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Industrial Organization and Trade Liberalization

Evidence from Korea

Jaime de Melo
and
David Roland-Holst

The welfare gains Korea would realize from abolishing the tariffs and equivalent import restraints prevailing in 1982 are likely to be substantial.

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Drawing on evidence about industrial organization and market structure, de Melo and Roland-Holst develop a computable general equilibrium model in selected industrial sectors with increasing returns to scale.

They use this model to estimate the welfare gains Korea would realize from abolishing the import restraints (tariffs and equivalent measures) prevailing in 1982.

Under constant returns to scale, they estimate welfare gains to be 1 percent of GDP.

With increasing returns to scale in three industrial sectors, they estimate welfare gains ranging from -0.5 percent to 10 percent of 1982 GDP, depending on assumptions about the pricing behavior (markup pricing or Cournot competition) and profit levels that existed under protection.

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**Industrial Organization and Trade Liberalization:
Evidence from Korea**

by
Jaime de Melo
and
David Roland-Holst.

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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 Korea. Following a drive to develop heavy and chemical industries in the mid 1970s, Korea found itself with an 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 which 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 super-normal 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 2 we go into some detail on recent Korean industrial organization and industrial policies, as we believe they provide good support for our modelling of trade policy in the Korean environment. Section 3 discusses our modelling of imperfectly competitive markets and how we calibrated the model to 1982 data. Results are in section 4 and conclusions follow in section 5.

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%), durable construction (64%), and machinery (44%).

The shift towards 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 (referred to as 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 towards 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% 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 1a). For example, in 1982, the top 50 Korean firms accounted for 37 percent of total sales, while the corresponding figure for Japan is 27 percent for the top 100 firms and for Taiwan 16 percent for the top 50 firms. Furthermore, the percentage of sales classified as "competitive" (three-firm concentration ratio less than 60%), which has been relatively low since 1970, declined as a result of the HCI drive.⁵

Various factors led to accelerated economic concentration. Introducing 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 policies, 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 1b 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,

Table 1: COMMODITY MARKET STRUCTURE AND PERFORMANCE IN KOREAN MANUFACTURING**(1a) Commodity Market Structure^a
(1982)**

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

**(1b) 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)	0.29	0.26	0.	0.24	0.25	0.29

Note: Monopoly if $CR_1 > 80$ percent, $S_1/S_2 < 10$.

Duopoly if $CR_2 > 80$ percent, $S_1/S_2 < 5$, $S_3 < 5$ percent.

Oligopoly if $CR_3 > 60$ percent (monopoly and duopoly excluded).

Competitive if $CR_3 > 60$ percent.

Where CR_i indicates i -firm concentration ratio, and S_i indicates area of largest i th firm.

a. Numbers in parentheses are percentage: totals sum to 100.

b. Percent • PCM is calculated as value of sales less labor costs divided by value of sales.

Source: Lee, Urata, and Choi (1988), Tables 3 and 8.

attempt to isolate the effects of industry structure on sectoral average price - cost margin (PCMs) after controlling for other factors affecting the PCM, like differences in technology across sectors. In the Korean case, estimates by Lee, Urata, and Choi (1988) for 65 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 statistically 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 enacted in 1981. About 10 percent of firms designated by 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 1. First, Korea appears to have achieved a very concentrated industrial structure by the early 1980s. This was a legacy of the HCI drive when industrial policy discouraged firm entry. Secondly, 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.

3. Modelling Imperfectly Competitive Domestic Markets⁹

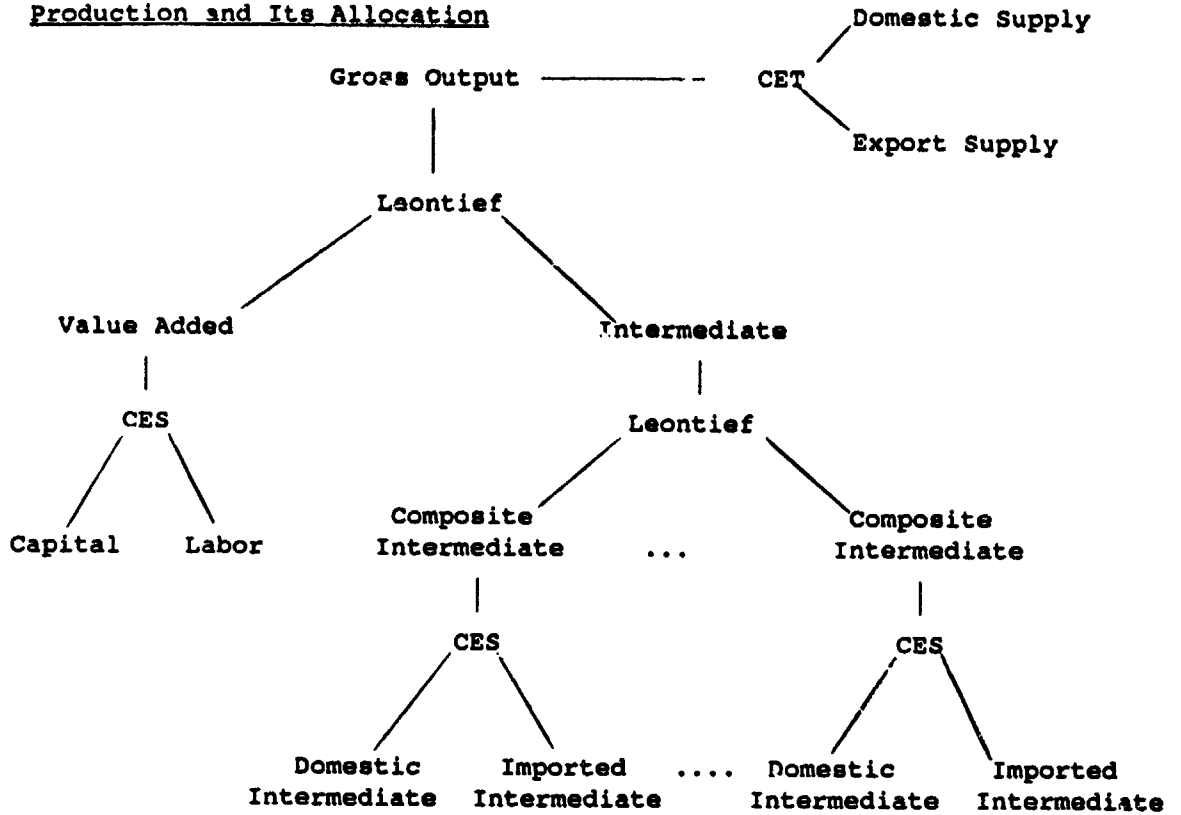
On the basis of the evidence discussed above, we concentrate on modelling the implications of imperfectly competitive behavior in domestic markets in sectors with IRTS. At the same time, in the absence of evidence to the contrary, we assume that Korean exports are sold in competitive world markets. We 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.

Substitution possibilities in production and demand are summarized in figure 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 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

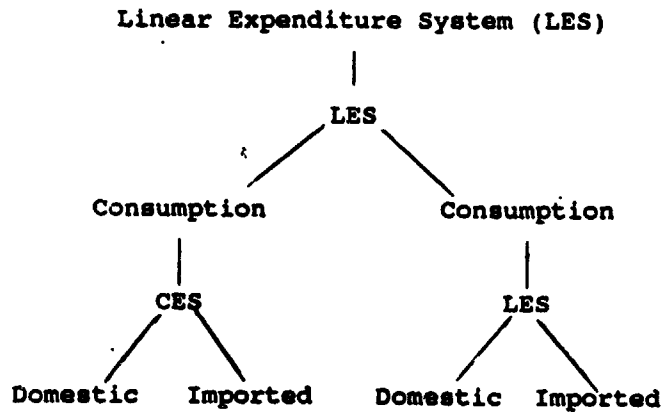
Figure 1: MODEL STRUCTURE

1. Substitution in Production

Production and Its Allocation



2. Substitution in Final Demand



derived from the Stone-Geary utility indicator allows for non-unitary income elasticities of demand and non-zero cross-price elasticities of demand between domestically produced and foreign produced consumption good.

Traded goods are imperfect substitutes by country of origin. 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. This assumption is maintained also for sectors with IRTS. In those sectors, goods are produced by N_i identical firms. Thus, 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 modelled 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.

The next two implications bear on the monopolistic competitive approach to modelling imperfectly competitive behavior. The assumption of national product differentiation implies that the domestic firms' perceived elasticity of demand 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. The other implication of national product differentiation is that adjustment to achieve zero profits occurs by firm entry/exit. In the case of

firm entry, one gets market fragmentation which 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. 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. Omitting sectoral subscripts, in this contestable market scenario,

$$(1) \quad PX = AC$$

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. 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. In our simulations we also compare this to a fixed profit rate mark-up pricing strategy (defined below).

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, i.e.:

$$(2) \quad \frac{PD - MC}{PD} = \frac{1 + \Omega}{N\epsilon}$$

where MC is marginal cost, PD is the unit price on domestic sales, and ϵ is the endogenous elasticity of aggregate sectoral demand. The variable Ω 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 conjectural variations case.

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:

$$(3) \quad \epsilon = \epsilon^F S^F + \epsilon^V S^V$$

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.

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. In the other, which

may be more representative of a long-run equilibrium, entry/exit ensures zero profits, so the model also includes explicitly the zero profit condition:

$$(4) \quad \pi = 0$$

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 firm's conjectures depend on the number of firms, and more importantly 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:

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

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

In light of the evidence in section 2, we present a variant of the model in which protection allows for supernormal profit because of barriers to entry. In the presence of supernormal profits firms sell in the domestic market at a price $\tilde{P}_D > P_D$. The rate of profit, ψ , per unit of domestic sales, is an

exogenous parameter. Then, in the mark-up pricing case, equation (1) is replaced by:

$$(1') \quad PX (\bar{P}D, PE) = AC (1+\psi)$$

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

$$(4') \quad \pi = \psi$$

which sets the profit rate to its exogenously determined value. Thus, we assume for experimental purposes that liberalization eliminates the market power of domestic firms, and removing protection entails concurrently setting $\psi = 0$ in equation (1') or (4'). To control for the effect of entry/exit in the conjectural variations case, we also ran this specification with no entry/exit under both profitability scenarios. Altogether, this yields six alternatives to perfect competition under CRTS. Each alternative entails a different model calibration.

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 of 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 $\bar{\Omega}$. This implies that the conjecture is in fact calibrated.¹² Hence we denote the calibrated conjecture by $\bar{\bar{\Omega}}$. The calibrated values of $\bar{\bar{\Omega}}$ appear in table 4 below.

In the presence of supernormal profits, we allocate fixed costs as before and then, given the profit rate ρ and all quantities and foreign prices, we solve for the domestic price \tilde{P}_D which satisfy the firm's profitability constraint.¹³ As before, the value of \tilde{Q} is obtained from equation (2), but with the new set of domestic prices.

Apart from these features, the CGE model is quite standard. In this application there are two primary factors labor and capital, which 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.

For the seven sectors in the present aggregation, table 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 2 gives the value of the calibrated price elasticity of demand, ϵ .

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 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

Table 2: STRUCTURE OF PRODUCTION, TRADE, AND ELASTICITY VALUES

	Percentage			Elasticity of Substitution in Production (σ_p) (4)	Export Supply Elasticity ^a (σ_t) (5)	Import Elasticity of Demand ^a (σ_v) (6)	Nominal Tariff Rate ^b (t_m) (7)	Price Elasticity of Demand for Domestic Sales (ϵ) (8)
	Share in Gross Output (X) (1)	Exports/Output (E/X) (2)	Imports/Domestic Sales (M/D) (3)					
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	--
Non-Traded 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 non-tariff barriers.

is the high protection conferred on the primary sector. This reflects Korea's tradition of protecting its agricultural sector.

Tables 3 and 4 report the aggregate and sectoral resource pull effects (respectively) of removing protection under the six market structure and conduct alternatives described above. To facilitate interpretation of results, we compare them with those obtained under CRTS. 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 assumed, regardless of whether or not there is protection. In the second case, in line with the pattern of PCM values described in section 2, we assume that a supernormal profit rate of 10 percent ($\pi = 10$) 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 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. EV 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

Table 3: AGGREGATE WELFARE EFFECTS OF TRADE LIBERALIZATION

Column	CRTS (1)	Mark-up Pricing		Conjectural Variations			
		(2)	(3)	No Entry/Exit (4)	(5)	Entry/Exit (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. $EV = C [IU (P_1, Y_1), P_1] - C [IU (P_0, Y_0)]$ where C is the cost function associated with the indirect utility function (IU) corresponding to the LES utility function describing consumer choice.

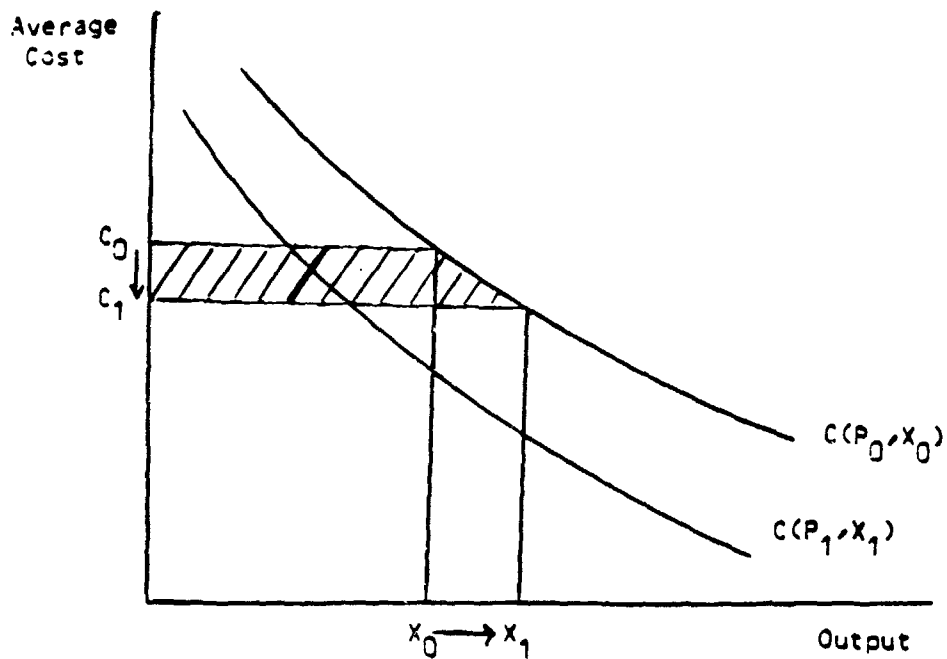
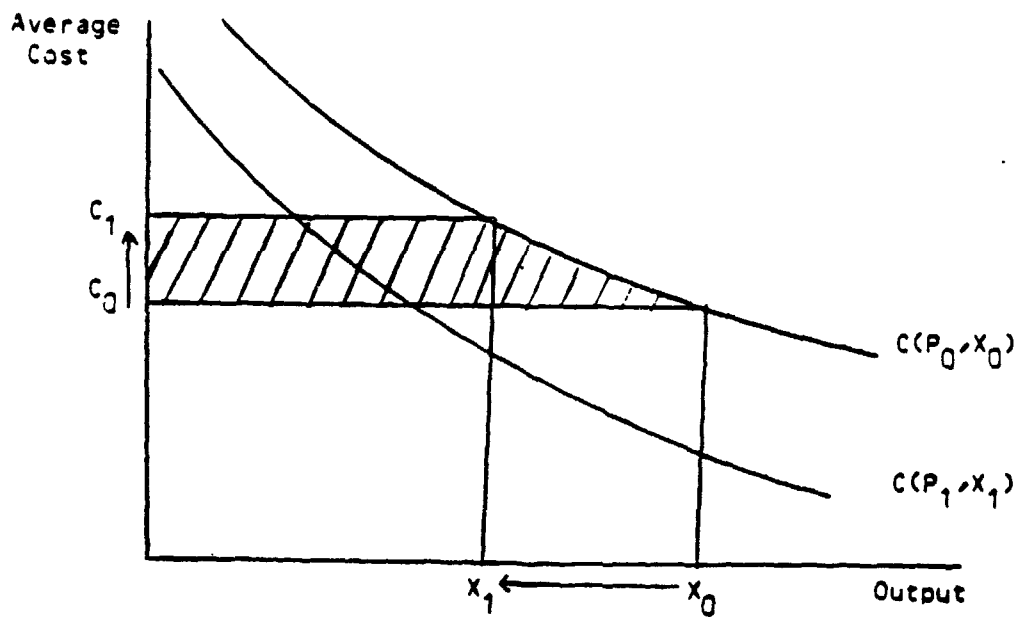
c. $SE = (TC (P_0, X_0) - TC (P_0, X_1))/GDP_0$ is a vector of product and factor prices, and GDP_0 is real GDP prior to the removal of protection.

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 2 illustrates the measure of scale efficiency change used in table 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 (2a), there is output expansion, leading to an estimated scale efficiency gain indicated by the shaded area. In contrast, in figure (2b) 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 3 is the sum of the sectoral gains and losses.

Table 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 (column 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 mark-up pricing. In this specification there is no firm entry, so scale efficiency gains/losses vary directly with sectoral output. Sectors which 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

Figure 2a: SCALE EFFICIENCY GAIN**Figure 2b: SCALE EFFICIENCY LOSS**

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 ($\pi = 10\%$), 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 conjectural variations model -- see table 4). For example, with the combination (CDR = 10%, $\pi = 10\%$), EV = 4.9% of GDP. Compared with the case of no initial profits (EV = 2.6% of GDP), the greater welfare gain can be decomposed into two components: the first is the scale efficiency gain (2.0% versus 1.1%) 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 (CDR = 20%, $\pi = 10\%$), welfare gains from trade liberalization are estimated at 10.2 percent of GDP.

The case of conjectural variations 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. As firms enter (exit), incumbents adapt their conjectures and price less (more)

competitively. Third, but apparently less significant, is the pro-competitive effect which is due to trade liberalization raising the elasticity of sectoral domestic demand, ϵ (see table 4).¹⁴

Compare mark-up pricing and conjectural variations with no entry/exit (cols. 4 and 5). In the mark-up case, scale efficiency gains are higher because firms expand output to maintain or to achieve zero profits. On the other hand, in the conjectural variation specification with no entry/exit firms may make profits, realizing less scale efficiency gains. At the same time, higher profits in the conjectural variations case reduce welfare gains as prices diverge further from marginal costs. These two factors explain why welfare gains are larger under mark-up 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 Horstman and Markusen (1986). In the case of $CDR = .10$, this effect dominates the positive output effect of liberalization on scale efficiency, so that overall scale efficiency is reduced.¹⁵ By contrast, with $CDR = .20$ 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.

Table 4: SECTORAL RESULTS (CDR = .10)
(Percent Changes)

Column		CRTS (1)	Mark-up Pricing		Conjectural Variations			
			Pricing		No Entry/Exit		Entry/Exit	
			$\pi=0$ (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	21.8	17.4	45.3
	SE		1.6	1.9	0.3	0.3	-1.8	-1
	ϵ Ω				0.9	0.9	.8	1.4
	N						0.2	0.4
						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	-4
	ϵ Ω				0.2	0.3	.2	2
	N						0.2	0.3
						21.6	24.1	
Heavy Industry	X	-1.7	-5.1	8.4	-3.3	-1.7	-5.6	4.3
	E	9.7	2.8	23.8	6.9	10.3	4.6	19.5
	SE		-6	.7	-1	0.0	-1.8	-1.0
	ϵ Ω				2.6	2.6	2.5	3.1
	N						0.2	0.3
						10.7	17.0	

Note: X = Gross output; E = Exports
 SE = Scale efficiency measure (see table 3) expressed as a percent of sectoral sales at current prices.
 N = Number of firms (initially set equal to 1)
 ϵ = Elasticity of demand (defined in equation 3).
 Ω = Calibrated conjecture.

However, there is a counter-balancing 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 4 summarizes the microeconomic results from removing protection for the sectors with IRTS and a CDR value of 0.10. The table also displays the value of \tilde{Q} which suggest 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 reason 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 mark-up pricing and least under conjectural variations, with CRTS in the middle. The reason for a stronger expansion under mark-up pricing is the absence of firm entry to impede 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 conjectural variations is only half that achieved under CRTS. There are two reasons for this smaller output expansion. First, the higher price for domestic sales because of less efficient scale means less demand for domestic consumer goods (and greater demand for imported consumer goods). Second, because of interindustry linkages, under conjectural variations

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 (columns 3 and 5), removing protection leads to a magnification effect on resource pulls. The magnification effect is stronger under conjectural variations for consumer and producer goods than under mark-up 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 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.

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 provide good support for the alternative modelling 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 mark-up pricing scenario is replaced by one with conjectural variations, even if one recognizes that firm entry/exit may occur. Under the conjectural variations 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 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 conjectural variations than in one of mark-up 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.

Notes

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 Venables and Smith (1988).
3. Developing country case studies include Bergsman (1974), Rodrik (1988), Gunasekera and Tyers (1988), Devarajan and Rodrik (1989a,b), Condon and de Melo (1990).
4. For further discussion of the HCI drive see World Bank (1987).
5. The market share of the 20 leading Jaebol continued to rise until the early 1980s.
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" which sees in this relationship rent-seeking behavior by oligopolistic firms. It 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 as the "import discipline" hypothesis in the industrial organization literature. See the symposia led by Caves (1980) and by Gerorski and Jacquemin (1981).
9. For a fuller description of the model, see de Melo and Tarr (forthcoming).

10. For an approach that relies on product differentiation at the firm level see Brown and Stern (1989).
11. While conjectural variations are a convenient way of parametrizing oligopolistic behavior and suitable for a static simulation exercise, they are inadequate to study detailed interactions under dynamic oligopoly. For a critique of the conjectural variation approach see Shapiro (1989).
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 equations (2) and (3) can only deliver two of the three variable Ω , N , and ϵ .
13. Because of interindustry relationships, this calibration involves solving simultaneously for the vector of domestic prices, $\tilde{P}D$.
14. This effect is also discussed by Devarajan and Rodrik (1989).
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).

References

- Bergsman, J. 1974. "Commercial Policy, Allocative Efficiency and X-Efficiency," Quarterly Journal of Economics, 409-33.
- Brown, D., and R.M. Stern. 1989. "US-Canada Bilateral Tariff Elimination: the Role of Product Differentiation and Market Structure," in R. Feenstra (ed.), Trade Policies for International Competitiveness (Chicago: University of Chicago Press).
- Caves, R. 1980. "Introduction to the Symposium on Trade and Industrial Organization," Journal of Industrial Economics, 11-28.
- Condon, T., and J. de Melo. 1990. "Industrial Organization Implications of QR Trade Regimes: Evidence and Welfare Costs," Empirical Economics (forthcoming).
- Corden, M. 1967. "Monopoly, Tariffs, and Subsidies," Economica, 50-8.
- Devarajan, S., and D. Rodrik. 1989a. "Trade Liberalization in Developing Countries: Do Imperfect Competition and Economies of Scale Matter?" American Economic Review, Papers and Proceedings, May.
- Devarajan, S., and D. Rodrik. 1989b. "Pro-Competitive Effects of Trade Reform: Results from a CGE Model for Cameroon." Working Paper, J.F. Kennedy School of Government, Harvard University, Cambridge.
- Dixit, A. 1986. "Comparative Statics for Oligopoly," International Economic Review, 107-22.
- Dixit, A. 1988. "Optimal Trade and Industrial Policies for the US Automobile Industry," Robert Feenstra (ed.), Empirical Methods for International Trade, Cambridge: MIT Press.
- Geroski, P., and A. Jacquemin. 1981. "Imports as Competitive Discipline," in P. Geroski and A. Jacquemin (eds.), "Symposium on Industrial Organization and International Trade," Recherches Economiques de Louvain 47, 197-208.
- Gunasekera, D.B.H., and R. Tyers. 1988. "Imperfect Competition and Returns to Scale in a Newly Industrializing Economy: A General Equilibrium Analysis of Korean Trade Policy," processed, National Centre for Development Studies, Australian National University, Canberra.
- Harris, R.G. 1984. "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition," American Economic Review 74:5, 1017-1032.
- Harris, R.G. 1989. "The New Protection Revisited," Canadian Journal of Economics 24:4, 751-778.

- Helpman, E., and P. Krugman. 1989. Trade Policy and Market Structure. Cambridge: MIT Press.
- Horstmann, I., and J. Markusen. 1986. "Up the Average Cost Curve: Inefficient Entry and the New Protectionism," Journal of International Economics, 225-48.
- Kierkowski, H. (ed.). 1984. Monopolistic Competition and International Trade. Oxford: Oxford University Press.
- Kim, J.W. 1985. "The Rate of TFP Changes in Small and Medium Industries and Economic Development: The Case of Korea's Manufacturing," Working Paper No. 85-01, Korea Development Institute, Seoul.
- Krugman, P. 1984. "Import Protection as Export Promotion: International Competition in the Presence of Oligopoly and Economies of Scale."
- Lee, K., S. Urata, and I. Choi. 1988. "Recent Developments in Industrial Organization in Korea," World Bank Working Paper.
- Melo, J. de, and D. Tarr. Forthcoming. A General Equilibrium Analysis of U.S. Trade Policy, Cambridge: MIT Press.
- Rodrik, D. 1988. "Imperfect Competition, Scale Economies, and Trade Policy in Developing Countries," in R.E. Baldwin (ed.), Trade Policy Issues and Empirical Analysis, University of Chicago Press and N.B.E.R., Chicago and Cambridge.
- Shapiro, C. 1989. "Theories of Oligopoly Behavior," in . Schmalensee and R. Willig (eds.), Handbook of Industrial Organization, North-Holland, Amsterdam.
- Smith, A., and A. Venables. 1988. "Completing the Internal Market in European Community: Some Industry Simulations," European Economic Review 32, 7: 1501-1525.
- Snape, R. 1977. "Trade Policy in the Presence of Economics of Scale and Product Variety," Economic Record, 525-33.
- Venables, A. 1985. "Trade and Trade Policy with Imperfect Competition: The Case of Identical Products and Free Entry," Journal of International Economics, 1-19.
- World Bank. 1987. Korea: Managing the Industrial Transition. Washington, D.C.: The World Bank.
- Young, S. 1985. "Role of Trade Policy in Korea's Economic Development and Problems of Import Liberalization," Korea Development Institute, Seoul.

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