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Chapter Author: Dani Rodrik

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8 Industrial Organization and Product Quality: Evidence from South Korean and Taiwanese Exports

Dani Rodrik

8.1 Introduction

For developing countries, probably the predominant question of strategic trade policy is, How can entry be facilitated into markets for sophisticated manufactured goods characterized by imperfect competition and well-entrenched oligopolists? Pessimism regarding the prospects for successful entry into such markets underlies the widespread unease with outward-oriented trade strategies. Yes, as the experiences of Japan and the East Asian tigers following on its heels have amply demonstrated, well-positioned entrants can always create room for themselves. These countries have diversified into manufactured products of increasing sophistication, demonstrating that even the tightest international oligopolies can be penetrated.

The broad reasons underlying the export success of the East Asian countries are well known. My focus in this paper is on a narrow but significant aspect of their performance: the transition from standardized, labor-intensive manufactures to sophisticated, skill-intensive products where quality plays an important role. While traditional factor-endowment considerations typically play the determinant role with the former group of products, the role of industrial organization comes into its own with the latter. Putting it somewhat crudely, the transition can be viewed as a shift from price to quality as the source of competitiveness. The higher-end products typically require not only a broader range of skills and technological sophistication, but also investment in product quality, customer loyalty, and reputation.

Dani Rodrik is professor of economics and international affairs at Columbia University, a research fellow of the Centre for Economic Policy Research, and a research associate of the National Bureau of Economic Research.

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The rate at which the transition takes place, if it takes place at all, is naturally influenced by a wide range of factors and country characteristics. Can industrial policy play a role here as well? As a first pass, I focus in this paper on broad patterns of industrial organization. We can identify two relevant models for policy here. In the first, policy would favor the formation of large firms and conglomerates and would direct resources toward them, discriminating against small firms and potential entrants. In the second, policy would be neutral, and a more fluid, diffuse industrial structure would result. Which pattern is more conducive to making the transition to high-end products? In the next section, I will discuss a simple theory which suggests that the transition can be achieved more easily when domestic industry is highly concentrated. The basic argument is that such industries are better able to cope with the inevitable reputational externalities involved in producing high-quality goods for foreign markets.

Is there any empirical evidence to support this proposition? Fortunately, South Korea and Taiwan provide as close to a controlled experiment for testing the hypothesis as can be hoped for in economics. Starting from a tiny base, both countries have been phenomenally successful in expanding and diversifying their manufactured exports. Their trade and macroeconomic policies have been broadly similar, as are their income levels. Yet, the two countries are radically different in their patterns of industrial organization. Korean industry is dominated by a handful of large conglomerates, and firm-concentration ratios are uniformly high. In Taiwan, large conglomerates are the exception rather than the rule, and individual industries are typically less concentrated than their Korean counterparts. It would be very surprising indeed if their respective trade patterns did not somehow reflect this difference. In light of the considerations discussed above, this paper looks for evidence of differential performance with respect to product quality. I find strong support for the hypothesis that industrial organization and product quality are related in the expected manner: the quality of Korean manufactured exports—with quality proxied by unit value—is systematically higher than that of Taiwanese exports.

The outline of the paper is as follows. The next section sketches out a simple theory which relates product quality to the number and size distribution of firms in an exporting industry. Section 8.3 compares briefly the industrial organization patterns in South Korea and Taiwan and discusses some of the reasons behind the differences. Analyzing the two countries' exports to the United States, section 8.4 presents evidence on their divergent performance with respect to product quality. The paper ends with concluding comments in section 8.5.

8.2 Product Quality and Industrial Organization: A Theoretical Sketch

New entrants into high-end product categories typically face an entry barrier altogether different from the usual obstacles. Perceived product quality is an

important component of demand for such products; to be judged high-quality by consumers, entrants must invest in reputation or other means of communicating quality. The problem is even more serious for firms from developing countries, as they may have to surmount a reputation for shoddy quality frequently associated with developing-country goods.[1]

Such informational barriers to entry have been the subject of a number of theoretical papers. In the simplest framework, one could imagine that (foreign) consumers' familiarity with quality increases with cumulated exposure to the product in question. Provided the actual quality level of home exports exceeds the perceived level, there may then be a role for export subsidies in speeding up the process of product familiarization (Mayer 1984). When domestic firms are differentiated by quality, high-end firms can try to signal quality by selling at low prices initially (in anticipation of future profits); subsidies can facilitate such signaling strategies, at an overall welfare gain to the home economy (Bagwell and Staiger 1989). But the problem is that subsidies may also encourage additional domestic firms to enter at the low end of the quality spectrum, failing to improve the perceived quality of home exports and increasing the cost to high-quality producers of distinguishing themselves from their low-quality counterparts (Grossman and Horn 1988). In all these cases, the transition to higher-quality products is hampered by informational entry barriers.

These papers do not consider directly the importance of domestic market structure in determining the average level of product quality in exports. A recent article by Chiang and Masson (1988), motivated specifically by policy discussions in Taiwan, focuses on this issue in the context of a simple model of reputational externalities in product quality. Their basic point is that concentrated industries will do a better job of internalizing these and that they will therefore tend to produce at the higher end of the quality spectrum. In what follows, I will base my argument on the same point and sketch out a similar model with a few additional twists.

Consider an industry which is a price-taker in world markets and which exports all of its output. Since my objective is to trace the effects of industry structure on product quality, I will take as given the overall size of the industry and the size distribution of firms within it. This is tantamount to assuming fixed capacities and full capacity utilization. Let the price received by each firm be a linear function of perceived quality, $p_i = \tilde{q}_i$, where i indexes firms. Marginal costs of production are linear in output, but increasing and convex in *actual* quality, q_i. For ease of exposition, I let these costs be quadratic. What is the relationship between perceived and actual quality? I assume that $\tilde{q}_i$ will generally lie somewhere between the the firm's actual quality (q_i) and the *average* quality ($\bar{q}$) of home exports:

$$\tilde{q}_i = \phi q_i + (1 - \phi)\bar{q}, \tag{1}$$

1. On country stereotyping with respect to product quality, see for example, Khanna (1986).

where ø is (for now) taken to be fixed. As a firm's perceived quality level (and hence price) will be based partly on other exporters' quality choices, this formulation introduces the externality which drives this section's results. The average quality level is simply

$$\bar{q} = \Sigma_j s_j q_j, \tag{2}$$

where s_j is firm j's (fixed) share in industry output.

Letting x_i denote firm i's (fixed) level of output, profits can be written as

$$\pi_i = (\tilde{q}_i - \frac{1}{2} q_i^2) x_i \tag{3}$$

which yields the first-order condition for quality:

$$q_i = \phi + (1 - \phi) s_i. \tag{4}$$

Note that the social optimum would require the reputational externality to be eliminated by setting $\tilde{q}_i$ equal to q_i, in which case the equilibrium level of q_i would be unity, irrespective of the firm's market share. As can be seen from (4), this case can be recovered in this framework when $\phi = 1$, i.e., when firms can costlessly and perfectly communicate their individual quality levels to foreign consumers. Note that ϕ denotes the weight attached to own-quality level in foreigners' perceptions. As long as $\phi < 1$, quality involves a positive externality, and firms' quality level will lie below unity. In the worst possible scenario, when firms are branded by the average quality level of the home industry ($\phi = 0$), q_i will equal the firm's share in the industry. In general, larger firms will choose higher levels of quality.

We can now investigate the effects of industry structure on average product quality. Suppose that ϕ is identical across firms. In the present framework, average quality then turns out to be a simple linear function of the Herfindahl index of concentration. Using (2) and (4) in conjunction with $\Sigma_j s_j = 1$, we get

$$\bar{q} = \phi + (1 - \phi) H, \tag{5}$$

where $H \equiv \Sigma_j s_j^2$ is the Herfindahl index. As $\bar{q}$ is increasing in H, more concentrated industries will operate at higher quality levels than less concentrated ones. For a given scale of industry output, the Herfindahl index is influenced both by the number of firms and by the size distribution of firms, so both factors will come into play in determining $\bar{q}$. Note also that whether a firm operates below or above the industry-wide average will depend on the relationship between its market share and H:

$$q_i - \bar{q} = (1 - \phi)(s_i - H). \tag{6}$$

Therefore, $q_i > \bar{q}$ whenever $s_i > H$.

As a tiny step toward added realism, consider now the case where firms can invest in advertising, marketing/distributional channels, brand names, and the like in order to differentiate their image from that of other firms in the home

industry. Let the amount of such investment be denoted by f_i. I assume that investment of this type serves to close the gap between actual and perceived quality. In the present framework, this amounts to letting ϕ be an increasing function of f_i. So we can write $\phi = \phi(f_i)$, with $\phi(0) = 0$, $\phi(\infty) = 1$, $\phi' \equiv \partial\phi/\partial f_i > 0$, and $\phi'' \equiv \partial^2\phi/\partial f_i^2 < 0$. Firm profits now become

$$\pi_i = \left(\tilde{q}_i - \frac{1}{2}q_i^2\right)x_i - f_i, \tag{7}$$

with $\tilde{q}_i$ defined as before in (1). Since it may not pay for a firm to invest in reputation building, we associate the Lagrange multiplier λ with f_i and write the Langrangian expression as

$$\mathcal{L} = \left(\tilde{q}_i - \frac{1}{2}q_i^2\right)x_i - f_i + \lambda f_i. \tag{8}$$

The first-order condition for q_i remains unchanged from (4)—except that ϕ is no longer a constant. With respect to f_i,

$$x_i\phi'(q_i - \bar{q}) - 1 + \lambda = 0. \tag{9}$$

Note that for firms that operate at or below average quality ($q_i - \bar{q} \leq 0$), this equality requires that $\lambda > 0$, implying $f_i = \phi = 0$. For low-end firms, it simply does not pay to communicate their true quality levels, as this hampers their free ride on higher-quality firms.

As (9) shows, firms that choose to invest in "reputation" will be those with sufficiently high quality relative to the average.[2] From our earlier discussion, these will be the firms with larger market shares. For such firms $\lambda = 0$, and we have

$$x_i\phi'(q_i - \bar{q}) = 1. \tag{9'}$$

Since ϕ'' is negative by assumption, high levels of q_i will be associated with high levels of f_i.

To determine the effect on the average level of quality in the industry, let us divide firms into two groups, one for which $f = 0$, and the other for which $f > 0$. Denote the second set by T (for top-quality firms). Since $\phi(0) = 0$, we have

$$\bar{q} = \Sigma_{j \notin T} s_j^2 + \Sigma_{j \in T}(\phi_j s_j + (1 - \phi_j)s_j^2), \tag{10}$$

where ϕ_j denotes $\phi(f_j)$. This yields

$$\bar{q} = H + \Sigma_{j \in T}\phi_j(s_j - s_j^2), \tag{11}$$

where H is once again the Herfindahl index. If firms were unable to distinguish themselves from their competitors, $\bar{q}$ would equal H (as $\phi(0) = 0$). As (11)

2. What "sufficiently" means in this context depends on the magnitude of $\phi'(0)$. The larger $\phi'(0)$, the smaller the threshold above $\bar{q}$ for investing in reputation.

shows, the ability of firms to communicate their true quality—as partial and costly it may be—raises the average quality level of exports.

The bottom line of this discussion is that, all else being equal, we would expect more concentrated industries to produce and export a higher-quality range of products. When firms have the ability to build reputation and brand loyalty, the expectation is that the quality differential between concentrated and unconcentrated industries will be even larger: this is because the incentive to undertake such investments depends on how skewed the size distribution of firms (and hence the quality distribution) is in the first place.

To be sure, the model presented here is no more than a parable. It focuses on only one possible link between industry structure and product-quality choice. We should certainly not expect it to provide great explanatory power regardless of context. But I suspect that for many developing countries the considerations raised here are likely to be important ones. Therefore, it would be useful to see if there is evidence which supports the basic hypothesis. Before I go on to discuss the evidence from Korean and Taiwanese exports, however, I provide a brief overview of industrial organization in the two countries.

8.3 Industrial Organization in South Korea and Taiwan

Probably nothing better illustrates the difference in the industrial organization of the two countries than the fact that South Korea has 11 firms in the Fortune International 500, compared to Taiwan's three.[3] Some of the major Korean conglomerates are now becoming household names in the industrialized countries (Hyundai, Samsung), while even sophisticated consumers would be hard pressed to come up with the name of a single Taiwanese firm—this despite the fact that Korean GNP per capita is a quarter lower than Taiwan's and the overall magnitude of the two countries' exports are similar.

The differences in the industrial structures of the two countries have received little attention to date, with a few notable exceptions. In his comparative account of economic development in the two countries, Tibor Scitovsky (1986) focused on these differences and stressed that the Taiwanese economy is organized much more along free-market lines than is the Korean one, with much greater competition among firms in Taiwan.[4] In a series of papers based on

3. The Korean firms in the top 500, with their ranks in parentheses, are: Samsung (21), Lucky-Goldstar (37), Daewoo (39), Sunkyong (82), Ssangyong (152), Korea Explosives (182), Hyundai Heavy Industries (187), Hyosung (195), Pohang Iron and Steel (216), Hyundai Motor Company (261), and Doosan (431). The three Taiwanese companies are Chinese Petroleum (104), Nan Ya Plastics (467), and China Steel (489).

4. Scitovsky takes it on faith that more-competitive industries will perform better. But he is forced to conclude, "Ironically, in Korea there is no evidence that the large profits and fast accumulation of great fortunes that Korea's economic policies made possible had any unfavorable effects on the drive, stamina, and efficiency of Korea's businesses." He ends, in a way that could easily give cultural explanations a bad name, by saying "perhaps this is due to the Chinese cultural background" (1986, 151).

case studies of Taiwanese and Korean firms, Brian Levy has investigated the implications of market structure on strategies and likely success of these firms in foreign markets (Levy 1987; Levy and Kuo 1987a, 1987b). He finds that firm strategies are predictably influenced by size but that small size has not adversely affected the ability of Taiwanese firms to break into high-technology markets, at least when investment requirements are not too large.

Direct, comparative evidence on industrial organization patterns in the two countries is hard to come by. Table 8.1 summarizes the broad size distribution of enterprises in the manufacturing industry. Because the size distribution is not sufficiently disaggregated, the data here are not particularly meaningful. They show that large enterprises (300 or more employees) account for 64 percent of total value added in Korea, compared with 59 percent in Taiwan. The share of small enterprises (5–19 employees) is 4 percent in Korea and 8 percent in Taiwan. These numbers do not point to a great discrepancy between the two economies, but this is highly misleading. For one thing, the table excludes the smallest firms (with fewer than five employees), as statistics are not compiled on such firms in Korea—which in itself is meaningful. These smallest firms account for almost half the total number of manufacturing firms in Taiwan. More important, the Korean industrial censuses collect data at the establishment (plant, factory, workshop, etc.) level rather than the firm or enterprise level, as in Taiwan. This naturally biases the Korean concentration figures downward. Moreover, the preponderance in the Korean economy of the *chaebul* (conglomerates) spanning diverse activities across subsectors introduces another important source of downward bias. In 1985, the top five *chaebul* accounted for 27.0 percent of Korean manufactured exports, and the top 30 for 41.3 percent (Lee 1988, table 20). There are few such giants in the Taiwanese economy. As a consequence, the figures in table 8.1 greatly underestimate the degree of concentration in Korea.

There are other indicators that suggest that the extent of competition in Taiwanese industries surpasses that of Korea. Scitovsky (1986, 146) draws the following interesting comparison: 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 (measured again by

Table 8.1 **Distribution of Value Added in the Manufacturing Industry (%)**

Size of Enterprise or Establishment (number of employees)	South Korea (1984)	Taiwan (1981)
5–19	4.3	7.8
20–299	32.0	33.2
300+	63.7	58.9

Sources: Biggs and Lorch (1988); Economic Planning Board (1986).

Note: We exclude enterprises/establishments with fewer than five employees.

employees) increased by 176 percent. The relative ease of entry into Taiwanese industries is also corroborated by the high rate of bankruptcy in that country (Scitovsky 1986, 151). In Korea, by contrast, bankruptcy is not even legally recognized, and business failure carries great moral stigma extending beyond the entrepreneur to his family (Michell 1983, 168–69).

The reasons behind these divergent patterns of industrial organization are due partly to historical circumstance and partly to policy. Among the former, possibly the key role in Taiwan was played by the immigration of overseas Chinese who brought substantial capital with them (30 percent of the total inflow of foreign capital) and used it to establish new enterprises (Scitovsky 1986, 146). With respect to policy, the Taiwanese government's attitude has been much more benign toward small enterprises, and there has been little overt support for large firms. In Korea, the situation has been quite different. "Since 1961," writes Michell (1983, 168), "it has been the continual mission of the Ministry of Commerce and Industry [of Korea] to prevent what is termed 'reckless overcompetition.'" Given the transactions cost of dealing with governmental bureaucracies, it is also likely that the more active role of the Korean government in industry (in credit allocation, for example) would have served to discriminate against small and medium-sized firms, even when policy had no such objective (see Levy 1987). Taking some license with terminology, it can be said that "industrial policy" favored industrial consolidation in Korea and was indifferent to firm size in Taiwan.

8.4 Evidence on Product Quality from U.S. Imports

I will now discuss the available evidence on product quality in Korean and Taiwanese exports. Note first that, by most relevant criteria, Taiwan is the more economically developed of the two countries (see table 8.2). Most important from our perspective, Taiwan is comparatively rich in human skills and education by virtue of having been an early starter compared to Korea. As table 8.2 shows, Korea now appears to have caught up with Taiwan in terms of *flow* additions to the educated work force, but Taiwan is still endowed with a proportionately larger stock of skilled and educated workers. On these grounds, then, we would expect Taiwan to be further along in the transition to high-end products than Korea. The industrial-organization effects discussed above go in the opposite direction.

To check for systematic differences in product quality, I examine the unit values for the two countries' exports to the United States, disaggregated at an appropriate level. A critical maintained hypothesis is that unit values are a good proxy for quality. For manufactured exports of the type that will be the focus of the analysis, this seems to be a sensible working hypothesis.[5] The

5. I have also computed unit values for Japanese expots to the United States (see app.). These are almost without exception higher than those for Korea and Taiwan. This is consistent with what we know about Japan's successful transition to products at the very high end of the quality spectrum.

Table 8.2 Basic Indicators of Development

Indicator	South Korea	Taiwan
GDP per capita (1983 $)	2,010	2,670
Electric power consumption per capita (kWh)	915	2,131
Life expectancy at birth (years)	65	72
Infant mortality (per 1,000 live births)	37	25
Daily calorie intake per capita	2,785	2,805
Daily protein intake per capita (grams)	70	78
Households with running water (%)	55	67
Households with TV sets (%)	79	100
School enrollment rates (% of age group):		
Primary	111	100
Secondary	76	80
College and universities	12	10

Sources: UNIDO (1986, table 1); Scitovsky (1986, tables 2 and 4).

analysis is restricted to the U.S. market in order to obtain closely comparable trade data for the two countries. The United States is by far the largest export market for both countries, accounting for roughly one-half of total sales. It is unlikely that substantial biases are introduced by restricting attention to the United States.

Selecting the level of disaggregation at which the comparison of unit values is carried out requires care. At too aggregated a level, there is always the danger of comparing apples to oranges. At too *dis*aggregated a level, on the other hand, the quality range of the product in question may be needlessly compressed, leaving out useful information about the upper and lower ends of the range.[6] I have chosen an intermediate level of disaggregation, using the four-digit Schedule A classification for U.S. import statistics (U.S. Department of Commerce 1986). These import data are recorded on a "customs value" basis, defined as "the price actually paid or payable for merchandise when sold for exportation in the United States, excluding U.S. import duties, freight, insurance and other charges incurred in bringing the merchandise to the United States."[7] In order to focus on products which are important exports for the two countries, I restrict the analysis to categories in which at least one of the countries had exports to the United States exceeding $100 million. In 1986, there were 49 such product groups. Exports included in these groups amount to $9.6 billion for Korea and $14.5 billion for Taiwan, substantial parts of each country's total exports to the United States.

Table 8.3 lists the respective unit values for each of these 49 categories for the two countries. The product groups are ranked in ascending order of (pro-

6. For example, the highly detailed seven-digit TSUSA classfication contains categories such as: "moccasins, soled, leather, for women, *not over $2.50* pair" (emphasis added).

7. The description further adds, helpfully, "In the case of transactions between related parties, the relationship between buyer and seller should not influence the Customs value" (U.S. Department of Commerce 1986).

Table 8.3 **Unit Values in Korean and Taiwanese Exports to the United States, 1986 ($ per 1,000 lbs.)**

Code	Description[a]	South Korea	Taiwan	Percent Differential
753.0	Automatic data processing (ADP) machines	6,347	6,214	2.1
891.0	Articles of rubber or plastics, nspf	940	913	3
658.9	Tapestries & made-up articles	3,080	3,212	−4.1
781.0	Passenger motor vehicles	2,410	2,529	−4.7
898.3	Sound, etc., recordings & blank media	3,430	3,603	−4.8
846.8	Under garments (including shirts) of textile nspf materials, knit	4,533	4,763	−4.8
845.5	Sweaters & other outerwear of textile materials, knit	5,587	6,029	−7.3
776.4	Integrated circuits	88,333	82,203	7.5
764.8	Audio and video tape players and records	7,038	6,514	8
764.9	Parts nspf of telecommunication & sound reproducing equip.	6,426	5,932	8.3
678.6	Pipes, tubes, & blanks, iron or steel	194	177	9.6
674.0	Plates & sheet, iron or steel	173	192	−9.9
699.1	Locks, safes, etc., of base metals	1,204	1,362	−11.6
635.9	Articles manufactured of wood, nspf	1,201	1,365	−12
749.2	Taps, cocks, valves, & parts	1,235	1,443	−14.4
762.0	Radio receivers (AM/FM) & combinations	4,309	3,759	14.6
844.1	Men's & boys' shirts cotton, wool, manmade fibers, not knit	4,860	5,752	−15.5
761.0	Television receivers & combinations	2,983	3,580	−16.7
699.8	Articles of cast iron,nspf	1,006	842	19.5
764.4	Electric telephone & telegraph equip. & parts	7,756	6,486	19.6
851.0	Footwear, new, excluding military or orthopedic	3,724	3,113	19.6
785.2	Adult cycles	1,151	1,463	−21.3
694.0	Nails, screws, & other fasteners of base metals	325	425	−23.5
588.8	Profile shapes, rubber & plastic	703	567	24
759.9	Parts of ADP & calculating office machines	2,009	2,703	−25.7
788.0	Parts nspf of motor vehicles & handling equip.	819	1,113	−26.4
879.2	Jewelry, etc., costume & semiprecious	7,530	5,911	27.4
763.8	Microphones, speakers, & audio amplifiers	2,297	1,758	30.7
634.7	Plywood, including wood veneer panels	220	326	−32.5
842.3	Slacks, etc., cotton, wool, manmade fibers	6,158	4,517	36.3
771.2	Nonrotating electric power equip.	6,840	4,999	36.8
775.8	Electro-thermic appliances nspf & parts	1,759	2,803	−37.2
812.4	Lighting fixtures and fittings	812	1,373	−40.9
773.1	Insulated electrical conductors (cables)	1,312	2,263	−42
821.8	Furniture & parts thereof, nspf	1,208	795	51.9
894.2	Toys, games, Christmas ornaments, etc.	2,705	1,780	52
697.2	Household & sanitary ware of iron or steel	1,247	807	54.5
848.1	Gloves, belts, other wearing apparel of leather, nspf	9,974	6,140	62.4

Table 8.3 (continued)

Code	Description[a]	South Korea	Taiwan	Percent Differential
843.7	Garments for rainwear; other outerwear, nspf	10,331	6,347	62.8
831.0	Luggage, handbags	2,926	1,763	66
635.4	Wood manufacturers, domestic & decorative use	1,946	1,157	68.2
884.2	Eyeglasses, eyeglass frames, & parts	10,823	6,250	73.2
775.7	Electro-mechanical household appliances nspf & parts	2,252	1,296	73.8
695.3	Hand tools, nspf of base metal	1,807	1,031	75.3
894.7	Sporting goods, etc., nspf	2,246	1,228	82.9
736.1	Metal-cutting machine tools	2,338	1,160	101.6
881.1	Still cameras & parts; flash apparatus	27,438	12,308	122.9
778.8	Ferrites nspf; elect machinery & equip. nspf	10,372	3,745	177
848.3	Fur clothing & other articles except headwear	38,801	10,474	270.5
	Unweighted average	6,431	4,826	26.7

Source: U.S. Department of Commerce (1986).

Note: nspf = not specially provided for.

[a]Commodity descriptions are abridged versions. Full descriptions can be found in U.S. Department of Commerce (1986).

portional) difference between Korean and Taiwanese unit values. A quick glance at the table reveals clearly that Korean exports tend to have higher unit values than Taiwanese exports. Of the 49 products, 30 exhibit higher unit values in Korean exports. Moreover, all of the larger discrepancies in unit values are in favor of Korea. The unweighted average differential between Korean and Taiwanese unit values is 27 percent. On the basis of weighted averages, Korean exports command a price premium of 19 percent (Korean export weights) to 22 percent (Taiwanese export weights) over Taiwanese exports.

Is the observed discrepancy in unit values statistically significant? An appropriate statistical test here is the Wilcoxon signed-ranks test, which takes into account both the frequency with which Korean unit values exceed Taiwanese ones *and* the relative magnitudes of the discrepancies (see DeGroot 1975, 483–86). Using this test, the null hypothesis that Taiwanese unit values are at least as high as Korean unit values is decisively rejected at the 5 percent confidence level, with a z-value of 2.75. Notice that this is a particularly stringent test of our hypothesis, as a priori we would expect Taiwanese products to be of higher quality than Korean ones on all grounds but industrial organization.

A related implication of the model is that Korean exporters would be more likely to specialize at the high-end of the quality spectrum *across* broad product categories, as they possess a comparative advantage there relative to Taiwan. Figure 8.1 shows that this is indeed the case. Ranking product groups by

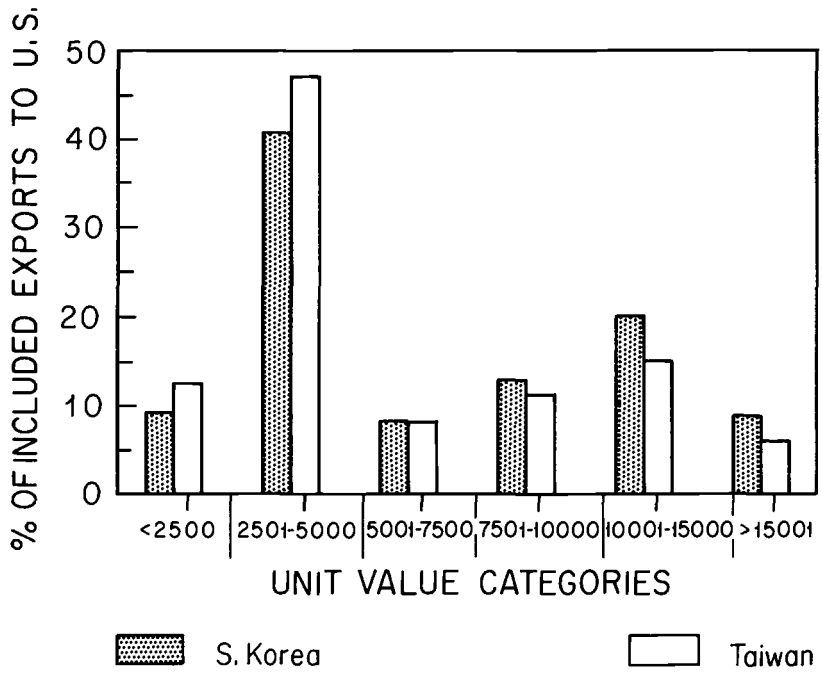

Fig. 8.1 Distribution of exports by unit value
Note: Product groups are ranked using Japanese unit values for each group. Unit values are in dollars per 1,000 lbs.

Japanese unit values to establish a rough quality hierarchy, we find that the distribution of Korean exports is relatively skewed toward the top end. Of Korea's (included) exports, 29 percent are in the "top" quality range (unit values greater than $10,000), compared to 21 percent for Taiwan. Korea has 50 percent of its exports at the low end (unit values $5,000 or lower) and Taiwan 60 percent.

A further test of a different nature would be to see whether the differences in unit values are proportionately more pronounced in products for which quality plays an important role. Remember that, in terms of our model, industrial organization becomes important only when quality is a predominant characteristic of the product group in question. Unfortunately, there is no clear-cut way of determining the products for which this is likely to be true. A shortcut is to assume that higher unit values are associated with "quality-intensive" products. Using Japanese unit values to rank industries by this criterion, the following regression results are obtained:

$$\begin{aligned} \text{PREM} &= -1.03 + 0.15\ \ln(\text{JAP}), \\ &\qquad (0.06) \\ R^2 &= 0.11,\ N = 49, \end{aligned}$$

where PREM is the Korean unit-value premium over Taiwan (in percent) and JAP is the Japanese unit value for the corresponding product group. The standard error of the slope coefficient is in parentheses. This suggests that the Korean quality advantage over Taiwan increases as we move from low-end to high-end products. A doubling of the average level of product quality—as measured by unit values of Japanese exports—is associated with an increase of 15 percent in the Korean price premium over Taiwan. This finding is consistent with the discussion in section 8.2.

To sum up, these data reveal an interesting divergence in the export performance of the two countries.[8] It is of course entirely possible that these findings reflect some other unidentified statistical quirks. For example, Taiwanese exporters could be prone to underinvoicing. Or, the relatively greater downstream integration of the Korean exporters in the U.S. market may lead to high transfer prices being set on these exports, *provided* that it is viewed as preferable to hold income in South Korea rather than in the United States. In any case, the hypothesis that quality differentials between the exports of Korea and Taiwan are systematically related to their industrial organization patterns would appear to be worth a closer look.

8.5 Concluding Remarks

This paper has combined a simple—perhaps simplistic—theory with a simple test. The findings are twofold: (i) Korean exports tend to be systematically of higher quality than Taiwanese exports, at least when quality is proxied by unit value, and (ii) this is consistent with a model of quality choice in which reputational externalities are less damaging in heavily concentrated industries.

A crucial final point concerns the normative aspect of the analysis. Nothing that has been said here should be construed as advocacy of an industrial policy that actively pursues concentration. Before we can go from the positive analysis to policy prescription, we will need a more complete welfare analysis and a more complete model in which to carry it out. There are at least two sets of reasons, besides policymakers' obvious concern about quality upgrading, to suspect that the findings here have normative significance. First, higher-quality products may carry price premiums exceeding the additional cost of producing them, as excess profits serve as the carrot needed to sustain quality levels (Shapiro 1983). Public policies in pursuit of such excess profits can potentially improve welfare. Second, there may be significant skills generated as countries move up the quality spectrum, and these may in turn create substantial positive externalities for the rest of the economy. Once again, policy may have a role to play. If domestic industrial structure and export performance are indeed linked,

8. Based on a quick look at 1975, it would appear that earlier years show the same pattern as 1986. Among included categories, the Korean premium in 1975 ranges from 20.1 percent (Taiwanese export weights) to 30.9 percent (Korean export weights).

as the preliminary results presented here would indicate, these would be fruitful areas for further research.

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Appendix

Table 8A.1 Unit Values and Exports of Korea, Taiwan, and Japan, 1986

Category	Description[a]	Unit Value ($ per 1,000 lbs.)			Total Value (million $)		
		South Korea	Taiwan	Japan	South Korea	Taiwan	Japan
588.8	Profile shapes, rubber and plastic	703	567	1,349	28.8	100.6	165.5
634.7	Plywood, including wood veneer panels	220	326	422	6.4	122.4	25.6
635.4	Wood manufactures, domestic & decorative use	1,946	1,157	2,517	2.2	164.5	5.9
635.9	Articles manufactured of wood, nspf	1,201	1,365	1,616	5.8	102.4	4.9
658.9	Tapestries & made-up articles	3,080	3,212	6,226	40.5	156.8	14.9
674.0	Plates & sheet, iron or steel	173	192	233	258.95	23.35	1,096.7
678.6	Pipes, tubes, & blanks, iron or steel	194	177	280	169.7	52.97	397.1
694.0	Nails, screws, & other fasteners of base metals	325	425	748	111.3	207.2	384.4
695.3	Hand tools, nspf of base metal	1,807	1,031	2,262	17.4	193	113.1
697.4	Household & sanitary ware of iron or steel	1,247	807	1,803	68.7	111.7	42.6
699.1	Locks, safes, etc., of base metals	1,204	1,362	2,364	18.97	175.9	127.1
699.8	Arts nspf of cast iron	1,006	842	1,286	50.5	122.1	102.3
736.1	Metal-cutting machine tools	2,338	1,160	4,161	10.8	106.9	745.6
749.2	Taps, cocks, valves, & parts	1,235	1,443	3,493	28.5	100.8	235.4
753.0	Automatic data processing (ADP) machines & auxillaries	6,347	6,214	10,223	362.9	713.96	2,781.1
759.9	Parts of ADP & calculating office machines	2,009	2,703	2,461	94.1	399.97	1,957.2
761.0	Television receivers & combinations	2,983	3,580	6,335	442.3	445.2	869
762.0	Radio receivers (AM/FM) & combinations	4,309	3,759	12,344	214	263.7	1,785.4
763.8	Audio & video tape players and records	7,038	6,514	12,009	352.2	187.6	5,364.8
764.2	Microphones, speakers, & audio amplifiers	2,297	1,758	4,204	45.2	133.2	500.4
764.4	Electric telephone & telegraph equip. & parts	7,756	6,486	21,586	153.3	287.2	1,095.4
764.4	Integrated circuits	88,333	82,203	132,704	442.3	240.4	929.5
764.9	Parts nspf of telecommunication & sound reproducing equip.	6,426	5,932	12,109	313.1	491.6	1,734.5
771.2	Nonrotating electrical power equip.	6,840	4,999	9,815	19.2	125.3	237.7
773.1	Insulated electric conductors (cable)	1,312	2,263	5,359	32.6	304.6	177.3
775.7	Electro-mechanical household applicances nspf	2,252	1,296	3,888	38.9	117.1	71.8

(*continued*)

Table 8A.1 (continued)

Category	Description[a]	Unit Value ($ per 1,000 lbs.) South Korea	Taiwan	Japan	Total Value (million $) South Korea	Taiwan	Japan
775.8	Electro-thermic applicances nspf & parts	1,759	2,803	2,654	300.1	94.97	592.6
778.8	Ferrites nspf; electrical machinery & equip. nspf	10,372	3,745	5,743	96.5	236.1	750
781.0	Passenger motor vehicles (except buses)	2,410	2,529	3,321	798.7	2.4	2.2
785.2	Adult cycles	1,151	1,463	4,057	13.7	199.5	68.4
788.0	Parts nspf of motor vehicles & handling equip.	819	1,113	2,486	56.3	204.7	2,972.3
812.4	Lighting fixtures & fittings	812	1,373	3,863	19	288.6	20.1
821.8	Furniture & parts thereof, nspf	1,208	795	3,184	53.5	968	177.4
831.0	Luggage, handbags	2,926	1,763	4,317	331.1	522.8	33.6
842.3	Slacks, etc., wool, mmf	6,158	4,517	12,532	65.6	157.8	16.2
843.7	Garments for rainwr; other outerwear nspf	10,331	6,347	8,517	328.4	401.1	174.1
844.1	Men's & boys' shirts, cotton, wool, manmade fibers, not knit	4,860	5,752	14,582	270.3	199.7	2.8
845.5	Sweaters & other outerwear of textile materials, knit KT	5,587	6,029	8,203	647.4	765.4	40
846.8	Undergarments (including shirts) of textile materials, nspf, knit	4,533	4,763	9,146	237.9	336.6	28.7
848.1	Gloves, belts, other wearing apparel of leather, nspf	9,974	6,140	11,115	347.3	141.8	9.9
848.3	Fur clothing & other articles except headwear	38,801	10,474	33,778	120.4	5.6	0.3
851.0	Footwear, new, excluding military or orthopedic	3,724	3,113	4,304	1489	2,101.1	13.1
879.2	Jewelry, etc., costume & semiprecious	7,530	5,911	32,946	79.4	106.6	63.5
881.1	Still cameras & parts; flash apparatus	27,438	12,308	47,152	17.5	105.1	792.4
884.2	Eyeglasses, eyeglass frames, & parts	10,823	6,250	39,687	31.4	114	86
891.0	Articles of rubber or plastics nspf	940	913	3,148	100	699	374.9
894.2	Toys, games, Christmas ornaments, etc.	2,705	1,780	3,789	519.5	787.1	346.2
894.7	Sporting goods, etc., nspf	2,246	1,228	4,004	163	534.8	143.3
898.3	Sound, etc., recordings & blank media	3,430	3,603	5,669	173.8	35.7	961.1

Source: U.S. Department of Commerce (1986).

Note: nspf = not specially provided for.

[a]Commodity descriptions are abridged versions. Full descriptions can be found in U.S. Department of Commerce (1986).