Measuring the cost of barriers to trade in services

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To what extent can the traditional tools of trade policy analysis be used to analyse the economic costs of barriers to trade in services?

Traditional analysis of trade barriers has focused primarily on the effects of tariffs. These are discriminatory taxes levied on foreign-produced goods at the border of a country.

The Heckscher-Ohlin (HO) framework is a standard framework in which tariffs have been analysed (Heckscher 1919, Ohlin 1933). This framework assumes perfect substitutability between domestically produced and foreign goods of the same type, fixed endowments of primary factors of production, and perfect mobility of those factors between sectors within an economy. The framework has been extended to consider more than two goods and factors (Jones and Scheinkman 1977), the presence of a sector-specific factor of production (Mayer 1974, Mussa 1974), imperfect competition (Markusen 1981), increasing returns to scale (Melvin 1969) and product differentiation (Krugman 1979, Helpman 1981).

But barriers to trade in services are unlike tariffs. They are typically regulatory barriers, rather than explicit taxes. They need not discriminate against foreigners. Indeed, barriers to market access are often designed to protect incumbent firms from *any* new entry, be it by domestic or foreign firms. And barriers to services trade are not restricted to affecting the *output* of services firms. One particularly important category of barriers to services trade — restrictions on foreign direct investment by service firms — affect the use of primary factors. These restrictions

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are recognised in the General Agreement on Trade in Services (GATS) under the WTO, since this agreement recognises commercial presence as one of the modes by which services are traded.

To date, few papers of either a theoretical or empirical nature have reviewed all these aspects of barriers to services trade. A few theoretical papers in the late 1980s examined some of the important characteristics of services, including knowledge intensity (eg Markusen 1989, Melvin 1989). This characteristic also featured in subsequent analysis of goods trade under imperfect competition (eg Grossman and Helpman 1991). But those early theoretical papers did not look at the nature of barriers to services trade. Recently, a few empirical papers have examined the effects of removing barriers to trade in services. Many of these have failed to take account of barriers to commercial presence as an important category of barrier to trade in services (Brown et al. 1995, Brown, Deardorff and Stern 1996, Hertel 1999, Nagarajan 1999). One seminal paper by Petri (1997) introduced a treatment of barriers to foreign direct investment in the services sector, but failed to take into account barriers on the other modes of service delivery. And all empirical papers have suffered from a dearth of convincing empirical estimates of the incidence of barriers to services trade.

A recent empirical paper by Dee and Hanslow (2000) sought to analyse the effects of removing barriers to services trade in a more comprehensive fashion. The barriers included non-discriminatory barriers to market access, as well as discriminatory restrictions on national treatment. They included barriers to commercial presence as well as barriers to the other modes of service delivery. The focus of that paper was to compare the gains from liberalising services trade with the gains from removing all post-Uruguay barriers to trade in agriculture and manufacturing. The paper also compared the gains from the total removal of barriers to services trade with the gains from several alternative approaches to partial liberalisation. It identified significant second-best problems with some approaches to partial liberalisation.

The purpose of this paper is to look more deeply at that analysis of services trade liberalisation to assess the extent to which the traditional Stolper-Samuelson (1941) and Rybczynski (1955) results from the HO framework are still relevant in a more realistic model of services trade liberalisation. In the process, the analysis examines whether and how the benefits of services trade liberalisation are passed on to other sectors in the economy. Thus, the analysis tries to open up the ‘black box’ of what is a rather complex general equilibrium model of services trade, in order to gain insights into the sectoral results from that model in terms of more simple textbook treatments of trade policy analysis.

The structure of the paper is as follows. It first describes the model used — a multi-sector, multi-regional computable general equilibrium model of world trade and investment. The theoretical structure of the model covers both FDI and portfolio investment. The model's database contains estimates of FDI stocks and the activities of FDI firms, each on a bilateral basis. Thus the model recognises that both goods and services can be delivered via FDI as well as by conventional trade. The paper then looks at the size of the barriers to trade in services, and the cost impost they impose on other sectors of the economy. This analysis uses the first of a comprehensive new set of estimates of barriers to services trade. To understand the general equilibrium effects of removing these barriers, the effects on each sector in selected economies are built up from a more restricted, partial equilibrium multi-country model. To this partial model are gradually added the resource constraints and income linkages associated with general equilibrium. It is as the resource constraints are added that the relevance of Stolper-Samuelson and Rybczynski effects can be analysed. Finally, the paper identifies areas for further research.

1 The FTAP model

The model is a version of GTAP (Hertel 1997) with foreign direct investment, known as FTAP. The treatment of FDI follows closely the pioneering work of Petri (1997). FTAP also incorporates increasing returns to scale and large-group monopolistic competition in all sectors. This follows Francois, McDonald and Nordstrom (1995), among others, who adopted this treatment for manufacturing and resource sectors, and Brown et al. (1995) and Markusen, Rutherford and Tarr (1999), who used similar treatments for services. Finally, FTAP makes provision for capital accumulation and international borrowing and lending. This uses a treatment of international (portfolio) capital mobility developed by McDougall (1993), and recently incorporated into GTAP by Verikios and Hanslow (1999). FTAP is implemented using the GEMPACK software suite (Harrison and Pearson 1996). Its structure is documented fully in Hanslow, Phamduc and Verikios (1999). The model and its documentation are available at the Productivity Commission web site at http://www.pc.gov.au.

Theoretical structure

FTAP takes the standard GTAP framework as a description of the *location* of economic activity, and then disaggregates this by *ownership*. For example, each industry located in Korea comprises Korean owned firms, along with US, Japanese

and other multinationals. Each of these firm ownership *types* is modelled as making its own independent choice of inputs to production, according to standard GTAP theory. And each firm type has its own sales structure.

On the purchasing side, agents in each economy make choices among the products or services of each firm type, distinguished by both ownership and location, and then among the individual (and symmetric) firms of a given type. Thus, the model recognises the firm-level product differentiation associated with monopolistic competition. Firms choose among intermediate inputs and investment goods, while households and governments choose among final goods and services.

Agents are assumed to choose first among products or services from domestic or foreign locations, with a CES elasticity of substitution of 5. They then choose among particular foreign locations, and among ownership categories in a particular location, both with a CES elasticity of substitution of 10. Finally, they choose among the individual firms of a particular ownership and location, with a CES elasticity of substitution of 15. With firm-level product differentiation, agents benefit from having more firms to choose among, because it is more likely that they can find a product or service suited to their particular needs. Capitalising on this, Francois, McDonald and Nordstrom (1995) show that the choice among individual firms can be modelled in a conventional model of firm types (not firms) by allowing a productivity improvement whenever the output of a particular firm type (and hence the number of individual firms in it) expands. But because the substitutability among individual firms is assumed here to be very high, the incremental gain from greater variety is not very great and this productivity enhancing effect is not particularly strong (the elasticity of productivity with respect to output[2] is 1/15 = 0.0667).

The first two choices, among domestic and foreign locations, are identical to the choices in the original GTAP model. They have been parameterised using values, 5 and 10, that are roughly twice the standard GTAP Armington elasticities. Two reasons can be given for doubling the standard elasticities. One is that only with such elasticities can GTAP successfully reproduce historical changes in trade patterns (Gehlhar 1997). The other is that higher elasticities accord better with notions of firm level product differentiation.

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2 The equivalent elasticity of productivity with respect to *inputs* is 0.0667/(1 – 0.0667) = 0.0714, where this latter concept is used by Francois, McDonald and Nordstrom (1995). The elasticities of productivity with respect to output and inputs are not equal because of the assumption of increasing returns to scale. Another reason that scale effects are not strong is that, with this nested structure, the economies of scale are regional rather than global.

The order of the first three choices, among locations and then among ownership categories, is the opposite of the order adopted by Petri (1997). The current treatment assumes that from an Korean perspective, for example, a US multinational located in Korea is a closer substitute for an Korean owned firm than it is for a US firm located in the United States. Petri's treatment assumes that US owned firms are closer substitutes for each other than for Korean firms, irrespective of location.

There are two reasons for preferring the current treatment.

The first is that Petri's treatment produces a model in which multilateral liberalisation of tariffs on manufactured goods produces large economic welfare losses, for most individual economies and for the world as a whole — an uncomfortable result at odds with conventional trade theory. The reason for the result is spelt out in more detail in Dee and Hanslow (2000).

The second reason for preferring the current treatment is that, in many instances, it accords better with reality. One of the distinguishing characteristics of services is that they are tailored each time to meet the needs of the individual consumer. Another characteristic is that they are often delivered face to face, sometimes making commercial presence (through FDI) the only viable means of trade. These taken together mean that service firms in a given location, irrespective of ownership, will tailor their services to meet local tastes and requirements, and thus appear to be close substitutes, as in the current treatment.

While the demand for the output of firms distinguished by ownership and location is determined as above, the supply of FDI is determined by the same imperfect transformation among types of wealth as in Petri (1997). Investors in each economy first divide their wealth between 'bonds' (which can be thought of as any instrument of portfolio investment), real physical capital, and land and natural resources in their country of residence. This choice is governed by a CET semi-elasticity of 1, meaning that a one percentage point increase in the rate of return on real physical capital, for example, would increase the ratio of real physical capital to bond holdings by one per cent. A bond is a bond, irrespective of who issues it, implying perfect international arbitrage of rates of return on bonds. However, capital in different locations is seen as different things. Investors next choose the industry sector in which they invest (with a CET semi-elasticity of 1.2). They next choose whether to invest at home or overseas in their chosen sector (with a CET semi-elasticity of 1.3). Finally, they choose a particular overseas region in which to invest (with a CET semi-elasticity of 1.4).

The less than perfect transformation among different forms of wealth can be justified as reflecting some combination of risk aversion and less than perfect information. It is important to note, however, that while the measure of economic welfare in FTAP currently recognises the positive income contribution that FDI can make, it does not discount that for any costs associated with risk taking, given risk aversion. This is an important qualification to the current results, and will be the subject of further research.

While the chosen CET parameters at each 'node' of the nesting structure may appear low, the number of nests means that choices at the final level (across destinations of FDI) are actually very flexible. For example, it can be shown that, holding total wealth fixed but allowing all other adjustments across asset types and locations to take place, the implied semi-elasticity of transformation between foreign destinations can easily reach 20, and be as high as 60. The variation across regions in these implied elasticities comes about because of the different initial shares of assets in various regional portfolios.

The choice of CET parameters at each 'node' was determined partly by this consideration of what they implied for the final elasticities, holding only total wealth constant. They were also chosen so that this version of FTAP gave results that were broadly comparable to an earlier version of GTAP with imperfect international (portfolio) capital mobility, for experiments involving the complete liberalisation of agricultural and manufacturing protection (Verikios and Hanslow 1999). Imperfect capital mobility was also a feature of the GTAP-based examination of APEC liberalisation by Dee, Geisler and Watts (1996) and Dee, Hardin and Schuele (1998). These parameters thus provide a familiar starting point, from which variations could be made in the future.

In one respect, however, the current version of FTAP does differ from previous versions of GTAP with imperfect capital mobility. The GTAP variants assumed that capital was perfectly mobile across sectors, whereas FTAP has less than perfect sectoral mobility. Furthermore, the choice of sector is relatively early in the nesting structure, so that the implied elasticities guiding choice of sector, holding only total wealth constant, are relatively low (eg 1.2 in the United States). As a result, FTAP tends to exhibit behaviour where resources move less readily between sectors in a given region, but more readily across regions in a given sector, although the differences are not dramatic. The current treatment is consistent with the idea that the knowledge capital often required to succeed in foreign direct investment, despite the difficulties of language and distance, is likely to be sector-specific.

Petri's model assumed that total wealth in each region was fixed. In FTAP, while regional endowments of land and natural resources are fixed (and held solely by each region's residents), regional capital stocks can accumulate over time, and net bond holdings of each region can adjust to help finance the accumulation of domestic and foreign capital by each region's investors. The treatment of capital accumulation follows the original treatment of McDougall (1993), and was also used by Verikios and Hanslow (1999), Dee, Geisler and Watts (1996) and Dee, Hardin and Schuele (1998).

With this treatment of capital accumulation, FTAP provides a long-run snapshot view of the impact of trade liberalisation, ten years after it has occurred. To the extent that liberalisation leads to changes in regional incomes and savings, this will be reflected in changes to the capital stocks that investors in each region will have been able to accumulate. As noted, investors in each region are not restricted to their own savings pool in order to finance capital investment. They may also issue bonds to help with that investment, but only according to their own preferences about capital versus bond holding, and only according to the willingness of others to accept the additional bonds.

Model database

The starting point for FTAP's database was not the standard GTAP database, since this includes measures of trade and investment barriers that are still to be eliminated under the Uruguay Round agreement. Instead, the starting point was an updated version of the GTAP database, following a simulation in which the barriers yet to be eliminated under the Uruguay Round had been removed. Such a database was provided by the work of Verikios and Hanslow (1999), under their assumption of less than perfect capital mobility.

The Petri treatment of FDI requires the addition of data on bilateral FDI stocks, and on the activity levels and cost and sales structures of FDI firms. The methods used to estimate such data were similar to those of Petri. APEC (1995) and United Nations (1994) provided limited data on FDI stocks by source, destination and sector. These data were fleshed out to provide a full bilateral matrix of FDI stocks by source, destination and sector, using RAS methods (Stone, Strzelecki and Welsh 2000). The resulting estimates are summarised in Dee and Hanslow (2000). The data were collected (and the model implemented) for 19 regions and three broad sectors. The three sectors — primary (agriculture, resources and processed food), secondary (other manufacturing), and tertiary (services) — correspond broadly to the three areas of potential trade negotiation in a new trade round. The

intention is to use similar methods to produce a model with greater sectoral detail in the future.

The FDI stock data were used in turn to generate estimates of the output levels of FDI firms. To do this, capital income flows were estimated by multiplying the FDI stocks by rates of return. These capital rentals were then grossed up to get an output estimate for FDI firms, using capital rental to output ratios from the GTAP database. Again, the resulting estimates are summarised in Dee and Hanslow (2000).

The detailed cost and sales structures of FDI firms were assumed to be the same as for locally owned firms, and were obtained by pro-rating the GTAP database. A subject for future research will be to make use of available information on the true cost and sales structures of FDI firms.

In a final step, estimates of existing barriers to services trade were injected into the model's database, using the techniques of Malcolm (1998). The process is documented in Hanslow, Phamduc, Verikios and Welsh (2000).

The estimates of barriers to services trade were the first of a comprehensive new set of estimates, to be documented in Findlay and Warren (2000). Estimates of barriers to trade in banking services were taken from Kaleeswaran et al. (2000), and estimates of barriers to trade in telecommunications services were taken from Warren (2000). The rates can be taken as indicative of post-Uruguay rates, since while the Uruguay Round established the architecture for services trade negotiations, it did not achieve much in the way of services trade liberalisation (Hoekman 1995).

A simple average of the estimates for banking and telecommunications was taken as being typical of most services — all of the GTAP service categories of trade and transport and finance, business and recreational services, and half of public administration and defence, education and health. The remainder of public administration and defence, education and health, along with electricity, water and gas, construction, and ownership of dwellings were assumed to be strictly non-traded (note that engineering services are part of business services, not construction). The resulting average estimates of barriers to trade in the tertiary sector would have been about 50 to 100 per cent bigger, had the banking and telecommunications estimates been taken as indicative of the whole of the services sector. A topic of future research is to use the next version of the GTAP database, which will have more services sector detail, to model barriers to each service separately, thus overcoming the arbitrariness of these assumptions.

Table 1 **Tax equivalents of post-Uruguay barriers to trade and investment (per cent)**

	Imports		*Exports*		*Domestic output*	*Foreign affiliates' output*	*Domestic capital*	*Foreign affiliates' capital*
	Pri	*Sec*	*Pri*	*Ter*	*Ter*	*Ter*	*Ter*	*Ter*
Australia	1.69	7.30	0.65	4.81	0.00	0.69	0.62	14.79
NZ	1.16	4.51	-3.25	3.78	0.00	0.67	0.41	4.18
Japan	16.19	1.81	-8.12	4.41	3.59	4.75	0.33	3.01
Korea	12.95	6.61	-1.22	4.57	5.11	6.78	1.91	22.01
Indonesia	4.40	6.71	0.00	4.68	13.23	28.11	22.69	68.06
Malaysia	21.18	5.97	6.68	4.50	3.58	10.20	15.35	37.58
Philippines	16.16	18.51	-0.10	4.80	8.38	22.65	7.40	54.28
Singapore	3.22	0.56	0.01	4.70	3.40	8.32	2.42	24.50
Thailand	12.12	14.81	-16.98	4.14	4.69	13.36	12.16	36.49
China	8.92	28.45	5.13	4.08	18.75	36.40	123.46	250.66
Hong Kong	0.00	0.00	0.00	9.91	1.39	2.36	1.35	5.41
Taiwan	27.31	5.63	-1.82	4.35	2.88	4.90	1.90	19.19
Canada	3.57	1.40	-0.43	3.54	0.25	1.67	0.53	6.11
USA	1.29	2.24	-0.02	4.26	0.07	1.08	0.00	3.83
Mexico	-1.50	2.99	1.89	5.23	2.17	5.59	0.68	12.99
Chile	6.76	10.26	0.02	4.36	2.97	4.11	14.15	20.36
R. Cairns[a]	3.82	13.39	6.30	4.49	0.98	5.55	7.19	19.45
EU	3.17	1.13	-2.33	4.72	0.10	1.31	1.33	6.49
R. World	15.94	13.67	0.59	4.95	4.89	13.92	39.07	86.97

a Rest of Cairns group — Brazil, Argentina, Colombia and Uruguay.

Source: FTAP model database.

The resulting structure of post-Uruguay barriers to trade in services is summarised in table 1. Barriers to trade in agricultural and food products are represented via a combination of taxes on imports, and subsidies (shown in table 1 as negative taxes) on exports and output. Unfortunately, at FTAP's three sector level of aggregation, the actual taxes on primary exports and output are a combination of subsidies used for protective purposes, and taxes (eg excises on alcohol and tobacco) used for revenue raising. (While the average taxes on primary output are not shown in table 1, they are all relatively small and mostly positive.) In future, using a database with greater sectoral detail will reduce the problems associated with 'aggregation bias'.

The structure of barriers to services trade in the last five columns of table 1 requires some explanation. The General Agreement on Trade in Services (GATS) framework distinguishes four modes of service delivery — via commercial presence, cross border supply, consumption abroad, and the presence of natural

persons. Accordingly, the FTAP model distinguishes barriers to establishment from barriers to ongoing operation. This is similar to the distinction between commercial presence and other modes of delivery, since barriers to establishment are a component of the barriers to commercial presence.

In table 1, barriers to establishment have been modelled as taxes on capital. Barriers to ongoing operation may affect either FDI firms or those supplying via the other modes, and have been modelled as taxes on the output of locally-based firms (either domestic or foreign owned), and taxes of the same size on the exports of firms supplying via the other modes, respectively. The estimates of export taxes on services in the fourth column of table 1 are trade weighted averages of the taxes on exports to particular destinations, where these are equal in turn to the taxes on foreign affiliates' output in the destination region, shown in the sixth column. These are modelled as taxes in the exporting region, rather than as tariffs in the importing region, to allow the rents created by the barriers to be retained in the exporting region. The issue of rents is addressed in more detail shortly.

The GATS framework also distinguishes restrictions on market access from restrictions on national treatment. As noted above, the former are restrictions on entry, be it by locally owned or foreign owned firms. In this sense, they are non-discriminatory. Restrictions on national treatment mean that foreign owned firms are treated less favourably than domestic firms. These restrictions are discriminatory. Thus the taxes on domestic capital and domestic output in table 1 represent the effects of restrictions on market access (affecting establishment and ongoing operation, respectively). The taxes on the capital and output of foreign affiliates are higher than the corresponding taxes on domestic firms, because they represent the effects of restrictions on both market access and national treatment. The estimation of barriers to trade in banking and telecommunications services by Kaleeswaran et al. (2000) and Warren (2000) allowed the price effects to be split up according to this two-by-two classification.

The estimates in table 1 indicate that barriers to trade in services are generally at least as large as those on agricultural and manufactured products. Most economies have at least some significant barriers to trade in services. The only regions where barriers are low across the board are New Zealand, Japan, Hong Kong, Canada, the United States and the European Union. But this statement should be heavily qualified, because it is based only on estimates of barriers to banking and telecommunications.

Barriers to trade in services have been modelled as tax equivalents that generate rents — a mark-up of price over cost — rather than as things that raise costs above

what they might otherwise have been (eg Hertel 1999). This decision was based on the way in which the price impacts of barriers to trade in banking and telecommunications services were measured. Kaleeswaran et al. (2000) measured the effects of trade restrictions on the net interest margins of banks, a direct measure of banks' mark-up of price over cost. Warren (2000) measured the effects of trade restrictions on the quantities of telecommunications services delivered, and these were converted to price impacts using an estimate of the elasticity of demand for telecommunications services. Thus, Warren's estimates did not provide direct evidence of a mark-up of price over cost, but the relative profitability of telecommunications companies in many countries suggests that some element of rent may exist. By contrast, there is evidence that trade restrictions in sectors such as aviation raise costs (Johnson et al. 2000, Tamms 2000). As estimates of the effects of trade barriers in these sectors are incorporated into the model, it will be appropriate to treat some restrictions as cost-raising rather than as rent-creating.

One important implication of the current treatment is that welfare gains from liberalising trade in services are likely to be understated, perhaps significantly. If trade restrictions create rents, then the allocative efficiency gains from trade liberalisation are the 'triangle' gains associated with putting a given quantum of resources to more efficient use. By contrast, if trade restrictions raise costs, the gains from trade liberalisation include 'rectangle' gains (qualified by general equilibrium effects) from lower costs, equivalent to a larger effective quantum of resources for productive use.

Because barriers to services trade appear to be significant, and because they have been modelled as taxes, the rents they generate will be significant. A key issue is whether those rents should be modelled as being retained by incumbent firms, appropriated by governments via taxation, or passed from one country to another by transfer pricing or other mechanisms. In FTAP, the rents on output have been modelled as accruing to the selling region, and those on capital have been modelled as accruing to the region of ownership, once the government in the region of location has taxed them at its general property income tax rate. Despite this, the asset choices of investors are modelled as being driven by pre-tax rates of return. This is because many economies, in the developed world at least, have primarily destination-based tax systems. For example, if tax credits are granted for taxes paid overseas, investors are ultimately taxed on *all* income at the owning region's tax rate. Although such tax credits have not been modelled explicitly, their effect has been captured by having investors respond to relative pre-tax rates of return. Nevertheless, investor choices are also assumed to be determined by rates of return excluding any abnormal rent component. Investors would like to

supply an amount of capital consistent with rates of return including abnormal rents, but are prevented from doing so by barriers to investment. The amount of capital actually supplied is, therefore, that amount that investors would like to supply at rates of return excluding abnormal rents.

Thus a portion of the rent associated with barriers to services trade is assumed to remain in the region of location in the form of property income tax revenue, while the remainder accrues to the region of ownership. Thus liberalisation of services trade could have significant income effects in both home and host regions as these rents are gradually eliminated. Dee and Hanslow (2000) show how significant these effects are, relative to the allocative efficiency effects and other effects normally associated with trade liberalisation.

A final point to note is that the model's database does not contain estimates of barriers to investment in agriculture and manufacturing, even though they are likely to be significant. It is unlikely that a new trade round would include negotiations on them. Nevertheless, their omission will affect the model's estimates of the effects of liberalisation elsewhere, and the results need to be qualified accordingly.

2 The cost impact of barriers to trade in services

Table 1 shows that the direct 'tax equivalents' of barriers to trade in services are often significant, compared with the trade barriers expected to remain in agriculture and manufacturing after full implementation of the Uruguay Round. It also shows that barriers to services trade tend to be much higher in developing than in developed economies.

A priori, this does not mean that the developing economies would suffer most from services trade liberalisation. One reason is that many of the barriers do not discriminate against foreign service suppliers, so removing the barriers can benefit domestic new entrants as much as foreign suppliers. Another reason is that although barriers to services trade are high, if other sectors are intensive users of service inputs, then other sectors could gain significantly from services trade liberalisation.

Figure 1 **Direct and indirect input requirements per unit of final demand**

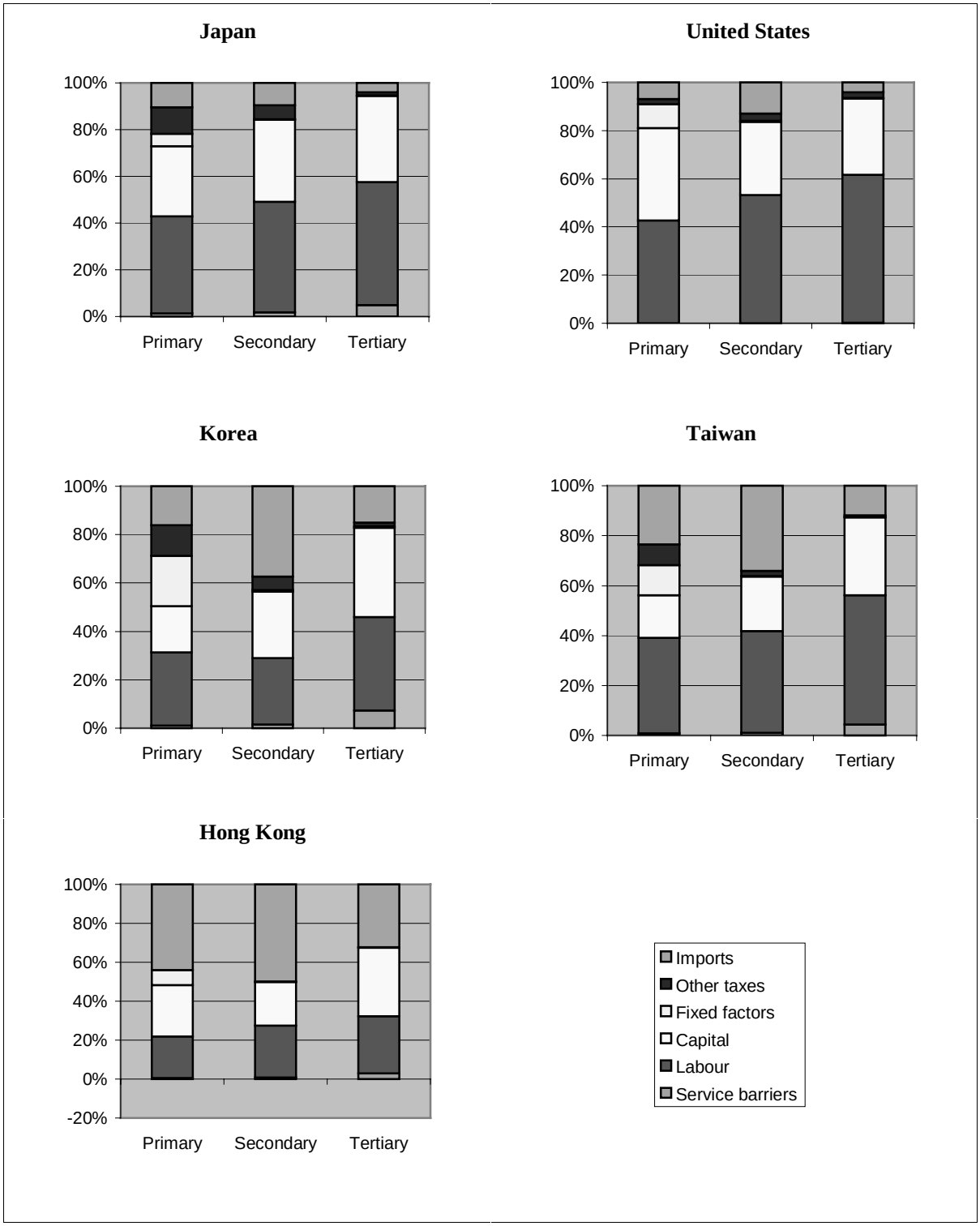

Figure 1 (continued)

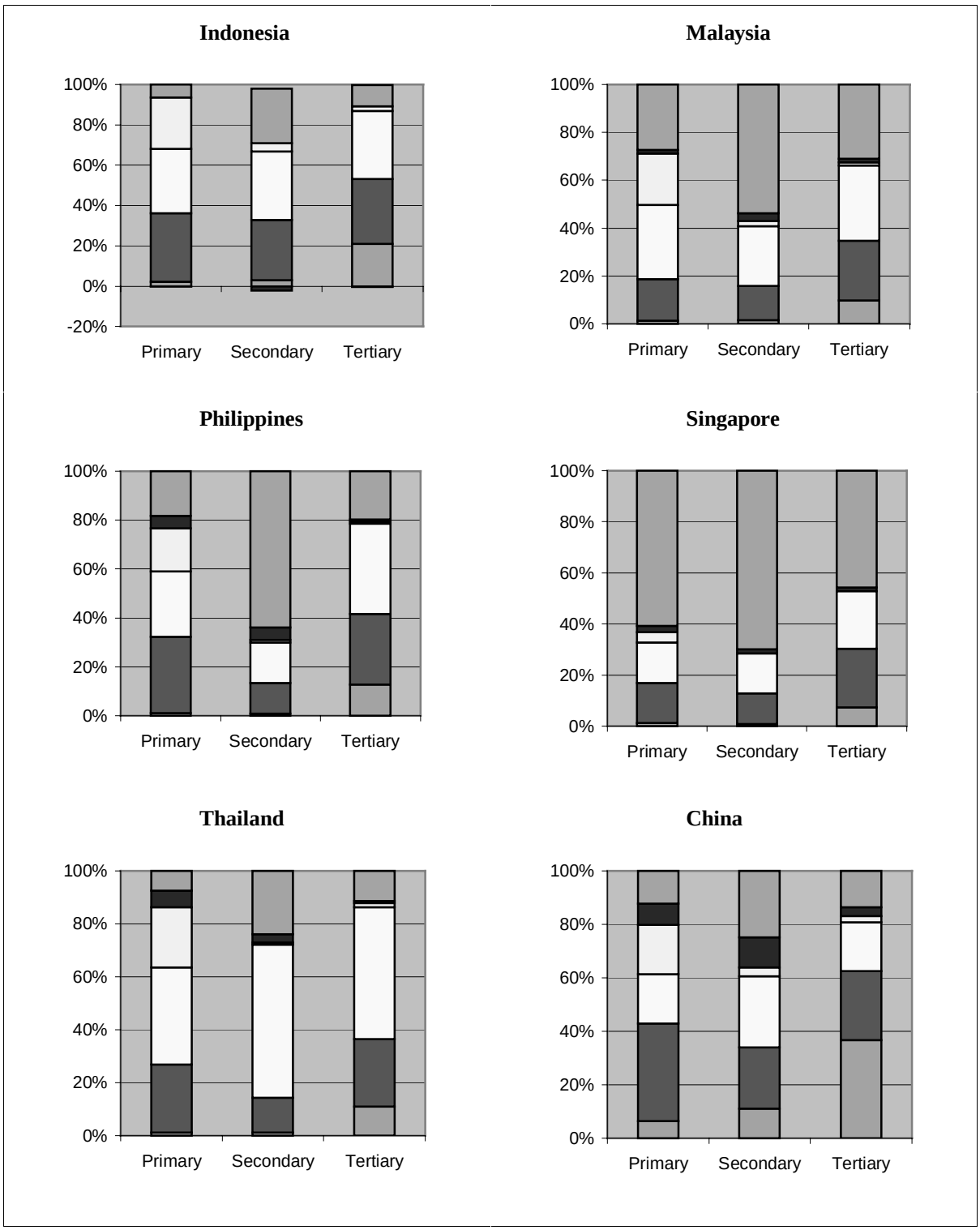

Figure 1 addresses this second point by showing the direct and indirect cost impost those domestic barriers to trade in services impose on all sectors in selected model regions, as calculated from the FTAP model database.

In general terms, the figure shows the direct and indirect input requirements needed to produce a unit of final demand in each sector. For example, a unit of processed food (a primary activity) sold to households might require inputs of unprocessed food (another primary activity), as well as packaging materials from the secondary sector. The packaging materials might again require inputs from forestry (a primary activity), along with electricity from the tertiary sector. Each of these direct and indirect inputs would have their own requirements for labour, capital, fixed factors (land and natural resources) and imported inputs, and these can be added up. Where the cost of the direct and indirect inputs is inflated by taxes, the direct and indirect tax contributions can also be calculated.

Thus, the direct and indirect cost impost of domestic barriers to services trade has been calculated by adding together the following:

- the output and capital taxes on direct and indirect services inputs, where those taxes represent the effects of domestic barriers to commercial presence (both establishment and ongoing operation); and
- the export taxes in the source region falling on direct and indirect imported inputs, where these export taxes represent the effects of domestic barriers to cross-border services trade (where the term ‘cross-border’ is interpreted loosely to include services traded via the temporary movement of the producer or consumer).

All other domestic taxes are collected in the contribution of ‘Other taxes’, and all other taxes on imports (primarily tariffs) are included with the contribution of ‘Imports’.

Figure 1 shows that, in every region shown, the greatest unit cost impost from services trade barriers falls on the services sector itself. This reflects two factors. First, the services sector experiences a direct taxing effect, whereas in other sectors the burden is indirect, through the higher cost of service inputs. Second, this effect is reinforced by the fact that in both developed and developing economies, the services sector itself tends to have a higher direct services input requirement than any other sector. Although other sectors may need service inputs, the greatest intensity of use of services is within the services sector itself. Thus, as will be seen, the benefits of services trade liberalisation in many economies are

concentrated within the services sector. This result is contrary to the normal effects of tariff removal, where the benefits are typically concentrated in other sectors.

Another feature of figure 1 is that in the economies with the highest per capita incomes (Japan, United States, Korea, Taiwan and Hong Kong), the cost impost of domestic services trade barriers on other sectors is minimal. Although these economies tend to be more service-dependent, in terms of having higher direct service input requirements, their domestic barriers to services trade are also relatively low.

Somewhat surprisingly, in the economies with the lowest per capita incomes (Indonesia, Malaysia, Philippines, Singapore, Thailand, China), the cost impost of domestic services trade barriers on other sectors is not much greater. Only in China, where services trade barriers are particularly high, does the cost impost on other sectors approach 10 per cent.

By showing the cost impost of only domestic barriers to trade in services, figure 1 understates the potential first-round impact of multilateral liberalisation of services trade. When barriers are removed globally, not only will domestic goods and services be cheaper, but so too will goods and services available in other economies. This benefit is likely to be significant in the highly import-intensive economies such as Korea, Taiwan, Hong Kong, Malaysia, the Philippines and Singapore. And since the trade and transport services used to ship goods internationally will also be cheaper, there will be an additional cost reduction effect not captured in figure 1.

3 The sectoral effects of removing barriers to trade in services

Partial equilibrium effects

A useful way to understand the sectoral effects of removing barriers to trade in services is to start with a partial equilibrium framework, and to gradually add the economy-wide constraints that distinguish a general from a partial equilibrium approach. This is a very useful technique of analysis developed by Hertel (1997).

An initial partial equilibrium model is obtained by ‘turning off’ the following parts of FTAP.

- Factor supply contraints. Each sector in each region can get all the labour and capital it needs at the going wage or rental price. Thus, the secondary and tertiary sectors in each region have horizontal supply curves (which nevertheless move downward as services barriers are removed). The primary sector continues to have an upward sloping supply curve because fixed factors (land and natural resources) are still treated as being in fixed supply in each economy.
- Income linkages. Irrespective of what is projected to happen to factor prices and other variables, the model's measure of welfare is held fixed in each region. This 'equivalent variation' is essentially a measure of net national product, or the real income accruing to the residents of each economy. In general equilibrium, it is affected not just by the amount of activity generated within a region, but also by net foreign interest and dividend payments associated with foreign borrowing and lending and with FDI.
- The endogenous productivity changes associated with a love of variety.

In partial equilibrium, all the demand side substitution possibilities of the full FTAP model are still in operation. Thus, for example, the demand for the output of the secondary sector in a region will depend on:

- how the cost (and hence price) of its output changes relative to the cost (and price) of output of secondary sectors in other economies, and how consumers and users in each region substitute between domestic and various imported sources of secondary output as a result of those relative price changes;
- how the cost (and hence price) of its output changes relative to the average price (across sources) of primary and tertiary output, and how domestic consumers and government substitute between the outputs of these different sectors as a result of these relative price changes;[3] and
- what the secondary input requirements are per unit of output in other sectors, and whether those other sectors are expanding or contracting.

Thus, even in the partial equilibrium model, the richness of substitution possibilities and inter-industry linkages on the demand side make for a rather complicated story.

[3] In FTAP, as in GTAP, consumers and government are the only agents to substitute directly among different commodities. For intermediate and investment usage, different commodities (aggregated across sources) are used in fixed proportions.

Because real incomes in each economy are assumed to be fixed, it would be expected that unless substitution effects dominate, the demand for, and hence output of, a commodity or service should increase whenever services trade liberalisation reduces its price. And the only sector in which services trade liberalisation would conceivably *not* reduce the price is the primary sector, where the return to the fixed factor could conceivably be bid up. Thus, the presumption is that services trade liberalisation should reduce prices and increase output. Where this does not occur, it must be as a result of substitution effects.

Within the services sector itself, prices fall and output rises in the ASEAN economies and China (table 2). Note that although the prices of domestic services fall in these economies, the prices of imported services fall by significantly more. Thus, substitution towards imports in these economies might suggest that services output should fall. But offsetting this is an increase in exports of services from these economies. In the services sector, the price of a service import in the destination country can fall by significantly more than its output price in the exporting country. This is primarily because services trade liberalisation involves removing the 'export tax' equivalent of barriers to cross-border trade imposed by the destination country. So although domestic services in the ASEAN region and China are disadvantaged relative to imports at home, when those same services are exported, their prices compare favourably with service exports from most other regions. (This is indicated indirectly by the fact that the domestic output price of services falls by more in ASEAN and China than in the other regions.) Thus, the services output expansion in ASEAN and China is primarily an export story.

In the higher per capita income economies, services output falls, despite a reduction the domestic price, because of substitution towards imports. This is in accordance with the relative price movements shown in table 2.

The declines in the output of the secondary sector in Japan and the United States are because of substitution towards imports, especially in intermediate usage. For the other higher income economies (Korea, Taiwan and Hong Kong), the prices of domestic secondary output do not change greatly relative to secondary import prices, so the secondary output expansions in these economies are primarily an export story. In ASEAN and China, the secondary output expansions are because of both increased exports and substitution away from imports.

Table 2 **Partial equilibrium effects on selected regions of removing global barriers to trade in services, by sector[a]**
(per cent)

	Primary			*Secondary*			*Tertiary*		
	Q	*Pd*	*Pm*	***Q***	*Pd*	*Pm*	***Q***	*Pd*	*Pm*
Japan	**-0.3**	-2.4	-0.9	**-1.4**	-2.6	-3.9	**-3.4**	-2.1	-21.9
United States	**-1.3**	-0.7	-1.3	**-7.3**	-0.6	-3.3	**-4.3**	-0.4	-13.6
Korea	**-0.1**	-1.9	-1.0	**2.3**	-2.9	-3.1	**-2.3**	-3.5	-16.3
Taiwan	**1.2**	-1.2	-0.9	**2.9**	-2.3	-2.9	**-4.5**	-2.5	-14.7
Hong Kong	**6.9**	-1.1	0.1	**15.2**	-3.8	-3.9	**-14.5**	-5.2	-23.1
Indonesia	**2.7**	-0.5	-0.9	**8.8**	-3.6	-3.1	**13.4**	-12.1	-30.6
Malaysia	**4.2**	0.5	-0.9	**6.9**	-3.3	-2.9	**0.3**	-8.2	-21.3
Philippines	**1.2**	-1.1	-0.9	**2.9**	-2.9	-2.9	**8.1**	-7.5	-27.9
Singapore	**18.2**	-1.6	-0.9	**8.9**	-3.5	-3.0	**1.9**	-6.7	-19.6
Thailand	**3.1**	0.6	-1.3	**-5.3**	-1.9	-3.0	**0.3**	-7.6	-21.9
China	**36.6**	18.1	-1.2	**132.0**	-10.2	-2.6	**245.2**	-27.9	-31.9

a Q stands for domestic output quantity, Pd stands for domestic price, and Pm stands for import price.

Source: FTAP model projections, partial equilibrium closure.

While in the secondary and tertiary sectors the results are driven primarily by substitution among different sources of each commodity, in the primary sector it is possible to see the effects of households in each region substituting among different commodities. This explains the slight falls in the output of the primary sector in Japan and Korea. In these economies, the prices of imported services fall significantly more than the prices of any other final commodity. Households tend to substitute towards imported services and away from everything else. Thus primary output in these economies falls, despite the price of domestic primary output falling by more than its import price.

In the United States, the effect on primary sector output of households switching away from the primary sector in general is reinforced by substitution (in relative terms) towards primary imports.

In Taiwan, Hong Kong, Singapore and Thailand, the expansion of the primary sector is primarily an export story. (The landed cif price of Thai primary exports falls, despite a slight increase in the domestic output price, because of cheaper international trade and transport services.) This can be confirmed by looking at more detailed model results not shown in table 1.

In Indonesia, Malaysia, the Philippines and China, the switch by households away from the primary sector in general is offset by increased intermediate input demand, and some increase in export demand, for primary sector output. The increased intermediate demand occurs despite an adverse relative price movement against imports (in all but the Philippines), because of inter-industry linkages between the primary sector and the downstream secondary and tertiary sectors.

In summary, multilateral liberalisation of services trade reduces domestic costs and prices across all economies, and the partial equilibrium sectoral effects are of three types.

- In economies such as Japan and the United States, where initial domestic services barriers are particularly low, domestic prices do not fall by much, and substitution towards cheaper imports leads to a reduction in output in all sectors of the economy. Real income can remain constant, however, because of the cheaper imports.
- At the other extreme, in the economies of the ASEAN region and China, where initial domestic services barriers are relatively high, domestic prices tend to fall significantly, and output in (almost) all sectors of these economies expands.
- In between are the economies of Korea, Taiwan and Hong Kong, where initial domestic services barriers are moderate, but where all sectors are more trade exposed than in Japan and the United States. Thus, while the services sectors in these economies may not benefit from services trade liberalisation, at least some of their other sectors benefit from cheaper domestic and imported inputs and thus gain an advantage on export markets.

General equilibrium effects

The partial equilibrium results of table 2 assumed that each sector in each economy could get any additional labour and capital at the going wage or rental price. The results also ignored the income implications of services trade liberalisation.

In table 3, these effects are gradually reintroduced into the model. The first column reproduces the partial equilibrium results from table 2. In the second column, primary factor supply constraints are imposed. As in textbook models, aggregate supplies of capital and labour are assumed to be fixed, and these factors are treated as being perfectly mobile within each sector of the economy. In the third column, sectoral capital stocks are assumed to take the values they would in the full general equilibrium model. Thus, not only do aggregate capital stocks change in each

economy, but capital is no longer perfectly mobile across sectors. Finally, the full general equilibrium results are presented. These incorporate not only the primary factor behaviour of the full general equilibrium model, but also the associated income effects (including the net foreign income flows associated with foreign direct investment).

In broad terms, the imposition of factor supply constraints is the single most important step in taking the partial equilibrium sectoral results towards their general equilibrium values.

Even with factor supply constraints, the results for the tertiary sector in each region are qualitatively quite close to the partial equilibrium results:

- the services sectors in Japan and the United States are still smaller than in the absence of services trade liberalisation;
- the services sectors in most other high income economies are also projected to decline (Korea is the exception); and
- the services sectors in the ASEAN region and China still gain from services trade liberalisation.

But now the wage/rental ratios in each economy adjust to ensure that the induced output changes in other sectors do not lead to a violation of the overall primary factor supply constraints. Thus, the output of the primary and secondary sectors in Japan, the United States, Taiwan and Hong Kong is now projected to rise to counteract the decline in their services sectors. And in the ASEAN region, China and Korea, output in many of the primary and secondary sectors is now projected to decline to offset the expansion of their services sectors.

One question is whether the changes in wage/rental ratios in the ‘fixed factors’ version of the model are consistent with those predicted by the Stopler-Samuelson theorem. That theorem would predict that in the face of a decline in the relative price of services (induced by services trade liberalisation), there would be a decline in the real return to the factor of production used relatively intensively in the services sector. In most economies, that factor is labour (see figure 1). While the assumption of fixed factor supplies and perfect factor mobility is consistent with the assumptions of the Stopler-Samuelson theorem, there are many other assumptions in the ‘fixed factors’ model that do not match the textbook Stopler-Samuelson assumptions exactly. It is nevertheless useful to see if the ‘fixed factors’ model retains a Stopler-Samuelson flavour in the context of services trade liberalisation.

Table 3 **Partial and general equilibrium effects on sectoral output in selected regions of removing global barriers to trade in services**

(per cent)

		Full PE	*Fixed factors*	*Capital as in GE*	*Full GE*
Japan	Primary	-0.3	0.2	-0.3	-0.4
	Secondary	-1.4	0.9	-0.5	-0.3
	Tertiary	-3.4	-0.3	0.2	0.1
United States	Primary	-1.3	2.4	0.4	0.6
	Secondary	-7.3	1.9	0.2	0.6
	Tertiary	-4.3	-0.7	-0.2	-0.4
Korea[a]	Primary	-0.1	-0.5	-0.7	-0.8
	Secondary	2.3	-0.4	-1.4	-1.6
	Tertiary	-2.3	0.3	1.0	1.1
Taiwan[a]	Primary	1.2	0.4	-0.1	0.1
	Secondary	2.9	2.5	0.2	1.0
	Tertiary	-4.5	-1.1	0.1	-0.2
Hong Kong[a]	Primary	6.9	3.7	0.0	0.2
	Secondary	15.2	9.0	-1.2	-2.2
	Tertiary	-14.5	-2.1	0.4	0.6
Indonesia[a]	Primary	2.7	-3.4	0.3	0.3
	Secondary	8.8	-9.7	2.5	2.6
	Tertiary	13.4	8.9	8.5	9.2
Malaysia[a]	Primary	4.2	-1.1	0.0	0.1
	Secondary	6.9	-1.8	0.2	0.1
	Tertiary	0.3	3.3	1.5	1.5
Philippines[a]	Primary	1.2	-3.0	-1.9	-1.9
	Secondary	2.9	-6.6	-2.6	-3.6
	Tertiary	8.1	5.6	2.3	2.5
Singapore	Primary	18.2	3.2	-4.0	-4.0
	Secondary	8.9	-4.2	-5.6	-6.6
	Tertiary	1.9	4.5	0.6	1.0
Thailand[a]	Primary	3.1	0.7	-0.2	-0.1
	Secondary	-5.3	-8.0	-0.7	-0.8
	Tertiary	0.3	8.1	1.3	1.3
China[a]	Primary	36.6	-6.5	-1.1	-0.2
	Secondary	132.0	-16.7	4.5	2.5
	Tertiary	245.2	43.7	28.7	32.5

a Aggregate capital stock projected to increase in general equilibrium closure.

Source: FTAP model projections, partial and general equilibrium closures.

Broadly speaking, the Stolper-Samuelson theorem would predict a decline in the wage/rental ratio in most economies — by contrast, the wage/rental ratio faced by producers in all economies in the 'fixed factors' model is projected to rise. The reason is simple. Services trade liberalisation includes liberalisation of foreign direct investment in the services sector. The removal of taxes on service sector capital leads to a direct and significant decline in capital rentals, relative to wages, since with fixed capital supplies, the loss of rents from barriers to capital are borne directly by capital owners.[4]

Thus, the nature of barriers to services trade leads to a significant departure from one of the standard textbook trade theorems.

The results in the third column hint at the complexity of the capital supply story in the full FTAP model. Even though services trade liberalisation involves removing taxes on service sector capital, it is not always the case that cautious investors would invest more in those service sectors than they would if they viewed investment in any sector as being equally desirable (consistent with perfect sectoral capital mobility). In Japan, the United States, Korea, Taiwan and Hong Kong, service sector capital stocks are larger than in the 'fixed factors' case, but in the other economies they are smaller. This demonstrates how the capital supply behaviour in the FTAP model plays an important role in relocating capital across regions within a sector, as opposed to the textbook treatment of capital allocation across sectors within a region.

One question is whether the sectoral output responses associated with a change in aggregate capital stocks are consistent with those predicted by the Rybczynski theorem. That theorem states that if product prices are fixed (say, by 'world prices'), an expansion in capital would lead to an expansion in the output of the product that uses capital relatively intensively, and a contraction of the other product. Leamer and Levinsohn (1994, p. 7) give an insightful reinterpretation of the Rybczynski theorem:

> What is really at stake here is not the Rybczynski Theorem but rather its travelling companion, the Factor Price Equalisation Theorem. These results together imply that factor supply changes … do not have much affect on factor prices because the potential effect on factor prices is dissipated by product mix changes in favour of the products that use the accumulating factor intensively.

Clearly, critical assumptions of the Rybczynski Theorem do not hold in the FTAP model. Products are imperfect substitutes, so that product prices are not 'given' to

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[4] The implications of this for regional incomes is not yet incorporated.

any single region. As a result, relative factor prices can also change to absorb the impact of an increase in capital, so that it does not have to be absorbed by changes in product composition.

But one would expect the FTAP model to display the same underlying economic forces that lead to the Rybczynski result under its special set of assumptions. This can be demonstrated in an intermediate simulation in which aggregate capital in each region moves as it does in general equilibrium, but is still perfectly mobile between sectors (thus each region still has a unique economy-wide wage/rental ratio). In this intermediate simulation, there is the expected relationship between the direction of movement of the capital stock, and whether the wage/rental ratio is higher or lower than in the 'fixed factors' version of the model. When the capital stock rises, the wage/rental ratio is higher than in the 'fixed factors' case, and when the capital stock falls, the wage/rental ratio is lower.

The final column of table 3 incorporates the FTAP model's income linkages — real income in each region is no longer constant, but reflects the induced changes in factor prices and international capital movements.

Dee and Hanslow (2000) demonstrate that such income effects are crucial to the welfare implications of liberalising trade in services. In particular, a few economies, including the United States and the European Union, are projected to lose in welfare terms from services trade liberalisation. An important contributing factor is the loss of rents earned by their incumbent multinationals from existing impediments to services trade. Note, however, that this result is sensitive to a range of model assumptions, including the existence of rents and their distribution.

Table 3 shows, however, that these income effects do not have strong additional effects on the sectoral distribution of gains from services trade liberalisation.

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General equilibrium models are often regarded as 'black boxes', with little chance of understanding what is inside. The above analysis suggests that because the structure of barriers to services trade is complex, the hardest part about understanding the effects of multilateral liberalisation of services trade is understanding what happens in partial equilibrium.

The partial equilibrium results help to demonstrate how liberalisation of services trade can differ from tariff removal. Barriers to services trade affect domestic new entrants as well as foreign suppliers, and the sector to benefit most in output terms from liberalisation can often be the services sector itself.

The transition from partial to general equilibrium analysis also demonstrates how some of the standard textbook results fail to hold in the context of services trade liberalisation. In particular, because services trade barriers affect the price of service sector capital as well as service sector output, the Stopler-Samuelson theorem fails to hold — the movement of relative factor prices is dominated by the removal of the barriers to capital movement. The Rybczynski theorem also fails to hold in its textbook form, but the underlying economic forces that lead to its result are still relevant.

4 Agenda for further research

Much of the research agenda for further development of the FTAP model has been outlined already. It involves continuing to obtain estimates of the price impacts of barriers to services trade, along the lines outlined in Findlay and Warren (2000). Such methods could also be used to estimate the price impact of barriers to foreign direct investment in agriculture and manufacturing. More sectoral detail needs to be incorporated into FTAP, to model the barriers to each service separately. More research is required to obtain more realistic cost and sales structures for FDI firms and, if possible, a realistic initial allocation of rents. And the welfare measure in FTAP needs to be amended to take account of the costs of risk taking, given risk aversion.

But there is also scope for much more work using simple analytical models of services trade that better incorporate the features of services and the nature of the barriers to their trade. Insights of the sort available in Markusen, Rutherford and Hunter (1995), for example, provide invaluable guidance to those attempting to build better empirical models of FDI and services trade.

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