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Industrial Investment Incentives, Cost of Capital and Employment Creation in the Thai Manufacturing Sector

by

Sawong Swetwatna

คณะเศรษฐศาสตร์
FACULTY OF ECONOMICS

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Note

The data used and the Computer Results in detail are not published in this report. However, these relevant data can be obtained from the investigator upon request.

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Dedication

To

Professor Puey Ungphakorn

The contribution, if any, of this study to an understanding about the issue of factor market imperfections that have occupied such a prominent place in industrial policy implementation concerning LDCs manufactures in recent years, will be dedicated to Professor Puey Ungphakorn, former Rector of Thammasat University and former Governor of the Bank of Thailand, etc. I always treasure the "arts and sciences" of Dr. Puey's vision, creativity and philanthropy in his administration renowned at all levels and in all areas of human activity. One of the story, Dr. Puey narrated at a Faculty of Economics, Thammasat, at the time he began to initiate the Rockefeller Foundation to assist in the ten year development program at the Faculty, is indeed stimulating and penetrating, and reflects the far-reaching impact on our present Faculty of Economics : encouragement a young man (or woman) to seek new ideas and knowledge, for he always upholds the principle that ideas (from education) form a basis upon which knowledge is built, and that knowledge leads to understanding, and understanding leads to wisdom. Therefore, one of the more important factors in economics progress (or progress in general), Dr. Puey enunciated, is to find people who have the capacity to create something novel. Dr. Puey then related a very illustrative story originally told by Sir Edward Appleton, a British winner of a Nobel Prize when receiving the Prize in Stockholm several years ago. The story went like this.

At a meeting at Cambridge University, England, when candidates were being selected for a scholarship, one of the Fellows of the College spoke warmly and enthusiastically for one candidate. That follow concluded with words : "I think that I can best describe the standard that characterizes this man by saying that when has his words on some matter it is also the final word on the matter." To this the Dean of the Faculty at Cambridge remarked : "That may well be so, but I think we should do better to get hold of a young man who says the first word on some matter."

All of us at Thammasat, especially at the Faculty of Economics, will agree that Dr. Puey Ungphakorn, the founder of our Faculty, the co-founder of Bank for Agriculture and Agricultural Cooperatives, Regional Offices of the central bank, the Fiscal and Economic Policy Office at the Ministry of Finance, and other numerous novel activities at the NESDB, the Bank of Thailand, the Buruau of the Budget, and so on, can very well be identified with the young man (in the sense of Thomas Emerson that....... made weak by time and fate, but strong in will; to strive, to seek, to find, but not to yield.) who says the first word, who takes initiative. To him more than anyone, is to be credited for the fact that the Rockefeller Foundation-supported master-degree program, and progress in economics at our Faculty, including the Thammasat Economic Research Unit, and a large number of other programs, has been founded. The present study which the author wishes to dedicate to him, symbolizes somewhat tardily, the recognition accorded to the young scholar.

Acknowledgements

In working on this research project I have incurred many debts which can be only partially and inadequately acknowledged here.

The ideas leading to this research arose from my dissatisfaction with the 1970s. Industrial Promotion Act provided for Thai manufactures which effectuated protective bias or factor market distortions to a significant degree, and from my belief that even a complete elimination of such factor market distortions, if feasible, would not bring about a greater scope of employment creation in Thailand's manufactures. Thus, a middle-ground or a second-best investigation into the extent of distortions and the potential employment creatinn following a reduction of distortions should be brought into quantitative analysis. For, these issues bear relerancy for the industrial promotion strategy,including domestic resource use in relation to exports of our manufactured goods in the future.

Several persons have shared with me their insights about the industrial promotion strategy in which protective elements permeating distortions in the factor market should be gradually palliated. W.A. McCleary was very helpful to me; a number of individuals at the Bank of Thailand, especially Mr. Chavalit Thanachanant, assistant to Governor of the Bank clarified a number of points. Several persons at the BOT were also very helpful. The ideas in this research have been drawn with gratitude from the work of Professors Balassa, Corden, Krueger, among others.

I wish to express my appreciation to Medhi Krongkaew, then chairman of the Economic Research Unit, and the current chairman, Praipol Koomsup, who kindly extended the profect which made it possible for its completion. I wish also to thank the NSO from which the census data on manufactures for 1971 and 1974 were obtained. Computer work was performed efficiently by Khun Sunit, Bank of Thailand. Research assistance has been ably provided by several students at Faculty of Economics, Thammasat University. Finally, I wish to thank the Economic Research Unit, Faculty of Economics, Thammasat University, for the project was financed by grants from this research unit.

Of course, non of the individuals or institutions cited should in any way be responsible for whatever errors that remain. These are solely the responsibility of the investigator.

Sawong Swetwatna

Summary

The present study attempts to analyze the question of factor market distortions in the Thai manufacturing sector for the census years of 1971 and 1974, with a view to identifying quantitatively the magnitude of distortions and to assessing the employment-effect possibility if such distortions were eliminated.

It is found in this study that factor market distortions did persist in Thai manufactures for the years indicated, and this may be traceafly to a number of institutional constraints pertaining to monopoly power, minimum wage lows, subsidies cum tariff protection on the one hand, and import licenses, subsidized rate of interest, investment allowances, on the other. Thus, when the value-added of different sub-sectors of Thai manufactures are evaluated in accounting price thought form, the market rates of interest do not correctly measure the rates at which the value of future consumption declines over time or the social rate of discount. As a benchmark for identifying the degree of distortions, the conceptual frame lies in the constant elasticity substitution (CES) production function parameters in accounting price terms were estimated for the entire group of manufacturing industries for 1971 and 1974. It was found that the values of substitution elasticities based on market factor prices, namely market wages and rental prices of capital and those based on effective factor prices differed markedly for both census years.

In assessing the industrial investment for varions sub-sectors of the manufactures in terms of employment impact, two levels of adjustments were expedited for adjustment of the factor market distortions. First, the factor market prices, namely, market wages and rental prices of capital were adjusted, taking into account the social costs as resources are shifted from their original use to alternative use in various industries. The social costs in this view reflects essertially

the opportunity cost of these resources, that is, the opportunity cost of labour equals the effective or shadow wages and the opportunity cost of capital must equal the shadow rental prices of capital. Secondly, a further adjustment need to be facilitated taking into account the effects of industrial investment on the level of aggregate savings and investment to be generated over time. The whole question boils down to the notion of discount rate. It was argued that under the circumstances of institutional constraints prevailed in the Thai manufactures for 1971 and 1974, the social rate of discount could not be estimated on the basis of the market rate of interest. If the level of savings and investment are sub-optimal, the value of a unit of savings and consumption may be equal in terms of market prices the unit of savings is higher. This is so because the value of a unit of saving is not savings per se but is a stream of additional future consumption it may generate. The non-optimality of savings and investment in the Thai manufactures have a number of implications.

First, it implies that the market wages are distorted, since the wage bill represents an important component of the costs of using resources and of the aggregate value-added of any industry valued at domestic prices. The degree of distortion thus impinges on the difference between the value-added at domestic prices and at world market prices. Second, it also implies that the market rental prices of capital are distorted, as compared with the effective rental prices, viewed in terms of the opportunity cost of capital.

The foregoing discussions indicate the nature of factor market distortions for the Thai manufacturing sector for 1971 and 1974. Would the employment effect be augmented, were such distortions eliminated? In this study, the demand for labour function is formulated in the framework of the CES production function. The regression results suggest that in a majority of industries, a one percentage change in an effective output, meaning a Pareto optimal condition in which no distortions exist, brought about a less-than-one percentage change in labour employment; similarily, a one percentage change in an effective wage rate and/or rental prices of capital effectuated a less-than-one perentage change in employment. Thus, variations in labor employment are linked with the output and wage-rental price paramters, in effective thought forms, through the values of the elasticities of factor substitution of the production function in logarithmic form. Insofar as such substitution elasticities were found to be less than unity in most industries, the elimination of distortions would not generate a high degree of employment creation as commonly undustood. Finally, to the extent the employment in manufactures could be created, the elimination of distortions should center more on the relatively cheapened rental price of capital rather than on the wage rate alone.

Chapter I

Introduction

1.1 The Problem in the Setting

During the past two decades, the government of many less-developed countries undertook to make efforts at development planning which essentially placed primary emphasis on the rate of capital formation. The underlying philosophy and the rationale of the solution to the problems of economic growth in general and unemployment in particular were based mainly on the allegedly received tradition that increased capital investment in various sectors of the economy was a prerequisite for economic development and output expansion, and that output increase would trigger off employment growth and more equitable income distribution. It was also widely held that because of a rapidly growing population in labour force of developing countries, coupled with the limits which the agricultural sector could expand and to which this sector could aborb labour, the manufacturing sector would have to serve as a base for absorbing a large proportion of labour force and providing for an expansion in manufactured exports, essential for self-sustained growth.

The economic theory generally adopted by policy planners in developing economies as a rationale for effecting the said development objective, has been the neoclassical theory of resource allocation based principally on the Pareto optimum type. Essentially, the Pareto optimum model centers around the propositions that for a perfectly competitive economy without market imperfections and monopoly power in commodity and factor markets, the production and consumption patterns will be characterized by Pareto optimum as the economy operates with technical efficeincy in the sense that it lies on the "best" transformation surface.

Under Pareto optimality[1/], the frist order conditions for a maximum of economic efficiency of resource allocation holds for any pair of commodities : marginal rate of transformention in domesti production equals the marginal foreign rate of fransformation and simultaneously equals the marginal rate of substitution in the community's consumption. Moreover, the main strand of economic postulates associated the Pareto optimum asserts that a perfectly competitive condition in the factor market would bring about equalization of the rates of return to each of the factors in the production process across industries, so that the allocation of resource must be technically <u>efficient</u> and economic welfare measured by the factors'distributive share must be at the <u>maximum</u> point. Finally, said the allegation implies that Pareto optimum has been applied with equal full force especially to the area of international economics which in essence centers on the proposition that international trade flows are most <u>efficiently</u> facilitated by the principles of comparative advantage and differences in relative factor endowments. This proposition concludes, in effect, that if the conditions that the marginal rate of substitution between goods in consumption equal to the marginal rate of transformation through international exchange as well as transformation through domestic production were satisfied, the maximum welfare would be attained.

Recognizing the strategic imporfance of capital formation in the development process, theoretical economists and government officials responsible for the task of development planning

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1/ H.G. Johnson [10] , rp.191-193.

and implemintation in developing economies over the past two development decades', formulated a vast variety of channels through which the governments intitiative and pre-emptive intervention in the private sector could be carried out. In consequence, the foremost channel undertaken directly by government concerns the financing of social overhead investment which was viewed to be a prerequisite for economic growth and employment expansion. The second machinery deals with those areas in which actual investment projects are in private hands but the capital funds are made available through government finance. Still, another development strategy, which will be our preoccupation in the present study, revolves around the specific areas of intervention and the monetary and fiscal incentives accorded to private investment in the form of taxation, investment allowances and tariff measures designed to protect and stimulate particular industrial development. In retrospect, the underlying arguments for government intervention and the necessity of provision for incentives have been elaborated intensively by a large number of academic economists as well as policy makers and need not detain us at this initial stage of discussion.[2/] The point of central importance is that government intervention is necessitated by the presumption that private market mechanism in and of itself, would not result in Pareto optimum, since imperfections, monopoly and monopsony power in the product and factor markets pervade the setting of developing countries. In these circumstances it was concluded, the potentially maximum level of aggregate output and national welfare could be acheived only only by means of some kinds of government intervention.

As a preliminary to the development of the main theme, the objectives and expected results of the presnet investigation,

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2/ A summary review is provided in D.T. Healey [33], pp.759-64.

it is necessary to be precise about certain aspects of setting of the problem and the definition of the terms.

In the first place, it needs be made clear that when theoretical econonists and policy makers originally considered the problem of imperfections in the product and factor markets during the 1950 , they meant specifically that the free market chanism would not be relied upon to assure the maximum level of put and welfare, because the socalled 'private interest,' was not compatible with the 'social goals' of resource allocation. It is the emphasis on discrepancy between the private interests and social goals which promted and justified government intervention in many areas of economic activity in the first place, with a view to gearing structural change in the manufacturing sector of developing economies towards or close the Pareto optimum, specified above.

However, as the notion of development planning gained wider acceptance, government intervention has become an unquestioned and pervasive machinery of remedying free market imperfections, encompassing a wide range of domestic as well as foreign trade activities. As regards the domostic private investment and production, the government authorities were prone to grant numerous inducements with a view towardeencourgpement of investment created incentives granted generously to certain nascent firms as industries. Equally significant has been the belief that, in the area of foreign trade, newly established firms or industries should be granted import licenses and tariff protection for the main reason that these mensures would confer significant operating advantages on these particular industries. As one auther notes :

" Ministers of trade and industry are deluged with plausible allegations that particular new industries or firms need protection to cover initial losses although they will ultimately be profitable at world prices. A 'temporary' tariff or quota restriction on competing imports raises the internal price of the domestic output at little immediate political cost------. This is the principal technique for implementing the import substitution strategy common to almost all under-developed economies." 3/

In this connection, the use of the term 'protection' should be clarified, because the confusion of the term may lead to serious analytical errors and improper policy implications. In the present study, the term " protection " either via subsidy or tariff will be confined to government policies that create divergence between the relative prices of products to domestic consumers and producers, and their relative prices in world market. It goes without saying that this definition of the term " protection" differs sharply from the term 'intervention' loosely used as an instrument of correcting unsatisfactary market mechanism, as originally envisaged by economists.

In the second place, in recent years, after the two decades of fragile development planning efforts, theoretical economists and research investigators have shifted the center of

3/ R.I. McKinnon [53], p.22.

emphasis to employment, income distribution, rural development and the rural urban differences. Foremost, many developing countries which failed to remedy distortions or imperfections in the factor market have expereinced slow growth in industrial investment, production and export of manufactured products which, further exacerbated the problems of unemployment, income distrilution and absolute poverty of the mass of population. In view of the large amount of policy packages based on tax and other fiscal incentives provided for specific firms or industries, price distortions will inevitably be reflected in cheapening of capital goods imported from abroad on the one hand, and in raising prices of labour in the manufactured sector, on the other. As Stewart clearly enunciates :

> " Those who stress price distortions as a prime cause many of the problems of LDC's, including inappropriate technology and employment problems, are generally primarily concerned with the following 'distortions':
> (a) relatively high wages in the moclern sector;
> (b) relatively low price of capital, caused by low interest rate, tax incentives related investment...
> (c) overvalued exchange rates combined with high levels of protection."4/

The Internationl Labour Organzation study also acknowledges the role of distortions generated by the prevalent use of capital intensive teckniques :

> " The types of tax concessions offered ....support the hypothesis that there is a distinct bias favoring the use of capital intensive methods of production

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4/ F. Stewart, in E.O.Edwards [21], rp. 105-106.

> or more advanced technology .... Concessions which are linked directly to employment creation do not exist,which leads to the conclusion that modifications are needed in order to reflect a more realistic incentive programme in terms of factor auailability and potential of these countries (LDC's). ---- duty free importation of equipment and machinery affects the relative costs of capital goods and --- makes it cheaper to use capital than labour ".5/

In our study, the term 'distortions' in the factor market will be limited to the government policy mensures that cause divergence between the relative capital costs to domestic producers and their relative costs in world market.

With regard to wages, distortions will be used to refer to the discrepancy between the relative wages of labour imployed in the modern manufacturing sector and the imputed marginal costs of labour on the basis of labour's productivity. More specifically, in view of the fact that both employment and output objectives are furthered by an appropriate 'threshold' wage levels and other labour payments, those government inducement policies that push up wage rate in the modern sector above labour's imputed marginal costs to be substantiated in this study will be regarded as distortions in the Labour market.

1.2 The Significance of the Problem

To recapitulate, the main theme of analysis is that, in a dynamically free enterprise or mixed economy of developing

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5/ International Labour Office, Fiscal Measures for Employment Promotion in Developing coutries, [40], p.203.

countries, an objective appraisal of private investment and production and the valuation of private cost of capital, the social rate of returns on private profits, will be matters of significance. And yet in economic lilterature, economists have concerned themselves exclusively with a method designed to evaluate only public sector projects, to the virtual neglect of private sector projects. Thus, social cost-benefit analysis that has been thoroughly explored and rigorously developed in several investigations, has been substantially relevant to public sector projects alone. This position applies to such thoroughly comprehensive studies as the Little-Mirrless Mannal (Little and Mirrless, 1968 [49] , and the U.N.I.D.O Guidelines for Profect Evaluatim, 1972 [71]. In these two articulate studies primary interest was given to social cost-benefit analysis applicable specifically to evaluation of public sector projects, as if the provate investment and production were nonexistent. Hence, in the work of Little and Mirrless, which deals in a most rigorous manner with public sector evaluation, only a couple of pages (pages 264 - 66) were devoted to discussions of possible complications if the private sector were taken into account. Likewise, in the U.N.I.D.O. Guidelines only brief discussions were offered in connection with evaluation of the private sector projects (page 181 - 84).

In the mixed free entuprise economy where a substantial proportion of production and investment takes place in the private sector, granted the equally significant role of the government sector, the evalution of the private investment, production gross private profits and cost of capital and the social rate of returns on private projects should be viewed in its proper focus for the following reasons. Firstly, in the case where public projects purchase inputs from the private sector or sell product to that sector, the transaction will certainly affect the level of profits in the private sector, and the evaluation of these profits and capital costs doubtless will enter into accounting price of the output or input. In an evaluation of the private manufacturing sector, the accounting price of factor inputs encountered in the sector need be explicitly taken into consideration, and the shadow wage or accounting price of labour will in turn be significantly affected by the private cost and production. Secondly, even where there is no change in private profits, or cost of capital, when the public sector purchases a privately produced goods and sevrices either through the normal budgetary disbursiment or other channels, it will be paying interest and depreciation on the privately owned capital, whose social and private costs may differ considerably and need be evaluated.

Probably more significantly, is the fact that the government generally concentrates on and has been concerned with fostering private industrial investment, and thus, has promulgated into Laws a number of inducement policies, oriented toword fostering and encouraging industrial growth and employment, in the form of tax concessions, fiscal incentives and a vast variety of tariff protection for certain private industries mentioned above. In these specific circumstances, it is operative that, if efficeincy should reign as the main criterion for finannal resource allocation, the social cost of allowing or encouraging funds to be used in these various ways, need be assessed. Generally the banking sector intermediates in a partial transfer of funds or debt capital between sectors, the direction and extent of which should presumably be based on the social valuation of the transfer. Finally, the economic planning authority in general and investment promotion authority in porticular, will be interested in the rate of profits and costs of capital in the private sector, imputed at accounting prices, because it should serve as a proximate indicator of the appropriate level for the shadow or accounting rate of interest. These considerations suggest that an evalustion of private investment must be a fruitful and worthwhile undertaking.

1.3 Purposes and Scope of the Study

There are two main purposes for the present investigation : analytical and an empirical purpose. The broad corcern of the two purposes is to show how far the industrial inducement package based in tax concessions, generous investment allowances, tariff protection, and a vast syndrome of government measures, has been effective as a vehicle for fostering manufacturing growth and employment generation. However, from the period beginning in 1960 to the present, two constrasting forms of industrial promotion policy were used by the government of Thailand, namely, the policy of industrial import substitution and export-oriented promotion measures (IBRD Study on Industrial Development [39]). In 1970, a major change in the tariff schedule in cluding the rates of more than 200 items were raised as a palliative measure remedying balance of payments difficulties, and at the same time business taxes were escalalated from 12 percent to 15 percent for electrical appliances, from 10 to 12 percent for motor-cycles, from 20 to 25 percent for electrical fan, etc. It is inevitable that the impact of this fundamental shift in industrial policy on relative fuctor and manufactured goods prices must be substantial and the effect of price changes on resource utilization must be equally considerable. Yet, very little attention has been focused on the impact triggered off by such relative price changes on the resource use and employment in the study manufacturing, (one exception is the study by N. Akrasance [2]). Thus, one of the main objectives of the present study is to provide for an analysis of the underlying production relationships in Thai manufacturing and of the derived demand functions for factor input, especially, the employment creation in this sector. Moreover, the purpose of this investigation is to explore the hypothesis that in LDC's, most of the secular variation in over all productirity improvement, private gross profits, and the relatively functional distribution of income among factors in value-added, can be explained by the ability of the industrial sector to allocate primary resources in a more nearly optimal (secund best) situation. Specifically, in view of the syndrome of government monetary and fiscal measures designed to stimulate industrial growth and employment creation, distortions and monopoly power are built into the markets for factors, producing deleterious effects on the relative prices of factor inputs, and in case where foreign - imported technologies dominate, these distortions cause misallocation of resources to a significant extent. It will be our task to measure quantitatively the magnitude of such distortions in the market for factors. The central theme of the present study indicates clearly that the Thai manufacturing in facing the capital constraint is characterized by a stream of income and optimization pattern which differs significantly from the case of traditional capital saturation. This distinative characteristic will explain variation in business investment (fixed capital assets), gloss profits and capital costs in imputed or "shadow price" framework. It is hoped that an assessment of private returns, production, wages and capital costs on private projects will permit an assessment of the manufacturing growth, in the light of inter - industry analysis, the nature of relationship between growth in manufacturing output and employment creation, and the monopoly power and magnitude of imperfections in the factor market.

Finally, the present investigation will make effort at indicating substitution possibilities in the Thai manufacturing setting

The issue is of crucial importance if we are to develop any understanding of the long-term path of industrial growth which would result from alternative factor pricing policies. An objective evaluation of the private production, rate of return, costs of capital and factor pricing policies must essentially be consistent with imperfections in the capital and labour markets. Our theoretical model will assist in examining the empirical analysis of the tariff structure on domestic value added, employment and capital-investment in the industry. It is hoped that the study will indicate a broad framework of industrial growth and employment strategies which should facilitate and expedite encreased productirity, manufactured expansion and aceelerated capital investment compatible with appropriate employment of labour, and the distribution of income.

1.4 Thailand's Present Industrial Promotion Measures.

Prior to undertaking an analysis in the present study, it will be necessary to indicate their relevancy to Thailand's manufactures including recently implemented incentive and promotion measures.

In 1973 manufacturing industries accounted for about 18 per cent of GDP (at constant 1962 prices compared with 17 per cent in 1970 and 13 per cent in 1960. The share of manufacturing grew to value of a total GDP of Baht 32 billion (in 1973 current market prices) compared with a value of Baht 6.8 billion in 1960, indicating an average growth rate of over 10 per cent, as compared with 7.5 per cent for GDP as a whole. Employment in manufacturing industries has been estimated at approximately 852,000 persons in 1973, increasing from 682,000 in 1970. Although the data have limitations, it suggests the growth rate of almost 25 per cent in three years or at the growth rate of 8.3 percent per annum, of this rather substantial growth that has caused complacency and neglect in the government circles of official articulation regarding the gravity of the unemployment problem in Thailand. It should be noted, however, that job seekers coming to the employment market each year is now over 450,000, while agriculture has been absorbing 150,000 - 200,000 per year as against an annual absorption of about 50,000 in industry. The rates of unemployment remains relatively high, as can be seen from Table I, when compared with other developing countries.

Table I

Unemployment Rates in Some LDC's

(percent of total labor forces)

country	year	Age 15-24		Total	Age 15 ober		Total
		Male	Females		Mail	Memales	
Ceylon	1968	36.1	48.4	39.0	12.9	25.9	15.0
Colombia	1968	21.8	24.3	23.1	10.3	18.5	13.6
Korea (S)	1968	25.6	21.5	23.6	9.3	7.9	8.9
Malaysia	1965	17.7	26.8	21.0	7.4	16.7	9.8
Singapore	1966	-	-	15.7	-.	-	9.2
India (urban) areas	1961/62	8.1	7.7	8.0	3.2	3.4	3.2
Taiwan	1966	5.8	8.1	6.9	2.1	6.8	2.6
Thailand (urban areas)	1966	8.0	7.3	7.7	3.2	3.4	3.4

Source : Turnham, David and Jaeger, Ingelies, The Employment problem in Less - Developed Countries pp. 58 - 60.

Since 1972 Thai government has become increasingly conscious of the limitation based on policies of import substitution, and has, therefore, initiated a variety of measures to promote industrial development. During the first two plan periods (1962-1966, 1967-1971), the Thai Government set out to establish a number of state-owned enterprises on its own initiatives, and the government had a share in the manufacture of sugar, gunny gags, tobacco, wood products, and so on. However, in the Third Plan period, 1972 - 1976, just completed, the government has refrained from creating new enterprises, and has devoted greater attention to the grantings of fiscal incentives, tariff modifications and other quantitative restrictions on imports and to promotion of industrial investment and exports.

The fiscal measures recently implemented for industrial and investment promotion incentives may be grouped into five categories. IBRD, Industrial Development in Thailand [39]

(1) Those that specifically reduce the profit tax liability of enterprises. By the provisions of the Investment Promotion Act of 1972, selected enterprises are granted the following fiscal incentives : full exemption from the corporate income tax on net profits for three to eight years, beginning when the business starts operations; exemption from the payment of customs duties and business taxes on imported machinery and equipment, provided such equipment are not being manufactured in Thailand; exemption from export duties and business taxes of manufactured export product. The Board of Investment (BOI) is empowered to decide whether an enterprise will be granted tax exemption and for how long. Moreover, BOT also recommend prohibition of certain imports for Cabinet approval.

(2) Under the 1972 Promotion Legislation : the BOI was empowered to grant one or more special rights and benefits to

promoted firms in the form of : (a) investment allowance comprising deduction from taxable corporate income of up to 25 per cent of the cost of installation and construction of industrial infrastructure, which may be taken on any one of the first ten years; (b) deduction from taxable corporate income of twice the cost of transport, electricity and water supply; (c) exemption of up to 90 per cent of business taxes on sales and up to 50 per cent of import duties and business taxes on imported and or essential materials up to five years; (d) exemption of one half of corporate income tax for a period of five years.

(3) The measures that reduce the exporter's costs which comprise what are known as the tax rebate scheme and the drawback scheme. The main purpose of the tax rebate or "credit" scheme implimented in 1971 is to promote Thai exports of manufactured goods by making them more competitive through the refund of indirect taxes : business taxes, excise taxes, import duties, and other levies and fees on raw materials, equipment, parts, machinery, fuels and energy used in manufacturing the exported products.

(4) Under the Drawback Scheme, customs and business tax drawback permits a rebate equal to 7/8 the of the custom duty paid on raw material imports used in industrial exports, and in 1971 the said buties were reduced to 10 per cent, making the effective duty paid by exporters of manufactured products equal to 8.7 per cent, which applies to both promoted and non-promoted firms.

(5) Financial incentives provided to exporters by the Bank of Thailand through its special credit scheme which lowers the cost of borrowing for exports. Under the rediscount facility commercial banks which lend to manufacturers of export products

are able to rediscount promissory notes at an interest rate of 5 per cent which is considerably below the prevailing market rate of 8.5 to 12 per cent (1975). [Bank of Thailand, Monthly Bulletin, January 1976, 14, 30 - 31]

The impact of this fundamental policy shift definitely produces substantial changes on relative costs of capital, wage rates and the private profits and investment, as well as on the employment pattern and the functional distribution of income in 1971 and 1974.

II. Some Theories of the Industrial Promotion : The Issues In Historical Perspective.

The investigation and method of the present work are primarily empirical but an analytical framework is required, a thought form oriented toward a more robust theory of optimization of the firm which hopefully serves as methodological bridges from economic to "shadow pricing" analysis. To prepare for such a background, it will be instructive to review the mainstream of thinking which over the past two decades underlies the rationale of industrial development strategies in developing countries. The present section is devoted to such a review. However, it is not proposed in this section to undertake an exhanstive survey of the literature on theories of development strategies. The subject has rampified to such a degree that it is virtually impossible to mention every suggested hypothesis. Therefore, we shall concentrate on the theories which are especially relevant to our study.

In pursuit of industrial development growth and development, the government officials of many developing countries over the past two decades, initiated a policy package with view to gearing the manufacturing sector as close as possible to the Pareto optimum.

Admittedly, this type of policies amounts to affecting the "second-best" optimization of resource allocation rationalized on the basis of the neoclassical theory. Unfortunately, after a period of two decades has elapsed, academic economists and probessional policy - makers have now taken a concientiously new look at past development xperience and begin to evaluate the outcomes in terms of what have or have not been accomplished. In general, the message is explicitly clear. The main summary conclusions emerged from a large number of expirical studies in recent years is that, athough industrial development strategies in the past achieved their express goal of higher production and income growth, the benefits of this growth have not been widely shared. Unemployment has continued predominantly to permeate the urban - rural scene of developing countries.[6/] In fact, evidence indicates that the elasticity of employment with respect to output in developing economies has been extremely low and in view of this fact, there has been a concensus among economists that past failures of industrial development planning and policy implementation manifest themselves most obviously in the unemployment problem. Equally disillusioned, is the question of severity of current poverty and inequality of the income distribution, and the fact that, inequality and poverty have not substantially been alleviated by growth policies, have convinced many economists in recent years to suggest that growth has been over - emphasized to the virtual exclusion of distribution aspect.[8/] A review of evidence by Weisskoff on some Latin American countries concludes that between 1950 and 1963, a 37 per cent increase in per capital GNP was achieved but during the same period the percentage

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8/ R. Weisskoff," Income Distribution and Economic Growth, [73], 303-331.

of total income received by the poorest 30 per cent declined from 9.9 per cent to 7.6 per cent, implying that the real income of this group remained essentially constant. Another study by Fishlow on the distribution situation in Brazil demonstrates clearly that the Brazilian industrial growth during the 1960's was accompanied by a deterioration in the distribution of income and little real income growth was shared by the poorest half of the population.[9/] In effect, it is now generally agreed that employment expansion in the context of the manufacturing sector in the past, has not kept pace with investment and output growth. And, it is against this background that we turn to specific development strategies which probably account for such failures.

2.1 Import Substitution Strategy. Planners of development in developing economies during the 1960's adopted as the fountainhead of their planning efforts the policy referred to as the import substitution strategy. In effect, theoretical economists and policy makers during the decade of 1960's beleived that increased capital investment would lead to expansion in employment and in manufactured output. Hennce, the import substitution based on tariff protection provided for certain selected industries, appeared to the most convenient way of initiating industrialization and promoting the manufacturing industries. The essence of import substitution is simply imposing of impediments on the importation of certain products, particularly manufactured consumer goods. The adoption of import

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9/ A. Fishlow, " Brazilian Size Distribution of Income," American Economic Review (May 1972), 391 - 402.
A most rigorous and provocative discussion is found in Direk T. Healy [33], 760 - 64.

substitution means that the investible resources are allocated mainly on the basis of demand conditions, with little reference to supply factor endonment conditions. The underlying presumptions responsible for import substitution are numerous and they have been elaborated by a large number of economists. For our present purpose, the following points should be noted. First, the import substitution approach to development is based on the presumption that the imports being impeded are <u>less</u> demanding of these resources with which a developing country is most abundantly endowed. Second, advocates of import protection argue that because the market for commodities concerned already <u>existed</u>, the import substitution strategy would assist in absorbing an increasing proportion of labour on the hand, and effectuate adaptation as to technique of production and increases in over-all productivity, on the other. As new industrial activities are created with help of protective barriers, a growth rate of output is expected to exceed the growth rate of GDP, and thus additional employment is expected. Finally, import substitution has been alleged to provide for not only <u>self-reliance</u> in production and utilization of domestic resources, but also the benefits of earning forcign exchanges which are scarce in a developing country. In view of substantial advantages afforded by import protection, the use of import substitution as a development strategy was pervasive during the late 1960's.

However, empirical and qualitative evidence accumulated by a large number of investigations on this approach, suggest that, while it was easy enough to reduce imports of the goods by tariff imposition, it was not always realized that import substibution would result ultimately in imports of even greater magnitude, namely, capital goods, raw materials and other intermediate inputs necessary for a newly established protected home industries.[10/] Thus, while it

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10/ M.D. Little, T.Scitovsky and M.Scott, [48], 58-61., A most rigorous and articulate theoretical argument concerning the effects of protection has been provided by Johnson [41], 190-196; A review of policy controversies is in D.T. Healey [33], <u>ibid.</u>, is true that the protection policy was quite successful in creating output and incomes, more imports of factor inputs would inevitably be induced. Secondly, it was pointed out that import substitution at one stage of production leads to its being attempted at another. In these circumstances, the effects of import substitution strategy have been severely criticized by Little, Scitovsky and Scott in a most articulate report: " too much capacity at the final and too little at the intermediate stages of production. " 11/ Thirdly, these authors forcefully argued that the tariff protection for domestic industries has frequently lent support to licensing imports of capital goods' other inputs, and foreign technologies which were alien to the country's factor endowment, thereby, discriminating against labour employment. Further, the import substitution policies having been carried out too far, resulted not only in underutilization of capacity at the final stages of production, but also tended to raise the prices of goods of protected industries in relation to the prices of outputs from other sectors. Fifthly, these authors have shown that the contribution to value - added of certain protected industries based on import substitution policies turned out to be actually negative. Finally, import substitution policies has caused a shift in the distribution of income in favor of the urban sector and the higher income groups, whose expenditure pattern has trypically the highest component of imports. 12/ In effect, protection taxes agriculture because it raises the price of industrial as compared with the price of agricultural goods in domestic market.

11/ I. Little, T. Scitovsky and M.Scott [48], p.62.

12/ I. Little, T. Scitovsky and M.Scott [48], p.63; D.T. Healey, op. cit. p.761-762.

In view of these summary arguments, it is perfectly clear that import substitution policies failed to accomplish what it was intended to do. In short, one may conclude on the basis of the foregoing evidence that while import substitution policies originally initiated as a development strategy with a view to coping with the existence or alleged existence of domestic distortions, the adverse effects inherent in this policy turn out to have exacerbated the distortions even to a greater extent. The empirical magnitude of these distortions will be explored in the present study.

2.2 Distorted Prices of Capital Goods. In pursuit of industrial development and industrialization, a vast varicty of inducements have been put forward to stimulate investment. The industrial investment-inducement package used by the government of developing countries and Thailand reviewed above, has taken the form of tax holidays, exemptions from import duties, import licensing, generous investment allowances, subsidized credit program, over-valued exchange rates and other fiscal incentives. Evidently, this type of inducement policies results in making the cost of capital lower than it would otherwise be. Moreover, import substitution policies generate the perverse results to the effect that it confers significant operating advantage on specific promoted firms while discrimates against others, "---restrictions on foreign trade tilt the whole structure of relative prices, reducing them in certain broad classes of commodities as it raises them in others. The costs in domestic currency of imported machinery and industrial inputs-----are reduced substantially."[13/] As a consequence, even in the sector or industry in

13/ R.I. McKinnon [53] , p.25.

As a consequence, even in the sector or industry in which labour is relatively abrendunt, capital-intensive method of production is still adopted. It seems, therefore, that efforts are made, on the basis of mentioned policies, to save the abundant rather than the scarce poorly-endowed factor at the prevailing factor prices.

The situation of the manufacturing sector has been accentuated by the fact that contemporaneous policies in developing countries tend to result in relatively high wage rates, especially in the modern sector where industrial activities have found establishments. These latter policies comprise minimum wage legislation, labour union laws that make dismissal difficult and expensive, pressures of urban labour unions, and so forth. Furthermore, import substitution policies and the pervasive use of advanced technology often leads to relatively hige wages in the sector affected (i.e. modern sector). In view of these adverse effects of protection, distortion is virtually built into the system. As the subsequent avalysis of the Thai manufacturing industries reveals, the problem of relying on tariff protection as a vehicle for industrial development has been exacerbated by the fact that, the effective tariff protection accorded to protected industries appeared to exceed the nominal tariff rates specified by public authorities. In effect, the recognition of the shortcomings pertaining to the policy of protection, outlined in the preceding paragraph,implies that reliance on this policy as an instrument of income and employment expansion has now been called into question. It is, therefore, necessary that an appropriate assessment of the magnitude of distortions in the factor market must be objectively undertaken, if an alternative proper policy recommendation can be expedited.

2.3 Incompatibility of Output Growth and Employment Expansion. Over the past two decade, one underlying theme of economic theory which had been rationalized as a basis for industrial planning and policy implementation is the traditional neoclassical economic postulate, By and large, the development efforts during the past decades were based on the postulates that costless surplus labour from the agricultural sector of developing countries could be transferred to support modern industrial based sector expansion at the subsistence wage level, and that a proper development strategy should make it possible to shift its center of emphasis from agricultural to industrial sector by allocating its investible resources in such a manner that the manufacturing sector forms a critical base for absorbing the surplus labour from agriculture at a pace compatible with the rate of population growth. If this thesis holds in reality, employment in the developing countries would expand accordingly.

However, in view of the preceding discussions, and as available evidence about developing countries indicates, insofar as the employment of labour in the manufacturing sector is concerned, while it is true that output expansion proceeded at a considerably high rate, employment has lagged for behind.[14/] In many instances where the rates of investment have been high, labour absorption has increased only slowly or even declined in some sectors. A review of evidence in a number of developing countries uncovers the incredible fact that lower-income groups especially the poor may not be improving their lots at all, even as rapid development proceeds. The problem has been exacerbated when the same set of evidence reveals that there are substantial and increasing numbers of peoples available for work who are unable to even maintain a decent standard of living on the basis of employment opportunities accessible to them, As a way out of this deadend, a large number of workers desperately turn to cities seeking for jobs, but unfortunately they have been absorbed into a slow-growing, low productivity manufacfuring and service activities. Open unemployment permeates the urban scene and it is no exaggeration to say that open

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14/ E. Edwards [21], pp. 56-58.

unemployment as commonly measured by the observed unemployment rate, is but one manifestation of the real employment problem. Other indicators such as low participation rate, acceptance of part-time employment, use of child labour, and a vast variaty of low productivity employment, all testify to the conclusion that under-utilization of labour predominantly pervade the industrial setting of developing economies. In this connection, Turnham and his associates notes:

> "---- these considerations suggest that the employment employment problem in less-developed countries cannot just be identified with an employment problem Although the rates of unemployment are often extra--ordinarily high, as important, probably more important, is the situation of employed groups who carn and consume very little because their productivity is so low." 15/

Some economists, however, have been reluctant to acknowledge the allegation that conffficts between output growth and employment do exist. Peacock and Shaw, in particular, warns us that such conficts do not and cannot, in fact, arise so long as fiscal policy implementation is effectively monitored such that an increase in one reinforces the effectuation of the other. 16/ Here again, the controversy still looms large, for evidence of developing economies points to the conviction not only that such conflicts have occurred in the past but must necessarily continue in the future, if a reorientation of development strategy is not pursued.

2.4 Capital-Intensive versus Labour-Intensive Technique Arguments. Over the past two decades, some economists advocated capital-intensive as opposed to labour-intensive (or capital-saving) production technologies as a development strategy. The proponents of this approach orgue that labour-intensive technique of production

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16/ A. Peacock and G.K. Shaw | 61 |

is incompatible with industrial growth and that the capital intensive production method, being more efficient, could stimulate a more rapid rate of growth and consequently a larger output and employment.[17/] The substantive arguments used to support this approach are twofold. First, it is generally admitted that the rate of saving and the rate of reinvestment are higher in capital intensive than labour-intensive industries which implies that a capital cost per unit of output is relatively lower in the former. Second, if the total output of the industrial sector of a developing economy is to be maximized, its scarce capital resorurces should be utilized in such an efficient manner that could maximize the net value added and the contribution to national income from a given level of investment. Thus the capital-intensive production techniques could fulfill this requirement.

On the contrary, the proponents of labour-intersive technologies advocated that in a densely-populated, capital deficient economy of developing countries, where high employment and under-employment are predominated, the labour-intensive or capital--saving production would economize both the use of scarce capital and simultaneously provide for increasing employment opportunities. Economists who subscribed to this view went so far as to proposing and outlining a set of criteria for subsidizing labour-intensive technologies with the explicit object of enhancing the levels of employment in the manufacturing sector of developing countries.[18/]

In recapitulation, the thrust of arguments is that controversy over the development planning issues will not easily be settled in a foresecable future. Even in the present state

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17/ W. Galenson [28] , 2. Stern [66] .
18/ A. Peacock and G.K. Show [61] op cit.

of knowledge, we are surely safe in saying that each approach commented on briefly in the preceding sections its own merit and at the same time its inherent shortcomings. The findings of the present study seem to support the conclusion that while it may be true that the saving and the reinvestment rates are higher in the capital-intensive techniques of production, it is equally true that the more labour using and more labour-intensive technologies in many manufacturing industries and production processes also save on capital per unit of value added. On the theoretical ground, formulated in the present study, it will be shown that it is entirely unsatisfactory to view the employment in terms of large-scale versus small-scale industries with the implicit assumption usually made that small-scale industries are more labour-intensive on the one hand, and that large-scale industries are more capital-intensive on the other. The issue will be taken up in the following section. But before doing this it will be helpful to provide for a general review of literature on the subject.

III. Review of Gurrent Methodologies

3.1 The Role of Distortions in the Factor Market.

In the preceding section we have reviewed the general approaches to industrial planning strategy which have been used as a fountain-head of development efforts in developing economies over the past two decades. Against this background, we may specifically consider the question of distortions or imperfections in the factor market in proper focus.

During the recent decades, substantial interest has been given to, and considerable work has been done on, the question of distortions in the factor market in developed and developing countries. The central theme of investigations on the issue ranges from efforts to measure the extent of imperfections in the fector market and to describe the characteristics of monopoly power in the labour market and the adverse effects of minimum wage legislation, to construction of theoretical models designed to demonstrate why recent industrial development has not in and of itself generated employment expansion to the extent commensurate with productivity growth and technological progress in the manufacturing industries of developing countries. Most of the studies on the subject deal exclusively with the theoretical aspects, addressing themselves primarily to the welfare effects of distortions in the factor market. They have been concerned to show that distortions in the factor market lead to a loss of economic efficiency and thereby ruling out the Pareto optimum which underlines the efficiency conditions for the resource allocation in the sense that the community's output lies inside the non-distorted transformation surface. These notable theoretical studies include[19/], among others, the work of Fishlow and David [26], Bhagwati and Ramaswami [9], Johnson [41], Bhagwati [10], Herberg and Kemp [34], and Krueger [47]. Some of these analyses have pointed out the theoretical possibility that it is the distortions in the factor market which are responsible for discriminating against labour employment, and for the so-called factor intensity reversal, and thereby causing a breakdown of the factor price equalization theorem in international trade. Most of these authors' solution for palliating the factor market imperfections centers about the neoclassical "first - best" prescription of tax-cum-subsidy policy on resource allocation.

19/ For a comprehensive survey of the literature to date, see S.Magee [52]. Some of the mentioned studies have concentrated on the effects of distortions in the product market as well.

The rationale underlying such a policy has been that the established equilibria in practice will be close to a Pareto optimum and welfare losses are of a second order of magnitude,[20] and that with such a policy at least welfare losses as arisen would not be aggravated.

Moreover, empirical studies on the question of monopoly power and distortions mentioned above have given an excusive attention in almost all cases to the product market at the neglect of factor markets. For developing countries, Harberger [31] was among the first (1959) to provide the estimates that the total cost of product and factor market distortions in the Chilean economy accounted for fifteen per cent of GNP. Balassa and his associates [5], on the other hand, applying a modified but similar methodoligy as Haberger's discovered that for a sample of developing countries the welfare losses due to factor misallocation did not exceed 2.4 per cent of GNP. As of late, three scholary empirical studies dealing particularly with the question of distortions in the factor market, have been published. These are the work of Dougherty and Selowsky (1972) on Colombia [20], the study by Floystad (1975) on the manufacturing industries of Norway [27], and finally the investigation undertaken by de Melo (1977) on Colombia [18]. A brief comment on each of these studies will be of relevance to our pursuit.

Both the studies of Dougherty and Selowsky and of Floystad make use of the methodology specifying sectoral production functions for primary factors of a number of sectors and

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20/ S. Magee [52], *ibid.*, p.19; H.G. Johnson [41] solving the optimum values on the supply condition, assuming product and factor prices fixed. In this way, these authors make efforts to measure the production costs of imperfections in the factor market on the basis of wage differentials across different sectors. Then, estimates of the cost of distortions in the markets for factors are evaluated by comparing actual observed sectoral factor demand and outputs with those which would occur under the optimal solution, assuming productive factors receive equal returns across manufacturing sectors. The obvious shortcomings of these studies reside mainly in the fixed-price assumption which is not realistic from the standpoint of developing economies and in the virtual neglect of possible protective effect affilialed with protection, licenses, and other restrictions on trade. In view of the predominant role of foreign trade on the resource allocation of developing countries, the foregoing analyses may be of little relevance to analysis of the factor market imperfections in the manufacturing sector of LDC's.

In the work of de Melo [18], a Walrasian general equilibrium model of resource allocation has been developed as a frame of analysis. An interesting features of Melo's model consist of the following methodological groundwork. "On the supply side producers maximize profits subject to a Leontief technology for intermediate inputs and non-competitive imports. Multi-factor Cobb-Douglas production functions are specified for value-added. All primary factors (land, skilled, unskilled labour, capital) are inelastic supply and are fully employed; factor returns are endogenously determined.-----Consumers maximize a Stone-Geary utility function which generates the linear expenditure system. Finally,-----a distinction is made between tradable goods whose prices are determined in world morkets and home goods whose prices adjust to clear their markets[21/]."

21/ J.A.P. de Melo [18], pp. 398-99.

The general equilibrium model of resource allocation expounded by de Melo has a considerable intuitive appeal and it will be partly used as an ingredient in our model. However, this model is based on the Cobb-Donglas type of production function in which the sectoral substitution elasticities are restricted to unity, and identification of the source of distortions pertaining to factor employment on this basis would be valid only if the underlying assumptions were safisfied. In addition, empirical studies on the question of distortions in the markets for factors noted in the preceding paragraphs, have revealed one common strand of thinking : these analyses have been necessitated to use indicators of various kinds as measures of labour intensity. Unfortunately, there has been as of late no general consensus among economists regarding the reliability of these indicators.

For example, capital intensity and size have a wide and continuous range and the crerrent interest in the so-called "intermediate" technology indicates clearly that no exact line exists between the capital versus labour ittensity dichotomy. Nevertheless policy makers often rely on operational indicators of labour intensity when choosing between alternative projects. The point of crucial importance is that there is probably no such thing as a true index of labour intensity, or the different indicators, often alluded to by economists. Thus, the following section is devoted to a review of these verrious indicators of factor intensity frequently used as a powerful apparatus by economists who investigate the factor market imperfections. The review will serve as a point of departure from which the theoretical model we set out to construct, as a frame for analysis of the distortions in the factor market, can be viewed in a proper perspective.

3.2 The controversy Over Indicators of Factor Intensity.

As noted in the preceding discussions, economists have devised a variety of indices to measure labour intensity in the analysis of the factor market. Available evidences suggests that the ranking of manufacturing sectors by the varying indices turn out to result in conflicting and inconsistent outcomes. (Stern; [66] . If this should prove to be the case, the investigations of factor market distortions based on the fixed price assumption and on the unitary substitution-elasticity Cobb-Douglas production function would be for off the mark. A brief comment on each of the factor intensity indicators used by these investigators will help substantiate the point that their methodologies are of little relevance to the factor market analysis .

Among the various indicators of labour intensity commonly used are the ratis of value-added per worker (V/L); the labour-output coefficient (L/Q), the share of wages in the value-added (w.L/V); the capital-coefficient (K/V or K/Q), and the capital-labour ratio (K/L). We shall consider the rationale and the assumptions involved in using these coefficients as labour (or capital) intensity with a view to clarifying their implications for analysis of the imperfections in the factor market.

The value-added per worker (V/L) is generally used by economists to differentiate between capital-intensive and labour-intensive investments, in the same way as an index of labour intensity. But on the theoretical level, it is a confusing and misleading index. For under conditions of factor substitution in the production function, the technical choice is not simply dualistic. Under such a condition, varying amounts of capital can be comfined with varying amounts of labour, and output is increased if the input of either factor is increased without a reduction in the other. Moreaver, in the production process, the objective is not simply to maximize employment as such, but to increase <u>productive</u> employment, the optimum degree of labour intensity cannot be decided upon without some criterion of efficiency and cost minimization. And, V/L is not an appropriate index of labour productivity because, as Bhalla notes, " The treatment of value-added per employee as an index of factor intensity simply implies that labour productivity is a composite index of the contribution of both capital and labour---" 17 [8; p.21]. Only under restrictive, and generally inappropriate assumptions regarding the factor market,--- fixed prices, constant factor shares, perfectly competitive, etc., can we infer that a high ratio of labour to value-added implies degree of factor intensity. Thus, this ratio should not be used as an index of labour intensity. The most conspicuous reason is that imperfections in the product markets may be responsible for productivity differences which have nothing to do with differences in the technical input requirements. Firms operating in a monopolistic market may charge high prices for their output, thereby raising observed value-added per worker, a situation which reflects a monopoly rent rather than a high contribution of labour or capital to production.[22/]

In studies regarding the manufacturing production and employment, some economists use the ratio of wages to value-added (w.L/V) as an index of labour intensity by which to rank industries. The observed value of this coefficient will become more misleading and irrelevant, when we take account of the influence of wage legislation and the role of labour union pressures which do distort factor prices and the share of wages in value-added. Thus, the ratio has little relevance to the technical relationship between the factor inputs employed in the firms and

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22/ A.S. Bhalla, ibid; On this ground N. Akrasanee's study [2], encounters a serious shortcomings because it is based on the notion that V/L is a reliable proxy for capital intensity.

the level of output. Theoretically, the share of wages in value-added can be used as a proxy of labour intensity only under restrictive assumptions of perfect competition in fuctor and product markets, constant return to scale and the elasticity of substitution of labour and capital is less than or equal to unity. In case of unitary elasticity of substitution it is well known that the relative share of wages and profits in value added will always remain constant. In the case of less-than one elasticity of substitution, the relative wage share will increase, whereas in the case of greater than one elasticity of substitution, the wage share in value added will decrease. The use of this ratio may lead to the inconsistent and conflicting results that a product technique or industry which permits labour-capital substitution and could be seemingly operated in a labour intensive manner may turn out ot have a low wage share if the elasticity of substitution is greater than one and in fact such a technique or industry operated in a capital intensive manner. 23/ In effect, the wage share ratio tells us nothing about factor intensity in case where the elasticity is one, unless we invoke the further restrictive assumptions that all firms or industries pay identical wages for the homogenous class of workers. And, in view of the unreliable information on the parameter, of the substitution elasticities, as will be discussed more fully in the subsequent section, the wage share is an inaccurate index of labour intensity.

Equally unsatisfactory is the use of capital-output ratio as an index of labour intensity. In particular, differences

23/ A.L. Bhalla, *ibid.*, p.24. A review in this section owes much to the stimulating work of A. S. Bhella.

in the durability of capital and the pattern of output yields overtive need to be taken into account. Moreover, the valuation capital is bound to raise the difficult theoretical problems. Finally, increases in output may be due to the application of better techniques. to existing plant without the use of additional capital. In short, inter-industry comparisons of capital-output ratios can be a misleading index of labour intensity.

The capital-labour ratio[24/] (K/L) is one of the most commonly used indices of labour intensity, notably in studies concerning the employment implications of technological choice. In studies relating to distortions in the factor market, The capital-labour ratio can be suitably adopted as an index of labour intensity, when imputed margical costs (or imputed factor prices) constructed for the purpose of analysis are inserted as the key arguments in the technical relationship, and when some definite form of technological change is also specified. In the manufactures in which capital constitutes the binding constraint on the prochetion process and in which labour in the manufacturing sector possesses similar skills, the K/L ratio could serve as a useful indicator of labour intensity. The clarification on our preference to this ratio will be provided in the next section.

3.3 Underlying Assumptions of Conventional Analyses: A General Critique

The preceding considerations instance the meaning attached to the conventional methodological points which an examination of the literatur on industrial planning strategies reveals. For the present we note three of the prominent methodological points implicit in the conventional theory which has been widely applied to the factor market enalysis.

24/ *ibid.*,

First, many of the theoretical and empirical studies on industrial development and employment in general and on the factor market imperfections in particular, with a few exceptions to be noted in a moment, are based on the traditional micro-economics neoclassical literature which addresses itself primarily to the theory of the firm. These studies have been concerned principally with a solution to the firm's production, factor use, price and output problems, to the virtual exclusion of the questions of capital investment and financing. The long-standing tenet of neoclassical analysis implicit in these studies has been the proposition that the employment of labour is carried to an optimum level when the marginal revenue product per unit of labour is equal to the marginal cost per unit. This same proposition applies with equal force to the utilization of capital in the firm by postulating that additional units of capital should be employed by a firm so long as the marginal product of capital is greater than its marginal cost. In short, this traditinal proposition is concerned mainly with the optimum level of factor usage, taking the prices of the factors involved as "givens".25/ Secondly, the neoclassical theory of firm, used as a groundwork in most studies referred to in the preceding section, again with some significant exceptions, has preoccupied foremostly with the assumption of "capital saturation" in that capital funds are abundantly available to the firm at the prevailing prices. Moreover, the analysis is further surrounded by ambiguities in their treatment which specifically regards 'money capital' as a factor in the production function. Acceptance of the proposition would stunt the theory into a rapid dead end.26/

25/ V. Smith [63]; R.I. McKinnon [53], ch.2 and the appendix of chapter 5.

26/ V. Smith [63], ibid., R.I. McKinnon [53], ch. 2. and references there-in.

No possibility then exists of defining a genuine enterprise optimum situation which incorporates the possibility of financial leverage and other components resposible for such an optimum. Thirdly, the neoclassical theory centers about the tacit assumption of "perfect competition" on either side of the product and factor markets. Perfect pompetition was not only an over-riding assumption that had trapped economists but if situations of perfection were observed in the real world, the description of them were to be understood as special rather than general cases. Specifically, in the economic setting of developing countries, where perfection in the capital market hardly prevails, in most literature dealing with the question of distortion in this market, the assumption of perfect competition has still been imported as a powerful tool of analytical parentage.

These basic assumptions carried from the corpus of the neoclassical theory are particularly prominent in the work of Dougherty and Selowsky [20], Fishlow and David [26], and Floystad [27], already commented on. By virtue of perfect conpetition in the factor and commodoclity markets, the degree of distortions in the factor market has been captured by an asymmetry in nebulous sectoral production conditions where diffrent combinations of factors are chosen by the firm, given the prevailing 'perfectly competitive' factor prices. Thus, in this vien, the generalization is that variations in the structure of different firms are traceable to the relative intensity of factor used. However, as the preceding discussions regarding controversy over the factor intensity suggests, the conclusion does not lead us to any meaningful implication for policy recommendation. For, the fact is that in a developing economy, various sub-sectors of industries differed not only in the exclusion or inclusion of particular factors in the production process but also in the nature of specific technology employed as reflected in production parameters, in the rate and bias of technological change, and finally in possibility of financial leverage, including the savings and investment behavior of the firm. An analysis which ignores changes in the functional distribution of income,and the foreign-trade protection effect on a shift of factor shares, will invariably be inaccurate.

Likewise, the'capital saturation' assumption cannot be accepted as a situation which correctly characterizes the capital market of developing countries. As already emphasized in the second section of the present study, protection granted for certain promoted industries as reflected in licensing imports of capital goods and other inputs and foreign technologies, and the inducement policy package such as tax and fiscal incentives, all tend to create a distortion with respect to the cost of capital. As one author concretely enunciates: "The scope for interpersonal decision making, within which the entrepreneur maximizes his utility, can usefully be reduced to three components: (1) his endowment or own capital; (2) his own peculiar productive or investment opportunity; and (3) his market opportunities for external ---borrowing over time outside his own enterprise. At a very general level, a fragmented capital market, which is characteristic of undevelopment, is one where the three components are badly correlated." 27/

In the present study, the structure of protection will be incorporated as an integral part of the analysis with a view toward capturing the financial resource constraints on Thailand's industrial structure. In particular, explicit consideration

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27/ R.I McKinnon [53], p.10.

will be given to an external capital constraint, and our analysis has shown that the optimum factor combination implied by our constrained optimization model produces an outcome which differs significantly from that of the neoclassical capital "saturation" case. Treatment of the price of labour will be similarly performed. In short, the imputed marginal cost price of a scarce resource in our ensuring analysis will be recognized as the analogue of the "dual shadow price" in the corresponding Kuhn-Tucker generalized model 28/ and of "shadow prices" thought form developed in the work of Smith, and Little and Scott. 29/ Essentially, it will be demonstrated that, on the basis of the optimization structure model of firm to be constructed in the following section, a price can be imputed only to a resource that is sufficienlly scarce to constrain the equilibrium solution value of the variables in the objective function. In this view, an appropriate analysis of distortions in the markets for factors can be expedited and a quantitative measurement of the imperfections therewith may be assessed

Finally, a brief comment should be offered regarding money capital or capital funds in the firm. In economic literature, confusion looms large over the question concerning the employment of capital and its marginal productirity. For the brevity's sake, the crux of the matter lies in the confusion as to what exactly should be regarded as the factor of production. When the concepts of theoretical economics are imported into the financial analysis of the firm, 30/ is it possible or meaningful to speak of money capital

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28/ See V. Smith [63], an appendix for the Kuhn-Tucker generalization.

29/ M.D. Little and M. Scott [50]. V. Smith [63] and M.D.Little and M.Scott: work, and recent study by M.F. Scott, J.D.Mac Arthur and D.M. Newbery [65] are the only exceptions which escape the neoclassical trap.

30/ The literature on this critical point has been extensive, but for a lucid and rigorous exposition see R.I. McKinnon [53], pp. 42-45.

as an argument in the production function and to view its marginal revenue product and its marginal costs in conceptnal terms?
In line with McKinnon [53], Smith [63] Adelman and Robinson [1], de Melo [18], Ferguson [24], among others, we take the view that money capital is not to be conceived of as a factor of production. A brief remark on the characteristics of money capital will clarify the point.

First, money capital is not a factor of production in the sense of technological production function. What distinguishes fixed (real) capital from money capital is that while the latter is homogenous, the former is not. Money capital represents a purchasing power, liquidity and financial leverage conferring on the firm the command over the asset and factor services it wishes to employ. Moreover, the terms, costs and conditions on which capital funds are made available, constitutes one of the most critical constraints against which the optimization decisions of the enterprise are to be made. The implication of money capital constraint is that the enterprise optimum decision making is a constrained decision.

Second, the firms demand for external finance or debt capital is determined not only by its usage of fixed capital but on the employment of all other productive factors with which fixed capital is combined. Analytically, therefore, the demand for money capital cannot be specified independently of the specification of factor combinations adopted by the firm.

Third, if money capital is not a factor of production, it must be necessary for our purpose to construct a theoretical framework which explicitly specifies the production function precisely on the one hand, and take account of the ways in which factor employment actually raises the demand for money capital, on the other. It follows, finally, that a direct analogy between the productivity characteristics of labour, which represents truely a factor of production, and money capital which cannot be regarded as such, does not exist in any meaningful sense.

IV. Methodological Formulation and Framework of Analyis

The preceding arguments suggest that the underlying elements of the production process of the manufacturing industries are complex and in view of the fact that the markets for factors of production, constitute an integral component of the production process, a reorientation of the analysis is required and an integrated theoretical framework must be developed. The new framework should permit an examination of the relation that the structure of a firm bears to the aggregate manufacturing industries, especially, the capital structure which with to finance a given level of total investment and employment of labour including other factor inputs. The essence of this structure of the firm analysis resides in the enterprise decision nexus, the point that will be elaborated on in the next section.

4.1 The Enterprise Decision Nexus.

The main corpus of the theory of firm postulates that the general objective of enterprise management is essentially the optimization of economic position of the firm. This may be interpreted as the maximization of economic value of the owners' investment, and in the context of the corporation it may be viewed as the maximization of the market value of the shares of common stock.[31/] Moreover, this motion of financial function cannot be understood in isolation from a larger nexus of the firms'decision making forces.

31/ V.Smith [63].

Our conception of distortion in the factor market is multidimentional in that it incorporates the interdependent forces governing the enterprise. The nexus of interdependent forces revolves around the optimum enterprise structure as reflected in the enterprise's balance sheet, which describes in money terms the positionk of the firm as of a specified moment of time, and in the income statement, which summarizes the flows of revenues and costs over the period of time.[32/] Thus, a brief review of these concepts is now in order.

(a) The Balance Sheet

As far as the balance sheet is concerned, the following remarks will clarify the operating and planning decision problems of the firm which aims at effecting an optimum structure and their financial implications.

32/ The pro forma financial statements underlying our discussion are shown in Tables A and B.

Table A. Balance Sheet

Assets	Liabilities
1. Current Assets	Current liabilities
Cash	Accounts payable
Accounts receivable	Short-term debt
Inventory	Long-term capital
	Debt
	Preferred Stock
2. Fixed assets	Owners' equity
3. Total assets	Total liabilities

Table B. Income Statement.

1. Total Sales.
2. Less: Variable factor costs
   : Fixed factor cost
3. Net Operating income
4. Less Interest on debt capital
5. Income befere tax
6. Less tax liability
7. Net income

First, the total assets of the balance sheet indicates the total investment that has been made in the firm.[33/] The asset accounts describe the ways in which the money capital funds available to the firm have been committed to investment activities with the objective of generating an income stream and the economic ualue, for the owners of the firm. It need be emphasized that assets generate income and the causation runs from the availability and acquisition of money capital to commitment to assets, to the generation of income streams, to the realization of economic values. The value of investment and the generation of income depend on the risk and uncertainty characteristics associated with the prevailing economic environment.

Second, the structure of the assets of the balance sheet describes the structure or composition of investment that has been made by the firm. This piont follows from the foregoing argument which implies that in any given economic environment, there exists more than one way in which the available money capital can be put to work in the firm. What emerges from this[34/] consideration is that it raises two questions of importance. First, is it possible to conceive of criteria to determine whether any particular combination of assets including fund capital can be viewed as the optimum enterprise, and second, can it be decided whether the management decisions, reflected in the asset composition of the balance sheet, are in fact optimizing decisions?

Finally, when we turn to the liabilities side of the balance sheet which exhibits the total money capital employed in a firm, an important perspective of analytical significance is bronght into focus. Firstly, the availability of money capital

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33/ V. Smith [63] , op.cit.
34/ V. Smith [63] , ibid; G.E. Ferguson [24] .

(assuming the accounts at book value does not differ significantly from economic values) constitutes a constraint on the investment decisions of the firm and this means the optimization process is one of constrained optimization. Secondly, by focusing attention on the liabilities side of capital employed in the firm, we are alerted to a sharp distinction between fixed capital assets one the one hand and money capital on the other. This distinction should be made explici because it lies precisely in its relevance for the relation between the theory of production and the theory of capital. As has been indicated it is held in the present study that while real capital represents a factor of production, money capital is not.

In particular, fixed capital factors consist of various asset facilities of heterogeneous type in which it is essential to invest in order to provide for operating capacity and manintaining productive process. Money capital may be used for acquisition of such fixed assets. But it may equally be used for acquisition of current assets, including liquidity. In particular, the principal information provided by the balance sheet is an information regarding the structure of the firm, the structure of investments ---the production, sales, and revenne-generating activities---- on the one hand, and the structure of its financing on the other. The sources from which money capital is obtained include equity capital or debt capital from the banking system. The prior existence of equities determines the extent of the borrowing ability of the firm. To the extent it does borrow, the firm is said to be engaged in financial leverage. 35/

35/ V. Smith [63], C.E. Ferguson [24]; McKinnon [53].

Thus, the management of the enterprise can be viewed as the task of management of the underlying income-generating process reflected in asset transformation; and, the sources of money capital by which the investment has been financed represent an optimum structure of financing spectrum. Since the requirements of capital funds bear directly on the need to support the productive process, the need for assets depends on the magnitudes and capital intensities of factor inputs employed in the firm. In this view, the demand for assets and the requirements of capital funds center on the technological potentialities of substitution between fixed capital assets and other factors in the production function and on the extent to which elasticities of substitution as exist should be exploited. The issue will be taken up in the subsequent section.

(b) The Income Statement 36/

At this initial point, we are interested in the income statement of the firm not primarily with respect for accounting conventions, but in the perspective in which it will be helpful in our analysis of the factor-employment decisions of the firm. In mathematical form the income statement may be written as follows:

$$\pi = pQ - \sum b_i X_i - rB \qquad (1)$$

Where the following notation is used.

π = net residual income to the firm

p = selling price of output per unit

36/ V. Smith [63], ibid.,

Q = number of units of output sold
Xi = quantity of units of factors employed for each factor i
bi = input cost per unit of factor
r = average rate of interest per annum on borrowed capital funds
B = total amount of borrowed (debt)money capital employed in the firm.

Equation (1) indicates that the income available to the owners of the firm is the residual of the total sales revenue minus all factor costs of production, and minus the intesest income on borrowed debt capital. If, for the time being, we invoke some qualifications, namely neglecting income tax liabilaty, dividends and retained carnings, for purposes of our analysis, it is evidnet that the residual income designated π in the equation is the "net income" of the firm.

With respect for the cost items in the income statement, the distinction between operating costs and variable costs should be noted. The variable costs involve cost of acquiring the necessary services of those factors of production whose durability does not extend beyond the period in which their services are provided. The wages paid to employed labour falls into this category. The fixed factor costs represent the total annual cost of providing the requisite amount of services of capital assets whose durability does extend beyond the period in which their services are provided. Equally significant is the fact that the fixed factor costs shown in the income statement include also those allowances for depreciation of durable assets that are necessary to maintain the asset investment intact. What has emerged from the structure of the income statement relevant to our interest, pertains to (1) the proportion of relative income share received by different agents of production including providers of debt capital, (2) the proportionate division of total operating costs between different factors of production, and (3) the net income which constitutes the true residual income to the owners of the firm; the net income differs from the operating income in that the latter being a measure of the total income-generating ability of the total investment in the firm.

At this stage, it will be useful if we pause to draw together the main threads of the preceding discussions and highlight the conceptual groundwork we have laid down. Firstly, we shall be using the balance sheet and the income statement relationships as an aid in optimum enterprise planning and in understanding the determinants and criteria that describe the optimization conditions of the firm. In this perspective the production decision nexus is concerned principally with deciding upon the optimum level of output and with the optimum combination of input factors of production which with, given the technological possibilities in the production function, the planned outputs should be produced.

Secondly, the investment problem of the firm is characterized by the optimum amount and combination of invest ments in fixed capital assets and labour and other inputs that are essential to sustain the production process in the firm. Thirdly, the financing problem is concerned with deciding on the optimum management of financing sources that should be used to finance investment necessary to keep the operating processes of the firm proceed apace.

An optimization structure model developed in the present study incorporates interdependent relations between money capital requirement on the one hand, and factor combinations employed, and thus the optimum structure of the enterprise, on the other.

In this connection, the tax incentives, fiscal inducement program, especially in the form of tax holidays, import licenses, generous investment allowances, special credit policies, indirect tax rebates, and tariff protection, all confer on particular manufacturing industries significant operating advanturing and must have direct bearing on the effective prices of factors. These effects will definitely be reflected in the demand for (employment of) the factor concerned.

4.2 The Production Function: (a) A First Approximation

In order to clarify the issues at this stage and to indicate the way in which differing thought forms, outlined in the preceding section, influence model construction, it will be useful to bring to the fore the ways in which the cooperation of input factors has been conceived to be relevant to the optimum position of the firm. Fundamentally, economists' production function has been demonstrated in detail to be analogous to the industrial engineers' technical efficiency relations (V. Smith [63]; F.M. Fisher [25]; M. Brown [11]). In considering the notion of the production function and its relevance to enterprise optimum, differences of view have emerged on at least two levels. One is concerned with the way in which money capital is to be regarded as a factor of production. We have already indicated our view on this point of difference. Another difference in theory has to do with the crucial concepts underlying factor use and factor costs which should be regarded as appropriate arguments in the production function. In anticipation of our subsequent development of the model on optimization structure,let us pause at this stage to consider the essence of the neoclassical model and examine some typical conclusions of the theory of the firm, the essence which embodies the basic assumptions alluded to in the preceding section and which will serve as a point of departure for subseqnent analysis.

The production function describes the technical relationships existing between different amounts and combinations of factor inputs per unit of time and the potential output of product during the same period of time. The typical production function may be writhen as 37/

$$Q = F(K, L, \ldots) \quad (1)$$

where Q refers to the quantity of output, and K and L......denote the different factor inputs. More precisely, these inputs, or these arguments in the production function, are normally interpreted as units of factor services. What should be emphasized, so far as this production function is concerned, is that the factors of production and the costs associated with them, are not the assets invested in the firm, but rather a unit of services the assets provide. In addition, the translation of the production function to the cost function may be effected by the flow unit costs of K and L as c_1 and c_2 respectively.

In this view, the simple model of profit maximization under conditions of capital "saturation" implicit in the neoclassical theory may be indicated. The enterprise objective of maximizing profit takes the following form: 38/

$$\pi = p(Q)f(K,L) - c_1K - c_2L \quad (1.1)$$

where π stands for the owners' residual income, the first term on the right-hand side of the equation is the total sales revenue,

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37/ The preliminary discussion on the production in the present context concentrates mainly on a general form which will be helpful for our immediate exposition.

38/ C.E. Ferguson [24] .

and, c_1K and c_2L represent, respectively, the direct costs of factor K and L.

By means of the familiar optimization, the first-order conditions can be obfained by differentiating equation (1.1) partially with respect to K and L and setting the resulting expressions equal to zero:

$$\frac{\partial \pi}{\partial K} = (p + Q\frac{dp}{dQ})\ f_k - c_1 = 0 \qquad (1.2)$$

$$\frac{\partial \pi}{\partial L} = (p + Q\frac{dp}{dQ})\ f_L - c_2 = 0 \qquad (1.3)$$

From these two equations, it must follow that

$$\frac{fk}{fl} = \frac{c_1}{c_2} \qquad (1.4)$$

The expression in parentheses in equation (1.2) and (1.3) is referred to as the marginal revenue of output. The value of this marginal revenue term will depend on the firm's selling price or its demand curve. The terms f_k and f_l in the above equations represent the partial derivatives of the production function with respect to the factors employed, K and L, respectively. They may be interpreted as the marginal physical products of the respective factors.

The optimization condition indicated in equation (1.4) yields the following statement. The optimum employment of factors will be carried out to a point where the marginal revenue product of each of the factors will be equal to its unit input price (marginal costs), assuming in this that the firm is purchasing its inputs in perfectly competitive markets, and that the unit factor cost is not dependent on the quantity of factors employed.

However, these received neoclassical results are based on the extremely unrealistic and tacit assumptions that the firm, in making its optimum production and factor employment decisions, does not confront any shortage of money capital on the one hand, and does purchase its factor inputs in perfectly competitive makets, on the other. So long as the neoclassical theory is confined to the assumptions of money capital saturation and perfectly competitive pricing in the factor market, its relevance for any enterprise optimum structure analysis is completely stultified and evacuated. For, the optimum factor input combination which can be effected by equalization of the ratio of the marginal physical products of the factors with the ratio of their unit prices, suggested by equation (1.4), holds if and only if these heroic assumptions continued to be satisfied. If these assumptions are not fulfilled, the entire picture and underlying analysis are seriously changed.

Realistically, evidence suggests that a manufacturing industry in developing countries does face not the problem of capital saturation, but a rather imperfect and fragmented capital market reflected in capital constraint,and under the capital constraint situation, the firm may decide to operate with a factor cost budget of a certain specified size, depending among other things, on the availability, the terms, and condition, of external finance.[39/] Moreover, if the arguments in the production functiob, K and L in the present context, refer to all factors employed, conceivably variable factors on the one hand

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39/ R.I. McKinnon [53], pp. 30-36; I.M.D. Little and M. Scott [50], pp. 158-160, are most explicit in analysis of the robe of external finance an the structure of firms. The role of external finance was first elaborated by I. Hirschleifer, Investment, Interest and Capital,1970, referred to in R.I. McKinnon.

and the services of fixed capital on the other, then we must recognize the unit costs of all factors as including not only the direct cost of purchasing the factors but also an imputed cost of the capital funds, the investment of which is necessitated by the factor employment. When it is realized that factor employment necessitates the investment in money capital, the effective marginal cost of a given factor is not simply the direct costs such as designated by c_1 and c_2. The effective marginal cost is then the emputed marginal cost or what has been referred to in recent literature as " shadow prices " of the respective factors.[40/] As our ongoing discussion reveals, it is the notion of shadow prices or accounting prices imputed to the productive factors that is central to the relevant determinant in the enterprise optimization decisions, and accordingly, the optimum factor employment in the production process. In this view, the principal issue pertinent to the analysis of misallocation and imperfections or distortions in the factor market will be shown to turn on the concept of effective margical costs and its imputation to the different factors employed in the firm.

4.2 (b) The General Optimization Model: A Second Approximation.

For purposes of our present discussion, we assume that in general the firm's behavior can be characterized by risk aversion. The underlying forces of risk aversion will, firm the standpoint of the firm's optimization decisions, reflect themselves in the way indicated in an equity owners' capitalization rate function. At this point, it will be our task to incorporate in our analytical models of the firm the equity capitalization rate applicable to the net carnings of an equity capital structure.

40/ M.D.Little and J.A. Mirrless [49] ; M.D.Little and M.D. Scott [50] ; and M.D. Scott, J.D.MacArthur and D.M.Newbery [65]

Granted that the level of income expectations is taken as given, the capitalization rate will vary inversely with the coefficient of variation of total capital and directly with financial leverage, or debt-equity ratio, as follows.

$$\Omega = a - b \quad D + B \quad + c\,(\frac{B}{E})^2 \qquad (2.1)$$

where E and B, respectively, denote the equity capital and the debt capital employed, and the first term in parentheses in the equation represents total capital. More generally, the capitalization rate function may be writhen in the following form:

$$\Omega = \Omega(\theta, M, F) \qquad (2.2)$$

Where θ stands for the coefficient of firm's total net operating income stream, M refers to total capital employed and F the financial leverage or debt-equity ratio. In the analysis to follow, the equity capital at work in the firm, measured at its book value, is represented by the symbol E and the debt capital by the symbol B. The money capital supply is:

$$\bar{M} = \bar{E} + B \qquad (2.3)$$

In the present context, we assume the firm possesses a given amount of equity capital in the form of self-finance, designated as $\bar{E}$. On the basis of its ownership of these funds, it will be probable for the firm to acquire a certain amount of external capital (B) by forrowing from the banks and the extent of borrowed funds depends significantly on the availability, the terms, conditions, and the costs of loan capital.

Suppose for the present that it is possible to specify a set of money capital requirements, m_1, m_2... relative to the employment of a unit of factor K,L--- respectively. Thus, the utilization of a unit of factor K requires the investment of m_1 units of money capital, and a unit of L requires m_2 units of capital funds. Thus a partial money capital requiument[41/] may be written as :

$$M^1 = m_1 K + m_2 L \qquad (2.4)$$

Moreover, the money capital requirement specified in (2.4) refers to only a partial portion of the total money capital, because it takes no account of the net working capital requirements. The working capital normally vary with thanges in the level of output, and with changes in the level of employment of the firm's productive factors. Net operating capital requirements (OM) may be written as:

$$OM = f\ (\sum piQi) \qquad (2.5)$$

where the level of the firm's output is designated as ($\sum$piQi) which for brevity's sake may be rewritten as:

$$OM = g\ (Q) \qquad (2.6)$$

Thus, a more complete statement of the firm's total money capital requirement function may be specified as:

$$M = g\ f(K,L) + m_1K + m_2L \qquad (2.7)$$

Or,

$$M = g\ (Q) + m_1K + m_2L \qquad (2.8)$$

41/ V. Smith [63], appendix; I.M.D.Little and M.F. Scott [50], pp.163-171; M.F. Scott, J.D. MacArthur and D.M. Newbery [65], ch.2.

At this stage, an analysis of our work can be seen in proper focus by bringing together the supply conditions of money capital on the one side and the firm's requirements of money capital on the other. The firm's money capital requirment function is specified in equation (2.8), and the total supply of the firm's money capital is represented in Equation (2.3). It follows, therefore, that the money capital constraint facing the firm's enterprise optimization decisions may be expressed in the following manner:

$$g(Q) + m_1K + m_2L < \bar{E} + B \qquad (2.9)$$

It will be our next effort to show clearly the manner in which the money capital constraint of inequality (2.9) influences the determination not only of the firm'a optimum money capital allocation, but also its asset investments and particularly factor combinations.

To show the precise manner of this situation, it will be assumed for the present that the amount of equity capital changes in a rather regular manner and that, on the basis of existing equity, the firm's engagement in financial leverage is augmented to some optimum level. Increases in equity may take the form of new issues of common stock or, more significantly in the environment of developing countries, may occur by means of the retention and reinvestment of current carnings.

As equation (2.3) indicates, the money capital supply (availability) function

$$M = \bar{E} + B \qquad (2.10)$$

specifies that total money capital represents the sum of equity and debt capital respectively. Moreover, by recourse to debt capital in the form of bank credits, the firm incurs an interest cost; and the average rate of interest on the firm's debt capital is interpreted to depend on the amount of debt capital incurred which may be written as:

$$r = r(B) \qquad (2.11)$$

The total interest cost in any operating period is equal to the average rate of interest on loan multiplied by the total amount of loan outotanding, namely, r (B).B.

(4.2) (c) Debt Capital and Constrained Optimization

With the incorporation of debt capital and interest costs, a novel specification of the owners' profit function is required, and it will be written as [42/]:

$$\pi = p(Q)f(K,L) - c_1K - c_2L - r(D)D \qquad (2.12)$$

On the basis of the preceding discussions, the terms included in this profit function is self - explanatory.

Our immediate task at this stage is to demonstrate the constrained optimization decisions of the firm when the debt capital variable is incorporated as an argument in the objective function. We have already specified the money capital requirements function in equation (2.4), and combining this with the capital availability function results in the money capital constraint inequality expressed in (2.9). Now, these components must be incorporated in the optimization model at hand.

42/ V.Smith [63], op.cit.

The familiar method of tackling the problem may be worked out as follws. First, define the constrained Lagrange or objective function which incorporates all of the elements discussed in the preceding paragraph. The objective function in the present context takes the form:

$$\psi = p\ (Q) f(K,L) - c_1 K - c_2 L - r\ (D).D + + \lambda \left[\overline{E} + D - g(Q) - m_1 K - m_2 L \right] \quad (2.13)$$

The case in hand is to derive the optimization conditions and determine the solution values of the decision variables in the model specified in equation (2.13). The decision variables are K,L, and D and the coefficient of the money capital constraint variable λ.

Next, differentiate equation(2.13) partially with respect to each of the requisite set of simultaneous equations for the derivation of the solution values of the variabbles, The partial derivatives with respect to K,L, and D when setting equal to zero are as follows:

$$\frac{\partial \psi}{\partial K} = (p + Q\frac{dp}{dQ})\ f_k - c_1 - \lambda\ \ g'(Q) f_k + m_1 = 0 \quad (2.14)$$

$$\frac{\partial \psi}{\partial L} = (p + Q\frac{dp}{dQ})\ f_1 - c_2 - \lambda\ \ g'(Q) f_1 + m_2 = 0 \quad (2.15)$$

$$\frac{\partial \psi}{\partial D} = -(r + D\frac{\partial r}{\partial D}) + \lambda = 0 \quad (2.16)$$

By way of solving this set of simultaneous equations (3.14) through (3.16), the solution values are obtained of the factor inputs on the one hand and the factor unit costs and the constraint debt-capital varible, on the other. On the basis of knowledge of the parameters of the underlying functions (production condition, factor input costs, and money capital coefficients), the interpretation of the solution conditions implicit in equations (2.14) - (2.16) may be explored as follows. First, let us make arrangement of the first two equations (2.14) and (2.15). From equation (2.14) it is effected that

$$R - \lambda g' \ (Q) \quad f_k \quad = c_1 + \lambda m_1 \qquad (2.17)$$

where R represents the marginal revenue of the product sold. The term in the bracket is an expression for the surplus net marginal revenue, taking account of the increase operating capital costs associated with an incuase in output. Similarly, if an arrangement of equation (2.15) is effected, we obtain the following result

$$Z - \lambda g'(Q) \quad f_1 \quad = c_2 + \lambda m_2 \qquad (2.18)$$

The interpretation of terms in this equation will be familiar from what has gone before. Next, by dividing equation (2.18) by (2.17), the equilibrium factor employment relationship results:

$$\frac{fk}{f_e} = \frac{c_1 + \lambda m_1}{c_2 + \lambda m_2} \qquad (2.19)$$

The main thrust of the arguments emerged from equation (2.19) is of crucial importence to our understanding of the interdependence between the firm production and its capital investment decisions. Specifically, in the present context, investments of money capital is not only integrated with the possible combinations of the respective factors of production, but the amount of debt capital at work is brought to the limelight as a decision variable in the optimization structure of the firm. This model exhibits a robust understanding about the manner in which the optimum usages of money capital including borrowed funds in the form of bank credits influences the asset investments, factor employment and the productive structure of the firm.

The question of considerable interest is prompted by the implication of the equilibrium value of the ratio of marginal productivities of the factors f_k/f_1, and their relative factor costs, expressed in equation (2.19). It is evident that under the conditions of capital scarcity or constraint, the textbook optimization solution of equating the ratio of marginal products to the ratio of marginal factor cost no longer holds. Rather, in the money capital constraint case, the equilibrium condition may be indicated as follows:

Firstly, the outcome of the optimization decisions of the firm has been one of equating the marginal revenue product to the effective marginal cost of the factor, and this effective marginal cost of the factor is separable into two components. One component represents the direct unit cost c_1 and the other component, captured in the term $\lambda\, m_1$, will turn out to be the imputed capital cost. As it stands, the imputed capital cost is simly the money capital requirement coefficient m_1 multiplied by the capital constraint variable coefficient λ. Secondly, the factor combinations adopted by the firm under the capital constraint condition will differ significantly from that in the capital saturation case, Thus, the imputed capital cost pertaining to the capital constraint will induce a change in the optimum factor combinations, and the extent of substitution of one factor for another will be accordingly altered. By comparing equation (2.19) with the condition (2.6), it will be evident that f_k/f_1 in the capital constraint case is lower than in the capital saturation case. Specifically, this must be true, if the following expression holds:

$$\frac{c_1 + \lambda m_1}{c_2 + \lambda m_2} < \frac{c_1}{c_2} \qquad (2.20)$$

Only in perfectively competive factor markets, where

$$\frac{f_k}{f_1} = \frac{c_1}{c_2} \qquad (1.4)$$

as shown in the preceding section (equation 1.4), will the neoclassical optimum condition holds, that the equilibrium employment of factors will be carried out to a point where the marginal revenue product of each factor equal its unit input prices. Thus, equation (1.4) is a special case for the general condition expressed in equation (2.19). The concept of imputed capital cost or shadow prices will be taken up in section (4.3)

Appendix : Aspecial Case

It should be noted in this context that if the net operating capital and debt capital are given and fixed, equation (2.9) will become

$$m_1K + m_2L = \bar{E} \qquad (3.1)$$

in which case when we have solved the simultaneous system we would obtain the solution values of the of the factor inputs and the Lagrangian variable λ . We are intensted now in the economic interpretation of this variable. By proceeding in the same manner as the foregoing operations, we have

$$\frac{\partial \psi}{\partial \lambda} = \bar{E} - m_1K - m_2L - = 0 \qquad (3.2)$$

where as already noted the net operating and debt capital are taken as given for the moment.

By the ways of taking the total differial of this equity capital constraint condition,

$$dE = \alpha dK + \beta dL \qquad (3.3)$$

The firm's profit function in the case of given operating and debt capital will take the form

$$\pi = p(Q)f(K_1L) - c_1X - c_2Y + \lambda\ \bar{E}-m_1K-m_2L \qquad (3.12)$$

in which case, it can be shown that at the solution values of this optimization model, the following condition holds:

$$d\pi = \lambda(\alpha dK + \beta dL) \qquad (3.5)$$

$$\frac{d\pi}{dE} = \lambda \qquad (3.7)$$

Thus, the definition of λ turns out to be equal to the derivative of the firm's prefit function with respect to money capital. The economic interpretation of this variable is that it is the marginal efficiency of money capital.

Chapter II

2. Development of the Shadow Pricing Model

2.1 Introduction

The preceding discussions suggest that for the mixed and free enterprise economy of Thailand especially the manufacturing sector, the evaluation of business investment, production, gross private profits, the costs of capital and the social rate of return, etc. on private projects should be expedited in its proper perspective, that is, the "shadow pricing" thought forms. The main objective of the present section is, therefore, to make an assessment of the Thai manufactures in these terms. The analysis will shed light on the value - added at the world price compared with that at the domestic price, the wage rates, the private profits, the costs of capital, etc. at the world price in comparison with the domestic price setting.

In making an appraisal of the Thai private manufacturing production, capital investment, factor prices, and rate of returns, etc., we would need to resolve the problem of valuating income payments accrued to the private firms of at least two forms. One portion relates to those which increase their incomes which constitute extra income or surpluses and not payments made in any way of return of goods and services, since the latter include a compensation for loss of output had it been employed in alternative activities. The other portion centers on the payments for the hire of capital. Specifically, an evaluation of the private puterprise over the period under consideration is concerned with three related issues. First, we need to estimate of the accounting ratio for extra income accruing the private firms in the industry. Second, we develop a framework which assists us in appraising the private industrial sector performance. And, third, we will construct a procedure which facilitates an estimate of the accounting ratios of indirect input of private capital, i.e. imputed interest rate, depreciation, including the accounting ratio of wage rates.

2.2 Formulation of the model.

To construct a model which captures what has been explained above, we will ask the question what happens when the government provide extra - profits or surpluses of one baht (unit of currency) for the private company. Certainly, the company in question will allocate the surpluses accrued in three forms : one portion of extra income, t, would flow back to the government as direct taxes on profits and dividends, another fraction, s, is saved as undistributed or retained carnings and net lending to the company by shareholders, and the remaining pertion, c, is used for consumption by the company owner. Thus, it must be true that

(1) $c + s + t = 1$

The existence of extra-savings made by the company to the extent of s, however, does not mean that the private business investment must necessarily equal this fraction. In fact, extra private investment will generally be greater than s, assuming that all the savings are reinvested for the following reasons. Firstly, by virtue of investment in fixed capital, the company is entitled to investment allowance in accordance with that specified in the investment promotion act; assume that the firm is permitted to write off a fraction of (a) of eligible investment which equals a proportion (v) of the total and it saves tax at the rate t_1. Thus, if the rate of extra investment is k, it follows that the total tax saved will be k vat_1 and obviously k exceeds s to this extent. Secondly, the extra savings mean an increase in the equity value of the enterprise and this permits it to borrow from the banking system, say, a fraction (b) of gross investment which is related to its book value of fixed assets. If the company's gross investment is financed by the banking system to the extent of b, then, [M.D.Little and M. Scott [50] ,ch.6,]

(2) $$k(1 - b - vat_1) = s$$

or

(3) $$k = ms$$

where $$m = \frac{1}{1-b-vat_1}$$

Assume that the rate of profit net of depreciation but before tax is r (and that true depreciation and depreciation for tax perposes coincide, the extra investment k generates a stream of profits rk, and after deducting interest payments on bank loans (at the annual boan rate of i) amounting to ibk, a fraction of (r - ib) k is left. Of these a fraction s is saved and ms will be reinvested in the enterprise, to the effect that the equilibrium capital growth will be

(4) $$g = ms(r - ib)$$

where g is the growth rate of capital investment, and r and i are, respectively, real rates of return and interest prevailing in the market. So far we have dealt with market values of the relevant parameters. Now, we turn to values at <u>accounting</u> prices. Suppose the accounting ratios for capital goods invested in the company is designated, f_k, that for consumption of capitalists is f_c, and that for extra profits is f_p. It should be noted that in view of the notation given in this context, the capital stock k produces rk profits at market prices and $rk.f_p$ at accounting prices, and that f_p is the ratio of profits at accounting prices to their actual value at market prices. Of this rkf_p, the fraction (r - ib) k is attributed to share - holders and the companies' consumption will be c(r - ib)k ; and the social cost of the use of resource in this connection is

(5) $$ck(r - ib)\ f_c$$

If the company is to grow steadily at rate g, the remaining profits will be reinvested and generate investment at the rate gk. The social cost of this resource utilization for investment is gkf_k. Thus, it follows that, as a result of extra investment k, the social benefit which accrues in the year is

(6) $$B = rkf_p - ck(r-ib)f_c - msk(r-ib)f_k$$

This equation implies that the benefit accruing in the period is what remains from the extra profits at accounting prices after extra companies' (capitalists') consumption and extra private investment have been deducted from it,profits these being valued accounting or shadow prices.

In view of the fact that a large part of the benefits of private investment will be generated in the future as profits are reinvested, the present value of a stream of social benefits growing as a result of reinvesting profits depends on the difference between the accounting cost of capital (R) and the rate of capital growth. It was emphasized above (4) that the benefit grows at the some rate as k, namely, at the rate of

$$g = ms\ (r-ib)$$

Thus, its present value, when discounted at the accounting rate of interest, is

$$(7) \qquad V = \frac{B}{R - ms\ (r - ib)}$$

where R is the effective or accounting rate of interest, or the rate of discount.

At this point, we are in a position to bring together the various elements of the total cost of paying out an extra unit of currency to a private company, measured at accounting prices. This cost is the accounting ratio we seek to determine: it consists of direct extra consumption of the company plus cost of direct extra private investment less net present value of social benefits flowing from that extra investment. Thus, the net social cost of payments of one pecuniary unit, which will be referred to as the accounting ratio for companies' extra income is

$$(8) \qquad z = cf_c + kf_k - V$$

or, writing in full form

$$(9) \qquad z = cf_c + msf_k - \frac{ms(rf_p - c(r-ib))f_c - ms(r-ib)f_k}{R - ms(r-ib)}$$

The meaning of this equation is straight-forward in view of the foregoing analysis. That is, the accounting ratio of private extra income net social cost, discounting at the total costs and the total benefits associated with the transfer of one -nit of currency to the private company.

Next, we need to provide for the social rate of return on private investment which will be belpful for the government to decide whether to alow a proposed private project (investment) to go alead and to estimate an appropriate accounting cost of capital (ARI). In pursuit of this, we begin by estimating the accounting ratio of private investment, designated by Ω. The accounting price of private investment is the cost of one unit of currency the company invested in capital goods, f_k, less the benefit general per unit of currency worth of investment. Thus,

$$\Omega = f_k - \frac{B}{k\ (R - g)} \tag{10}$$

Alter natively, this may be rewritten as

$$\Omega = \frac{\Omega - cf_c}{k}$$

$$\Omega = \frac{Rf_k + c(r-ib)f_c - rf_p}{R - ms(r-ib)} \tag{11}$$

Further, the accounting price of saving will be calculated as follows. A unit of saving, as seen from the preceding discussion, leads to m units of investment, the accounting price of private saving is

$$fs = m\,\Omega = \frac{m}{k} (\Omega - cf_c) \tag{12}$$

where k = ms from equation

In other words

$$\Omega = sf_k + cf_c$$

indicating that the social cost of profits equals the sum of the social costs of the fractions saved and consumed.

In calculating the social rate of return to private investment, the next step involves finding the social value of one unit of net private profit (before tax). To convert private profits A P_s we multiply by the appropriate accousting ratio for f_p. The net social value in this connection will constitute the profit at the accounting prices less the social cost of the profits attributable to equity which is designated in the preceding discussion as (r - ib)/r, and their relevant social cost per unit is Ω . Let us refer to this ratio of the value of social profit to its value at market prices, f_π , then

$$(13) \qquad f_\pi = f_p - \left(\frac{r-ib}{r}\right) \quad Z$$

In view of the equations (8) and (9)

it may be verified that

$$(14) \qquad f_\pi = \frac{R}{R-g}\left[f_p - \left(\frac{r-ib}{r}\right)(cf_c + kf_k)\right]$$

$$\text{Or} \qquad f_\pi = \frac{RB}{kr\ (R-g)}$$

If we look at equation (10)

$$f_k - \Omega = \frac{B}{k(R-g)}$$

and from equation (14) f_k • can be substituted, from which the following results.

$$(15) \qquad r_s = R,$$

where r_s is the social rate of return which is equivalent to

$$(16) \qquad r_s = \frac{rf_\pi}{f_k - f_f/m}$$

where f_f is the accounting ratio for finance which equals the cost of private saving, f_s. The expression (16) indicates that, other things being equal, private investement made by companies in the manufacturing sector which is switched from similar other investment in the economy has a zero net present social value discounted at the accounting rate of interest which implies that such an action confers no additional social benefits to the economy. What will be the value of the accounting ratio for interest rate will be taken up in the next section.

2.3 The accounting rate of interest (ARI)

During the past three Five-Year plans , the Thai Government has not been conscientious about the use of shadow price as a measure of resource cost and benefit, and the appraisal of public projects has been made using rule of thumb (W.A.McCleary, and M.Allal and B. Nilsson, Equipment Versus Employment : A Social Cost-Benefit Analysis of Alternative Techniques of Feeder Poad construction in Thailand, ILO, 1976, pp.45). To evalurate the private sector performance consistenlly, the imputed or accounting prices of capital goods must be taken into account. The preceding discussions intance that the various accounting ratios for private gross profits, for savings, the social value of net profits, and the social rate of returus, all contain the factor

$$R/(R-g) .$$

We need to obtain the information regarding the growth rate of capital investment, and the rate of reinvestment to arrive at the estimate of the shadow rate of interest (SRI). Since, the foregoing analysis indicates that the rate of return on private investment is determined by rf_p/f_k, where rf_p is the profit rate at accounting prices resulting from one unit of capital at market prices, whose accounting price is f_k. Thus, for the marginal project undertaken which receives this level of profit, it must follow that the accounting cost of capital would be rf_p/f_k.

If the government transfers this amount of funds to the private industries which use the funds in the most efficient manner, the social costs pertaining to this allocation of funds were negative, that is, Z turns to be negative. On the other hand, if the government does not believe that subsidies (free gifts) are socially efficient, it follows that Z must be positive. That is, in case R is greater than g, the value of Z will be positive, as can be verified from equations (4.10) and (4.11) if

$$(17) \qquad R < \frac{rkf_p}{cf_c + kf_k}$$

The minimum rate of discount at which the government will not make free gifts to the private company is denoted by the right-hand-side expression (5.17). Thus, the valuation of the accounting rate of interest would depend essentially on

$$(.18) \qquad \frac{rf_p/fk}{1+cf_c/(msf_k)} < \frac{rf_p}{f_k}$$

If it is assumed that the government were able to undertake projects as efficiently as the private company, the ARI or the accounting cost of capital would be rf_p/f_k. The factor $1/1+cf_c/(msf_k)$ would represent a critical limit below which the government should abstain from undertaking productive investment.

2.4 Shadow Wage Rate (SWR)

In a evaluation of private manufactures' performance, the conceptual idea lies in the possible divergence between the market wage rate paid to an additional worker on the investment of the industries and the actual value of output foregone elsewhere resulting from such employment. The differential arises if the economy as a whole experiences unemployment of some forms. In case of open unemployment, hiring an additional worker by the private firms will lead to a reduction in unemployment and thus output foregone is nil. In case of under-employment in the traditional (rural) sector, to migration of a worker to seek for jobs in the manufactures would not cause a decline in total farm production and hence the opportunity cost is negligible. In both cases, the actual wage rate paid by manufactures overstates the cost to the economy, reckoned in terms of accounting or shadow wage rate. And, controversy persists on this issue. In an appraisal of the **Thai** manufacturing sector, we follow a shadow wage rate model (introduced by Little and Mirrless Manual of Industrial Project Analysis in Developing Countries, Vol. II, O.E.C.D. 1971, pp, 157 - 76, and M.C.Scott, J.D. MacArthur, and D.M. Newbery [65], ch.4).

The conceptual idea centers on the following expression

$$(17) \qquad SWR = C - \frac{1}{S_O} (C - U)$$

Where C = consumption of urban worker; U = maginal productivity of rural worker

S_O = ratio of the value of savings to consumption

The expression holds when a further necessary condition is satisfied.

$$(18) \qquad S_O = P^{inv} = \frac{u(1-s)}{R - q.}$$

and,

$$(19) \qquad q = y - wn$$

where the additional notation is as follows:

w = the wage bill per unit of investment
q = the marginal productivity of capital
S = the average marginal propensity to save
R = the rate of discount
y = increment of value added per unit of investment
n = increment in imployment per unit of investment

Equation (17) indicates that the accounting wage rate consists of two components; i.e. the marginal productivity of labour or the output foregone and the additional consumption of the worker migrating to the industrial sector which constitutes an indirect cost to the society; and the second part which implies that the increase in consumption of the worker at the expense of a tax-payer's savings represents a resource cost as well. In view of the availability of data pertaining to the censuses on the manufacturing sector, we will make efforts at obtaining these parameters which will occupy an important part of our analysis and evaluation of the relative factor share and the employment generation during the periods under study.

2.5 Empirical Estimates For Thai Manufacturing

2.5.1 Accounting Ratio for Profits and Capital

The parameters appear crucial, in the preceding section, for the estimates of various accounting prices are of two categories.

The first set of parameters depend importantly on the structure of business taxes and tariffs, and include not only tax rates and allowances such as t, a, t_1, but also the accounting ratios, f_k, f_c, f_p. The remaining set of parameters may be designated constants, chosen by the behavior of the business industies.

The accounting ratio for business (capitalist) consumption can be estimated assuming that this income - groups have the same pattern of consuming behavior as middle-income consumers in Bangkok-Thonburi (metropolitan) areas. The method of calculation is similar to that reported by P. Thammatinno [80] which provides for a value of capitalist consumption of the order of 0.82 for the year 1969. We shall have to accept this value as a proxy the accounting ratio of marginal capitalist consumption for Thai manufacturing applicable to the years 1971, and 1974.

Equation (9) should serve as a basis in determining the accounting ratio for private gross profits accruing to various sub-sectors of the Thai manufacturing industries. For our purpose the entire manufacturing industries, in the census years 1971 and 1974, from which data from Censuses of Manufactures have been reported and reliable, are divided into 26 sub-sectors, as shown in Tables 2.1 and 2.2. As indicated, the division criterion is based on the characteristics of industries and the number of sample which should cover at least 14 observations. The characteristics of these sub-sector industries certainly differ in regard to the proportion of income saved, being taxed, accounting ratios pertaining to their profits, rates of return on rein vestment, and so on. Unfortunately, it has not been possible in the present study to provide detailed and rigorous analysis of all of the necessary data. We have to rely on some preliminary estimates to derive rough orders of magnitude of the crucial parameters, as published by McCleary, et.al. [52.a] and so.on. At any rate, these estimates should be relevant and important in any evaluation of a private sector enterprise in Thai manufacturing.

The values required to estimate Z in equation (9) are presented in Table 1.

Table 1

		(1) Average rate of return	(2) marginal return	(3) Comment (See notes)
1	Fraction of profits consumed	.22	-	reliable
2	Fraction of profits saved, s	.22	-	NESDB&BOT.
3	Fraction of profits taxed t	.50	-	Lent,
4	Fraction of investment financed via book b	.20	-	NESDB&BOT
5	Loan rate from banks, i	.10	-	BOT
6	Fraction of business investment grant v,	.70	-	Lent
7	Rate of investment grant, a	.20	-	Assumed
8	Corporate tax rate t_1	.15	-	Lent
9	Accounting ratio for con. f_c	.82	-	reliable
10	Accounting ratio for capital, f_k	.90	-	reliable
11	Accounting ratio for profits, f_p	.85	-	see table2.1,2.2
12	Private rate of return	.20	.25	see tables2.1,2.2
13	Accounting rate of interest, R	.10	.15	McCleary, etal.
14	Z	.12	.26	
15	Accounting savings ratio	-.27	.04	

Note : Basic information pertaining to these estimates are derived from, Asia Corporate Profits and National Finance, Asia Finance Publications Ltd., 1977; data on Thailand, pp. 268-84.

Notes: NESDB, and Bank of Thailand, W.A.McCleary, etal. Flow of-Funds Accounts of Thailand, 1977; G. Lent, Texation in Thailand, 1974, memeographed, np.35-39; BOT. Monthly Bulletin, various issues.

It should be emphasized that the accounting ratios estimated for profits, f_p, vary quite considerably, depending on the characterestics of the sub-sector of industry groups, and it is negative in some cases, where heavy protection was provided as illustrated in the Table 2.1, and Table 2.2. The value of .75 is an average for a subset of the Thai manufacturing industries as reported in the 1971 and 1974 Censuses of Manufactures. The procedure of arriving at this accounting ratio is as follows. We first estimated value-added at domestic and world prices for all sub-sets of Thai manufacturing in 1971, and 1974, and similar treatment applied for wage cost. That is, the latter were converted to world prices and then subtracted form value added at world prices using Corden's effective tariff formula (Corden [16]), and more will be said about the shadow wage rate in the latter section. Essentially, what we have done is to obtain estimates of the average degree of nominal protection tariff applied to different groups of manufacturing industry for 1971, and 1974, and also estimates of the average effective rate of profection received by such groups of industry, and value added at domestic prices and at world prices, according to the familiar Corden's method of effective calculation is,

$$e = 1 - \frac{\Sigma WVA}{\Sigma DVA}$$

where WVA denotes value added at world prices and DVA is value added at domestic prices, and e is a measure of effective protection, The values of the relevant variables are shown in Table 2.1

and Table 2.2, for 1971 and 1974, respectively.

In an evaluation of indirect capital inputs'including depreciation allowances, the ideal way is to analyze a full discounted cash flow of an industry or firms. However, at present, it is not possible to obtain the relevant data on the industry's or firm's profit and loss statement. In regard to indirect capital inputs M.Scott, J.MacArthur and D.Newbery, ([65], ch.6) have provided an ingenious method of calculation. In essence, capital inputes were decomposed into five major categories with the assumed lives and obtained their annuities discounting at the accounting rate of interest at 10 per cent per year, and for illustration, we quote these authors:

	Lifein years	annuity %
1. Building and construction	40	10.2
2. Machinery and equipment	14	13.6
3. Vehicles	6	23.0
4. Stocks	infinite	10.0
5. Furniture	14	13.6

Source: M. Scott, et al. [65], p.142.

The next step to arrive at the percentage composition of gross profits was to multiply the pereentage of each asset by its annuity rate. The annuity of each asset was multiplied by an accounting ratio for that asset, the result of which would be the weighted average accounting ratio we wish to apply to private gross profits. These authors proceeded to illustrate that assuming the present value of capital asset of an homogenous type with life of T years and whose accounting ratio being f_k, profits at market prices of 1 plus depreciation allowance d, so that gross profits at market prices is 1+d, and suppose f be the true accounting ratio which should apply to gross profits. Then the problem is to make the true net present social value of the costs in employing capital asset for T years equal to the net present value of paying f(1+d) for T years. Assuming all depreciation allowances are saved, the true cost of hiring capital each year is

$\frac{(r-ib)}{r}(cf_c+sf_s)$ and to its net social value we need to add the social cost of original capital investment, ie.K at market prices. As shown in the preceding section, this latter social cost is

$$Kf_k - \frac{Kf_f}{m} .$$

It can be shown that the net present value of amount 1 for T years discounted at the accounting rate of interest (ARI) annually, and net present value of the same amount for T years discounted by the private rate of discount, r_d, are related as follows, denoting the relation, xi

$$x = \frac{(1-\frac{1}{(1+r_d)^T}}{1-\frac{1}{(1+R)^T}} \quad ; \text{ where } x = 1, \text{ if } r_d=R.$$

where, it should be noted that $r_d = (r-ib)/(c+s)m$. That is,the private discount rate is given by the ratio of profits net of tax, interest and depreciation. If the value of depreciation allowance is known, say one-third of net profits, with the known values reported in Table 1, it turns out that f_k can be calculated to have the value of 0.90, and depending on the value of x, the estimated value of the true accounting ratio applying to gross profits will range from 0.84 to 0.94 if we assumed that the capital provided is switched from investment in other activities in Thailand. However, if we assunec that the capital provided constitutes some kind of new savings of the private business firms in Thai manufacturing, the true accounting ratio for gross private profits will range form 0.30 to 0.38, in which case the costs of indirect capital will be over-stated. In effect, we choose to work with the value 0.90, in view of the small charecteristics of Thai industry and of the fact that profits bear little tax burden.

Table 2.1: Value Added, Fixed Capital, and Wage Share at Marketing and Accounting Price For Thai Private Manufacturing, 1971 (in thousands of baht, except Labour) 1971

Industry Group	DVA (1)	L (2)	DW (3)	rK (4)	rKF (5)	WVA (6)	WF (7)
1. Meat products, Dairy, & food products, nec.	144,250	2,753	32,617	287,705	180,475	180,732	237
2. Canning & preserving of fruits & vegetables, fish canning etc.	8,471	608	2,630	11,432	9,984	10,036	52
3. Vegetable, animal oils & fats; prepared animal feeds,	47,756	1,126	10,627	104,169	3,510	53,582	72
4. Grain mill products. Bakery product.	79,062	2,580	21,046	113,453	31,961	32,187	226
5. Sugar factories & refineries. Cocoa, chocolate & suger confectionary.	743,090	4,893	43,911	615,536	155,052	155,137	85
6. Distilling, rectifying spirits soft drinks & carbonates Tobacco.	16,445	10,683	263,071	799,567	83,685	83,825	140
7. Thread and yarn	862,845	28,084	287,665	2,795,903	622,421	622,846	425
8. Made-up textile goods Knitting mills (outer wears) Carpet and rugs, cordage & rope	197,600	5,670	39,805	140,712	53,740	53,855	114
9. Wearing apparel. Leather products. Footwears	82,764	3,136	32,997	91,693	9,581	9,737	156
10. Sawmills, planing & wood, textile fabrics	253,197	4,089	51,212	179,045	46,205	46,504	299

Table 2.1 (cont.)

Industry Group	DVA (1)	L (2)	DW (3)	rK (4)	rKF (5)	WVA (6)	WF (7)
11. -Furniture & wood products	14,328	670	7,353	17,995	8,745	8,886	132
12. -Pulp, paper and paper board -Containers, boxes of paper -Paper products, nes.	1,181,660	3,694	45,452	486,838	83,380	83,545	165
13. -Printing, publishing dallied ind.	83,862	4,370	39,793	97,749	24,977	24,946	179
14. -Basic industrial chemicals. -Manf. of fertilizers	113,666	1,713	16,418	556,775	86,256	86,482	226
15. -Paints & lacquers. -Drugs and medicines -Manf. of chemicals, nes.	99,515	4,278	40,098	26,155	75,864	76,072	208
16. -Soap and other toilet prep,n.	116,164	1,761	25,554	85,920	110,007	116,156	149
17. -Tyre and tube in dustries -Other rubber products	315,734	4,792	73,276	552,748	271,825	272,142	317
18. -Manf. of plastic products, nes.	321,242	2,425	73,867	1,513,896	277,654	269,382	153
19. -Pottery and earthenware -Structural clay products.	17,691	3,928	8,694	470,969	10,252	10,284	32
20. -Glass and glass products	900,373	2,859	34,428	323,748	47,272	47,304	34
21. -Cement, lime and concrete products -Non-metallic mineral products.	805,273	6,771	97,996	974,218	484,610	484,761	184
22. -Primary metal products -Iron & steel -Non-ferrous metal	105,379	1,863	33,277	430,596	90,453	90,542	89

Table 2.1 (cont.)

Industry Group	DVA (1)	L (2)	DW (3)	rK (4)	rKF (5)	WVA (6)	WF (7)
23. -Cuttery tools -Furniture, fisture, primarily metal -Structural metal products. -Fabrics metal except electrical machinery	232,114	3,721	34,596	188,578	188,125	188,548	423
24. -Agricultural machinery -Special industrial machinery -Other non-elect machinery & equipment.	24,505	832	7,650	19,193	22,976	23,081	105
25. Slip building and repairing; car assembly. -Railroad equipment -Auto - assembly -Motorcycles and bicycles.	260,186	7,772	93,907	237,989	153,059	157,245	186
26. -Jewellery related articles -Musical instruments. -Sporting, athletic goods & other mis.	7,000	434	3,246	9,226	272	297	25

Notes and Sources: (i) Sources, same as table 2.1, 2.2.

(ii) DVA = Value added at domestic Price; L= member of workers; DW= wage billat domestic price

rK = gross profits at domestic prices; rKF = gross profits at world price;

WF = wage bill at world price.

Notes and Sources for Tables 2.1, and 2.2

Column (1) : The data are form Censuses of Manufactures, 1971, and 1974, respectively; DVA donotes value added at domestic prices; National Statistical Office.

Column (2) : Employed workers, from Censuses of Manufactures, 1971, and 1974, sespectively, National Statistical Office.

Column (3) : Total wage bill at domestic prices, from same sources, as (1) and (2); it is w.L.

Column (4) : Book value of fixed capital in private manufacturing, valued at domestic prices, from the same source as column (1) and (2)

Column (5) : Estimates of value of fixed capital at world or foreign free trade prices, derived from deduction of Col. (7) from Col. (6).

Column (6) : Estimates of value added at world or accounting prices (WVA), derived from Corden Formula for rates of effective protection:

(i) $$t_e = \frac{DVA - WVA}{WVA}$$ where t_e = rate of effective protection.

(ii) $$t_e = \frac{DVA - WVA}{DVA}$$, see W.M. Corden [16].

Column (7) : Estimates of the wage share at world price (see text).

Table 2.2: Value Added, Capital and Wage Share at Marketing and Accounting Prices, for Private Thai Manufacturing, 1974. (in thousands of baht, except Labour)

Industry Group	DVA (1)	L (2)	DW (3)	rK (4)	rKF (5)	WVA (6)	WF (7)
1. -Meat products -Dairy products & Food products, nes.	469,354	3,029	31,876	431,500	67,688	68,024	335
2. -Canning & preserving of fruits & veg -Canning, fish, similar food. -Food preservations.	30,451	2,581	11,290	133,316	30,956	31,019	63
3. -Vegetable & cenimal oils & fats.	8,585	728	4,657	22,207	35,124	35,182	58
4. -Grain mill products. -Bakery (Flour) products.	41,228	3,738	14,551	58,535	33,050	33,234	184
5. -Sugar factories & refineries. -Cocoa, chocolate & sugar prod.	323,713	5,406	47,475	668,843	190,339	190,415	76
6. -Distilling, rectifying spirits -Malt liquors. -Soft drinks	1,362,593	7,562	147,257	417,361	189,277	189,485	208
7. -Thread and yarn.	1,828,785	45,211	300,633	3,249,804	1,067,386	1,067,885	499
8. -Made-up textile goods. -Knitting mills (outer wear) -Carpet and rugs -Cordage, Ropet, Twine & allied -Manf, textiles, nes.	101,908	5,542	43,988	253,129	87,596	87,715	119
9. -Wearing apparel -Leather products, Footwear.	139,331	5,165	36,522	149,293	102,268	102,401	134
10. -Saw Mills & textile frabries	158,472	7,090	66,729	285,856	140,092	140,424	332

Table 2.2 (cont.)

Industry Group	DVA (1)	L (2)	DW (3)	rK (4)	rKF (5)	WVA (6)	WF (7)
11. -Furniture & wood products	37,491	1,408	9,523	83,749	20,627	20,707	80
12. -Pulp paper and paperboard. -Containers, boxes of paper. -Paper products, nes.	248,289	3,121	41,171	503,257	187,146	187,275	126
13. -Printing, publishing.	99,645	4,049	84,438	115,471	112,219	112,530	311
14. -Basic industrial chenicals. -Manf. of fertilizers -other chemical products.	2,806	2,806	22,776	990,333	162,751	162,919	168
15. -Paints -Drugs and medicines -Manf. of chemicals, nes.	197,010	8,162	93,238	260,395	954,685	255,252	576
16. -Soap and other toilet prep'n.	71,375	2,176	24,183	79,454	534,050	534,175	125
17. -Tyre and tube industries. -Other rubber products.	69,443	3,031	54,065	440,678	33,389	33,532	143
18. -Petroleum refineries. -Miseellaneous petrolium prod. -Manf.of plastic prod., nes.	310,022	1,767	75,577	793,691	47,657	47,212	155
19. -Pottery and earthenware -Structural clay products.	52,636	3,776	21,423	225,311	27,865	27,930	65
20. -Glass and glass products.	144,834	5,490	74,924	1 229,338	83,663	83,727	64
21. -Cement, Slabed lime and plaster. -Non-metallic mineral products.	239,357	2,313	29,871	700,198	154,981	155,116	135

Table 2.2 (cont.)

Industry Group	DVS (1)	L (2)	DW (3)	rK (4)	rKF (5)	WVA (6)	WF (7)
22. -Primary metal products : Iron & Steel. -Non-ferrous metal	308,830	4,604	97,418	912,017	80,154	80,319	165
23. -Cutlery tools. -Furniture, fixture, primarily metal. -Structural metal prod. -Fabrics metal except machinery.	298,169	8,280	103,181	579,579	167,000	167,304	713
24. -Agricultural machinery -Metal & wood working machinery -Special industrial machinery -Office computing & accounting equipment -Radio and communication equipment. -Other non-clectric machinery	296,020	5,129	53,651	481,992	132,504	132,719	215
25. -Ship building and repairing -Railroad equipment -Motor vehicles, Motorcycles and bicycles, Aircraft -Transportation equipment.	370,522	6,783	151,424	302,199	241,061	241,413	352
26. -Jewellery, related articles -Sporting, athletic goods and Instruments & related products of & Other miscel. products.	9,686	900	5,774	14,683	6,710	6,741	31

Notes and Sources :

See Notes, see Table 2.1, 2.2

2.5.2 Accounting Ratio for MP of Labour

In these Tables, the average marginal private rate of return in real terms in the years under consideration was 25 per cent which implies that the accounting rate of interest would be at least 15 per cent, The estimation of the value of capital is a complicated matter and is beyond the scope of this study. However, the estimates in Tables 2.1, and 2.2 illustrate that due to protection which accorded financial advantages to the various sub-industries, capital employed in these manufactures has been distorted, evaluated on the basis of world price criterion, to the extent of 15 percent to 20 per cent.

In regard to wages in the manufacturing sector, we estimate the shadow cost of skilled labour by using the method describeel in section 5.3. We have to obtain the value of labour's marginal product at accounting prices and we have to estimate the net social benefit or cost resulting from the transfer of incomes when its wages are bid up. In an imperfect market with marginal revenne below price, the value of skilled labour's marginal product will be, from the labour's view-point, less than the value of its warginal product times the price of that product. The marginal product of skilled labour may be the output of the relevant industry, but it may equally be the saving of other inputs into that industry. Skilled labour may substitute for unskilled labour, for capital, and for raw materials, etc. In other words, if more skilled labour is employed to produce more out-put, it may require more capital and less skilled labour. Thus, it is difficult to estimate the marginal product (MP) for skilled labour.

[65] It has been shown (M.F.,Scott, J.MacArthur, and D.M.Newbery ,pp.180-185) that the short-cut method, assuming that employing skilled labour increases gross output directly such that the value of its marginal product times its price equals the wage, the estimate of its marginal product at accounting prices, is $MP_1^* = \frac{1}{1 + t_n}$

where t_n is an average nominal tariff. On the other hand, if a business firm or industry employes more skilled labour which increases value-added, the accounting value of labour's marginal product will be

$$MP_L^* = 1- e = 1 - \left[1 - \frac{\Sigma DVA}{\Sigma WVA} \right].$$

Nonominal and effective protection rates are shown in Tables 3.1 and 3.2. The empirical results on imputed wage rate reported in Tables (2.1) (2.2), in which the wage share at world prices (WF) has been estimated for 1971 and 1974. It is evident that the over-all distortion with respect to wage cost was on the order of magnitude of 30 per cent of the market wages for 1971, since in this year the over-all nominal manufacturing tariff was 71.2 percent and the over-all effective protection was 16.8 per cent. Thus the marginal product of labour in terms of the above analysis turns out to be 0.71 and 6.83, respectively. For this reason, the marginal product of labour on the average will be in the neighborhood of 0.70 of the market prices, implying a distortion its the extent of 30 per cent. For 1974, the over-all nominal tariff applicable to Thai manufacturing was 14.28 per cent, and the effective protection was on the order of between 14.04 to 18.70, thereby indicating approximately the same order of magnitude for effective protection. In view of this, we take the accounting prices of wages in 1974 to be 0.70, as in 1971.

Table 3.1 : Nominal and Effective Tariff 1971.

ISIC	Industry Group	nominal tariff (%) tn	effective tariff (%) e (Corden)
3111	Meat products	61.7	-11.56
3121	Food preparation, nec.	61.9	-20.92
3112	Dairy products	40.0	2.42
3113	Canning & preserving of fuits & veg.	123.3	- 3.29
3114	Fish & sea food frozen	-2.0	-16.97
3115	Animal feeds	0	- 7.99
	Animal oils, & fats	34.2	-12.33
3116	Wheat flour (grain mill)	74.6	-186.58
	Cereal products	60.7	- 5.53
3117	Bakery products	74.6	186.58
3118	Sugar factures & refineries	115	- 6.36
3119	Cocoa, Chocolate	123	- 3.29
3131	Distilling, Spirets, whisky	309.2	147.4
3133	Malt liquors	272.8	35.6
3134	Soft drinks	69.6	-20.92
3211	Thread & yarn	44.2	64.0
	Cotton fabrics	41.5	7.50
3212	Made-up textile articles	37.0	44.14
3213	Knitting mills	20.00	n.a.
3214	Carpet & rugs	30.0	68.9
3215	Cordage, rope	27.7	26.25
3219	Manufactured of textile, nec.	54.3	- 7.06
3220	Wearing apparel	57.0	77.9
3233	Leather products	44.2	48.56
3240	Foot wear	57.0	77.9
3311	Veneer + Plywood Sawmills, planing	60.0	43.15
3312	Manufacture of Wooden & Canepro.		
3320	Metal Furniture Wood	50.0	- 2.12

Table 3.1 (cont.)

	Industry Group	nominal tariff (%) tn	effective tariff (%) e(Corden)
3411	Pulp & Paper	20.3	33.26
3419	Paper products & articles	39.4	55.4
3420	Printing & publishings	5.3	-20.3
3511	Basic industrial chemicals	28.0	24.97
3512	Manufacture of fertilizers	n.a	n.a
3513	Other basic chemical materials	31.4	31.42
3521	Paints	30.0	13.72
3522	Drugs & medicines	53.4	48.79
3529	Manufacture of chemicals, nec.	31.4	31.42
3530	Petroleum refineries	0	- 0.83
3540	Micellaneous petroleum Products	n.a	n.a
3560	Plastic industries	50	n.a
3551	Tyre & tube industries	26.9	25.17
3559	Other rubber matterials	33.0	-12.4
3523	Soap & detergents	50.1	20.74
3610	Pottery & earthware	47.8	71.79
3691	Stuctural clay products	4	
3620	Glass sheet	48.0	18.17
	Glass products	40.7	n.a
3692	Cement & lime	17.5	-16.13
3720	Non-ferrous metal basic industries	10.5	4.14
3711-3712	Primary metal products(iron&steel)	13.50	18.43
3811	Cutlery tools	30.0	100.63
3812	Furniture, metal	50.0	n.a
3813	Structural metal products	23.4	24.9
3819	Fabrics, metal except machinery	44.2	64.0
3822	Agricultural machinery	4.5	5.27
3823	Metal & wood machinery		

Table 3.1 (Count.)

	Industry Group	nominal tariff(%) tn	effective tariff (%) e
3824	Special industries machinery	15.9	4.16
3825	Office computing & accounting equipment	n.a	n.a
3832	Radio assembly parts	39.8	22.81
	T.V.appliances	52.958.59	
3829	Other non-electrical machinery		
3839	Electricle machinery (Radio, & parts)		
3841	Ship building & repairs		
3842	Railroad equipment		
3843	Motor vehicle parts	38.4	48.69
3844	Bicycle assembly	30.0	16.55
3845	Passenger car assembly	91.25	236.43
3849	Transportation equipment (Trucle)	40.0	59.35
3901	Jewellery & related articles	47.8	71.79
3903	Sporting, athletic artecles	30.0	100.63
3850	Instrument & related products.		
	All Industrics	71,2	16.68
	Export Industries.		
	Rice	-12.7	-16.77
	Tapioca flour	- 2.0	-29.82
	Fruit canning	- 2.0	-28.37
	Frozen sea food	- 2.0	-16.97
	Animal feeds	0	- 7.99
	Lumber + shaved wood	-18.7	-42.60
	Vegetable fibre	- 2.0	- 1.59
	Gunny bags	0	- 5.2
	All Industries in theis Group	- 7.4	-24.29

Table 3.2: Nominal and Effective Tariff, 1974

	ISIC Industry Group	nominal tariff (%) tn	effective tariff(%) e(Corden's)
3111	Meat products	69.0	117.3
3112	Dairy products	29.0	1,766.3
3121	Food products, nec.	61.55	-16.13
3113	Canning & preserving of fruit &	121.7	16.15
	vegetables.	- 2.0	- 8.03
3114	Fish & sea food frozen	- 1.5	-10.92
3115	Animal feeds	- 2.0	- 8.35
	Animal oils, & fats	16.0	- 9.1
3116	Wheat flour (grainmill)	30.0	30.26
	Cereal products	67.0	27.71
3117	Bakery products	n.a	n.a
3118	Sugar factories & refineries	- 50.0	- 84.02
3119	Cocoa, Chocolate	n.a	n.a
3131	Distilling, Spirits, Whisky	294.9	92.5
3133	Malt liquors (Beer)	278.6	65.3
3134	Soft drinks	49.4	200.91
3211	Thread & yarn	24.5	19.85
	Textile frabrucs	44.2	-16.6
	Cotton fabrics	41.5	-25.8
3212	Made - up textile articles	66.9(37.0)	7.3(-4.4)
3213	Knitting mills	n.a	n.a
3214	Carpet & rugs	n.a	n.a
3215	Cardage & rope	29.0	-18.27
3219	Manufacture of textiles, nec.	37.0	- 4.4
3 220	Wearing apparel (clothing)	66.9	7.3
3233	Leather products	39.8	
3240	Foot wear	67.1	6.8
3311	Sawmills, planing	n.a	n.a
3312	Manufacture of wooden & cane products	n.a	n.a

Table 3.2 (Cont.)

	Industry Group	nomimal tariff (%) tn	effective tariff (%) e(Corden')
3320	Metal & Furniture +	50.0	123.75
	Wood	59.4	9.95
3411	Pulp & Paper	3 5.0	-27.06
3412	Containers, boxes of paper	35.0	-27.06
3419	Paper products & articles	35.0	-27.06
3420	Printing & publishings	7.0	-10.72
3511	Basic industrial chemicals	34.0	34.85
3512	Manufacture of fertilizers	n.a	n.a
3513	Other basic chemical materials.	1 4.6	13.64
3521	Paints, pigment & vanishes	37.0	57.8
3522	Drugs & me dicines	37.5	-12.42
3529	Manufacture of clumical products	3 4.0	45.38
3523	Soap and deter gents	49.4	-10.6
3551	Rubber Tyres & tube industries	2 6.9	-12.7
3559	Other rubber articles	42.8	4.114
3550	Petroleum refineries	0	- 9.8
3540	Micellaneous petrolium products		
3560	Plastic products	50.0	n.a
3610	Pottery & earthware	47.8	78.13
3691	Structural clay products		
3620	Glass sheet	50.0	- 6.8
	Glass products	4 5.4	72.97
3692	Cement & lime	- 24.9	-42.90
3699	Non - metallic mineral products	3 3.2	18.78
3711-3712	Primary metal products	29.2	49.14
	(iron & steel)	13.9	37.7
3720	Non - ferrous metal basic industies	8.3	3.2
3811	Cutlery tools	3 0.0	36.26
3812	Furniture, metal	50.0	123.75
	Wood furniture	59.4	9.95

Table 3.2 (Cont.)

	Industry Group	nominal tariff (%) tn	effective tariff (%) e (Corden)
3813	Structural metal products		
3819	Fabrice, metal exceptmachinery	n.a	n.a
3822	Agricultural machinery	4.5	5.93
3823	Metal & wood machinery	n.a	n.a
3824	Special industries machinery	n.a	n.a
3825	Office computing & accounting equipment	n.a	n.a
3832	Radio assembly parts	27,2	-32.74
	T.V. appliances	52.9	830.2
3829	Other non - electrical machinery	13.0	-19.28
3839	Electrical machinery (wire cables)	39.4	2.77
3841	Ship building & repairs		
3842	Railroad equipment	n.a	n.a
3843	Motor vehicles parts	43.7	84.89
3844	Bicycle assembly & parts	30.0	- 3.30
3845	Passenger car assembly	102.5	353.88
3849	Transportation equipment (Truck)	40.0	100.65
3901	Jewellery, & related articles	0	- 2.47
3903	Sporting, athletic articles	41.0	103.4
3850	Instrument & related products	n.a	n.a
	All Industries, 1974	14.28	14.04to18.70

Sources : P. Wonwutliwat, The Structure of Differential Incentives in the Manufacturing Sector 76 Tables 4.8 and 4.9

Chapter III

. Evaluation of Productivity Growth and the Employment Greation

The thrust of the mainstream of arguments in the present investigation indicates that the structure of manufacturing industries of Thailand does face not the decision - making problem of capital saturation but rather the decision nexus regarding capital constraint, the environment in which the firm may decide to operate with a factor cost budget of specified size, depending crucially on the accessibility, the terms, and conditions of debt capital. In this view, the unit costs associated with all factor inputs employed in the firm must take account not only of the direct cost of purchasing the factors but also the imputed marginal costs of capital funds essential for investment and factor employ ment to attain the optimum level of production and the enterprise structure. We have provided tentative empirical estimates of these costs in the preceding section.

Our next task is to explore productivity growth and the employment creation in Thai manufacturing by establishing the integrated methodilogical points which statistically characterize the different sub-set of industry. In this connection, the main theme of analysis will consist of the followings :

First, specification of the production function, which for our purpose, indicates the ways in which the enterprise's demand for fixed (real) capital is tied in firmly to the form of its production function and to the technological possibilities of substitution between the factors represented by the arguments in that function. The greater extent of capital intensity of fixed capital will imply the greater money capital reguirement of the firm. In this view, it is possible to tackle the the question of optimum capital structure which to finance a given levelof total factor employment in the firm. Essentially, the viable theory of factor employment is inseparable from the theory of optimum factor combination, and the other determinants of the optimum structure of business enterprise.

Second, the question as to what optimum fixed capital should be employed in the firm hinges directly on the level and risk characteristics surrounding the firm's income-generating ability and financial leverage. Wage costs which constitute an important part of operating costs of the firm will emerge as a crucial arguments in the production function, and it means effective marginal costs imputed to this factor.

Thirdly, the structure of the business firm implied by the decision outcomes as reflected in the firm's financial statements, the balance sheet and income statement, discussed in detail in the foregoing section, furnishes us with a perspective of conceptual framework from which the formulation of the structure optimization model can be pursued. In this connection, our main purpose is to make possible to construct the firm's cost and profit functions which li behind the outcomes recorded in the income statement. For this purpose, it is necessary to use effective wage and capital costs involved in the enterprise prosess, that has been previously analyzed, as arguments in the production function. Foremostly, of course, our concern in achieving these objectives is that a more robust understanding might be captured of the interacting, interdependent and mutually determinant forces which determine the optimum enterprise planning, structure and management in the firm.

Thus the present section is devoted to discussion of the production function of a special form, i.e. the constant elasticity of substitution production function and its implications for demand for capital and the employment creation in Thai sector manufacturing during the period under investigation. It will be one of our purposes in this section to provide for more concrete evideuce on the issue of the elasticity of substitution in Thai manufacturing, and to explore the hypothesis that to what extent an elimination of distortions pertaining to wage rates and the prices of capital will effectuate a movement toward optimal resource allocation in this sector.

3.1 The Production Function: Main Feature of the CES Production Functions.

For the purpose of empirical analysis, the Thai manufacturing industries will be rationalized by the production conditions in which a single homogeneous commodity is produced, and this output may be used for consumption and for investment purposes, or both. Moreover, the manufacturing sector is open to international trade where tariff production effects, to be explored in the subsequent discussion, will be incorporated explicitly into our analysis of effective marginal costs of factor inputs and the relative factor shares in value added in some important ways. It will be assumed that there are two production agents: workers who supply labour services for employment in each of different manufacturing industries at the effective wage rate imputed to this particular factor in the manner outlined in the preceding section; and capitalists who provide entreprenenrial services necersary for the operation of the enterprise, again at the effective margical capital costs imputed in accordance with the methodological and empirical points presented in the foregoing section. Capitalists or owners of the firm determine not only the optimum technique of producing a tageted level of output but also the combination of factors of production, and other enterprise elements, especially the requirements of money capital and financial leverage.

Specifically, the production function used in the present study will be the constant elasticity of substitution (CES) production function ingeniously developed by Arrow, Chenery, Minhas and Solow (ACMS) in 1961 [3]. Following this class of CES production function, a great deal of professional interest has centered on the estimation of the elasticity of substitution in the aggregate economy and among manufacturing industries using cross-section and time series data in a broad range of developed and developing countries. Estimates of the elasticity of substitution between labour and capital have received great attention because they are useful for many economic decisions, private as well as public [Bruton(12)]. In reference to developing economies, interest in the elasticity of substitution may be attributable, firstly, to the failure of the manufacturing sector to absorb an increasing proportion of available labour force (Healey [33]; Pack and Todaro [60]; Edwards [21]). In his survey statement about the question at issue, Edwards, in particular, noted that labour participation rate in the manufacturing sector in several developing countries had in fact declined between 1960 and 1970 as already reviewed in the introductory section of the present study. Secondly, the significance of the elasticity of factor substitution lies in the presence or absence of the so-called factor intensity reversals in the theory of international trade (A.Krueger [47]; Balassa and Associates [5]; Arrow, et.al. [3]; Minhas [55] Akrasanee [2]). Thirdly, the stability of growth paths generated by certain growth models depends significantly on the elasticity of substitution porameter (C.E.Ferguson [24], Arrow, et.al. [3]); Lass but not least, the elasticity of substitution value is of critical significance in assessing the quantitative importance of various fiscal and monetary devices designed to stimulate and foster industrial investment and growth, the outcomes of which has been presented in the preceding section. Before our estimating model is formulated, it will be helpful to review the literature on the issue in somewhat detail.

The two - factor CES production function originally introduced by Arrow, et.al. [3] has become the most widely discussed and widely used function in the literature of the last few decades. A salient feature of the CES production function is that it has all the properties of the neoclassical production function and includes the Cobb-Douglas and the Leontief production functions as special cases. This production function is based on the first - order profit maximizing condition which takes the relation

$$(3.1) \quad \log \left(\frac{V}{L}\right) = a + b \log \left(\frac{w}{p}\right) + e_1$$

where V is output measured by the value - added of industries in question, L is the number of workers employed; w and p denote the wage rate and the price of output, respectively; e_1 stands for a schotastic error term; b represents the estimate of the elasticity of substitution. This relation assumes optimization behavior, the existence of an aggregate production function with disembodied technical change, the independence of labour productivity (V/L) from capital intensity (K/L), (K being a measure of the capital in the industry); no measurement errors in the variables and no adjustment costs between $\left(\frac{V}{L}\right)$ and (w/p). The class of the CES production functions in their complete form are writhen as:

$$(3.2) \qquad V = \gamma \left[\delta K^{-\rho} + (1-\delta) L^{-\rho} \right]^{-\frac{1}{\rho}} .$$

where V is the output produced in the i sector, and K and L are the amounts of capital and labour currently employed. Equation (3.2) is homogeneous of the first degree, implying an industry sector is subject to constant returns to scale. The technology embodied in this production function is characterized by the following parameters : (i) the "efficiency" parameter, γ , which measures the volume of output obtained from given quantities of factor inputs; (ii) the "distribution" parameter, δ , which is a measure of capital intensity of the technology, and it also indicates what the distribution of relative factor share is among capital and labour; and (iii) the "substitution" parameter ρ

which has a relation with ρ as follows :[44/]

$$\sigma = \frac{1}{1+\rho}$$

where σ is designated the elasticity of substitution. It should also be noted that

$$(o < d < 1; p > -1; \gamma > o.)$$

and the value of the elasticity of substitution should in general be non-zero and non-negative. If non-constant returns are assumed to prevail, the power $-\frac{1}{\rho}$ is replaced by $-\frac{h}{\rho}$, where h is the "degree of returns to scale parameter.

If ρ approaches zero, σ approaches the value of unity and the production function (3.2) reduces to the renowned Cobb-Douglas production function. If ρ approaches infinity, the production function will become the Leontief fixed proportions form.

44/ Specifically, the notion of the elasticity of substitution was presumably introduced to economics by Hicks [35].

Thus, according to Hicks,

$$\sigma = \frac{dk}{k} / \frac{dq}{q} = \frac{f'(f-kf')}{k\ ff''} \geq o;$$

where $q = F_L / F_K = (f-kf')/ f'$ is the ratio of marginal products; k is the capital labour rario (K/L); q is the marginal rate of technical substitution which must equal the ratio of marginal product of labour over the marginal product of capital; and dk and dq denote, respectively, variations in k and q along a constant product curve.

It should be noted emphatically, in view of the production function (3.1) that, average labour productivity depends on capital intensity, K/L, and the magnitudes of γ, δ, ρ and h; 45/ K and L are usually measured in physical units.

The empirical evidence seems to indicate that the parameters of the CES production function are highly sensitive to slight changes in the data used, measurement of variables, and methods of estimation. In fact, the point estimates of the most significant parameter, σ, vary considerably for different sets of data, industries, and levels of aggregation. Furthermore, they are sensitive to the government intervention policies, and cyclical changes in demand. Nerlove [59]; Minhas [55]; Brown [11]; Moroney [57]; Zaremba [77]. The only tentative conclusion, but by no means a concensus, is that most of the time series estimates of σ are below unity; while the cross-section estimates are generally higher than the time-series estimates and close to unity (Nerlove [59] and Zarembka [77]. The evidence on the estimates of other parameters, δ, γ, and h, is also mixed. The efficiency parameter varies widely, depending on the period of fit and the assumptions about the type of embodiment and returns to scale. The estimates of return-to-scale parameter are generally

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45/ This can be verified with an example. Following Brown [11] define,

$$A = \frac{\gamma\left[\delta K^{-\rho} + (1-\delta) L^{-\rho}\right]^{-h/\rho}}{(aL + bK)}.$$

By taking the total differential of this function with respect to time and then dividing by A we obtain

$$\frac{dA}{A} = \alpha 1 \left(\frac{d\gamma}{\gamma}\right) + d_2 \left(\frac{d\delta}{\delta}\right) + \alpha 3 \left(\frac{dh}{h}\right) + \alpha 4 \left(\frac{d\rho}{\rho}\right) + \alpha 5 \left(\frac{dK}{K}\right) + \alpha 6 \left(\frac{dL}{L}\right).$$

The first four terms on the right hand side indicate changes in the total factor productivity due to technical characteristics of the production function while the last two terms refer to those due to changes in the magnitudes of the factors production function.

greater than unity in time - series and about unity in cross-section estimates, but are sensitive to the rates of utilization of the inputs and the level of demand. 46/

To appreciate the problems which seem to be responsible for the instability and inconsistency of the estimated parameter particularly of σ, let us concentrate for a moment on the side condition, i.e., the first-order profit-maximizing conditions associated with equation (3.1). Suppose the folloning set of equations is specified:

$$(3.3) \qquad V_i = f\ (p_i)$$

$$(3.4) \qquad \pi_i = p_i V_i - w_i L_i - r_i K_i$$

$$(3.5) \qquad \frac{\partial \pi_i}{\partial L} = \frac{\partial \pi_i}{\partial K_i} = 0$$

Precisely, equation (3.3) is the demand **curve** of product. Profit is defined in equation (3.4), in which p_i, w_i and r_i represent prices of product, labour, and capital, respectively. Equation (.5) is the first-order profit-maximizing conditions. In reference to the original ACMS model, assuming further that factors are supplied competitively and designating the elasticity of demand for product as elasticity of demand for product as η_i, the factor market equilibrium expressed in (3.5) may be written in terms of the respective factor productivity relations as follows:

46/ For point estimates of γ, δ and h see Nerlove 1967 [59]. These estimates are proved to vary from period to period and are generally sensitive to small changes in σ. The work by R.Bodkin and L.Klein [10.b] 1967, P.Dhrymes 1965 [19], and Brown [11] suggested increasing returns for the U.S. manufactures during 1929-65. The cross-section estimates of h by Grilliches 1967 [29] and recently by Aarembka 1970 [77] support the constant-returns-to-scale hypothesis.

$$(3.6) \qquad \partial V_i/\partial L_i \equiv F_{L_i} = (1-\delta)\,\gamma^{-\rho}\, V_i^{\rho}\, L_i^{-\rho-1} = w_i \left[p_i \left(1 - \frac{1}{\eta_i}\right) \right]^{-1},$$

$$(3.7) \qquad \partial V_i/\partial K_i \equiv F_{K_i} = (\delta)\,\gamma^{-\rho}\, V_i^{\rho}\, K^{-\rho-1} = r_i \left[p_i - \frac{1}{\eta_i} \right]^{-1},$$

$F_{L_i} >, o \,;\, F_{K_i} > O; \quad F_{KK} < O \,; F_{LL} < O.$

Equations (3.6) and (3.7) are the equilibrium conditions of equality between marginal revenue products and marginal factor costs; where $w_i \left[p_i(1-{}^1/\eta_i) \right]^{-1}$ and $r_i \left[p_i\,(1-{}^1/\eta_i) \right]^{-1}$ are nominal factor prices divided by marginal revenue. The presence of these expressions insure that product markets are not perfectly competitive; that is, the circumstances in which all firms in an industry have attained optimum size but the absolute size of the optimum firm is sufficiently large to inhibit perfect entry into the industry. Under these circumstances, the equations (3.6) and (3.7) may be rewritten, transforming average product of labour into the left-hand side of the equation, as follows:

$$(3.8) \qquad \frac{V_i}{L_i} = \gamma^{1-\sigma}\,(1-\delta)^{-\sigma}\, w_i^{\sigma} \left[p_i\,(1-{}^1/\eta_i) \right]^{-\sigma}$$

$$(3.9) \qquad \frac{V_i}{K_i} = \gamma^{1-\sigma}\,\delta^{-\sigma}\, r_i^{\sigma} \left[p_i\,(1-{}^1/\eta_i) \right]^{-\sigma}$$

The original authors of the CES production function were concerned to obtain an identifiable unbiased estimate of   from the first-order profit-maximizing conditions (3.8) or (3.9) by deflating the nominal factor prices (w_i or r_i) by their respective marginal revenue products $\left[p_i\,(1-{}^1/\eta_i) \right]$ which was supposed to account for the influence in factor markets of imperfect product competition. By assuming that the marginal revenue products are infinite, it is possible to achieve identification of the elasticity of substitution, σ. It is on this basis of the assumeption which compelled the pioneer authors of the CES production function (ACMS) to propose the following equation:

$$(3.10) \qquad \left(\frac{V_i}{L_i}\right) = \left[\gamma^{1-\sigma}(1-\delta)^{-\sigma} \right] (w_i/p_i)^{\sigma}$$

By means of logarithmic transformation, and assuming that all variables are measured without error and if w_i is assumed to be exogenous and uncorrelated in the sample with p_i, equation (3.11) yields a consistent estimate of σ .

$$(3.11) \qquad \ln\left(\frac{V_i}{L_i}\right) = \ln A + \sigma \ln(w_i/p)$$

where $\ln A = (\gamma^{1-\sigma} (1-\delta)^{-\sigma})$ is an intercept, σ is interpreted as the elasticity of substitution between labour and capital. Similarly, by taking logarithms of the marginal productivity of capital relation, equation (7.9), one gets

$$(3.12) \qquad \ln\left(\frac{V_i}{K_i}\right) = \ln B + \sigma \ln (r_i/p)$$

Where we may note that wi and r_i are, respectivily, the input prices of labour and rental rate of capital services; and the constant terms A and B are non-linear combinations of γ , δ and σ . Equations (3.11) and (3.12) will be referred to as form I and form II of our estimation model. The meaning of this equation is analogous to (3.11) and (7.11), Moreover it is also possible to specify an alternative form of estimating equation such as equation (3.13) the meaning of which is straightforward in view of equations (3.8) and (.9) That is, in some empirical studies of the elasticity of substitution, the estimating model takes the following form [Katz 1976 [44] :

$$(3.13) \qquad \ln\left(\frac{V_i}{L_i}\right) = \left[(1-\sigma)\ln\gamma - \sigma \ln(1-\delta) + (1-\sigma)\ln p_i \right] + \sigma \ln w_i$$

3.2. Evidence on the CES Production Function

Unfortunately, the persistent conflicting results and inconsistency of the estimated elasticity of substitution may be attributed to a number of problems. An important factor in these problems certainly is of statistical nature, i.e., the data and construction of variables vary considerably from study to study. For our purpose, three specific problems should deserve attention: (1) the basic difference between the time-series and cross-section input-output relations;(2) the parameters of the production function often vary together, and their separate effects cannot be identified except under restrictive conditions and unless more information about the production process is available; and (3) estimation problems due to the simultaneity and non-linearities between the production function and marginal productivity conditions. Before an alternative production model is constructed for our purpose, a brief comment on each of the problems should help clarify the issues.

(1) The Questions Pertaining to Time-Series and Cross-Section Estimates. The time-series data actually embodies a dynamic adjustment process associated with a combination of factors such as changes in relative prices, technical changes and external shocks which are generally excluded in cross-section data. Thus, the time-series data are often biased because of simultaneity between the inputs and their prices, and misspecification of the adjustment lags between inputs and output, and the dominance of cyclical variations in production condition, e.g. under-utilization of capacity.

The cross-section results are also plagued by certain conceptual and estimation problems. In a competitive market there is no reason for relative prices to differ among production units. Any observed differences in firm managerial ability and consequently the individual production function is not identified (Walters, 1963 [73]). If there is insufficient variation the marginal productivity conditions, or if input differentials are due to differences in skill in the quality of the inputs, then cross-section estimates of σ will be biased towards unity. A point of importance is that the cross-section estimates ignore the temporal structural change of the economy and/or changes in the industrial structure. Furthermore, the estimate of constant returns to scale found in most cross-section studies may reflect external economies rendered by industry size (Walters [72]).

In effect, biases common to both time-series and cross-section studies of the elasticity of substitution may be attributed to the following sources. (a) The assumption underlying the marginal productivity condition refers to the relation of the "best practice" factor proportions to input prices, while the data used in estimation refer to the "average practice" factor proportion. The extent of bias depends on the departure of the average proctice from best practice factor proportions. (b) In most industry studies value-added data are used as a measure of output on the assumption that the ratio of raw materials to total output remains constant for various industries. However, improvements in technology, better inventory management and substitution of raw materials and primany inputs, may occur and the ratio would not remain constant, to the effect that the estimation of the elasticity of substitution leads to a bias. In the present study, correction will be made for the value-added which takes account of the effects related to tariff protection. (c) The prices of capital and labour used in most studies come from current data that prevail in the market conditions which may be distorted by a variety of factors due to the import substitution policy adopted by the government to foster industrial growth. As already emphasized, the nominal prices of capital and labour are themselves distorted considerably by the infhrences of imperfections and monopoly power in the market, and when they are used without appropriate correction, the estimation of the elasticity of substitution between K and L would inevitably be biased.

(2) Identification Problems. In statistical terms, it may be pointed out that in most studies, especially they are based on time-series, there are not enough degrees of freedom in the available data to identify and isolate the separate effects of the parameters of the production function. A number of factors may account for identification problems. One is that the aggregate data include both old and new capital. Another is the fact that in practice it is seldom possible to distinguish between embidied and disembodied technological change, as long as old capital stock remains productive in the production process and new investment is continually undertaken (Hall and Jorgenson 1963 [32]). For, if the rate of embodied technological change is a constant fraction of vintage, the rate of disembodied technical change a constant function of time, and depreciation rate a function of the age of capital, then these effects cannot be empirically identified. Moreover, if depreciation is viewed to depend not only on age but also on the rate of capital utilization, the identification problem would be even more severe, Finally, the effect of variations in factor supply upon relative factor prices and the effect of other government policies on relative factor prices, exacerbate the identification problem considerably.

In specific reference to equations (3.8)-(3.9) and equations (3.11), (3.12), the identification problem can be seen quite clearly. Assume for the purpose of onalysis that equations (3.11) and (3.12) are subject to random error due to enterprenenrial habits, inertia, market uncertainties, and so on. In order that an identifiable unbiased estimate of σ be achieved from either equation, it is necessary to deflate the nominal factor price (w_i and r_i) by the expression $\left[p_i(1-{}^{1}/\eta_i)\right]$ to account for the influence related to monopoly power and market imperfections. If this is not done, as in practically most studies on the subject, the estimate of δ turns out to be biased. The reason the nominal factor prices have not been deflated by $\left[p_i(1-{}^{1}/_{\eta_i})\right]$ lies in the fact that in practice η_i and p_i are usually not known. **And**, in order to obtain identification of the estimate of σ , the investigators assume η_i equal infinity so that the expression $(1-{}^{1}/_{\eta_i})^{-\sigma}$ equals unity. The stringency of this assumption is obvious and it certainly points to the serious identification problem. This will lead to erroneous estimates of σ .

Thus, a summary review drawn from a number of studies by Griliches [29] and more recentty by Zarembka [77] which applied the first-order profit-maximizing model to two-digit U.S. manufactures suggests that the elasticity of substitution is close to, and does not differ significantly from, unity. On the other hand, the successful application of the CES production function to industries in advanced economies reviewed by Nerlove(1967, [59]),provides evidence which indicates that the estimate of the elasticity of substitution was on the order of <u>less than</u> unity. More recent analyses which support the findings of less than unitary elasticity of substitution can be found in Ferguson and Moroney [23] , and Moroney [57], . These latter categories of empirical verification have been confirmed by data drawn from contemparary developing economies, especially in the work of Williamson [77] and Daniels [16.a] .

(3) <u>Estimation Problems</u>. In estimating the parameters of the CES production function, economists now agree that not only do cross-section and time-series estimates of σ differ considerably, but estimates of this important parameter, σ, are also sensitive to small changes in the specification of the model fitted, as Nerlove [59] long ago enunciated: "even slight variations in the period or concepts tend to produce drastically different estimates of the elasticity of substitution," (p.58).

Now, in particular reference to production function (3.1) it is possible to fit either the function directly or the marginal conditions. These two sets of relations are, however, interdependent, in view of the fact that there exists the joint distribution of the stochastic error terms of the production function and marginal productivity relations (Zeller [79]). The point of critical importance is that estimates of σ vary systematically with the choice of functional form of the estimating model. The most noteworthy estimation methods normally proposed for the estimating model are as follows:

(i) The first-order profit maximizing condition as originally advocated by the authors of the CES production function, expressed in equations (3.10) and (3.11) which are based on the assumption of constant returns to scale. The problem of using this side relations is that regressions based on the marginal products of labour relation gives higher estimates of σ than regressions based on the marginal product of capital relation, The point incidentally has been noted by some investigators, Hilderbrand - Liu [36], Dhrymes [19], and recently by Dhrymes and Zarembka [79]. The inconsistency of the estimates lies in that the equations embody certain misspecification errors that in turn bias the estimates of σ. In particular, there is reason to believe that $Y_1\ p_i$ and labour quality are variables that are positively correlated with the nominal wage rate; and, similarly, for the case of capital.

Furthermore, there is the possibility that there is measurement error in the observed labour input, attributable to embodied labour quality differences. Such differentials might be present, because of variation in the quality of educational opportunities, training, and especially the effects imparted by tariff protection in the industry. Suppose the true or qualityadjusted labour input $= L_i$ and suppose $L_i = L_i/e_i$, where e_i is measurement error, This measurement error imparts an error in the true value added per unit of labour and in the the wage rate. Therefore, the correetly-measured labour will be

$$w_i = w_i L_i/L_i = w_i L_i/L_i e_i = w_i/e_i$$

where wiLi is the observed wage bill in the industry in question.

For the case of capital input, the same procedure applies and it is evident that the correctly measured capital input will be

(3.14) $$r_i = r_i K_i / K = r_i K_i / K_i e_i = {}^{r_i}/_{e_i}$$

where $r_i K_i$ is the observed share of capital in the value-added. Finally, the correctly-measured value-added can simply be deduced from the foregoing consideration which will be elaborated on in the subseqnent section. What needs be noted at this stage is that the observed value-added of the industry embodies measurement error and to obtain unbiased estimates of σ this error of measurement must be corrected, taking account of factor market distortions attributable to tariff protection and other influences.

(ii) Prevailing results which have been evidenced by instability and inconsistency of the estimated parameter of the estimated parameter of the elasticity of substitution, have prompted some anthors to focus mainly on the estimation method. One common approach to estimation of the CES production is the stepwise procedure, constructed by Bodkin-Klein, 1976 [10.a]. The first step is to estimate the ratio of the marginal productivity relations to obtain estimates of the ρ and δ in equation (3.1). That is, fit the relation

(3.15) $$\log \left(\frac{K}{L}\right) = a_0 + b \log \left(\frac{w}{r}\right) + u_0$$

where $a_0 = \sigma \log (d/1-\delta)$ and other notation has been indicated. The second step involves using estimates $\hat{\delta}/(1-\hat{\delta})$ and $\hat{\rho}$ to estimate the constrained equations:

(3.16) $$\log V = \log \gamma + \frac{h}{\hat{\rho}} \left[\log \hat{\delta} K + (1-\hat{\delta}) L^{-\rho}\right] + u_1$$

Thus, from the first step one gets estimates of the ρ and δ ; and in the second step use these estimates to obtain the remaining parameters, i.e. h and γ. Unfortunately, this proccdure has shortcomings in that it rests on the stringent assumption that marginal productivity conditions hold, which in turn requires that the returns to scale parameter is unity, and that the current relative prices are exogenous and reliable proxies for their expected values. Our experiment in the present study on the basis of cross-section data pertaining to the Thai manufactures has yielded σ which does not significantly differ from zero, and hence the procedure is rejected.

(iii) Kmenta's approach is to use the least squares technique directly to estimate the production function by approximation (Kmenta [46])

$$(3.17) \qquad \ln V = \lg \gamma + h\delta \ln (K/L) + h \ln L + \beta \left[\ln\left(\frac{K}{L}\right)\right]^2 + u_2$$

where $\beta = \rho h \delta(1-\delta)/2$. However, our attempt to apply the data on Thai manufacturing industries for 1971 and 1974 to Kmenta's approxation has not been successful, because most of the parameters appear to be insignificant and this may be due to the unreliable current values of K, L and other variables in the production function. Essentially, as a measure of the "output" of the production function, published series or census data on value-added is used. By definition "value-added" is construed as gross output minus intermediate materials; such a value-added index corresponds with the production function only if all quantities or all prices of the intermediate inputs move proportinally with output quantity or price. In the circumstances where industrial structures change over-time, such a presumption would not hold. For instance, before 1973, the price of energy had increased less rapidly than that of other intermediate inputs, the quantity of energy demanded by industries must rise relatively more rapidly than other inputs. For the period following the oil crisis, the situation will be to the contrary. Thus, proportionality among intermediate inputs has not existed and this may be responsible for the breakdown of our application of Kmenta's application to our data.

In summary, our review of evidence on CES production function, especially on the elasticity of substitution parameter, has indicated that part of the difficulty with conflicting results lies in the problems of data and construction of variables used, of the identification and estimation procedure.

3.3 Alternative Formulation of the Estimating Model

3.3.1 Factor-Augmentation Model and the Nature of Technical Progress

In view of presence of the influence of factor markets of imperfect product competition, the absence of the marginal revenue $\left[p_i\ (1-{}^1/\eta_i)\right]^{-1}$, the uncertainty about returns to scale, and the specification error problem reviewed in the preceding subsection, it is necessary to develop an estimating model and a method of estimation, and to devise the data pertaining to the crucial arguments in the production function such that they reflect the "true" resource costs, to avoid biases regarding the data analzed in detail in the preceding section. Equally important, the data employed should not be sensitive to the returns to scale or variation in η_i, or to the specification error, etc. In view of these considerations, the production functions adopted as our empirical framework will be of factor-augmentation type which take the form :

$$(4.1) \qquad V_{it} = \gamma \left[\delta (E_K)\ K_{it}^{-\rho} + (1-\delta)\ (E_L)\ L_{it}^{-\rho} \right]^{-\frac{1}{\rho}}$$

where V_i is the quantity of the i^{th} sector currently produced; $K_i(t)$ and $L_i(t)$ are, respectively, the amounts of capital and labour employed in the ith. sector. In addition to previous notation, E_K and E_L represent the technological improvement which augment physical capital and labour, respectively. Thus,we shall view $E_K.K_t$ as "efficiency capital", and $E_L.L_t$ "efficiency labour", as analyzed and elaborated by David and de Klundert [17]. Our analysis that follows will show that the distinction between physical and efficiency units of capital and labour is crucial to understanding the industrial performance of an developing economy such as Thailand. While it is not our principal interest to focus on the nature of technological bias, it needs be noted that the nature of the bias in technical change will be analyzed in terms of the Hicksian sense of neutrality. According to this definition (Hicks [35]), technological progress is neutral if it leaves the K/L ratio unchanged at a constant ratio of factor prices. The Hicksian factor-saving bias is viewed to be the proportionate rate of change in the marginal rate of factor substitution in that sector. It has been demonstrated that given the proportionate rates of change of the marginal products of a capital and labour the extent of bias in technical improvement turns out to be (David and Klundert 17 ; and Williamson 75 , pp. 42-46)

(4.2) $$X_i(t) = \frac{(\lambda L - \lambda K)(1 - \sigma_i)}{\sigma_i}$$

where $X_{i(t)}$ is a measure of the bias in technical progress which traces the output-raising effect to the specific inputs. Thus, the degree of technical bias in this framework depends on the difference between the rates of factor augmentation and on the magnitude of the elasticity of substitution. If the manufacturing sector is characterized by biased technological progress, $\lambda_L - \lambda_K > 0$, implying Thai manufacturing can be explained by the labor-saving or capital - deepening technological characterization. We also assume $E_{K(t)}$ and $E_{K(t)}$ grow at exogenously given rates λ_K and λ_L , respectively. That is,

(4.3) $$E_K = E_K(o) \ e^{\lambda kt} \ ......$$

(4.4) $$E_L = E_L(o) \ e^{\lambda Lt} \ ......$$

3.3.2 <u>The Nature of Factor Markets.</u>

On the basis of the production functions of the factor-angmentation type, $K_{(t)}$ and $L_{(t)}$ are defined as the total stocks of capital and labour available for employment in the whole manufacturing sector at a given psint in time. For our purpose of evaluation of Thai manufacturing for the years 1971 and 1974, where the relevant data are available from Census of Manufactures, 1971, and 1974, the manufacturing sector is divided into 25 sub-sectors. Thus,

(4.5) $$K_{(t)} = K_{1(t)} + K_{2(t)} + ...K_{(25)} \ t$$

(4.6) $$L_{(t)} = L_{1(t)} + L_{2(t)} + ... L_{(25)} \ t.$$

The issue of importance in the factor markets centers on : what is the appropriate description of factor pricing within sectors in Thai manufacturing during the years under investigation? Fortunately, the issue has been treated rather substantively in the preceding section. It needs be added in this connection that we assume that capital and labour adjust instantancously to any price differentials between sectors and that in effecting the transfer of factors between sectors, the costs associated with the transfer are small and therefore can be regarded as negligible for the purposes of the analysis. Moreover, we assume that efficiency factors were paid their marginal value products, granted that the monopoly power and market distortions did exist during the period.

On the basis of the sectoral production functions, the efficiency wage and efficiency rental price of capital can be derived as follows :

$$(4.7) \qquad w_{(t)} = (1-\delta)\gamma^{-\rho} \left[\frac{V\ (t)}{E_L L\ (t)} \right]^{1+\rho}$$

$$(4.8) \qquad r_{(t)} = \delta\gamma^{-\rho} \left[\frac{V_{1(t)}}{E_K K\ (t)} \right]^{1+\rho}$$

where, w_t and r_t are, respectively, the current wage rate of efficiency labour and rental rate of efficiency capital.

From the preceding sections, we should emphatically enunciate the following summary main threads of arguments. First, although admitting that marginal product is founded on well-established postulates, we have identified pervasive theoretical arguments and empirical findings which reject the validity of marginal product pricing proper. Instead the concept of accounting or shadow prices of respective factors has been developed and we shall argue that these respective accounting factor prices should be used as arguments in the production applicable to Thai manufacturing. Second, our formulation of an alternative estimation model will be confronted by evidence from Thai manufacturing for the years involved, and the relative sucess or failure of our model will be judged by its ability in explaining and assessing productivity growth and employment changes in Thai manufacturing.

3.3.3 The Estimation Model.

We now turn to the estimation model. In providing for the important parameter of the production functions specied in the foregoing section, we adopt the estimating model based on constrained cost minimization. The basic behavior assumption is that entrepreneur attempts to produce on the expansion path in the long-run, and thereby minimizes the cost of producing a desired level of output. In competitive situation, the constrained cost minimization assumption is indistinguishable from the hypothesis of long-run profit maximization. However, the constrained cost minimization model is more general than the profit-maximizing hypothesis for the following reasons.

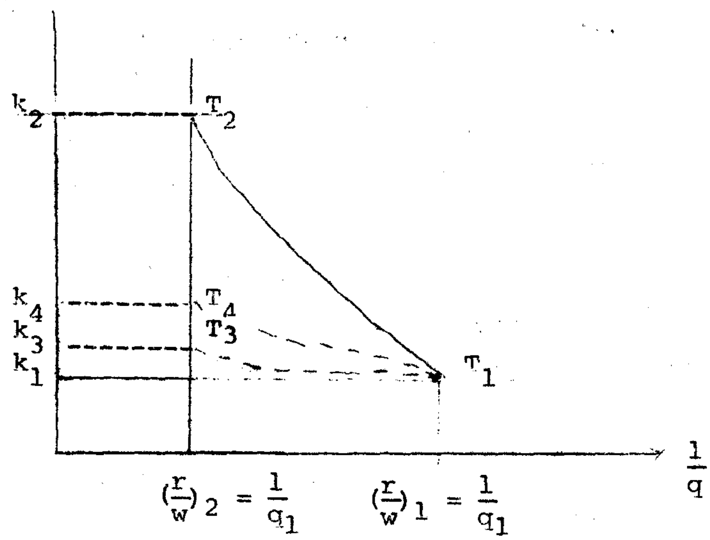
First, the cost mimization equation is compatible with a host of "satisficing" and "sales maximizing" hypotheses concerning the optimum choice of inputs. In brief, it assumes that a businessman attempts to produce according to his long-run average cost curve, with a view to "economic efficiency" proper. Second, a theoretical rationale underlying the numerical value of the elasticity of substitution consistent with the cost mimization may be clarified. To begin with, we must realize that the smooth and differentiable unit isoquant that is used to exemplify the production process of the industry, is an approximation which characterizes a spectrun of production processes. Hence, each point on the isoquant represents a different technique of production, and each technique requires a different set of capital investment or factor intensity. Moreover, the decision of the firm to invest in fixed capital equipment, is fundamentally different from the decision to employ additional labour. The fact is that capital investment in a kind of "sunk" cost in that, once the investment has been made, the future life and earnings of fixed capital depend entirely upon the money capital requirement , the variable costs of production, and the market price of the product that is generated in the firm. These key points, in effect, play a decisive role in determining the rate at which the firm or industry will adjust its factor proportions in response the a change in relative effective factor prices.[47/]

To clarify the theoretical implications of these basic propositions, let us pause and spell them out more thoroughly.

47/ For clarification, see the discussion in section (2.2.) of the present study.

Ex ante, the firm has available to it a variety of techniques which can be represented by a smooth and continuous isoquant, which in turn, means the smooth and continuous elasticity of substitution curve, shown in Figure 1.[48/] At a set of relative factor prices such as represented by q_1, the firm will select technique T_1 with the unique capital labour ratio, k_1. However, at the ruling factor price ratio q_2, technique T_2 will be selected. Suppose the firm operates on the basis of technique T_1. At the same time, due to tax other fiscal incentives and tariff protection, with the resultant lower prices of capital, the effect will imply that its wage-rental ratio increased from q_1 to q_2. In view of the assumption that the economic lives of T_1 and T_2 are identical, the indivisibilities of fixed capital and the sunk cost nature of previous investment decision imply that the firm will make adjustment by switching from T_1 to T_2 only if the variable costs of technique T_1 are higher than the total costs of adopting technique T_2. Certainly, if at the new wage-rental ratio the costs of technique T_1 does not exceed the costs of technique T_2, the firm will attach to its original technique. Under the general circumstances, it is difficult to ascertain on a <u>priori</u> grounds whether the firm will switch from the old to the new technique, given the changes in the relative wage-rental ratio. One important factor attributable to the adjustment in technique has to do with the rate of replacement. Thus,

48/ Figure 1 : Illustration of the "<u>ex ante" substition curve</u>"



the capital - labour ratio will rise from k_1 to , say, k_3 in Figure 1, with the resultant measure of the elasticity of substitution calculated as the elasticity of the line segment T_1T_3. If the longer the period of time is allowed to elapse, the closer will the estimated value of the elasticity of substitution be to its ex ante equilibrium value; with the resultant measure of the elasticity of substitution calulated as the elasticity of the line segment T_1 T_4, T_1T_2, etc.

Moreover, if we focus on the short run estimates of the elasticity, the numerical values of the elasticity of substitution are affected by the presence of a number of other variables which, as previously emphatically pointed out, have been virtually neglected in the empirical literature, First, the industry that is facing a rising demand for its product at the same time that it has experienced a change in its relative factor prices, firms will normally expand their capacity and adopt the new technique such as T_2, implying, in the shortrum, a larger percentage change in the industry capital-labour ratio. Second, firms in the industry will have an incentive to increase capital investment in the form of accelerating rate of replacement, if they are confronted with a technological progress ("technical efficiency"). In view of the fact that the most efficient technique will be adopted, a larger percentage change in the industry capital-labour ratio will be recorded, even though such technologies are alien to domestic factor endowment.

Furthermore , while it is difficult to ascertain on a priori grounds whether the firm will make adjustment in technique selection, in the specific circumstances in which firms do benefit from the inducements measures reflected in tariff protection effects, import licenses, fiscal and other incentives imparted to promoted industries, to the effect that "......restrictions on foreign trade tilt the whole structure of relative prices, reducing in certain broad classes of commodities as it retains them in others. The costs in domestic curreney of imported machinery and industrial inputs, whether or not they are licensed, are reduced substantially...." (R.I. Mc Kinnon [53] p.25), it is quite probable that firms will adopt the new technique, since they make effort at minimizing costs and maintaining efficiency

Finally, in view of the prevailing the minimum wage legislation, the role of labour unions, and other institutional factors, contribute at least partially to the phenomenon that cause the prevailing wage rates in urban industries to exceed labour productivity. Thus, the structure of wage rates confronted by the firms tend to move upward relative to the rental rate of capital. This will induce firms to substitute capital for labour to a considerable extent, and the new technique will be selected. The extent of this substitution will be our interest in the final section of this study.

In recapitulation the preceding considerations have brought the constrained cost mimization notion into the forefront. The first - order condition for minimizing the cost of a given output is equality between the marginal rate of technical substitution and the ratio of factor price. In reference to the CES production function and the marginal productivity relations, shown in equations (4.9) and (8.7), the cost minimization relation results :

(4.9) $$({}^{F}L/{}^{F}K)_i = \left[(1-\delta)/\delta \right] \left[K/L \right]_i^{1+\rho} = \left(\frac{w}{r}\right)_i$$

By differentiating (F_L/F_K) with respect L, it is shown that the MRS is continuously decreasing function of L, assuming that the second-order condition is fulfilled. Further, assume a desired level of output has been determined, and factor prices are determined exogenously to business firms. Then, the main decision of the firm is to adopt the least-cost factor proportions in view of the given factor prices and technologically determined parameters. On this basis, the stochastic specification of the cost-minimizing equation 49/ will be

$$(4.10) \qquad (K/L)_i = \left[\delta/(-\delta)\right]^{\sigma} \quad (\frac{w}{r})_i^{\sigma}\ u_i$$

where, $\sigma = 1/1+\rho$, and u_i is the log-normally distributed disturbance. A characteristic feature of equation (4.10) is that it is basically a "cost-minimizing" rationalation of an industry and it corresponds closely with the notion of the elasticity of substitution proper, as designated by Hicks. In addition, equation (4.10) suggests an expansion path characterized by the equation which indicates that firms adjust their input mix without cost in relative factor prices which in fact they do (i.e. facing wide variations in relative factor prices). The cost-minimizing model has advantages in that the nature of returns to scale, and the nature of product competition do not enter the relation in any way, and thereby would avoid certain specification errors that cause biases in the estimates of σ. In effect, the logarithm of equation (4.10) may serve as an estimating equation to obtain a maximum likelihood estimate of σ, which is identified without invoking any assumption about the degree of returns to scale or the elasticity of product demand (Moroney [57]). Equation (8.7) will be Form III of our estimation model.

(II) In connection with (4.10), an expression for relative factor payments can be derived from the cost minimization condition, Thus,

$$(5.1) \qquad \ln\ wL/rK = \ln(1-\delta)/\delta) + \rho\ \ln K/L + u_{i2}$$

49/ C.Ferguson [24] ; J.Moroney [57] ,

An estimate of σ can be explored from the coefficient of ln K/L. The relative factor shares method has been used by Bell [6] to estimate the elasticity of substitution.

(III) From the feature of cost-minimizing model, equation (4.10), an expression for relative labours share in the equilibrium situation can be derived 50/ as

$$(5.2) \qquad \frac{wL}{V} = (1-\delta)^{\sigma} \left(\frac{w}{Y}\right)^{1-\sigma}$$

with the same notation noted previously, and given an exogenously determined wage rate, it has been alleged that technological improvement of neutral type should tend to increase labour's share relative to that of capital. The evidence supplied in this study will permit us to explore this hypothesis for Thai manufacturing for the years 1971 and 1974. However, the performance of Thai manufacturing for these years, it should be noted, reveals no evideuce of an increasing labour share, but instead, the contrary. Substantiation of this point will be subsequently provided.

(III) As it has been shown by several authors (Hildebrand-Liu [36], Dhrymes-Zarembka [78], Dhrymes [19], and Lu-Fletcher) [51], that the marginal productivity conditions, expressed in equations (3.8) and (3.9) are not independent of the capital-labour ratio and the returns to scale. Thus, estimates of the elasticity of substitution from the marginal productivity conditions of labour and capital will certainly be biased. When it is admitted that the values of σ are sensitive to changes in capital intensity and returns to scale, an alternative development of estimating σ has recently been facilitated, especially by Lu and Fletcher [51]. The precedure in essence is to test the sensitivity of values of σ to variations in the capital-labour ratio (capital intensity) and the degree of returns to scale. The underlying idea boils

50/ K.Arrow, et al. [3], p.234, 244.

down to verifying the invariance of σ to capital intensity by fitting the following relation :

$$(5.3) \qquad \ln(V/L) = \ln A' + b \ln(w/p) - c \ln(K/L) + u_{i3}$$

where u_{i3} is the random error term. Following Lu and Fletcher [52] if the coefficient of log (K/L), namely c, is not zero, the labour productivity condition (5.3) implies the production function of the following form :

$$(5.4) \qquad y = \left[\beta k^{-\rho} + \alpha k^{-m\rho} \right]^{-1/\rho}$$

$$y = V/L \quad , \quad k = K/L$$

$$\rho = \frac{1-b}{b} \quad , \quad m = \frac{c}{1-b}$$

$$\alpha = \frac{1-b}{(1-b-c)} a^{1/b} \quad , \quad = \frac{-J(1-b)}{ba^{yb}}$$

and J = the constant of integration.

The elasticity of substitution is verified as

$$(5.5) \qquad \hat{\sigma} = \frac{1}{1 + \rho - \frac{m\rho}{V_K}}$$

where V_k is the share of capital. A novel feature of the relation (5.3) which distinguishes itself from the original CES production function is that the adapted CES relation (8.10) is a labour-embodied homogeneous CES type in which average labour productivity depends upon capital intensity. Because m and V_k are positive, the relationship between $\hat{\sigma}$ and σ depends on the magnitude of ρ . A further characteristic expressed in (8.10) lies in the manner in which the technical bias in Hicksian sense can be computed as follows :

$$(5.6) \qquad \gamma = 1 + \frac{m\rho\,(V_K - V_L)}{m\rho V_L - (1+\rho)V_K}$$

where ρ is the rate of technical change in the sense of Hicks, and V_L is the share of labour.

These various forms of the estimating equations will be applied to data pertaining to Thai manufacturing industry groups, from the Census of Manufacturing for the years 1971 and 1974.

3.3.4 Summary Statements of the Findings : Demand for Investment, Employment and Prices of Capital

Given the number of employed labour in different industry groups in Thai manufacturing, a striking feature of our findings is that the rate of capital formation in the manufacturing sector accelerated over the period 1970-1976, meaning that this accelerating rate of investment must have emerged for the years 1971 and 1974, the piriod under investigation. What forces were respensible for the investment growth acceleration ? The answer to this question has been partially given in the foregoing section. But the issue can be clarified with specification of the demand for investment function. Assume that all wage income is consumed, and the savings are performed by capitalists or business firms. Let Y_t denote gross product of the manufacturing sector and $(1-a_L)_t$ be the variable non-labour income share. From the condition that gross investment equals savings, where $R_{(t)}$ is the relative price of capital goods, it may be verified that

$$(5.7) \qquad \frac{K^{\cdot}_{(t)}}{K_{(t)}} = \frac{I_{(t)}}{K_{(t)}} - d = (1-a_L(t)) \; s. \left[\frac{R_t . K_{(t)}}{Y_{(t)}}\right]^{-1} - d.$$

where $I_{(t)}$ is investment rate; a_L share of labour, so that $(1-a_{L(t)})$ is the non-labour income share ; s is the savings rate, and d is the rate of depreciation. In view of equation (5.7) , rate of capital accumulation in manufacturing may take place for the following reasons : (i) an increase in the savings parameter, (ii) the functional income distribution may shify favoring non-labour income ; (iii) the capital-output ratio in physical terms may decline, and (iv) the relative prices of capital goods may fall. It is beyond the scope of this present study and will be far off our mainstream to deal with each of these factors extensively. However, our impirical evidence pertaining to the sources of accelerating rates of capital accumulation in Thai manufacturing suggests the followings :

First, Although the requisite annual data on business savings rates are meagure, we suspect that a significant portion of the acceleration in capital accumulation in Thai manufacturing can be attributed mainly to the relative decline in capital goods prices rather then to an increase in the savings rates. As our analysis of the prices of capital goods in accounting thought form indicates, the capital goods'relative prices during 1971 and 1974 were distorted in the neighborhood of 15 per cent to 25 per cent which means that the prices of capital inputs declined to that extent, Without the decline of the prices of capital inputs, the rate of accumulation in Thai manufacturing would have been retarded, perhaps enough to attenuate the expansion in capital formation. Second, it should be noted that the relative share favoring non-labour income increased markedly, across the whole industry group in most sector of Thai manufacturing in 1971 and 1974.

Third, the extent to which capital inputs are substituted for labour and other inputs depends on the relative prices of these inputs given technological parameters. The empirical evidence accumulated in our study apparently illustrates that the relative prices of capital goods declined to a significant extent and this has been fully analyzed in the preceding section. The implication of an increase in the industry-wide capital formation results in the higher capital stock per worker which in turn tends to raise the relative prices of labour, as our analysis regarding accounting wage rates proves. In consequence, substitution against labour takes place as firms attempt to save on the more expensive factor input, As long as manufacturing is characterized by labour-saving or capital-intensive, capital deepening takes place fostering a rise in the wage-rental ratio, and inevitably resulting in a fall in the capital goods prices.

Chapter IV

The Production Function Model Applied to Thai Manufacturing.

4.1 Substitution Elasticity Estimates :First Approximation.

In the present section, we present the regression results based on the model of estimation which will be applied to the 25 sub-set of Thai manufacturing for the year 1971 and 1974. The regression results reported were based on cross-section data, and the industry groups were tabulated on the basis of characteristics and sample size, shown in Table 2.1, and Table 2.2. The value of the elasticity of substitution reported exhibit variation in different sub-sets of Thai manufacturing for 1971 and 1974. In Table 4.1 and 4.2, the estimates of the elasticity were obtained using Form I and Form II of the estimation model, using the market values of the relavant variables without taking into accounts the accounting prices of the factors employed.

In this connection, some further remarks should be substantiated, In an evaluation of private enterprise, accounting prices of capital and accounting prices of labour, for Thai manufacturing in the years 1971, and 1974, are viewed to be of crucial importance as arguments in the production function and an axplaination of the expansion path which business firms adjust their input mix.

The divergence between short-run and long run elasticities depends upon the extent to which the current factor stocks can be made to to vary in response to changes in relative factor costs evaluated in accounting terms. Technology certainly determines the upper limit of substitution possibilities, but the rigidity of investment in capital is affected by a number of factors (Bhalla [8] ; Pack and Todaro [60] ; Morley and Williamson [56] : the average economic life of capital; the rate of investment, and the range of variation in the labour component that can be absorbed by installed equipment. As has been emphasized, there are other costs involved in changing factor input levels beyond the direct rental charges of factors, job-training, search, hiring, waiting and installation costs of new capital equipment, and in addition the markets for these goods are not efficiently organized. These considerations alert us to adopt the accounting prices of capital and of labour estimated in the preceding section as the robust proxies in the explanation productivity growth and capital-employment expansion in the Thai manufacturing sector for the years under investigation.

Table 4.1 and Table 4.2 provide the value of the elasticity of substitution, the extent of substitutability for Thai manufacturing for both the years 1971 and 1974 which is based on the estimation equation Form I and Form II. It consists of 25 sub-sectors of Thai manufacturing industry groups using observed values of capital and labour and their respective rental prices of capital and wage rates without making any adjustment in respect of their effective costs. The substitution elasticities based on the market wage-rental ratio are reported in Tables 4.1 and 4.2. And with another estimating model, the estimated substitution parameters, also based on the market rental price of capital and observed wage rate of the 25 industry groups, are reported in Table 5.1.

The elasticity of substitution estimates, expressed in terms of the relative factor share, designated Form III., is presented for the years 1971 and 1974, in the tables 5.1,5.2, The tables illustrate the results of fitting the regression across the 25 industry groups of Thai manufacturing in the same format as in Tables 4.1 and 4.2, but on the basis of market factor price relationshship. The values of the elasticity range very close to or greater than unity. Values of t stalistics are below 2.0 in only in three equations. [groups (2) (3) (4)] . However, it is surprising that the values of the substitution parameters were of this order of magnitude and it is possible to verify whether they are in fact consistent with Thai manufacturing industries.

Tables 5.1, and 5.2, present the regression results based the cost-minimizing model, using the factor costs in accounting terms--- as develcped fully in the present study. The remarkable results fitting the regression basing on

$$\ln K/L = \ln A + \ln \frac{w^*}{r^*}$$

where the relative factor prices are approximated by the their relative imputed costs, turn out to exhibit the values of substitution possibilities which in all cases are less than unity, confirming the hypothesis that the elasticity of substitation for manufacturing of LDC's [Williamson [75] , Daniels(16.a)] would be in the order of less than one, while considerable variation from industry to industry does occur. Values of t statistics are below two only in two categories (group 3 and 20 for 1971, and group 3 and 18 for 1974). This contrasts sharply with Tables 4.1 and 4.2.

4.2 Estimated Elasticity of Substitution Values.

Table 6.1 and Table 6.2 present the demand for labour and capital for the years 1977, and Tables 7.1 and 7.2 illustrate the regression results fitting for demand for labour and capital for 1974. It needs be pointed that, employment growth in Thai manufacturing varies positively with capital stock at accounting prices or value added at world prices and inversely with product wage rate at accounting prices. The results prove that the coefficients of all variables pass the stalistical test. The coefficients also were significantly different from zero and of the right sign which are consistent with the elasticity of substitution in excess of zero. The coefficients of value added were positive and those of the wage variable were negative. It should be noted that in all cases the coefficients of the demand for capital will respect to output have greater magnitudes than those of the demand for labour . And, the situation applies with equal full force to the accounting wage and rental rate variables. This implies that Thai manufacturing has been characterized by labour-saving technological process.

Table 4.1 : The Substitution Elasticities for 1971

Subsector (1)	Form I + II
Equation 1.1	$\ln \frac{V}{L} = 2.8355 + 0.8099 \ln w$ (1.0406) (2.6947) $R^2 = 0.7076$ F = 7.2615 D.W = 1.4139
1.2	$\ln \frac{V}{K} = -0.6316 + 0.4999 \ln r$ (-0.4916) (0.9161) $R^2 = 0.4186$ F = 8.8393 D.W = 1.7300

Note : The figures in parentheses are t-statistics. The meaning of Form I and Form II have been explained in text.

Subsector (2)	ISIC :- 3113 , 3114
Equation 2.1	$\ln \frac{V}{L} = 10.3022 + 1.1185 \ln w$ (2.7297) (1.2637) $R^2 = 0.2040$ F = 6.0695 D.W = 1.3283
2.2	$\ln \frac{V}{K} = 0.2795 + 0.6323 \ln r$ (0.0708) (4.6898) $R^2 = 0.5640$ F = 21.9949 D.W = 0.9383

Subsector (3)	ISIC :- 3115,3122
Equation 3.1 N = 50	$\ln \frac{V}{L} = 0.1872 + 1.1043 \ln w$ (0.6008) (7.2011) $R^2 = 0.6747$ $F = 51.8566$ $D.W = 1.7320$
Equation 3.2	$\ln \frac{V}{K} = 0.5787 + 0.7572 \ln r$ ((4.6757) (12.8928) $R^2 = .6243$ $F = 166.2262$ $D.W = 2.1451$
Subsector (4)	ISIC :- 3116, 3117
Equation (4.1)	$\ln \frac{V}{L} = 6.1815 + 0.4199 \ln w$ (6.0330) (3.3909) $R^2 = 0.2932$ $F = 11.4985$ $D.W = 2.5313$
4.2	$\ln \frac{V}{K} = 0.3556 + 0.7333 \ln r$ (0.3846) (7.9707) $R^2 = 0.5696$ $F = 63.5328$ $D.W = 1.6078$
4.3	$\ln \frac{V}{L} = 3.3274 + 0.6952 \ln w$ (1.9618) (4.7363) $R^2 = 0.2839$ $F = 4.5095$ $D.W = 2.1390$

Subsector (4)	
Equation(4.4)	$\ln \frac{V}{K} = \underset{(0.5427)}{0.2639} + \underset{(2.1235)}{0.5496} \ln r$ $R^2 = 0.2839$ $F = 4.5095$ $D.W = 2.1390$
Subsector(5)	ISIC :- 3118, 3119
Equation 5.1	$\ln \frac{V}{L} = \underset{(3.9912)}{11.8395} + \underset{(0.4967)}{0.7703} \ln w$ $R^2 = 0.8186$ $F = 90.2467$ $D.W = 1.7927$
5.2	$\ln \frac{V}{K} = \underset{(0.2914)}{0.1849} + \underset{(9.8888)}{0.7846} \ln w$ $R^2 = 0.8826$ $F = 97.7894$ $D.W = 1.7554$
Subsector(6)	ISIC :- 3131, 3134, 3142
Equation6.1	$\ln \frac{V}{L} = \underset{(3.0259)}{10.9616} + \underset{(0.7969)}{0.8809} \ln w$ $R^2 = 0.9455$ $F = 363.9655$ $D.W = 2.8695$

Subsector (6)	
Equation 6.2	$\ln \frac{V}{K} = \underset{(5.2875)}{0.7172} + \underset{(21.3019)}{0.8527} \ln w$ $R^2 = 0.4330$ $F = 453.7720$ $D.W = 1.5270$
Subsector (7)	
Equation 7.1	$\ln \frac{V}{L} = \underset{(2.8360)}{2.3417} + \underset{(8.2585)}{0.8309} \ln w$ $R^2 = 0.4311$ $F = 68.2033$ $D.W = 1.8863$
7.2	$\ln \frac{V}{K} = \underset{(2.6327)}{0.4410} + \underset{(9.9339)}{0.7158} \ln r$ $R^2 = 0.5230$ $F = 98.6837$ $D.W = 1.4759$
Subsector (8)	ISIC :- 3212, 3213, 3214
Equation 8.1	$\ln \frac{V}{L} = \underset{(0.8953)}{-1.0412} + \underset{(10.0618}{1.2160} \ln w$ $R^2 = 0.7018$ $F = 101.2404$ $D.W = 1.9017$
Equation 8.2	$\ln \frac{V}{K} = \underset{(4.2743)}{0.6264} + \underset{(14.0223)}{0.8166} \ln r$ $R^2 = 0.8205$ $F = 196.6254$ $D.W = 2.0544$

Subsector (9)	ISIC :- 3220, 3233, 3240
Equation 9.1	$\ln \frac{V}{L} = 0.9577 + 1.0116 \ln w$ (0.3669) (4.3331) R^2 = 0.6100 F = 18.7785 D.W = 2.3652
9.2	$\ln \frac{V}{K} = 1.0626 + 0.5331 \ln r$ (6.3531) (5.9332) R^2 = 0.6048 F =15.2027 D.W = 2.0470
Subsector (10)	ISIC :- 3311
Equation10.1	$\ln \frac{V}{L} = 3.6735 + 0.6743 \ln w$ (3.1333) (4.9887) R^2 = 0.2350 F = 24.8874 D.W = 1.9874
10.2	$\ln \frac{V}{L} = 1.2645 + 0.7250 \ln r$ (11.4433) (14.1045) R^2 = 0.7132 F = 198.9229 D.W = 1.7709
Subsector (11)	ISIC :- 3320
Equation 11.1	$\ln \frac{V}{L} = 2.5891 + 0.7805 \ln w$ (1.7464) (4.5307) R^2 = 0.4610 F = 20.5278 D.W = 2.0247

Subsector.(11)	
Equation 11.2	$\ln \frac{V}{K} = 1.0899 + 0.6218 \ln r$ (2.5083) (4.9034) $R^2 = 0.5004$ $F = 24.0441$ $D.W = 2.1527$
Subsector (12)	ISIC :- 3411, 3412, 3419
Equation 12.1	$\ln \frac{V}{L} = 8.4844 + 0.7193 \ln w$ (1.7924) (0.5808) $R^2 = 0.4138$ $F = 0.3374$ $D.W = 1.7306$
12.2	$\ln \frac{V}{K} = 0.4918 + 0.8908 \ln r$ (3.0781) (18.9586) $R^2 = 0.9374$ $F = 359.4082$ $D.W = 1.7558$
Subsector (13)	ISIC :- 3420
Equation 13.1	$\ln \frac{V}{L} = 5.3733 + 0.4823 \ln w$ (4.1909) (3.3049) $R^2 = 0.4854$ $F = 10.9224$ $D.W = 1.5481$
13.2	$\ln \frac{V}{K} = 0.6766 + 0.6493 \ln r$ (5.9775) (11.0286) $R^2 = 0.7170$ $F = 121.6319$ $D.W = 1.8496$

Subsector (14)	ISIC :- 3511, 3512
Equation 14.1	$\ln \frac{V}{L} = 1.3744 + 0.9882 \ln w$ (0.4487) (4.8445 $R^2 = 0.6100$ F =23.4697 D.W = 1.7417
14.2	$\ln \frac{V}{K} = 0.4660 + 0.7695 \ln r$ (1.0269) (3.4780) $R^2 = 0.4464$ F = 12.0967 D.W = 1.6089
Subsector (15)	ISIC :- 3521, 3522, 3529
Equation 15.1	$\ln \frac{V}{L} = 0.2378 + 1.0606 \ln w$ (0.2025) (7.8637) $R^2 = 0.6193$ F = 61.8392 D.W = 1.6954
15.2	$\ln \frac{V}{K}$ not significant
Subsector (16)	ISIC :- 3523
Equation 16.1	$\ln \frac{V}{L} = 3.9181 + 0.6388 \ln w$ (1.2773) (3.5946) $R^2 = 0.4178$ F = 12.9214 D.W = 2.0241

Subsector (16)	
Equation 16.2	$\ln \frac{V}{K} = 0.5104 + 0.6863 \ln r$ (2.3592) (4.7554) $R^2 = 0.7153$ $F = 22.6135$ $D.W = 2.3612$
Subsector (17)	ISIC :- 3551, 3559
Equation 17.1	$\ln \frac{V}{L} = 3.6497 + 0.7084 \ln w$ (2.2686) (18.0334) $R^2 = 0.6826$ $F = 64.5360$ $D.W = 1.5919$
17.2	$\ln \frac{V}{K}$ not significant
Subsector (18)	ISIC :- 3560
Equation 18.1	$\ln \frac{V}{L} = 0.3254 + 1.0570 \ln w$ (0.2340) (9.6939) $R^2 = 0.8033$ $F = 93.9720$ $D.W = 1.7205$
18.2	$\ln \frac{V}{K} = 0.5538 + 0.8124 \ln r$ (2.2654) (7.1053) $R^2 = 0.6870$ $F = 50.4853$ $D.W = 1.2180$

Subsector (19)	ISIC :- 3610, 3691
Equation 19.1	$\ln \frac{V}{L} = 2.6639 + 0.7164 \ln w$ (1.6435) (10.0590) $R^2 = 0.8082$ $F = 101.1849$ $D.W = 1.7395$
19.2	$\ln \frac{V}{K} = 0.6639 + 0.7366 \ln r$ (2.0001) (5.2043) $R^2 = 0.5301$ $F = 27.0849$ $D.W = 1.7109$
Subsector (20)	ISIC :- 3620
Equation 20.1	$\ln \frac{V}{L} = -1.7951 + 1.3638 \ln w$ (-0.2906) (3.3206) $R^2 = 0.5795$ $F = 11.0266$ $D.W = 2.0153$
20.2	$\ln \frac{V}{K} = 0.7309 + 0.8775 \ln r$ (1.7926) (3.6573) $R^2 = 0.6257$ $F = 13.3760$ $D.W = 1.5351$
Subsector (21)	ISIC :- 3692, 3699
Equation 21.1	$\ln \frac{V}{L} = 4.6932 + 0.5973 \ln w$ (0.8898) (4.3602) $R^2 = 0.3334$ $F = 19.0118$ $D.W = 1.9430$

Subsector (21)	
Equation 21.2	$\ln \frac{V}{L} = \underset{(2.8774)}{0.5457} + \underset{(20.3421)}{0.9064} \ln r$ $R^2 = 0.9158$ F =413.8021 D.W = 2.1996
Subsector (22)	ISIC :- 3711, 3712, 3720
Equation 22.1	$\ln \frac{V}{L} = \underset{(0.3072)}{0.9917} + \underset{(3.5904)}{0.9826} \ln w$ $R^2 = 0.4461$ F =12.8909 D.W = 1.6562
22.2	$\ln \frac{V}{K} = \underset{(2.1560)}{0.5368} + \underset{(3.9774)}{0.5873} \ln r$ $R^2 = 0.4971$ F = 15.8203 D.W = 1.4718
Subsector (23)	ISIC :- 3811, 3812, 3813, 3819
Equation 23.1	$\ln \frac{V}{K} = \underset{(2.2094)}{2.7303} + \underset{(5.6310)}{0.8002} \ln w$ $R^2 = 0.2788$ F = 31.7089 D.W = 1.6783
23.2	$\ln \frac{V}{K} = \underset{(1.6306)}{0.6465} + \underset{(15.0335)}{0.7619} \ln r$ $R^2 = 0.7337$ F =226.0077 D.W = 1.9216

Subsector (24)	ISIC :- 3822, 3824, 3829
Equation 24.1	$\ln \frac{V}{L} = 2.7731 + 0.7603 \ln w$ $(1.0249) \quad (2.4538)$ $R^2 = 0.2148$ $F = 6.0212$ $D.W = 1.8361$
24.2	$\ln \frac{V}{K} = 0.8303 + 0.8025 \ln r$ $(2.2293) \quad (8.1523)$ $R^2 = 0.7513$ $F = 66.4607$ $D.W = 2.0050$
Subsector (25)	ISIC :- 3841, 3842, 3844
Equation 25.1	$\ln \frac{V}{L} = 5.0961 + 0.5357 \ln w$ $(1.3591) \quad (2.8827)$ $R^2 = 0.1875$ $F = 8.3103$ $D.W = 2.1420$
25.2	$\ln \frac{V}{K} = 0.6515 + 0.7791 \ln r$ $(1.8424) \quad (11.3339)$ $R^2 = 0.7810$ $F = 128.4581$ $D.W = 2.1491$
Subsector (26)	ISIC :- 3901, 3902, 3903
Equation 26.1	$\ln \frac{V}{L} = 0.7086 + 0.9997 \ln w$ $(0.2407) \quad (4.8005)$ $R^2 = 0.6057$ $F = 23.0453$ $D.W = 2.0181$

Subsector (26)	
Equation 26.2 N = 20	$\ln \frac{V}{K} = 0.8485 + 0.7854 \ln r$ (4.7906) (7.7249) R^2 = 0.7991 F = 59.6742 D.W = 2.2526

Table 4.2. The Elasticity of Substition for 1974 (Form I + II)

Subsector (1)	
Equation 1.1 n = 14	$\ln \frac{V}{L} = 5.5127 + 0.5608 \ln w$ (1.5783) (1.5646) R^2 = 0.2896 F = 2.4462 D.W = 1.3566
1.2	$\ln \frac{V}{K} = 0.1950 + 0.8413 \ln r$ (0.8974) (8.4149) R^2 = 0.9216 F = 70.8114 D.W = 1.1148
Subsector (2)	
Equation 2.1	$\ln \frac{V}{L} = 2.3684 + 0.8089 \ln w$ (0.6722) (7.1641) R^2 = 0.7278 F = 51.3244 D.W = 2.0884

Subsector (2)					
Equation 2.2	$\ln \frac{V}{K}$	= 0.5388	+	0.8312	ln r
		(1.7874)		(3.7332)	
				R^2	= 0.6735
				F	= 32.8693
				D.W	= 2.0884
Subsector (3)					
Equation 3.1	$\ln \frac{V}{L}$	= 5.3234	+	0.4884	ln w
		(1.2211)		(3.4055)	
				R^2	= 0.2856
				F	= 11.5978
				D.W	= 1.8836
3.2	$\ln \frac{V}{K}$	= 0.4293	+	0.7391	ln r
		(2.3543)	+	(8.7397)	
				R^2	= 0.7534
				F	= 76.3832
				D.W	= 1.6659
Subsector (4)					
Equation 4.1	$\ln \frac{V}{L}$	= 3.8599	+	0.6492	ln w
N = 27		(1.3139)		(5.2917)	
				R^2	= 0.5283
				F	= 28.0027
				D.W	= 1.3967
4.2	$\ln \frac{V}{K}$	= 0.3569	+	0.6637	ln r
		(1.8383)		(6.3988)	
				R^2	= 0.6209
				F	= 40.9448
				D.W	= 2.0610

Subsector (5)		
Equation 5.1 N = 53	$\ln \frac{V}{L} = \underset{(4.3222)}{5.4216} + \underset{(3.9636)}{0.5579} \ln w$	$R^2 = 0.2355$ $F = 15.7106$ $D.W = 1.3576$
5.2	$\ln \frac{V}{K} = \underset{(1.0625)}{0.4009} + \underset{(6.3840)}{0.7241} \ln r$	$R^2 = 0.4432$ $F = 0.4759$ $D.W = 1.7876$
Subsector (6)		
Equation 6.1	$\ln \frac{V}{L} = \underset{(1.0835)}{4.2723} + \underset{(1.7995)}{0.6868} \ln w$	$R^2 = 0.2446$ $F = 3.2383$ $D.W = 1.4910$
6.2	$\ln \frac{V}{K} = \underset{(3.6904)}{0.6104} + \underset{(10.0176)}{0.7740} \ln r$	$R^2 = 0.9177$ $F = 100.3522$ $D.W = 1.2626$
Subsector (7)		
Equation 7.1 N = 167	$\ln \frac{V}{L} = \underset{(0.8031)}{4.0645} + \underset{(5.3412)}{0.6413} \ln w$	$R^2 = 0.2121$ $F = 28.5285$ $D.W = 2.9028$

Subsector (7)	
Equation 7.2	$\ln \frac{V}{K} = \underset{(4.6758)}{0.5788} + \underset{(12.8928)}{0.7572} \ln r$ $R^2 = 0.6244$ $F = 166.2262$ D.W = 2.1451
Subsector (8)	
Equation 8.1 N = 17	$\ln \frac{V}{L} = \underset{(0.8437)}{3.7679} + \underset{(2.1441)}{0.6508} \ln w$ $R^2 = 0.2346$ $F = 4.5973$ D.W = 2.7777
8.2	$\ln \frac{V}{K} = \underset{(1.3231)}{0.3911} + \underset{(3.4109)}{0.5099} \ln r$ $R^2 = 0.4538$ $F = 11.6339$ D.W = 2.8359
Subsector (9)	
Equation 9.1 N = 14	$\ln \frac{V}{L} = \underset{(1.1964)}{3.9407} + \underset{(2.2284)}{0.5974} \ln w$ $R^2 = 0.4983$ $F = 4.9658$ D.W = 1.8373
9.2	$\ln \frac{V}{K} = \underset{(1.0556)}{0.5675} + \underset{(2.4304)}{0.6627} \ln r$ $R^2 = 0.5416$ $F = 5.9066$ D.W = 1.5025

Subsector (10)	
Equation 10.1	$\ln \frac{V}{L} = \underset{(0.9627)}{6.7792} + \underset{(2.5962)}{0.3228} \ln w$ $R^2 = 0.2952$ $F = 6.7400$ $D.W = 2.0378$
10.2	$\ln \frac{V}{K} = \underset{(6.0791)}{0.6537} + \underset{(8.5118)}{0.5136} \ln r$ $R^2 = 0.5429$ $F = 72.4501$ $D.W = 1.6007$
Subsector (11)	
Equation 11.1 N = 18	$\ln \frac{V}{L} = \underset{(0.3351)}{1.9691} + \underset{(3.7761)}{0.6769} \ln w$ $R^2 = 0.7064$ $F = 38.4868$ $D.W = 2.3529$
11.2	$\ln \frac{V}{K} = \underset{(1.8049)}{0.6933} + \underset{(3.7761)}{0.6769} \ln r$ $R^2 = 0.4712$ $F = 14.2589$ $D.W = 1.2023$
Subsector (12)	
Equation 12.1	$\ln \frac{V}{L} = \underset{(0.6319)}{3.0409} + \underset{(3.9252)}{0.7439} \ln w$ $R^2 = 0.4612$ $F = 15.4071$ $D.W = 1.1713$

Subsector (12)	
Equation 12.2	$\ln \frac{V}{K} = \underset{(1.4969)}{0.7763} + \underset{(6.8711)}{0.7564} \ln r$ $R^2 = 0.7458$ $F = 16.6996$ $D.W = 2.2344$
Subsector (13)	
Equation 13.1 N = 49	$\ln \frac{V}{L} = \underset{(1.3138)}{7.5979} + \underset{(2.0427)}{0.2272} \ln w$ $R^2 = 0.0815$ $F = 4.1725$ $D.W = 1.6938$
13.2	$\ln \frac{V}{K} = \underset{(3.1795)}{0.8708} + \underset{(6.5075)}{0.7178} \ln r$ $R^2 = 0.4793$ $F = 42.3475$ $D.W = 2.3519$
Subsector (14)	
Equation 14.1 N N = 18	$\ln \frac{V}{L} = \underset{(0.7272)}{7.8509} + \underset{(1.1339)}{0.3017} \ln w$ $R^2 = 0.2703$ $F = 11.2857$ $D.W. = 1.9289$
14.2	$\ln \frac{V}{K} = \underset{(3.4874)}{0.5341} + \underset{(15.9590)}{0.8914} \ln r$ $R^2 = 0.9409$ $F = 254.6903$ $D.W = 1.2256$

Subsection(15)	
Equatór 15.1 N = 84	$\ln \frac{V}{L} = 6.1574 + 0.4213 \ln w$ (6.1844) (3.7319) $R^2 = 0.1452$ F = 13.9275 D.W = 2.7369
15.2	$\ln \frac{V}{K} = 0.6862 + 0.7629 \ln r$ (6.2559) (12.6955) $R^2 = 0.6796$ F =161.1769 D.W = 2.0385
Subsector (16)	
Equation 16.1 N = 21	$\ln \frac{V}{L} = 4.8089 + 0.5526 \ln w$ (3.9104) (7.1056) $R^2 = 0.2587$ F = 6.6302 D.W = 1.6985
16.2	$\ln \frac{V}{K} = 0.8810 + 0.6929 \ln r$ (3.9104) (7.1056) $R^2 = 0.7266$ F = 50.4897 D.W = 1.8891
Subsector (17)	
Equation 17.1 N = 21	$\ln \frac{V}{L} = 1.4013 + 0.8666 \ln w$ (0.8618) (4.8384) $R^2 = 0.5519$ F = 23.4103 D.W = 1.7617

Subsector (17)					
Equation 17.2	$\ln \frac{V}{K}$ =	0.4618	+	0.2306	ln r
		(2.2812)		(4.2564)	
				R^2 =	0.6937
				F =	18.1167
				D.W =	2.1421
Subsector (18)					
Equation 18.1					
N = 27	$\ln \frac{V}{L}$ =	0.6395	+	1.0487	ln w
		(0.2945)		(6.5634)	
				R^2 =	0.6328
				F =	43.0781
				D.W =	1.6581
18.2	$\ln \frac{V}{K}$ =	0.2848	+	0.6565	ln r
		(1,1975)		(5.2107)	
				R^2 =	0.5308
				F =	27.1515
				D.W =	1.9039
Subsector (19)					
Equation 19.1	$\ln \frac{V}{L}$ =	7.9419	+	0.1176	ln w
		(3.7537)		(0.4436)	
N = 27				R^2 =	0.1078
				F =	10.1978
				D.W =	2.7998

Subsector (19)	
Equation 19.2	$\ln \frac{V}{K} = \underset{(3.8254)}{0.6027} + \underset{(11.0032)}{0.7951} \ln r$ $R^2 = 0.8403$ $F = 121.0708$ $D.W = 2.2659$
Subsector (20)	
Equation 20.1 N = 14	$\ln \frac{V}{L} = \underset{(0.7174)}{1.7369} + \underset{(3.4890)}{0.8974} \ln w$ $R^2 = 0.5253$ $F = 12.1734$ $D.W = 1.7718$
20.2	$\ln \frac{V}{K} = \underset{(3.5945)}{0.8834} + \underset{(8.1366)}{1.0223} \ln r$ $R^2 = 0.8573$ $F = 66.1062$ $D.W = 1.5348$
Subsector (21)	
Equation 21.1 N N = 24	$\ln \frac{V}{L} = \underset{(1.4679)}{4.3076} + \underset{(3.5169)}{0.6345} \ln w$ $R^2 = 0.3599$ $F = 12.3691$ $D.W = 1.5094$
21.2	$\ln \frac{V}{K} = \underset{(2.1363)}{0.3918} + \underset{(8.2632)}{0.8249} \ln r$ $R^2 = 0.7563$ $F = 68.2803$ $D.W = 1.2154$

Subsector (22)	
Equation 22.1 N = 27	$\ln \frac{V}{L} = \underset{(1.6990)}{1.7292} + \underset{(7.8007)}{0.8979} \ln w$ $R^2 = 0.7088$ $F = 60.8516$ $D.W = 1.8705$
22.2	$\ln \frac{V}{K} = \underset{(3.6268)}{0.5571} + \underset{(11.0124)}{0.8188} \ln r$ $R^2 = 0.8348$ $F = 121.2729$ $D.W = 2.2217$
Subsector (23)	
Equation 23.1 N = 165	$\ln \frac{V}{L} = \underset{(2.2266)}{4.2888} + \underset{(7.1233)}{0.6039} \ln w$ $R^2 = 0.3300$ $F = 50.7409$ $D.W = 2.1755$
23.2	$\ln \frac{V}{K} = \underset{(6.4878)}{0.6906} + \underset{(13.0158)}{0.7079} \ln r$ $R^2 = 0.6288$ $F = 169.4101$ $D.W = 2.3351$
Subsector (24)	
Equation 24.1 N = 35	$\ln \frac{V}{K} = \underset{(1.0777)}{1.7489} + \underset{(4.9036)}{0.8956} \ln w$ $R^2 = 0.4215$ $F = 24.0453$ $D.W = 1.7849$

Subsector (24)	
Equation 24.2	$\ln \frac{V}{K} = 0.5566 = 0.6691 \ln r$ (2.1278) (5.5284) R^2 = 0.4808 F = 30.5635 D.W = 2.2053
Subsector (25)	
Equation 25.1 N = 44	$\ln \frac{V}{L} = 1.8423 + 0.8914 \ln w$ (0.8725) (6.6350) R^2 = 0.5118 F = 44.0238 D.W = 1.9463
25.2	$\ln \frac{V}{K} = 0.8179 + 0.6837 \ln r$ (2,6054) (7.7864) R^2 = 0.5908 F = 60.6282 D.W = 1.1795
Subsector (26)	
Equation 26.1 N = 8	$\ln \frac{V}{L} = 3.8122 + 0.6335 \ln w$ (1.2019)1 (2.1217) R^2 = 0.4287 F = 4.5018 D.W = 1.9172
26.2	$\ln \frac{V}{K} = 1.1289 + 0.7515 \ln r$ (3.2497) (5.1262) R^2 = 0.8141 F = 26.2781 D.W = 1.5537

Sources of Data ; Data were from Census of Manufactures, 1971 and 1972, National Statistical office, Bangkok .

Table 5.1 Elasticity of Substitution : Census Year 1971

(based on market wage rental ratio)

Subsector Equation	ISIC	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$		elasticity of substitution σ
1	3111 3112 3121	Meat products. Dairy products. Food products, nes.	$\ln \frac{w}{r} = -3.1595 + 0.7856 \ln \frac{K}{L}$ (-0.5792) (3.2536) $R^2 = 0.4145$ F = 10.5857 D.W = 1.7418	1.2738
2	3113 3114	Canning & preserving of fruits & veg. Canning, fish, similar food.	$\ln \frac{w}{r} = 2.0724 + 0.3226 \ln \frac{K}{L}$ (0.5835) (1.2848) $R^2 = 0.6885$ F = 1.6506 D.W = 1.8231	3.0998
3	3115 3122	Vegetable & animal ails & fats. Prepared animal feeds.	$\ln \frac{w}{r} = 1.5467 + 0.3608 \ln \frac{K}{L}$ (0.5070) (1.2733) $R^2 = 0.7109$ F = 1.6213 D.W = 1.7854	2.7716
4	3116 3117	Grain mill products. Bakery product.	$\ln \frac{w}{r} = 3.1098 + 0.1712 \ln \frac{K}{L}$ (1.7549) (1.3645) $R^2 = 0.6259$ F = 1.8619 D.W = 1.8270	5.8411
5	3118 3119	Sugar factories & refineries. Cocoa, chocolate & sugar	$\ln \frac{w}{r} = 1.6289 + 0.6321 \ln \frac{K}{L}$ (-0.6406) (3.5969) $R^2 = 0.3503$ F = 12.9374 D.W = 2.3310	1.5822

Subsector Equation	ISIC	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$		elastici substitu σ
6	3131 3134 3142	Distilling, rectifying spirits Sofy drinks Tobacco	$\ln \frac{w}{r} = -7.4853 + 1.2190 \ln \frac{K}{L}$ (-1.3702) (3.1030) R^2 = 0.3144 F = 9.6287 D.W = 2.5613	0.8696
7	3211	Thread and yarn	$\ln \frac{w}{r} = 0.0559 + 0.5140 \ln \frac{K}{L}$ (-0.0512) (6.6817) R^2 = 0.4367 F = 44.6456 D.W = 2.0247	1.9455
8	3212 3213 3214	Make-up tertile goods. Knitting mill (outer wear) Carpet and rugs.	$\ln \frac{w}{r} = -1.8248 + 0.7416 \ln \frac{K}{L}$ (-2.0730) (8.0517) R^2= 0.6695 F = 64.8296 D.W = 1.6521	1.3484
9	3220 3233 3240	Wearing apparil Leather products. Footwear	$\ln \frac{w}{r} = 0.5752 + 0.4469 \ln \frac{K}{L}$ (1.4418) (3.1164) R^2 = 0.4808 F = 9.7119 D.W = 1.7983	2.2376
10	3311	Sawmills, planing.	$\ln \frac{w}{r} = 1.4883 + 0.7428 \ln \frac{K}{L}$ (-1.7736) (7.9099) R^2 = 0.4615 F = 62.5668 D.W = 1.6584	1.3462

Equ.	ISIC	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$		σ
11	3320	Furniture	$\ln \frac{w}{r} = -0.7669 + 0.6640 \ln \frac{K}{L}$ (-0.2676) (2.9470) R^2 = 0.4741 F = 8.6847 D.W = 2.6909	1.5060
12	3411 3412 3419	Pulp, paper and paper-board. Containers, boxes of paper. Paper products, nes.	$\ln \frac{w}{r} = -3.2963 + 0.8323 \ln \frac{K}{L}$ (-1.4286) (5.4919) R^2 = 0.7510 F = 30.1605 D.W = 5.5879	1.2014
13	3420	Printing and publishing	$\ln \frac{w}{r} = -0.3537 + 0.5799 \ln \frac{K}{L}$ (-0.2671) (4.2678) R^2 = 0.3184 F = 18.2144 D.W = 1.9591	1.7244
14	3511	Basic industrial chemicals	$\ln \frac{w}{r} = -1.7031 + 0.7626 \ln \frac{K}{L}$ (-0.6236) (2.7208) R^2 = 0.5140 F = 7.4027 D.W = 2.3840	1.3113
15			$\ln \frac{w}{r} = -0.6468 + 0.6159 \ln \frac{K}{L}$ (-0.5034) (4.8222) R^2 = 0.5255 F = 23.2534 D.W = 1.6863	1.6236

Equ.	ISIC	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	elasticity of substitution σ
16		$\ln \frac{w}{r} = \underset{(-1.4299)}{-6.8599} + \underset{(3.3223)}{1.2276} \ln \frac{K}{L}$ $R^2 = 0.5798$ F = 11.0376 D.W = 1.7935	0.8149
17		$\ln \frac{w}{r} = \underset{(-4.2489)}{-4.9313} + \underset{(8.2049)}{0.9602} \ln \frac{K}{L}$ $R^2 = 0.6989$ F = 67.3199 D.W = 1.7347	1.0416
18		$\ln \frac{w}{r} = \underset{(-0.3200)}{-0.5486} + \underset{(4.9925)}{0.6014} \ln \frac{K}{L}$ $R^2 = 0.5201$ F = 24.9255 D.W = 2.0185	1.6627
19		$\ln \frac{w}{r} = \underset{(-0.8682)}{-2.0613} + \underset{(4.0328)}{0.7763} \ln \frac{K}{L}$ $R^2 = 0.3791$ F = 16.2632 D.W = 1.9562	1.2881
20		$\ln \frac{w}{r} = \underset{(1.3822)}{3.2855} + \underset{(0.8525)}{0.4477} \ln \frac{K}{L}$ $R^2 = 0.2833$ F = 8.7267 D.W = 1.5411	2.2336

Equ.	ISIC	$\ln \frac{w}{r} = \ln a\ (1+\rho)\ \ln \frac{K}{L}$	elasticity of substitution σ
21		$\ln \frac{w}{r} = -1.2222 + 0.6005 \ln \frac{K}{L}$ (-0.6356) (4.4888) R^2 = 0.3465 F = 20.1493 D.W = 2.0564	1.6652
22		$\ln \frac{w}{r} = 1.3672 + 0.4161 \ln \frac{K}{L}$ (0.4519) (1.9342) R^2 = 0.2895 F = 3.7411 D.W = 1.9204	2.4295
23		$\ln \frac{w}{r} = -1.0744 + 0.6265 \ln \frac{K}{L}$ (-0.6254) (5.0648) R^2 = 0.3383 F = 25.6524 D.W = 1.6950	1.5956
24		$\ln \frac{w}{r} = -0.4570 + 0.6045 \ln \frac{K}{L}$ (-0.1425) (2.5473) R^2 = 0.4278 F = 8.4885 D.W = 1.6053	1.6542
25		$\ln \frac{w}{r} = -1.5435 + 0.6599 \ln \frac{K}{L}$ (-0.6599) (3.056) R^2 = 0.2976 F = 15.2534 D.W = 2.2050	1.5153

Equ.	ISIC	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	Elasticity of substitution σ
26		$\ln \frac{w}{r} = -2.9926 + 0.8541 \ln \frac{K}{L}$ (0.9764) (3.5503) $R^2 = 0.4566$ F = 12.6045 D.W = 2.1171	1.1708

Table 5.2 Elasticity of Substitution, Census Year 1974.

Subsector Equation	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	Elasticity of substitution
1	$\ln \frac{w}{r} = -1.8231 + 0.6625 \ln \frac{K}{L}$ (-0.4778) (2.8651) $R^2 = 0.2042$ F = 8.2089 D.W = 1.9340	1.5-94
2	$\ln \frac{w}{r} = -3.9358 + 0.9293 \ln \frac{K}{L}$ (-1.7205) (5.7998) $R^2 = 0.6777$ F = 33.6379 D.W = 1.9634	1.0760
3	$\ln \frac{w}{r} = 8.5734 + 0.8042 \ln \frac{K}{L}$ (1.9143) (4.8661) $R^2 = 0.5129$ F = 23.6786 D.W = 1.8243	1.2434

Equ.	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	elasticity of substitution σ
4	$\ln \frac{w}{r} = -3.3548 + 0.8385 \ln \frac{K}{L}$ (-1.3967) (4.8661) $R^2 = 0.5129$ $F = 23.6786$ $D.W = 1.8243$	1.1314
5	$\ln \frac{w}{r} = 1.8400 + 0.5056 \ln \frac{K}{L}$ (0.6164) (1.4544) $R^2 = 0.4236$ $F = 8.1152$ $D.W = 1.5174$	1.9778
6	$\ln \frac{w}{r} = -6.8492 + 1.1586 \ln \frac{K}{L}$ (-1.3777) (3.6376) $R^2 = 0.5696$ $F = 13.2322$ $D.W = 1.5874$	0.8631
7	$\ln \frac{w}{r} = 1.4146 + 0.5843 \ln \frac{K}{L}$ (1.2231) (3.4009) $R^2 = 0.2001$ $F = 11.5659$ $D.W = 1.7195$	1.7114
8	$\ln \frac{w}{r} = -4.0109 + 0.9491 \ln \frac{K}{L}$ (-1.4822) (4.8485) $R^2 = 0.4948$ $F = 23.5075$ $D.W = 1.9398$	1.0423

Equ.	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	elasticity of substitution σ
9	$\ln \frac{w}{r} = -0.1932 + 0.5760 \ln \frac{K}{L}$ (-0.0000) (2.3683) $R^2 = 0.2832$ $F = 5.6088$ D.W = 1.9228	1.7355
10	$\ln \frac{w}{r} = -0.2362 + 0.5614 \ln \frac{K}{L}$ (-0.0863) (2.7482) $R^2 = 0.2102$ $F = 8.5528$ D.W = 1.9937	1.7806
11	$\ln \frac{w}{r} = -0.1149 + 0.5257 \ln \frac{K}{L}$ (-0.0350) (2.1450) $R^2 = 0.4233$ $F = 4.6009$ D.W = 1.8719	1.9018
12	$\ln \frac{w}{r} = -0.0761 + 0.5184 \ln \frac{K}{L}$ (-0.0144) (1.4992) $R^2 = 0.2232$ $F = 4.2477$ D.W = 1.9802	1.9282
13	$\ln \frac{w}{r} = 2.8040 + 0.6081 \ln \frac{K}{L}$ (1.1583) (1.7836) $R^2 = 0.2647$ $F = 8.1813$ D.W = 2.1623	

Equ.	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	elasticity of substitution σ
14	$\ln \frac{w}{r} = -6.6732 + 1.0965 \ln \frac{K}{L}$ (-18601 (4.6824) R^2 = 0.5781 F = 21.9251	0.9124
15	$\ln \frac{w}{r} = -0.1235 + 0.8156 \ln \frac{K}{L}$ (-0.0571) (3.3574) R^2 = 0.4292 F = 21.2722 D.W = 1.4721	1.2260
16	$\ln \frac{w}{r} = -3.2794 + 0.8930 \ln \frac{K}{L}$ (-0.7817) (2.8856) R^2 = 0.5047 F = 8.3266 D.W = 1.3898	1.1198
17	$\ln \frac{w}{r} = 3.1744 + 0.7985 \ln \frac{K}{L}$ (1.0116) (0.8461) R^2 =0.2928 F =8.7159 D.W =2.1725	1.2523
18	$\ln \frac{w}{r} = 2.0933 + 0.8389 \ln \frac{K}{L}$ (0.7909) (1.9052) R^2 = 0.4310 F = 8.6298 D.W = 2.1725	1.1920

Equ.	$\ln \frac{w}{r} = \ln a + (+\rho) \ln \frac{K}{L}$	elasticity of substitution σ
19	$\ln \frac{w}{r} = -2.1575 + 0.6983 \ln \frac{K}{L}$ (-0.4948) (2.0731) $R^2 = 0.4574$ $F = 10.2979$ $D.W = 1.5760$	1.4318
20	$\ln \frac{w}{r} = -0.5310 + 0.5649 \ln \frac{K}{L}$ (-0.2317) (3.2731) $R^2 = 0.4934$ $F = 10.7129$ $D.W = 1.6170$	1.7412
21	$\ln \frac{w}{r} = 0.5897 + 0.7702 \ln \frac{K}{L}$ (0.1788) (2.1514) $R^2 = 0.4738$ $F = 14.6286$ $D.W = 1.9242$	1.2987
22	$\ln \frac{w}{r} = -3.0654 + 0.8493 \ln \frac{K}{L}$ (-1.2876) (5.2247) $R^2 = 0.5321$ $F = 27.2978$ $D.W = 2.0527$	1.1774
23	$\ln \frac{w}{r} = -0.3771 + 0.6965 \ln \frac{K}{L}$ (-0.2459) (5.4716) $R^2 = 0.4322$ $F = 29.9379$ $D.W = 2.3440$	1.4357

Equ.	$\ln \frac{w}{r} = \ln a + (1+\rho) \ln \frac{K}{L}$	elasticity of substitution σ
24	$\ln \frac{w}{r} = \underset{(1.0995)}{2.2595} + \underset{(2.5567)}{0.8599} \ln \frac{K}{L}$ $R^2 = 0.4653$ $F = 16.5367$ $D.W = 1.7518$	1.1629
25	$\ln \frac{w}{r} = \underset{(0.9947)}{2.2399} + \underset{(2.1044)}{0.8379} \ln \frac{K}{L}$ $R^2 = 0.2954$ $F = 10.4284$ $D.W = 2.1989$	1.1934
26	$\ln \frac{w}{r} = \underset{(-1.0219)}{-5.3065} + \underset{(2.5240)}{1.1352} \ln \frac{K}{L}$ $R^2 = 0.5150$ $F = 8.3704$ $D.W = 2.1284$	0.8809

Table 5.3 : Elasticity of substitution ; Census Year 1971.
(Based on Effective Wage - Rental Ratio)

Subsector Industry Groups.	ISIC	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r}$	Elasticity of substitution σ
1	3111 3112 3121	Meat products. Dairy products. Food products, nes. $\ln \frac{K}{L} = 9.6387 + 0.2717 \ln \frac{w}{r}$ (2.9729) (3.2536) R^2 = 0.4135 F =10.5857 D.W = 1.3688	0.2717
2	3113 3114	Canning & preserving of fruits & veg. Canning, fish, similar food. $\ln \frac{K}{L} = 8.5252 + 0.4744 \ln \frac{w}{r}$ (2.4603) (1.2848) R^2 = 0.2885 F = 11.6506 D.W = 0.8851	0.4744
3	3115 3122	Vegetable & animal oils & fats. Pupared animal feeds $\ln \frac{K}{L} = 9.0233 + 0.3074 \ln \frac{w}{r}$ (2.9081) (1.2733) R^2 = 0.7109 F =11.6213 D.W = 2.0755	0.3074
4	3116 3117	Grain mill products. Bakery product. $\ln \frac{K}{L} = 9.2123 + 0.4513 \ln \frac{w}{r}$ (5.2661) (1.3645) R^2 = 0.6259 F =11.8619 D.W = 1.8859	0.4513

Subsector Industry groups.	ISIC	$\ln\frac{K}{L} = \ln\left(\frac{d}{1-d}\right) + \ln\frac{w}{r}$	Elasticity of substitution σ
5	3118 3119	Sugar factories & refineries. Cocoa, chocolate sugar. $\ln\frac{K}{L} = 7.5004 + 0.5541 \ln\frac{w}{r}$ (3.0091) (3.5969) $R^2 = 0.3503$ F =12.9374 D.W = 1.0371	0.5541
6	3131 3134 3142	Distilling, rectifying spirits Sofy drinks Tobacco $\ln\frac{K}{L} = 8.6371 + 0.2579 \ln\frac{w}{r}$ (3.4008) (3.1030) $R^2 = 0.3144$ F = 9.6287 D.W = 2.3713	0.2579
7	3211	Thread and Yarn $\ln\frac{K}{L} = 7.6354 + 0.4604 \ln\frac{w}{r}$ (7.0023) (6.6817) $R^2 = 0.4367$ F =44.6456 D.W = 1.7315	0.4604
8	3212 3213 3214	Make-up textile goods Knitting mills (outer wear) Carpet and rugs. $\ln\frac{K}{L} = 4.7745 + 0.9029 \ln\frac{w}{r}$ (4.2163) (8.0517) $R^2 = 0.6695$ F =64.8296 D.W = 1.8551	0.9029
9	3220 3233 3240	Wearing apparil Leather products Footwear $\ln\frac{K}{L} = 7.0954 + 0.4046 \ln\frac{w}{r}$ (5.1647) (3.1164) $R^2 = 0.4808$ F = 9.7119 D.W = 1.6745	0.4046

Subsector Industry Groups.	ISIC	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r}$		Elasticity of Substitution
10	3311	Sawmills, planing	$\ln \frac{K}{L} = 5.6253 + 0.6214 \ln \frac{w}{r}$ (6.5258) (7.9099) $R^2 = 0.4615$ F = 62.5668 D.W = 1.7128	0.6214
11	3320	Furniture	$\ln \frac{K}{L} = 6.7849 + 0.4128 \ln \frac{w}{r}$ (2.8604) (2.9470) $R^2 = 0.4741$ F = 8.6847 D.W = 2.0240	0.4128
12	3411 3412 3419	Pulp, paper, and paperboard. Containers, boxes of paper Paper products,nes	$\ln \frac{K}{L} = 5.6322 + 0.9023 \ln \frac{w}{r}$ (2.1898) (5.4919) $R^2 = 0.7510$ F = 30.1605 D.W = 1.6555	0.9023
13	3420	Printing and publishing	$\ln \frac{K}{L} = 6.8779 + 0.5489 \ln \frac{w}{r}$ (4.6564) (4.2678) $R^2 = 0.2384$ F =18.2144 D.W = 1.6701	0.5489
14	3511 3512	Basic industrial-chemicals. Manf. of fertilizers.	$\ln \frac{K}{L} = 5.7665 + 0.6740 \ln \frac{w}{r}$ (1.9804) (2.7208) $R^2 = 0.5140$ F =11.4027 D.W = 1.8235	0.6740

Subsector Industry Groups.	ISIC	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r}$	Elasticity of substitution σ
15	3521 3522 3529	$\ln \frac{K}{L} = 5.2849 + 0.8532 \ln \frac{w}{r}$ (2.9397) (4.8222) $R^2 = 0.5250$ F = 23.2534 D.W = 2.1908	0.8532
16	3523	$\ln \frac{K}{L} = 7.0768 + 0.4723 \ln \frac{w}{r}$ (0.3286) (3.3223) $R^2 = 0.5798$ F = 11.0376 D.W = 1.6793	0.4723
17	3551 3559	$\ln \frac{K}{L} = 6.5475 + 0.7279 \ln \frac{w}{r}$ (6.0258) (8.2049) $R^2 = 0.6989$ F = 67.3199 D.W = 1.8113	0.7279
18	3560	$\ln \frac{K}{L} = 5.2725 + 0.8649 \ln \frac{w}{r}$ $R^2 = 0.5201$ F = 24.9255 D.W = 1.2973	0.8649
19	3610 3691	$\ln \frac{K}{L} = 6.2547 + 0.5203 \ln \frac{w}{r}$ (3.0726) (4.0328) $R^2 = 0.4039$ F = 16.2632 D.W = 1.5198	0.5203

15	3521	Paints,
	3522	Drugs & medicines
	3529	Manuf of chemicals, nec.
16	3523	Soups and Detergents & allied products
17	3551	Tyre & Tube industries
	3559	Rubber matterials & products
18	3560	Plastic manufactures & products
19	3610	Pottery & earthwares
	3691	Structural clay products
20	3620	Class sheets & glass products
21	3692	Cement & lime
	3699	Concrete products
22	3711	Primary metal,
	3712	Iron products
	7720	Non-ferrous metal basic industries
23	3811	Cutlery tools
	3812	Furniture, metal
	3813	Structural metal
	3819	Fabrics, metal except machinery
24	3822	Agricultural machinery
	3824	Special in machinery
	3829	Non-electrical machinery
25	3841	Shipbuilding & repairs
	3842	Railroad equipment
	3843	Motor vehicle parts
	3844	Bicycly assembly
26	3901	Jewellery & related items
	3902	Cuttings, etc.
	3903	Sporting & atheletic articles

Subsector Industry Groups.	ISIC	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r}$	Elasticity of substitution σ
20	3620	$\ln \frac{K}{L} = \underset{(1.2446)}{6.9573} + \underset{(0.8525)}{0.5638} \ln \frac{w}{r}$ $R^2 = 0.2833$ $F = 10.7267$ $D.W = 2.6114$	0.5638
21	3692 3699	$\ln \frac{K}{L} = \underset{(3.6780)}{7.3002} + \underset{(4.4888)}{0.5770} \ln \frac{w}{r}$ $R^2 = 0.3465$ $F = 20.1493$ $D.W = 2.0996$	0.5770
22	3711 3712 3720	$\ln \frac{K}{L} = \underset{(2.1633)}{7.3953} + \underset{(1.9342)}{0.4555} \ln \frac{w}{r}$ $R^2 = 0.2895$ $F = 10.7411$ $D.W = 1.2432$	0.4555
23	3811 3812 3813 3819	$\ln \frac{K}{L} = \underset{(5.6427)}{7.8496} + \underset{(5.0648)}{0.3803} \ln \frac{w}{r}$ $R^2 = 0.2383$ $F = 25.6524$ $D.W = 1.7082$	0.3803
24	3822 3824 3829	$\ln \frac{K}{L} = \underset{(2.8401)}{7.5278} + \underset{(2.5473)}{0.5768} \ln \frac{w}{r}$ $R^2 = 0.4278$ $F = 11.4885$ $D.W = 1.8677$	0.5768

Subsector Industry Groups.	ISIC	$\ln \frac{K}{L} = (\frac{d}{1-d}) + \ln \frac{w}{r}$	Elasticity of substitution σ
25	3841 3842 3843 3844	$\ln \frac{K}{L} = 7.5305 + 0.4509 \ln \frac{w}{r}$ (3.7396) (3.9056) $R^2 = 0.2976$ $F = 15.2534$ $D.W = 2.0379$	0.4509
26	3901 3902 3903	$\ln \frac{K}{L} = 6.4711 + 0.5346 \ln \frac{w}{r}$ (2.5631) (3.5503) $R^2 = 0.6566$ $F = 12.6045$ $D.W = 1.6194$	0.5346

Table 5.4 Elasticity of substitution: Census Year 1974.
(Based on Imputed Wage-Rental Price Ratio)

Industry Groups.	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r} + Ui$	Elasticity of Substitution
1	$\ln \frac{K}{L} = 9.8301 + 0.3082 \ln \frac{w}{r}$ (3.6703) (2.8651) $R^2 = 0.2042$ $F = 8.2089$ $D.W = 1.7251$	0.3082
2	$\ln \frac{K}{L} = 6.0886 + 0.7292 \ln \frac{w}{r}$ (2.8519) (5.7998) $R^2 = 0.6777$ $F = 33.6379$ $D.W = 1.7668$	0.7292

Industry Group.	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r} + Ui$	Elasticity of substitution σ
3	$\ln \frac{K}{L} = 12.2541 + 0.6607 \ln \frac{w}{r}$ (2.3287) (-0.9931) $R^2 = 0.2097$ F = 10.9862 D.W = 1.9589	0.6607
4	$\ln \frac{K}{L} = 7.9984 + 0.3731 \ln \frac{w}{r}$ (4.8609) (4.8661) $R^2 = 0.5129$ F = 23.6786 D.W = 1.8608	0.3731
5	$\ln \frac{K}{L} = 7.9381 + 0.4043 \ln \frac{w}{r}$ (2.1509) (1.4544) $R^2 = 0.2236$ F = 8.1152 D.W = 9.9064	0.4043
6	$\ln \frac{K}{L} = 8.0958 + 0.4916 \ln \frac{w}{r}$ (2.4279) (3.6376) $R^2 = 0.5696$ F = 13.2322 D.W = 2.2208	0.4916
7	$\ln \frac{K}{L} = 8.7485 + 0.4604 \ln \frac{w}{r}$ (8.4502) (3.4009) $R^2 = 0.4001$ F = 11.5659 D.W = 2.0441	0.4604

Industry Group.	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r} + Ui$	Elasticity of substitution σ
8	$\ln \frac{K}{L} = 6.9856 + 0.5214 \ln \frac{w}{r}$ (3.3558) (4.8485) $R^2 = 0.4948$ $F = 23.5075$ $D.W = 1.8729$	0.5214
9	$\ln \frac{K}{L} = 7.6632 + 0.5181 \ln \frac{w}{r}$ (3.0765) (2.3683) $R^2 = 0.2832$ $F = 10.6088$ $D.W = 1.7492$	0.5181
10	$\ln \frac{K}{L} = 8.5019 + 0.4963 \ln \frac{w}{r}$ (5.1243) (2.7482) $R^2 = 0.4102$ $F = 8.5528$ $D.W = 1.7606$	0.4963
11	$\ln \frac{K}{L} = 7.3481 + 0.4248 \ln \frac{w}{r}$ (7.1506) (2.1450) $R^2 = 0.2233$ $F = 4.6009$ $D.W = 1.0880$	0.4248
12	$\ln \frac{K}{L} = 9.4483 + 0.4376 \ln \frac{w}{r}$ (2.5670) (1.4992) $R^2 = 0.2232$ $F = 7.2477$ $D.W = 2.3866$	0.4376

Industry Groups.	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r}$	Elasticity of substitution σ
13	$\ln \frac{K}{L} = \underset{(4.0883)}{8.6395} + \underset{(1.7836)}{0.5099} \ln \frac{w}{r}$ $R^2 = 0.1647$ F = 5.1813 D.W = 2.4186	0.5099
14	$\ln \frac{K}{L} = \underset{(5.6154)}{8.0472} + \underset{(4.6824)}{0.5272} \ln \frac{w}{r}$ $R^2 = 0.5781$ F = 21.9251 D.W = 1.8872	0.5272
15	$\ln \frac{K}{L} = \underset{(5.6154)}{8.7226} + \underset{(3.3574)}{0.4505} \ln \frac{w}{r}$ $R^2 = 0.2292$ F = 11.2722 D.W = 2.0153	0.4505
16	$\ln \frac{K}{L} = \underset{(2.9049)}{7.7441} + \underset{(2.8856)}{0.3412} \ln \frac{w}{r}$ $R^2 = 0.3047$ F = 8.3266 D.W = 1.9807	0.3412
17	$\ln \frac{K}{L} = \underset{(1.2723)}{7.0813} + \underset{(0.8461)}{0.7675} \ln \frac{w}{r}$ $R^2 = 2.2928$ F = 8.7159 D.W = 1.4555	0.7675

Industry Group.	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r} + Ui$	Elasticity of substitution σ
18	$\ln \frac{K}{L} = \underset{(2.7132)}{8.2868} + \underset{(1.9052)}{0.3876} \ln \frac{w}{r}$ $R^2 = 0.2314$ F = 8.6298 D.W = 1.2501	0.3876
19	$\ln \frac{K}{L} = \underset{(3.3456)}{8.4452} + \underset{(2.0731)}{0.2255} \ln \frac{w}{r}$ $R^2 = 0.2314$ F = 9.2979 D.W = 1.3096	0.2255
20	$\ln \frac{K}{L} = \underset{(1.6624)}{5.1815} + \underset{(3.2731)}{0.8734} \ln \frac{w}{r}$ $R^2 = 0.4934$ F = 10.7129 D.W = 1.7075	0.8734
21	$\ln \frac{K}{L} = \underset{(2.7870)}{8.5818} + \underset{(2.1514)}{0.6697} \ln \frac{w}{r}$ $R^2 = 0.2738$ F = 10.6286 D.W = 1.4033	0.6697
22	$\ln \frac{K}{L} = \underset{(3.1287)}{6.7446} + \underset{(5.2247)}{0.6266} \ln \frac{w}{r}$ $R^2 = 0.5321$ F = 27.2978 D.W = 1.6602	0.6266

Industry Groups	$\ln \frac{K}{L} = \ln (\frac{d}{1-d}) + \ln \frac{w}{r}$	Elasticity of substitution σ
23	$\ln \frac{K}{L} = 7.7407 + 0.5892 \ln \frac{w}{r}$ (5.9556) (5.4716) $R^2 = 0.2522$ $F = 29.9379$ D.W = 2.1214	0.5892
24	$\ln \frac{K}{L} = 7.5254 + 0.7593 \ln \frac{w}{r}$ (2.9444) (2.5567) $R^2 = 0.2653$ $F = 10.5367$ D.W = 1.8501	0.7593
25	$\ln \frac{K}{L} = 8.2871 + 0.5823 \ln \frac{w}{r}$ (3.7849) (2.1044) $R^2 = 0.2954$ $F = 8.4284$ D.W = 1.5605	0.5823
26	$\ln \frac{K}{L} = 6.3298 + 0.4537 \ln \frac{w}{r}$ (1.8862) (2.5240) $R^2 = 0.5150$ $F = 6.3704$ D.W = 2.1784	0.4537

8.6 The Employment of Labour and Capital Services in Thai Manufacturing Industry, 1971 and 1974.

At this point, we wish to focus on our particular problem of distortions pertaining to wages and the rental prices of capital and their impacts on productivity, employment of labour and capital services in Thai manufacturing sector for the years 1971 and 1974. The preceding discussions have paid considerable attention on estimation of the implicit rental price of capital services (user's cost of capital): the imputed rental price of capital services is the product of capital goods price and an additive terms including the interest rate and the replacement to capital stock ratio, minus the rate of change in capital goods prices. In view of lack of data on some of these items, we tackle the problem incorporating the tariff protective effects on the rental price of capital services supplied to manufactures. We argued that in Thai manufacturing industry in the years under investigation, variation in the rental price of capital services were attributed primarily to variations in protective effects which led us to formulation of the imputed or shadow rental price of capital and the shadow wage rate.

In the framwork of the CES class of production function under constant returns to scale, ontlined in the foregoing section, we may write

$$V = \gamma \left[\delta K^{-\rho} + (1 - \delta) L^{-\rho} \right]^{-\frac{1}{\rho}} \quad (8.1)$$

where γ will be recognized as the neutral efficiency parameter, δ the distribution parameter, or the degree to which the technology is capital intensive, and the elasticity of substitution of labour and capital σ is a function of the substitution parameter :

$$\sigma = \frac{1}{1 + \rho}$$

It can be simply verified that

$$\left(\frac{\partial V}{\partial K}\right) \Big/ \left(\frac{\partial V}{\partial L}\right) = \frac{\delta}{1-\delta} \; \frac{L}{K}^{\frac{1}{\sigma}} \tag{8.2}$$

Under the competitive equilibrium condition, the following condition holds :

$$\left(\frac{\partial V}{\partial K}\right) \left(\frac{\partial V}{\partial L}\right) = \frac{q}{w} \tag{8.3}$$

where q represents the real rental of a unit of capital services and w is the real wage rate. However, the main thrust of the formulation of imputed rental price of capital and the effective wage rate for labour indicates that q and w are replaced by the respective imputed values q^* and w^*, taking into account the protective effects to firms involved.

In view of equations (8.2) and (8.3), it can be shown that

$$\frac{L}{K} = \left(\frac{q^*}{w^*}\right) \left(\frac{\delta}{(1-\delta)}\right)^{-\sigma} \tag{8.4}$$

The equation is an expansion path which shows that the manufacturing firms adjust their input combination when faced with wide variations in relative factor prices. The divergence between short-run and long-run elasticities depends upon the degree to which the current capital stocks can be made to vary in response to current changes in relative imputed factor costs. To the extent that the rental price of capital services in Thai manufacturing industry was made cheapened by tariff or/and subsidized effects, the incentive to adopt a labour saving or capital-intensive technique is tikly to be significant. This would definitely exacerbate the employment of labour employment. The implication of these factor price distortions is that getting the factor price "right", i.e. reducing labour costs (probably through labour subsidies or abolition of payroll taxes) and/or correcting the rental price of capital, would generate some increase in both employment and output.

The point of crucial importance is that the cyclical behavior of labour and capital productivity pervaded the entire range of Thai manufactures in 1971 and 1974 and this productivity variation may be explained in the following terms. The observed productivity of capital and labour with respect to output is less than unity, that is,

$$\left(\frac{\Delta L}{\Delta V}\right) \left(\frac{V}{K}\right) < 1 \; ; \; \left(\frac{\Delta K}{\Delta V}\right)\left(\frac{V}{K}\right) < 1.$$

Theoretically, however, as far as the output impact is concerned, the coefficient of labour and capital demands with respect to output should equal unity. Two general explainations may be offered to account for the observed less-than-unitary behavior of labour and capital productivity. First, a given change in output measured by value added of an industry may produce a smaller percentage change in the desired or optimum level of employment. As already emphasized, this situation may be attributable to the distorted prices of labour and capital in a significant way. Secondly, there may be a lag in the adjustment of the actual level of labour employment to the 'desired' level, so that in a given time period observed labour employment is less than the optimum level. Moreover, in an imperfect capital market, there may be waiting and installation costs for new capital equipment. The problem of adjustment is not taken up in the present study, since only the cross-section data on industries are available.

At any rate, the divergence between observed cyclical behavior of capital and labour and equilibrium production relations can be viewed as a measure of the cost to the firm "of having on hand a capital stock that resists change in response to change in factor price".* Moreover, an assessment of the production and employment effects by correcting the factor prices "in the right direction" will be inadequate, if the distributional impact is not taken into consideration. There is general agreement that in industries in which the elasticity of substitution between labour and capital is less than unity, the share of wages in total value added will decline and that under there circumstances there is a possibility that total wages may also

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* M. Brown, On the Theory and Measurement of Technological change (Cambridge : Cambridge University Press) 1966), p. 72.

fall if the increase in output does not offset the decline in wage share [Williamson] . This section is devoted to testing these hypotheses.

To state the hypotheses in more specific terms, solving the CES production function in terms of labour and capital demands, writing L^* for the optimum level of employment and taking natural logarithm, yields

$$\ln \quad L^* \quad = \quad \sigma(1 - \delta) + a_1 \ln V \; - \; a_2 \ln W + u_1 \qquad (8.5)$$

where a_1, a_2 are parameters, w real wage u_1 the error terms. Writing K^* for the optimum level of employment of capital, we obtain

$$\ln \quad K^* \quad = \quad \sigma\delta + b_1 \ln V - b_2 \ln q + u_2 \qquad (8.6)$$

where q denotes the rental price of capital services.

In terms of the preceding discussion, the first hypothesis may be stated as : the coefficient of ln V in equations (8.5) and (8.6) should equal <u>unity</u>; i.e. $a_1 = 1$; and $b_1 = 1$.

The elasticity of substitution and declining wage share hypothesis can be verified by examining the coefficients of ln w and ln q, respectively. These coefficients measure the estimates of the elasticity of substitution between labour and capital of the industry groups under study.

Equations (8.5) and (8.6) will be our estimating equations which purports to explain the optimum labour employment and capital demand, respectively, having the imputed wage rate and rental price of capital services developed in the proceding section as the major arguments. The own-product real wage and rental price of capital should have expected (negative) signs. The model was applied to Thai manufacturing for 1971 and 1974.

Regression estimates of the parameters using in the labour and capital employment equations applying to 25 Thai manufactures for the year 1971, and the year 1974, are reported in Tables 6.1 and 6.2 and Tables 7.1 and 7.2. These equations were estimated by the method of ordinary least-squares using annual observations on different manufactures.

IX. Empirical Findings

Tables 6.1 and 6.2 present our regression results on labour employment and demand for capital for the 25 sub-sectors of Thai manufacturing for the year 1971. Similarly, Tables 7.1 and 7.2 report the results for the year 1974 industrial census. These results suggest a number of implications of substantive importance which require emphasis.

First, over the 25 sub-sectors of industry groups for both 1971 and 1974, a given change in output measured by value added of an industry produced a smaller percentage change in the desired level of employment i.e.the coefficient of ln value added in all cases were less than unity, confirming our hypothesis that Thai manufacturing industry for the years under investigation did experience cyclical behavior of labour and capital productivity. This suggests that the majority of industries under such circumstances incurred relatively larger outlays on their payroll of the labour including probably hiring, training and layoff costs associated with short-run employment. Secondly, the observed productivity of capital with respect to output was, for the entire group of manufactures, equal to or greater than unity, i.e. a given change in output measured by the industry's value-added produced a proportionate or equal percentage change in the optimum level of capital employment. This situation may be attributable mainly to the relatively cheapening rental price of capital due to favorable protective effects. In comparison, it is obvious that the rental price of capital is more distorted than that of labour for all industry groups. Thirdly, the estimates of the elasticity of substitution in Tables 4.1, 4.2, 5.1, in the preceding section which did not take into account the protective effects, exceed unity in almost all cases.

However, the estimates of the elasticity of substitution between labour and capital using imputed wage rate and rental price of capital yield values which were below unity in almost every industry group. Fourthly, the comparatively low values of the elasticity of substitution support the argument that over the entire Thai manufacturing industry, wage share in the years 1971 and 1974 declined relative to the share of capital.

Table 6.1 Regression Results on Demand for Labour 1971.

Industry Group	Demand for Labour	R^2	F	D.W
1	lnL = -2.8731 + 0.5705 lnVAW - 0.1914 lnw* (-14916) (8.1672) -1.5125)	0.6445	34.4523	1.7514
2	lnL = -6.5006 + 0.7657 lnVAW - 0.0129 lnwa* (-1.7011) (8.6518) (-0.0338) n = 19 EL = 52.4376	0.8061	38.4083	0.9307
3	lnL = -2.6979+ 0.5527 lnVAW - 0.1450 lnwa* (-10152) (4.5804) (-1.4563) EL = 57.8628	0.6980	13.8682	2.1692
4	lnL = -2.4752 + 0.5254 lnVAW - 0.0653 lnwa* (-3.0068) (9.1937) (-0.7123) EL = 211.0074	0.6285	58.3690	1.7161
5	lnL = -3.0125 + 0.5695 lnVAW - 0.0860 lnwa* (-2.1891) (9.1772) (-0.5022) EL = 106.9556	0.8341	57.8083	2.2244
6.	lnL = -6.2988 + 0.4081 lnWVA - 0.5914 lnwa* (03.5338) (7.2823) (3.3215) EL = 103.6999	0.8125	41.1651	2.2002
7	lnL = -1.4006 + 0.7058 lnWVA - 0.4845 lnw* (-15619) (20.6147) (-5.9046) EL = 549.7447	0.7590	225.2389	1.8290
8	lnL = 0.8230 + 0.8318 lnWAV - 0.9313 lnw* (0.6307) (14.6279) (-5.9763) EL = 170.4483	0.8648	133.9488	1.8491
9	lnL = -0.2332 + 0.7745 lnWVA - 0.7609 lnw* (-0.1253) (10.9492) (-5.9096) EL = 144.0330	0.7441	62.5089	1.7993
10	lnL = 2.5856 + 0.2481 lnWVA - 0.2809 lnw* (1.9762) (4.4157) (-3.1776) EL = 251.4316	0.3446	10.4280	1.4673

Industry Group	ln L	R^2	F	D.W
11	lnL = 0.0062 + 0.5465 lnWVA - 0.4711 lnwa* (0.0035) (5.4361) (-3.0191) EL = 67.5004	0.5774	15.0292	1.9699
12	lnL = -5.2667 + 0.4231 lnWVA - 0.3969 lnwa* (-2.8232) (6.3333) (1.9728) EL = 105.1914	0.7237	30.1277	1.6775
13	lnL = 0.7641 + 0.4786 lnWVA - -0.4248 lnw* (0.2578) (4.3533) (-3.0343) EL = 130.9720	0.4079	13.0919	1.1379
14	lnL = 1.5011 + 0.5878 lnWVA - 0.6698 lnwa* (0.9869) (8.0746) (-5.1801) EL = 65.4689	0.8306	34.8153	2.0736
15	lnL = -0.5011 + 0.5878 lnWVA - 0.5776 lnw* (-0.2128) (9.4129) (-3.5587) EL = 166.4571	0.7482	54.9643	1.6537
16	lnL = -3.1009 + 0.6381 lnWVA - 0.1944 lnwa* (-1.9491) (6.4710) (-1.0650) EL = 76.3228	0.7806	30.2382	2.4591
17	lnL = -3.0552 + 0.7768 lnWVA - 0.4149 ln w* (-2.8638) (13.7620) (-3.9899) EL = 133.9689	0.8999	130.4846	1.6490
18	lnL = -1.1042 + 0.7698 lnWVA - 0.6191 lnwa* (-1.1945) (10.8241) (-3.7857) EL = 89.4870	0.9018	101.0724	1.7460

Industry Group	lnL	R^2	F	D.W
19	lnL = -1.5471 + 0.8569 lnWVA - 0.6061 $lnwa^*$ (-2.4898) (22.0635) (-9.3223) EL = 99.4773	0.9550	243.8513	1.9472
20	lnL = -2.1642 + 0.4637 lnWVA - 0.0336 lnw^* (-0.5828) (2.8220) (0.0661) EL = 43.7028	0.7983	13.8563	1.4805
21	lnL = -3.2048 + 0.6529 lnWVA - 0.2359 $lnwa^*$ (-2.9381) (12.0111) (-2.1202) EL = 157.0512	0.8175	82.8881	1.4063
22	lnL = -3.4353 + 0.6396 lnWVA - 0.1610 lnw^* (-1.3664) (7.9906) (-0.6162) EL = 64.1008	0.8868	58.7835	1.7635
23	lnL = -0.4211 + 0.5089 lnWVA - 0.3393 $lnwa^*$ (-0.3841) (9.1922) (-2.9714) EL = 269.7802	0.5160	43.1922	1.6286
24	lnL = -4.0989 + 0.5835 lnWVA - 0.0096 $lnwa^*$ (-2.0157) (6.8427) (-0.0359) EL = 72.8304	0.7689	34.9441	2.0565
25.	lnL = -4.4065 + 0.5952 lnWVA - 0.0717 $lnwa^*$ (-3.1615) (9.0315) (0.4441) EL = 150.1194	0.7712	59.0111	2.3466

Table 6.2 Regression Results on Demand for Capital 1971.

Industry Group	ln KF	R^2	F	D.W
1	lnKF = 3.1453 + 1.063 lnVAW - 0.8166 lnr (7.4418) (29.6677) (-15.7764) n = 41 EKF = 611.0376	0.9587	441.3060	1.6563
2	lnKF = 2.0431 + 1.0620 lnVAW - 0.6866 lnr (0.9244) (6.7408) (-3.5173 n = 19 EKF = 245.0940	0.7519	24.2473	1.0299
3	lnKF = -0.0575 + 1.2497 lnVAW - 0.8540 lnr (-0.0308) (8.2889) (-4.7650) n = 15 EKF = 57.8628	0.8514	34.3718	1.6378
4	lnKF = 3.2072 + 0.9635 lnVAW - 0.6781 lnr (4.1441) (12.0265) (12.0265) n = 72 EKF = 850.9170	0.6773	72.3991	1.8090
5	lnKF = 2.3340 + 1.0715 lnVAW - 0.7874 lnr (6.5443) (47.6793) (-13.3156) n = 26 EKF = 373.6735	0.9903	1178.6427	2.4722
6	lnKF = 2.9170 + 1.0252 lnWVA - 0.8742 lnr (4.1609) (17.2503) (-12.6918) n = 22 EKF = 314.5159	0.9399	148.7880	2.8125
7	lnKF = 1.8998 + 1.1043 lnWVA - 0.8113 lnr (5.6275) (41.8282) (-18.8183) EKF = 1,958.4504	0.9280	922.4022	1.4390

Industry Group.	ln KF	R^2	F	D.W
8	lnKF = 2.7762 + 1.0354 lnWVA - 0.8432 lnr (6.3698) (26.8053) (-12.9463) n = 45 EKF = 587.2608	0.9449	359.9339	2.0925
9	lnKF = -1.1497 + 1.3008 lnWVA - 0.6814 lnr (-1.0331) (13.7407) -8.3868) EKF = 515.0017	0.8493	121.1466	1.7790
10	lnKF = 1.8968 + 1.0323 lnWVA - 0.7683 lnr (2.1165) (12.7043) (-13.3033) n = 75 EKF = 861.3837	0.7471	106.3693	1.6073
11	lnKF = 2.0789 + 0.9693 lnWVA - 0.6099 lnr 0.8794) (4.5686) (-4.1501) n = 25 EKF = 286.2679	0.5474	13.3049	2.1278
12	lnKF = 3.2159 + 1.0371 lnWVA - 0.9243 lnr (7.2978) (28.0859) (-16.0507) n = 26 EKF = 371.3231	0.9717	394.4345	1.8861
13	lnKF = 2.1169 + 1.0603 lnWVA - 0.7772 lnr (1.2749) (7.6421) (-9.2260) n = 41 EKF = 535.9214	0.7157	47.8317	1.8266
14	lnKF =-1.5328 + 1.3325 lnWVA - 0.7671 lnr (-1.2529) (16.8609) (-5.0399) n = 17 EKF = 242.9448	0.9568	155.1736	2.4858
15	lnKF =-0.2415 + 0.6950 lnWVA - 0.5845 lnr (-0.2565) (9.6460) (-3.6781) n = 40 EKF = 166.4571	0.7525	56.2423	1.6257

Industry Group.	ln KF	R^2	F	D.W
16	lnKF = 2.0377 + 1.0651 ln WVA - 0.8109 lnr (1.8437) (13.4736) (-10.7336) n = 20 EKF = 262.7558	0.9439	143.0863	1.2864
17	lnKF = 3.4858 + 1.0317 lnWVA - 0.9475 lnr (9.9216) (37.7798) (-25.7755) n = 31 EKF = 431.2463	0.9826	789.1271	2.0842
18	lnKF = 2.0483 + 1.1022 lnWVA - 0.8608 lnr (3.0494) (21.1085) (-7.7764) n = 25 EKF = 333.8614	0.9539	227.7239	1.2413
19	lnKF = 2.4695 + 1.0244 lnWVA - 0.7431 lnr (2.3615) (11.3605) (-5.0787) EKF = 311.4468	0.8587	69.8735	1.7009
20.	lnKF = 2.2083 + 1.1375 lnWVA - 1.0967 lnr (1.5211) (7.9202) (-3.2978) n = 10 EKF = 137.9679	0.9109	35.7792	1.1589
21	lnKF = 2.6031 + 1.0927 lnWVA - 0.9777 lnr (4.8941) (24.1009) (-17.7158) n = 40 EKF = 567.7660	0.9411	295.6427	2.1812
22	lnKF = 0.3071 + 1.1482 lnWVA - 0.6128 lnr (0.2872) (15.1724) (-4.4832) n = 18 EKF = 239.5668	0.9410	119.7618	1.65
23	lnKF = 2.0470 + 1.0754 lnWVA - 0.8009 lnr (3.2028) (19.1444) (-13.7658) n = 84 EKF = 1073.8402	0.8281	195.1195	2.0074

Industry Group.	ln KF	R^2	F	D.W
24	lnKF = 2.4425 + 1.0412 lnWVA - 0.8279 lnr (2.2471) (10.4468) (-7.0417) n = 24 EKF = 299.6785	0.8428	56.3228	1.9733
25	lnKF = 2.6832 + 1.0200 lnWVA - 0.7812 lnr (3.9155) (20.6478) (-11.2016) n = 38 EKF = 495.7368	0.9370	260.5870	2.1509

Table 7.1 Regression Results on Demand for Labour 1974.

Industry Group.	ln L =	R^2	F	D.W
1	(3)lnL = -2.4600 + 0.6554 lnWVA - 0.3027 lnw* (-1.4568) (8.4057) (-2.9168) EL = 124.2108	0.7149	38.868	1.674
2	(3)lnL = -0.3079 + 0.8096 lnWVA - 0.7833 lnw* ( ) (7.7847) (-7.4184)	0.8521	40.349	1.849
3	(2)lnL = 2.6627 + 0.3910 lnWVA - 0.4841 lnwa* ( ) (2.0937) (-1.3028)	0.4845	4.267	2.214
4	(2)lnL = -2.2112 + 0.6848 lnWVA - 0.3777 lnwa* (-1.8970) (10.0950) (-3.8645) EL = 175.8361	0.666	50.992	1.522
5	(3)lnL = 0.3252 + 0.6445 lnWVA - 0.6015 lnw* (1.1635) (9.863) (-4.8047) EL = 78.07424	0.8742	48.681	1.593

Industry Group.	ln L	R^2	F	D.W
6	(3)lnL = 0.4727 + 0.5990 lnWVA - 0.4820 lnw* ( ) (5.6206) (-2.0196) EL = 67.26953	0.7881	16.502	2.732
7	(2)lnL = -2.3725 + 0.6529 lnWVA - 0.2752 lnwa* ( ) (18.1919) (-3.0488)	0.782	184.443	1.687
8	(3)lnL = -2.6902 + 0.6784 lnWVA - 0.2575 lnw* (-1.039) (7.603) (-1.441) EL = 117.25794	0.7192	29.462	1.495
9	(3)lnL = -1.6270 + 0.8237 lnWVA - 0.6304 lnw* ( ) (11.1028) (-4.1111) EL = 108.3503	0.842	63.836	1.852
10	(3)lnL =-0.5841+ 0.5299 lnWVA - 0.3058 lnw* ( ) (8.2426) (-3.4332) EL = 245.91079	0.524	34.167	1.858
11	(3)lnL = -0.7826 + 0.7456 WVA -0.6233lnw* ( ) (7.0338) (-3.8673) EL = 63.275	0.524	34.167	1.858
12	(2)lnL = -2.8761 + 0.452 lnWVA - 0.0665 lnwa* (-1.3516) (5.0923) (1.357) EL = 82.7318	0.6777	25.772	1.173
13	(3)lnL = -5.6649 + 0.7477 lnWVA - 0.0812 lnw* (-3.8053) (13.8754) (1.8297) n = 48, EL = 170.1378	0.8206	102.94	2.175

Industry Group.	ln L	R^2	F	D.W
14	(3)lnL = -5.95622 + 0.5365 lnWVA + 0.2454 lnw* (-2.8828) (7.1521) (1.5671) EL = 70.72037	0.8454	41.00	1.782
15	(3)lnL = -0,7305 + 0.389 lnWVA - 0.1631 lnw* ( ) (6.1946) (-1.8915)	0.7551	30.407	1.809
16	(3)lnL = -0.9553 + 0.5686 lnWVA - 0.3239 lnw* ( ) (5.8143) (-2.1693) EL = 80.86637	0.653	16.937	1.633
17	(2)lnL = 1.9018 + 0.8091 lnWVA - 1.004 lnwa* ( ) (12.0175) (-8.0644) EL = 82.0865	0.9025	78.749	1.998
18	(3)lnL = 0.3291 + 0.5167 lnWVA - 0.3954 lnw* ( ) (5.9913) (-2.2739) EL = 102.6446	0.645	20.926	1.578
19	(2)lnL = -2.6455 + 0.4016 lnWVA + 0.2254 lnwa* ( ) (3.5733) (1.1281) EL = 105.5879	0.4830	18.357	2.231
20	(1)lnKF = 5.4145 + 0.8715 lnWVA - 0.9693 lnr (3.2574) (6.8585) (-7.1206) n = 15 EK = 179.2907	0.876	35.293	1.624
21	(1)lnKF = 3.3962 +1.0009 lnWVA - 0.8255 lnr (4.3944) (17.0927) (-7.5444) n = 24 EK = 353.371	0.933	147.251	1.317

Industry Group.	lnKF	R^2	F	D.W
22	(1) lnKF = 2.1566 + 1.0884 lnWVA − 0.8503 lnr (3.2213) (20.9079) (−11.4975) n = 26 EK = 356.775	0.950	239.48	2.265
23	(1) lnKF = 1.7188 + 1.0739 lnWVA − 0.7296 lnr ( ) (29.447) (−13.3478) n = 101 EKF = 1,294.4704	0.9053	468.26	2.302
24	(1) lnKF = 1.6764 + 1.0769 lnWVA − 0.7268 lnr (2.1636) (17.4677) (−5.6504) n = 35 EKF = 482.5128	0.905	152.794	2.171
25	(3) lnL = −0.6753 + 0.6420 lnWVA − 0.441 lnw* ( ) (8.7171) (3.0336)	0.691	45.744	2.000
26	(3) lnL = −1.5944 + 0.8023 lnWVA − 0.5807 lnw* ( ) (3.5979) (−1.9398) EL = 31.8289	0.726	9.647	1.613

Table 7.2 Regression Results on Demand for capital 1977.

1	(1) lnKF = 4.1646 + 0.9526 lnWVA − 0.8112 lnr (9.4189) (30.7252) (−13.7437) n = 34 EKF = 446.3046	0.973	553.35	1.469
2	(1) lnKF = 3.3663 + 0.9923 lnWVA − 0.8281 lnr (2.2344) (9.2879) (−5.2498) n = 17	0.9041	66.001	2.080

Industry Group.	ln KF	R^2	F	D.W
3	(1) lnKF = -6.8770 + 1.6696 lnWVA - 0.7735 lnr (-1.6148) (4.8080) (-2.1827) n = 14 EKF = 145.4964	0.7866	12.908	2.224
4	(1) lnKF = 3.4985 + 0.9449 lnWVA - 0.6959 lnr (4.5178) (14.0672) (-10.1767) n = 54 EKF = 692.3055	0.8150	112.399	1.837
5	(1) lnKF = 0.6901 + 1.1655 lnWVA - 0.8921 lnr (1.2838) (6.7484) (-3.7049) n = 17 EKF = 262.97148	0.7664	22.971	2.041
7	(1) lnKF = 1.4731 + 1.2283 lnWVA - 0.8580 lnr ( ) (29.3222) (-14.1988) n = 106 EKF = 1506.7313	0.8580	429.963	1.682
8	(1) lnKF = 1.1197 + 1.1525 lnWVA - 0.8993 lnr (1.1387) (13.8138) (-12.8384) n = 26 EKF = 363.8039	0.915	124.367	1.992
9	(1) lnKF = 1.5515 + 1.0254 lnWVA - 0.5653 lnr (1.1453) (10.9164) (-3.9340) n = 27 EKF = 365.3211	0.845	65.545	2.119
10	(1) lnKF = 0.2613 + 1.1137 lnWVA - 0.5448 lnr ( ) (17.5132) (-8.8795) n = 63 EKF = 320.3897	0.845	162.990	1.637

Industry Group.	ln KF	R^2	F	D.W
11	(1) lnKF = 2.0253 + 1.0422 lnWVA - 0.6994 lnr ( ) (5.9288) (-3.5236) n = 18 EKF = 222.1287	0.7171	19.007	1.188
12	(1) lnKF = 0.2288 + 1.2041 lnWVA - 0.8673 lnr ( ) (13.0599) (-7.8178) n = 18 EKF = 279.9512	0.921	87.595	2.364
13	(1) lnKF = 3.7658 + 0.8906 lnWVA -0.6777 lnr ( ) (10.6115) (-5.9597) n = 48 EK = 649.515	0.7319	61.450	2.276
14	(1) lnKF = 3.1857 + 1.0285 lnWVA - 0.8980 lnr ( ) (14.9164) (-15.0775) EKF = 259.445	0.959	177.180	1.223
15	(1) lnKF = 3.5892 + 0.9375 lnWVA - 0.7366 lnr (4.3143) (14.3342) (-11.1399) n = 78 EKF = 1072.0736	0.760	118.930	2.093
16	(1) lnKF = 0.9926 + 1.1104 lnWVA - 0.7366lnr ( ) (10.2853) (6.9255) n = 21 EKF = 277.7058	0.865	57.542	1.829
17	(1) lnKF = n = 20			
18	(1) lnKF = 1.2708 + 1.1333 lnWVA - 0.7672 lnr ( ) (14.7117) (-5.6026) n = 26 EKF = 371.2552	0.9047	109.252	2.146

Industry Group.	ln L	R^2	F	D.W
19	(1) lnL = n = 27			
20	(2) lnL = -0.6030 + 1.1896 lnWVA - 1.3253 lnwa* ( ) (5.4198) (-2.3687) EL = 65.3562	0.849	28.327	1.754
21	(3) lnL = -2.8064 + 0.6892 lnWVA - 0.3275 lnw* ( ) (10.2884) (-2.424) EL = 92.9312	0.853	61.042	1.728
22	(3) lnL = -1.5468 + 0.7968 lnWVA - 0.6037 lnw* ( ) (14.1888) (-4.8533) EL = 97.3559	0.906	111.172	1.676
23	(3) lnL = -1.8832 + 0.6361 lnWVA - 0.3161 lnw* ( ) (15.3189) (-4.4030) EL = 352.6418	0.712	121.209	1.879
24	(3) lnL = 0.8619 + 0.6051 lnWVA - 0.5651 lnw* ( ) (7.8769) (-4.3436) EL = 149.3377	0.678	35.824	1.934
25	(1) lnKF = 1.0979 + 1.1192 lnWVA - 0.7802 lnr ( ) (14.7407) (-7.3636) n = 44 EKF = 576.8300	0.843	109.700	1.142
26	(1) lnKF = 2.6802 + 0.9715 lnWVA - 0.7490 lnr ( ) (4.2273) (-4.6360) EL = 93.5395	0.875	27.53	1.537

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