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Chapter Author: Jaime de Melo, David Roland-Holst

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10 Industrial Organization and Trade Liberalization: Evidence from Korea

Jaime de Melo and David Roland-Holst

10.1 Introduction

The theory of industrial organization has exerted a strong influence on trade theory and commercial policy in recent years. At a theoretical level, the welfare implications of trade policy in the presence of unexploited economies of scale, exit and entry barriers, and oligopolistic markets are now better understood. Concurrent with the flow of new theoretical contributions,[1] a number of case studies, mostly partial equilibrium, have sought to evaluate the welfare and resource allocation effects of trade liberalization in sectors like autos where the above characteristics are an important feature of industrial organization.[2] Most case studies have been for developed countries, yet it is in developing countries, particularly the emerging so-called semi-industrial countries, that the interaction of unexploited economies of scale and oligopolistic market structures is likely to be greatest.[3]

A case in point is the Republic of Korea. Following a drive to develop heavy and chemical industries in the mid-1970s, Korea found itself with an

Jaime de Melo is an economist at the World Bank, teaches at the University of Geneva, and is a fellow of the CEPR. David Roland-Holst teaches at Mills College and was visiting at the U.S. International Trade Commission when this paper was written.

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1. Early contributions include Corden (1967) and Snape (1977). Major contributions in the new literature are surveyed in Helpman and Krugman (1985, 1989), and in the edited volumes by Kierkowski (1984) and Krugman (1988). For a recent survey, see Harris (1989).

2. See, for example, Dixit (1988) and Smith and Venables (1988).

3. Developing country case studies include Bergsman (1974), Rodrik (1988), Gunasekera and Tyers (1988), Devarajan and Rodrik (1989a, 1989b), and Condon and de Melo (1991).

extremely concentrated domestic industrial structure in the early 1980s, when it embarked on cautious trade liberalization. Government policies had not only erected entry barriers into those sectors in the hands of conglomerates but also conferred a high level of protection from import competition. In many ways Korea resembles the ideal case so often referred to in the recent research on trade policy in imperfectly competitive environments. Indeed the evidence we review in this paper indicates that protection in sectors with unexploited economies of scale erected entry barriers, which in turn allowed firms to exploit market power. What then would be the effects of an across-the-board trade liberalization in this environment?

In this paper, we apply a computable general equilibrium (CGE) model developed in de Melo and Tarr (forthcoming) to assess the welfare and resource allocation effects of trade liberalization in Korea. A CGE model is particularly relevant for such an exercise because of the relatively high and dispersed protection in the Korean economy and because of the importance of economies of scale in several sectors. Our calculations are derived from a seven-sector model calibrated to 1982, a year that has especially good protection estimates. Three sectors—consumer goods, producer goods, and heavy industry—are calibrated to increasing returns to scale (IRTS). In some simulations, in line with the empirical evidence, we allow these sectors to earn supernormal profits when protected. To anticipate our results, the welfare gains from a move to free trade reach up to 10 percent of GDP, an estimate tenfold larger than the corresponding gains under constant returns to scale (CRTS). Even if, when protected, these sectors cannot earn above normal profits, our estimates of the welfare gains reach up to 5 percent of GDP.

Our results stand in sharp contrast to other estimates of the costs of protection, one exception being the work of Harris (1984) on Canada. To judge the plausibility of these results, one must question whether our model of the Korean industrial organization structure is a reasonable one. Therefore, in section 10.2 we go into some detail on recent Korean industrial organization and industrial policies, as we believe they provide good support for our modeling of trade policy in the Korean environment. Section 10.3 discusses our modeling of imperfectly competitive markets and how we calibrated the model to 1982 data. Results are in section 10.4 and conclusions follow in section 10.5.

10.2 Trade Policies, Industrial Structure, and Industrial Organization Policies in Korea

Until the move to a sectoral development strategy focusing on heavy and chemical industries (HCIs) between 1973 and 1979, Korea's outward-oriented strategy was predicated on superior organizational ability and emphasis in development of labor-intensive activities. During this early phase (prior to 1973), Korea's innovative policies included a rationalized exchange rate regime, strong export incentives, selective import liberalization, directed credit, and a host of finely tuned export promotion instruments. A key feature of that phase was high protection of the domestic market in industries in which Korea did not face favorable international prospects, combined with low protection in industries where Korean products were competitive. As a result, unlike many other countries following an active industrialization strategy, Korea offered little incentive for industries producing exportables to keep them at home. Examples of heavily protected sectors (effective protection rates for 1968 in parenthesis) were transport equipment (163 percent), durable construction (64 percent), and machinery (44 percent).

The shift toward HCIs was achieved by directing to these sectors up to four-fifths of manufacturing investment credit, usually at preferential rates, by providing protection, and by encouraging the development of conglomerates ("Jaebol"). These policies recognized that most industries favored by the HCI drive have large economies of scale and hence that efficient production implied capacities well beyond the scale of the domestic market. However, this shift from a broad, export-led strategy toward a more typical sector orientation had some undesirable side effects, including underutilized capacity and a sharp decline in the incremental output-capital ratio, effects that eventually led to a return toward greater industrial neutrality and cautious import liberalization starting in 1979. Nonetheless, it should be recognized that the HCI drive achieved many objectives, including the target of 50 percent of export sales for the HCIs and the successful transition to an economy fully based on modern technology by a leapfrog strategy with respect to technological requirements during the HCI drive.[4]

A legacy of the HCI drive, however, has been an extremely concentrated industrial structure by international standards (see table 10.1, panel A). For example, in 1982, the top fifty Korean firms accounted for 37 percent of total sales, while the corresponding figure for Japan is 27 percent for the top one hundred firms and for Taiwan 16 percent for the top fifty firms. Furthermore, the percentage of sales classified as "competitive" (three-firm concentration ratio less than 60 percent), which has been relatively low since 1970, declined as a result of the HCI drive.[5]

Various factors led to accelerated economic concentration. The introduction of mass production techniques into a small domestic market at a relatively early stage of development allowed conglomerates to accumulate stocks of superior human and physical capital while they were protected from domestic and international competition by various institutional barriers erected to limit new entry into the market. In addition, sometimes the government's economic policy intensified concentration. During the HCI drive, overlapping investment was prevented in the most important industrial branches. Furthermore, Lee, Urata, and Choi (1988) conclude that the protection and incentive poli-

4. For further discussion of the HCI drive see World Bank (1987).
5. The market share of the twenty leading Jaebol continued to rise until the early 1980s.

Table 10.1 Commodity Market Structure and Performance in Korean Manufacturing

A. Commodity Market Structure, 1982[a]

	Monopoly	Duopoly	Oligopoly	Competitive	Total
Number of commodities	533 (23.6)	251 (11.1)	1,071 (47.4)	405 (17.9)	2260 (100)
Sales (billion won)	5,649 (11.4)	3,275 (6.6)	24,967 (50.6)	15,481 (31.4)	49,372 (100)

B. Performance of Different Market Structures (average of 1978 and 1983)

	Monopoly/ Oligopoly	Competitive	Protected	Less Protected	High Export Share	Low Export Share
Price cost margin[b] (mean)	29.0	26.0	34.0	24.0	25.0	29.0

Note: Monopoly if $CR1 > 80$ percent, $S1/S2 < 10$; duopoly if $CR2 > 80$ percent, $S1/S2 < 5$, $S3 < 5$ percent; oligopoly if $CR3 > 60$ percent (monopoly and duopoly excluded); competitive if $CR3 > 60$ percent, where CRi inicates i-firm concentration ratio, and Si indicates area of largest ith firm.

Source: K. Lee, S. Urata, and I. Choi, "Recent Developments in industrial organization in Korea," World Bank Working Paper (Washington, D.C., 1988), tables 3 and 8.

[a]Numbers in parentheses are percentages; totals sum to 100.

[b]Percent; PCM is calculated as value of sales less labor costs divided by value of sales ($\times$ 100).

cies, including taxation, banking, and commercial policy measures, operated almost exclusively to the advantage of the conglomerates.

Many observers of Korea agree that conglomerates exercise market power on domestic sales. However, the data in table 10.1, panel B, suggest that sectors competing in international markets (i.e., sectors with high export shares and/or low rates of protection) price more competitively.[6] One way of finding out if this is so is by cross-section regressions linking performance with structure. Such regressions, traditionally carried out by industrial organization economists, attempt to isolate the effects of industry structure on sectoral average price-cost margin (PCMs) after controlling for other factors affecting the PCM, such as differences in technology across sectors. In the Korean case, estimates by Lee, Urata, and Choi (1988) for sixty-five manufacturing sectors for 1983 show that, after controlling for capital intensity, R&D expenditures (and other factors), the PCM is positively (and significantly) related to concentration.[7] More interestingly, they also find a statisti-

6. Mean price-cost margins (PCMs) for protected sectors were a third higher than for less protected sectors in 1982.

7. The positive correlation between PCM and concentration does not necessarily support the "structuralist view" that sees in this relationship rent-seeking behavior by oligopolistic firms. It

cally significant negative correlation between PCMs and import shares in domestic sales, suggesting that imports exert a discipline on the pricing of domestic firms.[8] These authors also note that the pace of import liberalization was accelerated in markets dominated by a few firms.

Perhaps the most telling indication that regulation of market structure became a major concern for Korean industrial policy comes from the vigorous enforcement of the Monopoly Regulation Act of 1981. About 10 percent of firms designated by the government as dominating their respective markets were accused of having their market position. Administrative recommendations and orders were issued to trade associations that had clauses permitting undue concerting activities in their articles of incorporation. Over two hundred cases in violation of the provisions against unfair trade practices were leveled between 1981 and 1985. Moreover, 35 percent of the 2,600 applications for international agreements during this period were judged to contain provisions restricting competition or involving unfair trade practices and had to be revised.

Two stylized facts emerge from this discussion and from the data in table 10.1. First, Korea appears to have achieved a very concentrated industrial structure by the early 1980s, as a legacy of the HCI drive when industrial policy discouraged firm entry. Second, the evidence suggests that, after controlling for other factors, highly protected sectors were earning above normal profits. By creating barriers to entry, protection allowed conglomerates to exercise market power. These stylized facts are incorporated in the model outlined below.

10.3. Modeling Imperfectly Competitive Domestic Markets[9]

On the basis of the evidence discussed above, we concentrate on modeling the implications of imperfectly competitive behavior in domestic markets in sectors with IRTS. At the same time, in the absence of evidence to the contrary, we assume that Korean exports are sold in competitive world markets. We also assume that Korea is a small economy in the markets in which it trades. This implies that there are no induced terms-of-trade effects from changes in trade policy. While this small-country assumption may be debatable for a few export markets in which Korea competes, it has the great advantage of simplifying the interpretation of welfare calculations and, in any case, could be relaxed without difficulty as in de Melo and Tarr (forthcoming).

could also reflect the superior performance of large firms according to the "efficiency-based view." However, in the case of Korea, evidence indicates that the efficiency of small and medium-sized firms had caught up with that of large firms by the end of the 1970s. See Kim (1985).

8. This result is known in the industrial organization literature as the "import discipline" hypothesis. See the symposia led by Caves (1980) and Geroski and Jacquemin (1981).

9. For a fuller description of the model, see de Melo and Tarr (forthcoming).

Apart from the treatment of imperfect competition discussed below, the CGE model is quite standard. In this application two primary factors, labor and capital, are in fixed supply but mobile between sectors. Intersectoral mobility leads to equal rewards across sectors for each type of factor. Domestic demand includes two components, final and intermediate. The government collects (and distributes in lump sum) revenues from tariff collection.

Substitution possibilities in production and demand are summarized in figure 10.1. Production possibilities are parametrized by assuming CES functions for value-added and Leontief functions between intermediates (as a whole) and value added, as well as within intermediates. However, within each sector, intermediate demand is a CES function between the domestically produced intermediate and the competing foreign intermediate. To give an example, no substitution in purchases is allowed between consumer goods and producer goods, but substitution in purchases is allowed between domestically produced consumer goods and foreign-produced consumer goods when their relative prices change as a result of a change in trade policy. Likewise in consumption demand, the demand system derived from the Stone-Geary utility indicator allows for nonunitary income elasticities of demand and nonzero cross-price elasticities of demand between domestically produced and foreign-produced consumption good.

Traded goods are imperfect substitutes by country of origin (CES assumption). In each sector, goods produced domestically are imperfect substitutes for imports. As in the case analyzed by Snape (1977), changes in trade policy will shift the demand curve of domestic firms. Likewise, goods supplied on the domestic market are imperfect substitutes for goods supplied for export (CET assumption). The implications of this treatment of foreign trade with production differentiation on the import and export sides is analyzed in greater detail in de Melo and Robinson (1989), where it is shown that the domestic country's foreign offer curve has the usual shape.

For sectors with IRTS, goods are produced by N_i identical firms. All goods produced for domestic sales in the same sector are perfect substitutes, allowing us to aggregate sectoral demand and supplies. The assumption that product differentiation is modeled at the national level rather than at the firm level has three implications for the welfare estimates reported below. First, because all domestic firms are identical and supply a homogeneous product, one cannot capture product variety and hence we may underestimate the benefits of trade liberalization as additional product variety occurs. Second, the assumption of national product differentiation implies that the domestic firms' perceived elasticity of demand (defined below in eq. [3]) only depends on the number of competing domestic firms rather than on the total number of competing firms in the world. Our numerical results, however, show that the value of the perceived elasticity of demand is quite insensitive to firm entry/exit. Third, the assumption of national product differentiation implies that adjustment to achieve zero profits occurs by firm entry/exit. In the case of firm entry,

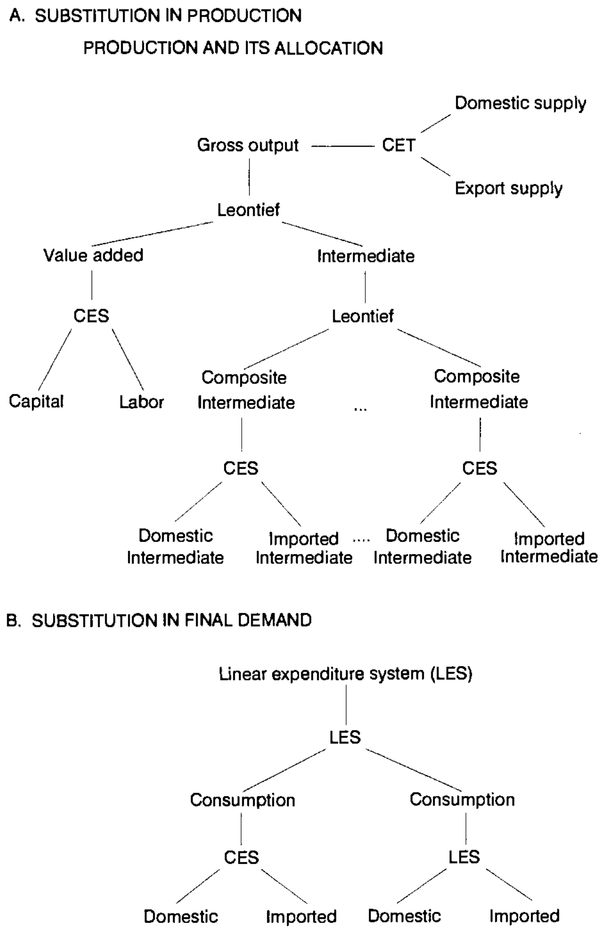

Fig. 10.1 Model structure

one gets market fragmentation that may overstate scale inefficiency.[10] If Korean firms are indeed "small" in the market in which they compete, an increase in the number of Korean firms would have little effect on their demand. Hence adjustment to zero profits would occur by an alternative mechanism. One possible adjustment is that which occurs when incumbent firms price competitively, just covering average costs.

In view of these implications of the national product differentiation assumption, we shall contrast two pricing hypotheses in IRTS sectors against the alternative of CRTS where marginal cost pricing prevails. Furthermore, we

10. For an approach that relies on product differentiation at the firm level see Brown and Stern (1989).

shall consider for each pricing hypothesis the possibility that protection, by creating barriers to entry, allows for supernormal profits.

10.3.1 Contestable Market Pricing

In the first alternative, we specify an analogue to the case of perfect competition under CRTS. We assume costless entry/exit, so that the threat of entry forces incumbent firms to price at average cost. We shall refer to this hypothesis as the *contestable market* pricing rule. Omitting sectoral subscripts:

$$PX = AC \tag{1}$$

for each sector with IRTS, where PX is the weighted sum of the unit sales prices on the domestic (PD) and export (PE) markets (recall that in the export market the unit sales price in domestic currency is determined by the exogenously given price in foreign currency times the exchange rate) and AC is average costs. As shown below, this pricing rule represents only a small departure from competitive pricing and has the advantage of isolating the role of market structure from that of market conduct.

10.3.2 Monopolistic Competition

In the second alternative, we assume that each identical firm behaves in the domestic market as a monopolist facing a downward-sloping demand curve. In equilibrium, each firm equates marginal revenue with marginal costs, that is,

$$\frac{PD - MC}{PD} = \frac{1 + \Omega}{N\epsilon}, \tag{2}$$

where MC is marginal cost, PD is the unit price on domestic sales, and ϵ is the representative firm's conjecture about the response of competitors to its output decision with respect to firm j. That is, if Q_{-j} denotes the aggregate output of the remaining firms in its sector, then $\Omega \equiv \Delta Q_{-j}/\Delta Q_j$. We refer to this specification as the *monopolistic competition* or *exogenous conjectures* case (to distinguish it from the variant below where conjectures are endogenous).

For the functional forms selected to represent import demand and export supply, de Melo and Tarr (forthcoming) show that the perceived elasticity of demand facing each firm is given by

$$\epsilon = \epsilon^F S^F + \epsilon^V S^V, \tag{3}$$

where S^F and S^V denote the shares of final and intermediate goods in total demand, respectively, and ϵ^F and ϵ^V are functions of the parameters describing substitution effects in intermediate and final demand.

Expression (3), which is obtained by differentiating the first-order conditions describing demand for domestic and imported goods, indicates that the perceived elasticity of demand is a share-weighted average of the price elasticities of demand for final (ϵ^F) and intermediate (ϵ^V) goods. Because the shares depend on quantities demanded that are themselves price-responsive, the perceived elasticity of demand is itself endogenous and will increase in response to trade liberalization. This implies that there is a "pro-competitive" effect of trade liberalization in the monopolistic competition model.

Whereas the threat of entry insures zero profits in the contestable market alternative, in the conjectural variation case we have to make assumptions about entry and exit. In one closure, we assume no entry/exit. One can think of this alternative as the *short-run monopolistic competition* case. In the other, which is more representative of a long-run equilibrium, entry/exit ensures zero profits. Then the model also includes explicitly the zero profit condition

$$(4) \qquad \pi = 0,$$

where π is the profit rate.

One might expect the degree of firm collusion to vary with the number of firms. The fewer the number of firms, the more collusive behavior is likely to be. Indeed, if N represents the number of firms, one would expect that $\Omega \rightarrow 0$ as $N \rightarrow \infty$ so that firms behave competitively as N becomes large. In our case, N is an arbitrary number normalized to unity in the calibration. To capture the idea that firms' conjectures depend on the number of firms, and, more important, to account for the fact that firm entry implies the availability of a larger number of varieties, we add the following equation to determine conjectures:

$$(5) \qquad \Omega = \Delta Q_{-j}/\Delta Q_j = N^{-1}.$$

We refer to this variant as the *endogenous conjectures* case. This means that, as firms enter (exit), incumbents adapt their conjectures and price more (less) competitively. Equation (5) can be viewed as a shortcut to account for product variety and the influence of the number of firms on behavior.[11]

10.3.3 Supernormal Profits

In light of the evidence in section 10.2, we present a variant of the model in which protection allows for supernormal profit because of barriers to entry. Supernormal profits exist because of protection. This variant is applied to both pricing rules described above. In the presence of supernormal profits, firms sell in the domestic market at a price $\tilde{PD} > PD$. The rate of supernormal profit, ψ, per unit of domestic sales, is an exogenous parameter. Then, in the contestable market case, equation (1) is replaced by

$$(1') \qquad PX\,(\tilde{PD}, PE) = AC\,(1 + \psi),$$

which is contestable for $\psi = 0$. In the conjectural variation case, equation (4) is replaced by

11. While the conjectural variation approach is a convenient way of parametrizing oligopolistic behavior and suitable for a static simulation exercise, it is inadequate to study detailed interactions under dynamic oligopoly. For a critique of the conjectural variation approach see Shapiro (1989).

$$(4') \qquad \pi = \psi,$$

which sets the profit rate to its exogenously determined value. In the experiments reported below, we assume that liberalization eliminates the market power of domestic firms in the domestic market. Therefore removing protection entails concurrently setting $\psi = 0$ in equation (1′) or (4′). To control for the effect of entry/exit in the monopolistic competition case, we also run this specification with no entry/exit under both profitability scenarios.

10.3.4 Data and Calibration

In the application, we remove protection in a model where the economy is disaggregated into seven sectors. Table 10.2 gives the aggregation and structure of production and final demand. The base case against which we contrast our various pricing rules assumes constant returns to scale (CRTS) for all sectors. When we assume IRTS, three sectors have increasing returns: consumer goods, producer goods, and heavy industry. Together, these three sectors account for 42 percent of value added. Each of the three pricing hypotheses requires a different calibration so as to replicate quantities and values contained in base data.

In the case of normal initial profits ($\psi = 0$), to incorporate fixed costs while replicating observed prices and quantities in the CRTS case, we reduce the primary variable cost component to total costs by the amount of fixed costs. In the case of monopolistic competition, equation (2) is also solved to yield the value of the conjecture Ω. This implies that the conjecture is in fact calibrated.[12] Hence we denote the calibrated conjecture by $\tilde{\Omega}$. The calibrated values of $\tilde{\Omega}$ appear in table 10.4 below.

In the presence of supernormal profits, we allocate fixed costs as before and then, given the profit rate ψ and all quantities and foreign prices, we solve for the domestic price vector $\tilde{PD}$ which satisfies the firm's profitability constraint.[13] As before, the value of $\tilde{\Omega}$ is obtained from equation (2) but with the new set of domestic prices.

For the seven sectors in the present aggregation, table 10.2 gives the composition of sectoral output, exports and imports. Also included are estimates for (1) elasticity of capital/labor substitution; (2) import price elasticities of demand; (3) export supply price elasticities. The last column of table 10.2 gives the value of the calibrated price elasticity of demand, ϵ.

12. An equivalent approach is to read in Cournot conjectures and calibrate for N_i, the Cournot-equivalent number of firms. An alternative (but in our view less appealing) approach is to solve for marginal costs or demand elasticities, both of which are likely to be more reliable information than conjectures. In any case, the system of eqs. (2) and (3) can only deliver two of the three variables Ω, N, and ϵ.

13. Because of interindustry relationships, this calibration involves solving simultaneously for the vector of domestic prices, $\tilde{PD}$.

Table 10.2 **Structure of Production, Trade, and Elasticity Values**

	Share in Gross Output (X) (1)	Exports/ Output (E/X) (2)	Imports/ Domestic Sales (M/D) (3)	Elasticity of Substitution in Production (σp) (4)	Export Supply Elasticity[a] (σt) (5)	Import Elasticity of Demand[a] (σv) (6)	Nominal Tariff Rate[b] (tm) (7)	Price Elasticity of Demand for Domestic Sales (ε) (8)
Primary	8.9%	4.9%	64.4%	2.5	0.75	1.8	59.7	—
Food processing	9.6	2.5	6.7	1.5	1.5	2.5	18.4	—
Consumer goods	14.4	32.5	11.2	1.0	1.5	2.4	15.7	1.49
Producer goods	20.1	16.6	19.7	0.9	1.5	2.2	17.6	1.30
Heavy industry	7.7	31.9	47.3	0.9	1.5	1.9	28.3	1.31
Traded services	13.2	24.4	6.1	1.5	1.5	2.0	0.0	—
Nontraded services	26.1	—	—	0.9	—	0.4	—	—

[a]Income compensated price elasticity of export supply (import demand).

[b]Nominal tariff rate includes an estimate of tariff equivalent protection conferred by existing nontariff barriers.

10.4 Simulation Results

The simulations consist of the abolition of the import protection Korea had in 1982, the year for the most recent input-output table. Column (7) in table 10.2 gives the nominal tariff structure of Korea in that year. The protection rates reported here are based on direct comparisons of domestic and international prices. Hence they include tariff equivalent protection by existing non-tariff measures, and are as reliable an estimate of protection as one is likely to obtain. The most notable feature of the tariff structure displayed in column (4) is the high protection conferred on the primary sector. This reflects Korea's tradition of protecting its agricultural sector.

Tables 10.3 and 10.4 report the welfare and sectoral resource pull effects of removing protection under the pricing alternatives described above. To facilitate interpretation of results, we compare them with those obtained under CRTS. Recall that for the cases with IRTS, the three sectors with increasing returns are consumer goods, producer goods, and heavy industry. Simulations are for two sets of parameter values describing unexploited economies of scale in the base solution. For the case of low economies of scale, we assume for all three sectors a cost-disadvantage ratio (CDR) of 0.10, which is thought to be a conservative value for Korean manufacturing. For the case of medium/high economies of scale, a cost-disadvantage ratio of 0.20 is assumed. Each set of CDRs is applied to the three pricing rules described earlier. For profits, we also assume two alternatives. In the first, normal profits ($\pi = 0$) are as-

Table 10.3 **Aggregate Welfare Effects of Trade Liberalization**

				Monopolistic Competition			
	CRTS	Contestable Market		No Entry/Exit		Entry/Exit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cost Disadvantage Ratio[a]	0.0	0.10	0.20	0.10	0.20	0.10	0.20
	% of Base-Year National Income						
Equivalent variation (EV)[b]	1.1						
$\pi = 0$		2.6	5.3	2.1	4.7	−0.6	2.8
$\pi = 10\%$		4.9	10.2	2.5	5.2	1.6	6.0
Scale efficiency gain (SE)[c]	0.0						
$\pi = 0$		1.3	3.4	0.8	3.0	−1.4	1.5
$\pi = 10\%$		2.0	5.8	0.7	2.5	−0.4	2.9

[a]CDR = $1 - MC/AC$.

[b]EV = $C\,[\mathrm{IU}\,(P_I,\,Y_1,)P_1] - C[\mathrm{IU}\,(P_0,Y_0]$, where C is the cost function associated with the indirect utility function (IU) corresponding to the LES utility function describing consumer choice.

[c]SE = $[TC\,(P_0,X_0) - TC\,(P_0,X_1)]/\mathrm{GDP}_0$ is a vector of product and factor prices, and GDP_0 is real GDP prior to the removal of protection.

Table 10.4 **Sectoral Results (CDR = 0.1) (percentage changes)**

		Contestable Market		Monopolistic Competition			
				No Entry/Exit		Entry/Exit	
	CRTS (1)	$\pi = 0$ (2)	$\pi = 10$ (3)	$\pi = 0$ (4)	$\pi = 10$ (5)	$\pi = 0$ (6)	$\pi = 10$ (7)
Consumer goods:							
X	12.4	19.0	31.7	10.0	9.4	6.9	22.7
E	25.1	34.9	57.9	20.7	21.3	17.4	45.3
SE		1.6	1.9	0.3	0.3	−1.8	−0.1
$\underline{\varepsilon}$				0.9	0.9	0.8	1.4
Ω						0.2	0.4
N						25.8	23.8
Producer goods:							
X	12.9	17.2	26.5	12.9	10.9	10.1	18.8
E	40.1	48.2	69.9	39.9	37.8	36.6	55.8
SE		1.6	2.0	0.6	0.4	−1.1	−0.4
$\underline{\varepsilon}$				0.2	0.3	0.2	0.2
Ω						0.2	0.3
N						21.6	24.1
Heavy industry:							
X	−1.7	−5.1	8.4	−3.3	−1.7	−5.5	4.3
E	9.7	2.8	23.8	6.9	10.3	4.6	19.5
SE		−0.6	0.7	−0.1	0.0	−1.8	−1.0
$\underline{\varepsilon}$				2.6	2.6	2.5	3.1
Ω						0.2	0.3
N						10.7	17.0

Note: X = gross output; E = exports; SE = scale efficiency measure (see table 10.3) expressed as a percentage of sectoral sales at current prices; $\underline{\varepsilon}$ = elasticity of demand (defined in eq. [3]); Ω = calibrated conjecture; N = number of firms (initially set equal to 1).

sumed, regardless of whether there is protection. In the second case, in line with the pattern of PCM values described in section 10.2, we assume that a supernormal profit rate of 10 percent (π = 10) is achievable under protection because of the barriers to entry from restricted foreign competition.

Two measures of the gains/losses from removing protection are reported in table 10.3. The equivalent variation (EV) measure is derived from the indirect utility (IU) function associated with the Stone-Geary utility function assumed for final demand. EV is an aggregate measure of both efficiency gains in production and in consumption. It measures how much the representative consumer would have to be compensated, at the new set of prices, to be indifferent to the bundle of goods now available at the initial set of prices. The second measure is the scale efficiency gain/loss (SE) from moving along the average cost curve. Like EV, SE evaluates the new output level at old prices, so that the measure controls for shifts in the average cost curve induced by changes in factor and product prices.

Figure 10.2 illustrates the measure of scale efficiency change used in table 10.3. Prior to removing protection, the observed cost output combination is (C_0,X_0). As a result of the removal of protection, relative product and factor prices change, leading to a shift in the cost curve. Consider two cases. In figure 10.2, panel A, there is output expansion, leading to an estimated scale efficiency gain indicated by the shaded area. In contrast, in panel B there is output contraction and, therefore, a scale efficiency loss, again indicated by the shaded area. In both cases, the scale efficiency change is measured by evaluating the cost function at the initial vector of product and factor prices. The measure (SE) reported in table 10.3 is the sum of the sectoral gains and losses.

Table 10.3 expresses both EV and SE as a percentage of initial national income (GDP). In the reference case of CRTS, liberalization yields a 1.1 percent increase in welfare (col. 1). Because there are no scale efficiency effects, the welfare gain under CRTS is the sum of the traditional producer and consumer surplus gains from removing distortions.

Now compare this result with the corresponding estimate under contestable market pricing. In this specification there is no firm entry, so scale efficiency gains/losses vary directly with sectoral output. Sectors that expand (contract) will achieve scale economy gains (losses). In the case of no initial supernormal profits, welfare gains are higher than under CRTS because, on average, sectors with IRTS expand as a result of removing protection. This is so because resources are pulled out of the heavily protected primary sector into industry, where three out of the five sectors have IRTS.

As expected, welfare gains are greater the greater the degree of unrealized scale economies. Doubling the value of CDR approximately doubles the overall welfare gain, although it almost triples the associated scale efficiency gains. Note also that the EV measure under IRTS is greater than the sum of the EV measure under CRTS and the corresponding SE measure. This is so because there is a further gain as average cost pricing comes closer to marginal cost pricing.

When trade liberalization eliminates supernormal profits (π = 10 percent), welfare and scale efficiency gains increase substantially. This is one aspect of the pro-competitive effect of trade liberalization (the other appears in the form of a higher elasticity of demand in the monopolistic competition model; see table 10.4). For example, with the combination (CDR = 10 percent, π = 10 percent), EV = 4.9 percent of GDP. Compared with the case of no initial profits (EV = 2.6 percent of GDP), the greater welfare gain can be decomposed into two components: the first is the scale efficiency gain (2.0 percent versus 1.1 percent) as firms expand more because they can no longer price restrictively. The second component is again due to the welfare gains of pricing closer to marginal costs. This effect is about 1.8 = 4.9 − (1.1 + 2.0) percent of initial GDP. In the not implausible combination

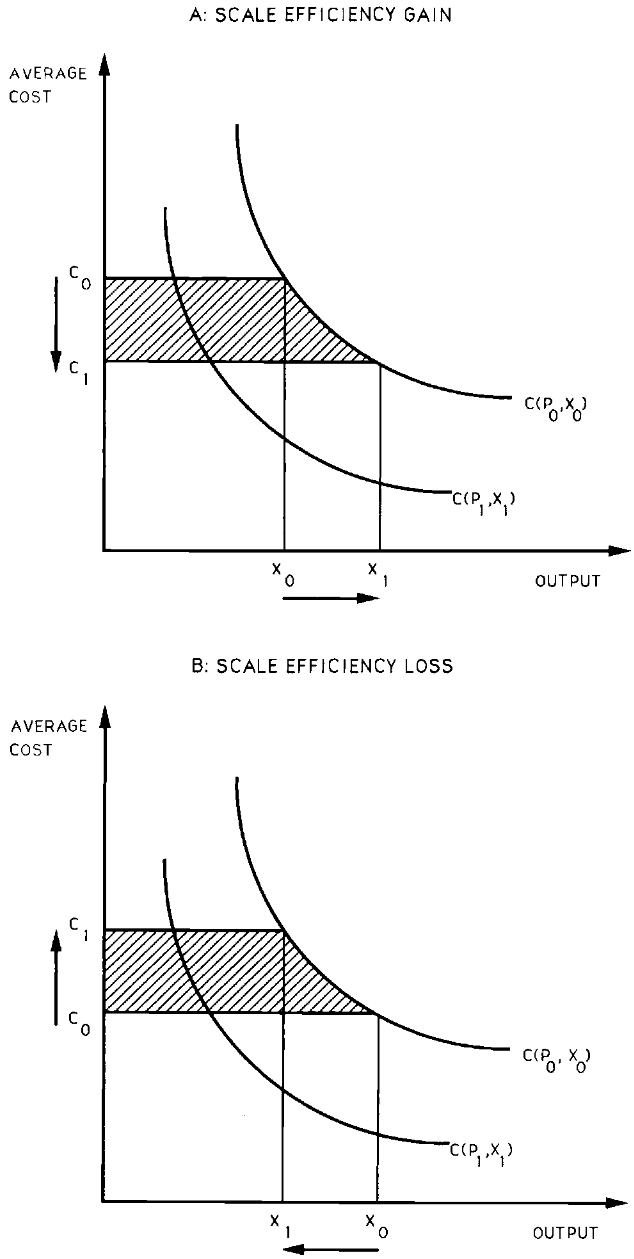

Fig. 10.2 Efficiency effects on aggregate welfare

(CDR = 20 percent, π = 10 percent), welfare gains from trade liberalization are estimated at 10.2 percent of GDP.

The monopolistic competition case is more complicated, since there are three additional adjustment mechanisms that affect the calculated welfare gain measure. First, there may be firm entry/exit to attain exogenously specified profit rates. A second factor is the endogeneity of oligopoly behavior, an effect we consider later. As firms enter (exit), incumbents adapt their conjectures and price less (more) competitively. Third, but apparently less significant, is the pro-competitive effect that is due to trade liberalization raising the elasticity of sectoral domestic demand, ϵ (see table 10.4).[14]

Compare contestable market pricing and monopolistic competition with no entry/exit (cols. 4 and 5). In the contestable market case, scale efficiency gains are higher because firms expand output to maintain or to achieve zero profits. On the other hand, in the monopolistic competition case, with no entry/exit, firms may make profits, realizing lower scale efficiency gains. At the same time, profits reduce welfare gains as prices diverge further from marginal costs. These two factors explain why welfare gains are larger under contestable market pricing. The larger difference in welfare gains for the specification with positive profits in the base results from substantially greater output expansion to achieve the necessary price reductions after the removal of protection.

Now consider firm entry, which exerts a crowding effect that diminishes the overall scale efficiency gain (this is the effect analyzed in Horstmann and Markusen 1986). In the case of CDR = 0.10, this effect dominates the positive output effect of liberalization on scale efficiency, so that overall scale efficiency is reduced.[15] By contrast, with CDR = 0.20, average sectoral output expands more than the firm population and scale efficiency is increased. In the case of zero initial profits, the scale efficiency loss is large enough to offset the other welfare gains from trade liberalization.

When there are profits in the initial situation, as before, there is a gain from moving closer to marginal cost pricing with trade liberalization. However, two other effects are also at work. On the one hand, more firm entry is required to eliminate excess profits, with its deleterious effect on scale efficiency. However, there is a counterbalancing effect as firm entry leads to more competitive behavior. The net result is that scale efficiency improves more and that the overall welfare gain is greater than in the zero initial profit scenario. Since we have not taken direct account of increased product variety on welfare, these results may understate the benefits of increased competition.

Table 10.4 summarizes the microeconomic results from removing protection for the sectors with IRTS and a CDR value of 0.10. The table also dis-

14. This effect is also discussed by Devarajan and Rodrik (1989b).

15. The reduction in scale efficiency obtained here also occurs for certain parameter configurations in the theoretical models of Krugman (1984), Snape (1977), and Venables (1985).

plays the value of $\tilde{\Omega}$, which suggests that all three sectors are more competitive than Cournot. For each of the three sectors with IRTS, exports expand, even though under most scenarios output contracts for heavy industry (the most protected sector after agriculture). The reasons for export expansion despite output contraction is that removing protection leads to a real exchange rate depreciation, a general equilibrium effect.

Consumer and producer goods follow similar patterns: with $\pi = 0$, expansion is greatest under contestable mark-up pricing and least under monopolistic competition with CRTS in the middle. The reason for a stronger expansion under contestable market pricing is the absence of firm entry that impedes the realization of economies of scale. Interestingly, the scale efficiency loss caused by firm entry (the number of firms increases by between 21 and 25 percent) can dampen output expansion below that achieved under CRTS when $\pi = 0$. Compare columns (6) and (1) in the case of consumer goods, where firm entry is greatest and scale efficiency loss greatest. Output expansion under monopolistic competition is only half that achieved under CRTS. There are two reasons for this smaller output expansion. First, the higher price for domestic sales resulting from less efficient scale means less demand for domestic consumer goods (and greater demand for imported consumer goods). Second, because of interindustry linkages, under monopolistic competition production costs go up in sectors that are intensive purchasers of producer goods and heavy industry.

When protection alters market structure by allowing for supernormal profits (cols. 3 and 5), removing protection leads to a magnification effect on resource pulls. The magnification effect is stronger under monopolistic competition for consumer and producer goods than under contestable market pricing. For heavy industry, the (exogenous) pro-competitive effect of eliminating profits is sufficient to compensate for the negative resource pull effect of eliminating protection. This example illustrates the possibility that sectors that would be predicted to contract because of liberalization expand instead because they become more competitive. Even in this highly aggregated model, a ranking of sectors in ascending order of effective protection would thus not be an accurate ranking of comparative advantage.

The other pro-competitive effect of trade liberalization comes from the greater elasticity of demand facing firms after protection is eliminated. For the functional forms specified here, the results in table 10.4 indicate that this effect is small. However, one cannot judge the likely importance of this effect from the simulations reported here, since constant substitution elasticities are maintained throughout. Changes in the values of ϵ are entirely accounted for by changes in import (and domestic) shares in final and intermediate demand.

So far, all the results for the monopolistic competition case are with exogenous conjecture. We have seen that firm entry to eliminate profits reduces the welfare gains of trade liberalization because of less scale efficiency gain. Moving to the assumption of endogenous conjecture (eq. [5]) increases scale efficiency because incumbent firms price more competitively as new firms enter. As a result, welfare gains under the monopolistic competition scenario with endogenous conjectures (not reported here) are between those obtained under contestable market pricing and those obtained under monopolistic competition with exogenous conjectures.

10.5 Conclusions

This paper has developed a simulation model to evaluate the welfare effects of trade liberalization. In contrast with previous general equilibrium simulation exercises, this paper decomposes the welfare effects of trade policy changes into its various components. Although the calibrated simulation exercise for Korea relies on judgmental parameter values to represent demand and supply elasticities, evidence on the links between trade policies, industrial structure, and industrial organization policies in Korea provides good support for the alternative modeling approaches adopted here. The estimated gains from trade liberalization were found to be quite sensitive to the specification of firm pricing behavior in the three manufacturing sectors with IRTS.

In the benchmark case of across-the-board CRTS, elimination of protection yields a welfare gain of 1.1 percent of GDP. This gain represents the traditional production and consumption costs of protection. Under IRTS and no firm entry, net scale efficiency gains (scale efficiency gains in consumer goods and producer goods coupled with scale efficiency losses in heavy industry) give an additional gain between 1.3 and 3.4 percent of GDP, depending on the extent of unrealized economies of scale. If it is recognized, as the evidence suggests, that protection allowed Korean conglomerates to act collusively in their sales on the domestic market, one would obtain an additional welfare gain of between 1.3 and 4.9 percent of GDP, thereby yielding a total gain of between 5 percent of GDP if unexploited economies of scale are small and 10 percent of GDP if they are in a range commonly attributed to them in this country (a cost disadvantage ratio of 20 percent).

Welfare gain estimates are, however, much lower if the contestable market scenario is replaced by one with the assumption of monopolistic competition, even if one recognizes that firm entry/exit may occur. Under the monopolistic competition scenario where liberalization is accompanied by firm entry, the number of firms increases by between 10 and 25 percent in sectors with IRTS. Trade liberalization results in scale efficiency losses. In some cases there is sufficient entry to yield a net aggregate welfare loss if firms are not allowed to make excess profits under protection. If firms are allowed to earn supernormal profits under protection, aggregate welfare gains are between 1.6 and 6.0 percent of GDP.

In the Korean example, trade liberalization would favor industry since agriculture is the most heavily protected sector. In many other semi-industrial countries, elimination of protection would involve a resource shift out of manufacturing. A case in point is Chile, where trade liberalization involved a relative expansion of agriculture. In this case, scale efficiency gains would only be achieved if the elimination of protection were accompanied by firm exit, and the scale efficiency gains of trade liberalization would be greater in a world of monopolistic competition than in one of contestable market pricing. However, the competitive effects of trade liberalization could be even greater than those estimated here.

It should be apparent from this summary description of the results that the welfare cost estimates of protection are quite sensitive to the specification of market structure and conduct and, in particular, to the firm entry/exit patterns accompanying trade liberalization. In the Korean case, estimates of the gains from trade liberalization are much larger under IRTS than under CRTS, if inefficient firm entry is forestalled while the competitive discipline imposed by greater import competition is maintained on the domestic market.

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Comment Dani Rodrik

It has now become commmonplace to point out that the markets of developing countries are rife with imperfect competition and unexploited scale economies, on account of which trade liberalization can either go horribly wrong or magnify the conventional gains from trade. Since sensible theoretical models

Dani Rodrik is an associate professor of public policy at Harvard University and a faculty research fellow at the National Bureau of Economic Research.

can be constructed to demonstrate the possibility of either outcome, we must rely on empirical evidence to fortify our intuition regarding likely scenarios. The problem is that empirical evidence is hard to come by and even harder to interpret. Very few developing countries have undertaken genuine and substantial import liberalization prior to the 1980s; and the more recent cases are too fresh to yield much evidence. With regard to the few cases of genuine liberalization there is the thorny issue of how to disentangle the effects of the macroeconomic context from trade policy proper.

While numerical simulation exercises perhaps ought not count as empirical evidence, they are nonetheless useful in sharpening our intuition about the range of possible outcomes. General equilibrium models of developing countries that are sensitive to market structure issues can be counted with the fingers of one hand. Therefore, the marginal value of the type of exercise carried out by de Melo and Roland-Holst is quite high. In this case, unlike with partial-equilibrium simulation exercises applied to the trade problems of advanced industrial countries, we have not yet reached a point of sharply diminishing returns.

The basic story told in the paper is sensible and, in its broad outlines, would appear to be robust to minor changes in calibration and specification. In Korea, trade protection in the early 1980s favored the primary sector (agriculture) over industry. Consequently, we expect trade liberalization to direct resources toward industry. Now, since it is industry where excess profits and unexploited scale economies reside, such resource pulls would tend to magnify the conventional gains from liberalization. And this is generally the outcome in the scenarios labeled "contestable markets." The fly in the ointment comes with the conjectural variations model under free entry. The increased profitability of the manufacturing sectors attracts entry, which is disadvantageous in view of the duplication of fixed costs. With such entry, the scale diseconomies can be large enough to outweigh the conventional gains from liberalization.

Fortunately, the actual behavior of the South Korean economy tends to rule out the second scenario. In a comparison of the Korean economy with Taiwan's, Tibor Scitovsky presents the following striking facts: between 1966 and 1976, the number of manufacturing firms in Taiwan increased by 150 percent while the number of employees per firm increased by 29 percent; in Korea, the number of firms increased only by 10 percent, while average firm size increased by 176 percent.[1] It would appear that the last thing one needs to worry about in Korea is the threat of excessive entry. Hence, I would have preferred to see the model run under the assumption of no entry/exit, especially since the authors spend considerable effort to motivate the presence of excess profits in Korean industry.

1. Tibor Scitovsky, "Economic Development in Taiwan and Korea, 1965–81," in *Models of Development: A Comparative Study of Economic Growth in South Korea and Taiwan*, ed. Lawrence J. Lau (San Francisco: ICS Press, 1986), 146.

Related to this last point, the authors' liberalization experiments in fact combine two conceptually separate shocks: one, the conventional shock, is the elimination of all tariffs; the other, the unconventional one, is the reduction of all excess profits to zero. Now, the whole point of having a structural model of imperfect competition is to determine the level of profits (i.e., price-cost margins) endogenously. Within the context of the authors' model, there is no reason why trade liberalization on its own should drive excess profits to zero, since domestic and foreign goods are imperfect substitutes for each other. Imposing a zero-profit condition under liberalization amounts to comparing a short-run equilibrium under protection (with excess profits) to a long-run equilibrium under free trade (with zero profits). This may not be quite the right comparison. If, contrary to the evidence, one is willing to believe in free entry, one may still want to compare the *long-run* equilibria under the two policy regimes.

There are also difficulties in interpreting the contestable-markets scenario. First, the assumption of increasing returns to scale has the implication under this scenario that the entire manufacturing sector in Korea contains only three firms, one each in producer goods, consumer goods, and heavy industry. Korean industry may be highly concentrated, but perhaps not to that extent. Second, the assumption of excess profits sits ill at ease with the assumption of contestability. Perhaps the incumbents have a cost advantage that accounts for these profits; but then why would these profits necessarily go to zero as a result of trade liberalization?

Another unconventional feature of the model is that the conjectural variation parameter is endogenized by making it proportional to the inverse of the number of firms. Given the inherent difficulties with conjectural-variations models, this compounds interpretational problems. And it does not appear to be necessary. Even if the cleaner Cournot assumption is made, the fact that the price-cost margin of the representative firm is decreasing in the number of firms ensures the result that the authors are most interested in obtaining: the reduction in profits with entry.

In conclusion, this is an instructive paper from which we learn that the structure of protection in Korea has probably pulled resources away from manufacturing industries where they could have contributed to the further realization of scale economies. Some of the unconventional features of the model notwithstanding, this is a useful lesson. But as de Melo and Roland-Holst also stress, its relevance to other developing countries may be limited as the typical pattern of protection in these countries is biased in favor of, and not against, industry.

Comment Marie Thursby

de Melo and Roland-Holst use a seven-sector CGE model to examine the effects of trade liberalization in South Korea. Four sectors exhibit perfect competition with constant returns to scale, and three (consumer goods, producer goods, and heavy industries) are imperfectly competitive with increasing returns to scale (IRTS). The question addressed is whether liberalization rationalizes production in the IRTS sectors. With protectionist policies, such sectors may be characterized by too many firms producing at a relatively high average cost. If liberalization leads to an increase in firm size (hence, a lower average total cost), then production is rationalized, but if equilibrium firm size is smaller after liberalization, derationalization occurs.

The authors argue effectively that Korea is an ideal case to study since government policies in the 1970s led to an oligopolistic industry structure with unexploited scale economies. The Korean case is an interesting one, and a general equilibrium approach is clearly the appropriate one for this case. With the high degree of Korean agricultural protection, one would expect the major impacts of trade liberalization on the IRTS sectors to be general equilibrium effects. Because of this, it would be nice if the authors were to give us more information related to these effects. In particular (and, as the authors state), rationalization is a function of factor price changes and, hence, resource pulls across sectors. It would be easier to interpret the rationalization effects if we knew the factor price changes implied by each of the simulations. For example, a change in factor prices will shift the average cost curves of firms, while liberalization per se will have a pro-competitive effect on the perceived elasticity of demand. Each of these will affect rationalization, so that information about factor price changes can be useful in sorting out the two effects.

It would also be nice to see some sensitivity analysis other than that done for scale economies. Besides sensitivity to the elasticities of substitution in production, sensitivity to the elasticity of substitution in consumption (and hence, demand elasticities) is of interest. Sensitivity analyses in other CGE studies of trade liberalization with imperfect competition have shown the results can be quite sensitive to the elasticity of substitution in consumption.[1]

The most interesting aspect of the paper, but the most disappointing in some respects, concerns the effects of market structure on rationalization. The authors do a good job of relating rationalization to the degree of unexploited scale economies and to entry and exit. They also show that assumptions about profit margins and firm behavior are important in determining welfare effects.

Marie Thursby is professor of economics at Purdue University and a research associate of the National Bureau of Economic Research.

1. D. K. Brown and R. M. Stern, "U.S.-Canada Bilateral Tariff Elimination: The Role of Product Differentiation and Market Structure," in *Trade Policies for International Competitiveness*, ed. R. C. Feenstra (Chicago: University of Chicago Press, 1989), 233.

Unfortunately, the market assumptions used are a bit ad hoc. In these models N identical firms are assumed to produce a homogeneous commodity, and a conjectural variation model is used to proxy effects of product differentiation among firms within the country. The only product differentiation allowed is at the national level by employing the Armington assumption (both on the import and export side). Since firm product differentiation would imply intra-industry trade, it would yield different results in terms of intersectoral resource pulls with trade liberalization. In the case of Canada-U.S. trade liberalization, Brown and Stern show that the two types of differentiation have dramatically different effects.[2] In all fairness, de Melo and Roland-Holst do note the limitations of the Armington assumption. Since market structure appears to be an important feature of the analysis, a more explicit approach to modeling behavior would have been preferable.

2. Ibid.