Discussion Paper

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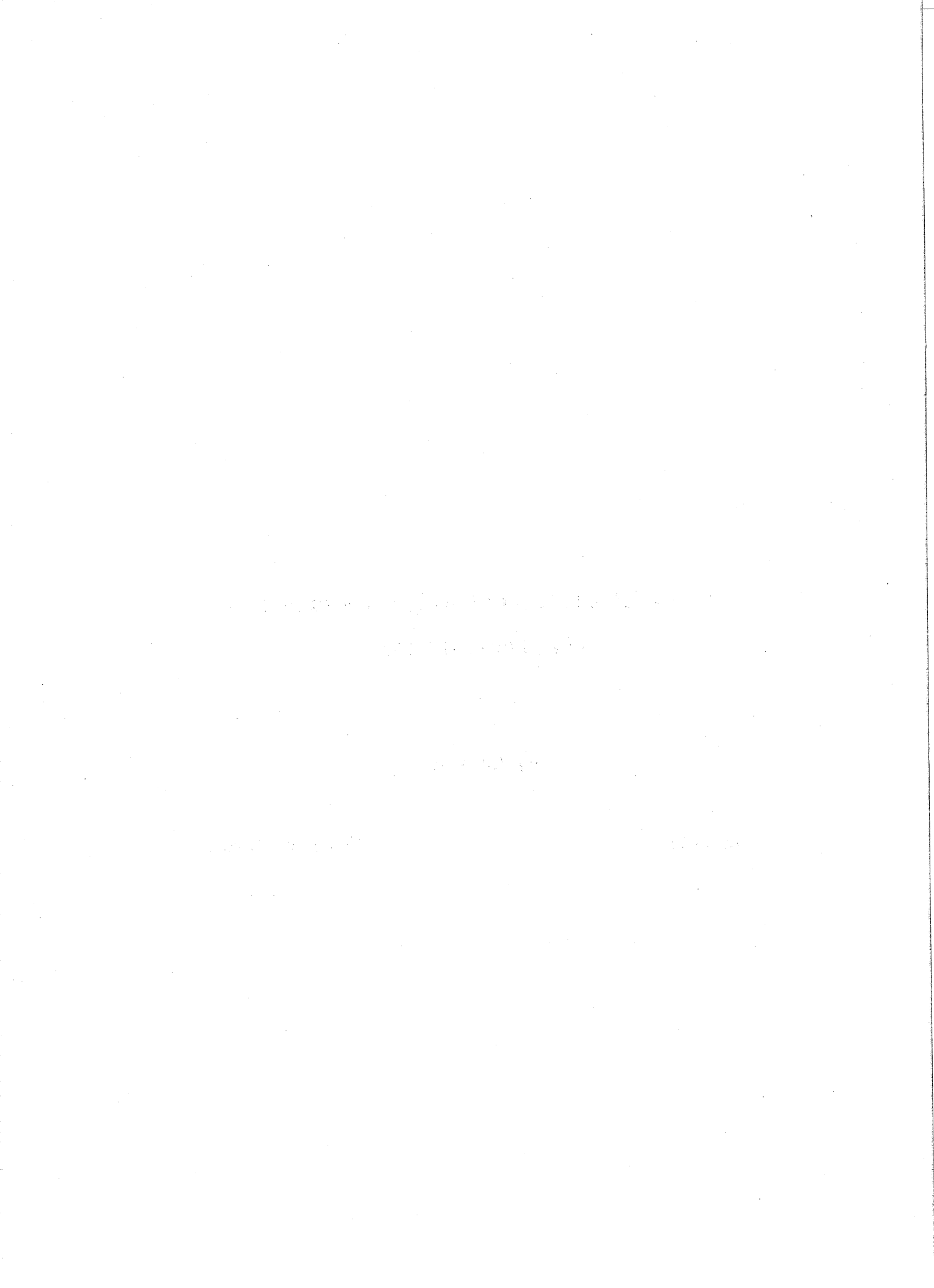
The Bilateral Case

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CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH

75 Chang-Hsing St., Taipei, Taiwan 106

Republic of China

Trade Effects of Direct Foreign Investment:
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An-loh Lin[*]

Abstract

This paper examines the trade effects of direct foreign investment (DFI) between Taiwan and each of the following countries: Indonesia, Malaysia, the Philippines, and Thailand. Regression results show that Taiwan's outward DFI has a significant positive effect on exports to and imports from the host country, whereas no such effects were consistently found for inward DFI from the same country.

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1. Introduction

Although Mundell (1957) presented a case in which product trade and direct foreign investment (DFI) can be substitutes, Schmits and Helmberger (1970) and Markusen (1983) argued that they are generally complements. Adler and Stevens (1974) pointed out the complexities of export displacement involved while Lipsey and Weiss (1981) found that U.S. foreign manufacturing investment tended to promote U.S. exports. Ozawa (1971) and Kojima (1973) also characterized Japanese overseas investment as trade-oriented DFI.

Thus, the exact relationship of trade and DFI is essentially an empirical one. To present statistical evidence, this paper focuses on the effect of DFI on aggregate exports and imports between two countries. Specifically, we estimated the effect of Taiwan's outward DFI in a host country on exports to and imports from the host country and the trade effect of inward DFI from that country based on time series data. The countries considered are: Indonesia, Malaysia, the Philippines, and Thailand, all in Southeast Asia.

In the following, we discuss the relationship of trade and DFI in Section II and the statistical model in Section III. Regression results and the conclusion are given in Sections IV and V, respectively.

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2. DFI and Trade

Table 1 summarizes the possible effects of DFI on trade between countries A and B, devised from the standpoint of A investing in B and receiving investment by B. The effects depend on whether the investment is made to produce services (S), final goods (F), or material including parts (M) for market A, B, or C (other countries). Tradable goods are classified into three categories: equipment & machinery (E), material (M), and other goods (G).

To explain the table we consider three cases. First, if country A (say, Taiwan) invests in country B (say, Indonesia) to establish a trading company, a banking business, or a retail store, trade between A and B should expand.

Second, country A invests in country B to produce final goods because of low wages, market proximity, trade barriers, or internalization, or for other reasons. A common practice is for A to export to B equipment and machinery for plant installation and then material for processing or parts for assembling. Thus, A's exports of equipment and material to B should increase. The export of equipment may occur only once, but that of material tends to be recurrent unless the supply is later replaced by a new source other than A. Consequently, A's imports of final goods made in B may increase. The increased imports may reduce the imports from B of the material previously used by A to produce the final goods at home. If the

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Tabe 1 DFI and Trade between Two Countries

DFI	in Production of	for Market of	Export from A to B			Import to A from B		
			E	M	G	E	M	G
Outward:	S	B	≥0	≥0	≥0	≥0	≥0	≥0
from A	F	A	≥0	≥0	0	≥0	≤0	≥0
to B		B	≥0	≥0	≤0	0	≤0	0
		C	≥0	≥0	0	0	≤0	0
	M	A	≥0	≥0	≥0	0	≥0	0
		B	≥0	≥0	0	0	0	0
		C	≥0	≥0	0	0	0	0
Inward:	S	A	≥0	≥0	≥0	≥0	≥0	≥0
from B	F	B	≥0	≤0	≥0	≥0	≥0	0
to A		A	0	≤0	0	≥0	≥0	≤0
		C	0	≤0	0	≥0	≥0	0
	M	B	0	≥0	0	≥0	≥0	≥0
		A	0	0	0	≥0	≥0	0
		C	0	0	0	≥0	≥0	0

A=country A, B=country B, C=other counties, E=equipment and machinery, F=final goods (E included), G=final goods (E excluded), M=material (primary & intermediate), parts and components, S=services.

final goods formerly produced in A were exported to B, the exports are expected to decrease as a result of export displacement.

Third, when country A invests in country B to produce primary or intermediate material or industrial parts, exports of equipment and/ or material from A to B may increase. The produced material may be shipped back to A with or without some of the previous imports of material from B being replaced. The final goods made from the imported material at home may return to B from A.

The above discussion is made for outward DFI and trade between the home and host countries. Symmetrical relationships can be also stated for inward DFI and trade as given in the lower portion of Table 1.

3. The Statistical Model

For demonstration, we examine the bilateral trade effects of DFI between Taiwan and each of the four countries stated above. We note that Taiwan's outward DFI rose dramatically after 1986 for four reasons: (a) tremendous appreciation of the Taiwan currency against the US dollar (a 38 percent rise in 1986-1987), (b) deteriorating domestic investment conditions, (c) intense international competition, and (d) relaxation of foreign exchange control. The six-year total of Taiwan DFI to Indonesia, Malaysia, the Philippines, and Thailand during 1987-1992 (about US$13 billion as approved by the host countries) was 87.8 times the total for the period 1981-1986. As a result, Taiwan's total exports to and imports from the four countries had risen by 3.7 and 2.7 times between 1986 and 1992, respectively. On the other hand, the total of inward DFI from the four countries for the second period (merely US$0.4 billion) was about 3.7 times the total for the first period.

As pointed out by Chen (1992), Taiwanese DFI in the ASEAN countries was mainly motivated by low wage considerations and thus was predominantly in the labor-intensive industries. The provision of equipment and material came mostly from Taiwan and a portion of output was then shipped back home. This investment pattern shows that Taiwan's DFI in the above four countries is a cause, rather than an effect, of the expansion of trade with those countries. We also argue that inward DFI from

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those countries, mostly in the service industries, is not trade-induced but made for the local market. These observations are rather consistent with the results from the Granger causality test on DFI and trade.

Our statistical model consists of the following export and import equations:

$$EX_t = a_1 + a_2 \overset{+}{YH}_t + a_3 \overset{-}{PW}_t + a_4 \overset{+}{OI}_t + a_5 \overset{?}{COI}_{t-1} + a_6 \overset{?}{CII}_{t-1} + u_t \qquad (1)$$

$$IM_t = b_1 + b_2 \overset{+}{YT}_t + b_3 \overset{+}{PW}_t + b_4 \overset{+}{II}_t + b_5 \overset{?}{CII}_{t-1} + b_6 \overset{?}{COI}_{t-1} + v_t \qquad (2)$$

where   EX = Taiwan's real exports to country i

IM = Taiwan's real imports from country i

YH = real GDP of country i

YT = real GDP of Taiwan

PW = wholesale price ratio between Taiwan and country i

OI = Taiwan's real outward DFI to country i

II = Taiwan's real inward DFI from country i

COI = cumulative OI

CII = cumulative II

u,v = error terms

a_j's, b_j's = parameters

t = year

+,-,? = expected signs

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The specification is explained below. Basically, an income or output variable and a relative price variable should appear in (1) and (2). Thus, country i's GDP appears in the export equation while Taiwan's GDP is in the import equation. The wholesale price ratio of Taiwan to the ith country is used in both equations. We tried a scheme by which two price variables were employed, one for the relative price of Taiwan to the group of the four countries and the other for the relative price of the group to the ith country concerned. But the scheme was abandoned because of its poor results.

The remaining variables are the DFI variables for testing their trade effects. Current OI (II) is introduced mainly to account for Taiwan's exports (imports) of machinery and equipment to (from) country i. One-year-lagged OI (II) was tried and then abandoned. Both COI and CII appear in (1) and (2) to account for the shipments of material and/or final goods resulting from all past DFI, outward as well as inward. They are lagged one year due to time lags in production. Although the signs of parameters of these two variables are uncertain, they are believed to be positive. Our purpose is to determine empirically their signs in both (1) and (2) and their statistical significance.

4. Results

Equations (1) and (2) in level form were estimated by the least squares method which took serial correlations into account for the sample period 1972-1992. Log form is not used because some values of OI or II are zero. There are 21 annual observations and 15 degrees of freedom. One or two more earlier observations were employed as initial values in the case of AR(1) or AR(2). Sources of data and the regression results are given in Table 2. It is noted that the amount of outward DFI approved by the Taiwan government was much smaller than the amount approved by the host country. Thus, data from the latter were used in our analysis.

Table 2 yields several results. First, Taiwan's current outward DFI (OI_t) has a significant positive effect on exports to the host country for each country considered, but Taiwan's current inward DFI (II_t) shows no such effect on imports from the home country.

Second, Taiwan's cumulative outward DFI (COI_{-1}) has a very significant positive effect on exports to and imports from the host country. The only exception is the Philippines for which the effect is significant on exports but nil on imports. The trade effects of cumulative inward DFI (CII_{-1}) are less consistent. They are mostly positive but significant only for the exports to the Philippines and Thailand. The significantly negative effect on the imports from Thailand may reflect some

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Table 2 Regression Results (1972-1992)

Variables	Indonesia EX	Indonesia IM	Malaysia EX	Malaysia IM	Philippines EX	Philippines IM	Thailand EX	Thailand IM
YT_t		.002 (.4)		.007 $(3.0)^a$		.003 $(3.7)^a$		.004 $(1.76)^c$
YH_t	.001 (.02)		.163 $(3.5)^a$		-2.5 (-.3)		4.31 (1.2)	
PW_t	-137.4 $(-2.53)^b$	-79.3 (-1.1)	-4.3 (-.4)	-15.1 (-.5)	62.9 (1.4)	82.8 $(1.67)^d$	-117.8 $(-2.89)^a$	255.0 $(3.8)^a$
OI_t	.212 $(2.14)^b$		.197 $(11.2)^a$		1.727 $(6.3)^a$		.341 $(9.1)^a$	
COI_{-1}	.243 $(3.8)^a$	.296 $(3.6)^a$	.182 $(14.4)^a$	.172 $(7.4)^a$	.316 $(1.89)^d$	-.072 (-.2)	.250 $(20.2)^a$	.255 $(9.4)^a$
II_t		-.794 (-.1)		1.205 (.8)		.007 (.01)		.314 (.05)
CII_{-1}	6.972 (1.5)	5.097 (.7)	-.178 (-.3)	.856 (.7)	1.992 $(5.8)^a$	.027 (.1)	9.47 $(1.92)^d$	-21.6 $(-2.65)^b$
C	24801 $(2.85)^b$	15740 (1.3)	-3103 (-1.74)	-2221 (-.6)	-11641 (-1.45)	-11831 (1.5)	11126 $(2.73)^b$	-18629 $(-3.3)^a$
Rho1	.293 (1.1)	.316 (1.2)				.338 (.9)	-.824 $(-3.5)^a$	
Rho2	-.599 $(1.84)^d$					-.400 (-.9)		
R^2	.885	.889	.996	.978	.972	.884	.994	.941
DW	1.57	1.71	1.86	1.64	1.88	1.83	2.29	1.79

EX=Taiwan's exports to country i shown, IM=Taiwan's imports from same country. Other variables are those given in Section 3. R^2 is adjusted. DW is Durbin-Watson statistic. Figures in parentheses are t-statistics. Superscript a, b, c or d means significant at the 1, 2.5, 5 or 10 percent level, respectively, under a one- or two-sided (for uncertain signs) test. Data on trade, GDP, wholesale prices, and exchange rates are from Taiwan and IMF statistics. Data on DFI are figures approved by host countries. All variables are in New Taiwan dollars except YH which is in the host country's currency.

degree of import displacement. The apparent asymmetric effects of inward DFI may be due to the fact that inward DFI is quantitatively much smaller compared with outward DFI and is aimed mainly at the domestic market as noted above.

Third, GDP should have a positive effect on trade. This is so for imports but less so for exports. The relative price should affect exports negatively but imports positively. This is clearly so for Thailand but less so for the other countries. Further research is needed to explore these differences.

5. Conclusion

The dramatic rise in Taiwan's outward DFI in recent years has greatly increased trade with the host countries as shown above. Another example is the phenomenal increase in Taiwan's DFI and trade with China, but it is not examined due to data insufficiency. During 1987-1992, cumulative Taiwan DFI approved by China amounted to US$8.98 billion, almost 6.9 times the total for the countries given above. As a result, Taiwan's exports to China grew 38 percent annually during that period, mostly in the shipment of equipment and material. Imports from China also grew at 31.1 percent per year during the same period. This provides another case in favor of DFI for the promotion of world trade.

References

Adler M. and G.V.G. Stevens, 1974, "The Trade Effects of Direct Investment," *Journal of Finance*, pp.655-676.

Chen, T., 1992, "Taiwan's Direct Foreign Investment: Patterns and Effects on Trade, 1992," *Proceedings of Kyushu University International Symposium on which direction the Asia-Pacific is Moving Towards*, pp.240-272.

Kojima, K., 1973, "A macroeconomic approach to foreign direct investment," *Hitotsubashi Journal of Economics*, pp.1-21.

Lipsey, R.E. and M.Y. Weiss, 1981, "Foreign Production and Exports in Manufacturing Industries," *Review of Economics and Statistics*, pp.488-494.

Markusen, J.R., 1983, "Factor Movements and Commodity Trade as Complements," *Journal of International Economics*, pp.341-356.

Mundell, R.A., 1957, "International trade and factor mobility," *American Economic Review*, pp.321-335.

Ozawa, T., 1971, *Transfer of Technology from Japan to Developing Countries* (United Nations, New York).

Schmitz, A. and P. Helmberger, 1970, "Factor Mobility and International Trade: the Case of Complementality," *American Economic Review*, pp.761-767.

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