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# DISCUSSION PAPER SERIES

Number 51

Reserve Pooling in The Asean Region

by

Praiphol Koomsup

Number 52

Incentives and Factor Intensity in the Manufacturing Sector in Thailand*

by


## คณะเศรษฐศาสตร์
## FACULTY OF ECONOMICS

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"RESERVE POOLING IN THE ASEAN REGION"

Introduction:

Many countries have long realized that economic growth can be accelerated by cooperating with other countries-particularly with the countries in the same regions. Regional economic cooperation and integration can occur in the form of commodity agreements, free trade areas, customs unions, common markets, economic unions, etc. In most cases, some kinds of financial arrangements are essential for providing mutual clearing and credit facilities to reduce the adverse impacts of trade liberalization programs involved in regional cooperation.[1/] One example of these arrangements is the European Payments Union (EPU), a clearing union, which played an important role, at least in the beginning, in the working of the Organization for European Economic Cooperation (OEEC). Another example is the monetary union in the Central American Common Market (CACOM). One kind of payments arrangements, which is related to but distinct from a clearing union, is reserve pooling. Though the idea of pooling of international reserves among countries in a region has been increasingly receiving attention from various economists (See Campbell (1), Cooper (4), Triffin (13) (14), Wadhva (16), and UNCTAD (15), it is very much in a hypothetical and experimental stage.

The objective of this paper is to theoretically examine the case for and against reserve pooling and to try to measure some possible gains in a hypothetical reserve pooling by the countries in the Association of

South East Asian Nations (ASEAN).[2/]

The idea of a regional "Reserve Centre" or "Reserve System" jointly managed by countries in Asia was first conceived in 1967 (See Triffin (13) (14)). The reserve arrangements were to be limited to the ECAFE region. However, the project was never put into use due to various factors.[3/] The ECAFE region emcompass many countries whose mutual distrust and rivalries are very difficult to be overcome. Consequently, an all ECAFE payments arrangement would be politically difficult and unwieldy to manage. Moreover, Japan, whose contribution and cooperation will be vital to the success of such an arrangement, is presently opposed to such a plan. For these reasons, it is reasonable to limit our attention to the ASEAN region, which is better organized and is now considering a similar plan of reserve pooling as a potentially feasible one. (See Campbell Feasibility Report (1)).

The prospective gains from reserve pooling can be discussed under the following principles.[4/]

(a) Risk Insurance :

Countries hold international reserves primarily to finance deficits in their balance of payments and to maintain confidence in the ability of their central banks to defend their currency exchange rates. Without or with insufficient reserves, maintaining a fixed exchange rate means that a deficit in a country's balance of payments can be coped with, at a cost in terms of output and employment, by adopting one or more of the policies eg. exchange controls, tariffs, import quotas, adjusting domestic

demand, and IMF borrowings. It is therefore, reasonable to expect that the amount of reserves required to hold be directly related to the expected variation of net foreign exchange earnings. To the extent that the pooling of reserves of a group of countries can reduce the variation of the pooled reserves, some of the reserves held individually by the countries can be saved when the reserves are pooled and the risk of running out of reserves is reduced. The principle involved here is similar to the one used by individuals in collectively taking out insurance policies against accidents, whereby the risk of losses is pooled and fluctuations in losses and gains are smoothed out.

The magnitude of this type of gain hinges very much on the postulate that the standard deviation of the pooled reserves is smaller than the sum of the standard deviations of the unpooled reserves. Theoretically, one can say that countries in the same geographical region tend to have the same kind of random shocks (e.g. weather, natural disasters), and hence, the disturbances to their balance of payments tend to be similar. Their reserve holdings tend to move together and the standard deviation of the pooled reserves is less likely to be reduced. (Of course, the larger the region is, the less true the above statement is. Also, disturbances on the balance of payments can be caused by policy mismanagement which is hardly random.). However, as long as reserve changes are less than perfectly and positively correlated, there is a chance that the variation of the pooled reserves can be reduced. [5/] This is the area in which we will empirically investigate later in this paper with a special reference to the ASEAN countries.

(b) Internalization :

A reserve pool (and a clearing union, in this case) can bring foreign-exchange savings to the countries involved by internalizing trade among them which was formerly external to each individual country. Intra-regional settlements in mutual trade can be facilitated through credit clearing arrangement or through a reserve pool. The use of foreign currencies for these settlements can be avoided to some extent by doing away with exchange margins and other costs charged on exchange operation through different banks on different key currencies. Consequently, the working balances of foreign currencies earmarked for intra-regional transactions can be reduced, and the savings may be passed on to traders and serve as an incentive to the growth of intra-regional trade.

There are some economists who are rather skeptical about this type of benefit from reserve pooling among developing countries. Kafka (See Kafka (6)), for instance, points out that mutual trade among the developing countries is usually limited due to the similarlity of their production and consumption pattern. The "internalization" benefit of reserve pooling in these cases, therefore, is rather insignificant.[6/] Commenting on Kafka's statement, Balassa disagrees by citing the example of Central America where a reserve pooling arrangement does lead to increases in intra-regional trade (Balassa's Comment is in the same volume as Kafka (6)). A substantial degree of economizing on internal reserves is also envisaged by Triffin in his writing about the clearing union plan applied to the ECAFE region where, according to him, intra-regional trade accounts

for a large portion of the total trade of the region (in 1965, e.g., intra-regional exports accounted for 35% of the total exports of the ECAFE region, as against 10% in Latin America and 21% in EFTA. See Triffin (14)). In the later part of this paper, we will try to measure the extent of the mutual trade in the ASEAN area, using the past data of imports and exports.

(c) Inventory and Economies of Scale :

Once the management of a reserve pool (or a clearing union) is merged, further savings are possible through the economies of scale associated with spreading overhead costs of transactions. The reserves saved through the "insurance" and "internalization" principles can be invested more profitably in longer maturity bonds than if each country separately holds its own reserves. It is even envisaged that some will be invested within the region to finance regional development programs rather than being lent to foreign money markets (such as London, New York). This will be equivalent to diverting some funds from the developed area of the world to the developing region which badly need more investment.[7]

Other benefits from reserve pooling can be derived from enhanced bargaining strength of the regional reserve fund in the world trade, investment, and monetary negotiations. But we can not exaggerate these benefits from reserve pooling, since there are already many other forms of arrangement and institution which can produce the same kinds of benefits. However, whatever the arrangements a group of countries may have, a stronger bargaining power leads to a stronger position of the regional currencies if they act collectively rather than individually.

There are also some indirect benefits from reserve pooling. For example, gains can be reaped from "the pooling of information, the exchange of ideas and the cooperative decision-making which necessarily accompany an exercise in multi-national monetary cooperation" (Cooper (4)).

This brings us to the point made earlier that reserve pooling (and some other international payments arrangements) is often seen as a preliminary step toward more regional economic (and sometimes political) cooperation. But to make this first step sucessful needs a greater degree of coordination in government policies among countries in the region than ever before. Here is where the opinions of the optimists and the pessimists differ greatly. The optimists like Triffin, for instance, would suggest that a limited scope of payments arrangements be established initially (e.g. 10% of total reserves deposit, discretionary borrowing), and once experience in policy harmonization and consultation is gained the scope (though, not necessarily the size of the region) will be enlarged. On the other hand, Sohmen is rather pessimistic about the success of reserve pooling. He argues, in the case of the EEC, that a regional reserve bank means that "balance-of-payments deficits can be incurred more easily, (and) the need for harmonizing monetary policy is weakened" (See Sohmen (12) p.398). It can be argued here that from the point of view of an individual country such a need may be weakened, but from the point of view of the region as a whole the need must certainly be stregnthened.

It is this need for policy coordination among the member countries of a reserve pool which incurs a cost - perhaps one of the biggest stumbling

blocks to the establishment of a reserve pool - to the participants. It is a cost in the sense that a member countries lose some degrees of freedom in adopting monetary and fiscal policies to pursue their own objectives. For instance, a country cannot be allowed to use its inflationary policies by running down its reserves persistently and/or borrowing from the pool to reach full employment, since such policies may involve credit risks to other member countries, and weaken their reserve position. It is perhaps the fear of lack of this kind of policy coordination that makes Japan reluctant to join the proposed ECAFE reserve system, since they are potential creditors such as Japan who will lose when policies cannot be restrained by borrowing members. In practice, however, a provision can be included such that any large automatic borrowings can be prevented (See Triffin (14)). It goes without saying that we assume here that currency exchange rates are to be fixed. If exchange rates are perfectly flexible, then there is no point for countries to hold any reserves (except perhaps some for working balances), and the argument about reserve pooling becomes irrelevant.

Measurement of Some Possible Gains in Reserve Pooling in the ASEAN Region:

The gains to be measured here are those derived from the principles of risk insurance and internalization. The gain from the former can be ascertained by comparing the standard deviations of the pooled and unpooled reserves in the region, while the gain from the latter depends on the share of intra-regional trade in the region's total trade.

It is assumed throughout this section that reserve changes are normally and independently distributed. As Wadhva points out (See Wadhva (16) p.311-2), the ideal data to be used in measuring the standard deviations of the pooled and unpooled reserves are the data on ex ante disturbances of the balance of payments, since the ex post data are influenced by the policies of the monetary authorities, and hence are less likely to be independently normally distributed. Unfortunately, we have no choice but to use the ex post annual data of reserves of the five countries in the region. Another problem is the tendency of reserve changes to be serially dependent or autocorrelated, (See Kenen and Yudin (8)) i.e. a reserve change in this period is likely to be correlated (either positively or negatively) to last period's change. If this is true, then the assumption of independently distributed reserve changes is invalid, and some qualifications have to be made in interpreting the empirical results.

For the purpose of illustration, we postulate two hypotheses about the probability of reserve exhaustion:

Hypotheses I: Each country and the pooled-reserve fund hold reserves large enough to avoid running out of reserves not exceeding a period of two years with a probability of 95%. Based on the probability assumption we make, this requires each country and the fund to hold the reserves of 2.33 times its own standard deviation of reserve changes.

Hypotheses II: Each country and the fund hold enough fund before exhausting reserves in a period not exceeding five years with 95% probability.

This is equivalent to holding the reserves of 3.68 times the corresponding standard deviation.

Table II shows the standard deviations of the unpooled and the hypothetically pooled official reserves in the ASEAN region. It can be seen that the unpooled standard deviation (mill $1387 which is the sum of each individual country's standard deviation) is only slightly greater than the pooled standard deviation (mill $1337.8). Under hypothesis I, the unpooled required reserves are 3232 million dollars, while the pooled required reserves are 3117.1 million dollars. Under hypothesis II, the former are 5104.5 million dollars, while the latter are 4923.1 million dollars. Under both hypotheses, the reduction of required reserves resulting from pooling of reserves among the ASEAN countries is 3.55%. Comparing with Wadhva's results for reserve pooling for the Asia and the Far East (ranging from about 60% for the ECAFE region to about 35% for a subregion in the ECAFE region), (See Wadhva's, p.325. Wadhva does not calculate for the ASEAN region) our result is very small indeed. If this is any indication of the gain derived from the risk insurance principle, the gain from pooling reserves by the ASEAN countries is relatively small. This can be explained from the fact that during the period 1966-1973, reserves changes in the ASEAN countries are highly positively correlated - the pairwise correlation coefficients ranging from 0.65 to 0.97 (See Table III). It should also be noted that reserves holdings in all ASEAN countries has almost continuously and dramatically (with the exception of Thailand) grown over the last eight years. (See Table I). Four countries of five more than doubled their reserves holdings over the period.

Table I:

Total and Individual Annual Official International Reserves Holdings of the ASEAN Countries, 1966-1973

(million dollars)

| Year | Thailand | Philippines | Malaysia | Singapore | Indonesia | ASEAN Region |
|---|---|---|---|---|---|---|
| 1966 | 924 | 194 | 681 | 228 | 23 | 2050 |
| 1967 | 1009 | 180 | 457 | 198 | 6 | 1850 |
| 1968 | 1021 | 161 | 515 | 216 | 87 | 2000 |
| 1969 | 935 | 121 | 680 | 244 | 122 | 2152 |
| 1970 | 916 | 251 | 733 | 294 | 160 | 2354 |
| 1971 | 877 | 382 | 899 | 592 | 187 | 2937 |
| 1972 | 1052 | 551 | 981 | 876 | 574 | 4034 |
| 1973 | 1284 | 1038 | 1367 | 1188 | 807 | 5684 |

Source: IMF, International Financial Statistics, 1966-1974

Table II:

Standard Deviations of Total and Individual Reserve Changes in the ASEAN Countries and the Required Pooled and Unpooled Reserves Holdings.

(million dollars)

| Countries and Region | (1) Standard Deviation | (2) Required Reserves Under Hypothesis I ((1)x 2.33) | (3) Required Reserves Under Hypothesis II ((1)x 3.68) | (4)* % Reduction of Reserves by Pooling (under both hypotheses) |
|---|---|---|---|---|
| Thailand | 126.2 | 294.0 | 464.4 | |
| Philippines | 308.3 | 718.3 | 1134.4 | |
| Malaysia | 291.5 | 679.3 | 1072.9 | |
| Singapore | 372.9 | 869.0 | 1372.5 | |
| Indonesia | 288.1 | 671.4 | 1060.3 | |
| Total (unpooled) | 1387.0 | 3232.0 | 5104.5 | 3.55% |
| ASEAN Region (pooled) | 1337.8 | 3117.1 | 4923.1 | |

* $\frac{\text{(Unpooled Required Reserves - Pooled Required Reserves)}}{\text{Unpooled Required Reserves}} \times 100$

Source: Data calculated from Table I.

Table III: Correlation Coefficient Matrix of Annual Official Reserve Changes of the ASEAN countries, 1966-1973.

| | Thailand | Philippines | Malaysia | Singapore | Indonesia |
|---|---|---|---|---|---|
| Thailand | 1.00 | 0.80 | 0.65 | 0.72 | 0.80 |
| Philippines | | 1.00 | 0.95 | 0.97 | 0.95 |
| Malaysia | | | 1.00 | 0.95 | 0.93 |
| Singapore | | | | 1.00 | 0.97 |
| Indonesia | | | | | 1.00 |

Source: Data based on Table I.

Table IV: Autocorrelation Coefficients for Annual Official Reserves Changes of the ASEAN Countries, 1966-1973.

| Country | Autocorrelation Coefficient(b)* | Is b significant at 0.05 level or not?** |
|---|---|---|
| Thailand | 0.79 | No. |
| Philippines | 1.52 | No. |
| Malaysia | 0.13 | No. |
| Singapore | 0.79 | No. |
| Indonesia | 0.28 | No. |

* $R_t = a + b R_{t-1}$, where $R_t$ is an official reserve change in year t.

** An appropriate t-test is used to determine the significance of b.

Source: Calculated from Table I.

Table V: Maximum Continuous Reserve Losses of ASEAN Countries, 1966-1973

| Country | Period | Reserve Level at End of Preceding Year ($ million) | Maximum Reserve Loss ($ mil.) | (% of reserve) |
|---|---|---|---|---|
| Indonesia | 1967 | 23 | 17 | 74% |
| Malaysia | 1967 | 681 | 224 | 33% |
| Philippines | 1967-69 | 194 | 73 | 38% |
| Singapore | 1967 | 228 | 30 | 13% |
| Thailand | 1969-71 | 1021 | 144 | 14% |
| ASEAN | 1966-67 | 2050 | 200 | 10% |

Source: Data based on Table I.

Table VI; Percentages of Intraregional Trade in the ASEAN Region (1960,1965 and 1970)

| Year | Imports from the ASEAN countries to the ASEAN region as a percentage of total regional imports. | Exports from the ASEAN countries to the ASEAN region as a percentage of total regional exports. |
|---|---|---|
| 1960 | 31 | 27.5 |
| 1965 | 8.5 | 22 |
| 1970 | 4.5 | 7 |

Sources: International Monetary Fund/International Bank for Reconstruction and Development, Direction of Trade, A Supplement to International Financial Statistics, 1960-1970, and H.G. Grubel and T.Morgan (ed.)
Exchange Rate Policy in South East Asia, 1972, Appendix on Statistics on South East Asia Trade, p.93-102.

To be sure about our assumption, we test if there is any auto-correlation in the reserve changes of each individual country. The results are shown in table IV which enable us to conclude with 95% statistical confidence that no significant serial dependence is present in the past data of the reserve changes.

Another simpler method of measuring the risk-insurance gain of reserve pooling is to compare the maximum continuous loss of gross reserves by individual countries with that experienced by the ASEAN reserve fund. This is done in table V, from which we can see that the maximum continuous loss of the ASEAN pooled reserve is only 10%, while the loss in each individual country ranges from 13% for Singapore to 74% for Indonesia. The pooling of at least 10% of the total reserve during the period would be enough for covering the maximum continuous loss by the group as a whole. If the future performance of the ASEAN countries is at least no worse than their past one, their partial pooling should be beneficial in reducing to some extent the risk of reserve losses. Other gains such as longer term investment and intra-regional investment will be possible once the pooled risk is reduced.

The gain of reserve pooling from internalizing the intra-regional trade can be gauged by a rather crude way of observing the trend of the share of intraregional trade in the total regional trade. In table VI we tabulate the intraregional trade in the ASEAN region as a percentage of both the region's total imports and exports for the years 1960, 1965, and 1970. It is clear that intraregional trade both as a percentage of the

region's total imports and exports declines dramatically over time. Mutual trade among the ASEAN countries seems to assume less and less importance vis-a-vis trading with the rest of the world. Perhaps, similarity in the pattern of production and little complementarity in the process of production are dominant among the countries in the region. Whatever the causes of this downward trend are, if the trend continues it means that little can be gained from internalizing the mutual trade when reserves are pooled. However, if reserve pooling encourages more mutual trade, as the example of the Central American reserve pooling might suggest, the potential gain of this type can be quite substantial.[8/]

Concluding Remarks:

Like many cost-benefit case studies, the cost-benefit case study of reserve pooling (or some other kinds of international payments arrangements) cannot be easily conclusive on theoretical grounds. Even on empirical grounds, any decisive solution is not easier to be found. There are several costs and benefits which cannot be measured, e.g. the cost of policy coordination among participating countries. The scope of this paper is confined to only reviewing and measuring some gains in a hypothetical case of reserve pooling in the ASEAN region. There are many present and future events which are relevant to the discussion above. Two of these can be briefly mentioned here. The first is the US military withdrawal from South East Asia and the consequent smaller US military-related expenditure in the region. This will somewhat reduce foreign exchange earnings of some

countries in the ASEAN region, e.g. Thailand, and the Philippines. The second is the soaring world price of oil, from which an oil-producing country like Indonesia will benefit in terms of more foreign exchange earnings, while the rest of the ASEAN region face worsening balance of payments positions. These two events may make some countries more eager to form an ASEAN reserve fund, while others may even be more reluctant to do so. It is beyond the scope of this paper to analyse motivations of each country with regard to reserve pooling. The point is raised to demonstrate that we should make a qualification to our empirical results above -- a qualification that history and past data may not be adequate for an analysis of future international payments arrangements like an ASEAN reserve fund.

Footnotes:

1/ There are three main types of regional payments arrangements:
   a) A clearing union provides a mechanism for the multilateral compensation of payments in respect of intraregional transactions and the periodic settlements of net outstanding balances.
   b) A payments union provides medium term balance of payments credit (cf. only interim credit in a clearing union)
   c) A reserve center involves the joint holding and management of a portion or a total of each participating member's official monetary reserves. See Bahram Nowzad and Jean Messenesi (10).

2/ ASEAN embraces Malaysia, Indonesia, the Philippines, Singapore, and Thailand. It was established in 1967; one of its aims is "to accelerate the economic growth, social progress and cultural development in the region through joint endeavours".

3/ The latest progress so far is the signing in April 1973 of Iran and Sri Lanka in the Agreement of Establishing the Asia Clearing Union. Iran, Nepal, Sri Lanka and Pakistan officially offered host facilities to the Union, and Japan has gradually changed its negative position toward the Union.

4/ The terminology of the principles is used after Mundell's. See R. Mundell (9). The principles apply for both partial and total reserve pooling.

5/ The strict condition for the standard deviation of the pooled reserves to be reduced is $\Sigma_i \Sigma_j P_{ij} < \frac{n(n-1)}{2}$, where $P_{ij}$ is a correlation coefficient between country i's and country j's reserves, and n is the number of the countries. See Wadhva (16), p.311.

6/ Nevertheless, he goes on to say that there is no harm in attempting to gain maximum benefits that can be achieved through such experiments.

7/ This may require charging interest rate as high as that in major foreign money markets on the intraregional investment --- an argument which Triffin (14) and Grubel (5) both put forward.

8/ It must be warned here that increasing intraregional trade itself may not be economically desirable if it involves a "trade-diverting effect" -- a familiar theoretical argument against customs unions.

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Number 52

# INCENTIVES AND FACTOR INTENSITY IN THE MANUFACTURING SECTOR IN THAILAND*

by

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with assistance from
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* Financial support for the paper was received from the International Bank for Reconstruction and Development.

# Incentives and Factor Intensity in the Manufacturing Sector in Thailand



## I. Introduction

One basic objective of industrialization in Thailand during the last decade has been to provide more employment opportunity. This was implicit in the 1960's during which the Board of Investment was always making the point of stating the number of workers to be employed in each promoted investment project.[1/] The employment objective became explicit in the Third National Economic and Social Development Plan.[2/]

The creation of employment could be approached in two ways. One is to choose industrial project which could create a large number of employment, direct and indirect, irrespective of the size of capital required. Another is to choose labor intensive industries, measured in term of labor-capital ratio, or by designing investment incentives such that labor intensive industries are favored. In view of the apparent

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1/ See announcement of the Board of Investment on promoted firms published in "The Investor", Bangkok, various issues.

2/ NEDB, Third National Economic and Social Development Plan, 1972-1976, Bangkok, 1973.

scarcity of capital in Thailand, the latter approach would be more appropriate. Obviously a labor intensive industry could also have a strong linkage effect, thus creating a large number of employment.

This paper is to evaluate whether investment incentives in Thailand have been in favor of labor intensive industries. The answer would have important policy implications for the development of the manufacturing sector.

In the previous study by the author the answer on the relationship between incentives and labor intensities was found to be negative.[3/] But the result there was obtained from a simple chi-square test, with a rather arbitrary grouping of the ranking of incentives and factor intensity. In any case, the even more important point was that economic implications of the result were not obvious. It is therefore felt that more work would have to be done before some meaningful implications could be drawn.

To do so certain conceptual and methodological problems would first have to be cleared up. For example, what should we expect the relationship between incentives and labor intensity to be in a developing country which is supposed to be labor abundant? Another equally important issue is the measurement of incentives and factor intensity.

This paper has five sections. In Section II the conceptual and methodological problems are discussed, followed by the discussion on data used in Section III. Section IV presents our findings and economic

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3/ Narongchai Akrasanee, The Structure of Effective Protection in Thailand, a Study of Industrial and Trade Policies in the Early 1970's, Report prepared for the Ministry of Finance and the IBRD, Bangkok, March 1975, pp.186-187.

implications thereof. The last section is summary and conclusion.

## II. Distortion and Factor Intensity of Production and Trade

Under the system of free trade, without distortion in both product and factor markets, and with other well-known assumptions, the Heckscher - Ohlin theory of international trade states that the country will find it advantageous to export commodities which use its abundant factor more intensively.[4/] The theory implies that, if labor and capital are the two major primary factors of production, exports of labor abundant countries should be labor intensive relative to their imports.[5/] When the product market is distorted by means of protection, the production of importables becomes profitable, and domestic production of import competing goods expands. With the assumption of no factor reversal, the H-O theory implies that the protected import competing goods would be capital intensive. The production of even more capital intensive goods would be viable when effective protection is high enough. Furthermore if effective protection is high enough the country may export capital intensive goods. It thus follows that more capital intensive industries would have a higher level of effective protection. In other word, under this system one should expect a positive association between the effective rate of protection and the degree of capital intensity.[6/] The causation would run from the degree of protection to the choice of industry.

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4/ See, for example, J. Bhagwati, "The Pure Theory of International Trade: A Survey", in Surveys of Economis Theory, Macmillan, 1967.

5/ We exclude natural resource based commodities and consideration of home goods for the time being.

6/ Note that with the assumption of similar production function and no factor reversal, only the issue of the choice of industry is involved here.

Suppose for the time being that production and trade do behave according to the H-O prediction, then testing the relationship between capital intensity and the effective rate of protection would be equivalent to testing the H-O hypothesis. The answer would imply the optimality aspect of production and trade.

Three cases could be considered.

1. Positive Relationship

For a labor abundant country a positive relationship between the effective rate of protection and capital intensity would confirm the H-O prediction. The conclusion which could be drawn is that production responds to incentives. But the relationship alone will not be sufficient for us to conclude as to how far the output mix differs from optimality. That conclusion will also depends on the factor intensity of production and trade. That is, if exports are labor intensive relative to import competing goods, then protection has not distorted the output mix too much. Import competing goods are produced because of protection, and they have to be capital intensive. On the other hand, if exports become capital intensive, the output mix is very much distorted.

If we were to evaluate the structure of incentives in terms of employment in this case, the degree of incentives indicates the direct resource cost of creating an extra employment. The more employment to be created the higher will be this direct resource cost.

Would an alternative protection strategy such as higher protection for labor intensive industries provide more employment at lower

cost? According to the model under consideration labor intensive industries do not need protection unless they are very inefficient. Therefore the answer to the question is 'not necessarily'. But if the alternative strategy is to provide no protection, and resources are "fully employed" as assumed in the model, then employment is created at lower cost.

2. **Negative Relationship.**

If the relationship has been found to be negative, the structure of incentives is not in favor of capital intensive industries, and production would appear to have responded to incentives. The production of import competing goods perhaps only involves goods which are not very capital intensive. The structure of incentives implies an export-oriented trade strategy. If production has really responded to incentives, the policy would be judged to be appropriate. It is however possible that, for reason to be explained later, there is no causal relationship. The association found could be due to chance, and the policy used can not be judged.

3. No or Insignificant Relationship.

This is perhaps not an unlikely case. The reason is that the H-O hypothesis assumes that the choice of, say, a labor intensive industry depends very much on the wage rental ratio, and the wage rental ratio will be such that the labor intensive industry is relatively a cheaper industry. This assumption inplies that there is no distortion in the factor market. If that is not the case then the production pattern

might not follow the H-O prediction; it will depend on whether the direction of the wage-rental distortion is in the same direction as the country's factor endowment, and at the same time the structure of protection.[7/] Therefore unless we know the distortion in the factor market we will not be able to say whether the no relationship means that incentives are not in favor of capital intensive industries.

The last point we have made is a very important one. It means that in order to study the relationship between incentives and factor intensity it is important to understand the factor market. First, it is the distortion in relative factor prices, and second, how factors respond to factor prices. On the first problem it is well known that in developing countries the government interferes in the factor markets such that the wage rental ratio could be distorted. In Thailand, for example, there is the minimum wage, and the purchase of capital goods of some promoted industries was exempted from import taxes. As for the second problem, it is not at all obvious how factors respond to factor prices.

In this study we will not be able to measure the distortion in the wage rental ratio. We feel that the ratio is distorted, and the direction of distortion is opposite to the factor endowment of Thailand. But the distortion should not be too large since there has not really been an extensive subsidization of capital and the industrial wage rate should not be too far off the efficient level, especially that our study

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7/ The issue was summarized by Anne Krueger, "Comparative Advantage and Factor Market Distortions in Developing Countries," lecture in honor of Frank Graham, Princeton University, April 10, 1975.

is on 1971 when the minimum wage law was not yet introduced. We are, however, more concerned with the functioning of the factor market. More work would need to be done before we can say anything about it. Specifically a study would have to be made about the labor market and how firms make their decision regarding the wage rental ratio. The interpretation of our result below is, therefore, made with reservation.

On the other hand if the wage rental ratio is not very much distorted, then the situation of no relationship could indicate the case of factor reversal in some industries which could be large enough in number such that no significant relationship can be found. For example high incentives might have been given to labor intensive industries at first. But after a while some of the industries which received a high level of incentive might have invested more capital per worker whereas industries with a low level of incentive might have invested less, thus resulting in a change in the capital labor ratio.[8/] Therefore when we compare the effective rate of protection with the degree of capital intensity we might find that there was no systematic relationship between them.

## III. Data and Measurement Problems

To study the relationship between incentives and factor intensity we use data of the year 1971. Effective rate of protection is used as an indicator of incentives. The rates were calculated and reported in

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8/ I am indebted to Michael Lav for this point.

the earlier study by the author.[9] The rates used here will the realized effective rates, which have been calculated from price comparisons. They indicate protection actually utilized, thus a suitable measure to use.

The indicator of factor intensity is more complicated. Ideally one should use machine hours per man hours for the production of one unit of output. But the data are simply not available. In such a situation value added per employee has been used as a proxy for factor intensity.

This proxy, first introduced by Hal B. Lary, is a composite index of both human and physical capital.[10] The higher the value added per employee, the more capital intensive the industry. An industry with a higher value added per employee can be said to use either a large capital equipment per employee or higher proportion of skilled employees, or both. The statement can be made clearer by separating value added per employee into two parts; one is wage salary per employee and the other is non-wage component of value added per employee. The increase in value added per employee is due to either of the two factors or both. Hal Lary used U.S. data to test the correlation between wage-salary per employee and the proportion of skilled worker in total employment and found that the industries using a higher proportion of skilled workers have a higher wage rate per employee. This implies that although the increase in wage component may be due to other factors such as union

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9/ Narongchai Akrasanee, "The Structure of Effective Protection in Thailand", op.cit.

10/ Hal B. Lary, Imports of Manufacturing from Less Developed Countries, National Bureau of Economic Research, New York, 1968.

power, industries with higher wage can be expected to employ relatively more skilled labor. He also found the relationship between non-wage part of value added per employee and the physical capital per employee. The strong correlation of the last two variables indicates that the industries with higher non-wage value added per worker also have higher physical capital labor ratio. These evidences accompanied with the positive relationship between wage rate per employee and non-wage part of value added per employee using U.S. data confirm Hal Lary's introduction of value added per employee as a good proxy for skill and physcial capital per unit of employment.

However, there are also some limitations on using the index. When we use value added per employee for the purpose of comparison among industries, we have to beware that the product market imperfections can affect the non-wage component of value added independently of the inter-industry variations in the use of capital per employee. That is the industries with higher non-wage part of value added may be the results of their advertising effects, their efficient research and development effects and even due to the difference in the rates of return on capital. Similarly, imperfection in the labor market owing to the differences in the strength of organized labor as well as in the extent of the government intervention in the fixation of wages, affect the interindustry differences in the wage component of value added independently of the skill component of the labor force. Anyhow, it will be assumed that these influences are not important enough to cause the interindustry differences in respect of skill and physical capital per employee.

For Thailand, with very limited data on capital stock, value added per employee with some assumptions on its possible shortcomings seems to be the best measure of factor intensity available at present. The validity of this proxy has been tested using gross value added per employee. The Spearman rank correlations have been calculated for five pairs of variables based on the data from the 1971 Industrial Census. The correlation coefficient of .35 for the relationship between non-wage part of value added per employee and the book value of fixed assets per employee which is used to represent physical capital per employee shows a significant positive relationship between them at .05 level of confidence. Alternatively for the relationship between wage salary per employee and the proportion of skilled labor to total employment, the correlation of .51 indicates that skilled labor is more concentrated in the industries with high rather than low wage rate. These two correlation coefficients show that value added per employee can well reflect the human as well as physical capital intensity of an industry.

While variations in the value added per employee are due to variations in its components, i.e., wage and non-wage elements, the correlation between value added and its non-wage component is higher than that between value added and its wage component. The rank correlation coefficients are .98 for the former and .74 for the latter. Furthermore, we have also computed the correlation between these two components of value added each in terms of total employment. The correlation as high as .62 points out that they are significantly associated with each other at either .01 or .05 level of confidence. This implies that an increase

in skill intensity is highly correlated with an increase in material capital intensity. We have also calculated the correlation between value added per employee and the value of fixed assets-labor ratio. Although the rank correlation is not impressively high, an estimate of .58 is high enough to conclude at both .01 and .05 levels of confidence that they are positively related to each other. These statistics confirm to some extent that value added per employee can be reasonably used to represent capital intensity.

The value added used in the discussion above is gross value added, i.e., inclusive of business and excise taxes. However the indicator of factor intensity to be used in testing the relationship between incentives and factor intensity is derived from net value added, i.e., net of business and excise taxes. This would be better than the gross value added, especially if we assume that consumers bear the entire burden of both taxes. Since business tax rates do not differ much from industry to industry they would not affect the ranking of industries in term of value added per employee very much. On the other hand, the difference in excise tax rates is rather large among industries, thus the ranking of industries would be affected. There are, however, only a few industries which are subject to excise tax.[11/]

Another problem which should be considered is whether net value added should be in domestic or world prices. Net value added in world prices are obtained by deflating net domestic value added by the effective

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11/ Narongchai Akrasanee, "The Structure of Effective Protection in Thailand," op.cit. pp.26,44.

rate of protection. Net domestic value added is considered to be distorted, thus could exaggerate the degree of capital intensity especially in the case when protection creates excess profit. However if we use net world value added, it could underestimate the degree of capital intensity. For when the effective rate is very high, the net world value added would tend to be very low; we could even have net negative world value added for highly protected industries. Obviously if protection is just enough for an industry to survive in all cases, then net domestic value added would be more appropriate. This is because, as discussed in Section II, capital intensive industry starts its production when protection is high enough, and this protection is given by the excess of domestic over world value added. In our case we do not know for certain whether protection is just enough. We are, therefore, using both types of net value added.

There are other measurement problems such as the level of capacity utilization at the time, firms with different sizes in the same industry, the decreasing cost versus increasing cost industries, etc., which would affect the degree of capital intensity. We have not been able to resolve these problems. We simply have to bear them in mind when interpreting the results.

## IV. Incentives and Factor Intensity: Some Empirical Findings

The computed net value added per employee, net world value added per employee, and Balassa's and Corden's realized effective rates of protection are shown in Table 1. To aid in the analysis, we have classified the industries into 5 classes according to the levels of value added per employee calculated by each method. The "very high" class includes the industries with V/L higher than ₱100,000; "high" class, between 50,000 and 100,000; "medium" class, from 25,000 to 50,000; "low" class, 10,000 to 25,000; and "very low" class refers to those less than 10,000. Table 2-6 show the ranked industries for each class for different proxies of factor intensity.

Consider net value added per employee first. Since there are only 6 industries, i.e., non-alcoholic, beer, whisky, cigars, cement and petroleum product industries which are subject to excise tax, the industries in each class are not much different from those classified by gross value added per employee. That is most of the industries in "very high" and "high" classes are import-competing whereas those in "low" and "very low" classes are non-import competing and export-oriented industries. Most industries are gathered in the "medium" class, with imppxt competing and non-import competing industries being the majority. The only change in the comparison of each class of gross value added and net value added per employee is that beer and whisky industries which belong to "very high" class according to the former proxy are switched to "high" class under the latter. This indicates

Table 1 Net Value Added per Labor and Effective Rate of Protection, 1971

| Industry | | Net V.A./Labor | $\frac{\text{Net V.A.}}{1+ERP_{(B)}}$ / Labor | $\frac{\text{Net V.A.}}{1+ERP_{(C)}}$ / Labor | $ERP^C$ | $ERP^C$ |
|---|---|---|---|---|---|---|
| Meat Product | | 1,879.65 | 2,877.17 | 2,125.34 | - .3467 | - .1156 |
| Sugar | | 24,910.98 | 27,608.31 | 26,602.92 | - .0977 | - .0636 |
| Confectionary | | 4,265.71 | 5,340.14 | 4,917.81 | - .2012 | - .1326 |
| Sweet Condensed milk | HO | 45,709.33 | 43,976.65 | 44,629.30 | .0394 | .0242 |
| Rice | | 39,196.09 | 48,402.19 | 47,093.71 | - .1902 | - .1677 |
| Cereal prep., nes. | | 13,908.76 | 14,798.12 | 14,722.93 | - .0601 | - .0553 |
| Gourmet seasoning | HO | 20,914.29 | 29,007.33 | 25,350.65 | - .2790 | - .1750 |
| Tapioca flour | | 44,286.66 | 60,853.64 | 63,104.39 | - .3568 | - .2982 |
| Food seasoning | | 5,109.21 | 6,220.13 | 5,651.16 | - .1786 | - .0959 |
| Fruit & vegetable preserved | | - | - | - | - | - |
| Fruit canning | HO | 8,555.41 | 19,740.23 | 11,943.90 | - .5666 | - .2837 |
| Frozen seafood | | - | - | - | - | - |
| Other food preparation, nes. | | 23,028.12 | 32,256.78 | 29,120.03 | - .2861 | - .2092 |
| Non-alcoholic beverages | HO | 17,413.89 | 24,955.42 | 22,020.60 | - .3022 | - .2092 |
| Beer | HO | 64,854.93 | 19,400.22 | 47,828.15 | 2.3430 | .3560 |
| Whisky | HO | 98,472.85 | 33,022.42 | 39,803.09 | 1.9820 | 1.4740 |
| Cigar & Cigarettes | HO | 139,976.83 | 148,595.36 | 148,595.36 | - .0580 | - .0580 |
| Cement | | 200,306.49 | 243,208.46 | 238,829.72 | - .1764 | - .1613 |
| Vegetable oils | HO | 42,966.80 | 50,400.94 | 49,009.70 | - .1475 | - .1233 |
| Lumber & shaved wood | | 16,409.82 | 36,200.79 | 28,588.54 | - .5467 | - .4260 |

(Table 1 continued)

| Industry | | Net V.A./Labor | $\frac{\text{Net V.A.}}{1+\text{ERP}_{(B)}}$ / Labor | $\frac{\text{Net V.A.}}{1+\text{ERP}_{(C)}}$ / Labor | $\text{ERP}^{B}$ | $\text{ERP}^{C}$ |
|---|---|---|---|---|---|---|
| Plywood | | 9,251.94 | 2,540.35 | 4,864.32 | 2.6420 | .9020 |
| Parquet | | 11,295.08 | 4,518.03 | 6,684.44 | 1.5000 | .6890 |
| Leather | | 25,712.89 | 31,709.08 | 31,284.70 | - .1891 | - .1709 |
| Vegetable fibres | | 27,411.06 | 27,953.35 | 27,853.94 | - .0194 | - .0159 |
| Thread & yarn | HO | 28,766.88 | 19,280.75 | 20,651.02 | .4920 | .3930 |
| Synthetic fibre | HO | 66,487.67 | 39,110.40 | 52,978.23 | .7000 | .2550 |
| Cordage rope | HO | 7,308.89 | 5,382.50 | 5,789.22 | .3579 | .2652 |
| Petroleum product | HO | 155,698.28 | 169,108.59 | 157,001.39 | - .0793 | - .0083 |
| Glass sheet | HO | 51,438.59 | 42,128.25 | 43,529.31 | .2210 | .1817 |
| Chemical Mat. | HO | 77,786.79 | 53,399.32 | 59,189.46 | .4567 | .3142 |
| Iron & steel basic prod. | HO | 37,676.47 | 26,167.85 | 31,813.28 | .4398 | .1843 |
| Iron & steel wire rod | HO | 30,444.92 | 16,857.65 | 25,057.55 | .8060 | .2150 |
| Non-ferrous metal basic (excl.Tin) | | 24,748.34 | 23,551.90 | 23,764.49 | .0508 | .0414 |
| Textile fabric | HO | 34,965.97 | 17,905.55 | 21,320.71 | .9528 | .6400 |
| Cotton fabric | HO | 19,194.14 | 17,363.97 | 17,855.01 | .1054 | .0750 |
| Gunny bags | HO | 7,596.99 | 1,383.03 | 4,202.10 | 4.4930 | .8079 |
| Paper products | HO | 29,859.29 | 12,909.33 | 22,406.79 | 1.3130 | .3326 |
| Rubber tyre and tube | HO | 127,653.47 | 88,488.47 | 101,984.08 | .4426 | .2517 |
| Synthetic rubber waste & scrap & mat. of rubber | | 26,517.24 | 26,731.09 | 26,650.49 | - .0080 | - .0050 |
| Articles of rubber | HO | 18,645.11 | 21,807.14 | 21,284.37 | - .1450 | - .1240 |
| Finished structural metal | HO | 25,961.18 | 20,028.69 | 20,785.58 | .2962 | .2490 |
| Other metal product | HO | 19,261.66 | 16,090.27 | 16,235.38 | .1971 | .1864 |
| Pigment, paints | HO | 37,293.85 | 21,914.36 | 32,794.45 | .7018 | .1372 |
| Misc. chem. product, plastic, synthetic | | 8,987.70 | 6,775.49 | 7,191.88 | .3265 | .2497 |
| Other wood products | | 11,148.79 | 6,673.53 | 7,262.11 | .6706 | .5352 |
| Clothing | HO | 5,581.83 | 6,226.24 | 6,005.84 | - .1035 | - .0706 |
| Textile articles | HO | 14,460.93 | 8,841.90 | 10,032.56 | .6355 | .4414 |
| Shoes | HO | 23,167.97 | 13,023.03 | 14,470.94 | .7790 | .6016 |
| Printing & Publishing | HO | 25,149.69 | 32,451.22 | 31,555.45 | - .2250 | - .2030 |

(Table 1 continued)

| Industry | | Net V.A./Labor | $\frac{\text{Net V.A.}}{1+ERP_{(B)}}$ / Labor | $\frac{\text{Net V.A.}}{1+ERP_{(C)}}$ / Labor | $ERP^B$ | $ERP^C$ |
|---|---|---|---|---|---|---|
| Leather goods | HO | 8,596.02 | 4,983.78 | 5,786.23 | .7248 | .4856 |
| Pharmaceutical | HO | 15,767.69 | 7,088.19 | 10,597.28 | 1.2245 | .4879 |
| Soap, detergent | HO | 276,873.95 | 203,090.99 | 229,314.19 | .3633 | .2074 |
| Pottery china & earthen ware | HO | 5,869.76 | 2,552.40 | 3,416.83 | 1.2997 | .7179 |
| Precious stones | HO | 19,668.33 | 20,612.38 | 20,483.58 | - .0458 | - .0398 |
| Badminton shuttle cocks | HO | 45,719.38 | 17,911.61 | 22,787.91 | 1.5525 | 1.0063 |
| Matches | HO | 30,974.15 | 35,274.06 | 34,233.14 | - .1219 | - .0952 |
| Wood Furniture | HO | 31,567.50 | 32,420.15 | 32,251.23 | - .0263 | - .0212 |
| Motorcycle assembly & parts | HO | 48,387.03 | 27,080.27 | 30,951.85 | .7868 | .5633 |
| Bicycle assembly & parts | HO | 9,319.69 | 6,339.06 | 7,996.30 | .4702 | .1655 |
| Radio & equipment | HO | 61,875.31 | 48,963.61 | 50,382.96 | .2637 | .2281 |
| T.V., household appliances | HO | 28,302.29 | 15,743.62 | 17,846.21 | .7977 | .5859 |
| Storage batteries | HO | 38,378.99 | 45,003.52 | 44,762.07 | - .1472 | - .1426 |
| Electric bulbs | HO | 26,378.97 | 17,836.88 | 20,271.24 | .4789 | .3013 |
| Tractor assembly | HO | 161,949.92 | 152,927.22 | 151,261.46 | .0590 | .0527 |
| Other agr. & non electric machine | HO | 14,236.34 | 13,586.20 | 13,669.68 | .0480 | .0416 |
| Wire, cable & accessories | HO | 25,315.76 | 18,852.96 | 20,923.84 | .3428 | .2099 |
| Motor vehicle parts | HO | 24,438.87 | 10,873.37 | 14,495.18 | 1.2476 | .6860 |
| Truck assembly | HO | 163,791.58 | 54,354.42 | 102,787.31 | 2.0134 | .5935 |

Note: ERP = Effective Rate of Protection

B = Balassa

C = Corden

Source: Narongchai Akrasanee, "The Structure of Effective Protection in Thailand," op.cit.

Table 2: Industries with Very High Value Added per Employee ($\frac{NV}{L}$ > 100,000.-)

| $\frac{NV}{L}$ | $\frac{NV_W^B}{L}$ | $\frac{NV_W^C}{L}$ |
|---|---|---|
| Soap & detergents | Cement | Cement |
| Cement | Soap & detergents | Soaps & detergents |
| Truck | Petroleum | Petroleum |
| Tractor | Tractor | Tractor |
| Petroleum products | Cigars & Cigarettes | Cigars & Cigarettes |
| Cigars & Cigarettes | | Truck |
| Rubber tires & tubes | | Rubber tires & tubes |

Source: Table 1

Table 3: Industries with High Value Added per Employee ($\frac{NV}{L}$ = 50,000 - 100,000)

| $\frac{NV}{L}$ | $\frac{NV_W^B}{L}$ | $\frac{NV_W^C}{L}$ |
|---|---|---|
| Whisky | Rubber tires & tubes | Tapioca flour |
| Chem. mats. | Tapioca flour | Chem. mat. |
| Syn. fibre | Truck | Syn. fibre |
| Beer | Chem. mat. | Radio & equip. |
| Radio & equip. | Veg. oils | |
| Glass sheet | | |

Source: Table 1

Table 4: Industries with Medium Value Added per Employee ($\frac{NV}{L}$ = 25,000 - 50,000)

| $\frac{NV}{L}$ | $\frac{NV^B_W}{L}$ | $\frac{NV^C_W}{L}$ |
|---|---|---|
| Motorcycle | Radio & equip. | Vegetable oils |
| Bad. shuttle cock | Rice | Beer |
| Sweet condensed milk | Storage batteries | Rice |
| Tapioca flour | Sweet condensed milk | Storage batteries |
| Vegetable oils | Glass sheet | Sweet condensed milk |
| Rice | Synthetic fibre | Glass sheet |
| Storage batteries | Lumber | Whisky |
| Iron & steel basic | Matches | Matches |
| Pigment, paints | Whisky | Pigment, paints |
| Textile fabric | Printing & publishing | Wood furniture |
| Wood furniture | Wood furniture | Iron & steel basic |
| Matches | Other prep., nes. | Printing & publishing |
| Iron & steel wire rod | Leather | Leather |
| Paper prod. | Gourmet seasoning | Motorcycle |
| Thread & yarn | Vegetable fibre | Other food prep., nes. |
| T.V. & household app. | Sugar | Lumber |
| Vegetable fibre | Motorcycle | Vegetable fibre |
| Synthetic rubber | Synthetic rubber | Synthetic rubber |
| Electric bulbs | Iron & steel basic | Sugar |
| Finished structural metal | | Gourmet seasoning |
| Leather | | Iron & steel rod |
| Wires, cable | | |
| Printing & publishing | | |
| Sugar | | |

Source: Table 1

Table 5: Industries with Low Value Added per Employee ($\frac{NV}{L}$ = 10,000 ~ 25,000)

| $\frac{NV}{L}$ | $\frac{NV_W^B}{L}$ | $\frac{NV_W^C}{L}$ |
|---|---|---|
| Non-ferrous metal | Non-alc. beverage | Non-ferrous |
| Motor vehicle parts | Non-ferrous | Bad. shuttle cock |
| Shoes | Pigment, paints | Paper prod. |
| Other food prep. nes. | Art. of rubber | Non-alc. beverage |
| Gourmet seasoning | Precious stones | Textile fabric |
| Precious stones | Finished structural metal | Art. of rubber |
| Other metal prod. | Fruit canning | Wires & cables |
| Cotton fabric | Beer | Finished structural metal |
| Art. of rubber | Thread & yarn | Thread & yarn |
| Non-alc. beverage | Wires & cable | Precious stones |
| Lumber | Bad. shuttle cock | Electric bulbs |
| Pharmacueticals | Textile fabric | Cotton fabric |
| Textile art. | Electric bulbs | T.V., household app. |
| Machine shops. | Cotton fabric | Other metal prod. |
| Cereal prep. | Iron & steel rod | Cereal prep. |
| Parquet | Other metal prod. | Motor vehicle |
| Wood product | T.V. & household app. | Shoes |
| | Cereal prep. | Machine shops |
| | Machine shops | Fruit canning |
| | Shoes | Pharmaceuticals |
| | Paper prod. | Textile art. |
| | Motor vehicle parts | |

Source: Table 1

Table 6: Industries with Very Low Value Added per Employee ($\frac{NV}{L}$ < 10,000.-)

| $\frac{NV}{L}$ | $\frac{NV^B_W}{L}$ | $\frac{NV^C_W}{L}$ |
|---|---|---|
| Bicycle & parts | Textile art. | Bicycle |
| Plywood | Pharmaceuticals | Wood prod. |
| Misc. chem. prod. | Misc. chem. prod. | Misc. chem. prod. |
| Leather goods | Wood prod. | Parquet |
| Fruit Canning | Bicycle and parts | Clothing |
| Gunny bags | Clothing | Cordage & rope |
| Cordage & rope | Food seasoning | Leather goods |
| Pottery, china | Cordage & rope | Food seasoning |
| Clothing | Confectionary | Confectionary |
| Food seasoning | Leather goods | Plywood |
| Confectionary | Parquet | Gunny bags |
| Meat products | Pottery, china | Pottery, china |
| | Plywood | Meat prod. |
| | Meat prod. | |
| | Gunny bags | |

Source: Table 1

that the capital intensiveness of the beer and whisky industries will appear to be somewhat lower if net value added per employee is taken as a proxy for factor intensity.

Since the ranking of both Balassa's and Corden's realized effective rates of protection is quite similar except that the rates under Corden's method are mostly lower than those of Balassa's, the industries in each class of Balassa's net world value added per employee (net value added per employee deflated by Balassa's realized ERP) are not much different from each class of Corden's. It is observed that under these new proxies the values of factor intensity of most industries have decreased. Most industries are not concentrated in the "medium" class as in the case when gross or net value added per employee is used as a proxy. They are transferred to the "low" and "very low" classes. However, most of the very high capital intensive industries remain in the "very high" class no matter which proxy is employed since their realized rates of protection are usually not high compared to others. These industries are cement, soap and detergents, petroleum product, tractor, truck and cigarette industries. The industries which have a drastic change under the proxy of net world value added per employee are beer, whisky, plywood, and parquet industries. Their capital intensities appear to be much lowered under the latter proxies of which realized ERP's are the deflator. Beer and whisky industries come under "medium" and "low" classes under these new proxies. On the other hand, the levels of capital intensity

of some industries which are penalized by the rates of protection (have high negative rates of protection) have been raised by these new measures. For example, tapioca flour industry is changed from "medium" to "high", lumber and gourmet seasoning industries, from "low" to "medium", and fruit canning industry, from "very low" to "low".

Besides, another important point observed from using net world value added per employee as a proxy is that most of the import-competing industries now belong to "low" class while most non-import competing and export oriented industries belong to the "medium" class. In other word, by this method of measuring factor intensity, more import competing industries are in low level of capital intensiveness.

We employ 3 statistical methods in measuring the relationwhip between the realized effective rates of protection and value added per employee. They are Spearman rank correlation analysis, contingency table analysis and regression analysis. The results are discussed in turn below.

1. Rank Correlation Analysis

The rank correlation coefficient between net value added per employee and Balassa's realized effective rates of protection is .1235 which is not significant at both .01 and .05 levels of confidence. When the net value added per employee is correlated with the realized effective rate of protection computed by Corden's method,

Table 7: Contingency Table, $\frac{NV}{L}$ & $ERP^B$

(Ho: $\frac{NV}{L}$ is independent on $ERP^B$)

| $\frac{NV}{L}$ | VH | H | M | L | VL | Total |
|---|---|---|---|---|---|---|
| $ERP^B$ | | | | | | |
| VH | 2 (1.27) | 2 ( 1.09) | 2 (4.91) | 3 (3.09) | 3 (2.18) | 12 |
| H | (0.74) | 1 (0.64) | 2 (2.86) | (1.80) | 1 (1.27) | 7 |
| M | 2 (1.91) | 3 (1.64) | 5 (7.36) | 5 (4.64) | 3 (3.27) | 18 |
| L | 3 (2.12) | (1.82) | 9 (8.18) | 6 (5.15) | 2 (3.64) | 20 |
| VL | (0.95) | (0.82) | 3 (3.68) | 3 (2.32) | 3 (1.64) | 9 |
| Total | 7 | 6 | 24 | 17 | 12 | 66 |

Source: Table 1

$$X^2 = 0.42 + 0.76 + 1.72 + 0.00 + 0.31$$
$$+ 0.74 + 0.20 + 1.60 + 1.80 + 0.06$$
$$+ 0.00 + 1.13 + 0.76 + 0.03 + 0.02$$
$$+ 0.37 + 1.82 + 0.08 + 0.14 + 0.74$$
$$+ 0.95 + 0.82 + 0.13 + 0.20 + 1.13 = 15.93$$

Accept

Table 8: Contingency Table, $\frac{NV}{L}$ & $ERP^C$

(Ho: $\frac{NV}{L}$ is independent on $ERP^C$)

| $ERP^C$ \ NV/L | VH | H | M | L | VL | Total |
|---|---|---|---|---|---|---|
| VH | ( .21) | 1 ( .18) | 1 ( .73 | ( .48) | ( .39) | 2 |
| H | ( .42) | ( .36) | (1.45) | 1 ( .97) | 3 ( .79) | 4 |
| M | 3 (3.08) | 5 (2.64) | 12(10.55) | 5 (7.03) | 4 (5.71) | 29 |
| L | 4 (2.65) | (2.27) | 9 (9.09) | 8 (6.06) | 4 (4.92) | 25 |
| VL | ( .64) | ( .55) | 2 (2.18) | 2 (1.45) | 2 (1.18) | 6 |
| Total | 7 | 6 | 24 | 16 | 13 | 66 |

Source: Table 1

$$X^2 = .21 + 3.74 + .10 + .48 + .39$$
$$+ .42 + .36 + 1.45 + .001 + 6.18$$
$$+ .002 + 2.11 + .20 + .59 + .51$$
$$+ .69 + 2.27 + .001 + .62 + .17$$
$$+ .64 + .55 + .01 + .21 + .57 = 22.47$$

Accept

Table 9: Contingency Table, $\frac{NV^B}{L}$ & $ERP^B$

(Ho: $\frac{NV^B}{L}$ is independent on $ERP^B$)

| $ERP^B$ \ $\frac{NV^B}{L}$ | VH | H | M | L | VL | Total |
|---|---|---|---|---|---|---|
| VH | (0.83) | 1 (0.83) | 1 (3.17) | 4 (3.67) | 5 (2.50) | 11 |
| H | (0.53) | (0.53) | 1 (2.02) | 5 (2.33) | 1 (1.59) | 7 |
| M | 1 (1.36) | 2 (1.36) | 4 (5.18) | 6 (6.00) | 5 (4.09) | 18 |
| L | 4 (1.59) | 1 (1.59) | 9 (6.05) | 5 (7.00) | 2 (4.77) | 21 |
| VL | (0.68) | 1 (0.68) | 4 (2.59) | 2 (3.00) | 2 (2.05) | 9 |
| Total | 5 | 5 | 19 | 22 | 15 | 66 |

Source: Table 1

$$\chi^2 = 0.83 + 0.03 + 1.49 + 0.03 + 2.5 + 0.53 + 0.53 + 0.52 + 3.06 + 0.22 + 0.10 + 0.30 + 0.27 + 0 + 0.20 + 3.65 + 0.22 + 1.44 + 0.57 + 1.61 + 0.68 + 0.15 + 0.77 + 0.33 + 0 = 20.03$$

Accept

Table 10: Contingency Table, $\frac{NV^C}{L}$ & $ERP^C$
(Ho: $\frac{NV^C}{L}$ is independent on $ERP^C$)

| $ERP^C$ \ $NV^C/L$ | VH | H | M | L | VL | Total |
|---|---|---|---|---|---|---|
| VH | (0.21) | (0.12) | 1 (0.63) | 1 (0.63) | (0.39) | 2 |
| H | (0.42) | (0.24) | (1.27) | 1 (1.27) | 3 (0.79) | 4 |
| M | 3 (3.08) | 3 (1.76) | 6 (9.23) | 11 (9.23) | 6 (5.71) | 29 |
| L | 4 (2.76) | (1.58) | 12 (8.27) | 6 (8.27) | 4 (5.12) | 26 |
| VL | (0.53) | 1 (0.30) | 2 (1.59) | 2 (1.59) | (0.99) | 5 |
| Total | 7 | 4 | 21 | 21 | 13 | 66 |

Source: Table 1

$$X^2 = 0.21 + 0.12 + 0.22 + 0.22 + 0.39$$
$$+ 0.42 + 0.24 + 1.27 + 0.06 + 6.18$$
$$+ 0 + 0.87 + 1.13 + 0.34 + 0.01$$
$$+ 0.56 + 1.58 + 1.68 + 0.62 + 0.25$$
$$+ 0.53 + 1.63 + 0.11 + 0.11 + 0.99 = 19.74$$

Accept

the coefficient is reduced to .0556. Therefore, although the coefficients' signs are positive, we have no reason to conclude that they are correlated to each other. It should be noted that these coefficients are not much different from the correlation coefficient of gross value added per employee and realized rates of protection on the account that there are only a few industries which are subject to the excise tax.

The coefficients between Balassa's world net value added per employee and Balassa's and Corden's realized effective rates of protection are -.4710 and -.4017 respectively. They are all significantly different from zero at either .01 or .05 critical level. By these coefficients, we cannot say that there is more realized protection in capital intensive industries. But when Corden's world net value added per employee is correlated with both Balassa's and Corden's realized effective rates, the coefficients are -.1797 and -.2560 respectively. The first coefficient is not significant at both .01 and .05 levels whereas the latter is significant at .05 level. The negative sign of the coefficients can be explained by the fact that when net world value added is used as a proxy for factor intensity, most of the import-competing industries which are measured to be relatively capital intensive by other proxies become much less capital intensive by this indicator. And when the net world value added per employee of these mostly protected import-competing industries is correlated with the rates of protection, there is a good chance that the sign becomes negative.

We may therefore conclude from the rank correlation analysis that there is not enough evidence that high levels of capital intensity are associated with high levels of incentives. The test shows two cases of negative relationship which were significant, however.

2. Contingency Table Analysis

Our hypothesis is that high levels of capital intensity are not dependent on high levels of realized effective rates of protection. We have also classified effective rates into 5 groups; greater than 100% are "very high"; 70-100% are "high"; 10-70% "medium"; -20 to 10% "low"; and "very low" for the rates lower than -20%. The results are discussed below.

For the relationship between net value added per employee and Balassa's realized effective rates of protection, the calculated $X^2$ is 15.93.

For the relationship between net value added per employee and Corden's realized effective rates of protection, the calculated $X^2$ is 22.47.

For the relationship between Balassa's world net value added per employee and Balassa's realized effective rates of protection, the calculated $X^2$ is 20.03.

For the relationship between Corden's world net value added per employee and Corden's realized effective rates of protection, the calculated $X^2$ is 19.74.

The $X^2$'s with 16 degrees of freedom from the statistical table are 23.54, 26.30 and 32.00 at .1, .05 and .01 level of confidence respectively.

Therefore, for any stated level of confidence, we have no statistical reason to support that high levels of capital intensity are correlated with high levels of effective rates of protection.

The result seems to coincide with that obtained from the rank correlation analysis between gross value added per employee and realized ERP's as well as between net value added per employee and realized ERP's calculated by either Balassa's or Corden's method.

3. Regression Analysis

The following results have been obtained from the regression analysis.

1. $$\frac{NV}{L} = \underset{(318808.27)}{105470.53 - 38994.44 \ ERP^B}$$

$$R^2 = 0.011$$

2. $$\frac{NV}{L} = \underset{(52245.88)}{41818.33 + 4228.17 \ ERP^C}$$

$$R^2 = 0.085$$

3. $$\frac{NV^B}{L} = \underset{(45972.03)}{41443.72 - 12172.39 \ ERP^B}$$

$$R^2 = 0.049$$

$$4.\quad \frac{NV^C}{L} = 42708.24 - \underset{(47719.11)}{22277.79}\ ERP^C$$

$$R^2 = 0.028$$

All these results show clearly that there is no statistical evidence to believe that there is a systematic relationship between incentives and factor intensity. The signs are all negative except in the case of the relationship between net value added per employee and the Corden realized effective rates of protection. In all cases the standard error values are very large, indicating no significant relationwhip at any reasonable levels of confidence. The $R^2$ values are extremely low, which confirms the insignificant relationship.

Thus the results from all methods of analysis employed have shown conclusively that net value added per employee is independent of the effective rate of protection. If value added per employee is an accurate measure of the degree of capital intensity, then what we have shown is that the degree of capital intensity is independent of the structure of incentives. Or, in other words, it can not be confirmed that more incentives have been given to capital intensive industry, which is contrary to the general belief.[12/]

We have made another effort to find the relationship between capital intensity and effective rates. By arguing that the H.O. hypothesis is more suitable when all goods are tradable, we have excluded

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12/ This issue is different from the one about the system of protection being biased in favor of capital intensive technique of production. In that case we only need to show that capital cost is subsidized while wage cost is taxed, resulting in the higher wage rental ratio.

some industries which appeared to be natural resource based or home goods industries. (In fact all manufacturing should be considered tradable.) The rank correlation results hardly improve at all. They are 0.092 and 0.064 for the relationship between net value added per employee and the Balassa and Corden effective rates respectively.

The implication of our findings, assuming relatively little distortion in the factor market, is that the structure of protection can not be said to be against employment. This conclusion is made with some reservation because we do not know enough about the factor market. Our assumption has been that producers respond normally to the wage rental ratio. Given factor endowment and thus the wage rental ratio which is supposed to be uniform among industries, higher protection should be associated with capital intensive industry, because it is considered to be of higher cost. But, in the first place, wage rental ratio may not be uniform among industries because of the distortion in the factor market. An industry faced with a higher wage rental ratio because its capital is subsidized will not require a high protection to carry out if it is a capital intensive industry, as compared to the one with lower wage rental ratio. In the second place producers may not respond to incentives and the wage rental ratio as we have visualized.

But if the distortion in the factor market is not large enough to influence the overall pattern of factor intensity, then our results of no significant relationship could be interpreted to mean that the structure of incentives had changed the degree of factor intensity in

some industries. As discussed under case 3 in Section II, high incentives might have been given to labor intensive industries at first. But these industries need relatively low level of protection, following the H.O. reasoning, thus having low realized effective rates of protection. This might have led them to invest more capital per worker, more than what they would have done without protection. Industries falling under this category are those in the groups of processed food and non-durable consumer goods.

The above interpretations are offered only to assist in understanding the results obtained. For the latter case, before we can conclude with certainty we feel we need to know whether the ranking of industries in terms of factor intensity changes over time. As for the former case, the study which would be interesting to carry out will be on the distortion in the factor market. Specifically one would need to know the wage rental ratio faced by different industries. To do so would require as well the understanding of the functioning of the labor and capital markets in Thailand. Another study would be on the behavior of the firm in response to changes in factor prices.

The results and the discussion given above suggest that there was no systematic relationship between incentives and factor intensity in the manufacturing sector in Thailand. This does not, however, mean that the structure of incentives does not affect resource allocation, particularly employment. The decision to invest in what industry would depend very much on the level of effective protection given to that industry. If the effective rate is high, there is a

tendency for investment to be in the more capital intensive industry. In Thailand, as shown in Table 1, the effective rates of protection vary a great deal from industry to industry. This means some industries were established because the effective rate was high enough for it to be viable even at a small share of the market. Employment in that industry was therefore created at high social cost. The effect of protection on employment is clearly seen in this sense. One could actually go on to measure the "cost of employment" based on the level of protection and the number of employment created. But on the whole this "cost of employment" can not be said to be too high. However if we want to say whether the structure of protection has been or has not been "employment oriented", we have to be able to find a systematic relationship between the degree of protection and the degree of labor intensity on the one hand, and on the other hand the effect of incentive measures on relative factor prices. As for the latter it is abvious that the incentive measures tend to raise the wage-rental ratio, but it is not at all obvious to what extent the wage-rental ratio is distorted upward. It is well known that the wage rate has been kept low partly but significantly by the low price of rice through the rice premium. Furthermore, one can not say that the capital cost is much subsidized. There is no large scale subsidization of capital. Secondly the shadow exchange rate is not very different from the market exchange rate because major exports are also taxed quite heavily. Finally before 1973 equipment and machinery imports were subject to the tariff rate of about 10 percent. Therefore one can not simply say

that the wage-rental ratio is distorted against employment, especially when the manufacturing sector as a whole is considered. And for the former case, i.e. the level of protection and factor intensity, as shown in this study, we have not been able to find a systematic relationship between them. We thus conclude that the system of incentives in Thailand as a whole could not be said to be "anti-employment."

## V. Summary and Conclusion

This paper has attempted to analyse the relationship between factor intensity and incentives in the manufacturing sector in Thailand. This is in order to evaluate the employment implication of the structure of incentives. The hypothesis has been that higher degree of capital intensity is positively related to higher degree of protection.

Basically the hypothesis follows from the Heckscher-Ohlin theory of international trade, which was discussed in Section II. It was pointed out that one major assumption for the hypothesis was that the wage rental ratio was uniform, or that there was no distortion in the factor market. Another assumption is that factor intensity does not change over time. If so a positive relation between capital intensity and incentives would imply a high cost of creating employment. A negative relationship would imply the opposite. Finally an insignificant relationship would be inconclusive. All these implications would depend on the validity of the assumption about the factor market and the degree of factor intensity over time. Ideally one should also study the distortion and the functioning of the labor market and the structure of factor intensity over time so that the economic implications of the findings could be better assessed.

In Section III data and measurement problems were discussed. The effective rate of protection was used as indicator of incentives. Arguments and statistical tests were made for using net value added per employee as a proxy for the degree of capital intensity. Data

used were of the year 1971. The effective rates were previously calculated, using the structure of tariff, taxation, industrial promotion and the industrial survey for the year 1971. Value added per employee data were also from the 1971 industrial survey.

Ih testing the relationship between value added per employee and effective rates of protection we have used net domestic as well as net world value added, and these were tested against both Balassa and Corden effective rates. Almost all of the statistical methods used, i.e. the Contingency Table, the Spearman Rank Correlation, and the Regression, have yielded insignificant relationships. It was therefore concluded that statistically we could not confirm that value added per employee was related to effective rate of protection.

The results obtained led us to conclude that the choice of capital intensive industry was "not related" to the higher degree of protection. Thus we could not say that the cost of creating employment in the manufacturing sector as a whole in Thailand was systematically high. We have also offered some judgements on other aspects of protection and employment, and concluded that the system of incentives as a whole could not be said to be "anti-employment." The conclusion was made with reservation regarding the validity about the assumption of the factor market. The study calls for further work on factor market distortion and the behavior of producers in responding to the change in relative factor prices.

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