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# MODELLING MULTILATERAL TRADE LIBERALIZATION IN SERVICES

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Paper prepared for the Third International Conference on the Asia-Pacific Economy, "International Trade in Services," Brisbane, Australia, July 12-13, 1995.

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**ABSTRACT**

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We examine the importance of various characteristics of services for the modelling of the effects of trade liberalization in services. We consider first the characteristics that our own computable general equilibrium (CGE) modelling framework has been designed to address: variety, scale, and competition. Modifying it somewhat so as to distinguish the separate roles of these characteristics, we find the characteristics to be relatively unimportant for the conclusions that one reaches about the effects of trade liberalization on the economy. We then consider other characteristics that may distinguish services from goods, and ask whether these also need to be taken into account in such modelling exercises. With one exception we conclude that these characteristics are unlikely to play an important role in future models of trade liberalization. The one exception is a characteristic identified by Ethier and Horn (1991), who saw producers of services as specializing their products to the particular needs of their customers. While it does not seem feasible at this time to incorporate this feature into a manageable CGE framework, we believe that it could have interesting and important implications for our understanding of the effects of trade liberalization if it were ever done.

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# MODELLING MULTILATERAL TRADE LIBERALIZATION IN SERVICES*

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**Executive Summary**

In this paper we examine the importance of various characteristics of services for the modelling of the effects of trade liberalization in services. The analysis takes two forms. First, we use our computable general equilibrium (CGE) modelling framework to compute the effects of a hypothetical liberalization of trade barriers in service industries, as this would affect trade, output, and employment in an eight country/region model of the world economy. The analysis is repeated four times, incorporating varying assumptions about the roles of product variety, increasing returns to scale, and the nature of competition in the services industries. Comparing across these model solutions, we find that these particular industry characteristics make very little difference for the calculations of the effects of liberalization. This is reassuring, since there is little empirical basis for choice among these assumptions. It appears, therefore, that at least within the context of our own CGE model, analysis of the effects of prospective trade liberalization need not wait for improved data on at least these aspects of the services industries.

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*The authors have benefitted from the comments and suggestions of Colin Hargreaves and an anonymous referee.

In the second part of our analysis, we depart from the formal modelling structure of the Michigan CGE modelling framework and consider a more informal discussion of the roles that other service industry characteristic may play in determining the effects of liberalization. Many distinctive features of services production and trade have been suggested over the year as setting services apart from goods. These include the movement of factors internationally to permit on-site production of services, the perishability of services, the distinctive nature and size of transport costs in services, the role of traditional comparative advantage in determining patterns of services trade, and the embodiment and disembodiment of services into and out of goods. For all of these features, our analysis suggests that they either are not of special importance for the issue at hand, the effects of trade liberalization, or, in some cases, that they are important but are not distinctive to markets for services. There is one additional characteristic, however, that has been identified by Ethier and Horn (1991) that we believe does pose the potential for causing a divergence between the effects of trade liberalization in goods and that in services. This is the fact that many services may be customized to the needs of individual purchasers. We do view this as a potentially critical property of services for the effects of their international trade, although at the present time it does not seem possible to incorporate this property into any formal empirical analysis.

We conclude, then, that in almost all respects, the widely discussed differences between services and goods, though of course very interesting and important in their own right, are not of critical importance for the particular issue of determining the effects of trade liberalization in services.

## I. Introduction

The Michigan Modelling framework, which was developed originally for the purpose of calculating the sectoral and other effects of multilateral and regional trade liberalization in goods, has recently been expanded to include trade in services. This paper will report some illustrative results of the expanded model, focusing primarily on its quantitative results for some scenarios in which crude estimates of barriers to trade in services (taken from Hoekman (1996)) are reduced on a multilateral basis. Attention is given to the role of market and industry structure in these results, in an effort to ascertain the extent to which results depend on whether services sectors are modelled as perfectly competitive versus monopolistically competitive, and in the latter case on the extent to which economies of scale and variety play a role in production functions and preferences.

The growing literature on services, and especially on trade in services, has emphasized a variety of ways that services are distinct from goods.[1] Indeed, an important focus of this conference is on exactly that issue and the ways that the special characteristics of services ought to be incorporated into economic models. Nonetheless, the Michigan Model's extension to trade in services reported here has essentially treated services as being qualitatively the same as goods. Therefore a second purpose of this paper will be to examine many of the characteristics that have been suggested as unique or especially important for services and to discuss why their inclusion in the Michigan Modelling framework has not been attempted.

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[1]See for example Hill (1977), Hindley (1984), Deardorff (1985), Stern (1985), and Hoekman (1994).

To some extent, these reasons will draw attention to many of the limiting features that we believe are necessary in a large-scale CGE model that is intended to address issues of multilateral trade liberalization. That is, there is a need to model simultaneously the markets of multiple industries and multiple countries, and to do so in a way that will be reasonably transparent in the economic linkages and effects that drive the results. This imposes a somewhat minimalist structure on what can be attempted at the industry level. The question, then, is whether any of the purported special characteristics of services that we omit from our model are so important as to cast serious doubt on the usefulness of the results that we obtain. We will address these issues too in the course of our discussion, although our answers here are necessarily speculative.

In Section II we provide a brief introduction to the current structure of the Michigan Model, focusing especially on the aspects of the model that are important for the analysis undertaken here. That analysis is introduced in Section III, which also presents the results of our model for a hypothetical policy exercise of multilateral trade liberalization in services. The results are presented for four scenarios, or separate solutions of the model, in which differing assumptions are made about the structure of services industries and markets. The section concludes with a comparison of these results and an indication of the importance (or lack thereof) of the assumptions that have been tried.

These results, as will be seen, suggest that within the range of assumptions that we have employed, it makes very little difference for our calculations of the effects of trade liberalization which particular assumptions we use. In view of the common perception that services differ from goods in ways that we have not captured, we therefore turn in Section IV to a discussion of these other issues. Our conclusion there is that, while there are many potential economic mechanisms

and linkages that might well change the calculations of the effects of trade liberalization if they were taken into account, these omissions from our model are not unique to services. By and large, we do not find trade in services to be particularly special, from an economic behavioral standpoint, in ways that should matter for the effects of trade liberalization. As services come to play an increasing role in the future of multilateral trade liberalization, therefore, we recommend that they be incorporated into analyses of trade liberalization in largely the same ways that have been used for goods, and that further efforts to refine the modelling of services should attend to the same issues that are understood to be potentially important for trade in goods. Services are very special, however, in terms of the difficulty of collecting (and sometimes in even defining) the data that are needed for analyses of this sort. Therefore further effort is also needed to establish a reliable data base on trade in services that will be comparable to and compatible with the data on goods that are already available.

There are very difficult problems in measuring international services transactions, e.g., as in the case of electronic data services and information flows. These have been discussed in detail by Stern and Hoekman (1987) and Hoekman and Stern (1991), among others, and they arise in part from the fact that there are a variety of modes of supplying services internationally. The cross-border movement of services themselves is only one of the possible modes of supply. Some services require a local presence in the form of foreign direct investment or movement of workers. Others require that consumers of services move to the supplying country. These issues will be touched on later in the paper, although for the most part they pose greater problems of data collection than of modelling.

## II. Introduction to the Michigan Modelling Framework

The Michigan Modelling Framework was first developed in the mid-1970s with a series of papers by two of the present authors using a 34-country, 29-industry computable general equilibrium (CGE) model that was based on, among other things, assumptions of perfect competition and Armington-differentiation of products by country of origin.[2] More recently, building also upon the U.S.-Canada model of Brown and Stern (1989), the present authors have constructed a series of CGE models that have incorporated assumptions of monopolistic competition, increasing returns to scale, and differentiation of products by firm rather than by country of origin. We have constructed these models for a reduced number of countries and country aggregates, drawing upon and combining the same 34 countries used in the earlier work. These models have included a four country/region model of the NAFTA in Brown, Deardorff and Stern (BDS) (1992a, b) and several eight country/region models designed to study the formation of free trade areas among countries in the western hemisphere in BDS (1996a) and in East Asia in BDS (1996c). Most recently we have also developed other eight country/region models to examine association with the European Union for Tunisia in BDS (1995) and for countries in Eastern Europe in Brown et al. (1996b).

In Brown et al. (1996) we applied the modelling framework to analysis of the Uruguay Round of multilateral trade liberalization, setting out to model liberalization in both goods and services. In the event, we were persuaded by Hoekman (1996) that no real liberalization of services trade actually took place in the Uruguay Round. The achievements of the services negotiations thus had more to do with setting up a framework for future negotiations. Therefore,

[2]See Deardorff and Stern (1986, 1990).

our analysis of services liberalization in Brown et al. (1996) was a hypothetical one, examining an arbitrary 25% multilateral reduction in the ad valorem tariff equivalents of barriers to trade in services, as these had been "guesstimated" by Hoekman (1996). It is that hypothetical policy experiment that we will explore further here.

The version of the model used for this purpose has the 34 countries of our database grouped into the following eight countries/regions: United States, Canada, Mexico, Europe, Japan, Asian Newly Industrializing Countries, Australia/New Zealand, and a group of Other Major Trading Nations.[3] All remaining countries of the world are consigned to a residual rest-of-world to close the model. The sectoral coverage in each country/region consists of 29 sectors, all of which are tradable. These include one agricultural sector, 21 manufacturing sectors, one mining sector, and five services sectors.[4]

Our modelling framework allows industries to be modelled as either perfectly competitive with Armington product differentiation by country of origin, or as monopolistically competitive with product differentiation by firm, along the lines of Dixit and Stiglitz (1977). The latter will be explained more fully in a moment. As has become familiar in the literature on international CGE modelling[5], some form of product differentiation is necessary in order to generate models with

[3]Europe includes the 15 members of the European Union plus Norway and Switzerland; the Asian NICs include Hong Kong, South Korea, Singapore, and Taiwan; and the Other Major Trading Nations include Argentina, Brazil, Chile, Colombia, India, Israel, Turkey, and Venezuela.

[4]For a complete list of these industries see almost any of the cited publications by Brown, Deardorff, and Stern. The services sectors are identified below in Table 1.

[5]See Srinivasan and Whalley (1986).

feasible levels of aggregation that are also consistent with empirically observed flows of intra-industry trade and responsiveness of trade to changes in prices.

As introduced by Dixit and Stiglitz (1977) and incorporated into trade theory by Krugman (1979) and Helpman and Krugman (1985) among others, the standard monopolistic competition model is based on a utility function of the form

$$U = \left( \sum_{i=1}^{n} c_i^{\rho} \right)^{1/\rho} \qquad \textbf{(1)}$$

where $1 > \rho = (\sigma - 1)/\sigma > 0$ and $\sigma > 1$ is the elasticity of substitution among the *n* varieties of a good, each of which is produced by a different firm, *i*, and consumed at level $c_i$. This is combined with a cost function that includes both a fixed cost and a constant marginal cost,

$$C = C_0 + cx \qquad \textbf{(2)}$$

where *x* is output of the representative firm. For a given number, *n*, of identical firms, each one faces a (positive) elasticity of demand under Cournot competition of

$$\eta \equiv - \frac{p}{x} \frac{\mathrm{d}x}{\mathrm{d}p} = \sigma - \frac{(\sigma - 1)}{n} \qquad \textbf{(3)}$$

and it maximizes profit by setting a markup of price over marginal cost as follows:

$$p = \left( \frac{\eta}{(\eta - 1)} \right) c \qquad \textbf{(4)}$$

Finally, there is free entry, so that $n$ adjusts until profits are eliminated, $p=C/x$, which with (2) gives

$$x = \frac{C_0}{c}(\eta - 1) \qquad \textbf{(5)}$$

Variety and scale economies play specific roles in this model, intertwined with the degree of competition. An increase in industry demand[6], for example, causes firms to sell more at their initial markups and thus to make profits. This attracts new entrants, raising $n$ in (3) and increasing the demand elasticity faced by each firm. Firms therefore reduce their markups, following (4), and a new free-entry equilibrium is found as in (5) with greater output per firm.

The economy gains from this process through three channels. First, greater competition and reduced markups mean that consumer choices are less distorted, since they are responding to prices that are closer to marginal costs. Second, increased output per firm means that average costs are reduced, reflecting the increasing returns to scale that are implicit in the presence of the fixed cost in (2). And third, the increased number of firms provides increased variety to consumers, who gain utility independently of the total quantity demanded. To see this last point, note that with identical firms all selling at the same price (again a simplicity that is not present in our many-country CGE model), consumers demand the same quantity, $c_i=c$, of each variety and (1) becomes

[6]Due to opening of markets, perhaps, although this requires a more cumbersome formulation, such as appears in our CGE model, that distinguishes firms from different countries.

$$U = (nc^{\rho})^{1/\rho} = n^{\left(\frac{1-\rho}{\rho}\right)}(nc) \qquad \textbf{(6)}$$

For a given total quantity, *nc*, utility is increasing in *n* as long as $\rho > 0$. Note too that in this standard Dixit-Stiglitz formulation, all three of these effects operate essentially off of the same parameter, $\sigma$. It determines the elasticity of demand and hence the markup or price distortion faced by consumers. It also determines the ratio of price to marginal cost or degree of increasing returns to scale. And finally, through $\rho$ in (6), it determines the benefits of product variety.

For our purposes we have found it useful to break some of these links, by complicating the formulation above through the use of additional parameters and changed assumptions.

First, to allow variety to matter for utility independently of the elasticity of substitution among goods, we insert a parameter $\nu$ into the exponent of *n* in (6) that, if set to zero, will eliminate the variety effect completely, but if set to one will duplicate the Dixit-Stiglitz formulation. This requires the utility function in (1) to be modified as follows

$$U = n^{\frac{(\nu-1)(1-\rho)}{\rho}} \left( \sum_{i=1}^{n} c_i^{\rho} \right)^{\frac{1}{\rho}} = n^{\nu\left(\frac{1-\rho}{\rho}\right)}(nc) \qquad \textbf{(7)}$$

To distinguish the effects of variety from scale and competition, we solve the model under both assumptions, $\nu = 0$ and $\nu = 1$.

Second, the Dixit-Stiglitz formulation also pegs the equilibrium degree of economies of scale (as measured by the excess of average over marginal cost) to the demand elasticity and thus the substitution elasticity. We wish to break that link also, and thus to consider cases in which the

services sectors are not subject to economies of scale, while still allowing them to be imperfectly competitive. For that purpose we replace the assumption of free entry, (5), with the alternative that the change in number of firms equals the change in industry output, so that output per firm remains constant. Given the assumed structure of costs, this serves to prevent scale effects from causing any change in costs.

This procedure is a bit ad hoc, and it may not represent any plausible assumption about technology or market behavior, but it serves the purpose within our structure of eliminating the role of scale economies without moving all the way to perfect competition. The reason that markets remain imperfectly competitive is that we continue to assume Cournot oligopoly pricing, as in (4), subject to a firm elasticity of demand that is determined by (3). Thus an expansion of demand still expands the number of firms, reducing elasticities of demand faced by firms and thus reducing their markups of price over marginal cost.

In our scenarios for services liberalization below, therefore, we will report both what we take to be the "normal case" of Brown et al. (1996), in which scale economies are present in services sectors that are monopolistically competitive with free entry and where variety effects are allowed to play a role.[7] We then experiment with these assumptions about the services sectors by first eliminating the variety effect completely ( $\nu=0$ ), then in addition eliminating scale effects by fixing output per firm, and finally eliminating imperfect competition as well. Throughout, however, we continue to assume that products are differentiated -- by firm whenever there is

[7]As discussed in BDS (1996c), we have found on occasion that the full variety effect that is present in the Dixit-Stiglitz formulation ($\nu=1$ in the notation here) introduces a potential instability into markets, since expansion of an industry via entry adds varieties and thus makes the product of the industry as a whole more desirable. To avoid this instability in subsequent models, we have set $\nu=0.5$ in our "normal case."

imperfect competition, and by country of origin when there is perfect competition -- and that the elasticity of substitution that characterizes this product differentiation is the same in all cases.

This discussion has focused so far on the particular characteristics of our CGE model that are the subject of experimentation later in the paper. Before proceeding we should also briefly describe other features of our modelling framework that will not be the focus of attention here but that nonetheless contribute to an understanding of our results.[8] These include several further important assumptions that either are built into the model or are implemented by the model for the present analysis, as follows:

**Full Employment** -- The analysis assumes throughout that the aggregate, or economy-wide, level of employment is held constant in each country. The effects of trade liberalization are therefore not permitted to change any country's overall rates of employment or unemployment. This assumption is made because overall employment is determined by macroeconomic forces and policies that are not contained in the model and are not themselves to be included in any services negotiations. The focus here is on the composition of employment across sectors as determined by the microeconomic interactions of supply and demand resulting from services liberalization.

**Balanced Trade** -- It is assumed that trade remains balanced for each country, or more accurately that any initial trade imbalance remains constant, as trade barriers are changed. This assumption is intended to reflect the reality of mostly flexible exchange rates among the countries involved. It also, like the full employment assumption, is appropriate as a way of abstracting from the macroeconomic forces and policies that are the main determinants of trade imbalances.

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[8]Readers who are not interested in these other details of our models, or who are already familiar with them from our earlier work, may wish to proceed to the results of the analysis reported in the sections immediately following.

**Rents and Revenues** -- Revenues from tariffs are assumed to be redistributed to consumers in the tariff-levying country and are spent like any other income. Similarly, the rents from NTBs and the tariff equivalents of services barriers are also assumed to remain within the importing country and are spent like other income. When tariffs and tariff equivalents are reduced, this means that income available to purchase imports falls along with their prices, and there is no overall bias towards expanding or contracting demand.[9]

**Fixed Relative Wages** -- While the economy-wide wage in each country is permitted to adjust so as to maintain full employment, the wages across sectors are held fixed relative to one another. This permits the analysis to focus on the labor-market adjustments that might be required, independently of any relative wage changes that may facilitate those adjustments.[10]

**Fixed Labor Supply** -- The total labor supply in each country is assumed to be held fixed in the analysis, and cross-border movement of labor is not permitted. This is not to say that changes in labor supply will not occur in the course of the phase-in of any services liberalization, but only that such changes are assumed not to be the result of the liberalization.

The policy inputs to the model are the Hoekman (1996) guesstimates of the tariff equivalents of trade barriers in services that will be introduced below. Because our model is static, we assume that any reduction in these barriers takes place all at one time rather than in stages. When policy changes are introduced into the model, the method of solution yields

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[9]In the event that foreign suppliers capture the rents, as in the case of voluntary export restraints, we would model the reduction of tariff equivalents as a reduction of export taxes in the supplying countries.

[10]In effect, then, we do not distinguish workers according to their skill characteristics and therefore how the wages and employment of different skill groups may be affected by services liberalization.

percentage changes in variables of interest for each country/region. Multiplying the percentage changes by the actual (1990) levels given in the data base yields the absolute changes, positive or negative, that might result from liberalization.

We should further mention that we do not take account in our model of changes in foreign direct investment and the cross-border movement of workers that might occur as a result of changes in the rate of return on capital and changes in wages.[11] We also do not make any allowance for dynamic efficiency changes and economic growth. We are aware that any liberalization of trade in services is likely to have such effects to some extent, but it is difficult to quantify what these effects may be.

[11]We do allow, though only implicitly, for the possibility that labor or capital may need to move internationally as a condition for supplying services abroad, so long as the factors that are so employed can continue to be regarded as participating in the factor markets of their country of origin. Thus, what we omit is the possibility that factors may be induced by liberalization to flow into foreign factor markets and thus expand the host country's capacity to produce in its own industries.

## III. Results of the Analysis

The scenarios that we report all calculate the effects of a hypothetical liberalization of trade in services. Table 1 reports the guesstimates of tariff equivalents provided by Hoekman (1996) for each of the eight country/regions of our model and each of the five services sectors of the model. As can be seen, they are quite substantial, especially in transportation, and of course they are subject to a considerable margin of error. Since no meaningful liberalization of these barriers was achieved in the Uruguay Round, the liberalization that we consider here is purely hypothetical: a 25% reduction in the barriers reported in Table 1. Since these reductions are therefore proportional to the assumed tariff equivalents themselves, we expect -- and find -- the largest resulting changes in the sector with the largest barriers, transportation.

We model the services sectors as functionally identical to goods sectors, and the barriers to trade in services as functionally identical to tariffs or quotas on trade in goods that raise domestic prices over world prices by their tariff equivalents. Our experiment therefore consists of reducing such "tariffs" on imports of services in each country/region by 25% of the amount reported in Table 1. There are many reasons to suspect that this treatment of services trade as analogous to goods trade is inappropriate because of special features that distinguish services from goods. We will discuss these issues below in Section IV.

Allowing for the experimentation with variety, scale, and competition that was discussed above in Section II, our four scenarios are therefore as follows:

**Scenario A:** Services trade liberalization with monopolistic competition, including effects of scale and variety.

**Scenario B:** Services trade liberalization with monopolistic competition, including effects of scale but excluding effects of variety.

**Scenario C:** Services trade liberalization with imperfect competition, excluding effects of both scale and variety. (Output per firm is fixed and firms engage in Cournot oligopoly pricing.)

**Scenario D:** Services trade liberalization with perfect competition and product differentiation by country of origin.

Note that in all of these scenarios, we continue to model all sectors except services in our normal way, with perfect competition in agriculture and with monopolistic competition, including both scale and variety, in manufactured goods.

A summary of the results of these scenarios is provided in Table 2, which reports various total effects on each country/region for each of the four scenarios. These include total exports and imports, the terms of trade, an "equivalent variation" measure of national welfare (expressed as both percentage of GDP and in dollar values), and the weighted average real returns to both labor and capital across sectors.

Results for Scenario A, which is essentially the same as Scenario B of Brown et al. (1996), are very similar to what we have found before. All countries/regions gain in the aggregate from the assumed liberalization of trade in services, although the increases in welfare never are much

more than two percent of GDP, and for large countries they are considerably less than one percent.

Total trade expands, of course, for all countries/regions, but the terms of trade moves by small amounts in favor of some and against others. With services liberalization, the demand for services on world markets rises, tending to raise their prices. One would therefore expect countries that are net exporters of services to experience terms of trade improvement, although exceptions are possible depending on how services interact with goods. According to our model, the United States, Europe, and the Asian NICs all stand to experience a slightly improved terms of trade as a result of services liberalization. The terms of trade of the other countries/regions worsen, though never by much, and never by enough to cause a net reduction in overall welfare, which improves due to the many other benefits that the model incorporates as flowing from trade liberalization.

In the United States, the real return to labor rises slightly while the real return to capital falls. However, in all other countries both real returns improve. This is a phenomenon that we have met before and that runs counter to the Stolper-Samuelson Theorem. The improvements here could result from several effects, including the variety and scale effects that we will be examining here, as well as the role of product differentiation that, in all of our scenarios, distinguishes our model from the Heckscher-Ohlin Model of Stolper-Samuelson.[12]

Comparing now the results for scenarios B, C, and D in Table 2 with scenario A, the first and most compelling message is that, at least at this overall country/region level, the assumptions

[12]Note that scale and variety effects are present in all of our scenarios in the manufacturing sectors, where expansion can occur due to reductions in prices of their service inputs.

made about services do not matter much. All of the effects reported for all of the countries/regions are very similar across scenarios. If there is any pattern at all to these results, it appears that the welfare benefits for most (but not all) countries decline slightly as we first remove variety effects, then remove scale effects while keeping oligopoly pricing, and then switch to perfect competition. Since the full model of scenario A incorporates channels for gains from trade through variety, through scale, and through increased competition, all in addition to the standard gains from trade that arise from specialization and efficiency, it is not surprising that gains from trade might be somewhat dampened when these effects are removed from the services sectors. Indeed, what may be most interesting is how small this dampening effect turns out to be and the fact that it is not uniform for all countries/regions and scenarios. The exceptions could occur because of terms-of-trade effects and/or various sector-specific roles of variety, scale, and competition in determining the performance of particular sectors.

It might not be surprising that assumptions about behavior in services would make only a small difference to the overall effects on countries reported in Table 2, since we are keeping unchanged our assumptions about all other sectors, and these provide the bulk of the interaction among countries through international trade. We therefore turn in Tables 3 and 4 to a comparison of some disaggregated effects on the services sectors alone. With five sectors, eight countries, and four scenarios, there are far too many results to report in their entirety. We therefore focus on just three of the eight countries/regions: the United States, Europe, and the Asian NICs. Table 3 reports sectoral effects on exports and imports for the five services sectors and these three countries across the four scenarios. Table 4 in a similar fashion reports percentage changes in output per firm and employment by sector.

Once again, we see that the variations in assumptions about the services sectors have made very little difference, even to these sectoral results. Exports, for example, expand in three of the services sectors and contract in two, and the variations across scenarios occur only in tenths of a percent in the United States and Europe. Only in the Asian NICs do we note any larger response, primarily in the sector that responds by far the most to services liberalization in all countries/regions, transportation. Here the expansion in exports is slightly dampened when variety and scale effects are removed, and more noticeably dampened when services are switched to perfect competition. On the import side, the United States and Europe are similarly insensitive to assumptions, while the Asian NICs are again somewhat more sensitive, especially in transportation.

As noted above, the large changes in trade for the transportation sector reflect its considerably larger barriers in Table 1 that are being reduced.[13] As noted, the switch to perfect competition in Scenario D causes a sizable reduction in the expansion of exports in transportation services by the Asian NICs, and a sizable increase in their expansion of imports. We have no good explanation for this result, except to conjecture that this is a sector where the Asian NICs are at a competitive disadvantage, and that forces of competition may exacerbate that disadvantage.

The entries in Table 4, for output per firm and employment, are all quite small, and the effects of the different assumptions may therefore be hard to pick out. Results on output per firm

[13]There are other instances where the sizes of the tariffs show up in these results. For example, the fact that the Asian NICs are calculated as expanding exports of transportation services by more than twice the percentage of their expansion in imports is undoubtedly due to their comparatively low tariff in that sector, and the somewhat similar results for the United States and contrasting results for Europe also reflect the sizes of their tariffs relative to others.

exclude Scenarios C and D, where output per firm is fixed and undefined, respectively. For the scenarios listed, and for employment in all scenarios, it appears that results are very insensitive to our variations in assumptions.

We set out in this section to determine how the results of a services trade liberalization are likely to depend upon particular assumptions made about the services sectors, in terms of the roles of variety, scale, and competition. The answer, it seems, is not much.

## IV. Other Characteristics of Services and of Trade in Services

We turn now to a less formal and less quantitative examination of the modelling of services. As noted in the introduction, many have identified a variety of characteristics that are said to distinguish services from goods, and it has been suggested that these characteristics need to be taken into account in the modelling of services. This, we think, is not self evident. It is also true that goods could be classified into separate categories that might be very important for some purposes, but not necessarily for others. For example, goods could be classified by whether or not they give off an odor, and it is plausible that those designing packaging for these products would use quite different methods for the odoriferous goods than for the others. But that does not mean that their odor needs to be taken into account for other purposes, such as determining the effects of taxing their production.

In our model we have done very little to distinguish services from goods. Our reason was the practical one that we were busy with other things, such as trying to find the data on trade in services that were necessary before we could implement any modelling strategy.[14] We really

[14]There has been little mention of data in this paper, except for the barriers to trade in services. Readers may consult any of our other papers for details of the data that we use routinely in our models. Regarding trade in services, see especially Brown et al. (1996), where we discuss

chose to model services as functionally the same as goods only as a first pass, thinking that we might well, later on, decide that the model should be changed to accommodate their special characteristics.

First, however, we had to decide how to treat services within our existing modelling framework, in which we have previously modelled some sectors as perfectly competitive and others as monopolistically competitive. It was not obvious which should be used for services, and we chose the latter in our earlier work only tentatively. From our findings above, it appears that this choice did not matter much, and this is somewhat reassuring in view of the weak basis for our choice.

The question now is whether there are other characteristics of services that we have ignored in our model that we and others should take into account in the future. Since, as the odoriferous goods example suggests, the answer is likely to depend on the purpose to which a model is to be put, we will restrict our discussion to the importance of these characteristics for models of the effects of trade liberalization. Obviously, models with other purposes (analyzing growth, forecasting exchange rates) might assign these characteristics quite different roles.

*Movement of factors:* It is often said that trade in services entails the international movement of factors of production, on the grounds that services typically require the simultaneous presence of the producer and the consumer in the same place. Since except in tourism, education, and medical services the consumer seldom moves, the producer must move

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how we assembled data from a variety of balance of payments and other sources. These included only incomplete breakdowns into bilateral trade flows, and we have completed the breakdown for our purposes using an RAS procedure based on bilateral trade in goods

instead and that seems to imply factor movements. Melvin (1989) has gone so far as to equate services trade with trade in factor services, although that is probably an extreme position.

If factors from the exporting country must travel to the importing country in order to provide the service, this is not a problem from the standpoint of the modelling we have done here. Such factors are still part of their home country's factor markets, and the fact that they happen to be located abroad should not matter for the determination of the various market equilibria. If movement of such factors is resisted by policies in either country, then this may amount to a barrier to trade in services, but this could be taken into account by the tariff equivalent of such barriers as we have done here, since such barriers will add to the cost, perhaps prohibitively, of trading the service.

More interesting issues in fact arise not if factors move with services trade, but if instead the trade requires factors to be employed from the importing country's factor markets. This is quite common in services trade, where exporters staff local establishments with local labor, for example, and this will surely matter for the effects of trade on the economies involved. This, however, is not distinctive to services, since exporters of goods also typically employ some factors in the importing country to help get the goods into the hands of final users. Of course the share of local inputs is likely to be much larger for some services than for most goods, so that this is a more important thing to take into account in modelling services. In principle these local factor demands could enter a CGE model by having trade (in both goods and services) give rise to intermediate demands in the importer's domestic market, but the data requirements of such a model would probably be prohibitive.

*Services are perishable:* Since services are rendered over time, a service that is not provided at a particular moment ceases to exist. The parallel with perishable goods that gives this characteristic its name also suggests that it is not really unique to services. But since it may be more pervasive for services than for goods, a model that stresses services might well be expected to take it into account.

This would certainly be the case if one were attempting to model the behavior of an economy over time, where inventory accumulation and its absence in services might importantly affect the levels of supply and demand at any point in time. Our model, however, is static, and the questions that we address about trade liberalization are also static. To the extent that it is inventory behavior that we are omitting, it is not the perishability of services that is a problem, but the durability of goods.

On the other hand, there is also a difficult conceptual problem here, insofar as the provision of perishable services may require a "standby" capacity in the form of idle physical and human capital, and we have also omitted any explicit consideration of that. The problem of optimal capacity choice may therefore be complex. However, as long as the solution to that problem entails a well-defined level of capacity for each level of expected output, and as long as this relationship does not change with trade liberalization, the formulation used in our CGE model will be satisfactory.

*Transport costs for many services are distinctive in their size, in their form, and sometimes in their absence:* This too is not a criticism of the modelling of services per se, since trade in goods also (perhaps more so) involves transport costs. These costs are not explicit, for goods or services, in a model such as ours. On the other hand, as long as transport costs remain

more or less constant in response to trade liberalization, then their presence or absence in the model will not matter. Only if trade liberalization itself changes those transport costs -- an interesting possibility but one that is probably quantitatively insignificant in the world so far -- would it matter for the kinds of effects examined here. Of course, if services trade liberalization really were to be undertaken in a major way, the large barriers that we have noted in transportation services could become quite important for trade in goods. We have not allowed for that possibility here, since it would require knowing how trade, not just production, uses inputs from the transportation industry, and we do not have that information.

An interesting feature of many services is the extent to which the cost of trading them has declined in recent years with advances in technology. Advances in data processing and data transfer, for example, have made the international provision of financial services feasible in a way that was simply impossible before. This feature, interesting and important as it may be for, say, forecasting the future growth of services trade, is largely ancillary to the issue of the effects of liberalization of that trade.

*Ambiguities of comparative advantage:* There has been concern over the years that the determinants of comparative advantage are somehow different in services than in goods, or even that the principle of comparative advantage as both a positive and a normative guide to trade does not apply to services. The theoretical literature on this subject has largely dismissed this concern -- see Hindley and Smith (1984), Deardorff (1985), and Melvin (1989). In any case, for analyzing the effects of trade liberalization what matters primarily are the existing patterns of trade and the barriers that restrain them, and not whether those trade patterns have been determined by comparative advantage or by some other mechanism. Unless there is something about services

that causes other aspects of their markets to be distorted, putting us into the world of the second best, there is no reason why this needs to matter for the effects of trade liberalization. And even if services markets are distorted, this will matter only for the welfare effects of liberalization, not for the positive effects on sectoral trade and employment, for example.

*Changes in embodiment and disembodiment ("splintering") of services in goods:* Bhagwati (1984) has drawn attention to the ways that services may become embodied into goods (home appliances that replace domestic servants, live performances that are captured on audio and video cassettes, services formerly provided by people now provided by computers, etc.) and that goods may become "splintered" into other goods and services. These are fascinating issues, and are certainly very important for the long term evolution of the service economy. To the extent that barriers to trade are different for services than for goods, these transformations may over time be the endogenous result of such barriers, in order to cross international borders with the least cost. However, such considerations take one well beyond the relatively short-run horizons that are usually (and perhaps regrettably) the focus of analyses of trade liberalization. In any case, once one allows for transformations of this sort, one should also allow for other more basic transformations that also occur over time, such as capital accumulation, technical progress, and so forth. Fascinating as they may be, it is not clear that these phenomena that relate to services should lead the list on this agenda for future modelling.

*Services are specialized to requirements of the buyer:* This characteristic of services has been emphasized by Ethier and Horn (1991), who also argued that there are some initial economies of scope, as service providers expand beyond serving a single buyer, but that diseconomies then also set in, preventing them from serving an unlimited number of buyers. They

used this as the basis for a theoretical model of trade in services that was ingenious and illuminating in a number of respects. Conceptually their model could be adapted to a CGE context, since in some ways it simply builds upon the structure that we described above. However the resulting model would be extraordinarily complex, which is a problem less for computation than for understanding the results, and the task of finding empirically based values for the model's many parameters would probably be impossible.

On the other hand, this is one characteristic that feels intuitively like it could matter a great deal for the effects of trade liberalization. If barriers to trade in services prevent producers in some countries from having access to providers of intermediate services that, were they available and tailored to their needs, could enhance their productivity, then these trade barriers in services could determine not only trade in services itself but also the trade in goods that depends upon it. To some extent such linkages through intermediate inputs are already present in standard CGE models such as ours, but the Ethier and Horn model suggests not only that the linkages exist but that, because of the economies and diseconomies of scope, they may be very nonlinear. If this is true then our largely linear models could be missing some dramatic effects that trade liberalization might have on trade.

## V. Conclusion

We set out in this paper to examine the importance of various characteristics of services for the modelling of the effects of trade liberalization in services. We confined attention first to the characteristics that our own CGE modelling framework has been designed to address: variety, scale, and competition. Modifying the model somewhat to enable us to distinguish the separate roles of these characteristics, we found that they are apparently relatively unimportant for the

conclusions that one reaches about the effects of trade liberalization on the economy. We then turned to a number of other characteristics that have been identified by others as distinguishing services from goods, and we asked whether these also need to be taken into account in such modelling exercises. With one exception we concluded that these characteristics are unlikely to play an important role in future models of trade liberalization. The one exception was a characteristic identified by Ethier and Horn (1991), who saw producers of services as specializing their products to the particular needs of their customers. While it does not seem feasible at this time to incorporate this feature into a manageable CGE framework, we believe that it could have interesting and important implications for our understanding of the effects of trade liberalization if it were ever done.

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TABLE 1
Average Tariffs for Service Sectors
(in Percent)

| Country/Region | ISIC Sector | | | | | Average |
|---|---|---|---|---|---|---|
| | Construction (5) | Whl. Trade (6) | Transportation (7) | Fin. Services (8) | Pers. Services (9) | |
| United States | 5.0 | 4.6 | 111.4 | 21.7 | 31.7 | 71.6 |
| Canada | 6.0 | 9.0 | 117.7 | 25.9 | 40.2 | 57.8 |
| Mexico | 24.0 | 21.2 | 152.3 | 40.9 | 29.8 | 78.4 |
| Europe | 10.0 | 9.4 | 170.8 | 25.2 | 24.1 | 91.8 |
| Japan | 5.0 | 4.6 | 142.0 | 28.9 | 32.3 | 71.0 |
| Asian NICs | 10.6 | 12.1 | 100.2 | 18.5 | 20.7 | 53.7 |
| Australia-New Zealand | 10.1 | 8.9 | 183.0 | 26.1 | 27.3 | 105.9 |
| Other Trading Nations | 29.9 | 28.1 | 162.3 | 45.3 | 42.2 | 110.2 |
| Average | 9.5 | 8.9 | 139.2 | 26.4 | 30.2 | 78.2 |

Source: Adapted from Hoekman (1996)

TABLE 2

CHANGES IN COUNTRY IMPORTS, EXPORTS, TERMS OF TRADE, WELFARE AND RETURN TO LABOR AND CAPITAL

(Trade in Millions of U.S. Dollars)

| Country | Imports* | Exports* | Terms of Trade | Equivalent Variation | | Wage Rate | Return to Capital |
|---|---|---|---|---|---|---|---|
| | | | Pct. Change | Percent | Millions | Pct. Change | Pct. Change |
| | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| A. Base Case with Monopolistic Competition, Variety, and Scale | | | | | | | |
| United States | 19,925.4 | 18,921.7 | 0.2 | 0.5 | 25,813.7 | 0.2 | (0.1) |
| Canada | 3,457.9 | 3,587.6 | -0.1 | 0.7 | 3,979.2 | 0.4 | 0.0 |
| Mexico | 1,575.0 | 1,658.4 | -0.2 | 2.1 | 4,985.8 | 0.3 | 0.3 |
| Europe | 16,019.6 | 15,588.7 | 0.1 | 0.4 | 28,718.4 | 0.1 | 0.0 |
| Japan | 10,276.6 | 11,312.5 | -0.3 | 0.4 | 12,500.8 | 0.2 | 0.3 |
| Asian NICs | 6,142.5 | 5,944.6 | 0.1 | 1.0 | 4,909.3 | 0.7 | 0.3 |
| Australia/NZ | 2,742.7 | 2,955.5 | -0.4 | 1.9 | 3,846.6 | 0.3 | 0.5 |
| Other NICs | 5,461.2 | 5,833.4 | -0.3 | 0.7 | 8,352.6 | 0.2 | 0.4 |
| B. Variety Effects Removed in Services | | | | | | | |
| United States | 19,933.7 | 18,910.9 | 0.2 | 0.5 | 26,418.2 | 0.1 | (0.1) |
| Canada | 3,455.6 | 3,584.2 | -0.1 | 0.5 | 3,111.9 | 0.4 | 0.0 |
| Mexico | 1,566.8 | 1,654.6 | -0.2 | 1.2 | 2,817.1 | 0.4 | 0.3 |
| Europe | 16,027.2 | 15,595.0 | 0.1 | 0.5 | 31,508.5 | 0.1 | 0.0 |
| Japan | 10,273.2 | 11,355.9 | -0.3 | 0.5 | 13,963.9 | 0.2 | 0.3 |
| Asian NICs | 6,191.7 | 5,938.0 | 0.1 | 0.8 | 4,196.9 | 0.6 | 0.2 |
| Australia/NZ | 2,737.8 | 2,957.1 | -0.4 | 1.5 | 2,979.5 | 0.3 | 0.5 |
| Other NICs | 5,454.5 | 5,837.5 | -0.3 | 0.7 | 8,337.0 | 0.3 | 0.4 |
| C. Variety and Scale Effects Removed in Services | | | | | | | |
| United States | 19,572.2 | 18,582.7 | 0.2 | 0.5 | 24,943.9 | 0.1 | (0.1) |
| Canada | 3,250.9 | 3,362.6 | -0.1 | 0.4 | 2,330.4 | 0.4 | 0.0 |
| Mexico | 1,550.2 | 1,640.7 | -0.2 | 1.1 | 2,712.8 | 0.4 | 0.3 |
| Europe | 15,892.3 | 15,460.0 | 0.1 | 0.4 | 30,117.3 | 0.1 | 0.0 |
| Japan | 10,169.9 | 11,221.3 | -0.3 | 0.4 | 12,660.0 | 0.2 | 0.3 |
| Asian NICs | 5,952.1 | 5,623.5 | 0.1 | 0.7 | 3,523.2 | 0.5 | 0.2 |
| Australia/NZ | 2,712.4 | 2,930.3 | -0.4 | 1.4 | 2,737.3 | 0.3 | 0.5 |
| Other NICs | 5,431.7 | 5,793.7 | -0.3 | 0.7 | 7,938.8 | 0.2 | 0.3 |
| D. Perfect Competition in Services | | | | | | | |
| United States | 19,663.4 | 18,821.1 | 0.2 | 0.4 | 22,627.2 | 0.1 | (0.1) |
| Canada | 3,383.5 | 3,453.3 | 0 | 0.6 | 3,398.5 | 0.3 | 0.0 |
| Mexico | 1,544.1 | 1,623.0 | -0.2 | 2.0 | 4,826.9 | 0.3 | 0.2 |
| Europe | 16,053.9 | 15,586.1 | 0.1 | 0.4 | 26,426.9 | 0.1 | (0.1) |
| Japan | 10,133.0 | 10,962.7 | -0.2 | 0.4 | 11,777.8 | 0.2 | 0.2 |
| Asian NICs | 6,270.3 | 6,135.3 | 0.1 | 0.9 | 4,556.2 | 0.4 | 0.2 |
| Australia/NZ | 2,668.1 | 2,851.4 | -0.3 | 1.8 | 3,633.5 | 0.3 | 0.4 |
| Other NICs | 5,419.6 | 5,754.8 | -0.2 | 0.7 | 7,928.8 | 0.2 | 0.3 |

*Exports and imports valued in U.S. dollar base period prices.

TABLE 3

EFFECTS ON TRADE IN THE SERVICES SECTORS,
COMPARISON ACROSS SCENARIOS IN SELECTED COUNTRIES

PERCENTAGE CHANGES IN EXPORTS AND IMPORTS

| Country | ISIC Sector | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Scen. A | Scen. B | Scen. C | Scen. D | Scen. A | Scen. B | Scen. C | Scen. D |
| | | Base Case | Exc. Variety | Exc. Variety & Scale | Perfect Competition | Base Case | Exc. Variety | Exc. Variety & Scale | Perfect Competition |
| | | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| UNITED STATES | | | | | | | | | |
| | 5 Construction | 4.8 | 4.8 | 4.7 | 4.8 | 4.2 | 4.2 | 4.3 | 4.0 |
| | 6 Wholesale Trade | 6.4 | 6.4 | 6.3 | 6.4 | 3.5 | 3.5 | 3.5 | 3.5 |
| | 7 Transportation | 40.6 | 40.8 | 40.3 | 40.5 | 34.7 | 34.7 | 35.0 | 34.4 |
| | 8 Financial Services | (0.2) | (0.2) | (0.3) | (0.2) | 0.2 | 0.1 | 0.1 | 0.1 |
| | 9 Personal Services | (0.5) | (0.5) | (0.6) | (0.5) | 0.5 | 0.4 | 0.4 | 0.3 |
| EUROPE | | | | | | | | | |
| | 5 Construction | 3.8 | 3.8 | 3.7 | 3.7 | 7.4 | 7.4 | 7.5 | 7.3 |
| | 6 Wholesale Trade | 6.7 | 6.7 | 6.6 | 6.6 | 6.7 | 6.6 | 6.7 | 6.7 |
| | 7 Transportation | 37.4 | 37.5 | 37.2 | 37.9 | 38.4 | 38.4 | 38.6 | 37.8 |
| | 8 Financial Services | (0.1) | (0.1) | (0.1) | (0.1) | 0.0 | 0.0 | (0.1) | 0.0 |
| | 9 Personal Services | (0.4) | (0.4) | (0.4) | (0.4) | 0.3 | 0.3 | 0.2 | 0.3 |
| ASIAN NICS | | | | | | | | | |
| | 5 Construction | 3.6 | 3.5 | 3.6 | 3.6 | 7.7 | 7.8 | 7.5 | 7.2 |
| | 6 Wholesale Trade | 4.4 | 4.2 | 4.5 | 4.5 | 7.9 | 7.9 | 7.5 | 7.4 |
| | 7 Transportation | 48.1 | 47.2 | 47.9 | 40.9 | 21.7 | 22.4 | 21.6 | 27.7 |
| | 8 Financial Services | (0.7) | (0.7) | (0.7) | (0.5) | 0.9 | 0.8 | 0.7 | 0.4 |
| | 9 Personal Services | (0.5) | (0.4) | (0.6) | (0.4) | 0.7 | 0.6 | 0.6 | 0.3 |

TABLE 4

EFFECTS ON OUTPUT AND EMPLOYMENT IN THE SERVICES SECTORS,
COMPARISON ACROSS SCENARIOS IN SELECTED COUNTRIES

PERCENTAGE CHANGES IN OUTPUT PER FIRM AND SECTORAL EMPLOYMENT

| | | Output per Firm[a] | | Employment | | | |
|---|---|---|---|---|---|---|---|
| | | Scen. A | Scen. B | Scen. A | Scen. B | Scen. C | Scen. D |
| Country | ISIC Sector | Base Case | Exc. Variety | Base Case | Exc. Variety | Exc. Variety & Scale | Perfect Competition |
| | | (2) | (3) | (4) | (5) | (6) | (7) |
| UNITED STATES | | | | | | | |
| | 5 Construction | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 6 Wholesale Trade | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 7 Transportation | 0.3 | 0.2 | 0.9 | 1.0 | 1.0 | 1.1 |
| | 8 Financial Services | 0.1 | 0.1 | 0.0 | 0.0 | (0.1) | 0.0 |
| | 9 Personal Services | 0.1 | 0.1 | 0.0 | (0.1) | (0.1) | (0.1) |
| EUROPE | | | | | | | |
| | 5 Construction | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 6 Wholesale Trade | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 7 Transportation | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 |
| | 8 Financial Services | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 9 Personal Services | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| ASIAN NICS | | | | | | | |
| | 5 Construction | 0.6 | 0.5 | (0.3) | (0.2) | 0.1 | (0.2) |
| | 6 Wholesale Trade | 0.6 | 0.5 | (0.2) | (0.2) | (0.1) | (0.1) |
| | 7 Transportation | 1.1 | 0.9 | 6.5 | 6.2 | 6.8 | 4.7 |
| | 8 Financial Services | 0.3 | 0.2 | 0.0 | 0.0 | (0.1) | (0.1) |
| | 9 Personal Services | 0.4 | 0.3 | (0.1) | (0.1) | (0.2) | (0.3) |

[a]Output per firm not reported for Scen. C, where it is fixed, and Scen. D, where it is undefined.