R. G. Myers, "Schooling, Exprience and Gains and Losses in Human Capital Through Migration," Journal of American Statistical Association, 62, (September, 1967), pp. 875-98.

[95]In fact, "native countries not only obtain the scientific knowledge free, but they are actually likely to get more than they would have had the men stayed at home," Grubel and Scott, Ibid., p. 248.

due to the flight of college graduates will not be very large because students are rarely experienced workers at the time of their departure. They tend to gain better experiences and more advanced learning in the countries of destination which are more advanced both economically and scientifically than the students' homeland.

In conclusion, it is suggested that the outflow of college graduates in Taiwan can be viewed as an overflow resulting from inadequate absorbing capacity of the economy.

CHAPTER V

SUMMARY AND CONCLUSIONS

The bulk of economists dealing with the demand for education have taken the number of students enrolled as a measure of demand. This necessarily presupposes that the supply is in no way restricted. In the United States where the supply of educational services is relatively abundant and where there always or nearly always are college places available for those who possess a high-school diploma and who are financially able to purchase a college education, the number of students enrolled can adequately reflect the demand situation. Unfortunately, this has not been the case in Taiwan where the number of college places available for high-school graduates is so limited that a very stringent entrance examination has to be imposed to eliminate some of the potential college students. Under such circumstances, the number of students enrolled should be taken as a measure of supply rather than demand, since the number of students accepted by educational institutions reflects quantitatively the amount of educational services that an institution can produce on the basis of the existing teaching facilities.

According to this interpretation, there has clearly been excessive demand for undergraduate education in Taiwan during the past two decades.

Income is the primary factor responsible for the increase in the demand for undergraduate education in Taiwan. Ironically, neither the price of higher education nor the expected income from a particular line of concentration plays a role of significance in influencing the demand. In effect, undergraduate education in Taiwan is more a consumer good than an investment good. This can be realized from the fact that the demand for undergraduate education was not in line with the demand for labor at all. Consequently, many college graduates were unable to secure employment in their fields of specialization.

In theory, one way of matching the increasing demand for undergraduate education is to increase the supply of it. But, in reality, to increase supply will pose another problem for the economy in that it will aggravate the economy's inability to absorb graduates. Hence, if supply does not increase today, there is unemployment today; if supply does increase today, there will be unemployment tomorrow when college students are graduated. To increase supply is only to postpone unemployment. This will continue to be so until the economy develops to a certain stage that its absorbing capacity is able to match the increasing number of graduates. As a final resort to resolve this dilemma, college graduates

leave the homeland supposedly for graduate education abroad. At this juncture, the cost-benefit analysis becomes relevant. The demand for graduate education must be treated as an investment rather than a consumption. In this study, it has been shown that investment in graduate education abroad was influenced by the leaving of others and that people's willingness to return hinges upon the degree of industrialization in the homeland.

In this connection, it is hardly justifiable to call the outflow of college graduates a "brain drain." Since the economy cannot absorb students as fast as they are graduating, the outflow may be regarded as an "overflow" spilling out of the economy.

Whether or not this outflow of college graduates will impede economic growth in the long run is still unknown. But, the short-run effect is not as detrimental as the "brain drain" thesis suggests.

APPENDIX I

TABLE 1

THE NUMBER OF INSTITUTIONS OF HIGHER EDUCATION, CLASSES, FACULTY NON-TEACHING STAFF, STUDENTS, AND GOVERNMENT SPENDINGS ON HIGHER EDUCATION IN TAIWAN, 1945 & 1950-1969

Year	Institution[a]		Class		Faculty		Non-teaching		Student		Gov. (1961 price Spendings[b] = 100)	
	No.	% Change	No.	% Change	No.	% Change	No.	% Change	No.	% Change	NT$ (in mil.)	% Change
1945	4	0	--	-	-	-	-	-	2,022	-		
1950	7	75	229	0	964	0	-	-	6,665	229.6	100.3	0
1951	-	-	-	-	-	-	-	-	-	-	-	-
1952	8	100	288	25.76	1,077	11.7	1,385	0	-	-	-	-
1953	9	125	341	48.90	1,205	25.0	1,490	7.5	11,943	490.6		
1954	14	250	397	73.36	1,459	51.3	1,646	18.8	13,670	576.0		
1955	15	275	550	140.17	1,662	72.4	1,707	23.2	18,714	825.5		
1956	17	325	665	190.39	1,910	98.1	1,837	32.6	22,606	1,018.0		
1957	17	325	756	230.13	2,216	129.8	2,001	44.4	25,619	1,167.1		
1958	21	425	847	269.86	2,520	161.4	2,153	55.4	27,938	1,281.7		
1959	22	450	925	303.93	2,801	190.5	2,267	63.6	29,770	1,372.3	141.0	40.5
1960	27	575	1,124	390.82	3,149	226.6	2,359	70.3	35,060	1,633.9	163.8	63.3

TABLE 1--continued

Year	Institution[a]		Class		Faculty		Non-teaching		Student		Gov. (1961 price Spendings[b] = 100	
	No.	% Change	No.	% Change	No.	% Change	No.	% Change	No.	% Change	NT$ (in mil.)	% Change
1961	30	650	1,222	433.62	3,523	265.4	2,508	81.0	38,403	1,799.2	228.0	127.3
1962	33	725	1,369	497.81	3,739	287.8	2,704	95.2	44,314	2,091.5	250.3	149.5
1963	35	775	1,576	588.20	4,279	343.8	2,921	110.9	51,707	2,457.2	278.8	177.9
1964	41	925	1,838	702.62	4,805	398.4	3,234	133.5	64,010	3,065.6	313.4	212.4
1965	56	1,300	2,270	891.26	5,622	483.1	3,789	173.5	85,346	4,120.8	423.4	322.1
1966	69	1,625	2,877	1,156.33	6,726	597.7	4,325	212.2	113,855	5,530.8	500.5	399.0
1967	79	1,875	3,426	1,396.05	7,564	684.6	5,032	263.3	138,613	6,755.2	690.0	587.9
1968	86	2,025	3,889	1,598.25	8,549	786.8	5,544	300.2	161,220	7,873.2	962.1	958.9
1969	86	2,050	-	-	-	-	-	-	-	-	-	-

Sources: Council for International Cooperation and Development, Taiwan Statistical Data Book. Taipei: Executive Yuan, ROC, 1969, pp. 167-70.

[a]See also A List of Public and Private Colleges and Universities. Taipei: Ministry of Education. ROC, August, 1969; Educational Statistics of the Republic of China. Taipei: Ministry of Education, ROC, pp. 70-71.

[b]Council for International Cooperation and Development, Economic Construction in Connection with the Educational Investment and the Demand for and Supply of Manpower. Taipei: Executive Yuan, ROC, pp. 40-42.

TABLE 2

PERCENTAGE INCREASE IN THE NUMBER OF TEACHING STAFF, STUDENTS ENROLLED, AND THE INSTITUTIONS OF HIGHER LEARNING, VARIOUS COUNTRIES, 1950 THRU 1968

	Country	Year	Institution (% change)	Year	Staff (% change)	Year	Students (% change)
UNDERDEVELOPED	Algeria	1950-64	160	1960-64	20.4	1950-66	105.5
	Ghana	1950-64	200	1955-67	1,038.9	1955-67	2,170.4
	Brazil	1950-64	87.8	1950-66	293.3	1950-66	252.4
	Columbia	1950-66	1,034.7	1950-66	367.7	1950-66	369.6
	Burma	1950-60	0	1950-64	622.9	1950-64	515.5
	Thailand	1950-63	-52.0	1950-67	282.0	1950-67	38.0
	India	1950-62	212.3	1950-62	207.2	1950-65	170.6
	Iraq	1950-63	138.4	1950-65	-10.6	1950-65	491.6
	Turkey	1950-64	600.0	1950-67	434.6	1950-67	405.9
DEVELOPED	U.S.A.	1950-64	15.6	1955-64	29.8	1950-67	200.9
	U.S.S.R.	1950-64	-14.3	-	-	1950-68	258.3
	Japan	1950-63	110.5	1950-67	149.2	1950-67	256.9
	France	1950-64	0	1960-64	56.1	1950-66	280.9
	West Germany	1950-63	79.1	-	-	1950-67	239.6
	Italy	1950-64	48.6	1950-64	151.1	1950-67	157.9
	England	1950-63	16.2	1950-66	238.7	1950-67	191.2
	Sweden	1960-64	19.4	1960-67	147.7	1950-67	121.4

Sources: Reproduced from UNESCO, Statistical Yearbook, New York: UNESCO Publications Center, 1965, pp. 249-65, pp. 716-38.

TABLE 3

POPULATION, THE NUMBER OF STUDENTS ENROLLED IN INSTITUTIONS OF HIGHER EDUCATION, AND THE STUDENT-POPULATION RATIO IN TAIWAN 1950-68

Year	Population[a] (1)	Students[b] (2)	(2)/(1) (%)
1950	7,554,399	6,665	0.08
1951	7,869,247	-	-
1952	8,128,374	-	-
1953	8,438,016	11,943	0.14
1954	8,749,151	13,670	0.16
1955	9,077,643	18,714	0.21
1956	9,390,381	22,606	0.24
1957	9,690,250	25,619	0.26
1958	10,039,435	27,938	0.28
1959	10,431,341	29,770	0.29
1960	10,792,202	35,060	0.32
1961	11,149,139	38,403	0.35
1962	11,511,728	44,314	0.39
1963	11,883,523	51,707	0.44
1964	12,256,682	64,010	0.52
1965	12,628,348	85,346	0.67
1966	12,992,763	113,855	0.88
1967	13,071,929	138,613	1.06
1968	13,045,827	161,220	1.23

Sources: [a]Annual Census Report. Taipei: Department of Police, Provincial Government of Taiwan, 1969, p. 15.
[b]Taiwan Statistical Data Book. Taipei: Executive Yuan, 1969, p. 170.

TABLE 4

THE NUMBER OF PERSONS TAKING JCEE, THE NUMBER BEING ACCEPTED, AND ITS RATIO 1953-1968

Year	Number Taking JCEE (1)	Number Accepted (2)	(2)/(1)
1953	7,750	4,525	58.38
1954	9,000	4,781	53.12
1955	10,249	5,247	51.19
1956	15,222	5,743	37.72
1957	18,601	5,728	30.79
1958	17,688	7,620	43.08
1959	23,683	9,095	38.40
1960	26,565	11,197	42.14
1961	29,959	11,984	40.00
1962	32,490	13,068	40.22
1963	33,449	14,101	42.15
1964	36,596	15,506	42.37
1965	44,030	17,496	39.73
1966	49,141	19,976	40.05
1967	55,854	24,871	44.52
1968	58,791	26,428	44.95

Sources: Ministry of Education, ROC. Also Central Daily News (Taipei) of various dates. See Bibliography.

TABLE 5

THE NUMBER OF PEOPLE IN THE 20-24 AGE GROUP AS A PERCENTAGE OF POPULATION, 1953-68

Year	Number	As a Percentage of population
1953	766,000	9.1
1954	779,000	8.9
1955	766,000	8.4
1956	740,000	7.9
1957	744,000	7.7
1958	764,000	7.6
1959	769,000	7.4
1960	759,000	7.0
1961	775,000	7.0
1962	781,000	6.8
1963	792,000	6.7
1964	786,000	6.4
1965	768,000	6.1
1966	771,000	5.9
1967	776,000	5.8
1968	800,000	5.9

Source: Taiwan Statistical Data Book, pp. 10-11.

TABLE 6

CHANGES IN PER CAPITA INCOME, MEASURED IN CURRENT AND CONSTANT DOLLARS TAIWAN, 1951-69

Year	Per Capita Income			
	Current Dollars NT$	Per Cent Changes (1964 = 100)	Constant Dollars (1964 = 100) NT$	Per Cent Changes (1964 = 100)
1951	1,275	18.95	3,728	55.41
1952	1,716	25.51	4,017	59.71
1953	2,215	32.92	4,146	61.62
1954	2,273	33.78	4,194	62.34
1955	2,604	38.70	4,409	65.53
1956	2,858	42.48	4,450	66.14
1957	3,198	47.53	4,620	68.67
1958	3,434	51.04	4,702	69.89
1959	3,849	57.21	4,901	72.84
1960	4,557	67.73	5,033	74.81
1961	4,953	73.62	5,281	78.49
1962	5,189	77.13	5,415	80.48
1963	5,782	85.94	5,966	88.67
1964	6,728	100.00	6,728	100.00
1965	7,082	105.26	6,981	103.76
1966	7,677	114.11	7,340	109.10
1967	8,461	125.76	7,843	116.57
1968	9,554	142.00	8,278	123.04
1969	10,305	153.17	8,709	129.44

Source: National Income of the Republic of China. Taipei: Direcorate-General of Budgets, Accounts, and Statistics, Executive Yuan, ROC, 1969, pp. 17-18.

TABLE 7

COLLEGE DROP-OUTS AS A PERCENTAGE OF TOTAL ENROLLMENT, 1962-68

Year	Number of Drop-outs	Drop-outs as a Percentage of Total Enrollment
1962	3,455	7.68
1963	2,173	4.11
1964	1,499	2.27
1965	2,374	2.68
1966	4,551	3.86
1967	4,723	3.28
1968	5,245	3.14

Source: The Economic Construction in Connection with the Educational Investment and the Demand for and Supply of Manpower. Taipei: Council for International Cooperation and Development, Executive Yuan, 1969, p. 57.

TABLE 8

GOVERNMENT SPENDINGS ON HIGHER EDUCATION AND THE AVERAGE GOVERNMENT SUBSIDY FOR EACH STUDENT AT PROVINCIAL COLLEGES, 1949-1968

Year	Government Spending[a] (in mil. of NT$) (1)	GNP[b] (in dollars) (2)	Gov. Spendings as a % of GNP (1)/(2)	Gov. Spendings as a % of Total Ed. Budget	Subsidy Per Student[c] (in dollars) NT$
1949	-	-	-	-	1,547
1950	-	-	-	-	2,752
1951	-	12,315	-	-	2,804
1952	-	17,247	-	-	3,389
1953	-	22,988	-	-	3,336
1954	-	25,225	-	-	3,218
1955	-	30,088	-	-	3,616
1956	-	34,543	-	-	5,306
1957	-	40,291	-	-	5,149
1958	-	44,752	-	-	5,557
1959	142.0	51,727	27	11.13	5,426
1960	163.8	62,561	26	11.14	5,212
1961	228.0	69,792	32	12.04	7,129
1962	250.3	76,882	32	12.23	7,672
1963	278.8	87,134	31	11.54	7,821
1964	313.4	102,209	30	12.14	7,935
1963	423.4	112,867	37	13.09	8,928
1966	500.5	125,554	39	13.40	8,336
1967	690.0	143,045	48	15.51	8,743
1968	962.1	167,975	57	15.78	-

Sources: [a]Economic Construction in Connection with the Educational Investment and the Deamand for and Supply of Manpower, p. 40-43.

[b]National Income of the Republic of China, 1969, p. 14.

[c]Taiwan Statistical Abstract, No. 28. Taichung: Bureau of Accounting, and Statistics, Provincial Government of Taiwan, 1969, p. 373.

TABLE 9

THE AVERAGE PRIVATE COST (TUITION AND FEES ONLY) OF HIGHER EDUCATION IN TAIWAN, 1953-1968

Year	Price Index (1961=100)	Tuition and Fees	
		In Current Dollars, NT$	In Constant Dollars, NT$
1953	52.39	302	576
1954	53.63	322	600
1955	61.19	622	1,016
1956	68.97	695	1,007
1957	73.94	695	937
1958	74.94	810	1,080
1959	84.86	1,475	1,738
1960	96.87	2,249	2,321
1961	100.00	2,302	2,302
1962	103.04	2,813	2,730
1963	109.70	3,170	2,889
1964	112.41	3,038	2,702
1965	107.19	3,496	3,261
1966	108.77	3,911	3,596
1967	111.51	4,643	4,163
1968	113.73	5,363	4,627

Source: Department of Statistics, Ministry of Education, ROC.

TABLE 10

THE NUMBER OF COLLEGE GRADUATES TAKING EFSA IN TAIWAN, 1946-1968

Year	College Graduates[a] (1)	Number Taking EFSA[b] (2)	(2)/(1) %
1946	154	-	-
1947	313	-	-
1948	263	-	-
1949	1,185	-	-
1950	1,537		
1951	1,352	-	-
1952	2,190	-	-
1953	2,540	295	11.61
1954	2,872	569	19.81
1955	3,168	853	26.92
1956	3,350	576	17.19
1957	3,759	1,399	37.21
1958	5,773	1,739	30.12
1959	6,029	1,677	27.81
1960	6,706	3,727	55.57
1961	6,273	6,258	99.76
1962	8,256	6,837	82.81
1963	9,584	6,204	64.73
1964	10,699	4,523	42.27
1965	11,923	5,013	42.04
1966	14,319	4,630	32.33
1967	20,042	4,306	21.48
1968	23,386	4,937	21.11

Sources: [a]The data for 1946-49 was from Educational Statistics of Taiwan. Taichung: Bureau of Accounting and Statistics, Taiwan Provincial Government, 1950, p. 12 & 15. The data for the remaining years were from Statistical Abstract of the Republic of China. Taipei: Executive Yuan, 1955, p. 300; 1958, p. 438; 1969, p. 519.

[b]Ministry of Education, ROC.

TABLE 11

THE PERCENTAGE OF STUDENTS RETURNING FROM ABROAD, 1952-1968

Year	Number of Returnees (1)	Number of People Left (2)	(1)/(2) %
1952	13	377	3.44
1953	16	126	12.69
1954	21	399	5.26
1955	34	760	4.47
1956	66	519	12.71
1957	62	479	12.94
1958	89	674	13.20
1959	70	625	11.20
1960	47	643	7.30
1961	52	978	5.31
1962	63	1,833	3.43
1963	95	2,125	4.47
1964	96	2,514	3.81
1965	120	2,339	5.13
1966	136	2,189	6.21
1967	153	2,472	6.18
1968	184	2,711	6.78

Sources: Statistical Abstract of the Republic of China, 1955, p. 297; 1959, p. 418; 1969, p. 522 & 524; also, Educational Statistics of the Republic of China, 1969, pp. 144-47.

TABLE 12

COMPARISON BETWEEN THE PER CAPITA INCOME AND THE PRICE OF HIGHER EDUCATION IN TAIWAN, 1953-1968

Year	Price[a] NT$	Income[b] NT$	Price/Income
1953	302	2,215	13.6
1954	322	2,273	14.1
1955	622	2,604	23.8
1956	695	2,858	24.3
1957	695	3,198	21.7
1958	810	3,434	23.5
1959	1,475	3,849	38.0
1960	2,249	4,557	49.3
1961	2,302	4,953	46.4
1962	2,813	5,189	54.1
1963	3,170	5,782	54.8
1964	3,038	6,728	45.1
1965	3,496	7,082	49.3
1966	3,911	7,677	50.9
1967	4,643	8,461	54.8
1968	5,363	9,554	56.1

Sources: [a]Ministry of Education, ROC.

[b]Taiwan Statistical Data Book, 1969.

TABLE 13

EMPLOYMENT AND UNEMPLOYMENT OF HIGH SCHOOL GRADUATES FAILING IN THE JCEE IN 1969

	Employed		Unemployed		Total	
	Number	Per cent	Number	Per Cent	Number	Per cent
Male	2,146	20.8	8,193	79.2	10,319	100
Female	909	24.4	2,809	75.6	3,718	100
Total	3,055	21.76	10,982	78.24	14,037	100

Source: Council for Guiding Youth, Reports on the Future Prospect of Youth Failing in the JCEE. Taipei: Executive Yuan, ROC, p. 53.

TABLE 14

THE NUMBER OF HIGH SCHOOL GRADUATES ENTERING MILITARY ACADEMIES AFTER FAILING IN THE JCEE IN 1969

	Number of Students Failed in JCEE	Number of Students Enter Military Academies			
		Male	Female	Total	
		No.	No.	No.	Per cent
Group A (Science & Engineer)	3,442	95	3	98	2.84
Group B (Liberal Arts)	2,963	52	0	52	1.75
Group C (Agriculture)	2,609	34	0	34	1.30
Group D (Others)	5,023	59	1	60	1.17
Total	14,037	239	4	243	1.73

Source: Council for Guiding Youth, Reports on the Future Prospect of Youth Failing in the JCEE. Taipei: Executive Yuan, ROC, 1970, p. 41.

Year	Total	M	F	Humanities			Education		
				Sub-total	M	F	Sub-total	M	F
1950	216	132	84	28	-	-	15	-	-
1951	340	-	-	32	-	-	20	-	-
1952	377	257	120	46	20	26	20	1	19
1953	126	79	49	25	6	19	4	1	3
1954	399	253	146	32	13	19	5	2	3
1955	760	554	206	69	43	26	14	13	1
1956	519	406	113	54	32	22	2	1	1
1957	479	359	120	88	46	42	10	4	6
1958	679	487	187	108	46	62	12	4	8
1959	625	478	147	140	84	56	12	6	6
1960	643	497	146	96	47	49	8	7	1
1961	978	785	193	150	79	71	17	13	4
1962	1,833	1,371	462	279	120	159	44	32	12
1963	2,125	1,541	584	274	113	161	55	29	26
1964	2,514	1,782	732	354	134	220	73	36	37
1965	2,339	1,535	804	383	124	259	72	35	37
1966	2,189	1,426	763	336	124	212	67	31	36
1967	2,472	1,604	868	302	94	208	86	41	35
1968	2,711	1,727	984	394	164	230	60	32	28

Source: Statistical Abstract of the Republic of China. Taipei: Directorate-General of Budgets, Accounts, and Statistics, Executive Yuan, 1955, p. 297; 1959, p. 418; 1969, p. 522.

TABLE 15

THE NUMBER OF CHINESE STUDENTS WHO WENT ABROAD FOR GRADUATE STUDIES, 1950-1968

Fine Arts			Law			Social Sciences			Natural Sciences		
Sub-total	M	F	Sub-total	M	F	Sub-total	M	F	Sub-total	M	F
-	-	-	32	-	-	4	-	-	27	-	-
-	-	-	55	-	-	12	-	-	29	-	-
15	11	4	5	5	-	75	55	20	41	31	10
2	1	1	1	1	-	21	14	7	21	13	8
3	2	1	4	4	-	56	47	9	41	35	6
4	4	-	17	13	4	85	78	7	38	31	7
5	3	2	12	11	1	76	69	7	38	26	12
6	1	5	16	10	6	74	61	13	47	31	16
14	6	8	21	15	6	112	84	28	39	27	12
13	7	6	25	15	10	94	69	25	32	22	10
26	13	13	32	28	4	80	64	16	60	42	18
25	17	8	57	44	13	144	109	35	109	80	29
38	26	12	85	75	10	306	226	80	229	160	69
56	31	25	70	48	22	398	239	159	267	189	78
52	30	22	84	70	14	541	330	211	315	214	101
54	30	24	76	55	21	501	276	225	315	204	111
48	30	18	54	38	16	445	207	238	372	262	110
38	19	19	57	35	22	483	227	256	429	309	120
80	52	28	77	59	18	555	260	295	577	375	202

Engineering			Medical Sciences			Agriculture			Not Specified		
Sub-total	M	F	Sub-total	M	F	Sub-total	M	F	Sub-total	M	F
18	-	-	18	-	-	6	-	-	68	-	-
45	-	-	42	-	-	25	-	-	80	-	-
79	75	4	45	24	21	26	21	5	25	14	11
37	36	1	4	1	3	10	5	5	1	1	-
102	95	7	4	3	1	34	24	10	118	28	90
136	131	5	124	19	105	44	37	7	229	185	44
178	166	12	-	-	-	60	44	16	94	54	40
175	161	14	1	1	-	50	35	15	12	9	3
244	219	25	3	2	1	101	67	34	20	17	3
246	234	12	9	5	4	74	58	16	16	14	2
239	227	12	10	4	6	89	63	26	3	2	1
239	333	6	20	10	10	112	95	17	5	5	-
575	549	26	42	12	30	225	163	62	10	8	2
693	656	37	56	38	18	250	192	58	8	8	-
715	693	22	83	43	40	291	226	65	6	6	-
553	535	18	74	61	33	281	207	74	10	8	2
521	501	20	107	66	41	234	165	69	5	2	3
633	605	28	112	63	48	336	203	133	8	8	-
576	554	22	104	60	44	287	171	116	-	-	-

TABLE 16

THE CLASSIFICATION OF CHINESE STUDENTS BY THE COUNTRIES OF DESTINATION, 1958 AND 1968

Country	1958			1968		
	Total	M	F	Total	M	F
ASIA	82	74	8	227	209	18
India	-	-	-	1	1	-
Israel	-	-	-	1	1	-
Japan	68	61	7	199	182	17
Jordan	-	-	-	2	2	-
Korea	9	8	1	1	1	-
Philippines	2	2	-	1	-	1
Thailand	-	-	-	17	17	-
Turkey	1	1	-	5	5	-
Iraq	2	2	-	-	-	-
AMERICA				2,380	1,448	932
Brazil	-	-	-	1	1	-
Canada	9	6	3	107	78	29
U.S.A.	570	394	176	2,272	1,369	903
EUROPE	13	13	-	97	66	31
Austria	-	-	-	3	1	2
Belgium	-	-	-	10	5	5
France	1	1	-	27	16	11
Germany	11	11	-	31	26	5
Greece	-	-	-	1	1	-
Italy	-	-	-	1	-	1
Spain	1	1	-	17	11	6
Sweden	-	-	-	1	1	-
Switzerland	-	-	-	3	2	1
United Kingdom	-	-	-	3	3	-
OCEANIA				7	4	3
Australia	-	-	-	7	4	3

Sources: Educational Statistics of the Republic of China. Taipei: Directorate-General of Budgets, Accounts, and Statistics, Executive Yuan, 1959, p. 418; 1969, pp. 144-45.

TABLE 17

FOREIGN STUDENTS IN AMERICAN COLLEGES AND UNIVERSITIES BY COUNTRIES[a] ACADEMIC YEAR 1960-1961

Country	Number of Students	As a Percentage of the Total
Canada	6,058	11.4
China[b]	5,304	10.0
India	4,835	9.1
Iran	2,880	5.4
Japan	2,434	4.6
Korea	2,310	4.3
Philippines	1,727	3.3
Mexico	1,490	2.8
Venezuela	1,207	2.3
Greece	1,200	2.3
United Kingdom	1,069	2.0
Thailand	966	1.8
Jamaica	930	1.8
Israel	877	1.7
Germany	868	1.6
Turkey	867	1.6
Egypt	840	1.6
Cuba	837	1.6
Others	16,408	30.9

Source: A Fact Book on Higher Education, American Council on Education, 1961, p. 225.

[a]This table included only countries with 800 or more students in the U.S. All told, 143 foreign countries and territories are represented.

[b]Students from Taiwan, Hong Kong, Macao, and the mainland

TABLE 18

GROSS NATIONAL PRODUCT OF TAIWAN
1951-1969

Year	Book Value (At Current Price)		Real Product (At Constant Price of 1964)	
	Amount (NT$million)	Growth Rate (%)	Amount (NT$million)	Growth Rate (%)
1951	12,315	-	36,037	-
1952	17,247	39.9	40,698	12.9
1953	22,988	33.3	44,472	9.3
1954	25,225	9.7	47,776	7.4
1955	30,088	19.3	51,745	8.3
1956	34,543	14.8	54,189	4.7
1957	40,291	16.6	58,155	7.3
1958	44,752	11.1	62,327	7.2
1959	51,727	15.6	66,952	7.4
1960	62,561	20.9	71,177	6.3
1961	69,792	11.6	76,736	7.8
1962	76,473	9.6	82,272	7.2
1963	87,336	14.2	90,314	9.8
1964	102,492	17.4	102,492	13.5
1965	113,112	10.4	115,228	12.4
1966	125,496	10.9	126,007	9.4
1967	144,148	14.9	138,474	9.9
1968	167,975	16.5	152,218	9.9
1969	190,421	13.4	165,400	8.6

Source: National Income of the Republic of China. Taipei: Directorate-General of Budgets, Accounts and Statistics, Executive Yuan, ROC, 1970, pp. 8-9.

APPENDIX II

PART A

Variable entered	R	R^2	Increase in R^2
X_2	0.9833	0.9669	0.9669
X_1	0.9878	0.9757	0.0088
X_5	0.9897	0.9796	0.0039
X_3	0.9904	0.9808	0.0012
X_6	0.9912	0.9826	0.0017
X_4	0.9928	0.9857	0.0031

PART B

CORRELATION MATRIX

Y_u	X_3	X_5	X_1	X_2	X_4	X_6
1.00	0.93	0.89	0.95	0.95	0.31	0.91
	1.00	0.89	0.95	0.95	0.32	0.94
		1.00	0.97	0.96	0.38	0.98
			1.00	0.98	0.32	0.98
				1.00	0.23	0.97
					1.00	0.38
						1.00

PART C

Analysis of Variance

	DF	SS	MS	F Ratio
Regression	3	2047458816	682486272	165.646
Residual	4	16480556	4120139	

Variables in Equation

Variable	Coefficient	Std. error	F to Remove
(Constant	36683.94531)		
t	743.56543	933.98120	0.6338(2)
X_1	4.04200	2.66829	2.2947(2)
X_2	2.59320	2.27822	1.2956(2)

Summary of Correlation Coefficient and Coefficients of Determination

Step	Variable entered	R	R^2	Increase in R^2
1	X_2	0.9924	0.9848	0.9848
2	X_1	0.9954	0.9907	0.0060
3	t	0.9960	0.9920	0.0013

Part D

Variable entered	R	R^2	Increase in R^2
X_7	0.8698	0.7565	0.7565
X_8	0.8777	0.7704	0.0138
X_3	0.9366	0.8772	0.1068
X_5	0.9593	0.9202	0.0430
X_{12}	0.9630	0.9274	0.0071
X_{11}	0.9635	0.9284	0.0010
X_9	0.9643	0.9298	0.0014

Analysis of Variance After the Deletion of X_7 & X_{12}

Source of Variation	D.F.	SS	MS	F Value
Due to Regression	5	2.25066	0.45013	6.8209
Deviation about Reg.	10	0.65994	0.06599	
Total	15	2.91060		

Intercept: 6,64169

Var.	Mean	S.D.	Reg. Coef.	S.td Error Reg Coef.	T Value	Partial Cor. Coef.
X_{11}	3.7402	0.1008	-0.6276	4.91321	-0.12775	-0.04036
X_3	0.3035	0.0981	-4.6898	3.77330	-1.24289	-0.36583
X_5	1.7152	0.0207	-7.3484	13.41697	-0.54770	-0.17067
X_8	3.8412	0.2915	3.4503	1.23416	2.79570	0.66238
X_9	0.9227	0.1130	-0.1654	0.97655	-0.16937	-0.05349

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