Measurement and Modeling of the Economic Effects of Trade and Investment Barriers in Services

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Abstract

In this paper, we adapt the latest version of the Michigan Model of World Production and Trade to incorporate relationships and data for cross-border services trade and foreign direct investment (FDI) in the major developed and developing countries subsumed in the model's structure and database.

Firms are taken to be monopolistically competitive. Each firm produces a set of differentiated products. Products are differentiated both by the original R&D undertaken at headquarters that defines the basic product and by the final location of production. Each firm faces a fixed cost in the country where production occurs, and it then sets an optimal mark-up of price over marginal cost for sales from each location. Free entry guarantees that profits are zero.

Firms locate production for export or for local consumption depending on the type of barriers restraining the conduct of multinationals. In this version of the model, barriers to trade in services take two forms. First, firms may face an *ad valorem* tax on local capital installed. Second, foreign affiliate firms may face a policy-induced fixed cost of production for local operations.

We report the impact on welfare, trade, factor prices, sectoral output, economies of scale, and activities of multinationals that might occur following the introduction of national treatment of multinational firms in all countries of the model.

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I. Introduction

In this paper, we adapt the latest version of the Michigan Model of World Production and Trade to incorporate relationships and data for cross-border services trade and foreign direct investment (FDI) in the major developed and developing countries subsumed in the model's structure and database. Our objective is to conduct a variety of model simulations to assess the economic effects of the reduction/removal of the existing services trade and FDI barriers. It is hoped that our computational analysis will be useful as a backdrop to inform the WTO 2000 multilateral services negotiations.

The paper is structured as follows. In Section II, we discuss a number of salient issues that arise in the measurement of barriers to services trade and FDI. Alternative approaches to the modeling and analysis of these barriers and their reduction/removal are discussed in Section III. With this as background, we present in Section IV details of the adaptation of our Michigan Model of World Production and Trade that is to be used for computational and analytical purposes. The data, parameters, and solution procedure of the model are discussed in Section V. In Section VI, we outline the various modeling scenarios for liberalization of existing services trade and FDI barriers and present and discuss our computational results. Our conclusions and policy implications are indicated in Section VII.

II. Measurement of Barriers to Trade in Services and FDI[1]

Given the fact that international trade in services has been increasing significantly in recent decades and now is equal to about 20 percent of global merchandise trade, it is obviously important to

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[1] Adapted in part from Deardorff and Stern (1998, Appendix 4).

consider the barriers that affect services trade and issues of measurement of these barriers. There has been similarly an increasing amount of foreign direct investment (FDI) in both goods and services sectors in and between advanced and developing countries. FDI is subject to a variety of barriers as well and thus merits attention in its own right.

Characteristics and Modes of International Transactions in Services

The most distinguishing characteristic of services transactions is that their production and consumption occur simultaneously, thus often requiring direct contact between producers and consumers. While some services are traded internationally across borders (e.g., "separated" services such as telecommunications) in a manner similar to cross-border trade in goods, other services may require the consumer to move to the location of the producer, as in the case of tourism. Further, because of the necessary proximity of consumers and producers, factors of production may have to move across national boundaries to the place of consumption. Thus FDI may be necessary in order to establish a foreign commercial presence, and there may also be temporary cross-border movement of labor that is required to serve foreign consumers. An indication of the magnitudes of the four modes of services transactions is provided in Table 1.

Types of Barriers to Trade and FDI in Services

As noted by Hoekman and Primo Braga (1997, p. 288), because of the simultaneity of the production and consumption of services, border measures such as tariffs will generally be difficult to apply because customs agents cannot readily observe the service as it crosses the border. Typically therefore the restrictive policies followed will be designed to limit the access of foreign services and the suppliers of services to domestic markets. Hoekman and Primo Braga distinguish the following types of barriers: (1) quotas, local content, and prohibitions; (2) price-based instruments; (3) standards, licensing, and procurement; and (4) discriminatory access to distribution networks. To explain further:

(1) Quantitative-restriction (QR) type policies are commonly applied to service providers. Two prominent examples are the bilateral agreements regulating international air transportation services, which are usually reciprocal and company specific, and ocean-cargo-sharing arrangements, which also often rely on reciprocity in providing shipping services in mutual trade. In many countries, there are outright prohibitions directed against foreign providers of such services as domestic transportation, basic telecommunications, and legal, insurance, education, surveying, and investment advising services. Restrictions on transborder data flows are also prevalent and may impede market access by foreign providers.

(2) Price-based instruments may take the form of visa fees and entry or exit taxes, discriminatory airline landing fees, and port taxes. Tariffs can be significant barriers to trade in goods that embody services (e.g., films, television programs, computer software) or goods that are used in producing services (e.g., computers, telecommunications equipment, advertising material). Further, many service sectors are subject to government-sanctioned or monitored price controls, examples including air transportation, financial services, and telecommunications. Government subsidies are commonly used in such service sectors as construction, communications, and road and rail transport.

(3) Licensing or certification requirements may be imposed on foreign providers of professional and business services. Environmental standards may also impact on service providers, particularly in transportation and tourism. Government procurement policies are often designed to favor domestic over foreign providers of services as well as goods by means of preference margins and outright prohibitions.

(4) Discriminatory access to distribution and communications systems exists in many countries in such sectors as telecommunications, air transport, advertising, insurance, and dealer networks.

Hardin and Holmes (1997) have focused specifically on barriers to FDI. They define (p. 24) an FDI barrier as "…any government policy measure which distorts decisions about where to invest and in what form. …policy measures such as limits on the level of foreign investment, or the need to go through costly and time-consuming screening processes to convince authorities that FDI in a project will be in the national interest, are considered barriers."

In considering ways of classifying FDI barriers, Hardin and Holmes note (pp. 33-34):

"The appropriate classification system may vary, depending on the purpose of the exercise. For example, if the purpose is to check and monitor compliance with some policy commitment, then the categories should reflect the key element of the commitment…. If the primary interest is instead the resource allocation implications of the barriers, some additional or different information may be useful.

Barriers to FDI may distort international patterns and modes of…trade. They may also distort allocation of capital between different economies, between foreign and domestic investment, between different sectors, and between portfolio and direct investment. …the

> classification system…should highlight the key characteristics of the barriers that will determine their size and impact. Market access and national treatment are…relevant categories from a resource allocation perspective. …national treatment is generally taken to refer to measures affecting firms after establishment. A…way to classify barriers is therefore…according to what aspect of the investment they most affect: establishment, ownership and control; or operations. In addition…, some further information may be useful…on distinctions…between direct versus indirect restrictions on foreign controlled firms; and rules versus case-by-case decisions."[2]

The main types of FDI barriers that have been identified by UNCTAD (1996) are noted in Table 2. Further information on the barriers most commonly used to restrict FDI especially in the APEC economies is provided in Hardin and Holmes (1997, esp. pp. 37-40 and 45-55). As they note (p. 40), some common characteristics appear to be:[3]

> "application of some form of screening or registration process involving various degrees of burden for the foreign investor; restrictions on the level or share of foreign ownership, particularly in some service sectors, and often in the context of privatisations; widespread use of case-by-case judgments, often based on national interest criteria; widespread use of restrictions on ownership and control (e.g., restrictions on board membership), particularly in sectors such as telecommunications, broadcasting, banking; and relatively limited use of performance requirements on input controls in services sectors."

Measurement of Barriers to Trade and FDI in Services

The measurement of services barriers parallels to an extent the measurement of NTBs that limit trade in goods. However, services barriers involve greater complexities when account is taken of the different modes of supply of services that include not only cross-border trade but also the movement of consumers to the location of providers as well as FDI and temporary international movement of labor.

Frequency Measures

Frequency measures of services barriers have been constructed by PECC (1995) and Hoekman (1996). These are based on the information contained in the country schedules of the General Agreement

[2] Direct restrictions include limitations on the total size or share of investment in a sector and requirements on inputs used (e.g., local content). Indirect restrictions include net benefit or national interest criteria and limitations on membership of company boards. The distinction between rules and case-by-case decisions relates to issues of clarity in specification and transparency as compared to the exercise of administrative discretion.

[3] Hardin and Holmes (pp. 40-43) also provide information on investment incentives, which are widely used and for the most part are not subject to multilateral disciplines.

on Trade in Services (GATS) and refer to all four modes of the supply of services. Frequency ratios are constructed based on the number of commitments scheduled in the GATS by individual countries that designate sectors or sub-sectors unrestricted or partially restricted in relation to the maximum possible number of unrestricted commitments. As noted in Hoekman (1996, p. 101), there are 155 sectors and sub-sectors and four modes of supply, which yields 620×2=1,440 total commitments on market access and national treatment for each of 97 countries.[4]

Hoekman (1995) has used frequency ratios to approximate the relative degree of restrictiveness of market-access barriers to services trade across countries and sectors. He established a judgmental set of benchmark tariff equivalents for individual sectors to reflect the degree to which market access to these sectors was restricted. The benchmark tariff equivalents chosen ranged from a high of 200 percent for sectors (e.g., maritime cabotage, air transport, postal services, voice telecommunications, and life insurance) in which market access was essentially prohibited in most countries to 20-50 percent for sectors in which market access was less constrained. He then assigned a value to each country and sector using the benchmarks multiplied by the calculated frequency ratio. Thus, for example, assuming a benchmark tariff equivalent of 200, say, for postal services and a frequency ratio of 50 percent to reflect the scheduled market access commitments, the tariff equivalent for that sector is set at 100 percent. Using the value of output by sector for a representative industrialized country, it is then possible to construct weighted average measures by sector and country. The weighted average tariff equivalents for 1-digit ISIC sectors for selected countries are indicated in Table 3.

It should be emphasized that Hoekman's measures are designed to indicate the *relative* degree of restriction and are not to be taken literally as indicators of absolute ad valorem tariff equivalents. But even granting this, there are some important limitations worth mentioning. Thus, as Hardin and Holmes (1997,

[4] As noted in Hardin and Holmes (1997, p. 70) the GATS commitments are based on a "positive list" approach and therefore do not take into account sectors and restrictions which are unscheduled. In PECC (1995), it is assumed that all unscheduled sectors and commitments are unrestricted, which will then significantly lower the calculated frequency ratios. It would be useful accordingly to determine how accurate the PECC assumption may be.

p. 72) note, Hoekman's method may be misleading or biased because it assumes that the absence of positive country commitments in the GATS schedules can be interpreted as indicating the presence of restrictions, which may in fact not be the case. Also, the different types of restrictions are given equal weight and are not distinguished according to their economic impact. Finally, market access restrictions are the only ones taken into account.

Hardin and Holmes (1997) have attempted to build on and improve Hoekman's methodology for constructing guesstimates of tariff equivalents for services. In particular, they use information on actual FDI restrictions and incorporate information on the types of barriers and their economic impact. Their objective is to construct an index of FDI restrictions that can be translated into a tariff equivalent or tax equivalent. The components of their proposed index and the weights assigned to the different sub-categories are given in Table 4. They set the weights to reflect the relative degree of restriction of different barriers. Foreign equity limits are given greater weights than the other barriers noted. Hardin and Holmes confine their calculations of the indexes of FDI restrictions to the services sectors in the APEC countries.[5] Their results are summarized in Table 5. It is evident that communications and financial services are most subject to FDI restrictions, while business, distribution, environmental, and recreational services are the least restricted.

Warren and Findlay (1999) have reviewed a number of studies of services sectors based on the use of frequency-type indices of services impediments:

1. Mattoo (1998) analyzed market access commitments in financial services, covering direct insurance and banking. His results indicate that Latin America is the most restricted in direct insurance and Asia the most restricted in banking services.
2. McGuire (1998) showed that Australia's impediments in financial services, including banking, securities, and insurance, were much lower as compared to other economies in Asia.
3. McGuire and Schuele (1999) constructed indices of impediments to trade in banking services for 23 countries plus the European Union that distinguished impediments on commercial presence and operations and impediments affecting foreign banks and all

[5] Details on the construction of the indexes and their sensitivity to variations in the restrictive weights are discussed in Hardin and Holmes (1997, esp. 103-11).

banks. Weighting the various indices by the degree of restrictiveness, they showed that there was a negative relation between GNP per capita and financial market restrictions.

4. The OECD (1997) developed a pilot study of barriers affecting accounting services for Australia, France, the United Kingdom, and the United States. The United Kingdom was found to be the most liberal, the United States the least liberal.
5. Marko (1998) found that 58% of the basic telecommunications services market for the 69 signatories of the February 1997 Agreement on Basic Telecommunications was covered by partial or full GATS commitments.
6. Warren (1999b) constructed a set of indices to measure the restrictiveness of telecommunications policies for 136 countries. There was a high degree of variation in the indices, indicating that many countries are resistant to liberalizing their telecommunications markets.
7. McGuire, Schuele, and Smith (1999) developed indices for restrictions on foreign maritime services suppliers and all maritime service suppliers covering 35 economies. The degree of restrictiveness varied considerably. Chile, the Philippines, Thailand, Turkey, and the United States treated foreign maritime service suppliers less favorably than domestic suppliers.

The various frequency-type measures that have been constructed are especially useful in identifying the types of barriers and the relative degree of protection afforded to particular sectors across countries. But, as is well known, frequency-type measures have only limited economic content with regard to assessing the size of service barriers and the consequences of maintaining or eliminating these barriers. The question then is whether it is possible to construct price-based or quantity-based measures of services barriers that can be used in quantitative assessment of the costs and benefits from the reduction or removal of the barriers. We turn next then to discuss a number of such recent measurement efforts.

Price-Based Measures of Services Barriers

Warren and Findlay (1999) have discussed ongoing efforts to construct price-based measures of services impediments, using estimates of price-cost margins. As they note, Kalirajan et al. (1999) have used a two-stage econometric technique to calculate the “net interest margins” for 694 national and state commercial banks in selected economies. Their results, which distinguish barriers to establishment and to ongoing operations for foreign and domestic firms, are summarized in Table 6. The price impacts of restrictions on foreign banks (F) are the highest for Indonesia, the Philippines, Malaysia, Chile, Singapore, South

Korea, and Thailand. Argentina, Australia, Canada, the EU, Hong Kong, Switzerland, and the United States appear to have relatively low non-prudential restrictions in foreign banks. The second set of domestic (D) measures noted apply equally to domestic and foreign banks and range from 0 to 24 percent.

Warren and Findlay also discuss (p. 17) work in progress on price-based measures of policy variables for maritime services:

> "This work is using an estimate of shipping expenses (derived from comparisons of values at the point of export and the variables at the point of import) in bilateral trades in each direction as a proxy for price variables. Statistical methods are [used] to test for the significance of the policy measures for variations in prices, after allowing for the impact of other variables which will affect those charges, including the distance between them, the scale of the trade, indicators of the composition of the bilateral trade, the extent of imbalances in the trade flows, and the degree to which the routes are isolated from substitutes. The data set includes 506 observations. The method used requires the separate inclusion of policy in both partner economies. The results will help answer the question of whether a high degree of restrictiveness is necessary in both economies in order to drive up shipping charges or whether a high degree in one partner alone is sufficient."

Quantity-Based Measures of Services Barriers

Warren (1999a) has assessed the quantitative impact of barriers in telecommunications services, chiefly mobile telephony and fixed network services, for 136 countries. Combining the quantitative estimates of the effects of removing existing barriers with an estimate of the price elasticity of demand for the telecommunications services involved, tariff equivalents in the form of price wedges can be calculated. The tariff equivalents for domestic and for foreign providers of telecommunication services in the major nations are shown in Table 7. The estimates for the advanced industrialized countries are relatively low in comparison to the much higher estimates for the newly industrializing countries shown. There are cases of developing countries (not shown) that in some cases have very large price wedges, including some with several hundred percent, e.g. China (804 and 1,000 percent), Colombia (11 percent and 24 percent), India (861 and 1,000 percent), Indonesia (71 and 128 percent), South Africa (14 and 21 percent), and Venezuela (10 and 15 percent).

Francois (1999) has fit a gravity model to bilateral services trade for the United States and its major trading partners, taking Hong Kong and Singapore to be free trade benchmarks. The independent

variables include per capita income, gross domestic product (GDP), and a Western Hemisphere dummy variable. The differences between actual and predicted imports are taken to be indicative of NTBs and then normalized relative to the free trade benchmarks for Hong Kong and Singapore. Combining this with an assumed elasticity demand of –4, tariff equivalents can be estimated. The results for business/financial services and for construction are indicated in Table 8. As noted in Deardorff and Stern (1998, p. 24), measures of this kind are useful mainly in identifying *relative* levels of protection across sectors and countries. But they have some important drawbacks.[6]

Financial-Based Measures of Services Barriers

Hoekman (1999) has suggested that financial data on gross operating margins calculated by sector and country may provide information about the effects of government policies on firm entry and conditions of competition. High margins may be attributable of course to a variety of economic and institutional factors. But since these margins may be indicative of relative profitability across sectors and between countries, they may yield insight about the relative size of existing barriers in individual countries/regions. The country-region results averaged over firms and sectors for 1994-96 are indicated for manufacturing and services in Table 9. Sectoral results for services only are given in Table 10.

III. Alternative Modeling Approaches

While the various measures of services barriers noted are of interest, they need to be incorporated into an explicit economic modeling framework in order to determine how the existence or removal of the barriers will affect conditions of competition and costs of production, economic welfare, and the intersectoral movement of capital and labor.

[6] That is, by attributing to NTBs all departures of trade from what the included variables can explain, there is a great burden on the model being used. Thus, the worse the model, the more likely it is that NTB estimates will have an upward bias. Moreover, since trade cannot be predicted accurately for particular industries and countries, it is not clear how the deviations should be interpreted and the extent to which existing trading patterns depart from free trade.

Most research to date on the measurement and modeling of barriers has been focused on international trade in goods rather than trade in services and FDI. The reasons for this stem in large part from the lack of comprehensive data on cross-border services trade and FDI and the associated barriers together with the difficult conceptual problems of modeling that are encountered. Some indication of pertinent modeling work done to date is provided in Table 11. Following Hardin and Holmes (1996, p. 85), the approaches to modeling can be divided as follows: (1) analysis of services trade liberalization in response to reductions in services barriers – Brown et al. (1996a,b), Robinson et al. (1999), Francois et al. (1996), and Tamms (1999); (2) FDI assumed to respond to trade liberalization or other exogenous changes that generate international capital flows in response to changes in rates of return – Martin and Yagashima (1993); Donovan and Mai (1996); McKibbin and Wilcoxen (1996); Bora and Guisinger (1997); Adams (1998), and Dee et al. (1996, 1998);[7] and (3) modeling of links between parents and affiliates and distinctions between foreign and domestic firms in a given country/region – Markusen et al. (1993, 1999); Benjamin and Diao (1997); Petri (1997); and Dee and Hanslow (1999).

Two of the studies that model links between parents and affiliates set a standard for other work that has followed. Petri (1997) introduces a model of foreign direct investment into a standard applied general equilibrium model using a nested utility function. Goods in the Petri model are produced by multinational firms. The multinational firms headquartered in each country produce a good that is differentiated from goods produced by firms headquartered in other countries. Multinationals locate plants around the world. Each of the plants themselves produces a variety that is differentiated from the variety produced in a plant in another host country.

Production in each host country requires inputs of capital, labor, intermediate inputs produced locally and an intermediate input imported from headquarters. Capital is allocated internationally depending on relative profitability of production in various locations. However, investors hold a diversified portfolio, so rates of return will vary across national locations.

[7] For some additional recent CGE modeling studies that focus on issues of international capital

Markets in the Petri model are perfectly competitive. Goods are aggregated into three sectors: primary, manufacturing and services. Barriers to multinational activities are modeled as region-specific taxes on capital income derived from foreign investments. Not surprisingly, barriers in the service sectors are considerably higher than in the primary and manufacturing sectors. The model has been used to analyze the economic effects of APEC's "Bogor Declaration."

A second approach has been developed by Markusen, Rutherford and Tarr (1999). They have constructed a small-country two-good model of trade in services. Though not used for policy analysis, the Markusen et al. model suggests an attractive approach for modeling services trade. They capture the essence of imported services through two channels: (1) the special knowledge needed to produce the foreign variety of services combined with (2) the importation of specialized intermediate inputs.

Services are treated as inputs in the production of one good in the Markusen et al. model. Service inputs are differentiated by firm and are supplied by both domestic and foreign firms. Producers purchase some of all service varieties available. A foreign firm that seeks to enter the market for services must first make a fixed investment. The foreign firm then faces a constant marginal cost composed of skilled and unskilled labor and an intermediate input imported from headquarters. The market structure for services is monopolistically competitive. Services providers set an optimal mark-up of price over marginal cost, and entry guarantees that profits are zero. The model is used conceptually to compare an equilibrium in which no trade in services is permitted with one in which free trade in services is permitted.

Unlike Petri and Markusen et al., our previous work, as noted, has not focused on the behavior of multinational firms. What we propose now is to address the issues of modeling services trade and FDI and the associated barriers along the lines of the third group of studies noted in Table 11. Let us turn then to our adaptation of the Michigan model.

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mobility, see Ianchovichina et al. (1999), Verikos and Hanley (1999), and Walmsley (1999).

IV. Adaptation of the Michigan CGE Model

Our model employed in this study draws from the structure developed by Petri and Markusen et al. The equations of the model and a list of variables are available from the authors on request. Each multi-national firm (MNC) produces a differentiated product and allocates production to its various host country locations. Each location has different characteristics of production. Therefore, the outputs supplied by a MNC from the various locations are imperfect substitutes.

Consumers use a three-stage budgeting procedure. Following the demand structure first developed by Petri, consumers first allocate expenditure between an aggregate of the output of a representative firm headquartered domestically and an aggregate of the output of firms headquartered in other countries. At the second stage, expenditure on the import aggregate is allocated across the varieties produced by representative firms headquartered in each of the foreign countries. At the third stage, expenditure on the output of each representative firm is allocated across the various plant locations.

Dee and Hanslow (1999) have produced a variant on the Petri model. Like Petri, Dee and Hanslow assume that consumers follow a three-stage budgeting procedure. However, in the first stage, consumers allocate expenditure between goods produced domestically and varieties imported. At the first stage consumers are not concerned with the nationality of each firm's headquarters, but rather the nationality of the plant location. At the second stage, consumers allocate imports across goods produced by each trade partner. At the third stage, imports from each national source and domestically produced goods are allocated across the various multinational firms.

Dee and Hanslow also incorporate imperfect competition. Firms are assumed to set an optimal mark-up over marginal cost. Entry and exit may not occur. Therefore, firm profits may not be zero.

In order to test the sensitivity of the model to the market structure, both the Petri and Dee and Hanslow approaches have been incorporated into the Michigan Model. Results from the two demand structures will be compared.

Turning to firm behavior, in order to undertake production, each MNC must employ capital and labor to engage in product development at their headquarters location. This expenditure generates a fixed

cost of labor and capital at home. The MNC then faces a fixed set-up cost of capital and labor in the host country location. Production, itself, requires capital, labor, and intermediate inputs. Intermediate inputs are both produced locally and imported. They are then used in fixed proportion with the primary inputs.

Firms set a price for the output of each plant with an optimal mark-up of price over marginal cost. The elasticity of demand is derived assuming that each stage of the consumer's utility function is CES with an elasticity of substitution equal to 3. However, the elasticity of substitution among various MNC products is taken to be 4. We consider both the possiblity of free entry, in which case each MNC's profits over all locations sum to zero. In separate simulations, we hold the number of firms in each country fixed, as in Dee and Hanslow,

Labor is taken to be freely mobile between sectors but not across borders. Therefore, there is an equilibrium wage for each country. Capital, however, is mobile internationally. New firms that enter a market purchase capital on international markets for installation in the host country. The degree of international capital mobility can be set exogenously. The rate of return paid for capital depends on the international interest rate plus a risk premium.

The risk premium paid by capital importers in a country depends on the overall change in its capital stock. In the results presented below, we experiment with various risk-premium elasticities in order to demonstrate the role of capital mobility in determining the effects of liberalization of trade in services. First, we will assume that capital is perfectly mobile between countries. Then we will assume that a one percent increase in a country's capital stock due to capital imports will generate a 0.5 percentage point increase in the interest rate.

Barriers to foreign direct investment are modeled in one of two ways. First, the barrier to foreign firms may take the form of an increased fixed cost of locating in a host country. Second, the barrier may take the form of a tax on installed capital. In the version of the model presented below, we focus on barriers that increase fixed cost.

Market equilibrium requires that consumers be willing to purchase the output sold by firms. In addition, each country is governed by a balance of trade constraint. Each country raises foreign exchange

by selling products, exporting capital, receiving remittances of operating surpluses from foreign subsidiaries and receiving subsidies from foreign headquarters for local subsidiaries that run an operating loss. A country which exports physical capital is paid interest each year. The rate of return is taken to be 15 percent. In addition, each MNC's subsidiaries are required to rebate any operating profits back to headquarters. However, subsidiaries that lose money receive a subsidy from headquarters to cover operating expenses. Foreign exchange is spent on goods imports, interest paid on physical capital imports, and remittance of operating profits to headquarters.

V. Data, Parameters, and Solution Procedure

There are 18 countries in the model trading three goods. Other countries of the world are aggregated into a single rest of world (ROW).

The model is specified using version 4.1 of the GTAP model of world trade. Data on foreign direct investment were provided by the Productivity Commission of the Australian Government and data on the barriers to foreign direct investment were provided by Bernard Hoekman, as indicated in our Tables 9 and 10.

Hoekman estimates the margin between price and marginal cost. Some of this gap is attributable to fixed cost. However, the estimates vary across countries. Therefore, in most cases, some of the price-cost gap can also be attributed to barriers to foreign direct investment. The price-cost gap is smallest (in most sectors) for Hong Kong, a country thought to be freely open to foreign firms. Hence, we will assume that the price-cost gap in Hong Kong is attributable to fixed cost. The excess in any other country in the model above the Hong Kong figures is taken to be due to barriers to foreign firms. The barrier is modeled as the cost increase is attributable to an increased in fixed cost born by multinationals attempting to establish an enterprise locally. In the experiments conducted below, the average fixed cost is reduced by the margin estimated by Hoekman.

VI. Liberalization Scenarios and Computational Results

We have performed seven liberalization scenarios. A summary of results is presented in Table 12. In scenario A, all barriers to trade in services are eliminated, capital is taken to be perfectly mobile between countries and the world-wide capital stock is held constant. We adopt the demand structure developed by Petri and free entry guarantees that profits are zero.

The changes in imports and exports are presented are columns (2) and (3), the percent change in the terms of trade is reported in column (4), welfare effects as a percent of GNP and in millions of dollars are presented in columns (5) and (6) and the percent change in the real wage is reported in column (7).

It is immediately apparent from columns (5) and (6) that welfare consequences of trade in services are both large and vary markedly across countries. The lion's share of the gain accrues to Japan, which enjoys $362.6 billion welfare gain, which is 7.1 percent of GNP. Japan's gain comes at the expense of the United States, which suffers a welfare decline of $220.3 billion, or 3.1 percent of GNP.

However, some smaller countries experience much larger changes in welfare when viewed in percent terms. For example, New Zealand's welfare rises by 29.7 percent while Mexico's welfare declines by 24.1 percent.

As we will see below, welfare effects are strongly associated with whether or not a country attracts or loses capital. Countries that lose capital become "smaller" in the economic sense of the word. As the economy contracts, surviving firms produce less than before. The fall in firm output generally occurs in order to avoid a large loss in variety of domestically produced goods. The subsequent economy-wide reduction in realized scale economies is usually the source of the welfare loss.

The percent change in wages is reported in column (7). Wage changes generally reflect the loss in national welfare. For example, wages in Mexico decline by 33.1 percent while wages in Hong Kong rise by 41.4 percent. Wage changes also mirror capital flows. It is generally the case that countries that acquire capital will see an increase in capital per worker. The consequent rise in the marginal value product of workers raises the wage by more than the overall welfare increase. That is, in most cases in which national welfare rises, wages rise also and by a greater percentage.

By contrast, labor is made worse off in countries where an outflow of capital occurs. For example, in Mexico, national welfare falls by 24.1 percent but wages fall by an even greater 33.1 percent.

In scenario A, there is a rise in the real return to capital. Therefore, it is likely that over time, there will be an increase in the world's capital stock. In scenario B, the world's capital stock is increased by 10 percent. This is the amount necessary to hold the real return to capital equal to the level in the base period. A summary of results is presented in section B of Table 12.

As we can see from columns (5), (6) and (7), the welfare effects of services liberalization are now positive for most countries. Mexico and Taiwan still suffer a decline in welfare, but the loss is much smaller than in the absence of new capital formation.

The results presented here, however, are very sensitive to the degree of international capital mobility. As discussed above, countries that import capital must pay a risk premium that is a function of capital imports. The elasticity of the risk premium with respect to the volume of capital imports can be set exogenously in the model. In section C, we assume that capital imports that result in a one percent increase in the capital stock generate an interest rate risk premium of 0.5 percent. That is, the risk premium elasticity is 0.5.

It is immediately apparent that an increase in the risk premium elasticity, signifying a decrease in capital mobility, significantly reduces the welfare effects of services liberalization. For example, New Zealand's welfare gain falls to 12.7 percent in scenario C, down from 29.7% in scenario A.

Again, there is an increase in the real return to capital. However, the larger the risk premium elasticity the smaller the increase in the demand for capital. Hence, the smaller the increase in the real return. When the risk premium elasticity is set at 0.5 only a 5 percent increase in the world's capital stock is necessary to maintain the real return at the base level. Results are reported in section D of Table 12. The dispersion of welfare results is now far smaller than before. For example, in scenario D, Mexico's welfare loss is only 2 percent of GNP as compared to nearly 10 percent in scenario B. Notice, however, that with a smaller increase in the world's capital stock the number of countries that gain from liberalization is now also smaller than before. In scenario B with perfect capital mobility, only Mexico

suffered a significant decline in welfare. By contrast, in scenario D, significant welfare losses were suffered by Canada (-3.7%), China (-4.2%), Indonesia (-6.1%) and Taiwan (4.4%).

It should be noted, that the welfare effects in scenario D, while smaller than in previous scenarios, are still far larger than we are accustomed to seeing from trade liberalization experiments in applied general equilibrium models. However, this is not a surprising result. It has been apparent from previous AGE analysis of trade liberalization that the largest welfare gains stem the subsequent capital flows rather than from the removal of consumer distortions in goods trade.

We next turn to the demand structure developed by Dee and Hanslow. Results reported in Table 12, section E are generated assuming that capital is perfectly mobile internationally, the world capital stock is fixed and there is free entry. Results from a similar experiment are reported in section F under the assumption that the risk premium elasticity is 0.5.

By comparing sections A and E of Table 12, it is immediately apparent that the model is extremely sensitive to the demand structure. Japan still gains more than any other country in absolute terms. However, Mexico was the biggest loser in percent terms under the Petri specification now becomes the biggest gainer under the Dee and Hanslow specification. Similar but smaller welfare reversals occur for Australia, Korea, Malaysia, Singapore, and ROC.

Finally, we undertake a scenario that most closely reflects the assumptions made by Dee and Hanslow. International capital flows are imperfect, there is no change in the capital stock, the number of firms headquartered in each country is fixed and we adopt the Dee and Hanslow demand structure. Results are reported in section G of table 12. Clearly, fixing the number of firms dramatically reduces the dispersion of welfare affects across countries. Firms are no longer able to relocate in order to take advantage of low cost product development sites. The largest positive welfare gain accrues to New Zealand (15.2%) and the largest loss is borne by China (-8.3%). By contrast, when the number of firms is allowed to vary the largest gainer is still New Zealand but the welfare impact is over twice as large as can be seen from section F of Table 12.

Sectoral Results

Detailed sectoral results for scenarios A and B are reported in Tables 13 and 14, respectively. In each case, we report the percent changes in exports and imports in columns (2) and (3), industry output in column (5), number of firms headquartered locally in column (6) and the output of foreign-owned affiliates in column (7).

Consider first the impact on sectoral output in scenario A reported in column (5) of Table 13. It is generally, though not exclusively, the case that countries that reported a decline in welfare in Table 12 also report a decline in output in Table 13. For example, Australia's output declines in all three sectors and welfare declines by 1.5 percent. A similar pattern emerges for the European Union, Indonesia, Korea, Malaysia, Taiwan, Thailand, the United States and Rest of Cairnes. The general fall in output across sectors is almost certainly the result of a loss in capital. Notice also, that most of these countries suffer a decline in output per firm and, therefore, smaller realized scale economies. This can be seen by comparing sectoral output with the number of firms. For example, output per firm declines in all three sectors in Canada, Korea, Mexico, Taiwan, Thailand, the United States, and rest of Cairnes. Scale losses also emerge in the manufacturing and services sectors of the EU and the agriculture and services sector in Malaysia.

By contrast, countries that report a welfare gain in Table 11 also report a rise in sectoral output and realization of economies of scale. Output increases economy-wide in Chile, China, Hong Kong, Japan, and New Zealand as foreign capital flows in. The only exception is agricultural output in Japan which accounts for a very small share of GNP. Scale effects are also generally positive. Output per firm in all three sectors rises in China, in agriculture and manufacturing in Chile, and in manufacturing and services in Japan and New Zealand.

The economic expansion enjoyed by these five countries is also accompanied by increased activity by foreign-owned affiliates, as can be seen in column (7) of Table 13. In fact, for China, foreign-owned affiliates are leading the economic expansion. By contrast, countries that lose capital may also see

a decline in the activities of multinational firms. Mexico is the most notable example in which affiliate output declines on the order of 20 percent in all three sectors.

However, it is important to note that in cases where production declines, the conduct of multinationals dampens the overall negative effect. For example, in all three sectors in Korea, Malaysia, Mexico, the Philippine Islands, Taiwan, Thailand, the United States, and Rest of Cairnes, the percent change in foreign-affiliate output is always larger than for the sector overall. Therefore, even though these countries are made worse off by global services liberalization, their loss would have been even larger had they not liberalized themselves.

In Table 14, we report sectoral effects under the assumption of perfect capital mobility and a 10 percent increase in the world's capital stock. Notice that the increase in the world's capital stock generates an increase in output in nearly every sector of every country. Furthermore, foreign-affiliate output rises in every sector in every country. The major exception remains, Mexico, of course, but the decline in output is now less than half the decline that occurred when the world's capital stock was not augmented.

Notice, also, that the realization of economies of scale is now far more prevalent than before. Scale gains emerge in every sector in Chile, China, the EU, the Philippine Islands, and Rest of Cairnes and in two of the three sectors in Australia, Indonesia, Japan, Korea, Malaysia, New Zealand, Taiwan, Thailand, and the United States. However, once again, Mexico is hard hit, suffering a decline in output per firm in all three sectors.

VII. Conclusions and Policy Implications

We have presented an applied general equilibrium model of the behavior of multinational enterprises. The model was used to evaluate the likely trade, production and welfare effects of liberalization of trade in services. We find that the welfare effects of services liberalization are large under all parameter specifications. Our results are surprising in light of previous analysis of liberalization experiments concerning trade in goods. However, it also the case that previous work indicated that

capital formation plays a far more important and substantive role than consumer distortions in determining the welfare effects of goods trade. In the analysis of the behavior of multinational firms, the international allocation of physical capital plays a central role. As a consequence, the welfare effects are far more pronounced than in previous applied general equilibrium analysis of trade liberalization.

Generally, it is the case that welfare gains emerge for those countries that succeed in attracting physical capital. The capital inflow is correlated with an expansion in output by most or all sectors of the economy. Furthermore, firms in expanding sectors also increase output, thus realizing economies of scale. The improvement in the scale of production contributes to the welfare gain for capital importing countries. By contrast, welfare effects for countries that experienced a capital outflow were generally negative.

In the initial liberalization scenarios, the real return to capital increased. So we then considered the possibility that new capital formation might occur. The expanding world capital stock permitted most countries of the model to increase output economy-wide. Realization of economies of scale for most countries in the model emerged as well. As a consequence, nearly all countries gained from services trade liberalization.

We then experimented with various degrees of international capital mobility. Not surprisingly, the less mobile capital the smaller the trade and welfare effects of liberalization. This is the case for both the absolute level and the dispersion. Nevertheless, the impact of trade in services was still substantial even for a fairly low degree of international capital mobility.

Countries that lose from global services liberalization may be tempted to forgo multilateral negotiations. However, in the competition for international capital, the countries that liberalize services will gain at the expense of those countries that attempt to preserve barriers. Therefore, countries are more likely to gain or minimize their losses if they engage in liberalization as well.

We then experimented with various other demand configurations and market structures. It is clear that the results are extremely sensitive to the assumed demand structure and whether or not entry

can occur. Much work remains to be done to fully understand the mechanics of the model that characterize the competing assumptions concerning consumer preferences.

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Table 1
Trade in Services by Modes of Supply, 1997

Mode of Supply[a]	Category	Value ($bn)	Cumulative share (%)
Mode 1	Commercial services (excl. travel)	890	41.0
Mode 2	Travel	430	19.8
Mode 3	Gross output of foreign affiliates	820	37.8
Mode 4	Compensation of Employees	30	1.4
Total		2,170	100.0

[a]Modes 1, 2, and 4 are derived from balance-of-payments data.

Source: Karsenty (1999).

Table 2
Barriers to FDI

Restrictions on market entry	Bans on foreign investment in certain sectors Quantitative restrictions (e.g., limit of 25 per cent foreign ownership in a sector) Screening and approval (sometimes involving national interest or net economic benefits tests) Restrictions on the legal form of the foreign entity Minimum capital requirements Conditions on subsequent investment Conditions on location Admission taxes
Ownership and control restrictions	Compulsory joint ventures with domestic investors Limits on the number of foreign board members Government appointed board members Government approval required for certain decisions Restrictions on foreign shareholders' rights Mandatory transfer of some ownership to locals within a specified time (e.g., 15 years)
Operational restrictions	Performance requirements (e.g., export requirements) Local content restrictions Restrictions on imports of labor, capital and raw materials Operational permits or licences Ceilings on royalties Restrictions on repatriation of capital and profits

Source: UNCTAD (1996).

Table 3
Constructed Ad Valorem Tariff Equivalent "Guesstimates" by 1-Digit ISIC Services Sectors for Selected Countries (Percentage)

Country	ISIC 5 Con-struction	ISIC 6 Wholesale & Retail Distr.	ISIC 7 Transp., Storage & Communic.	ISIC 8 Business & Fin. Services	ISIC 9 Social & Personal Services
Australia	12.0	7.4	183.4	24.8	25.4
Austria	5.0	4.6	98.7	20.1	13.9
Canada	6.0	9.0	117.7	25.9	40.2
Chile	40.0	34.4	182.2	45.2	42.9
European Union	10.0	10.0	182.0	27.2	23.6
Finland	19.0	14.6	181.0	23.8	31.7
Hong Kong	32.0	31.5	149.8	39.0	42.9
Japan	5.0	4.6	142.0	28.9	32.3
Korea	16.0	21.4	164.9	36.3	40.7
Mexico	24.0	21.3	152.3	40.9	29.8
New Zealand	5.0	13.4	181.5	30.5	36.1
Norway	5.0	13.4	122.2	25.7	24.0
Singapore	12.0	34.4	138.8	35.9	33.7
Sweden	12.0	13.4	184.2	22.5	26.9
Switzerland	5.0	8.0	178.1	27.7	32.3
Turkey	5.0	34.4	31.6	35.4	35.9
United States	5.0	4.6	111.4	21.7	31.7

Source: Hoekman (1995, pp. 355-56).

Table 4
Components of an Index of FDI Restrictions

Type of restriction	Weight
Foreign equity limits on all firms	
No foreign equity permitted	0.5
Less than 50 per cent foreign equity permitted	0.5
More than 50 per cent and less than 100 per cent foreign equity permitted	0.25
Foreign equity limits on existing firms, none on greenfield	
No foreign equity permitted	0.5
Less than 50 per cent foreign equity permitted	0.25
More than 50 per cent and less than 100 per cent foreign equity permitted	0.125
Screening and approval	
Investor required to demonstrate net economic benefits	0.1
Approval unless contrary to national interest	0.075
Notification (pre or post)	0.05
Control and management restrictions	
All firms	0.2
Existing firms, none for greenfield	0.1
Input and operational restrictions	
All firms	0.2
Existing firms, none for greenfield	0.1

Source: Hardin and Holmes (1997, p. 76).

Table 5

FDI Restrictiveness Indices for Selected APEC Economies and Selected Sectors (Percentage)

	Business	Communications	Distribution	Education	Financial	Transport
Australia	18	44	18	18	45	20
Canada	23	51	20	20	38	24
China	36	82	28	53	45	46
Hong Kong	2	35	5	0	23	9
Indonesia	56	64	53	53	55	53
Japan	6	35	5	20	36	11
Korea	57	69	63	55	88	57
Malaysia	32	42	8	8	61	12
Mexico	29	74	33	45	55	28
New Zealand	9	43	8	8	20	13
Papua New Guinea	30	48	30	30	30	30
Philippines	48	76	48	48	95	98
Singapore	26	52	25	25	38	25
Thailand	78	84	78	78	88	78
United States	1	35	0	0	20	3

Note: The higher the score, the greater the degree to which an industry is restricted. The maximum score is 100%.
Source: Adapted from Hardin and Holmes (1997, pp. 112-137).

Table 6
Price Wedge Data for Banking Services in Selected Economies
(Percentage)

Economy	Foreign or Domestic	Barriers to Establishment	Barriers to Ongoing Operations	Total
Argentina	F	2.53	2.81	5.34
	D	0.00	0.00	0.00
Australia	F	7.08	2.22	9.31
	D	0.00	0.00	0.00
Brazil	F	35.06	10.50	45.56
	D	0.00	0.87	0.87
Canada	F	2.53	2.81	5.34
	D	0.00	0.00	0.00
Chile	F	22.74	11.26	34.00
	D	15.47	7.73	23.20
Colombia	F	6.47	11.88	18.35
	D	3.54	0.00	3.54
Hong Kong	F	1.97	4.94	6.91
	D	0.00	2.65	2.65
India	F	28.58	26.50	55.08
	D	3.54	0.00	3.54
Indonesia	F	32.91	16.42	49.33
	D	0.00	5.35	5.35
Japan	F	2.05	13.22	15.26
	D	0.00	10.03	10.03
Korea	F	18.15	18.58	36.73
	D	0.00	14.93	14.93
Malaysia	F	35.92	24.69	60.61
	D	15.38	6.73	22.11
Mexico	F	10.48	2.92	13.40
	D	0.00	0.00	0.00
New Zealand	F	2.52	2.18	4.69
	D	0.00	0.00	0.00
Philippines	F	33.28	14.08	47.36
	D	7.32	3.66	10.99
Singapore	F	10.69	20.76	32.45
	D	0.00	8.15	8.15
South Africa	F	2.64	12.27	14.90
	D	0.00	0.00	0.00
Switzerland	F	2.24	3.71	5.95
	D	0.00	0.00	0.00
Thailand	F	20.56	12.50	33.06
	D	0.00	0.00	0.00
Turkey	F	23.12	8.43	31.54
	D	3.54	0.00	3.54
USA	F	1.95	2.80	4.75
	D	0.00	0.00	0.00

Uruguay	F	15.35	24.99	40.34
	D	11.00	0.00	11.00
Venezuela	F	5.35	8.09	13.44
	D	0.00	0.00	0.00
EU12*	F	2.52	2.80	5.32
	D	0.00	0.00	0.00

*Covers 12 EU economies. Finland, Ireland, and Luxembourg are not covered.
Source: Warren and Findlay (1999) and Philippa Dee (Australian Productivity Commission).

Table 7
Tariff Equivalents of Barriers to Telecommunication Services in Major Nations
(Percentage)

	Domestic	Foreign
Australia	0.31	0.31
Austria	0.85	0.85
Belgium	0.65	1.31
Brazil	3.81	5.68
Canada	1.07	3.37
Chile	1.68	1.68
Hong Kong	1.26	1.26
Colombia	10.55	24.27
Denmark	0.20	0.20
Finland	0.00	0.00
France	0.34	1.43
Germany	0.32	0.32
Ireland	1.46	2.67
Italy	1.00	1.00
Japan	0.26	0.26
Korea	4.30	8.43
Mexico	6.24	14.43
Netherlands	0.20	0.20
New Zealand	0.27	0.27
Singapore	2.10	2.72
Spain	2.03	3.93
Sweden	0.65	0.65
Switzerland	1.23	1.23
Turkey	19.59	33.53
United Kingdom	0.00	0.00
United States	0.20	0.20

Source: Adapted from Warren (1999a).

Table 8

Estimated Tariff Equivalents in Traded Services:
Gravity-Model Based Regression Method
(Percentage)

Countries/regions	Business/financial services	Construction
North America[+]	8.2	9.8
Western Europe	8.5	18.3
Australia and New Zealand	6.9	24.4
Japan	19.7	29.7
China	18.8	40.9
Taiwan	2.6	5.3
Other Newly Industrialized Countries	2.1	10.3
Indonesia1	6.8	9.6
Other South East Asia	5.0	17.7
India	13.1	61.6
Other South Asia[*]	20.4	46.3
Brazil	35.7	57.2
Other Latin America	4.7	26.0
Turkey*	20.4	46.3
Other Middle East and North Africa	4.0	9.5
CEECs & Russia	18.4	51.9
South Africa	15.7	42.1
Other Sub-Saharan Africa	0.3	11.1
Rest of World (ROW)	20.4	46.3

[*]Turkey and Other South Asia are not available, separately, in the U.S. data, and have been assigned estimated ROW values.
[+]North America values involve assigning Canada/Mexico numbers to the United States.
Source: Francois (1999).

Table 9

Average Gross Operating Margins of Firms Listed on National Stock Exchanges, 1994-96 by Country/Region (Percentage)

Country/Region	Agriculture	Manufacturing	Services
Australia	8.4	15.5	16.6
Canada	32.1	22.6	32.9
Chile	39.1	40.8	44.0
China	30.6	28.1	49.5
European Union	22.9	23.8	31.6
Hong Kong	25.9	12.8	18.1
Indonesia	41.8	34.3	41.3
Japan	38.4	26.4	28.7
Republic of Korea	11.2	25.7	25.8
Malaysia	22.6	6.0	21.6
Mexico	38.4	39.3	37.2
New Zealand	33.3	16.6	26.8
Philippines	18.1	28.6	42.3
Singapore	0.0	11.1	22.0
Taiwan	19.6	25.1	41.3
Thailand	38.2	27.3	52.6
United States	36.6	21.2	42.3
Rest of Cairns Group[a]	36.3	31.1	39.0

[a]Includes Argentina, Brazil, and Colombia.

Source: Hoekman (1999). Based on calculations using Worldscope (1998) data.

Table 10

Average Gross Operating Margins of Services Firms Listed on National Stock Exchanges, 1994-96, by Country/Region and by Sector (Percentage)

Country/ Region	Recrea-tion	Business services	Construc-tion	Consult-ing	Finance	Health	Hotels	Retail Trade	Wholesale	Transport/ utilities
Australia	17.9	13.8	15.3	7.0	41.0	b	27.3	7.9	9.1	-69.3[c]
Canada	60.1	51.7	14.4	19.2	44.5	2.3	67.8	12.0	16.0	36.5
Chile	b	b	68.7	b	55.2	b	b	21.3	27.9	46.8
China	b	b	45.9	67.1	34.0	b	77.5	24.4	25.5	46.9
European Union	42.5	32.1	19.3	22.1	51.6	22.3	23.7	23.6	19.9	32.6
Hong Kong	b	6.5	12.9	11.5	25.4	b	31.3	10.1	6.9	31.0
Indonesia	b	81.1	22.9	25.3	53.6	b	68.2	26.4	24.8	45.3
Japan	28.1	31.6	14.2	28.6	40.5	40.1	27.2	32.9	15.6	20.6
Republic of Korea	b	41.2	15.3	b	b	b	b	26.7	14.9	31.2
Malaysia	13.3	-39.9[c]	18.3	14.7	28.3	24.3	38.7	11.2	10.8	30.7
Mexico	19.6	b	25.7	37.3	33.3	b	49.6	28.4	25.0	51.0
New Zealand	b	b	13.8	b	57.6	b	26.9	6.6	19.7	35.6
Philippines	19.9	b	40.2	b	53.9	b	55.8	43.9	40.3	42.3
Singapore	46.7	8.6	10.6	7.7	46.3	29.2	28.2	5.4	7.9	28.0
Taiwan	79.9	36.3	21.6	11.1	64.8	b	74.5	21.5	23.2	38.9
Thailand	85.4	35.8	38.1	-8.8	60.3	40.6	55.5	44.2	25.6	56.7
United States	46.8	56.2	20.2	-136.0	56.3	37.0	48.5	34.6	27.0	43.4
Other Cairns[a]	b	b	28.9	26.2	69.8	29.3	64.6	24.2	22.9	52.4

[a]Includes Argentina, Brazil, and Colombia.
[b]Data not available.
[c]Reflects negative gross operating margin.
Source: Hoekman (1999). Based on calculations using Worldscope (1998) data.

Table 11
Alternative Approaches to Modeling the Impact of Barriers to Trade and Investment

1. Reduction in services barriers.
Brown et al. (1996a, b) Based on 8-region, 29-sector, 1990-reference year version of Michigan CGE model, with all goods and services tradable. Uses Hoekman's (1995) "guesstimates" of tariff equivalents covering all modes of providing services, including FDI. Factors involved in FDI assumed to be part of factor markets in country of origin.
Australian Department of Foreign Affairs and Trade (1999) Based on GTAP model, version 4 (1995) database covering 45 regions and 50 sectors in each region, and on the Asia Pacific G-cubed model with 18 regions and 6 sectors, with inclusion of a financial sector and full (dynamic) macroeconomic closure. Uses modifications of Hoekman's (1995) "guesstimates" of services tariff equivalents.
Francois et al. (1996) CGE analysis using 1989 reference year and calculation of the effects of price wedges that can be attributed to the Jones Act that restricts U.S. trade in domestic water transportation (cabotage) services.
Robinson et al. (1999) Based on 10-region, 11-sector, 1995-reference year CGE model, with all goods and services tradable. Uses Hoekman's (1995) "guesstimates" of services tariff equivalents, with allowance for growth in total factor productivity (TFP) stimulated from imports of services by developing countries.
Tamms (1999) Constructs cost functions using data for 50 airlines from 27 countries for 1982-95 and estimates a frontier function to determine the extent to which an airline lies off its frontier.
2. Flows of FDI respond to changes in rates of return.
Martin and Yagashima (1993) Analysis of trade liberalization in Asia-Pacific region coupled with assumed changes in inward FDI.
Donovan and Mai (1996) Use MEGABARE model to estimate effects of trade liberalization with varying degrees of international capital mobility responding to differential rates of return on investment.
McKibbin and Wilcoxen (1996) Use G-Cubed model with international capital mobility responding to changes in differential sectoral rates of return to capital.
Bora and Guisinger (1997) Analysis of investment liberalization in APEC, with allowance for international capital mobility.
Adams (1998) Based on GTAP model, with 14 regions and 37 perfectly competitive sectors, and post-NAFTA database. Each region contributes a fixed proportion of its income to a global savings pool. Investment allocation depends upon relative rates of return. Focus is on effects of trade liberalization in APEC. FDI is not modeled explicitly.

Dee et al. (1996) Based on 13-region, 4-sector, 1992-reference year CGE model, with all goods and services tradable, monopolistic competition in the resources, food processing, and manufacturing sectors, and allowance of capital accumulation and international factor mobility. Uses Hoekman's (1995) "guesstimates" of services tariff equivalents.
Dee et al. (1998) Based on same model and data as Dee et al. (1996), with analysis of APEC sectors selected for "early voluntary sectoral liberalization."
3. Links between parents and foreign affiliates and distinctions between foreign and domestic firms.
Markusen et al. (1995) Analysis of trade liberalization in the automobile industry in the NAFTA countries, using a model with multinational firms or national firms responding to changes in their market shares.
Markusen et al. (1999) Conceptual static and dynamic CGE model used to analyze how inward FDI in producer services may complement domestic skilled labor, affect the pattern of trade in goods, and determine the characteristics of the dynamic adjustment path.
Benjamin and Diao (1997) Based on 10-region, 11-sector CGE model, using data for the early 1990s, with the focus on liberalization of cross-border trade of other private services in APEC. Service providers in the single services sector are imperfectly competitive and have fixed costs, and are able to price discriminate across countries. Liberalization is modeled as both reducing fixed costs and removing the market segmentation that permits price discrimination. FDI is not modeled explicitly, but it could be.
Petri (1997) Based on 6-region, 3-sector CGE model, using 1992 GTAP dataset, with FDI distinguished between activities of domestic and foreign-owned firms. Products differentiated by both country of ownership and place of production. Capital allocation between sectors and between domestic and foreign investments responds to changes in rates of return and to investor preferences. Barriers to FDI modeled as a tax on FDI profits.
Dee and Hanslow (1999) Based on 19-region, 3-sector, 1995-reference year CGE model, with modifications of Petri's (1995) framework and updating of data on FDI stocks, output, and rates of return. Used averages of services barriers for banking and telecommunications services contained in Kalirajan et al. (1999) and Warren (2000).