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Computational Analysis of the Economic Impacts of Japan's FDI in Asia [1]

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Abstract

The Global Trade Analysis Project (GTAP) Model is used to analyze the possible impacts of Japan's FDI in Asia in a multi-country, multi-sector, general equilibrium framework. The majority of existing anti-FDI arguments are either non-economic such as the "nationalist" and "dependence" approaches, or economic but short-term, partial-equilibrium arguments such as the "exporting employment", and "balance of payments" stories that focus on the flow aspects of FDI. FDI, as a micro phenomenon, should not be blamed for negative macro outcomes such as a worsening trade balance that in principle is a reflection of a country's savings-investment imbalance. By focusing, instead, on the analysis of medium- to long-term general equilibrium impacts (stock impacts) of FDI, this paper tries to capture the growth and welfare impacts of Japan's FDI in Asia. Stock impacts analyzed in this paper are: 1) a capacity and output expansion in the recipient economies in Asia, matched by a reduced capital stock in Japan (stock effects); 2) an increase in productivity through technology transfer and spillover (technology effects); and 3) an increase in domestic investment driven by a higher expected rate of return on investment and larger domestic savings (cofinance effects). Following the existing dichotomy in the theories of FDI—those that assume perfect markets and the others based on imperfect markets—simulations are conducted under both industrial structures. Simulation results replicate the traditional transfer problem in real resources, and show that FDI is a positive-sum game. Larger gains are observed in the existence of scale economies. The results suggest the importance of two-way FDI flows for Japan in order to benefit from this game. The results also suggest that if FDI capital and technology are augmented by local investment (and savings), a possible secondary burden of transfer in real resources can be avoided.

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1. Introduction

Developing Asia (East and South-East Asia) has become the fourth growth pole of the world economy during the past decade. With a large amount of foreign direct investment (FDI) attracted from Japan and other developed economies in addition to its rapidly-growing intra-regional FDIs, the region has accomplished an FDI-supported export-led growth.[2] FDI recipient economies in developing Asia observed an expansion in the stock of productive capital and experienced accelerated growth in their income and foreign trade.

Observed impacts of FDI in recipient economies are multi-dimensional phenomena. FDI does not

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only mean a simple cross-border transfer of productive capital stock (a traditional "transfer problem" in real resources) but also includes important international transfers to the recipient enterprise of production and control technologies, and management resources including international marketing know-how. In addition, backward and forward technology spillover within and across industrial sectors has also been observed. The resultant increases in productivity and in the rate of return on investment provide new incentives for additional domestic savings and investment. These increases in savings and in gross investment over and above initial FDI are called the "cofinance effects" of FDI, and have been widely observed in China and other developing Asian economies.

As a supplier of FDI, Japan has observed in the early 1990's the benefit of increased real income through downward pressure on the general price level contributed by cheaper imports of finished products produced by FDI-related foreign affiliates, i.e. the "terms of trade effects" of resource transfer.

With regard to the costs and benefits of FDI, the majority of existing pro- as well as anti-arguments as summarized in Lall (1974), Tanaka (1994), and Caves, et al. (1996) are either non-economic or economic but short-term, partial-equilibrium arguments. For instance, "nationalist", "dependence", and "balance of payments" approaches in the analysis of impacts on FDI recipients, and "technology-nationalist", "employment", and "balance of payments" approaches and impacts on FDI suppliers fall into these categories. These arguments also often misconstrue the proper sequence of causes and effects of FDI. "Industry hollowing-out" and "exporting employment" arguments for FDI suppliers are the representative cases. As noted by Graham and Krugman (1989) and Tanaka (1994), FDI, as a micro phenomenon, should not be blamed for negative macro outcomes, such as a worsening trade balance, that in principle is a reflection of a country's savings-investment imbalance. Macro impacts of FDI, therefore, should only emerge through changes in savings-investment behavior triggered by this transfer of productive resources and technology. Sekiguchi (1988) and Graham and Krugman (1989) properly assert that these long-run effects of FDI should be separated from the short-term effects, and they should be evaluated in a general-equilibrium framework.

Analysis of flow impacts of FDI such as the dynamics of export-import trade flows after FDI as evaluated by Kojima (1975), Kawai and Urata (1995), Wei and Frankel (1997), Nakamura and Oyama (1998), and Otsubo and Umemura (2003) are of great concern in both Japan and developing Asia. By focusing, instead, on the analysis of medium- to long-term general equilibrium impacts (stock impacts) of FDI, this paper tries to capture the growth and welfare impacts of Japan's FDI in Asia. Stock impacts to be analyzed in this paper are: 1) a capacity and output expansion in the recipient economies though an increased capital stock, matched by a reduced capital stock in Japan (stock effects); 2) an increase in productivity through technology transfer (technology effects); and 3) an increase in domestic investment supported by a higher rate of return on capital and larger domestic savings (cofinance effects). FDI here is treated as a positive-sum game.

The Global Trade Analysis Project (GTAP) Model is used to analyze the possible impacts of Japan's FDI in Asia in a multi-country, multi-sector, general equilibrium framework.[3] Medium- to long-term general equilibrium impacts of FDI both at the macro as well as sector levels are simulated in order to draw policy implications on FDI-related strategies for both recipient and supplier economies. In the GTAP framework, the impacts of the implicit monetary policy reactions and exchange rate adjustments are captured through "terms of trade" effects. As the brief review of theories of FDI given in this paper indicates, there are basically two branches of FDI theories: those that assume perfect markets with perfect competition, and those based on imperfect markets and oligopolistic behaviors of multinational enterprises (MNEs). Simulations in this study are performed both under the assumption of perfectly-competitive markets and with the existence of scale economies and monopolistic competition in the FDI-targeted industrial sectors.

The paper proceeds as follows. Trends and characteristics of FDI in Asia in the decade since mid 1980's are first introduced in Section 2. Section 3 covers data issues and presents statistics on Japan's outward FDI. Theories and arguments on determinants and consequences of FDI are then reviewed in Section 4. In Section 5, the general framework of the GTAP model and modules related to the FDI analyses are briefly described. Section 6 introduces the simulation design and scenarios. Simulation results are presented in Section 7. Finally, Section 8 summarizes findings and conclusions of the paper.

2. FDI Trends in Asia[4]

FDI activities expanded rapidly on a global scale during the latter half of the 1980's. Flow statistics of FDI by the IMF show that the total amount of FDI grew from less than $60 billion in 1985 to $240 billion in 1990, and to about $300 billion in 1995 (Tables 1 and 2). The total amount of annual global FDI flows thus expanded more than 5 times during the decade. World trade expanded by only 2.7 times during the same period. Factors underlying this rapid expansion in global FDI were the developments in the world economy after the Plaza accord. These include a large-scale adjustment in exchange rates, a world-wide business-cycle expansion, a GATT/WTO-led systematic deregulation in cross-border transactions in goods and capital, wide-spread liberalization and market-orientation among developing and former communist countries, and a resurgence in regional economic/trading arrangements.

By examining the geographical distribution of global FDI, one notices an increasing importance of developing Asia. Developing Asia as a recipient of FDI increased its share in the world from 9 percent in 1985 to 20 percent in 1995. Major factors underlying this development were not only changes in the global economic environment but more importantly the structural adjustments in Asian economies including a liberalization of trade and financial flows—a sweeping shift in their development strategy from import-substitution to an FDI-led export-promotion. Compared to other

developing regions, Asia abounds in a cheap and educated workforce. In addition, given an expansion of its middle class due to sustained high growth, Asian markets have grown enough to call in FDI to serve local markets (spot marketing).

Another prominent feature of FDI in Asia is the large share of intra-Asia investment flows. As Boltho and Otsubo (1996) shows, intra-Asia FDI channels such as Asian NIEs—ASEAN/China and ASEAN—China expanded rapidly in the early 1990's. For instance, Asian NIEs collectively had become a principal FDI supplier to the ASEAN4 economies (Indonesia, Malaysia, Philippines, and Thailand) in the early 1990's. Of all the FDIs directed to China during this period, 70 to 80 percent were supplied by the region's developing economies (predominantly by NIEs). The number further increases to 82-87 percent if Japan is included as a supplier.

Looking at the Asian economies again as FDI recipients, trends show that flows have been redirected from NIEs and ASEAN, where wages have increased, to China. Recipient shares of NIEs, ASEAN4, and China changed from 44 percent, 36 percent, and 20 percent respectively in 1990 to 17, 22, and 66 percent in 1995.

Table 1. Outward FDI by Major countries (BOP-base flows)

(US$ million)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
USA	13,170	18,690	31,040	17,880	36,832	29,951	31,378	42,660	78,172	54,465	95,530
Canada	3,072	3,863	7,746	5,766	4,587	4,725	5,655	3,635	5,825	7,447	5,761
EU	26,459	48,029	71,120	92,856	111,536	132081	106,109	108,957	96,009	111,610	134,373
U.K.	10,643	17,577	31,446	37,314	35,484	19,323	16,307	18,991	25,516	28,284	40,325
Germany	5,933	10,506	9,197	12,702	15,261	24,195	23,719	19,667	15,275	16,689	34,894
Netherlands	2,693	4,228	8,788	6,772	14,893	15,388	13,565	14,257	11,708	16,738	12,060
Belgium, Luxembourg	296	1,723	2,782	3,784	6,486	6,314	6,271	11,407	4,904	588	-
France	2,243	5,403	9,210	14,496	19,498	34,823	23,932	31,269	20,605	22,801	18,734
Italy	1,874	2,696	2,362	5,576	2,160	7,394	6,928	6,502	9,271	5,639	6,926
Spain	250	378	745	1,235	1,473	3,522	4,442	2,192	2,652	3,831	3,574
Sweden	1,805	3,723	4,489	7,233	10,296	14,629	7,262	419	1,471	6,596	10,733
Switzerland	4,573	1,460	1,273	8,695	7,850	6,370	6,541	5,671	8,763	10,839	11,851
Japan	6,450	14,480	19,520	34,210	44,160	48,050	31,487	17,358	13,826	18,101	22,664
Australia	1,879	3,327	4,998	4,983	3,372	185	3,022	854	1,733	5,686	4,948
ASIA	956	778	1,889	5,286	9,332	9,309	4,957	8,532	11,207	11,497	14,003
South Korea	34	110	183	151	613	1,056	1,500	1,208	1,361	2,524	3,529
Singapore	238	181	206	117	882	2,034	526	1,317	2,021	3,104	3,906
China	628	450	645	850	780	830	913	4,000	4,400	2,000	2,000
Malaysia	-	-	-	-	-	-	-	-	-	-	-
Philippines	-	-	-	-	-	-	-	-	374	302	399
Thailand	1	1	170	24	50	140	167	147	233	493	886
Indonesia	-	-	-	-	-	-	-	-	356	609	603
World Total	58,292	93,767	139,629	171,567	222,883	235,321	193,379	190,481	221,873	227,725	297,264

Source: IMF, Balance of Payments Statistics Yearbook

Table 2. Inward FDI by Major countries (BOP-base flows)

(US$ million)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
USA	19,030	34,080	58,140	59,420	67,730	47,918	22,010	17,580	43,014	49,760	60,230
Canada	-1,773	1,217	4,198	3,795	5,029	7,855	2,740	4,517	4,997	7,299	10,786
EU	17,112	21,284	37,306	56,558	80,739	97,887	78,723	83,729	79,937	69,579	110,927
U.K.	4,732	7,309	14,106	18,263	30,553	32,427	16,213	16,135	15,544	10,295	32,208
Germany	2,722	722	1,490	875	7,152	2,532	4,108	2,642	1,818	815	8,938
Netherlands	1,374	3,514	2,891	5,037	8,563	12,349	6,316	7,790	7,661	5,616	10,228
Belgium, Luxembourg	1,051	730	2,355	5,212	7,020	8,047	9,363	11,286	10,750	7,464	-
France	2,595	3,256	5,140	8,487	10,304	13,183	15,153	21,840	20,754	16,628	23,735
Italy	1,067	-153	4,188	6,789	2,166	6,411	2,401	3,950	4,383	2,163	4,879
Spain	1,968	3,451	4,571	7,021	8,428	13,984	12,493	13,276	8,144	9,359	6,250
Sweden	393	942	578	1,514	1,812	1,982	6,351	-5	3,705	6,241	14,273
Switzerland	1,267	2,122	2,320	405	2,827	4,961	3,178	1,249	899	4,104	2,600
Japan	640	230	1,170	-520	-1,060	1,760	1,298	2,761	126	916	56
Australia	2,063	3,484	3,899	7,715	8,129	6,482	4,037	5,038	3,008	4,708	13,710
ASIA	4,863	5,720	8,510	12,735	14,269	18,421	20,779	25,597	44,970	52,515	63,223
South Korea	234	435	601	871	1,118	788	1,180	727	588	809	1,776
Singapore	1,047	1,710	2,836	3,655	2,887	5,575	4,887	2,204	4,686	5,480	6,912
China	1,659	1,875	2,314	3,194	3,393	3,487	4,366	11,156	27,515	33,787	35,849
Malaysia	695	489	423	719	1,668	2,332	3,998	5,183	5,006	4,348	5,800
Philippines	12	127	307	936	563	530	544	228	1,238	1,591	1,478
Thailand	163	263	352	1,105	1,775	2,444	2,014	2,113	1,804	1,366	2,068
Indonesia	310	258	385	576	682	1,093	1,482	1,777	2,004	2,109	4,348
World Total	50,975	76,052	122,175	150,449	193,826	201,230	153,840	165,862	210,272	230,953	316,441

Source: IMF, Balance of Payments Statistics Yearbook

3. Data on Japan's outward FDI

There are basically two classes of FDI-related data: BOP-based data and individual country statistics where each government compiles foreign direct investments one by one. In a BOP table, a foreign investment is categorized as FDI if it supplies more than 10 percent of the equity capital for the recipient entity. It is otherwise categorized as an indirect investment (portfolio investment). One should also note that outward FDI amounts reported in a BOP table are net amounts—net of repatriations. The advantage of BOP-based data is that these statistics are compiled following a uniform set of rules, thus making a cross-country comparison a useful exercise (see Tables 1 and 2). However, these statistics do not provide source- or destination-country information, nor an industry breakdown. For instance, trends in Japanese FDI to Asian economies cannot be discerned from these statistics.

In contrast, individual country statistics provide source and destination information, and a sectoral breakdown. Each one of the nine Asian target economies used in the simulation analyses compiles FDI data as these investments play an important role in their export expansion and economic growth. However, the basis for data compilation (reported, permits, survey, application, etc.) and categorization varies widely among these economies, hindering any meaningful cross-country analysis.[5] In Japan, the Ministry of Finance (MOF) compiles data on FDI. MOF statistics are on a gross-based and do not

Table 3. Japan's FDI to Asian Economies

(million US$)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Indonesia	48	124	250	859	1,276	1,154	807	1,676	813	719	1,271
manufactures (%)	*52*	*71*	*84*	*73*	*62*	*62*	*74*	*56*	*30*	*77*	*81*
Malaysia	79	158	163	387	673	725	880	704	800	742	590
	41	*41*	*90*	*89*	*70*	*80*	*70*	*66*	*86*	*76*	*87*
Philippines	61	21	72	134	202	258	203	160	207	668	736
	70	*72*	*71*	*67*	*63*	*76*	*78*	*65*	*63*	*46*	*81*
Thailand	48	124	250	859	1,276	1,154	807	1,236	578	719	1,271
	52	*71*	*84*	*73*	*62*	*62*	*74*	*58*	*72*	*77*	*81*
China	100	226	1,226	296	438	349	579	1,070	1,691	2,565	4,592
	22	*10*	*6*	*68*	*47*	*46*	*53*	*61*	*81*	*72*	*78*
Hong Kong	131	502	1,072	1,662	1,898	1,785	925	735	1,238	1,133	1,176
	11	*10*	*10*	*5*	*6*	*6*	*13*	*12*	*21*	*19*	*24*
Taiwan	114	291	367	372	494	446	405	292	292	278	467
	96	*94*	*69*	*71*	*61*	*62*	*46*	*43*	*67*	*68*	*60*
South Korea	134	436	647	483	606	284	260	224	247	400	461
	28	*33*	*38*	*53*	*41*	*52*	*60*	*41*	*31*	*27*	*39*
Singapore	339	302	494	747	1,902	840	613	670	644	1,054	1,215
	27	35	54	23	36	32	29	20	31	32	39
9-Country Total	1,055	2,183	4,543	5,800	8,765	6,996	5,479	6,765	6,510	8,278	11,778
% of total	*8*	*9*	*13*	*12*	*13*	*12*	*13*	*19*	*17*	*20*	*22*
ROW	11,464	22,468	30,361	42,572	56,697	50,688	36,735	28,209	30,821	33,609	40,898
Total	12,518	24,651	34,905	48,371	65,462	57,684	42,213	34,974	37,332	41,886	52,676

Source: *Kokusai Kinyu Nenpo* (Annual Report on International Finance), Ministry of Finance

include re-investments. They are also on a reported-base, and therefore include unused projects and/or unexecuted amounts. As such, the data might also be less reliable. There is, however, ample destination and sectoral information as summarized in Table 3.

Japan's outward FDI expanded rapidly amid the yen's appreciation after the Plaza Accord in 1985 (see Tables 1 and 3). The bulk of foreign investments were initially directed at the U.S. and W. European markets for local production in order to mitigate trade friction (such as in the transport equipment sector). However, as Table 3 shows, nine Asian economies selected as target destinations of Japanese FDI in this study increased their importance as recipients with their share of Japan's total outward FDI increasing from under 10 percent in 1985 to over 20 percent in 1995. A further decline in Asia's relative wage costs due to the yen's appreciation prompted Japanese industries to relocate their production base in Asia. Manufacturing sectors (particularly, electrical equipment and appliances and the auto & auto parts industry) have been the dominant recipient sectors except in Hong Kong, South Korea, and Singapore, where service industries such as the financial, commercial, transportation, and real estate sectors have drawn a substantial amount of FDI from Japan. While investments in property sectors in the U.S. and W. Europe shrank rapidly in the early 1990's due to the bursting of the financial bubble, Asia-bound FDI by Japan's manufacturing sectors accelerated due to the renewed appreciation of the yen during 1992-94. Before the Asian financial crisis in 1997, developing Asia had collectively replaced W. Europe in terms of target regions for Japanese FDI, second only to that of the U.S. market. Japan's FDIs to developing Asia used to be natural resource-

oriented or of the type aimed for vertical integration of production processes. However, after the two periods of rapid appreciation of the yen, shares of FDIs aimed for a horizontal integration of production and for local marketing have increased markedly. Given the technological developments in Asia during this period, local content of finished products has also increased visibly. The current study uses these MOF statistics as a guideline for simulations.

4. Theories on Determinants and Impacts of FDI

Economic impacts of FDI consist largely of two components: those resulting from the transfer of productive resources and those based on a redistribution of managerial resources. Although factor price equalization should materialize through free trade, if factor endowments widely vary among countries, trade does not equalize rewards to productive factors, and cross-border movements of productive resources are triggered. Furthermore, if restrictions on trade exist, they provide strong incentives for factors to move globally. This section reviews some of the major theories and arguments for determinants and impacts of FDI.

MacDougall (1960) draws on a basic framework of the Heckscher-Ohlin model and shows that from the initial condition of different capital endowments, capital moves from a capital-rich country to a capital-scarce country until the return on capital is equalized. This efficient allocation of capital across countries increases national income in both supplier and recipient countries. In a supplier country, capital income increases while labor income declines as a result of this capital transfer. In a recipient country, capital income declines while labor income increases. Sekiguchi (1988) modifies the MacDougall model by adding a technology advance—one that distinguishes FDI from indirect investment—in the recipient country and shows that labor in the supplier country suffers as a consequence of this technology transfer. These are in principle short-term partial-equilibrium analyses. They do not explain FDIs for the horizontal division of production processes, either.

Agarwal (1980) and Lizondo (1991) review more recent theories and determinants of FDI and available empirical studies for the validity of these theories. Lizondo (1991) presents "differential rates of return", "portfolio diversification", and "market size" arguments as theories of FDI based on an assumption of perfect markets. The "differential rates of return" approach states that FDI flows from countries with low rates of return to those with higher rates of return. The "portfolio diversification" argument focuses on the role of risk and captures FDIs as a behavior of risk diversification. The "market size" is the proxy for potential sales and therefore attracts FDI if the market is perfect and transaction costs are not involved. However, as Lizondo (1991) states, the "differential rates of return" approach does not explain two-way flows of FDIs. The "portfolio diversification" argument does not account for the observed differential tendencies of industries to engage in FDIs. The "market size" argument lacks any strong theoretical background.

As a hypothesis that mainly deals with industrialized countries' FDI to developing countries, the

"Kojima hypothesis" is worth noting. Kojima (1973, 1985) argues that FDIs are welfare-improving in both supplier and recipient countries if the FDIs are trade-oriented and allocated along the line of comparative advantage. Kojima finds that Japan's FDIs are trade-oriented while those by the U.S. firms are anti-trade-oriented. However, this hypothesis, too, assumes a perfect market.

For the more realistic arguments based on imperfect markets, there are static approaches such as "industrial organization" theory, "internalization" theory, an "eclectic approach", and more dynamic approaches such as "product cycle" theory and the theory of "oligopolistic reaction". The "industrial organization" approach by Hymer (1976) argues that for firms to operate in a foreign land with locational disadvantages, they must have some firm-specific advantages such as marketing and managerial skills and/or a brand name that eliminates or lessens competition. Graham and Krugman (1989) show the validity of this approach in explaining inward FDIs in the United States. Coase (1937) presented that market transaction costs were the very reason for a firm's existence. The "internalization" approach of FDI asserts that FDI is an act of internalization of costly market transactions. Rugman (1980) argues the general validity of this approach, while Buckley (1988) examines the testability of this hypothesis. Dunning (1977, 1979, 1988) presents OLI (ownership, location, and internalization) theory as an "eclectic approach". In analyzing prerequisites for FDI to take place, Dunning asserts that a firm should have a firm-specific advantage (ownership), a locational advantage to mobilize this firm-specific know-how (location), and an incentive to internalize external transactions (internalization). The product cycle theory by Vernon (1966, 1979) asserts that the pressure of exclusion in a maturing domestic market triggers FDI. The "Oligopolistic reaction" hypothesis by Knickerbocker (1973) states that oligopolistic behavior explains a series of successive investments after one firm's FDI in a local market. Kawaguchi (1994) surveys the factors of Japanese firms engaging in FDI and finds strong validity in this "oligopolistic reaction" among Japanese multinational enterprises (MNEs).

Helpman (1984) extends a general equilibrium model of international trade as a theoretical model of FDIs by MNEs that produce differentiated products in a number of countries. Horstmann and Markusen (1987) model a substitution between trade and FDI by incorporating firm-specific assets, transaction costs, and firm-level economies of scale. Other prominent studies on MNEs and FDI include Meier (1968), Streeten (1973), Caves (1982), and Blomstrom and Zejan (1991).

As part of the arguments about the determinants of FDI, the possible effects of various government regulations on FDI flows are summarized in OECD (1989).

Lall (1974), Tanaka (1994), and Caves et al. (1996) present lists regarding costs and benefits of FDI. As discussed in the earlier section, cited effects of FDIs are largely short-term oriented and partial-equilibrium oriented. On the technology-transfer effects and productivity spillovers of FDI, Blomström (1991) reviews relevant concepts and related empirical studies. He introduces the channels in which intra-industry spillovers may occur, such as increased competition, the training of labor and

management, and the MNE's role of speeding up technology transfer. Blomström argues the other major aspect of technology transfer is inter-industry spillovers that occur through backward and forward linkages of industries. For representative empirical studies on this issue of technology transfer, see Blomström (1983, 1989) on Mexico, Aitken and Harrison (1991) on Venezuela, Haddad and Harrison (1993) on Morocco, Okamoto (1994) on Malaysia, Rao and Thangavelu (1998) on Singapore, and Sjöholm (1998) on Indonesia.

On macro impacts of FDI, results from macroeconometric analyses by Fry (1993) show that, unlike Latin American cases, FDIs in Asia lead to a direct expansion of productive stock, and rates of domestic savings and investment tend to increase together with an inflow of FDI ("cofinance effects"). In Latin America, FDI is mainly used in order to fill balance-of-payment gaps, and is often associated with privatization of state-owned enterprises where FDI takes the form of a transfer of ownership without contributing to an expansion of real capital stock. Fry's finding of the increased rate of domestic savings in Asia rejects the implication drawn from the MacDougall model. In the framework of the MacDougall model, inter-sectoral transfer of income from capitalists to laborers in an FDI-recipient economy should reduce the rate of domestic savings provided that the capitalists' saving propensity is higher than that of laborers. Proper treatments of macro outcomes (such as employment and balance of payments) of FDI—a microeconomic behavior—are carefully argued in Graham and Krugman (1989). There the importance of a general-equilibrium approach in evaluating the impacts of FDI is stressed. Long-term endogenous changes in the savings-investment balance triggered by capital inflows and technology transfers are the keys to evaluating macro impacts properly.

If properly synthesized, a standard story of Japan's FDI in developing Asia that could be supported by the existing theoretical literature and by empirical findings should be as follows. The FDI-related transfer of real capital, technological, and managerial resources expands capital stock and productive capacity. It also triggers technological progress and productivity increases. If the recipient economy has a comparative advantage in relatively labor-intensive products, then the capital and technology go to these labor-intensive sectors. Domestic resources are also absorbed into these sectors as the rate of return to productive factors in these industries initially increases, resulting in increased production, exports, and imports of complementary capital-intensive goods. Terms of trade worsen in the FDI-recipient economy and improve in the FDI-supplier economy. As such, trade-oriented Japanese FDIs in Asia should contribute to an increase in economic welfare and trade. Changes in the Japanese employment situation should not be regarded as a consequence of FDI, as this is dominated by supply-side phenomena in the Japanese market. The employment situation in the recipient Asian economies should improve as these economies still possess dualistic sectoral as well as labor-market structures, and FDI inflow creates new job opportunities. Macro balance will be altered in the long run as savings-investment behavior changes in response to the FDI in both the supplier and recipient

economies.

5. The GTAP Model [6]

The GTAP model is a multi-region multi-industry CGE model constructed over a database consisting of bilateral trade, transport, and protection data for economic linkages among countries/regions, and of input-output tables that represent intersectoral interactions within each country/region.[7] Each industry is represented by a single homogeneous commodity. The model includes three factors of production: labor, capital, and land. Labor and capital are mobile across domestic sectors, while land is assumed to be used only in agricultural sectors. Capital is traded internationally like intermediate inputs, while labor and land are not mobile across borders.

The GTAP is, in principle, a static general equilibrium model. Simulation exercises conducted in this study are, therefore, comparative static analyses. Regional endowments of productive factors such as capital and labor are given, and sectoral outputs are determined as these factors are distributed among industries in such a way that rates of return are equalized across sectors. Given external shocks, movements in capital (investments) toward new equilibrium are treated as production and allocation of capital goods, adding to regional income generation. However, new production of investment goods does not automatically add to the region's capital stock and increase its production capacity. In order for new production of capital goods to lead to an expansion of productive capacity, endowment of capital stock must be altered accordingly. This study uses this option of semi-dynamics (capital accumulation).

The GTAP model does not contain a financial sector. An investment is therefore represented by a unique investment good that is not form-specific, sector-specific, or region-specific. As such, the model framework has a limitation in the flow analysis of FDI. The model is strongly relevant, though, to general equilibrium analyses of an FDI-related increase in a region's capital stock, and of a technology spillover.

Macro Framework

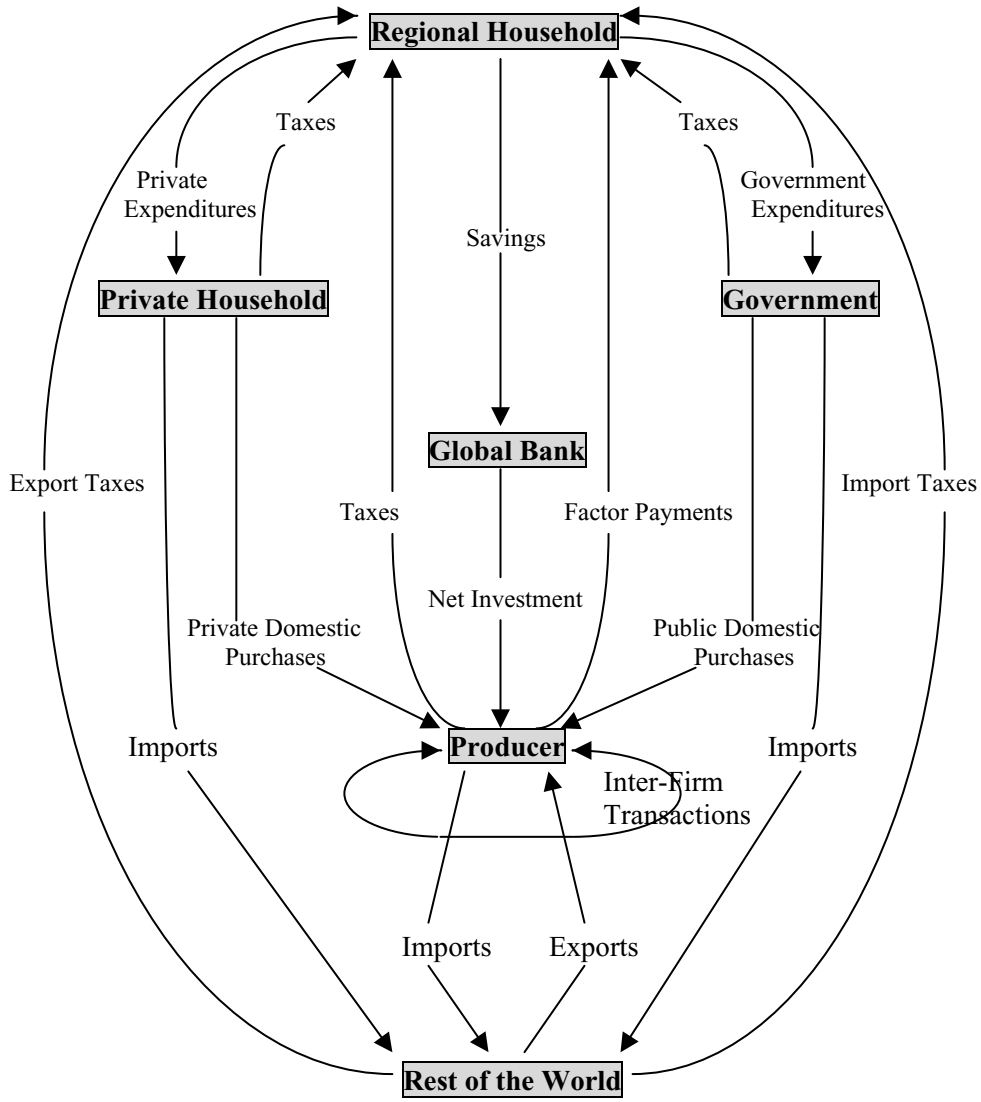
Figure 1 shows the macro framework of the GTAP multi-region open economy model. For each country/region, firms (producers), private households, and government are represented as economic agents. In the GTAP model, private households and government are treated as a single decision-making economic agent called the regional household. Private households supply productive factors (land, labor, and capital) to producers, and obtains factor income in return. Government revenues come from household income taxes, producers' taxes, and taxes on international transactions (minus subsidies if they exist). Regional income is defined as the sum of private households' factor income and government revenues minus capital stock depreciation. Regional income in excess of regional expenditures is saved and used as investments by producers. Two global sectors complete the

system. The global transportation sector provides services that account for the difference between FOB and CIF values for a particular commodity shipped along a specific route. The global banking sector is designed in such a way as to secure the global savings-investment consistency.

Household Savings Behavior

Regional household behavior is governed by an aggregate utility function specified over composite private consumption, composite government consumption, and savings. A solution for demand for

Figure 1. GTAP Macro Framework: Multi-Region Open Economy Model



Note: Arrows show direction of payments.
Source: Adapted from Brockmeier (1996), Figure 6.

savings, an intertemporal maximization problem, is reduced to a rather simple temporal maximization problem in a framework of an extended linear expenditure system by including savings as a commodity in a static utility function. The other distinct feature of the GTAP regional household utility function is the use of an index of current government expenditures as a proxy for the welfare derived from the government's provision of public goods and services to private households in the region. The GTAP model employs a special case of the Stone-Geary utility function where all subsistence quantities are equal to zero.

(1) $$U_r = \left(\frac{CP_r}{POP_r}\right)^{SHRCP_r}\left(\frac{G_r}{POP_r}\right)^{SHRG_r}\left(\frac{QSAVE_r}{POP_r}\right)^{SHRQSAVE_r}$$

(2) $$INCOME_r = CP_r + G_r + QSAVE_r$$

where, U_r denotes per capita utility from aggregate household expenditures in region r. CP_r and G_r denote private households' expenditures and government expenditures in region r, respectively. $QSAVE_r$ is region r's demand for savings. POP_r is region r's population. $SHRCP_r$, $SHRG_r$, and $SHRQSAVE_r$ denote expenditure shares.

The savings rate under a standard GTAP closure is, therefore, fixed. As a result, percent changes in real savings (*qsave*) are defined by the changes in nominal income (*y*) and price of capital goods supplied to savers (*psave*).

(3) $$qsave_r = y_r - psave + saveslack_r$$

However, GTAP provides an option to endogenize the savings rate by endogenizing *saveslack*, a slack variable in the (linearized) savings equation, and exogenizing real rate of return to capital.

Production Structure and Technological Advance

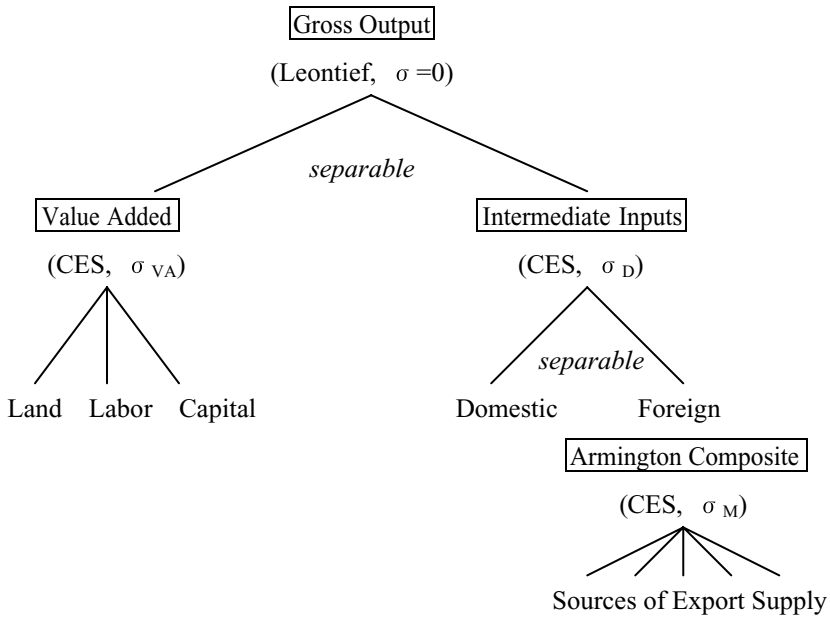
The GTAP model assumes that firms use a constant-returns-to-scale technology, and that they minimize the cost of inputs, given a level of output and technology. Firm behavior depends largely on the assumptions of separability in the production structure (as shown in Figure 2). Firms are assumed to combine a bundle of intermediate inputs in fixed proportions with a bundle of primary factors. The demand for each intermediate input is also assumed to vary in fixed proportions with the level of output. That is, the gross production function in the GTAP model has the following Leontief structure.

(4) $$QO_{jr} = e^{ao_{jr}t}\min\left(QVA_{jr}e^{ava_{jr}t}, QF_{ijr}e^{af_{jr}t}\right)$$

where, QO_{jr} denotes industry output of commodity j in region r. QVA_{jr} denotes value-added in industry j in region r. QF_{ijr} is demand for intermediate input commodity i for use in industry j in region r. ao_{jr}, ava_{jr}, and af_{ijr} are the parameters of technical change.

For industry value added, the following CES net output (value added) function is assumed.

Figure 2. Production Structure of the GTAP Model



Source: Adapted from Hertel (1997), Figure 2.6.

$$(5) \quad QVA_{jr} = e^{ava_{jr}t}\left(\sum_{i \in ENDW} d_{ijr}\left(QFE_{ijr}e^{afe_{ijr}t}\right)^{-\frac{1-\sigma_j}{\sigma_j}}\right)^{-\frac{\sigma_j}{1-\sigma_j}}$$

where, QFE_{ijr} denotes demand for endowment i for use in industry j in region r. σ_j is the elasticity of substitution in industry j.

Firms purchase intermediate inputs, some of which are produced domestically, and the rest are imported. Domestic and imported intermediate inputs can be substituted according to a constant elasticity of substitution. Similarly, a constant elasticity of substitution is assumed to capture the degree of substitutability between imports from different origins (Armington composite nest).

In simulating a technology transfer in this study, the rate of Hicks-neutral technological progress (ao_{jr}) in the gross output function (4) is augmented for each of the technology-recipient (FDI-recipient) industries.

Investment and Capital Stock

The GTAP model contains a global banking sector that creates composite investment goods ($GLOBINV$), based on a portfolio of net regional investment, and offers these investment goods to regional households to satisfy their savings demand.

(6) $$\sum_{r \in REG}(REGINV_r - VDEP_r) = GLOBINV = \sum_{r \in REG} SAVE_r$$

where, $REGINV_r$ denotes regional gross investment in region r. $VDEP_r$ denotes depreciation in region r. $SAVE_r$ denotes expenditure on net savings in region r.

All savers face a common price for this savings commodity ($PSAVE$). A consistency check on the accounting relationships involves separately computing the supply of the composite investment goods and the demand for aggregate savings. If all other markets are in equilibrium, all firms earn zero profit, and all households are on their budget constraints, then global investments must equal global savings by virtue of Walras' Law.

The GTAP model incorporates two alternative investment components into the model. The first enforces a close link between regional rates of return on capital (switch parameter $RORDELTA = 1$), and the second is based on the assumption that the regional composition of global capital stock is left unaltered during simulations ($RORDELTA = 0$).

The productive capacity of capital stock declines over time with a rate of depreciation $DEPR_r$. End-of-period capital stock (KE_r) is, therefore, defined as:

(7) $$KE_r = REGINV_r - VDEP_r + KB_r = REGINV_r + (1 - DEPR_r)KB_r$$

where KB_r is capital stock at the beginning of the period.

Current net rate of return on fixed capital in region r ($RORC_r$) is defined as follows.

(8) $$RORC_r = \frac{RENTAL_r}{PCGDS_r} - DEPR_r$$

where, $RENTAL_r$ is rental rate on capital in region r. $PCGDS_r$ denotes price of investment goods in region r ($QCGDS_r$).

Investors expect that a region's rate of return on capital in the next period will decline with positive additions to the capital stock in the current period. The rate of expected decline is a function of a parameter of the flexibility of expected net rate of return on capital stock ($RORFLEX$). For instance, $RORFLEX = 10$ implies that a 1% increase in capital stock is expected to reduce the rate of return on capital by 10%. $RORFLEX$ is set to 10 for all regions in the default database.

(9) $$RORE_r = RORC_r\left(\frac{KE_r}{KB_r}\right)^{-RORFLEX_R}$$

where $RORE_r$ is the expected net rate of return on capital stock in region r.

If investors are assumed to behave in such a way that changes in regional rates of return ($rore_r$) are equalized across regions at the percent change in global rate of return on capital ($rorg$), then:

(10) $$rore_r = rorg$$

Under this assumption, the model distributes changes in global savings across regions in such a way

that all expected regional rates of return change by the same proportions ($RORDELTA = 1$). It implies that international capital movements are allowed in this model. Global supply of capital goods for net investment ($GLOBALGDS$) is then defined as follows:

(11) $$globalcgds = \sum_{r \in REG} \left(\left(\frac{REGINV_r}{GLOBINV} \right) qcgds_r - \left(\frac{VDEP_r}{GLOBINV} \right) kb_r \right)$$

where lowercase variables represent percent changes.

The alternative investment component of GTAP adopts an extreme assumption that the regional composition of global capital stock does not change at all ($POPDELTA = 0$), and therefore, that regional and global net investment move together.

(12) $$globalcgds = \frac{REGINV_r}{NETINV_r} qcgds_r - \frac{VDEP_r}{NETINV_r} kb_r$$

International capital movements are not allowed in this GTAP investment component. Under this assumption, a percent change in the global rate of return on capital ($rorg$) is computed as a weighted average of percent changes in regional rates of return ($rore_r$).

(13) $$rorg = \sum_{r \in REG} \frac{NETINV_r}{GLOBINV} rore_r$$

The current study adopts the option where international capital movements are allowed and investors behave in such a way that changes in the regional rate of return on investment are equalized across regions. However, cross-border capital movements are limited when "cofinance effects" are simulated in a successive manner in order to force an increase in domestic savings to finance new domestic investment.

Country and Industry Aggregation

Simulations in the current study use 13-country by 14-sector data aggregation (Table 4). Nine Asian economies (Indonesia, Malaysia, Philippines, Thailand, China, South Korea, Singapore, Hong Kong, Taiwan) are selected as recipients of Japan's FDI in Asia. The three remaining regions are the United States, EU12, and the Rest of the World (ROW). Out of the 14 sectors, 7 industrial sectors (Food & Beverages, Textiles, Chemicals, Metals, Transport Equipment, Machinery & Equipment, Other Manufacturing) are designated as recipients of FDI-related technology transfer. Although these sectors are also targeted recipients of FDI capital, the region's increased capital stock will be reallocated in such a way as to equalize the return on capital across sectors following the model's general equilibrium framework.

Table 4. Regional and Industry Aggregations

Economies/Regions

Aggregation	(Name)	Corresponding components in GTAP database
1. JAPAN	(JPN)	Japan
2. INDONESIA	(IDN)	Indonesia
3. MALAYSIA	(MYS)	Malaysia
4. PHILIPPINES	(PHL)	Philippines
5. THAILAND	(THA)	Thailand
6. CHINA	(CHN)	China
7. HONG KONG	(HKG)	Hong Kong
8. TAIWAN	(TWN)	Taiwan
9. SOUTH KOREA	(KOR)	Republic of Korea
10. SINGAPORE	(SGP)	Singapore
11. USA	(USA)	USA
12. WESTERN EUROPE	(WEU)	European Union 12, Austria-Finland & Sweden, European Free Trade Area
13. REST OF THE WORLD	(ROW)	All the other regions

Commodities/Industries

Aggregation	(Name)	Corresponding components in GTAP database
1. AGRICULTURE, FORESTRY & FISHERY	(AGR)	paddy rice, wheat, grains, non grain crops, wool, other livestock, forestry, fishery
2. MINING	(MNG)	coal, oil, gas, other minerals
3. FOOD & BEVERAGES	(PFD)	processed rice, meat products, milk products, other food products, beverages & tobacco
4. TEXTILES	(TXL)	textiles & wearing apparel
5. CHEMICALS	(CHM)	petroleum & coal products, chemical rubbers & plastics, nonmetallic mineral products
6. METALS	(MTL)	primary ferrous metals, non ferrous metals, fabricated metal products
7. TRANSPORT EQUIPMENT	(TRN)	transport equipment
8. MACHINERY & EQUIPMENT	(OME)	machinery & other equipment
9. OTHER MANUFACTURING	(OMF)	leather etc., lumber & wood, pulp paper etc., other manufacturing
10. ELECTRICITY, GAS & WATER	(EGW)	electricity, gas & water supply
11. CONSTRUCTION	(CNS)	construction
12. TRADE & TRANSPORT	(T_T)	trade & transport
13. OTHER SERVICES (PRIVATE)	(OSP)	other services (private), ownership of dwellings
14. OTHER SERVICES (GOVERNMENT)	(OSG)	other services (government)

Source: GTAP database, Version 3.0

6. Simulation Design

Given the FDI-related controversies discussed in Section 1 and the synopsis of determinants and impacts of FDI, simulations in this study are organized in such a way as to provide a longer-term general-equilibrium assessment of the impacts of Japan's FDI in developing Asia. Simulations are geared to assess the "stock effects", "technology effects", and "cofinance effects" both under an assumption of perfect competition with constant returns to scale and an assumption of Chamberlinian

monopolistic competition with scale economies. Table 5 shows relationships among the six applied general-equilibrium simulations conducted in the current study.

Table 5. Simulation Design Matrix

	Perfect Competition	Monopolistic Competition
Transfer of Capital Stock	Simulation 1	Simulation 4
Transfer of Capital Stock & Technology	Simulation 2	Simulation 5
Cofinance — Joint Venture	Simulation 3 (on top of Simulation 2)	Simulation 6 (on top of Simulation 5)

Simulation 1: Transfer of Capital Stock under the Assumption of Perfect Competition (CRTS)

A transfer of capital stock from Japan to nine developing Asian economies/regions (Indonesia, Malaysia, Philippines, Thailand, China, Hong Kong, Taiwan, South Korea, and Singapore) is emulated in order to assess the "stock effects". Capital stock endowments of recipient Asian economies are augmented by 1 percent while Japan's capital stock is reduced by the amount equivalent to a total increase in the recipients' capital stock. Table 6 shows the size of capital stock in 1992 (simulation base year) and the relative sizes of recent Japanese FDI flows. A one percent increase in the recipient country's capital stock is equivalent to 2-3 years of FDI flows from Japan, except in the cases of South Korea and Taiwan where the sizes of annual Japanese FDI flows relative to the size of their capital stock are much smaller (but technology transfer plays a much larger role). Without an accompanied technology transfer, there is no distinction between indirect investments and direct investments. International capital mobility is assumed. The savings rate is fixed.

Simulation 2: Transfer of Capital Stock and Technology under the Assumption of Perfect Competition

Table 6. Changes in Capital Stock and Japan's FDI (US$ million)

	Capital Stock	FDI flows				b/a
	1992: a	1993	1994	1995	3-year average: b	(%)
Japan	12,088,694	-6,510	-8,278	-11,778	-8,855	-0.073
Indonesia	260,626	813	719	1,271	934	0.359
Malaysia	158,812	800	742	590	711	0.447
Philippines	149,444	207	668	736	537	0.359
Thailand	252,487	578	719	1,271	856	0.339
China	991,254	1,691	2,565	4,592	2,950	0.298
Hong Kong	281,374	1,238	1,133	1,176	1,182	0.420
Taiwan	392,752	292	278	467	346	0.088
South Korea	706,058	247	400	461	369	0.052
Singapore	167,301	644	1,054	1,215	971	0.580

Source: Kokusai Kinyu Nenpo (Annual Report on International Finance), Ministry of Finance; GTAP Database, Version 3.0

Production and managerial technologies accompany the transfer of capital stock. Assuming FDI flows to manufacturing sectors and there is resultant intra- and inter-industry technology spillover, the rate of technology growth is augmented in all seven manufacturing sectors (food & beverages, textiles, chemicals, metals, transport equipment, machinery, and other manufacturing) by 1 percent. The accompanying technology transfer distinguishes FDIs from indirect investments. International capital mobility is assumed. The savings rate is fixed.

Simulation 3: A Matching Increase in Capital Stock by Domestic Investment-Savings (Cofinance)

Perceived higher rates of return in industrial activities with FDI inflows prompt domestic investors to mobilize domestic resources (savings) to cofinance the industrial projects. Recipient countries' capital stock is further increased by an increment in domestic investment equivalent to the amount of the initial inflow of FDI. This simulation is conducted on top of Simulation 2 using the output file produced in Simulation 2. International capital flows are suppressed and the trade balance is fixed in order to force domestic savings to finance new domestic investment. The savings rate is thus endogenized on the marginal base.

As described in Section 5, the GTAP model does not treat savings behavior as a truly dynamic intertemporal maximization problem. Simulations 1 and 2 are therefore not designed to assess long-term impacts with an endogenous macro savings-investment balance. Rather, they show medium-term impacts. The marginal simulation conducted as Simulation 3 should be indicative of impacts under a flexible domestic savings rate.

In the next set of three simulations, industry-wide economies of scale are introduced in manufacturing sectors in order to capture monopolistic or oligopolistic behaviors of MNEs engaged in FDIs. A certain rate of output growth requires a lesser rate of increase in factor inputs with the existence of scale economies (increasing return to scale; IRTS). By comparing average cost (AC) with marginal cost (MC), this scale factor can be computed. First, the cost disadvantage ratio (CDR) is computed as:

(14) CDR = (AC - MC) / AC

Then, the scale factor is computed as:

(15) SCALE = CDR / (1 - CDR)

The actual sectoral values of CDR used in this study, compiled from Francois, McDonald and Nordstrom (1996), are given in Table 7. As Table 7 shows, an augmented Armington substitution parameter is computed as an inverse of CDR. Higher substitution parameters mean heightened substitutability between domestic and imported goods as well as among imports under economies of scale.

Table 7. Cost Disadvantage Ratios, Scale Factors and Substitution Elasticities

Sector	Cost Disadvantage Ratio	Scale Factor Applied under MC(2)	Value-added (σ_{VA})	Domestic/Imported (σ_D)		Sourcing of Imports (σ_M)	
				PC(1)	MC(2)	PC (1)	MC(2)
AGR	0.402		0.56	2.49	2.49	4.73	4.73
MNG	0.357		1.12	2.80	2.80	5.60	5.60
PFD	0.150	0.18	1.12	2.38	6.67	4.77	6.67
TXL	0.135	0.16	1.26	3.15	7.41	6.54	7.41
CHM	0.123	0.14	1.26	2.03	8.11	3.96	8.11
MTL	0.130	0.15	1.26	2.80	7.69	5.60	7.69
TRN	0.150	0.18	1.26	5.20	6.67	10.40	6.67
OME	0.150	0.18	1.26	2.80	6.67	5.60	6.67
OMF	0.120	0.14	1.26	2.43	8.33	5.63	8.33
EGW	0.357		1.26	2.80	2.80	5.60	5.60
CNS	0.526		1.40	1.90	1.90	3.80	3.80
T_T	0.526		1.68	1.90	1.90	3.80	3.80
OSP	0.526		1.26	1.90	1.90	3.80	3.80
OSG	0.526		1.26	1.90	1.90	3.80	3.80

Note: (1) Perfect competition (CRTS). (2) Monopolistic competition (IRTS).
Source: GTAP Database, Version 3.0

Simulation 4: Transfer of Capital Stock under the Assumption of Monopolistic Competition (IRTS)

Transfer of capital stock (Simulation 1) is repeated, but this time, under an assumption of monopolistic competition with scale economies in all of the seven manufacturing sectors (food & beverages, textiles, chemicals, metals, transport equipment, machinery, and other manufacturing). International capital mobility is assumed. The savings rate is fixed.

Simulation 5: Transfer of Capital Stock and Technology under the Assumption of Monopolistic Competition

Transfer of capital stock and technology (Simulation 4) is repeated, except that monopolistic competition is assumed for the manufacturing sectors. International capital mobility is assumed. The savings rate is fixed.

Simulation 6: A Matching Increase in Capital Stock by Domestic Investment-Savings (Cofinance)

Same as Simulation 3 except that the simulation is conducted under the assumption of scale economies and that the output file of Simulation 5 is used. International capital mobility is suppressed. The savings rate is endogenized.

7. Simulation Results

This section summarizes results and main findings of the simulations. Discussions are grouped according to three dimensions of the impacts of FDI: worldwide impacts, macro economy-wide impacts, and sectoral impacts.

Worldwide Impacts

Global impacts of Japan's FDIs to developing Asian economies are summarized in Table 8. Equivalent variations-the welfare measurements in computable general equilibrium models-show that the level of global welfare should improve as a result of Japan's FDIs. FDI is, thus, a positive-sum game like international trade. The volume of world trade expands while the price of world trade declines. Thus, as a result of Japan's FDIs in Asia, both consumers and producers the world over enjoy a greater flow of traded goods at lower costs in general. Japanese FDIs in Asia are also conducive to a greater allocative efficiency of capital. They increase net return on capital at a global scale and induce higher investment worldwide. This confirms the earlier findings by Kojima (1973, 1985) that Japan's FDIs are trade-oriented and thus welfare-improving. Unlike the Kojima hypothesis formulated in a partial-equilibrium framework and under the assumption of perfect markets, the current study confirms the point in a general-equilibrium framework and even under the more realistic assumption of oligopolistic behavior/monopolistic competition.

Table 8. World Aggregates

(percent change)

	Simulation 1	Simulation 2	Simulation 3	Simulation 4	Simulation 5	Simulation 6
Equivalent variation (US$ million)	2,220	16,141	5,347	2,837	16,665	6,315
Global net return on capital	0.01	0.06		0.02	0.04	
Global net investment	0.03	0.23	0.00	0.05	0.29	0.00
World trade volume	0.07	0.18	0.10	0.08	0.21	0.08
World trade price	-0.02	-0.06	-0.01	-0.01	0.00	-0.01

Economy-Wide Impacts under Perfect Competition

Table 9 presents economy-wide effects of Japan's FDI in Asia in both the recipient and Japanese economies under the assumption of perfect competition (CRTS).

Under Simulation 1 (transfer of capital stock), both the price of investment goods and return on capital decline as the size of capital stock increases in the recipient economies. Real GDP increases. Both exports and imports expand. The trade balance improves slightly for the majority of the recipient economies. Terms of trade, however, deteriorate as the traditional analysis of "transfer problem" in real resources indicates. Welfare levels improve, however, in all of the nine recipient economies, as the positive stock effects surpass the negative terms of trade effects. Real wages decline slightly, contrary to the implications of the analysis in MacDougall (1960).

In Japan, as the supplier of FDIs, both the price of investment goods and return on capital increase as the stock of capital declines. Output declines, product prices increase, and thus exports shrink while imports expand. Terms of trade improve. Although the changes are relatively small compared with the size of Japanese economy, a small outflow of capital stock results in declines in real GDP and the welfare level.

Table 9. Simulation Results under Perfect Competition (CRTS)—Economy-Wide Effects

(percent change)

	GDP quantity index	Export Volume	Import Volume	Export Prices	Import Prices	Terms of Trade	Trade Balance	Equivalent Variation (US$ million) Total	due to TOT changes	due to Technology changes	End-of-period Capital Stock	Output of Capital Goods	Demand for Net Savings	Price of Investment Goods	Current Rate of Return on Capital	Expected Rate of Return on Capital	Real Wage	Nominal Savings Rate	
	Simulation 1: Transfer of Capital Stock																		
Japan	-0.11	-0.4	0.12	0.07	-0.02	0.09	-1,483	-1,811	936	0	-0.26	-0.03	0	0.07	0.23	0.01	0.01	0	Japan
Indonesia	0.59	0.68	0.51	-0.13	-0.01	-0.12	37	573	-77	0	0.96	0.65	0.46	-0.09	-0.41	0.01	-0.04	0	Indonesia
Malaysia	0.63	0.66	0.52	-0.12	-0.02	-0.1	53	279	-64	0	0.95	0.56	0.43	-0.06	-0.5	0.01	-0.07	0	Malaysia
Philippines	0.49	1.12	0.19	-0.27	-0.02	-0.24	104	147	-52	0	0.91	-0.31	0.04	-0.18	-0.92	0.01	-0.1	0	Philippines
Thailand	0.69	0.71	0.59	-0.15	-0.01	-0.13	-34	573	-100	0	0.96	0.71	0.46	-0.12	-0.43	0.01	-0.06	0	Thailand
China	0.37	0.74	0.15	-0.14	-0.02	-0.12	450	792	-231	0	0.9	0.15	0.18	-0.11	-0.95	0.01	-0.06	0	China
Hong Kong	0.52	0.66	0.35	-0.15	-0.06	-0.1	47	227	-59	0	0.94	0.31	0.22	-0.13	-0.6	0.01	-0.06	0	Hong Kong
Taiwan	0.4	0.42	0.27	-0.08	-0.01	-0.08	99	585	-98	0	0.93	0.4	0.26	-0.05	-0.67	0.01	-0.01	0	Taiwan
South Korea	0.46	0.48	0.4	-0.09	-0.01	-0.08	-21	976	-144	0	0.94	0.56	0.32	-0.08	-0.61	0.01	-0.01	0	South Korea
Singapre	0.44	0.52	0.35	-0.11	-0.03	-0.07	61	50	-68	0	0.91	0.12	0.1	-0.06	-0.91	0.01	-0.16	0	Singapre
USA	0	0.04	0.02	-0.01	-0.02	0	200	-36	33	0	0	-0.02	-0.01	-0.01	0	0.01	0	0	USA
WEU	0	0.04	0.02	-0.01	-0.01	0	234	-60	-9	0	0	-0.02	-0.01	-0.01	0	0.01	0	0	WEU
ROW	0	0.02	0	-0.02	-0.01	0	252	-76	-68	0	0	-0.02	-0.02	-0.02	-0.01	0.01	0	0	ROW
																		0	
	Simulation 2: Transfer of Capital Stock & Technology																	0	
Japan	-0.11	-0.24	-0.11	-0.01	0.01	-0.02	-698	-3,042	-225	0	-0.26	-0.11	-0.1	-0.02	0.21	0.06	-0.01	0	Japan
Indonesia	1.3	1.16	1.07	-0.11	-0.05	-0.06	52	1,520	-40	822	1.05	1.4	1.47	-0.01	0.55	0.06	0.7	0	Indonesia
Malaysia	1.72	1.72	1.67	-0.17	-0.11	-0.06	91	1,013	-38	534	1.09	1.74	1.86	0.14	0.91	0.06	1.18	0	Malaysia
Philippines	1.3	0.83	1.42	0.02	-0.09	0.11	-121	654	23	340	1.07	1.95	1.8	0.28	0.74	0.06	0.94	0	Philippines
Thailand	1.57	1.26	1.36	-0.09	-0.06	-0.03	-131	1,619	-24	843	1.11	1.7	1.78	0.01	1.14	0.06	1	0	Thailand
China	1.24	0.09	1	0.1	-0.08	0.17	-843	4,684	323	2,947	1.13	2.16	2.03	0.26	1.39	0.06	1.06	0	China
Hong Kong	1.32	0.56	1.23	0.05	-0.14	0.19	-438	1,015	119	587	1.07	1.81	1.88	0.3	0.79	0.06	1.05	0	Hong Kong
Taiwan	1.64	1.27	1.15	-0.08	-0.03	-0.05	67	3,231	-68	2,452	1.13	2.13	2.37	0.36	1.34	0.06	1.32	0	Taiwan
South Korea	1.64	0.44	0.87	0.29	-0.01	0.3	-419	5,301	519	3,341	1.16	2.11	2.72	0.63	1.65	0.06	1.35	0	South Korea
Singapre	2.31	1.63	1.87	-0.17	-0.13	-0.04	-284	861	-38	711	1.23	3.18	2.69	0.09	2.37	0.06	1.92	0	Singapre
USA	0	0.15	0.07	-0.06	-0.07	0.01	729	-28	61	0	0	-0.07	-0.06	-0.07	0.02	0.06	0	0	USA
WEU	0	0.12	-0.06	-0.07	-0.03	-0.04	1,235	-717	-595	0	-0.01	-0.09	-0.08	-0.07	0.01	0.06	0	0	WEU
ROW	0	0.02	-0.02	-0.05	-0.05	0	760	31	-18	0	0	-0.07	-0.04	-0.06	0.02	0.06	0	0	ROW
																		0	
	Simulation 3: Cofinance-Joint Venture (on top of Simulation 2)																	0	
Japan	0	0.02	0.09	0.02	-0.01	0.03	0	310	309	0	0	0	0.02	0.02	0.01	0.01	0	-0.01	Japan
Indonesia	0.59	0.63	0.6	-0.1	-0.01	-0.09	0	604	-60	0	1	1	0.77	-0.07	-0.39	-0.39	-0.03	0.26	Indonesia
Malaysia	0.62	0.59	0.6	-0.09	-0.01	-0.07	0	301	-46	0	1	1	0.62	-0.04	-0.46	-0.46	-0.04	0.14	Malaysia
Philippines	0.51	0.73	0.5	-0.16	-0.02	-0.14	0	185	-31	0	1	1	1.67	-0.1	-0.79	-0.79	-0.05	1.42	Philippines
Thailand	0.71	0.85	0.62	-0.16	-0.01	-0.15	0	591	-111	0	1	1	1.01	-0.13	-0.44	-0.44	-0.07	0.54	Thailand
China	0.38	0.48	0.4	-0.07	-0.01	-0.06	0	999	-107	0	1	1	0.99	-0.04	-0.88	-0.88	-0.02	0.7	China
Hong Kong	0.52	0.64	0.41	-0.13	-0.04	-0.09	0	236	-55	0	1	1	-12.72	-0.1	-0.58	-0.58	-0.05	-12.98	Hong Kong
Taiwan	0.4	0.39	0.38	-0.06	-0.01	-0.05	0	630	-68	0	1	1	0.71	-0.04	-0.65	-0.65	0.01	0.41	Taiwan
South Korea	0.46	0.58	0.46	-0.09	0	-0.09	0	1,011	-156	0	1	1	0.96	-0.08	-0.62	-0.62	-0.01	0.65	South Korea
Singapre	0.44	0.51	0.43	-0.09	-0.03	-0.06	0	64	-57	0	1	1	1.21	-0.05	-0.85	-0.85	-0.13	1.06	Singapre
USA	0	0.02	0.04	0.01	-0.01	0.02	0	146	143	0	0	0	0.01	0.01	0	0	0	0	USA
WEU	0	0.02	0.03	0.01	0	0.01	0	143	153	0	0	0	0.01	0.01	0	0	0	0	WEU
ROW	0	0	0.01	0	0	0.01	0	126	86	0	0	0	0	0	0	0	0	-0.01	ROW

Under Simulation 2 (transfer of capital stock + technology transfer), output and income further expand in the recipient economies. Trade activities also expand. One highly visible impact of technology transfer is the larger import volumes associated with both a greater expansion of output/income and a greater need of imported capital goods. The accompanied technology transfer mitigates the deterioration in terms of trade caused by the transfer of capital stock, as this tends to upgrade exported goods with higher value added. With technology transfer, rates of return on capital in the recipient economies increase, and this produces higher output of capital goods and higher demand for savings. As a result, capital stock increases more than the amount of the initial transfer. The real wage increases visibly. Greater expansion in capital and output (stock effects) due to higher productivity and a smaller deterioration or even an improvement in terms of trade produce much larger gains in welfare in the recipient economies.

In Japan, on top of declines in output and income (negative stock effects), commodity terms of trade deteriorate as technology terms of trade worsen. The loss in welfare is, thus, greater with technology transfer.

Under the supplementary experiment of Simulation 3, both output and trade expand. Terms of trade move in favor of Japan. As a result, welfare improves in both the recipient and supplier economies. Saving rates increase in the recipient economies (with anomaly in Hong Kong). Although an increase in domestic savings is required in order to finance higher domestic investment, pressure on savings is mitigated as the price of capital goods declines with further expansion in the supply of capital goods.

Economy-Wide Impacts under Monopolistic Competition with Economies of Scale

Table 10 presents economy-wide effects of Japan's FDI in Asia in both the recipient and Japanese economies under the assumption of monopolistic competition (IRTS).

Results from Simulation 4 show that under the assumption of scale economies, the impact pattern of Simulation 1 is largely preserved but intensified. One visible difference is the change in real wages. The real wage increases in the capital-recipient economy while it declines in the capital-supplier economy. Together with a decline in return on capital in the recipient economy and an increase in the supplier economy, this set of simulation results conforms to the findings of traditional analyses with perfect markets.

Results from Simulation 5 are worth special attention as this simulation incorporates the most realistic assumptions pertaining to FDI activities in the real world. As the scale economies of a firm or an industrial sector are associated with the "degree of location", and as theAsian FDI-recipient economies often try to establish industrial park and/or export processing zones (EPZs) in order to create "agglomeration economies" to make themselves attractive targets of FDIs, a small initial transfer of capital and particularly a technology transfer could trigger a large swing in international

Table 10. Simulation Results under Monopolistic Competition (IRTS)—Economy-Wide Effects

(percent change)

	GDP quantity index	Export Volume	Import Volume	Export Prices	Import Prices	Terms of Trade	Trade Balance	Equivalent Variation (US$ million) Total	due to TOT changes	due to Technology changes	End-of-period Capital Stock	Output of Capital Goods	Demand for Net Savings	Price of Investment Goods	Current Rate of Return on Capital	Expected Rate of Return on Capital	Real Wage	Nominal Savings Rate	
	Simulation 4: Transfer of Capital Stock																	0	
Japan	-0.13	-0.35	-0.02	0.04	0	0.04	-1,071	-2,970	456	-585	-0.26	-0.09	-0.08	0.03	0.18	0.02	-0.01	0	Japan
Indonesia	0.68	0.8	0.65	-0.09	-0.01	-0.09	44	718	-55	97	0.97	0.77	0.67	-0.04	-0.27	0.02	0.05	0	Indonesia
Malaysia	0.77	0.57	0.57	-0.04	-0.03	-0.02	41	424	-10	90	0.99	0.92	0.73	-0.06	-0.07	0.02	0.22	0	Malaysia
Philippines	0.6	1.14	0.46	-0.2	-0.02	-0.18	65	221	-39	39	0.93	0.08	0.38	-0.08	-0.64	0.02	0.02	0	Philippines
Thailand	0.82	0.79	0.73	-0.12	-0.01	-0.11	-53	735	-79	121	0.98	0.9	0.71	-0.1	-0.14	0.02	0.08	0	Thailand
China	0.45	0.41	0.33	-0.03	-0.02	-0.01	102	1,317	-17	322	0.96	0.61	0.51	-0.05	-0.42	0.02	0.08	0	China
Hong Kong	0.6	0.69	0.48	-0.11	-0.03	-0.08	-21	294	-49	61	0.96	0.52	0.43	-0.07	-0.41	0.02	0.03	0	Hong Kong
Taiwan	0.48	0.54	0.38	-0.08	0	-0.08	97	760	-104	170	0.95	0.52	0.43	-0.01	-0.52	0.02	0.07	0	Taiwan
South Korea	0.55	0.45	0.44	-0.04	0	-0.04	-59	1,346	-65	269	0.96	0.72	0.56	-0.01	-0.39	0.02	0.09	0	South Korea
Singapre	0.71	0.71	0.6	-0.11	-0.03	-0.08	8	158	-71	104	0.96	0.58	0.47	-0.05	-0.42	0.02	0.11	0	Singapre
USA	0	0.04	0.01	0	-0.01	0	237	-57	25	-5	0	-0.03	-0.01	-0.01	0	0.02	0	0	USA
WEU	0	0.04	0	-0.01	0	0	350	-110	-31	-13	0	-0.02	-0.01	-0.01	0	0.02	0	0	WEU
ROW	0	0.02	0	0	-0.01	0	261	2	39	-32	0	-0.02	0	0	0	0.02	0	0	ROW
																		0	
	Simulation 5: Transfer of Capital Stock & Technology																	0	
Japan	-0.15	-0.28	-0.34	-0.06	0.05	-0.11	-571	-5,279	-1,127	-848	-0.27	-0.17	-0.24	-0.09	0.14	0.04	-0.05	0	Japan
Indonesia	1.74	2.57	2.46	0.12	0.02	0.1	102	2,191	63	1,176	1.09	1.76	2.51	0.53	0.97	0.04	1	0	Indonesia
Malaysia	2.35	3.68	3.36	-0.32	-0.02	-0.31	152	1,265	-193	755	1.11	1.98	2.59	0.46	1.16	0.04	1.19	0	Malaysia
Philippines	1.47	1.63	2.31	0.04	0.09	-0.05	-195	708	-10	421	1.12	2.69	2.27	0.38	1.24	0.04	0.99	0	Philippines
Thailand	1.76	1.35	1.55	0.08	0.06	0.02	-195	1,865	13	1,062	1.16	2.08	2.3	0.17	1.68	0.04	1.17	0	Thailand
China	1.22	-0.07	0.29	0.18	0.19	0	-655	4,273	-5	3,091	1.11	1.94	1.99	0.33	1.1	0.04	0.91	0	China
Hong Kong	1.49	0.76	1.59	0.32	0.14	0.18	-622	1,132	108	711	1.12	2.34	2.47	0.55	1.23	0.04	1.19	0	Hong Kong
Taiwan	2.77	-0.99	1.5	1.87	-0.03	1.9	151	8,145	2,430	4,090	1.51	5.54	6.35	0.42	5.19	0.04	3.38	0	Taiwan
South Korea	1.74	0.73	1.25	0.5	0.02	0.48	-435	5,885	820	3,463	1.17	2.21	3.13	0.9	1.76	0.04	1.46	0	South Korea
Singapre	4.12	3.46	3.99	-0.09	-0.08	-0.01	-569	1,644	-13	1,394	1.52	5.9	5.38	0.32	5.27	0.04	3.82	0	Singapre
USA	-0.02	0.01	-0.16	-0.08	0.01	-0.09	535	-1,898	-817	-656	0	-0.06	-0.12	-0.1	0	0.04	-0.03	0	USA
WEU	-0.01	0.17	0.02	-0.07	-0.02	-0.05	965	-1,231	-664	-565	0	-0.07	-0.09	-0.08	-0.01	0.04	-0.01	0	WEU
ROW	-0.03	0.05	-0.09	-0.07	-0.03	-0.04	1,338	-2,035	-621	-1,142	-0.01	-0.14	-0.13	-0.07	-0.05	0.04	-0.03	0	ROW
																		0	
	Simulation 6: Cofinance-Joint Venture (on top of Simulation 2)																	0	
Japan	0	0.01	0.04	0.02	0	0.02	0	220	203	-17	0	0	0.02	0.02	0	0	0	0	Japan
Indonesia	0.67	0.65	0.64	-0.08	-0.01	-0.08	0	729	-49	92	1	1	0.79	-0.04	-0.25	-0.25	0.04	0.13	Indonesia
Malaysia	0.76	0.7	0.74	-0.09	-0.04	-0.06	0	406	-37	73	1	1	0.63	-0.03	-0.2	-0.2	0.12	-0.06	Malaysia
Philippines	0.61	0.86	0.64	-0.14	-0.03	-0.11	0	246	-24	36	1	1	1.79	-0.04	-0.55	-0.55	0.05	1.29	Philippines
Thailand	0.83	0.91	0.72	-0.15	-0.03	-0.12	0	753	-93	128	1	1	1.01	-0.13	-0.12	-0.12	0.08	0.31	Thailand
China	0.45	0.38	0.37	-0.07	-0.04	-0.03	0	1,288	-65	251	1	1	0.96	-0.07	-0.58	-0.58	0.06	0.52	China
Hong Kong	0.59	0.66	0.44	-0.13	-0.06	-0.07	0	304	-44	59	1	1	-13.1	-0.08	-0.44	-0.44	0.04	-13.51	Hong Kong
Taiwan	0.32	-0.17	-0.48	-0.25	-0.01	-0.25	0	242	-323	49	1	1	0.57	-0.23	-0.68	-0.68	-0.07	0.63	Taiwan
South Korea	0.56	0.53	0.43	-0.06	0	-0.06	0	1,380	-101	299	1	1	1	-0.04	-0.35	-0.35	0.08	0.45	South Korea
Singapre	0.73	0.77	0.67	-0.13	-0.05	-0.07	0	186	-68	122	1	1	1.23	-0.05	-0.36	-0.36	0.16	0.71	Singapre
USA	0	0.03	0.06	0.01	-0.01	0.02	0	147	199	-27	0	0	0.01	0.01	0.01	0.01	0	0	USA
WEU	0	0	0.01	0.01	0	0.01	0	107	172	-37	0	0	0.01	0.01	0	0	0	0	WEU
ROW	0	0	0.01	0.02	0	0.01	0	309	231	3	0	0	0.02	0.01	0.01	0.01	0	0	ROW

transactions. The pattern of observed impacts under Simulation 5 is similar to that of Simulation 2 (transfer of capital and technology under perfect competition). There are, however, two distinct features in the results of Simulation 5. One is the much-accentuated pattern of results both at macro and particularly at sector levels (as discussed in the next subsection). The other is the fact that this simulation punishes non-recipients, supplier and outsiders alike. The current output and growth as well as both the supply and demand in the markets for capital goods (for future growth) decline in non-recipient economies. Terms of trade work against non-recipient economies. Contributions to welfare from "stock effects", "terms of trade effects", and "technology effects" are all visibly negative.

In the recipient economies, capital stock accumulation is accelerated as both the demand for savings and supply of investment goods expand. Return on capital and real wages increase visibly. As simulation results suggest, scale economies captured through the contribution of technology to welfare changes (equivalent variation) provide a majority of welfare improvements under this simulation, given an initial transfer of Japanese capital and technology in the form of FDIs.

As in Simulation 3, results from Simulation 6 show that local cofinance (with increased domestic savings) can mitigate the secondary burden on the FDI-supplier in the transfer of productive resources. It also reduces the possible negative impacts on third-party countries.

Sectoral Impacts

Tables 11 and 12 introduce impacts on the sectoral composition of output of Japan's FDI in Asia under the assumptions of perfect competition and monopolistic competition, respectively. Similarly Tables 13 and 14 cover effects on sectoral demand for labor.

Under the assumption of perfect competition and a simple transfer of capital (Simulation 1), although output increases in all sectors, those of mining, metal, and transportation equipment sectors are most prominent across the nine recipient economies. The pattern of sectoral changes in demand for labor follows the pattern of output changes. In Japan, declines in output due to the reduction in capital stock are relatively small. Of all the sectors, mining and transportation equipment show the largest reductions.

Accompanied by a transfer of technology (Simulation 2), a clearer sectoral pattern of impacts emerges. Stimulated by technological progress, manufacturing industries expand by absorbing resources from agriculture, mining, and service industries. Among the manufacturing industries, the transportation equipment sector and machinery and other equipment sectors expand most. These industries have relatively high income and own-price elasticities of demand as well as higher Armington substitution parameters. Technological progress engenders price reduction, and thus leads to relatively higher demand. Owing to an increase in productivity, output expansion may not necessarily lead to an expansion in sectoral employment demand. In fact, food processing and chemical industries generally reduce their employment. As the price and income elasticities of

Table 11. Simulation under Perfect Competition (CRTS)—Sectoral Outputs

(percent change)

	Japan	Indonesia	Malaysia	Philippines	Thailand	China	Hong Kong	Taiwan	S. Korea	Singapore	USA	WEU	ROW
Simulation 1: Transfer of Capital Stock													
AGR	-0.08	0.17	0.33	0.34	0.24	0.18	0.29	0.16	0.14	0.18	0.02	0	0.01
MNG	-0.36	1.28	1.29	1.14	1.07	0.75	0.67	0.61	0.54	1.01	-0.02	-0.01	-0.03
PFD	-0.06	0.22	0.3	0.36	0.41	0.25	0.76	0.19	0.22	0.45	0	0	0
TXL	-0.15	0.66	0.36	0.81	0.74	0.49	0.43	0.45	0.35	0.27	-0.05	-0.04	-0.04
CHM	-0.13	0.67	0.71	0.59	0.88	0.49	0.51	0.54	0.53	0.81	0	0	0
MTL	-0.15	0.91	0.85	0.71	0.97	0.72	0.57	0.6	0.74	0.59	0.01	0.01	0.02
TRN	-0.34	0.81	1.25	1.83	1.21	1.26	0.57	0.67	0.74	0.7	0.06	0.05	0.11
OME	-0.14	0.52	0.73	0.73	1	0.73	0.77	0.46	0.65	0.48	0.02	0.02	0.03
OMF	-0.14	0.52	0.54	0.85	0.94	0.57	0.66	0.37	0.39	0.44	-0.02	-0.01	-0.01
EGW	-0.12	0.63	0.64	0.56	0.78	0.49	0.51	0.45	0.52	0.5	0	0	0
CNS	-0.04	0.65	0.56	-0.19	0.71	0.15	0.32	0.41	0.55	0.13	-0.01	-0.01	-0.02
T_T	-0.1	0.7	0.59	0.65	0.8	0.37	0.5	0.41	0.54	0.4	0	0	0
OSP	-0.13	0.67	0.77	0.83	0.86	0.62	0.62	0.5	0.5	0.51	0	0	0
OSG	-0.04	0.23	0.36	0.28	0.44	0.29	0.18	0.23	0.28	0.12	0	0	0
Simulation 2: Transfer of Capital Stock & Technology													
AGR	0.06	-0.03	-0.03	0.01	-0.25	0.02	-0.37	-0.46	-0.41	-1.07	0.19	0.08	0.06
MNG	0.02	-1.12	-1.4	-0.59	-0.33	-0.93	0.27	-0.8	-1.23	-3.28	0.05	0.01	0.14
PFD	-0.08	0.7	1.72	0.77	0.91	0.56	1.66	0.87	0.91	2.8	0.01	0.01	-0.01
TXL	-0.34	4.5	3.58	3.5	2.63	1.04	1.84	1.17	1.32	2.1	-0.28	-0.23	-0.33
CHM	-0.15	1.69	1.72	1.56	1.34	1.14	1.76	0.61	0.72	1.27	-0.03	-0.02	-0.04
MTL	-0.2	2.58	2.65	2.8	2.91	1.81	1.94	1.82	1.16	3.22	-0.07	-0.06	-0.15
TRN	-0.29	2.37	5.42	4.51	4.83	5.35	0.54	4.91	2.22	5.91	0.01	-0.01	-0.08
OME	-0.19	4.6	3.9	4.21	3.1	2.58	2.37	2.53	1.57	4.2	-0.11	-0.09	-0.19
OMF	-0.18	2.05	2.2	1.62	2.03	1.05	2.12	0.93	0.74	1.79	-0.06	-0.04	-0.12
EGW	-0.14	1.29	1.28	0.95	1.01	0.54	0.79	0.66	0.5	0.91	-0.01	-0.01	-0.02
CNS	-0.11	1.37	1.63	1.72	1.66	2.16	1.41	1.88	1.96	3.09	-0.04	-0.06	-0.05
T_T	-0.07	1.14	0.72	0.66	0.89	0.86	0.67	0.13	0.42	-1.17	0.02	0.02	0.04
OSP	-0.11	1.17	0.54	0.37	0.72	-0.51	-0.45	0.47	0.82	-1.23	0.03	0.03	0.02
OSG	-0.04	0.24	0.29	0.87	0.63	0.9	0.6	0.72	0.67	1.24	0.01	0.01	0.01
Simulation 3: Cofinance-Joint Venture (on top of Simulation 2)													
AGR	0	0.14	0.29	0.31	0.24	0.07	0.24	0.1	0.06	0.14	0.02	0.01	0.01
MNG	-0.1	1.31	1.29	1.02	1.19	0.74	1.04	0.68	0.51	1.01	-0.02	0	-0.02
PFD	0	0.18	0.24	0.27	0.38	0.08	0.68	0.11	0.08	0.38	0	0	0
TXL	-0.04	0.54	0.24	0.54	0.73	0.22	0.3	0.35	0.33	0.19	-0.05	-0.04	-0.04
CHM	0	0.67	0.69	0.59	0.91	0.63	0.65	0.57	0.56	0.77	0	0	0
MTL	0.01	1.05	0.93	1.12	1.17	0.93	0.84	0.69	0.95	0.7	0	0	0.01
TRN	-0.03	0.93	1.2	1.5	1.32	1.33	0.7	0.66	0.94	0.7	0.02	0.01	0.03
OME	0.02	0.54	0.69	0.62	1.13	0.86	0.84	0.52	0.81	0.52	0.01	0.01	0
OMF	-0.02	0.49	0.47	0.7	0.99	0.41	0.54	0.33	0.43	0.4	-0.01	-0.01	-0.02
EGW	0	0.59	0.61	0.51	0.75	0.51	0.44	0.41	0.47	0.42	0	0	0
CNS	0	0.97	0.96	0.96	0.98	1	0.91	0.91	0.95	0.98	0	0	0
T_T	0	0.69	0.6	0.61	0.76	0.35	0.46	0.36	0.45	0.32	0	0	0
OSP	0	0.63	0.73	0.67	0.76	0.42	0.58	0.41	0.38	0.47	0	0	0
OSG	0	0.21	0.34	0.29	0.39	0.23	0.18	0.2	0.19	0.07	0	0	0

Table 12. Simulation under Monopolistic Competition (IRTS)—Sectoral Outputs

(percent change)

	Japan	Indonesia	Malaysia	Philippines	Thailand	China	Hong Kong	Taiwan	S. Korea	Singapore	USA	WEU	ROW
Simulation 4: Transfer of Capital Stock													
AGR	-0.02	0.13	0.1	0.27	0.13	0.09	0.22	0.12	0.09	-0.01	0.05	0.02	0.02
MNG	-0.19	0.84	0.55	0.82	0.84	0.45	0.68	0.57	0.38	0.46	0	0	0
PFD	-0.06	0.24	0.06	0.34	0.33	0.17	1.18	0.2	0.24	0.54	0.01	0.01	0.01
TXL	-0.09	2.41	-2.42	1.67	1.02	-0.6	0.29	1.23	0.06	-0.72	-0.02	0	-0.02
CHM	-0.12	0.76	0.78	0.68	0.9	0.54	0.7	0.6	0.5	0.86	0	0	0
MTL	-0.14	1.07	1.23	1.1	1.39	1.03	0.82	0.55	0.89	1.08	-0.01	-0.01	-0.01
TRN	-0.6	0.98	17.17	8.14	2.71	19.26	-2.28	-3.82	1.32	-0.27	0.02	0	0.03
OME	-0.15	1.32	0.66	1.71	1.77	1.08	1.73	0.94	0.85	1.37	-0.02	-0.02	-0.06
OMF	-0.11	0.38	0.18	0.77	1.01	0.02	0.89	0.39	0.21	0.08	0	0	0
EGW	-0.12	0.75	0.62	0.6	0.82	0.54	0.53	0.48	0.51	0.53	0	0	0
CNS	-0.1	0.76	0.89	0.14	0.89	0.61	0.48	0.51	0.69	0.58	-0.02	-0.02	-0.02
T_T	-0.1	0.74	0.5	0.62	0.79	0.45	0.51	0.36	0.51	0.15	0	0	0
OSP	-0.13	0.73	0.65	0.71	0.82	0.34	0.48	0.48	0.52	0.26	0	0	0
OSG	-0.05	0.23	0.29	0.37	0.46	0.35	0.24	0.26	0.31	0.28	0	0	0
Simulation 5: Transfer of Capital Stock & Technology													
AGR	0.18	-0.32	-0.33	-0.13	-0.63	0.13	-0.83	-3.26	-0.48	-3	0.3	0.1	0.14
MNG	0.33	-3.9	-2.56	-0.81	-0.92	-0.82	0	-4.76	-1.5	-7.64	0.11	0	0.33
PFD	-0.03	0.6	1.49	0.6	0.33	0.5	1.35	-0.33	0.95	-0.01	0.05	0.03	0.03
TXL	0.33	20.99	-3.58	-2.2	3.68	4.4	3.61	-34.85	6.03	-0.51	0.43	0.04	0.19
CHM	-0.08	1.99	1.88	1.93	1.34	1.27	2.07	-4.03	0.93	-1.95	0.06	0.03	0.03
MTL	-0.17	1.57	3.36	5.4	3.83	1.49	1.47	15.53	0.28	4.72	-0.19	-0.13	-0.24
TRN	-2.76	0.62	-45.04	8.18	9.63	-39.34	-26.61	410.77	0.17	17.51	-1.53	-0.92	-3.68
OME	0.05	11.5	15	14.99	6.17	3.87	2.84	-18.96	0.94	13.16	0.1	0	-0.02
OMF	0.07	0.66	3.84	1.48	1.82	1.79	3.19	-14.44	0.81	-3.41	0.21	0.11	0.24
EGW	-0.14	2.06	1.89	1	1.13	0.49	1.02	0.1	0.63	0.86	-0.01	-0.01	-0.01
CNS	-0.16	1.71	1.86	2.33	2.01	1.93	1.72	4.82	2.04	5.71	-0.04	-0.05	-0.11
T_T	-0.05	1.32	1.15	0.58	0.79	0.82	0.85	0.48	0.36	-2.96	0.03	0.03	0.05
OSP	-0.11	1.4	0.37	0.07	0.51	-0.56	-0.77	0.92	0.82	-3.34	0.03	0.03	0.02
OSG	-0.07	0.21	0.34	0.95	0.59	0.81	0.77	1.51	0.72	2.17	0	0.01	0.01
Simulation 6: Cofinance-Joint Venture (on top of Simulation 5)													
AGR	0.02	0.11	0.18	0.25	0.12	0.07	0.18	0.33	0.03	-0.07	0.04	0.02	0.01
MNG	-0.04	0.92	0.82	0.78	0.9	0.65	0.96	1.12	0.36	0.46	0.01	0	-0.01
PFD	0	0.22	0.2	0.26	0.32	0.1	0.99	0.19	0.13	0.23	0.01	0	0
TXL	-0.06	1.41	-0.89	1.47	0.97	-0.21	-0.03	4.23	-0.53	-1.81	-0.05	-0.04	-0.08
CHM	0	0.74	0.77	0.66	0.9	0.65	0.71	1.07	0.47	0.62	0	0	-0.01
MTL	-0.01	1.28	1.13	1.46	1.55	1.14	1.03	-0.07	1.15	1.01	-0.01	-0.01	-0.03
TRN	0.21	1.42	6.12	10.4	3.18	8.07	6.1	-9.99	2.15	0.93	0.13	0.12	0.6
OME	-0.05	1.38	1.44	1.3	1.83	1.14	1.79	4.48	1.09	1.61	-0.09	-0.07	-0.19
OMF	-0.02	0.29	0.37	0.59	1.02	0.32	0.62	2.07	0.14	-0.08	-0.02	-0.01	-0.05
EGW	0	0.7	0.71	0.56	0.8	0.53	0.39	0.42	0.45	0.42	0	0	0
CNS	0	0.97	0.96	0.94	0.98	1	0.91	0.91	0.95	0.98	0	0	0
T_T	0	0.75	0.62	0.59	0.77	0.4	0.42	0.31	0.46	0.07	0	0	0
OSP	0	0.71	0.73	0.6	0.77	0.37	0.45	0.33	0.43	0.2	0	0	0
OSG	0	0.22	0.33	0.37	0.43	0.3	0.21	0.1	0.25	0.25	0	0	0

Table 13. Simulation under Perfect Competition (CRTS)—Sectoral Demand for Labor

(percent change)

	Japan	Indonesia	Malaysia	Philippines	Thailand	China	Hong Kong	Taiwan	S. Korea	Singapore	USA	WEU	ROW
	Simulation 1: Transfer of Capital Stock												
AGR	-0.07	0.11	0.19	0.33	0.19	0.16	0.23	0.12	0.1	0.17	0.02	0.01	0.01
MNG	-0.24	0.44	0.46	0.47	0.25	0.1	0.02	0.03	0.17	0.39	-0.02	-0.01	-0.03
PFD	0.05	-0.44	-0.41	-0.29	-0.37	-0.49	0.22	-0.25	-0.25	0.02	0	0	0
TXL	-0.08	-0.08	-0.17	0.31	-0.04	-0.11	0.12	0.03	-0.11	0.11	-0.05	-0.04	-0.05
CHM	0.02	-0.09	-0.1	-0.17	-0.05	-0.24	0.09	-0.08	-0.12	0.14	0	0	0
MTL	-0.02	0.11	0.2	-0.13	0.19	-0.03	0.15	0.11	0.08	0.21	0.01	0	0.02
TRN	-0.23	0.14	0.5	1.26	0.44	0.55	0.3	0.33	0.28	0.39	0.06	0.05	0.1
OME	-0.02	-0.27	-0.02	0.12	0.19	0.07	0.3	0.09	0.13	0.12	0.02	0.02	0.03
OMF	-0.04	-0.2	-0.09	0.24	0.05	-0.04	0.15	0	-0.03	0.11	-0.02	-0.01	-0.01
EGW	0.07	-0.15	-0.17	-0.33	-0.16	-0.46	-0.26	-0.42	-0.36	-0.16	0	0	0
CNS	0.05	0.13	0.13	-0.74	-0.09	-0.12	-0.16	0.1	0.14	-0.23	-0.01	-0.01	-0.02
T_T	-0.01	-0.42	-0.35	-0.31	-0.37	-0.23	-0.22	-0.15	-0.39	-0.17	0	0	0
OSP	0.05	-0.08	-0.05	0.03	-0.06	-0.09	0.06	-0.16	-0.1	0.07	0	0	0
OSG	-0.01	0.1	0.16	0.13	0.21	-0.01	0.12	0.11	0.12	0.08	0	0	0
	Simulation 2: Transfer of Capital Stock & Technology												
AGR	0.12	-0.27	-0.42	-0.16	-0.61	-0.08	-0.69	-0.76	-0.88	-1.73	0.24	0.09	0.08
MNG	0.15	-2.16	-2.58	-1.34	-1.14	-1.78	-0.47	-1.53	-1.63	-4.22	0.05	0.02	0.15
PFD	0.03	-1.13	-0.34	-0.98	-0.86	-1.42	0.04	-0.67	-0.6	1.12	0.01	0.01	-0.01
TXL	-0.27	2.52	1.76	1.89	0.83	-0.77	0.48	-0.35	-0.19	0.83	-0.28	-0.22	-0.33
CHM	-0.01	-0.28	-0.46	-0.31	-0.59	-0.83	0.26	-1.16	-1	-0.78	-0.02	-0.02	-0.03
MTL	-0.08	0.56	0.68	0.82	1.1	-0.19	0.45	0.19	-0.57	1.61	-0.07	-0.06	-0.14
TRN	-0.17	0.51	3.27	2.82	3.01	3.36	-0.75	3.45	0.69	4.37	0.02	0	-0.07
OME	-0.07	2.55	1.77	2.47	1.27	0.68	0.82	1.06	-0.01	2.61	-0.11	-0.09	-0.19
OMF	-0.08	0.12	0.27	-0.08	0.14	-0.76	0.53	-0.53	-0.73	0.27	-0.06	-0.04	-0.11
EGW	0.06	0.31	0.1	-0.07	0.07	-0.72	-0.09	-0.44	-0.48	-0.11	0	0	-0.01
CNS	-0.02	0.7	0.99	1.07	0.86	1.79	0.85	1.5	1.49	2.51	-0.04	-0.06	-0.04
T_T	0.02	-0.28	-0.65	-0.44	-0.27	0.05	-0.16	-0.56	-0.63	-2.05	0.03	0.03	0.04
OSP	0.06	0.22	-0.66	-0.54	-0.2	-1.44	-1.09	-0.36	0.14	-1.91	0.03	0.03	0.03
OSG	-0.01	0.08	0	0.7	0.4	0.5	0.52	0.58	0.49	1.17	0.01	0.01	0.02
	Simulation 3: Cofinance-Joint Venture (on top of Simulation 2)												
AGR	0	0.06	0.14	0.27	0.18	0.01	0.17	0.03	-0.05	0.11	0.02	0.01	0.01
MNG	-0.1	0.46	0.43	0.33	0.36	0.08	0.39	0.09	0.14	0.37	-0.02	0	-0.02
PFD	0	-0.48	-0.5	-0.42	-0.4	-0.68	0.14	-0.34	-0.39	-0.05	0	0	0
TXL	-0.04	-0.21	-0.32	0.01	-0.05	-0.4	-0.01	-0.08	-0.14	0.02	-0.05	-0.04	-0.04
CHM	0	-0.1	-0.15	-0.21	-0.03	-0.12	0.22	-0.07	-0.1	0.08	0	0	0
MTL	0.01	0.24	0.25	0.24	0.38	0.16	0.42	0.19	0.28	0.31	0	0	0.01
TRN	-0.03	0.25	0.43	0.9	0.54	0.61	0.43	0.32	0.47	0.37	0.02	0.01	0.02
OME	0.02	-0.26	-0.09	-0.01	0.31	0.18	0.37	0.15	0.29	0.16	0.01	0.01	0
OMF	-0.02	-0.24	-0.18	0.07	0.11	-0.21	0.03	-0.05	0.01	0.06	-0.01	-0.01	-0.02
EGW	0	-0.19	-0.22	-0.42	-0.19	-0.45	-0.33	-0.48	-0.42	-0.25	0	0	0
CNS	0	0.44	0.51	0.37	0.18	0.72	0.42	0.6	0.53	0.61	0	0	0
T_T	0	-0.44	-0.38	-0.4	-0.41	-0.26	-0.27	-0.21	-0.5	-0.27	0	0	0
OSP	0	-0.13	-0.12	-0.16	-0.17	-0.29	0.01	-0.26	-0.24	0.01	0	0	0
OSG	0	0.08	0.13	0.14	0.17	-0.08	0.11	0.09	0.04	0.03	0	0	0

Table 14. Simulation under Monopolistic Competition (IRTS)—Sectoral Demand for Labor

(percent change)

	Japan	Indonesia	Malaysia	Philippines	Thailand	China	Hong Kong	Taiwan	S. Korea	Singapore	USA	WEU	ROW
	Simulation 4: Transfer of Capital Stock												
AGR	0.01	0.03	-0.13	0.22	0.01	0.03	0.14	0.06	0.01	-0.11	0.06	0.02	0.03
MNG	-0.06	-0.03	-0.32	0.14	0.03	-0.19	0.04	-0.02	0.02	-0.2	0	0	0
PFD	0.06	-0.49	-0.69	-0.39	-0.49	-0.59	0.47	-0.27	-0.26	0.01	0.01	0.01	0
TXL	0	1.3	-2.64	0.92	0.1	-1.12	-0.05	0.64	-0.41	-0.8	-0.01	0	-0.01
CHM	0.04	-0.13	-0.16	-0.19	-0.14	-0.25	0.2	-0.1	-0.22	0.03	0	0	0
MTL	0	0.1	0.39	0.09	0.43	0.16	0.3	-0.02	0.1	0.54	-0.01	-0.01	-0.01
TRN	-0.4	0.13	13.55	6.26	1.51	15.36	-2.19	-3.57	0.66	-0.56	0.02	0	0.03
OME	0	0.29	-0.23	0.81	0.69	0.26	1	0.43	0.2	0.78	-0.02	-0.01	-0.05
OMF	0	-0.42	-0.5	0.05	0.01	-0.58	0.29	-0.03	-0.24	-0.28	0	0	0
EGW	0.07	-0.06	-0.22	-0.31	-0.12	-0.39	-0.22	-0.4	-0.38	-0.17	0	0	0
CNS	0	0.21	0.43	-0.44	0.09	0.34	0	0.21	0.27	0.19	-0.01	-0.02	-0.02
T_T	0	-0.43	-0.48	-0.37	-0.37	-0.15	-0.2	-0.2	-0.43	-0.46	0	0	0
OSP	0.05	-0.05	-0.2	-0.11	-0.1	-0.35	-0.07	-0.19	-0.09	-0.21	0	0	0
OSG	-0.02	0.1	0.08	0.22	0.24	0.06	0.17	0.15	0.15	0.23	0	0	0
	Simulation 5: Transfer of Capital Stock & Technology												
AGR	0.28	-0.8	-0.87	-0.35	-1.21	0.04	-1.31	-4.65	-1.01	-4.66	0.37	0.12	0.18
MNG	0.45	-5.11	-3.82	-1.55	-1.69	-1.74	-0.7	-6.03	-1.9	-9.18	0.13	0.02	0.37
PFD	0.09	-1.32	-0.71	-1.07	-1.31	-1.48	-0.28	-2.09	-0.57	-1.96	0.06	0.03	0.05
TXL	0.35	15.7	-4.74	-3.27	1.53	2.04	1.9	-31.69	3.76	-1.73	0.38	0.04	0.19
CHM	0.07	-0.28	-0.49	-0.05	-0.6	-0.8	0.47	-5.75	-0.8	-4.32	0.07	0.03	0.06
MTL	-0.02	-0.69	1.01	2.82	1.68	-0.64	-0.04	11.31	-1.37	2.18	-0.16	-0.11	-0.18
TRN	-2.23	-1.31	-38.17	5.35	6.44	-32.45	-23.84	343.47	-1.21	13.09	-1.29	-0.78	-3.11
OME	0.16	7.52	10.42	10.93	3.54	1.45	1.04	-17.58	-0.64	9.14	0.1	0	0
OMF	0.16	-1.37	1.47	-0.26	-0.14	-0.18	1.36	-14.26	-0.64	-4.7	0.2	0.1	0.24
EGW	0.05	0.89	0.62	0	0.22	-0.86	0.19	-1.87	-0.38	-0.89	0.01	0	0.02
CNS	-0.07	0.92	1.18	1.7	1.23	1.54	1.19	4.11	1.56	4.7	-0.03	-0.05	-0.09
T_T	0.05	-0.37	-0.33	-0.5	-0.33	-0.04	0.06	-0.77	-0.71	-4.45	0.04	0.04	0.08
OSP	0.06	0.28	-0.91	-0.82	-0.38	-1.55	-1.37	-0.57	0.12	-4.49	0.05	0.04	0.05
OSG	-0.04	0.02	0.03	0.79	0.38	0.38	0.7	1.26	0.54	2.06	0	0.01	0.02
	Simulation 6: Cofinance-Joint Venture (on top of Simulation 5)												
AGR	0.02	0.01	-0.03	0.18	0	0	0.08	0.36	-0.1	-0.2	0.05	0.02	0.01
MNG	-0.04	0.05	-0.06	0.08	0.08	-0.02	0.29	0.58	0	-0.24	0.01	0	-0.01
PFD	0	-0.51	-0.58	-0.47	-0.51	-0.68	0.28	-0.24	-0.36	-0.27	0	0	0
TXL	-0.05	0.44	-1.33	0.73	0.06	-0.8	-0.34	3.24	-0.92	-1.74	-0.05	-0.03	-0.07
CHM	0	-0.15	-0.18	-0.23	-0.14	-0.18	0.19	0.35	-0.24	-0.22	0	0	-0.01
MTL	-0.01	0.28	0.29	0.38	0.56	0.22	0.47	-0.52	0.33	0.45	-0.01	-0.01	-0.03
TRN	0.18	0.5	4.36	8.12	1.91	6.05	4.87	-8.81	1.35	0.44	0.11	0.1	0.5
OME	-0.04	0.34	0.42	0.45	0.74	0.29	1.03	3.44	0.39	0.97	-0.07	-0.06	-0.16
OMF	-0.02	-0.5	-0.34	-0.12	0.01	-0.35	0.02	1.46	-0.3	-0.44	-0.02	-0.01	-0.04
EGW	0	-0.11	-0.14	-0.38	-0.14	-0.44	-0.4	-0.4	-0.44	-0.31	0	0	-0.01
CNS	0	0.42	0.5	0.35	0.18	0.72	0.41	0.62	0.53	0.57	0	0	0
T_T	0	-0.43	-0.37	-0.43	-0.39	-0.22	-0.33	-0.2	-0.5	-0.57	0	0	0
OSP	0	-0.08	-0.14	-0.24	-0.15	-0.35	-0.13	-0.29	-0.19	-0.3	0	0	0
OSG	0	0.08	0.12	0.22	0.21	-0.01	0.15	0	0.09	0.2	0	0	0

demand for these products are relatively low, a limited production increase coupled with an advance in technology reduces demand for labor in these sectors.

Under the assumption of economies of scale, one or two sectors can win the sectoral competition for productive resources given a certain combination of larger scale economies and higher price and income elasticities of demand. Table 12 shows that transport equipment, machinery and other equipment, and textile sectors are winning candidates, in this order. In an environment where economies of scale exist, a technology transfer further distinguishes the winning sector(s) from losing sectors. In addition, winners and losers may be inversely connected at an international level. For example, if one industry in a particular country wins out, the other country's leader in the corresponding sector might be negatively affected. Results from Simulation 5 introduced in Table 12 show that Taiwan's transport equipment industry comes out ahead and drives out that same sector in such countries as Malaysia and China, even though this was the leading sector for both countries under Simulation 4.

Changes in demand for sectoral employment follow more closely the changes in sectoral outputs under the assumption of scale economies (Table 14). Under scale economies, a large amount of capital might be attracted to a limited number of sectors (one or two), thus requiring input of other productive factors to complement the large expansion in capital stock.

Changes in sectoral trade balance under Simulation 2 and Simulation 5 are tabulated in Table 15.

Table 15. Trade Balance by Sectors

(US$ million)

	Japan	Indonesia	Malaysia	Philippines	Thailand	China	Hong Kong	Taiwan	S. Korea	Singapore	USA	WEU	ROW
	Simulation 2: Transfer of Capital Stock & Technology (Perfect Competition, CRTS)												
AGR	170	-83	-75	-42	-102	-471	-47	-104	-210	-36	325	151	517
MNG	82	-174	-125	-27	-66	-242	-38	-79	-143	-113	102	148	642
PFD	-5	16	87	4	58	-91	-17	-21	-22	40	-14	5	-67
TXL	-199	288	46	55	204	177	118	146	186	-25	-195	-336	-564
CHM	-72	17	-10	8	-15	32	-47	76	68	18	-43	-7	-67
MTL	-117	36	-23	-5	-36	56	-2	150	234	-50	-42	-42	-197
TRN	-466	63	25	-7	4	47	-40	93	167	-10	75	51	-25
OME	-573	-86	288	19	37	54	3	460	-11	389	-378	-193	-247
OMF	-133	129	85	13	71	132	53	90	27	-48	-97	-67	-344
EGW	0	0	0	0	0	-4	4	0	0	0	1	1	-1
CNS	0	0	0	-3	0	0	-21	0	-11	0	0	22	13
T_T	450	-72	-55	-81	-175	-1	-157	-478	-378	-262	463	656	684
OSP	163	-60	-75	-53	-103	-530	-234	-234	-235	-167	490	690	347
OSG	2	-23	-79	-1	-10	-2	-13	-33	-91	-19	41	157	71
	Simulation 5: Transfer of Capital Stock & Technology (Monopolistic Competition, IRTS)												
AGR	228	-160	-103	-53	-137	-462	-59	-151	-293	-64	393	153	704
MNG	90	-524	-208	-39	-104	-215	-49	-237	-193	-102	127	127	1,254
PFD	40	-35	70	-18	-24	-85	-29	-334	-35	-13	132	101	190
TXL	437	1,420	-109	-77	274	926	330	-5,128	1,103	-93	419	145	470
CHM	366	-163	-18	-2	-65	123	-104	-1,067	39	-374	393	322	515
MTL	308	8	-11	-24	-68	155	-18	-675	140	-211	41	-31	254
TRN	-5,223	-65	-852	0	78	-1,663	-201	20,831	-230	19	-4,168	-2,771	-5,931
OME	1,432	-75	1,548	209	236	783	-22	-8,047	-174	1,555	941	535	811
OMF	479	2	143	4	41	305	109	-2,889	21	-317	636	453	985
EGW	0	0	0	0	0	-1	1	0	0	0	1	-1	1
CNS	0	0	0	-4	0	0	-36	0	-14	0	1	29	26
T_T	928	-148	-91	-109	-267	-1	-203	-1,379	-424	-602	794	863	1,276
OSP	339	-120	-108	-80	-146	-517	-327	-677	-272	-326	759	820	656
OSG	4	-36	-110	-2	-13	-2	-15	-97	-102	-41	66	220	128

As indicated earlier, large sectoral swings can be detected from the results of Simulation 5. Advantage of specialization due to the "degree of location" and "economies of scale" is accentuated in Simulation 5, resulting in a fairly clear pattern of inter-sectoral shifts of production-exports and imports. For instance, Indonesia is projected to specialize in textiles, Malaysia in machinery and other equipment, Taiwan in transport equipment (including automobile), South Korea in textiles, and Singapore in machinery and other equipment.

Under the current experiments, FDI capital is not manually targeted to specific industries. Nor is FDI capital treated as sector-specific. Instead, the capital endowment of each recipient economy is augmented by Japan's FDI. Capital, then, is distributed and redistributed through the mechanism of a general equilibrium framework in such a way as to equalize sectoral rates of return on capital. In other words, capital is treated as fully mobile across sectors. Although this assumption is adopted to take advantage of the strong feature of a multi-sector general-equilibrium model, it certainly overstates inter-sectoral swings given shocks. Big changes in sectoral output, employment, and trade patterns should therefore be seen as indications of possible outcomes.

8. Conclusions

This study used the Global Trade Analysis Project (GTAP) Model in order to analyze the possible impacts of Japan's FDI in Asia in a multi-country, multi-sector, general equilibrium framework. This study constitutes one of the first applications of the model, originally developed for the analyses of trade liberalization, to the analyses of FDI and financial flows. The majority of existing anti-FDI arguments are either non-economic such as the "nationalist" and "dependence" approaches, or economic but short-term, partial-equilibrium arguments such as the "exporting employment", and "balance of payments" stories that focus on the flow aspects of FDI. FDI, as a micro phenomenon, should not be blamed for negative macro outcomes such as a worsening trade balance that in principle is a reflection of a country's savings-investment imbalance. By focusing, instead, on the analysis of medium- to long-term general equilibrium impacts (stock impacts) of FDI, this paper tried to capture the growth and welfare impacts of Japan's FDI in Asia. Stock impacts analyzed in this paper are: 1) a capacity and output expansion in the recipient economies in Asia, matched by a reduced capital stock in Japan (stock effects); 2) an increase in productivity through technology transfer and spillover (technology effects); and 3) an increase in domestic investment driven by a higher expected rate of return on investment and larger domestic savings (cofinance effects). Following the existing dichotomy in the theories of FDI—those that assume perfect markets and the others based on imperfect markets—simulations were conducted under both industrial structures. Simulation results replicated the traditional transfer problem in real resources, and showed that FDI was a positive-sum game. Larger gains were observed in the existence of scale economies.

Major strategic implications of the study for Japan (FDI-supplier) are:

(1) In order to benefit from the positive-sum game of FDI, Japan (or any FDI-supplier) should also provide a conducive environment to attract inward FDIs. Outward FDI alone is not likely to improve domestic welfare (just like the case in international trade) unless it is driven by welfare-improving domestic causes. Also, two-way flows in a large number of countries should enlarge the positive sum of FDI.

(2) In order for Japan (FDI-supplier) to avoid the possible secondary burden of a transfer of productive resources, it should also mobilize local savings by looking for local partners and/or raising local funds when executing FDIs.

(3) It may be important to retain R&D facilities in the domestic market and preserve technology terms of trade if one supplies technology abroad along with capital.

The findings and implications of this study should, however, be carefully interpreted. There are at least three major limitations that prohibit us from drawing decisive conclusions. The first one is related to the reliability of FDI data and structural parameters used in any CGE model. The second and third limitations are related to the current GTAP model framework. In order for us to draw a truly long-run general-equilibrium conclusion, the model should contain truly endogenous savings behavior that reflects an inter-temporal maximization problem. The savings module in the current version of the GTAP model is not yet adequate in this regard. The third limitation is related to the treatment of investment proceeds. As the simple MacDougall model of capital transfer showed, if the return on capital properly accrues to the investor, a (globally) higher rate of return on capital should increase the income of the investor (at the expense of labor's income). If the returns on FDIs are properly captured, and this remains a crucial yet unfilled task, welfare implications on the FDI-supplier country should greatly improve.

Notes

(1) This study was undertaken in conjunction with the research activities at the Economic Research Institute, Economic Planning Agency (now, the Economic and Social Research Institute, the Cabinet Office of the Government of Japan) where the author served as a visiting researcher. However, the findings and conclusions of this paper are the personal responsibility of the author, and do not necessarily reflect the views of the Economic Planning Agency of Japan. The author is grateful to the co-researchers at the EPA—Hideaki Kitaki, Mantaro Matsuya, Minoru Ono, and Hiroshi Ono—for their research/computational assistance and to participants of the EPA CGE Workshop (March 1998)—particularly Prof. Kanemi Ban, Prof. Hiro Lee, and Prof. Shujiro Urata—for their valuable comments on the earlier versions of this paper. Useful comments were also made by Prof. Peter Lloyd and Prof. Michael Plummer at the APEC Study Consortium 1999 Global Conference at Auckland, New Zealand. Research/editorial assistance provided by Debra A. Jewell, Charles O. Settle, and Megumi Yanagitsubo is acknowledged. This study is partly funded by the Ministry of Education Grant-in-Aid distributed through the Japan APEC Study Consortium.

(2) The Asian financial crisis emerged in 1997 after a rapid intake of debt-creating indirect financial inflows reconfirmed the importance of FDI for a sound buildup of productive capacity and sustained growth.

(3) The Global Trade Analysis (GTAP) Model was originally developed for the analyses of trade liberalization. As such, the research applications of this model have been largely limited to the reductions in trade-related and other relevant domestic price distortions caused by taxes and subsidies. This study constitutes one of the first applications of the model to the analyses of FDI and financial flows.

(4) This study focuses on FDI movements during the decade since 1985. Given the Plaza Accord in 1985, the following yen's appreciation vis-à-vis the US dollar was the fundamental factor for Japan's overseas investment activities including those in the developing Asia. Asia's intra-regional FDI linkages were formed in early 1990's with Asian NIEs' emergence as main investors in ASEAN and China. As such, this study uses GTAP 1992 database (version 3). This selection of the period of analysis also frees the study from disturbances caused by the Asian financial crisis emerged in 1997. The findings with respect to the qualitative impacts presented here, however, should continue to be valid even after the Asian financial crisis. That is, the stock impacts composed of stock effects, technology effects, and cofinance effects should continue to exist.

(5) Otsubo and Umemura (2003) used a reconciliation method over the BOP-based IMF statistics and individual country's reporting of inward FDI data in order to derive a matrix of intra-APEC bilateral FDI flows.

(6) See Hertel (1997) or the GTAP web site (www.agecon.purdue.edu.gtap) for a detailed account of the project and its research network, modeling structure and apparatus, and database. The Economic Planning Agency (now, the Economic and Social Research Institute, the Cabinet Office) of the Japanese government is a consortium member for this global network-based project together with international organizations such as the WTO and the World Bank. Also, see Ban, et al. (1997) for property simulations of the GTAP model.

(7) For a detailed account of the GTAP database, model structure, and key parameters used in this study, see Appendix B in Otsubo (1998).

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