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"The Determinants of Direct Foreign Investment with a Specific Role of a Foreign Exchange Rate : An Application to the Japanese Case in Thailand"

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"The Determinants of Direct Foreign Investment with a Specific Role of a Foreign Exchange Rate : An Application to the Japanese Case in Thailand"

by

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วิธีศึกษาสิ่งต่าง ๆ ที่เป็นตัวกำหนดการลงทุนโดยตรงจากต่างประเทศในระยะเวลา ๒๐ ปีที่ผ่านมานั้น กระทำได้ ๒ วิธีด้วยกัน วิธีแรก มีความเชื่อว่าบริษัทต่างประเทศจะเคลื่อนย้ายที่อยู่เสมอและสิ่งสำคัญที่จะอธิบายถึงสาเหตุของการลงทุนโดยตรงของเอกชนนั้นคือการสะสมทุน ซึ่งจัดอยู่ในเรื่องของหน่วยผลิตที่อยู่ในตลาดกึ่งแข่งขันกึ่งผูกขาด อีกวิธีหนึ่งนั้นกล่าวเน้นในเรื่องของการเคลื่อนย้ายเงินทุนอันมีสาเหตุมาจากการเปลี่ยนแปลงของอัตราแลกเปลี่ยนเงินตราต่างประเทศ งานวิจัยนี้มีจุดประสงค์ที่จะหาข้อสรุปของความสัมพันธ์ระหว่างการเปลี่ยนแปลงของอัตราแลกเปลี่ยนกับการลงทุนโดยตรงจากต่างประเทศทั้งในทางทฤษฎีและในทางข้อเท็จจริงที่เกิดขึ้นตามนัยของทฤษฎีนั้น มีการอ้างว่าถ้าประเทศใดลดค่าเงินลงแล้ว จะทำให้เกิดสิ่งดึงดูดให้มีการลงทุนในประเทศนั้นเพิ่มขึ้น และการไปลงทุนในประเทศอื่น ๆ จะได้รับความสนใจน้อยลง ดังนั้นจะมีการเคลื่อนย้ายทุนจากต่างประเทศเข้ามาในประเทศที่ลดค่าเงินตราลงเพิ่มขึ้น และในขณะเดียวกันจะมีการเคลื่อนย้ายเงินทุนออกไปจากประเทศนั้นเพื่อไปลงทุนโดยตรงยังประเทศอื่น ๆ ลดน้อยลง ทางด้านการวิจัยข้อเท็จจริง จึงได้ตั้งแบบจำลองทางเศรษฐมิติเกี่ยวกับการลงทุนโดยตรงจากต่างประเทศญี่ปุ่นเข้ามายังประเทศไทย เพื่อทดสอบถึงผลของการเปลี่ยนแปลงของอัตราแลกเปลี่ยนที่มีต่อการเคลื่อนย้ายเงินทุน โดยอาศัยตัวเลขรายปีของยอดรวมของการลงทุนโดยตรงของประเทศญี่ปุ่นในประเทศไทย และยอดสุทธิในช่วง ค.ศ.๑๙๖๖ ถึง ๑๙๗๙ ยอดรวมและยอดสุทธิของการลงทุนโดยตรงของประเทศญี่ปุ่นในประเทศไทยยังได้ถูกจำแนกออกตามประเภทของอุตสาหกรรมต่าง ๆ ในช่วง ค.ศ.๑๙๗๐ ถึง ๑๙๗๙ เพื่อนำมาใช้ทดสอบในแบบจำลองนี้ การทดสอบของแบบจำลองทางเศรษฐมิติได้อาศัยวิธีการของ Cochrane-Qrcutt ในการประมาณค่าสัมประสิทธิ์ต่าง ๆ ในแบบจำลอง ผลของการทดสอบสนับสนุนสมมุติฐานทางทฤษฎีที่ตั้งไว้เป็นอย่างดี

Abstract

There are two approaches to the study of the determinant of direct foreign investment in a recent development of the last two decades. The first approach hypothesizes that international firm went across the nations and the clue to the cause of private direct investment lied in the capital formation which is a theory of monopolistic competition. Another approach concentrates on the capital movement which may be caused by the exchange rate. The objective of this research is to find out the direct theoretical and empirical relationship between exchange rate change and the direct foreign investment. Theoretically, it has been asserted that devaluation by a country will make investment in that country becomes more attractive and investment abroad less attractive. Therefore, there will be more capital inflow into the devaluating country and less capital outflow from that country. An econometric model of Japanese direct investment flows to Thailand has been formed in order to test the effect of the exchange rate changes on the flow. The yearly data of the aggregate Japanese direct investment flow and its net flow from 1966 to 1979 have be utilized. The gross and net Japanese direct investment flow classified by various manufacturing sectors from 1970 to 1979 have also been employed to the model. The model is estimated by Cochrane - Orcutt iterative method and the results of the estimation indicate a good support to the hypothesis.

The Determinants of Direct Foreign Investment with a Specific Role of a Foreign Exchange Rate : An Application to the Japanese Case in Thailand

I. Introduction and Motivation of the Study

Traditionally, the international economics literature has emphasised the effects of an exchange rate disequilibria and parity changes on the trade balance and to some extent on the short-term capital account. The theoretical and emperical analysis respectively concern itself with the stability conditions of the foreign exchange market and the specific magnitude of variousl price elasticities required to affect real international trade flows as a result of a devaluation or revaluation.[1]

On the other hand, the direct relationship between the long-term capital movement in terms of direct foreign investment and the exchange rate-despite of its lion share in the total flow of international capital movement - has been largely ignored in the main body of the balance of payments literature up to the beginning of 1970's. Earlier analysis on capital movement on grants, aids, repatriation, as well as other forms of portfolio investment

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[1] See, for example, G. Harberler, "The Market for Foreign Exchange and the Stability of the Balance of Payments: a Theoretical Analysis," Kyklos, vol.3, 1949; A.C. Harberger, "Some Evidence on International Price Mechanism, "Journal of Political Economy, 1965. There has been since then growing attempts to empirically estimate the price responsiveness of the real flows of international trade.

concentrate mainly on the transfer problem. It deals with the adjustment process in the balance of payments in terms of the classical price approach or the Keynesian income approach.[1] Both approaches aim at anlysing how the monetary transfer gives rise to a change in real transfer of goods and services in the trade account. There are also various traditional work connecting non-direct investment items in the capital account with the levels of interest rate differentials. More recent studies, beginning since the mid-1960's,have attempted to relate international capital flows to the model of portfolio distribution developed by Markowitz and Tobin. These studies make the portfolio distribution of assets a function of the relative rates of return and the estimated risks for alternative assets both at home and abroad. This leads eventually to the stock-adjustment view of international capital movements.[2] Later work on the monetary approach to the balance of payments theory also excludes the direct role of the foreign exchange rate on direct foreign investment.[3]

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[1] The earlier writings on the non-official direct foreign investment flows in the minetenth century to the well known "regions of recent settlement" of, for example, America, Australia, and New Zealand, from Europe can also be grouped in the study on the adjustment process with its associated effect on the economic growth of the then recipient developing countries as well as the capital exporting countries.

[2] See, for example, Branson (1970); Branson and Hill (1971).

[3] See Kreinin and Officer's survey article (1978).

It is, however, our opinion that a prerequisit to an efficient public or governmental control, if desirable, of direct foreign investment is the understanding of what makes it tick. One aspect of the determination of the direct foreign investment concerns the foreign exchange rate. The primary purpose of this research paper is then to find out the direct theoretical relationship between the change in an exchange rate and the direct foreign investment. Following this introductory section, we will first discuss, in section II, two approaches to the study the determinant of direct foreign investment. The first approach attempts to analyse the determinant of international direct investment without even resorting to the role of the foreign exchange rate. The second approach has been much stimulated by the advent of one form or another of the managed floating exchange rate regime particularly of the developed countries since the early 1970's. The exchange rate changes are shown here to be directly and systematically explaning the international flows of direct investment abroad. A specific model is adopted and presented in details in chapter III. An application of the role of foreign exchange rate on the Japanese direct foreign investment in Thailand is then given in chapter IV. In this section, some partial analysis of the Japanese direct investment in Thailand is also analysed.

II Determinants of Direct Foreign Investment

(a) From International Trade and Industrial Organisation Perspective

In a recent development of the last two decades, several studies utilise various theoretical constructs and tools from the combined field of international trade theory and the industrial organisation to analyse the international direct investment. It can be said that the writings of these economists correlate with the emergence of multinationational corporation which are the prime movers of international flows in direct investments not only among developed economies but also from the developed countries to the developing economies. And mainly as a result of the heated controversy on multinational firms related to their foreign direct investment, there has been an overwhelming body of literature on the causes, consequences, and control of this investment.[1]

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[1]Of the present availability of various surveys, Hafbauer (1975) on empirical evidences, Johnson (1975) on theoretical and policy issues, and Vernon (1976) on past and present practices of multinational corporations deserve a special attention. On the Japanese direct foreign investment, see particularly K. Kojima (1978) who analysed the flow of direct investment in a macro-economic framework of international capital movement. He also characterised the American direct investment abroad as an "anti-trade-oriented" type while that of the Japanese as a "trade-oriented" type. Hence, the Japanese direct investment abroad contributed, according to Kojima, relatively more than the American investment to an international specialisation or division of labor.

The beginning in this area is a seminal article in the form of an unpublished dissertation by Stephen Hymer in 1960. Kinddleburger (1969), Vernon (1966,1974), Johnson (1970, 1974, 1975), Caves (1974), Dunning (1970), Horst (1969,1972,1975), and Orn (1975), among others, have since then made theoretical and empirical contributions.

Of particular interest to us here are the causes of foreign direct investment. Though most of the present literature on the causes of foreign direct investment usually deals with an induction method by suggesting a list of possible economic determinants of foreign direct investment flows in various economic activities. Kindelburger argued that the ultimate purpose of foreign direct investment is to maximise the long-run global profit of a multinational firm international grew out from local and regional firms. And the clue to the cause of private direct investment lied in the capital formation and hence in the theory of the firm, particularly in the theory of monopolistic competition. The nature of the monopolistic advantages that results in direct investment include (a) departures from perfect competition in both the product and factor market; (b) internal and external economies of scale giving rise to horizontal and vertical integration respectively; (c) government limitations particularly by host countries on their imports. Vemon argues that whatever its ultimate cause the immediate decision to invest abroad in manufacturing is almost always "defensive" in character. So, Vernon

wrote of manufacturing investment in foreign countries as, "Before setting up their subsidiaries abroad, many of these enterprises had already penetrated foreign markets by way of exports. The immediate action that led such firms to shift from an export position to a local production was usually their perception of the threat arising from local competition. Somtimes this threat of competition was made all the more real by the decision of foreign countries to raise their import restrictions of U.S. exports; but sometimes not." But Horst theoretically and empirically found out the direct relationship between the nominal (as well as effective tariff rate) on the choice between export and foreign subsidiary production. Canadian tariffs were found to be biased against U.S. exports for the subsidiary participation in the market. The United States exports and sales of her subsidiaries in Canada was, therefore, shown vividly to be rather substitutes for one and other. Horst also empirically estimated the extent of relationships between American export and sales by American-owned subsidiaries in Canadian on research and development expenditures (R & D) in America. He found that one percent increase in the level of R & D as a percentage of sales in the U.S. was associated with a 21.0 percent rise in the total American share of the Canadian market. But the composition of this American share was crucially related to the

Canadian tariffs as mentioned above.[1]

Caves grouped various determinants of foreign direct investment by a profit-maximising firm into three hypotheses. One of these three is the intangible capital hypotheses. Multinational corporations, investing abroad, under this hypothesis, must possess certain stock of knowledge which outweights all disadvantages in operating in foreign and unfamiliar environments. These intangible assets are mainly and operationally those associated with product differentiation. Foreign direct investments through multinational coporation is then, concentrated in industries with high degree of research and development expenditure and with a monopolistic or oligopolistic nature. The hypothesis was accepted in a statistical test against the data of foreign investment in manufacturing

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[1] Though tariff may reasonably be expected to affect direct the profitability of investment opportunity in that sector, it may indirectly affect foreign direct investment in the other sector which uses this protected product as an input. In addition, it also discourages the foreign capital inflow into the export sector (as well as other lower-protected importing competing industries) whose domestic factors of production are complementary to foreign capital inputs. The combined or total effect of tariff production on foreign direct investment is, therefore, not as obvious as it first appears. The ultimate effect will rest on the specific model used in analysing the role of the tariff protection on the international flow of direct in vestment. (See, for example, Cordon (1974), pp. 330-335). We will discuss this point again in our empirical result below. On the question of tariff, it is also argued that tariff cannot explain the firm's decision to invest abroad in the sequence of the growing market size of the host country. The tariff variable merely explains the foreign firm's decision whether the patent of the firm is to be exploited in the source country of the host country. The incentive to sell the patent rather than engaging in direct investment may grow as the market increases because of the cost of doing business abroad. There is a complicated choice among exports, licensing of patent, and foreign investment. See, for example, Aliber (1971).

industires both in Canada and in the United Kingdom.[1]

(b) The Role of the Foreign Exchange Rate

The role of the exchange rate in long-term foreign investment was mentioned by Machlup (1939) in his Theory of Foreign Exchanges as follows, "..... Apart from changes in expectations due to changes in the foreign exchange rate, it seems certain that the elasticity of demand for foreign exchange for purposes of long-term foreign investment is more than zero, it may be also more than unity ....." Later, in a study for the Joint Economic Committee of Congress, Houthakker (1962) also made a remark on the effect of overbaluation of the U.S. Dollar on private direct investment, ".....Not all capital movements, however, are independent of relative costs. Private investment abroad is frequently motivated by cost consideration. U.S. firms, for instance, often invest abroad because they find production costs elsewhere, calculated at official exchange

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[1] The other two hypothesis are the multiplant enterprise and entrepreneurial resources. The multiplant enterprise explains the incidence of direct investment through the construction of various multiplants of efficient scales across national boundaries. The multinational corporation is simply a species of the multiplant firm. Under the entrepreneurial resources, direct investment is an outlet for under-utilised entrepreneurs of the firm. While the multiplant hypothesis also received the statistical support for the Canadian data, the last hypothesis suffers a weaker theoretical base and gained neither an empirical support in the Canadian nor British data.

rates, lower than in this country. This U.S. controlled foreign production in turns competes with U.S. exports. Thus, overvaluation is bad not only for commodity trade but also for an important class of capital movements....." However, there has been no systematic analysis of the direct role of the exchange rate on direct foreign investment until the pioneering work of Aliber (1970).

The exchange rate realignment of the Smithsonian agreement in December 1971 together with its ensuing collapse of the adjustable-peg system have generated additional interest in the effect of exchange rate changes on the direction and magnitude of direct foreign investment flows. Dufey (1972),for instance, observed that a devaluation will cause a rise in the local currency cost of inputs for most firms, particularly those firms whose expenses constitute a large proportion of imported inputs. Firms using primarily domestic inputs will also experience some rise in total costs because the expanding export-and-import-competing sector will compete for more factors of production (materials as well as primary factors). However, the extent of rise in the total cost of local inputs will depend much on the employment situation before the devaluation, the effectiveness of the government's austerity program, and the supply responsiveness of those required productive resources. The prospect of devaluations and revaluations, Dufey concluded, is taken into account in the intial investment decision of the firms as well as their continuous decision-making over

whether to expand or curtail their investment. Devaluation by the source country will make foreign investment less attractive while a devaluation by the host country will make expansion of already foreign subsidiaries more profitable. Some studies on Japanese foreign investment by Litvak and Maule (1973), Sherk (1973), and Yoshihara (1978) also cited the early 1970's yen revaluation as a reason for the surge in Japanese foreign investment. Makin (1974) concluded that the 1960's view of the United States as a permanent capital exporter and Germany and Japan as permanent importer of capital is not correct. This view was due to to the overvalued U.S. dollar especially with the German mark and the Japanese yen. The slow-down or the reversed flow would be expected by the revaluation of yen and mark and the dollar devaluation.

In the latter half of 1970's there were several more studies on the role of the exchange rate on direct foreign investment. These studies are alexander and Murphy (1975), Logue and Willett (1977), Khlhagen (1977), and most recently Igawa (1979). We will look into some of them in rather details. Igawa, in an interesting paper, extended Aliber's theoretical analysis on the financial aspects of capital flow in direct foreign investment into a general equilibrium framework. Igawa's work is based on a usual specific factor model of two-good and three-factor Heckscher-Ohlin-Samuelson (H-O-S) type of production

function together with an assumption of an existence of non-tradable goods in each country. Hence, there are two kinds of industries, a tradable and a non-tradable goods industry. Real capital is specific for each of the two industries meaning that it is not sectorally mobile among different industries. Tradable goods with the specific factor for the industries move freely from one country to the other. Different countries may produce heterogenous non-tradable goods with their specific factors internationally immobile. There exists no markets for real capital stock. After adding (i) the demand side for goods being a function of relative prices and real expenditures and (ii) the real demand for money stock together its flow demand for hoarding and dishoarding, Igawa then mathematically proved the proposition that real capital moves from an appreciating country to a depreciating country. The economic mechanism that brings about this proposition starts from the effect of a change in the foreign exchange rate on the relative price of non-tradeable and tradable goods. With an exchange rate depreciation, the price of tradable goods rises in the depreciating country. The real money holding declines below the level desired for a stock balance. Accumulation of financial asset (in the form of cash holding here) is then called for resulting in money hoarding. Expenditures, therefore, decrease. Demand for non-tradable goods declines. The resulting rise in the real price of tradable goods relative to

non-tradable goods stimulates the expansion of the production of tradable-good industries increases. This induces the flows of real capital into these industries. An opposite direction of adjustment occurs, of course, in the appreciating country.

Logue and Willet (1977) utilizing a portfolio balance approach to international investment, argued that an exchange rate realignment alone was sufficient to cause a capital flow through the portfolio rebalancing. This is because solutions to portfolio-selection models usually involve determining the percentage of one's weath to invest in particular assets, and these percentages are adjusted only when there is a change in expected rate of return, variances or covariances among securities so long as tastes are unchanged. Therefore, given the expected money returns, the variances and the covariances among returns on various assets, a change in relative prices of the assets themselves will make the previous commitment to securities whose prices have increased (decreased) too great (too little) in the portfolio as a whole. Consequently, this change in relative prices would lead to a rebalancing of portfolios by a sale of the securities whose prices have decreased. Applying this argument to an internationally diversified portfolio, Logue and Willett concluded that a devaluation would make foreign investors increase

their investments in the devaluing country and make domestic investors sell foreign assets and buy more domestic assets. Therefore, a devaluation would lead to a capital inflow into a devaluing country due to a portfolio adjustment by both domestic investors and foreign investors. The capital inflow resulting from portfolio-rebalancing activities on the part of foreign investors could be substantial but might occur over time rather than all at once due to transactions costs.

However, for the direct incentive of investing in the U.S. as a result of the devaluation, Logue and Willett stated that exchange rate realignments should not have a direct impact on the expected profitability of foreign investments in the U.S. stock market and, in the absence of other considerations, should not have a significant influence on the incentive to invest. This is because a foreign investor with a given amount of foreign currency would be able to buy a larger amount of future American dividends after a devaluation of the dollar, but each dollar of these future dividends would be worth less foreign currency than before. Hence the foreigner would not earn a higher return than before.

Logue and Willett, then, believed that when foreign investors think that the current exchange rates are out of line, in particular that the dollar is undervalued relative to the

foreign currency at the time an initial investment is made, the favorable effect of the exchange rate on the investment decision is essentially a speculative matter. Logue and Willett, for example, indicated that prior to the U.S. devaluations, expectations of such changes would have reduced the incentive to invest in the U.S. Therefore, investment in the U.S. became comparatively more attractive after the exchange rate realignments due to the fact that the adjustment of the exchange rate reduced expectation of future devaluation.

Logue and Willett also offered some other reasons and empirical evidence why we should expect an increase in direct investment by foreigners in the U.S. after devaluation of the dollar. First, foreign corporations might engage in the sort of portfolio rebalance described above. Second, a U.S. devaluation enables foreign investors to afford American firms of to acquire American technology and managerial expertise. Finally, with a devaluation, some foreign firms may find it more attractive to produce in a U.S. rather than export to this country.

Kohlhagen (1977) set out an intelligently simple model of relative profitability in alternative production locations. A firm desiring to sell abroad chooses between the alternatives, producing abroad or producing at home and exporting. Starting with the assumption that a devaluation has no effect on general price levels on either domestic or foreign currency, and foreign subsidiary production incurs all costs in foreign currencies, he showed that the home country devaluation makes domestic

production relatively more profitable than foreign subsidiary production. Later, he allowed domestic prices to rise and foreign prices to fall by a common percentage α, as a result of a devaluation of size β, and he allowed some part of a foreign subsidiary's inputs to be purchased in domestic currency while none of a home firm's inputs are purchased in foreign currency. He showed that the same result still holds under certain conditions. Specifically, his derivation leads to the hypothesis that a devaluation is more likely to reduce the excess profitability of foreign production over that of domestic production the less production costs both at home and abroad respond to devaluation and the more foreign production costs are denominated in domestic currency. Formally, Kohlhagen derived:

(1) $P_d = xP_f - P_{\$'}$

where

P_f = profits of foreign subsidiary, expressed in foreign currency,

$P_{\$'}$ = profits from exporting the outputs from home production, expressed in dollars,

x = exchange rate, expressed as dollars per unit of foreign currency, and

P_d = difference in total profits.

(2) $xP_f = xP_fQ - xC_f^*(Q) - C_{\$'}(Q)$

where

Q = output,

P_f = price of output in foreign currency,

$C_f^*(Q)$ = part of costs of producing in foreign country, which are denominated in foreign currency,

$C_{\$'}(Q)$ = part of costs of producing in foreign country, which are denominated in dollars.

(3) $P_{\$'} = xP_fQ - C_{\$'}(Q)$

where

$C_{\$}(Q)$ = total costs of producing in domestic country, denominated in dollars.

$C_f^*(Q)$, $C_{\$'}(Q)$ and $C_{\$}(Q)$ are increasing functions of the output, Q. Therefore, the difference in total profits would be

(4) $$P_d = \left[xp_fQ - xC_f^*(Q) - C_{\$'}(Q)\right] - \left[xp_fQ - C_{\$}(Q)\right]$$
$$= C_{\$}(Q) - xC_f^*(Q) - C_{\$'}(Q).$$

Assuming that domestic prices rise and foreign prices fall by some percentage α due to a devaluation of size β, the difference in total profits is changed, after allowing for the cost adjustments of α in each market. Let

P_{d_2} = the difference in total profits after a devaluation of β and cost adjustments of α in each market.

Therefore,

(5) $$P_{d_2} = (1 + \alpha)C_{\$}(Q) - (1 - \alpha)(1 + \beta)xC_f^*(Q) - (1 + \alpha)C_{\$'}(Q).$$

The change in the difference in total profits due to a devaluation is then:

$$(6) \qquad P_{d_2} - P_d = \alpha C_{\$}(Q) + (\alpha - \beta + \alpha\beta) x C_f^*(Q) - \alpha C_{\$'}(Q)$$

which is always negative if

$$\frac{\alpha}{\beta} < \frac{x C_f^*(Q)}{C_{\$}(Q) - C_{\$'}(Q) + (1 + \beta) x C_f^*(Q)}$$

That is, a devaluation is more likely to reduce the profitability of foreign production relative to domestic production the less is α and the more is the $C_{\$'}(Q)$.

From the above inequality, Kohlhagen then concluded that :

> This condition implies that in a typical case (foreign production costs are roughly equivalent to domestic production costs) where there are no dollar-denominated foreign costs, as long as domestic and foreign costs do not adjust by more than 40-45% of the amount of the devaluation, the devaluation will have the effect of reducing the relative profitability of foreign production .....[1]

Kohlhagen finally concluded that the above inequality implies that only in the case in which the home country and the foreign country are extremely open, where overall costs of production will rise by roughly 50 percent of the amount of the devaluation, are foreign investment outflows from a devaluing country to be expected. However, outflows are not to be expected even then when some part of foreign production costs are dollar-denominated or when the foreign production costs are considerably different from domestic production costs.

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[1] Kohlhagen (1977), p.46.

Kohlhagen then developed a technique to test the hypothesis that the major exchange rate realignments (one-shot adjustment) of the currencies of the British Pound, French Franc, and the German Mark in the 1960's affected the U.S. foreign direct investment in a systemtic way. Nevertheless, it is worth mentioning that Kohlhagen claimed at one point of his analysis that :

> It does not follow that continuous fluctuations in exchange rates (in a floating peg regime) will affect the direction of direct investment flows. Such movements in the exchange rate presumably facilitate the equalization of long run rates of return. If, under a floating regime, exchange rates in the long run approach purchasing power parity then the "average" industry should receive no incentives from the exchange rate changes with respect to its direct foreign investment decisions. Industries whose costs are inflating faster domestically than abroad relative to the "average" industry (and presumably the exchange rate adjustments) will have an incentive to invest abroad..... But on the whole there should be no bias one way or the other[1]

This point is, however, not correct. In an earlier and comprehensive work by Alexander and Murphy (1975), the role of the exchange rate is shown to be influencing the direct investment flows in a systematic way. Since this model is the basis of another modified model which has been used in this study, we will show them in rather details.

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[1] Kohlhagen (1977), p.44.

III. The Specific Model Adopted

(a) The Model Basing on the Internal Rate of Return

Utilising the method of internal rate of return, Alexander and Murphy compare direct investments in various locations. Profit-maximising firms will make investment decisions for their overall portfolio of assets in accordance to the relative expected rates of return, given the pattern of risks. Hence, the desired ratio of equity in properties abroad relative to those at home will rise when the rates of return from foreign investment increase. We will show this below.

For the exposition of that model, and the other models to follows, a consisitent notation is introduced. Let:

α = the exchange rate, defined as the number of units of domestic currency per unit of foreign currency,

t = the time period,

$E_j(t, \alpha)$ or $E_j(t)$ = the expense incurred in time period t, which is or is not a function of α, respectively,

$R_j(t,\alpha)$ or $R_j(t)$ = the revenue from investment in time period t, which is or is not a function of α, respectively.

Subscript j, j = h,f to $E(t, \alpha)$, $E(t)$, $R(t, \alpha)$ and $R(t)$ indicates that the flow of expense or revenue is denominated in the home currency or the foreign currency, respectively.

k = the share of revenue of home investment that is generated in the international sector, either by (a) selling some of outputs abroad, or (b) selling some of outputs at home in competition with home country's imports, $0 \leq k \leq 1$,

$(1-k)$ = the share of revenue of home investment that is generated in the domestic sector, $0 \leq (1-k) \leq 1$,

γ = the share of expense of home investment that is in international type goods because of use of some intermediate goods that are traded internationally, $0 \leq \gamma < 1$,

$(1-\gamma)$ = the share of expense of home investment that is in domestic type goods, $0 < (1-\gamma) \leq 1$,

g = the share of revenue of investment abroad that is generated in the international sector, either by (a) selling some of the outputs back to home country, or (b) selling some of the outputs to the foreign country in competition with home's exports in that country, $0 \leq g \leq 1$,

$(1-g)$ = the share of revenue of investment abroad that is generated in the domestic sector of that foreign country, $0 \leq (1-g) \leq 1$,

σ = the share of expense of investment abroad that is due to international type goods, $0 \leq \sigma < 1$, and

$(1-\sigma)$ = the share of expense of investment abroad that is in domestic type goods of that foreign country, $0 < (1-\sigma) \leq 1$.

Throughout the chapter the following assumptions are used:

(1) there is a world of only two countries, namely the home country and a foreign country, with a single exchange rate, α ;

(2) the exchange rate is treated as a parameter that is though by investors to be fixed, and a change is assumed to generate no expectations of further change;

(3) the capital market is perfect--that is, there is a given borrowing-lending rate, to be called the rate of interest and designated by i, that is unaffected by the amount of borrowing or lending undertaken by an individual or firm,

(4) costs and returns from the investment are known with certainty;

(5) when the home country devalues its currency, the prices of all traded goods rise by a share, β, of the devaluation in terms of the home country's currency and fall by a share $(1-\beta)$ in terms of the foreign currency. Formally, we assume

$$(7) \qquad \frac{dR_h}{d\alpha}(t,\alpha) \cdot \frac{\alpha}{R_h(t,\alpha)} = \frac{dE_h}{d}(t,\alpha) \cdot \frac{\alpha}{E_h(t,\alpha)} = \beta,$$

and,

$$(8) \qquad \frac{dR_f}{d\alpha}(t,\alpha) \cdot \frac{\alpha}{R_f(t,\alpha)} = \frac{dE_f}{d\alpha}(t,\alpha) \cdot \frac{\alpha}{E_f(t,\alpha)} = -(1-\beta).$$

Now, take the case in which there are no intermediate goods traded, and consider, for example, a capital investment that is made abroad with the plan that its resulting outputs will be marketed in the home country, or, alternatively marketed abroad in competition with the home country's exports. The rate of return on the investment, r_f, is defined as the rate of discount that makes the net income stream equal to zero. Hence, r_f is the internal rate of return when

$$(9) \qquad \int_0^T R_f(t,\alpha) - E_f(t) \; e^{-r_f t} dt = 0,$$

and the effect of a change in the exchange rate will be :

$$(10) \qquad \frac{dr_f}{d\alpha} = -\frac{\int_0^T \left[\frac{dR_f}{d\alpha}(t,\alpha)\right] e^{-r_f t} dt}{\int_0^T t\left[R_f(t,\alpha) - E_f(t)\right] e^{-r_f t} dt}$$

$$= \frac{\int_0^T \frac{(1-\beta)}{\alpha} R_f(t,\alpha) e^{-r_f t} dt}{\int_0^T t\left[R_f(t,\alpha) - E_f(t)\right] e^{r_f t} dt}$$

The numerator of the above expression, taken alone, is positive since β is less than one. The denominator may be taken to be positive in the general case of an investment expected to have a positive rate of return since it is a time-weighted stream in which expenses are typically largest in early periods (when capital equipment is acquired) and revenues are largest in later periods. Therefore, Alexander and Murphy obtain $\frac{dr_f}{d\alpha} < 0$ through the assumption that the expense and revenue streams are such that the $\int_0^T t\left[R_f(t,\alpha) - E_f(t)\right] e^{-r_f t} dt > 0$. That is, in general a depreciation of the home currency will lower the rate of return from investment abroad. Therefore, depreciation will create an inducement for the ratio of holdings of equity abroad to total holdings to be reduced. To achieve an adjustment of stocks there will be a reduction in the home country's net outflow of direct investment and equity capital.

Similarly, consider the case of investment at home to produce a good or service to be marketed abroad, or at home in competition with imports. In this case, the rate of return is r_h when

$$(11) \qquad \int_0^T \left[R_h(t,\alpha) - E_h(t)\right] e^{-r_h t} dt = 0.$$

The effect of a home currency devaluation will be

$$(12) \qquad \frac{dr_h}{d\alpha} = \frac{\int_0^T R_h(t,\alpha) e^{-r_h t} dt}{\int_0^T t\left[R_h(t,\alpha) - E_h(t)\right] e^{-r_h t} dt} > 0,$$

when $\int_0^T t\left[R_h(t,\alpha) - E_h(t)\right] e^{-r_h t} dt > 0.$

That is, the relative depreciation of the home currency will raise the rate of return from home investments. Hence there will be an increase in the ratio of desired holdings of equity at home. To achieve the stock adjustment there will be an increased net inflow of direct investment and equity capital to the home country.

To permit a more realistic environment, Alexander and Murphy relaxed the assumption of no trade in intermediate goods. This relaxation allows the expense stream of investment to be influenced by a change in the exchange rate also. They found that the introduction of trade in intermediate goods reduces the

impact of a devaluation on the rates of return but does not change the direction of the effects. However, this is not true when the inputs are more international oriented than the output of investment. The result holds, however, only when the introduction of the traded intermediate good leaves output more internationally oriented than are inputs. Once the share of the traded input exceeds the share of the traded output, the direction of the exchange rate effects on direct investment are changed.

Finally, Alexander and Murphy derive the effect of a change in the exchange rate upon the rate of return for a general case in which a home investment produces some international goods, whose prices will be affected by a devaluation, and some domestic goods, whose prices will be affected by a devaluation, and some domestic goods, whose prices will not initially be affected by a devaluation. Putting both revenue and expense streams in the home currency, they derived

$$(13) \qquad \frac{dr_h}{d\alpha} = \frac{\int_0^T \left[\frac{k\beta}{\alpha} R_h(t,\alpha) - \frac{\gamma\beta}{\alpha} E_h(t,\alpha)\right] e^{-r_h t} dt}{\int_0^T t\left[kR_h(t,\alpha) + (1-k)R_h(t) - \gamma E_h(t,\alpha) - (1-\gamma)E_h(t)\right] e^{-r_h t} dt}$$

Similarly, for investment abroad,

$$(14) \qquad \frac{dr_f}{d\alpha} = \frac{\int_0^T \left[\frac{g(1-\beta)}{\alpha} R_f(t,\alpha) - \frac{\sigma(1-\beta)}{\alpha} E_f(t,\alpha)\right] e^{-r_f t} dt}{\int_0^T t\left[gR_f(t,\alpha) + (1-g)R_f(t) - \sigma E_f(t,\alpha) - (1-\sigma)E_f(t)\right] e^{-r_f t} dt}$$

To determine the signs of equations (13) and (14), with the assumption that these two projects characteristically have larger expenses in early periods and larger revenue streams in later periods such that the time-weighted stream, $\int_0^T t\left[gR_f(t,\alpha) + (1-g)R_f(t) - \sigma E_f(t,\alpha) - (1-\sigma)E_f(t)\right] \cdot e^{-r_f t}\,dt$, is positive, they argued that it is likely that labor costs are an important part of the total expense, therefore it is more likely that k will be larger than γ and g will be greater than σ in equations (13) and (14) repsectively. Hence the sign of equation (13) will be positive and the sign of (14) will be negative. That is, the rate of return on a home investment will increase and the rate of return on investment abroad will decrease when the home country devalues.

Consequently, the Alexander-Murphy hypothesis is that a devaluation of the home country will cause a reduction of direct investment flows out of the home country and cause an increase in the direct investment flows into the home country.

The equations (13) and (14) can be looked on as representative of the effects of exchange rate changes on the internal rate of return on all kinds of equity investment at home and abroad. By varying k and g such that $0 \leq k,g \leq 1$, and γ and σ such that $0 \leq \gamma,\sigma < 1$, one can accommodate every investment project. The sign of the derivative $\frac{dr_h}{d\alpha}$ depends upon the relative values of k and γ. It is clear that $\frac{dr_h}{d\alpha} \gtrless 0$ when $k \gtrless \gamma$. Similarly, $\frac{dr_f}{d\alpha} \lessgtr 0$ when $g \gtrless \sigma$.

It should be noted that, in order to get these relationships between the signs of $\frac{dr_h}{d\alpha}$, $\frac{dr_f}{d\alpha}$ and the relative magnitude of k and γ, and g and it was necessary to assume throughout the analysis that the revenue and cost streams are such that

$$\int_0^T t\left[kR_h(t,\alpha) + (1-k)R_h(t) - \gamma E_h(t,\alpha) - (1-\gamma)E_h(t)\right]e^{-r_h t}dt > 0,$$

and

$$\int_0^T t\left[gR_f(t,\alpha) + (1-g)R_f(t) - \sigma E_f(t,\alpha) - (1-\sigma)E_f(t)\right]e^{-r_f t}dt > 0.$$

These two assumptions turn out to be unnecessary when other decision rules of investment are used, as we shall see later.

(b) A Modified Model

The internal-rate-of-return criterion has disadvantages over the technique of present-value in an investment decision. Under the rule of comparing the internal rate and the market rate of interest and under the multiperiod investment as is the usual case for long-term foreign direct investment of productive activities, the internal rate of return may not give rise to a unique solution. The multiple solutions are a result of the alternation of signs in the multiperiod-income streams. [1]

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[1] Descartes' rule of signs tell us that the number of solutions is at most equal to the number of sign reversals in the net income stream.

Eventhough there is no problem with respect to the alternations of sign in the receipt streams, the rule of the internal rate and the interest rate comparison may not give a correct decision in the multually exclusive investment projects. If there are, for example two investment projects even of an equal size, the first project may be superior to the second alternative in its present value at low rate of interests while the reverse is true at high levels of interest rate. This is the case of the single reversal in two alternative investment opportunities. [1]

Since under the perfect capital market, the present-value concept is found to be advantageous to that of the internal rate of return, Sukrita Sachchamarga (1978) attempted to see whether the Alexander-Murphy results can be derived by means of the present value criterion. Consider, then, a general case in which an investment is to be placed at home to produce some international goods, whose prices will be affected by a devaluation of the home currency, and some domestic goods, whose prices will not initially be affected by a devaluation. There is trade in intermediate goods, thus permitting expenses as well as revenue streams to be influenced by a change of the exchange rate.

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[1] For more details on the shortcomings of the internal rate of return as a guide of investment decision, readers are referred to J. Hirschleifer (1970), pp. 51-81.

Let V_0^h denote the present-value of this home investment. By using the notation introduced earlier we then can write V_0^h as,

$$(15) \quad V_0^h = \int_0^T \left[kR_f(t,\alpha) + (1-k)R_h(t) - \gamma E_h(t,\alpha) - (1-\gamma)E_h(t) \right] e^{-it} dt$$

$$(16) \quad V_0^h = \int_0^T \left[kR_h(t,\alpha) + (1-k)R_h(t) - \gamma E_h(t,\alpha) - (1-\gamma)E_h(t) \right] e^{-it} dt.$$

In equation (15) the revenue that is generated in the international sector is obtained by selling some of the outputs abroad, and in equation (16) it is obtained by selling some of the outputs at home in competition with the home country's imports. However, whether the revenue is generated in the former way or the latter, the present-value obtained is the same since $\alpha R_f(t,\alpha) = R_h(t,\alpha)$.

Now let the home country devalue its currency. The effect of the devaluation on the present-value of the home investment is,

$$(17) \quad \frac{dV_0^h}{d\alpha} = \int_0^T \left[k \frac{dR_h}{d\alpha}(t,\alpha) - \gamma \frac{dE_h}{d\alpha}(t,\alpha) \right] e^{-it} dt$$

$$= \int_0^T \left[k \frac{\beta}{\alpha} R_h(t,\alpha) - \frac{\gamma\beta}{\alpha} E_h(t,\alpha) \right] e^{-it} dt.$$

Note that the magnitude of the above derivative is exactly equal to the numerator of the result that Alexander and Murphy get when $i = r$ (that is, when the market interest rate equals internal rate of return).

To determine the sign of this derivative, one must evaluate the value of the derivative at the market equilibrium. Since we assume perfect competition in the capital market, the present-value of all projects will in equilibrium be zero. Then

$$(18) \quad \int_0^T \left[kR_h(t,\alpha) + (1-k)R_h(t) - \gamma E_h(t,\alpha) - (1-\gamma)E_h(t) \right] e^{-it} dt = 0$$

or,

$$(19) \quad \int_0^T \left[\frac{\beta k}{\alpha} R_h(t,\alpha) + \frac{\beta(1-k)}{\alpha} R_h(t) \right] e^{-it} dt = \int_0^T \left[\frac{\beta\gamma}{\alpha} E_h(t,\alpha) + \frac{\beta(1-\gamma)}{\alpha} E_h(t,\alpha) \right] e^{-it} dt.$$

If $k \gtrless \gamma$ then

$$\int_0^T \left[\frac{k\beta}{\alpha} R_h(t,\alpha) \right] e^{-it} dt \gtrless \int_0^T \frac{\beta\gamma}{\alpha} E_h(t,\alpha)\, e^{-it} dt.$$

Therefore,

$$(20) \quad \frac{dV_0^h}{d\alpha} = \int_0^T \left[\frac{k\beta}{\alpha} R_h(t,\alpha) - \frac{\gamma\beta}{\alpha} E_h(t,\alpha) \right] e^{-it} dt \gtrless 0 \text{ for } k \gtrless \gamma,$$

$$0 \leq k \leq 1, \; 0 \leq \gamma < 1,$$

This means that, if it is likely that labor costs are an important part of the total expense (as Alexander and Murphy assert) then it is more likely that $k > \gamma$ and hence $\frac{dV_0^h}{d\alpha} > 0$. Thus, the present-value of home investment will become greater than zero as the home country devalues, and an investor, including a foreign investor, will invest in this project. Consequently,

there will be an increase in the home country's inflow of equity capital as the home country devalues her currency.

In a similar way we can consider investments abroad which produce some international goods and some goods for sale in the local market and which employ traded intermediate goods.

Let V_0^f be the present-value of this foreign investment. In equilibrium, the present-value of this project will be zero, therefore,

$$(21)\quad V_0^f = \int_0^T \left[\alpha g R_f(t,\alpha) + \alpha(1-g)R_f(t) - \alpha\sigma E_f(t,\alpha) - \alpha(1-\sigma)E_f(t) \right] e^{-it}dt$$

$$= 0.$$

When the home country devalues its currency, the effect of this devaluation on the present-value of investment abroad is,

$$(22)\quad \frac{dV_0^f}{d\alpha} = \int_0^T \left[gR_f(t,\alpha) + \alpha g \frac{dR_f}{d\alpha}(t,\alpha) + (1-g)R_f(t) - \sigma E_f(t,\alpha) - \alpha\sigma \frac{dE_f}{d\alpha}(t,\alpha) - (1-\sigma)E_f(t) \right] e^{-it}dt$$

$$= \int_0^T \left[gR_f(t,\alpha) - \frac{\alpha g(1-\beta)}{\alpha} R_f(t,\alpha) + (1-g)R_f(t) - \sigma E_f(t,\alpha) + \frac{\alpha\sigma(1-\beta)}{\alpha} E_f(t,\alpha) - (1-\sigma)E_f(t) \right] e^{-it}dt.$$

Substituting the equilibrium condition into the above equation, we get,

$$(23) \qquad \frac{dV_0^f}{d\alpha} = \int_0^T \left[-g(1-\beta)R_f(t,\alpha) + \sigma(1-\beta)E_f(t,\alpha)\right] e^{-it}dt$$

$$= -\int_0^T \left[g(1-\beta)R_f(t,\alpha) - \sigma(1-\beta)E_f(t)\right] e^{-it}dt.$$

Note again that, this magnitude is equal to the numerator of the Alexander-Murphy results, as i = r. The sign of equation (23) depends upon the value of g and σ . From the equilibrium condition that $V_0^f = 0$, we can derive that,

$$\int_0^T g(1-\beta)R_f(t,\alpha)e^{-it}dt \gtrless \int_0^T \sigma(1-\beta)E_f(t)e^{-it}dt, \quad \text{for } g \gtrless \sigma.$$

Therefore,

$$\frac{dV_0^f}{d} \lessgtr 0 \quad \text{for } g \gtrless \sigma$$

Again, if we follow Alexander and Murphy in asserting that it is more likely that labor costs are an important part of the total expense, then it is more likely that $\frac{dV_0^f}{d} < 0$. Hence, the present-value of investment abroad will become less than zero with devaluation of the home currency and thus an investor will not invest in this project so that there will be a reduction in the home country's outflow of equity capital.

From equations (22) and (23), one can derive all kinds of equity investment by varying k and γ , and g and σ It is clear that the direction of the effect of an exchange rate change on the present-value of various investments depends upon the degree to which outputs, on the one hand, and inputs, on the other, are priced on international markets. The results are identical to those obtained by Alexander-Murphy with the rate of return criterion.

The analysis shows that the Alexander-Murphy results are still valid under the present-value criterion. We have emphasized, however, the importance of trade in intermediate goods, the relative values of k and γ, g and σ , and important advantages of a present-value criterion over the internal rate of return that Alexander and Murphy used. In particular, it emerges that using the present-value criterion allows us to determine the sign of the derivative, $\frac{dV_0^h}{d}$ and $\frac{dV_0^f}{d}$, without making any assumption about the characteristic of the revenue and expense streams of a project.

IV. Empirical Application to the Japanese Direct Foreign Investment in Thailand.

Before the statistical estimation of equation, it is necessary to describe briefly the general Japanese government policy on direct foreign investment. This is because this policy can help or binder the net flows of direct foreign investment from Japan.

(a) Japanese Governmental Policy

Japan's private investment policies can be grouped in four branches as follows:-

1. Foreign exchange control
2. Monetary and fiscal measure
3. Private investment insurance
4. Various other minor measures including e.g. providing potential investors with information about the investment climate abroad by such semi-governmental agencies as the Japan External Trade Organization (JETRO) as well as by training in managerial and technical skills for intemational business.

Among all the measures taken, the most important are those related to the gradual relaxation of the foreign exchange control on direct foreign investment. This is because Japanese

direct foreign investment policies have mainly changed with the country's balance of payments. We will take up more of this aspect soon.

Under the foreign exchange and foreign trade control low of 1949, each direct foreign investment project has to be approved individually. Due to the balance of payment constraint, the first project was not approved until 1951. Large projects were under a tight control and if they were allowed, they were normally the resource-exploited projects. As the deficit in the balance faced away and continued and large surpluses were evidences, controls on direct foreign investment were gradually removed. Relaxations of exchange control were especially rapid in the early 1970's.

The major relaxation came in 1969. On October 1, 1969, overseas investment amounting up to U.S. $ 200,000.- was placed under an automatic approval by the Bank of Japan. On September 1, 1970, the ceiling for this automatic approval was raised to U.S. $ 1,000,000.- with a condition that the investment fund had to flow to the foreign subsidiary with at least 25 percent of equity belonging to Japanese ownership. On July 1, 1971, the condition of 25 percent Japanese equity participation was lowered to 10 percent. On June 8, 1972, virtually all direct foreign

investment applications, except in the sector of fishing, pearl-raising, banking and finance, special non-oil mineral industries and investment in foreign oil industry were automatically approved. On June 27, 1977, the acquisition of securities which was financed without having to send foreign exchange directly from Japan was not required to apply for an approval. This means that Japanese investors can borrow fund in local market for their investment in this market. Foregin investment does not, in this case, goes through the usual process of foreign exchange market. There is no net capital movement between Japan and say Thailand. The Japanese investor uses the local fund to acquire a physical asset in return for a finanical liability. The relaxation in 1977 also implies that direct foreign investment out of retained earnings is not subject for approval. This is important to know because the data on Japanese direct foreign investment as compiled and made available to public to public by the Bank of Japan is based on the approval basis. Actual foreign investment which includes reinvestment of profits in the local market do not coincide with the approved amount. [1]

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[1] The cumulative amount of the total Japanese direct private foreign investment as at 1972 was found by Y. Tsurumi (1976) in her field investigation to be twice greater than the officially approved amount.

Fiscal measures are tax credit derived from foreign sources and tax deferral. Monetary measures promoting direct foreign investment include basically the interest rate subsidy and availability of medium-and long-term loans to investors through various financial institutions e.g. Export-Import Bank (EXIM), Overseas Economic Cooperation Fund (OECF), Japan Intemational Cooperation (JICA), and Japan Overseas Development Corporation (JODC). Japan Petroleum Development Corporation and Metal Mining Agency of Japan (MMAJ) respectively provide long-term funds at low interest rate for investment in petroleum-related activities and mining. There are also various schemes of insurance set up by the Japanese government for foreign direct investment.

The risk insured are broken down into (i) political risk i.e. war, expropriation, and bans on transfer of investment income and (ii) non-political risk or "credit risk" which insures aganist bankruptcy or default of the boorower. The credit risk is applied to natural resource-related investment only.

(b) Japanese Yen and the U.S. Dollar

Due mainly to balance of payments constraint, the first project of Japanese overseas investment did not come to

existence until 1961. Table 1 presents the extent of the Japanese direct foreign investment flows from 1951 to 1976.

The global amount of Japanese direct foregin investment slowly increased after 1965. Concurrently around 1965, the balance of payments of Japan changed enormously. Trade balance which was politive by a small amount of U.S. $377 million in 1964 jumped to U.S.$1.901 billion in 1965, with the current account surplus of U.S.$932 million. During 1966-1971, trade balance and balance of payments were considerably favourable to Japan espectially in the last three years of 1969-1971. Balance of payments on the official reserve settlements amounted to U.S. $960 million in 1969, U.S. $ 1.128 billion in 1970, and U.S. $10.208 billions in 1971. As a result of this evidently large balance of payment surplus and pressure from outside Japan, the Bank of Japan decided to let the value of the yen to float upward on August 28, 1971. This floating, though it was not a completely free float, lasted for 4 months until the Smithsonain Agreement on exchange rate realignment of December 18, 1971. The yen was then repegged at 308.6 yen to the dollar, an appreciation of 16.66 percent. In addition, exchange rates were permitted to fluctuate within a permissible range of 2.25 percent on either side of the official parity or the central value. But due to the strong yen, the exchange rate of yen in the dollar fluctuated most likely around 302 yen.

With the variable and long time-lag adjustment of trade flows to an exchange rate change, the inadequate revaluation of the yen against the dollar, and particularly the still continuing large gap between the rising Japanese labor productivity in the manufacturing over that of its trading partners particularly the U.S., the Japanese balance of payments remained substantial in its favor up to 1973. The Bank of Japan decided then to adopt a managed floating regime after the U.S. devaluation of 10.0 percent in February, 1973. The yen, on the day of the dollar devalution, appreciated further by 2.7 percent against the dollar. Thus, the value of yen relative to the U.S. dollar rose by about one third during the end of August 1971 and February 13, 1973. The yearly average price of dollar against yen stood at 272 for 1973.

During the first half of 1970's, Japanese direct overseas investment surged upward rapidly. (See Table 1) The total value of permitted amount of direct investment increased by 1.36 times in 1970 as compared to 1969. Though the total value slightly went down in 1971, it rose even more spectacularly in 1972, i.e. being 2.73 and 2.59 times the value of 1971 and 1970 respecitively. In the time span of 1973 and 1976, the permitted outflow tended to stabilize falling in between U.S.$2.39-3.49 billion. In this latter period, the price of dollar against yen also fluctuated

much less than the earlier years of 1971-1973. The annually average exchange rate of the yen against one dollar was 297 and 270 in 1975 and 1978.

(c) The Exchange Rate between the Baht and Yen

After the abolishment of the multiple exchange rate system in 1955, the Bank of Thailand adopted a single exchange rate system up to November 1978. Though the parity of the Baht against gold and hence the American dollar was not declared with the International Monetary Fund until October, 1963, fluctuations of the value of baht against the dollar was found to be not more than 3 percent. Having declared the official parity of the baht, the exchange rate of the Thai currency in terms of one dollar would fluctuate in between one percent of the parity. Up to the Smithsonian realignment in 1971, the exchange rate between the baht and yen could then move up and down by 2.25 percent.

Under Thailand's foreign exchange rate system, the U.S. dollar was used as the intervention currency. This continued up to the adoptation of the so-called daily exchange-rate fixing on November 1, 1978. Even under this new regime, the daily peg was done against the American dollar by the Exchange Equalization Fund. The spot price of yen against the baht, as well as other foreign currencies to the baht, was then calculated from the cross rate following the official peg against the dollar.

However, when the dollar was devalued by 7.89 percent against gold in December 1971, the Bank of Thailand decided to devalue the baht against gold (and hence dollar) by the same percentage. Due to the wider band of exchange rate fluctuations around the central rates allowed, the exchange rate between the yen and the Thai currency could differ from each other by 4.5 percent. The baht was again devalued by 10.0 percent in February 1973 to keep its price in line with the American dollar. There was, later, a minor revaluation of the baht against the U.S. dollar by 3.8 percent on July 15, 1973. But with the American dollar floating against the Japanese currency, the value of baht vis-a-vis the yen then fluctuated along with the changing rate of the dollar. During the use of the above-mentioned daily exchange rate fixing regime from November 1978 to July 15, 1981, (the time of our writing this report) the exchange value of the baht for the yen, therefore, moved up and down not only in response to the changing price of the U.S. dollar against yen but also to the daily pegged rate against the dollar. Table 3 presents the annual exchange rate of the baht against the yen during 1966-1979.

(d) Japanese Direct Foreign Investment in Thailand

Table 1 present the extent of the permitted amount Japanese direct foreign investment in Thailand between 1951-1976.

Japanese direct foreign investment did not flow to Thailand until the late 1950's. In fact and as at 1960, not shown on the table, there were 45 projects permitted with the cummulative investment value of U.S.$5.15 millions. It can be seen from Table 1 that the share of Japanese direct investment going to Thailand was fluctuating downward after 1965. In 1965, Thailand's share of total annual flow of Japanese direct foreign investment was 3.77 percent. During the rapid growth of Japanese direct foreign investment from 1971 to 1973, where it grew by 4.07 times in absolute amount, the portion going to Thailand grew by only 3.78 times. In 1976, the share of Thailand in the total annual flow of Japanese direct foreign investment amounted merely to 0.55 percent. Thailand is, thus, a small recipient of Japanese direct foreign investment.

Though Thailand is a small recipient of the overall Japanese direct foreign investment, it is not always so when we considers its distribution. Table 2 provides some statistics of the sectoral distribution of Japanese direct foreign investment. The total cumulative investment for 1951-1976 is broken down into five categories, i.e. manufacturing industries, agriculture and forestry, fishery, mining, and others. Though the cumulative value of the Japanese direct investment in Thailand is only 1.18 percent, it differs markedly among sectors. For the category of

manufacturing industries as a whole, the share is 2.84 percent. However, within this category, Japanese direct investment in Thailand in food and textile sector amounted to 11.47 and 7.10 percent of its respective direct world investment. In fact, these two sectors combined contributed 67.44 percent of the total Japanese manufacturing direct investment in Thailand. It was also as much as 50.88 percent of the overall Japanese private direct investment in this country during that time span.

(e) Empirical Tests

The hypothesis is that a depreciation of a country's currency will cause a reduction of the flow of direct investment out of the country and an increase in the direct investment flow into the country, given that outputs of the international investment are more international oriented than inputs. In this section, we will develop a test for the hypothesis using the case of the Japanese direct foreign investment in Thailand which is the largest direct foreign investment in this country.

To test the hypothesis, the regression model is specified such that Japanese direct investment in Thailand, DI, is a dependent variable. The exchange rate, ER, defined as the price of one baht in terms of yens, is one of the explanatory variables and the expected sign of the coefficient of ER is negative.

DI can be measured in either bahts or yens. A decrease in ER or a depreciation of baht vis-a-vis yen raises the present values (as well as the rate of returns) for some prospective investment project in Thailand and lowers those of some projects in Japan. The rise in present value of investment projects in Thailand implies that Japanese investors will want more bahts to finance the investment plans here. More bahts can be bought, however, with the same of fewer yens as a result of the depreciation; the demand for an increased number of bahts does not issue that the yen value of the flow of investment toward Thailand increases. Thus, measureing the flow in yen terms, however, is a somewhat more severe test than one in which the flow is measured in bahts. Tests of the effect of the exchange rate on the flows are, then, carried out in terms of both currencies.

It is not only the exchange rate that affects the flows of direct investment. The literature, for example, Bandera and White (1968), and Scaperlanda and Mauer (1969, 1971, 1972, 1973 and 1974), suggest that the size of the market is an important determinant of the investment flows. This postulate can be viewed in two ways, both giving rise to an expected positive relationship between direct investment and market size. First, we consider that the GDP in the host country determines the intensity of demand for the output produced by foreign owned capital. Then the Japanese

profit-maximizing firm will increase investment in Thailand as the Thai market size increases. The second interpretation is that foreign investment will take place in a country as soon as the market of the receiving country is large enough to permit economies of scale to be captured. The latter rational may be relevant if tariffs transportation costs limit sales of the product abroad. Moreover, some products may need imported inputs which are difficult to acquire as a result of tariffs or transportation costs. This may cause the foreign firm to establish a subsidiary in the country inquestion in order to produce the product or to get a more complete vertical integration of its production process, as soon as the foreign market is large enough to permit economies of scale. Foreign investment is usually undertaken by a firm that already has substantial sales in its domestic market. Thus, it has acquired managerial know-how, trademarks, and other intangible assests which are now available for use elsewhere. Therefore, if the market size abroad is large, direct investment is an effective way to use these assets. Market size considerations may be viewed as a determinant of investment expansion in case of either vertical investment or horizontal investment.

We will use the real gross domestic product of Thailand, GDP, as a proxy variable for the size of the Thai market, as one

of the explanatory variable of DI, and the anticipated sign of the coefficient of GDP is positive.

A variable for Thai prices relative to Japanese prices, $\frac{P^T}{P^J}$, should be included as one of the explanatory variables, because if exchange rate changes exactly reflect relative price level changes, one should expect the exchange rate changes to have a smaller effect on direct investment flows. The relative consumer price index of Thailand to Japan are used to represent the relationship of Thailand to Japan prices. The anticipated sign of the coefficient of this variable is positive.

Finally, since DI will be measured in current prices, its time series is likely to be characterized by a strong price trend. The time variable, T. (where T = 1, 2, 3,.....), therefore, will be put in the equation to capture the price trend in the data.

From the discussion above, the regression equation can now be written as [1],

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[1] It is kept in mind that a tariff variable may be a relevant variable influencing the capital inflows. However, including the tariff variable requires a lot of extra time beyond this study. The variable, hence, is omitted here. The results of the omitted tariff variable will be discussed in details later.

$$(24) \quad DI = \alpha_0 + \alpha_1 ER + \alpha_2 GDP + \alpha_3 \frac{P^T}{P^J} + \alpha_4 T + \varepsilon$$

where is the disturbance term, and $\alpha_1 < 0, \alpha_2 > 0, \alpha_3 > 0$

Alternative functional forms will be specified to compare the fitness between a linear form and a non-linear form. The non-linear relationship of DI and its determinants is specified such that the relationship is in a log-linear form. Formally, we have

$$(25) \quad \log DI = \beta_0 + \beta_1 \log ER + \beta_2 \log GDP + \beta_3 \log \frac{P^T}{P^J} + \beta_4 T + \varepsilon$$

The model expressed by equation (24) and (25) is first estimated by the ordinary least squares using yearly data from 1966-79 when the dependent variable is the Japanese direct investment inflow and the Japanese net direct investment in Thailand. The model is also estimated by the ordinary least square using yearly data from 1970-79 when the dependent variable is the oversea investment inflow to a classified sector, such as, industry, textile, electrical appliance, machinery and transport equipment, and chemicals and paper, similar equations are again run for the net direct investment flows.

All regression equations discussed above are also re-estimated by using the Cochrane-Orcutt iterative method to correct autocorrelation. [1] This method gives the "final round" estimates of the regression coefficients which coincide with the value of maximum likelihood estimators. Monte Carlo experiments also showed that the interative method is more efficient than the method of ordinary least squares, especially when the sample size is less than 20. [2] The estimated results of the linear regression equation (1) using the Cochrane-Oreatt iterative method [3] are shown in table 6.

The results in table 6 show that the exchange rate has a strong effect on direct foreign investment. It shows that a depreciation of a baht vis-a-vis yen increases the Japanese direct investment flow into Thailand. The exchange rate coefficients have correct signs with significant t-statistics in 17 equations

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[1] The number of observations in this study are less than the number of observations in any available Durbin-Watsun statistic table. To test for an existance of autocorrelation, the table is interpolated to cover our tests. The test on autocorrelation shows that most of the cases are indetermined. Moreover, the interpolation is rather a rough method to extend this table. We, therefore, decided to use Cochrane-Orcutt iterative method to estimate all of the equations. However, some of the OLS results of estimater are also given in Table 8.

[2] Kmenta, Jan., 1971.

[3] The estimated results of the log-linear regression equation (25) have lower R^2 than those of linear regression equation (24). Those results are not reported in this study.

out of 24 estimated equations. These coefficients are significant at 5 percent and 10 percent level of significance in 13 and 4 equations, respectively. The coefficients have correct negative signs but are not statistically significant in 6 equations. Only in one equation the exchange rate coefficient has a positive sign but this coefficient is not at the 10 percent level of significance. This is the equation of net direct investment to the industry sector, measured in yen terms. On the question of weak and strong test of the effect of exchange rate on direct investment flow, table 6 shows that the effect of a depreciation of baht vis-a-vis yen on the level of the Japanese direct investment flow to Thailand is corrent and significant at 5 percent in 9 equations out of 12 equations out of 12 equations in a weak test. The magnitude of the coefficient is also substantial. For a strong test of the effect of exchange rate on direct investment, that is when the flows are measured in yen terms, it is found that one-third of cases show the exchange rate coefficients are significant at 5 percent and 10 percent level and have correct negative signs.

The coefficients of relative prices have correct positive sign in 20 equations out of 24 estimated equations. However, only 13 cases are significant. The relative price coefficients have wrong negative signs in 4 quations but these coefficients are not significant.

It should be noted that the estimated coefficient of GDP have wrong negative signs in most of the cases. The GDP coefficient has a wrong negative sign in 19 equations of which 13 are significant. The coefficient has a correct sign in 5 equations of which only 2 equations posses significant t-values. The wrong negative sign of GDP coefficient may be explained by the following reasons. First, the absolute size of GDP is a poor indicator in developing country like Thailand of market potential for the products of foreign investors. The absolute size of GDP is more likely to reflect the population size than the per capita income.[1] The empirical results in table 6 show that GDP is not a significant determinant of direct investment flows in 9 equations out of 24 equations. Second, excluding some variable may cause the wrong negative sign of GDP coefficient if that excluded variable is relevant to the model and correlates with GDP. [2] The excluded mentioned earlier here is the tariff variable. Formally, if the true model is

$$DI = \alpha_0 + {}_1ER + \alpha_2 GDP + \alpha_3 \frac{P^T}{P^J} + \alpha_4 T + \alpha_5 Tariff + \varepsilon$$

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[1] See Franklin R. Root and Ahmed A. Ahmed (1979)

[2] See Kmenta, J., for example. Elements of Econometrics, The Macmillan Company, New York 1971, pp. 392-395.

but we have specified the model as,

$$DI = \alpha_0 + \alpha_1 ER + \alpha_2 . GDP + \alpha_3 . \frac{p^T}{p^J} + \alpha_4 T + \varepsilon .$$

The GDP coefficient will be biased since

$$E(\hat{\alpha}_2) = \alpha_2 + \alpha_5 . d_{52}$$

where α_2 is earlier postulated as positive; and d_{52} is the correlation between tariff and GDP. It is well known that a high tariff causes a high degree of resource misallocation, thus the growth rate of GDP should decrease. The high rate of tariff would, then, be associated with a low GDP. The sign of d_{52}, therefore, should be negative. The amount of bias, $\alpha_5 d_{52}$, may be positive or negative and even outweight the amount of α_2, depending on the sign of α_5 and relative magnitude of these three parameters. Hence, the GDP coefficient may have a positive insignificant sign or a negative sign in some cases. The sign of α_5 itself is not unambiguous. Corden (1974) discussed the total effect of protection on capital inflow consists of two components-the direct effect and the indirect effect.

The direct effect of protection is an increase in profits or potential profits which should lead to a movement of domestic as well as foreign capital into the industry. The

protection effect, on the otherhand, reduces profits in foreign industry the exports of which have been excluded by protection, and thus causes a defensive investment. The indirect effects of protection has 3 qualifications. A tariff on a product which is an input in another industry will reduce effective protection in the other industry and thus can be expected to less capital inflow than would have taken place otherwise and conceivable even in time to capital outflow. Second, tariff on imports which is complementary with some foreign investment will discourage such foreign investment. Finally, protection of an industry, when there is full employment, raises domestic factor prices and hence causes export industries to become less profitable. Consequently, it might also be expected to lead to reduce capital inflow into export industry. Therefore, the total effect of protection on capital inflow as a whole is ambiguous while the total effect of it on capital inflow of particular sector is positive if the indirect effect of it is also positive and indetermined if the indirect effect is negative.

The wrong negative sign may be due to the fact that an increase in direct investment may cause an increase in imports which thus has a negative effect on on GDP and then reduces capital inflow. This might have time lags in a process which we did not

corporate in the model. [1] Table 6 shows that the imports of Thailand during the studied period are increased sharply during 1973-79. Finally, the direct investment in Thailand may be influenced by political factor which is ignored in this study.

V. CONCLUSION

There are two approaches to the study of the determinant of direct foreign investment in a recent development of the last two decades. The first approach utilizes the international trade theory and industrial organization. This approach asserts that international firm went across the nations and the clue to the cause of private direct investment lied in the capital formation and hence, in the theory of the firm - monopolistic competition. Direct investment may be a defensive one, or in some cases a substitution of exports. Multinational corporations investing abroad must possess certain stock of knowledge which outweights all disadvantages in operating there. Another approach emphasizes the capital movement nature of direct foreign investment. In this respect the role of the exchange rate is singled out for the study. Machlup asserted in 1939 that the elasticity of demand for foreign exchange for purposes of long-term foreign investment is more than zero and may even be more than one. Later in 1970s there has been

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[1] This point is benefited from our discussion with Dr. Somsak Tambunlertchai.

a systematic analysis of the direct role of the exchange rate on direct doreign investment. This approach concludes that devaluation by a country will make investment in that country more attractive and investment abroad less attractive. Hence, there will be more capital inflow into the devaluation country and less outflow from that country.

An econometric model of the Japanese direct foreign investment flows to Thailand, based on the combination of the two approaches, has been set out to test the effect of the exchange rate changes on the flow. For aggregate Japanese direct investment inflows and its net investment the yearly data from 1966-79 is used. But we utilize the 1970-79 data for the gross investment and its net investment for the various classified manufacturing sectors. The direct investment flow is explained by the exchange rate, GDP of Thailand, and the relative of Thai to the Japanese price level, along with a time trend variable. The model is estimated by the ordinary least squares first, and then by the Cochrane - Orcutt iterative method with both a linear and log-linear functional form. The direct investment flow is measured in both baht and yen terms. This is because the depreciation of baht vis-a-vis yen will induce an increase in the Japanese direct foreign investment flow to Thailand; but increases in direct investment when measured in bahts, however, do not insure that there are also increases in terms of yen.

The results of the estimation indicate that the exchange rate variable affects direct investment flows significantly in 17 equations and insignificantly in 6 equations out of 24 equations, in the hypothesized direction. Only one equation shows the opposite direction of the effect of exchange rate on direct investment flows but this is not statistically significant.

Since domestic protection of the Thai manufacturing sector is not directly taken into account in our empirical tests, and since it may also be an explanation of the Japanese foreign direct investment in Thailand, future studies should also pay attention to this espect. The effect of protection on direct foreign investment inflows constitute a major study of its own.

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Table 1

Japan's Direct Foreign Investment Flows to the World and Thailand

(million of U.S.$)

Japanese fiscal year	To the world		To Thailand	
	Number of project	Value $	Number of project	Value (%) $
1951-64	1,358	790	105	33 (4.18)
1965	196	159	10	6 (3.77)
1966	244	226	20	2 (0.88)
1967	290	275	20	8 (2.91)
1968	369	557	18	10 (1.80)
1969	545	665	42	19 (2.86)
1970	730	904	21	13 (1.44)
1971	904	858	34	9 (1.05)
1972	1,774	2,338	62	30 (1.28)
1973	3,097	3,494	76	34 (0.97)
1974	1,910	2,395	60	31 (1.29)
1975	1,592	3,280	26	14 (0.43)
1976	1,652	3,464	27	19 (0.55)
1951-76	14,661	19,405	521	228 (1.18)

Source : Ministry of Finance, Japan.

Table 2

Sectoral Distribution of Japanese

Direct Foreign Investment, 1951-1976

Activities	Total Direct Investment to world (millions of U.S. dollars)	Directed to Thailand (%)
I. Industries	6,065	2.84
1. Food products	314	11.47
2. Textiles	1,127	7.10
3. Lumber and pulp	575	0.35
4. Chemicals	1,044	1.63
5. Iron and steel and non-ferrous metal	952	1.16
6. General machinery	452	0.66
7. Electrical machinery	687	0.44
8. Transport equipment	453	1.99
9. Other manufacturing	460	2.17
II. Agriculture and forestry	260	1.54
III. Fishery	148	0
IV. Mining	4,589	0.11
V. Others	8,073	0.61
Total	19,405	1.18

Source : Ministry of Finance, Japan

Tabel 3

Partial data For Regression Analysis 1966 - 1979

Year	Japan's direct investment inflow to Thailand	Japan's Net direct investment to Thailand	Exchange rate (price of one baht in term of yens), ¥/฿	Thailand's gross domestic product, at 1975 price	Thai prices relative to Japanese prices $\frac{P^T}{P^J}$
	DI	NDI	R3	GDP	
1966	225,700	237.200	17.5830	158,270	1.23600
1967	183,000	160.200	17,5940	170.590	1.23900
1968	213,700	181.200	17.3300	185.050	1,19700
1969	423,200	404.300	17.2430	199.720	1.16500
1970	333.100	307.200	17.1740	212.670	1,08300
1971	261,000	243.600	15.1160	230,000	1.02400
1972	365,100	340.800	14.5020	239.850	1.03000
1973	727,900	677.800	13.6650	264.520	1.06300
1974	736,300	609.600	14.8620	278,910	1.06300
1975	471,000	361.600	15.0620	298,820	1.00000
1976	501,600	424,200	14.4240	326.720	0.953000
1977	883,100	764,700	11.8230	350.700	0,950000
1978	1148,80	686,700	9,61500	391,810	0.986000
1979	890,900	245.900	11,7900	418,110	1.046.00

Source : DI and NDI are taken from Bank of Thailand R3, GDP are taken from issues of the IMF's International Financial Statistics. P^T/P^J are calculated the data from the International Financial Statistics.

Table 4

Sectoral Distribution of Japanese

Direct Foreign Investment Inflow to Thailand

1970-1979

(millions of bahts)

Year	Industry	Textile	Electrical appliance	Machine and Transportation	Chemical and paper
	IDI	IDI	EDI	MDI	CDI
1970	202.900	131.500	9.20000	4.70000	22.7000
1971	69.8000	27.8000	11.3000	0.800000	6.90000
1972	182.200	127.200	16.9000	3.00000	15.1000
1973	370.500	221.200	26.8000	14.5000	81.7000
1974	501.400	140.300	36.8000	13.0000	47.6000
1975	269.300	118.600	3.90000	12.7000	10.8000
1976	227.100	111.300	9.00000	3.30000	81.8000
1977	537.600	432.100	5.60000	40.5000	25.3000
1978	411.000	198.900	22.2000	45.7000	49.5000
1979	183.100	0.60000	37.8000	49.0000	34.6000

Source : Bank of Thailand.

Table 5

Sectoral Distribution of Japanese Net Direct Foreign Investment to Thailand 1970 - 1978

(millions of bahts)

Year	Industry	Textile	Electrical appliance	Machine and transportation	Chemical and paper
	INDI	INDI	ENDI	MNDI	CNDI
1970	185.900	125.700	9.20000	4.70000	17.2000
1971	57.5000	26.4000	11.3000	0.800000	4.00000
1972	162.800	123.300	16.9000	0.800000	14.7000
1973	348.400	205.700	26.8000	14.5000	46.5000
1974	457.800	115.700	36.8000	13.0000	46.5000
1975	208.400	106.000	3.90000	-18.0000	7.80000
1976	177.000	103.800	7.00000	-9.60000	75.3000
1977	465.100	405.400	5.60000	40.1000	20.5000
1978	282.400	134.500	22.2000	44.7000	39.3000

Source : Bank of Thailand.

Table 6

The Results of the Estimation

Dependent variable in million units	Constant term	exchange rate(¥/฿)	G.D.P.	relative price (P^I/P^J)	T	R^2
Direct investment flow in bahts, DI(฿) (1966-79)	-22.788 (-0.021)N	-106.450 (-2.982)a	-5.057 (-1.204)N	2190.350 (2.104)a	148.959 (1.586)b	.90
Direct investment flow in yens DI(¥) (1966-79)	-12753.300 (-0.906)N	-644.187 (-1.380)N	-112.869 (-2.114)a	33447.400 (2.489)a	3133.690 (2.626)a	.80
Net direct investment in bahts, NDI (฿) (1966-79)	2100.160 (1.533)b	-109.265 (-2.423)a	-11.265 (-2.022)a	1211.830 (0.900)N	215.580 (1.731)b	.65
Net direct investment in yens, NDI(¥) (1966-79)	15126.900 (0.858)N	-816.900 (-1.395)b	-166.744 (-2.455)a	19590.200 (1.155)N	3447.290 (2.271)a	.53
Direct investment flow to industry in bahts IDI (฿) (1970-79)	3637.590 (2.921)a	-113.977 (-3.352)a	-20.257 (-3.972)a	1713.360 (1.790)b	458.663 (3.921)a	.83
Direct investment flow to industry in yens, IDI (¥) (1970-79)	37933.200 (2.24)a	-1096.800 (-2.374)a	-267.709 (-3.975)a	26864.300 (2.086)a	6125.490 (3.995)a	.81
Net direct investment to industry in bahts, INDI(฿) (1970-78)	-3631.680 (-2.647)a	-15.193 (0.778)N	1.585 (0.491)N	3403.280 (4.860)a	41.318 (0.723)N	.80
Net direct investment to industry in yens, INDI (¥) (1970-78)	-44513.2 (-1.807)b	38.182 (.106)N	-19.233 (-0.337)N	45580.8 (3.738)a	1372.4 (1.368)N	.72

Table 6 (Continued)

Dependent variable in million units	Constant term	exchange rate(¥/฿)	G.D.P.	relative price (P^T/P^J)	T	R^2
Direct investment flow to textile in bahts, TDI (฿) (1970-79)	4005.410 (4.177)a	-88.696 (-3.409)a	-10,737 (-3.235)a	-573.420 (-0.828)N	210.436 (2.884)a	.83
Direct investment flow to textile in yens, TDI (¥) (1970-79)	45849.300 (3.924)a	-964.130 (-2.995)a	-135.293 (-3.409)a	-5055.040 (-0.604)N	2681.340 (3.086)a	.81
Net direct investment to textile in in bahts, TNDI (฿) (1970-78)	7051.160 (3.267)a	-134.824 (-3.284)a	-20.742 (-3.440)a	-1109.240 (-1.199)N	403.535 (3.434)a	.83
Net direct investment to textile in yens, TNDI (¥) (1970-78)	83897.8 (3.259)a	-1538.55 (-3.172)a	-254.902 (-3.597)a	-12342.5 (-1.124)N	4958.05 (3.623)a	.82
Direct investment flow to electrical appliance in bahts, EDI(฿) (1970-79)	-217.362 (-4.469)a	-2.717 (-2.252)a	-0.256 (-1.944)b	302.520 (9.625)a	7.595 (2.772)a	.94
Direct investment flow to electrical appliance in yens, EDI (¥) (1970-79)	-2736.300 (-3.698)a	-29.270 (-1.598)b	-5.174 (-2.593)a	4116.630 (8.624)a	135.465 (3.266)a	.92
Net direct investment to electrical appliance in baht ENDI (฿)(1970-78)	-143.527 (-1.641)b	-3.787 (-2.867)a	-0.430 (-2.134)a	280.415 (6.668)a	10.256 (2.894)a	.94
Net direct investment to electrical appliance in yens, ENDI (¥),(1970-78)	-2039.18 (-1.370)N	-40.684 (-1.800)b	-6.864 (-1.998)b	3936.74 (5.526)b	160.617 (2.611)a	.92

Table 6 (Continued)

Dependent variable in million units	Constant term	exchange rate(¥/฿)	G.D.P.	relative price (P^T/P^J)	T	R^2
Direct investment flow to machine and transportation in bahts, MDI(฿) (1970-79)	-40.113 (-0.543)N	-4.987 (-2.649)a	0.249 (1.186)N	64.015 (1.312)N	-2.449 (-0.553)N	.95
Direct investment flow to machine and transportation in yens, MDI (¥) (1970-79)	-742.360 (-0.839)N	-42.427 (-1.913)b	1.592 (0.653)N	1013.550 (1.759)b	6.026 (0.118)N	.93
Net direct investment flow to machine and transportation in bahts, MNDI (฿) (1970-79)	-353.688 (-2.002)b	-8.169 (-3.217)a	1.249 (3.026)a	234.885 (2.630)a	-23.903 (-3.252)a	.88
Net direct investment flow to machine and transportation in yens, MNDI (¥) (1970-78)	-4048.14 (-1.374)N	-102.125 (-2.390)a	13.206 (1.929)b)	3035.69 (2.058)b	-255.945 (-2.121)b	.79
Direct investment flow to chemical and paper in bahts, CDI (฿) (1970-79)	152.366 (0.442)N	-5.083 (-0.582)N	-1.369 (-1.414)N	182.140 (0.804)N	32.936 (1.621)b	.44
Direct investment flow to chemical and paper in yens, CDI(¥)(1970-79)	1890.610 (0.379)N	-34.534 (-0.273)N	-20.415 (-1.451)N	2475.970 (0.754)N	491.775 (1.661)b	.41

Table 6 (Continued)

Dependent variable in million units	Constant term	exchange rate (¥/฿)	G.D.P.	relative price (P^T/P^J)	T	R^2
Net direct investment flow to chemical and paper in bahts, CNDI(฿) (1970-78)	131,733 (0,161)N	-5,196 (-0,404)N	-1,498 (-0,785)N	224,143 (0,588)N	35,554 (1,057)N	.42
Net direct investment flow to chemical and paper in yens, CNDI (¥) (1970-78)	2012,77 (0,171)N	-46,851 (-0,253)N	-22,857 (-0,833)N	2944,41 (0,538)N	537,089 (1,111)N	.41

The number in parenthesis under each coefficent is the t-statistics. The alphabets a and b indicate that each coefficient is different from zero with a 5 and 10 percent level of significance. The alphabet n indicates the coefficient is not different from zero with a 10 percent level of significance.

Table 7

Values and Changes of Thailand's Total Imports

1966 - 1979

Year	Imports (mills. of ฿)	Changes in Imports
1966	792	
1967	952	160
1968	1035	83
1969	1107	72
1970	1148	41
1971	1152	4
1972	1325	173
1973	1835	510
1974	2793	958
1975	2839	46
1976	3146	307
1977	4251	1105
1978	4913	662
1979	6828	1915

Source : Bank of Thailand.

Table 8

The Results of the OLS Estimation

Dependent variable in million units.	Constant term	exchange rate(¥/฿)	GDP	relative price (P^T/P^T)	T	R^2
Direct investment flow in bahts, DI(฿) (1966-79)	-12,043 (-0.012)N	-12,043 (-3.128)a	-105.761 (-1.186)N	-4.384 (2.185)a	133.100 (1.641)b	.90
Direct investment flow in yens, DI(¥) (1966-79)	-11756.4 (-0.854)N	-670.162 (-1.464)b	-100.607 (-2.448)a	32150.5 (2.563)a	2815.690	.81
Net direct investment in bahts, NDI(฿) (1966-79)	2014.530 (1.545)b	-104.141 (-2.400)a	-9.471 (-1.997)a	1050.100 (0.844)N	176.929 (1.699)b	.65
Net direct investment in yens, NDI (¥) (1966 79)	16342.6 (0.944)N	-837.552 (-1.454)b	-147.176 (-2.337)a	17480.200 (1.058)N	2954.190 (2.137)a	.51
Direct investment flow to industry in bahts, IDI (฿) (1970-1979)	1646.080 (1.080)N	-57.589 (1.359)N	-10.073 (-1.930)b	1218.330 (0.897)N	224.740 (1.923)b	.54
Direct investment flow to industry in bahts, IDI (฿) (1970-79)	13699.900 (0.700)N	-421.831 (0.775)N	-149.490 (-2.230)a	21781.300 (1.249)N	3434.160 (2.288)a	.52
Net direct investment to industry in bahts, INDI (฿) (1970-78)	-1219.490 (0.516)N	-18.489 (-0.422)N	-3.564 (-0.977)N	2469.660 (1.713)b	166.328 (1.514)N	.62
Net direct investment to industry in bahts, INDI (¥) (1970-78)	-123679.3 (-0.775)N	18.102 (0.320)N	-84.481 (-1.142)N	38041.9 (2.041)b	2526.79 (1.779)b	.63

Table 8 (continued)

Dependent variable in million units	constant term	exchange rate(¥/฿)	GDP	relative price (P^T/P^T)	T	R^2
Direct investment flow to textile in baths, TDI(฿) (1970-79)	2434.810 (1.857)b	-49.029 (-1.345)N	-5.117 (-1.139)N	-547.647 (-0.469)N	89.585 (0.891)N	.44
Direct investment flow to textile in yens, TDI (¥) (1970-79)	26107.300 (1,586)b	-453.157 (-0.990)N	-68.075 (-1.207)N	-4146.410 (-0.283)N	1252.060 (0.992)N	.35
Net direct investment to textile in baths, TNDI (฿) (1970-78)	1396.240 (0.558)N	-29.235 (-0.631)N	-3.331 (-0.553)N	-207.247 (-0.136)N	66.865 (0.575)N	.28
Net direct investment to textile in yens, TNDI (¥) (1970-78)	13258.5 (0.424)N	-230.707 (-0.398)N	-42.695 (-0.567)N	-185.538 (-0.973)N	895.615 (0.616)N	.16
Direct investment flow to electrical appliance in baths, EDI (฿) (1970-79)	-208.606 (-2.586)a	-2.732 (1.218)N	-0.275 (-0.996)N	295.833 (4.114)a	8.278 (1.338)N	.80
Direct investment flow to electrical appliance in yens , EDI (¥) (1970-79)	-2703.100 (-2.264)a	-27.485 (-0.827)N	-5.376 (-1.314)N	4065.350 (3.818)a	144.758 (1.580)b	.75
Net direct investment to electrical appliance in baths, ENDI (฿) (1970-78)	-154.299 (-1.033)N	-3.708 (-1.340)N	-0.387 (-1.075)N	280.482 (3.077)a	9.323 (1.387)N	.76
Net direct investment to electrical appliance in yens ENDI (¥) (1970-78)	-1970.08 (0.882)N	-40.948 (-0.990)N	-6.898 (-1.282)N	3865.31 (2.837)a	163.210 (1.572)b	.74

Table 8 (continue)

Dependent variable in million units	constant term	exchange rate(¥/฿)	GDP	relative price (P^I/P^T)	T	R^2
Direct investment flow to machine and transportation in bahts, MDI (฿) (197079)	-86.686 (-0.947)N	-4.049 (-1.590)b	0.284 (0.906)N	89.555 (1.097)N	-2.840 (-0.404)N	.89
Direct investment flow to machine and transportation in yens, MDI (¥) (1970-79)	-1335.540 (1.119)N	-30.874 (-0.930)N	-1.681 (0.411)N	1393.580 (1.309)N	10.999 (0.120)N	.84
Net direct investment flow to machine and transportation in bahts, MNDI (฿) (1970-78)	-102.369 (-0.360)N	-8.499 (-1.613)b	0.468 (0.683)N	134.514 (0.827)N	-9.820 (-0.742)N	.76
Net direct investment flow to machine and transportation in yens, MNDI (¥) (1970-78)	-978.969 (-0.242)N	-104.489 (-1.392)N	3.523 (0.361)N	1922.74 (0.778)N	-83.200 (-0.422)N	.64
Direct investment flow to chemical and paper in bahts, CDI(฿) (1970-79)	42.514 (0.115)N	-2.714 (-0.263)N	-0.713 (-0.562)N	143.697 (0.435)N	18.315 (0.645)N	.14
Direct investment flow to chemical and paper in yens, CDI(¥) (1970-79)	141.570 (0.027)N	4.118 (0.028)N	-11.116 (-0.618)N	2027.990 (0.434)N	288.701 (0.717)N	.10
Net direct investment flow to chemical and paper in bahts, CNDI (฿) (1970-78)	-293.001 (-0.422)N	1.067 (0.083)N	-0.326 (-0.195)N	324.084 (0.765)N	15.255 (0.473)N	.22
Net direct investment flow to chemical and paper in yens, CNDI (¥) (1970-78)	-4044.68 (-0.408)N	44.043 (0.240)N	-6.315 (-0.264)N	4378.67 (0.724)N	251.712 (0.546)	.19

The number in parenthesis under each coefficient is the t-statistics. The alphabets a and b indicate that each coefficient is different from zero with a 5 and 10 percent level of significance. The alphabet n indicates the coefficient is not different from zero with a 10 percent level of significance.

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