MEASURING QUALITY CHANGE IN QUOTA-CONSTRAINED IMPORT MARKETS

The Case of U.S. Footwear

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Theoretical models predict that quantitative import restrictions, such as orderly marketing agreements (OMAs), lead to substitution into higher quality products within the quota-constrained import category. The country specific nature of OMAs results in further substitution among supplying countries. Using index number techniques, this paper measures the impact of product and country substitution on the price of U.S. footwear imports in the period surrounding the 1977-81 footwear OMA with Korea and Taiwan. Upgrading of the import bundle was observed in most quota categories throughout the OMA period and accounted for 12 percent of the observed rise in the average price of footwear imports.

1. Introduction

In recent years countries interested in protecting domestic industries from import competition have gradually shifted from the use of general tariff restrictions to non-tariff barriers. Two increasingly common forms of non-tariff barriers used by the United States are orderly marketing agreements (OMAs) and voluntary export restraints (VERs). Both place quantitative restrictions on imports of particular products but, unlike general quotas, only pertain to specific countries and are administered by the exporting country. U.S. imports of shoes, textiles, automobiles, and recently, steel, have been affected by these trade restrictions. As with other import constraints, OMAs and VERs have been blamed for rapid increases in import prices as the supply of the the imported product is restricted.

Theoretical work by Falvey (1979) shows that OMAs and VERs will lead the exporting countries to substitute into more expensive goods within the general quota-constrained product category.† In addition, these country-

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†The theoretical impact of quotas on import quality has also been examined by Rodriguez (1979) and Santoni and VanCott (1980).

specific import restrictions, which are generally aimed at the low-cost supplying countries, divert import demand toward products from higher-cost non-controlled countries. Both these effects contribute to increases in the average price of the imported product.

The tendency for quantity-constrained countries to upgrade the quality of their exports has been noted in the case of textiles and footwear by Baldwin (1982), in steel by Patterson (1966), Meier (1973), and MacPhee (1974), and in oil by Barzel and Hall (1977). However, with the exception of Feenstra (1985), there is little empirical work which attempts to measure the effect of this quality shift on import prices. In this paper we use index number techniques to analyze the quality effects of the 1977–81 OMA on U.S. footwear imports from Taiwan and South Korea. The growth in unit-value indexes of footwear imports for each of five quota categories are disaggregated into measures of quality-adjusted price change and quality change where the latter captures the effect of the changing mix of products in the import bundle. The results indicate that, on average, substitution among products within each of the five quota categories led to higher prices when the OMA was in effect. In three of the five categories product substitution reduced prices in the non-OMA period.

In order to examine the effect of substitution from controlled to non-controlled countries, a unit-value index is constructed for the seven major exporters of footwear to the United States. The growth in this index is disaggregated into components representing quality-adjusted price change, the effect of changing product mix, and the effect of a changing mix of supplying countries. Substitution among supplying countries acted to reduce the average price of footwear in the years before and after the OMA and raise prices when the OMA was in effect.

Section 2 of this paper discusses the link between OMAs and import prices. Section 3 outlines the relevant index number techniques which have been largely developed and applied in the area of productivity measurement. Section 4 analyzes price changes for U.S. non-rubber footwear imports over the 1974–82 period.

2. Orderly marketing agreements and import prices

Falvey (1979) shows that quantitative restrictions placed on total imports for broadly defined product groups raise the relative price of the least expensive goods in the product category. Importers are therefore encouraged to increase the quantity of higher-priced products within the quota-constrained category. This quality upgrading of the import bundle, which occurs as a result of product substitution, leads to a rise in the unit-value index for the quota category. Unit-value import price indexes will tend to increase as a result of both the OMA-induced supply constraint and the quality upgrading.
The fact that OMAs are constraints that apply to particular exporting countries has additional implications for their effect on import prices. In general, OMAs are negotiated for product imports from the low-cost supplying countries whose exports are regarded as the source of injury to domestic producers in the importing country. By making the exports of these constrained countries less price competitive relative to the exports of non-controlled countries the OMA results in further substitution into the exports of these higher-priced non-controlled countries. This country substitution not only tends to raise average import prices but also acts to undercut the protection the OMA is intended to provide to the domestic producers of the restricted product. As a result, Pearson (1983) argues that OMAs are ineffective as well as inefficient.

A unit-value import price index defined over all supplying countries, both constrained and unconstrained, will rise if substitution occurs from low-cost to high-cost supplying countries, other factors held fixed. The next section of this paper outlines the methodology for disaggregating the growth in a unit-value index into its source components.

3. Quality-adjusted import price indexes

Aggregate unit-value indexes are biased measures of the true change in import prices because they contain errors due to improper aggregation over product categories and supplying countries. Jorgenson and Griliches (1967), Christensen and Jorgenson (1970), Gollop and Jorgenson (1980), and Chinloy (1980) have argued persuasively for the use of Divisia index numbers as a method for removing errors due to improper aggregation in the construction of price and quantity indexes. In addition, the difference between the rate of growth of an aggregate unit-value index and a Divisia import price index provides a measure of the change in import quality due to the changing mix of products and supplying countries in the import bundle. The construction of discrete-time Divisia price indexes (Tornqvist indexes) will allow us to disaggregate the growth in unit-value indexes into quality components due to the changing mix of products and supplying countries as well as a measure of true or quality-adjusted price change.

Chinloy (1980) uses a Tornqvist quantity index to measure the growth in labor input due to the changing mix of workers by sex, age, education, occupation, class, and sector. The disaggregation implemented in this paper is the same as that used by Chinloy except that we examine price changes rather than quantity changes.

An examination of the data for U.S. non-rubber footwear imports reveals that it is important to distinguish two dimensions of the import bundle: the

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2A theoretical discussion of the properties of Divisia index numbers is contained in Hulten (1973).
seven-digit product category and the country of origin. Besides differing significantly across products, the average price of imported footwear for any seven-digit product differs significantly across supplying countries. This indicates that changes in the mix of products or countries of origin of U.S. imports will lead to changes in an aggregate unit-value index even if there is no change in product prices. Suppose there are \( g = 1, \ldots, G \) products or goods categories and \( c = 1, \ldots, C \) supplying countries. The growth in an aggregate unit-value index for this group of products and countries can be measured as

\[
\Delta P(t) = \ln P(t) - \ln P(t - 1),
\]

where

\[
P(t) = \frac{\sum_{g} \sum_{c} V_{gc}(t)}{\sum_{g} \sum_{c} Q_{gc}(t)},
\]

\( V_{gc}(t) \) is the value of U.S. imports of product \( g \) from country \( c \) in year \( t \), \( Q_{gc}(t) \) is the corresponding quantity, and the \( \Delta \) operator is used to signify the difference in natural logs.

It can be seen from (1) that substitution into higher-priced products or supplying countries with the total quantity held fixed will result in an increase in the unit-value index. Tornqvist index numbers can be used to avoid this type of aggregation error.\(^3\)

The Tornqvist price index for a group of products and supplying countries is defined as the value-share weighted sum of the growth of the individual import product prices:\(^4\)

\[The properties of Tornqvist index numbers and their relationship to underlying translog utility or production functions are developed in Diewert (1976). The Tornqvist price index can be derived formally from a consumer optimization problem. The necessary assumptions are that import markets for shoes are competitive and that consumers choose quantities of imported shoes to minimize the expenditure on shoe imports subject to fixed prices and a fixed level of utility. Imports of shoes are also assumed to be separable from other arguments in the utility function.

\(^4\)The individual import product prices are constructed as the value of imports of good \( i \) from country \( j \) divided by the number of pairs of shoes of good \( i \) from country \( j \) and thus are unit-value indexes themselves. If seven-digit categories do not represent homogeneous products then a changing mix of products within a category will appear only as a change in price. If exporting countries respond to a quota by altering the mix of products within a seven-digit category the measures of quality change developed in this paper will be understated. While it is difficult to assess the degree of homogeneity within a seven-digit category the presence of cross-hauling and intraindustry trade at this level would indicate product heterogeneity. For non-rubber footwear, U.S. exports to these countries are negligible. At the seven-digit product level, the most disaggregated level for which import data is published, footwear imports are distinguished by type of material used in their construction, by the method of attaching the soles and uppers, by consumer group (men, women, misses, children, and infants) and in some cases by broad price categories.
The growth in import prices due to the recomposition of the import bundle among products and countries is measured as the difference between the growth in the unit-value index and the Tornqvist index:

\[ \Delta q(t) \equiv \Delta P(t) - \Delta P^*(t). \] (3)

The unit-value index will grow faster than the Tornqvist price index when there is a shift toward relatively more expensive products and supplying countries. \( \Delta q(t) \), which is positive in this case, is a measure of quality change due to the recomposition of the import bundle or, equivalently, the bias in the unit-value index which results from the fact that all products and supplying countries are treated as identical.

By itself, however, \( \Delta q(t) \) does not measure the relative importance of changing product mix and changing country mix as sources of import price change. The disaggregation of quality change into its separate sources involves defining partial indexes of import prices which are Tornqvist indexes defined over a subset of the import characteristics, in this case either country or product.

The Tornqvist partial price index for characteristic \( i \) is defined as the share-weighted growth in unit-value indexes defined over each category of characteristic \( i \):

\[ \Delta P^*_i(t) \equiv \sum_i S_i(t) \Delta P_i(t), \] (4)
and

\[ \Delta P_i(t) = \ln \left( \frac{\sum j V_{ij}(t)}{\sum j Q_{ij}(t)} \right) - \ln \left( \frac{\sum j V_{ij}(t-1)}{\sum j Q_{ij}(t-1)} \right), \quad i, j = g, c. \]

The two partial price indexes can be used to define two main quality effects as

\[ \Delta q_i^j(t) \equiv \Delta P(t) - \Delta P^*_i(t), \quad i = g, c. \]  

(5)

The quality index \( \Delta q_i^j(t) \) measures the effect of a changing mix of countries treating all products as homogeneous. If \( \Delta q_i^g(t) \) is positive it indicates that the import bundle has shifted toward more expensive supplying countries. Similarly, a positive \( \Delta q_i^c(t) \) indicates the import bundle is increasingly composed of relatively more expensive products.

In addition, the substitution may be occurring toward both more expensive products and countries. In this case \( \Delta q_i^g(t) + \Delta q_i^c(t) \) will overestimate the total quality change. An interaction term can be defined as the difference between the total effect and the sum of the main effects:

\[ \Delta q_i^{cg}(t) = (\Delta P(t) - \Delta P^*(t)) - (\Delta P(t) - \Delta P_i^c(t)) - (\Delta P(t) - \Delta P_i^g(t)) \]

\[ = \Delta q(t) - \Delta q_i^c(t) - \Delta q_i^g(t). \]  

(6)

Solving (6) for the total change in quality, substituting into (3), and solving for the growth in the unit-value index gives

\[ \Delta P(t) = \Delta P^*(t) + \Delta q_i^g(t) + \Delta q_i^c(t) + \Delta q_i^{cg}(t). \]  

(7)

Eq. (7) shows that the growth in the aggregate unit-value index for a group of countries and products can be divided into the growth in quality-adjusted prices plus the sum of three quality terms: a country mix term, a product mix term, and an interaction term. The separate components of this equation will be quantified in the next section of the paper.

4. Empirical estimates of quality change in U.S. footwear imports

In order to examine the changing quality composition of U.S. footwear imports we will examine imports from the major U.S. trading partners over

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5This disaggregation also can be applied to the imports (or a subset of the imports) from an individual country. In this case the only source of quality change is the change in the product mix \( \Delta q_i^p \). Both \( \Delta q_i^c \) and \( \Delta q_i^{cg} \) equal zero when there is only one country.
the 1974–82 period. The Tariff Schedule of the U.S. Annotated (TSUSA) reports the value and quantity of U.S. non-rubber footwear imports for 108 seven-digit products from approximately 100 supplying countries. We focus on the subset of 70 products and seven supplying countries which are dominant in the U.S. import bundle. These seven countries, Taiwan, Korea, Hong Kong, Mexico, Brazil, Italy, and Spain, account for 80.1 percent of the total value of U.S. non-rubber footwear imports in 1971 and 87.1 percent in 1982. Altogether the sample of seven countries and 70 products represents 77.8 percent of the value of U.S. non-rubber footwear imports in 1974 and 84.9 percent in 1982. The empirical analysis is divided into two sections. The first section examines the two OMA countries, Taiwan and Korea, and measures the effect of the changing product mix on their footwear prices. The second section examines all seven countries in order to measure the effect of both product and country substitution on import prices.

4.1. Product substitution

OMAs on U.S. footwear imports from Taiwan and Korea were in place from July 1977 through June 1981. The OMAs set separate quotas for three categories of imports from Taiwan (leather shoes, plastic shoes, and shoes with fiber uppers) and two categories from Korea (non-athletic leather shoes and other). Within each of the quota categories there are still numerous seven-digit products and the exporting country is allowed to substitute among these products as long as the overall quantity constraint is satisfied. The extent to which product substitution can affect the average price of imports in a quota category depends on the range of prices within the category. If the product prices lie in a narrow range, then substitution among products will have little effect on unit-value indexes. As the dispersion of prices increases, the effect of substitution on unit-value indexes should become more noticeable.

In order to assess the potential for upgrading of quality in each quota category, table 1 reports the average relative price of the most expensive to

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6 Non-rubber footwear categories are TSUSA codes 700-05 through 700-95 excluding 700-51, 52, 53, 54, 60, 75, and 90.

7 Construction of the Tornqvist price index between period \( t \) and \( t-1 \) requires an import price for each product from each country for both years even if imports in that category only occurred in one of the years. When the import series is very irregular prices must be imputed for missing years. This difficulty led us to drop 38 product categories for which U.S. imports from these countries either did not exist or were very small and irregular. Of the 70 remaining categories, import prices for missing years were imputed using the growth rate of the import price for the five-digit product category from that country. In total 8.9 percent of the prices were imputed. All imputations are for products which were not imported on a regular basis and these goods tend to have an extremely small share of import value when they are imported. Because the Tornqvist index weights the growth in price with the value share, goods with small shares have little impact on the final index.
Table 1
Ratio of the price of the most expensive products to the price of the least expensive products within quota categories (annual averages).

<table>
<thead>
<tr>
<th></th>
<th>Total period 1974-82</th>
<th>OMA period 1977-81</th>
<th>Non-OMA period 1974-76, 1982</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Taiwan</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leather</td>
<td>1.60</td>
<td>1.58</td>
<td>1.64</td>
</tr>
<tr>
<td>Plastic</td>
<td>1.42</td>
<td>1.38</td>
<td>1.48</td>
</tr>
<tr>
<td>Fiber uppers</td>
<td>1.91</td>
<td>2.09</td>
<td>1.68</td>
</tr>
<tr>
<td><strong>Korea</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-athletic leather</td>
<td>2.53</td>
<td>2.29</td>
<td>2.82</td>
</tr>
<tr>
<td>Other</td>
<td>2.94</td>
<td>2.04</td>
<td>4.06</td>
</tr>
</tbody>
</table>


The least expensive products in each category for three time periods. The relative price is a ratio of unit-value indexes of high-priced and low-priced goods where the unit values are defined over the most (least) expensive products responsible for at least 10 percent of the total quantity of imports in the quota category. On average the ratio is largest during the OMA period for the two Korean categories and Taiwanese shoes with fiber uppers. If firms respond to the OMA as predicted, then the quality effect due to the substitution among products should be larger for these three categories and smallest for imports of plastic shoes from Taiwan.

The decomposition of the yearly price change for the separate quota categories of footwear imports from Taiwan and Korea is reported in tables 2 and 3. The first two columns for each category list the rate of growth in the unit-value index and the growth in quality-adjusted prices as measured by the Tornqvist index. The final column reports the measure of quality change, the growth in price due to the changing mix of products. A positive (negative) value for \( \Delta q^g \) represents substitution into relatively higher-priced (lower-priced) products.

The OMAs for these two countries were in effect from July 1977 through June 1981. The data reported throughout this paper are annual averages.

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8The averaging is used to reduce the effect of individual products which may have the highest or lowest price but play a very small role in the total import bundle. Constructing the ratio of the price of the single most expensive product to the single least expensive product would not alter the pattern of relative prices reported in table 1 but would increase the magnitudes.

9Falvey's theoretical work predicts that the relative price of the most expensive to the least expensive products within each quota category should fall when the OMA is imposed, other factors held fixed. As shown in the last two columns of table 1 this narrowing of relative prices occurs in four of the five quota categories although the magnitude of the change is often small. The exception, fibre uppers from Taiwan, shows an increase in the relative price in the first year of the OMA followed by a narrowing in the remaining OMA years.
<table>
<thead>
<tr>
<th>Year</th>
<th>Leather footwear</th>
<th>Plastic footwear</th>
<th>Footwear with fiber uppers</th>
<th>Quality index ( A_{d_q} )</th>
<th>Unit-value index ( A_{d_P} )</th>
<th>Tornqvist index ( A_{d_{P*}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974-75</td>
<td>0.188</td>
<td>0.007</td>
<td>0.003</td>
<td>0.063</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>1975-76</td>
<td>0.072</td>
<td>0.002</td>
<td>0.002</td>
<td>0.063</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>1976-77</td>
<td>0.072</td>
<td>0.002</td>
<td>0.002</td>
<td>0.063</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>1977-78</td>
<td>0.271</td>
<td>0.399</td>
<td>0.078</td>
<td>0.307</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>1978-79</td>
<td>0.196</td>
<td>0.154</td>
<td>0.188</td>
<td>0.307</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>1979-80</td>
<td>0.162</td>
<td>0.154</td>
<td>0.188</td>
<td>0.307</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>1980-81</td>
<td>0.062</td>
<td>0.053</td>
<td>0.007</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>1981-82</td>
<td>0.062</td>
<td>0.053</td>
<td>0.007</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Average 1974-82</td>
<td>0.106</td>
<td>0.020</td>
<td>0.148</td>
<td>0.206</td>
<td>0.004</td>
<td>0.004</td>
</tr>
<tr>
<td>Average 1977-81</td>
<td>0.172</td>
<td>0.024</td>
<td>0.206</td>
<td>0.206</td>
<td>0.004</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Sources of price change in U.S. non-rubber footwear imports from Taiwan by quota category (average annual rates of growth).
### Table 3
Sources of price change in U.S. non-rubber footwear imports from Korea by quota category (average annual rates of growth).

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-athletic leather footwear</th>
<th>Other footwear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit-value index $\Delta P$</td>
<td>Tornqvist index $\Delta P^*$</td>
</tr>
<tr>
<td>1974–75</td>
<td>-0.210</td>
<td>-0.052</td>
</tr>
<tr>
<td>1975–76</td>
<td>0.075</td>
<td>0.058</td>
</tr>
<tr>
<td>1976–77</td>
<td>0.181</td>
<td>0.093</td>
</tr>
<tr>
<td>1977–78</td>
<td>0.315</td>
<td>0.176</td>
</tr>
<tr>
<td>1978–79</td>
<td>0.265</td>
<td>0.204</td>
</tr>
<tr>
<td>1979–80</td>
<td>0.000</td>
<td>-0.010</td>
</tr>
<tr>
<td>1980–81</td>
<td>0.106</td>
<td>0.097</td>
</tr>
<tr>
<td>1981–82</td>
<td>-0.039</td>
<td>-0.016</td>
</tr>
<tr>
<td>Average 1974–82</td>
<td>0.084</td>
<td>0.069</td>
</tr>
<tr>
<td>Average 1977–81</td>
<td>0.172</td>
<td>0.117</td>
</tr>
</tbody>
</table>

Some of the effects of the OMAs will appear in the 1976–77 growth rates but since adjustment by the exporting countries occurred with a lag, most of the effect will be seen in the 1977–78 growth rates. Conversely, the end of the controls in mid-1981 appears to have been well anticipated and most of the effect of the removal of the OMAs will be seen in the 1981–82 growth rates.\(^\text{10}\)

As reported for Taiwan in table 2, over the entire eight-year period the average price of leather footwear increased by 6.5 percent per year with about one-tenth of the increase due to upgraded quality. The price of plastic footwear increased 11.6 percent per year with virtually none of the increase due to quality change. Shoes with fiber uppers had the largest average increase in price, 14 percent per year, with approximately one-third of the increase due to upgrading of the product mix.

During the OMA years, 1977–81, sharp increases in unit-value indexes and upgrading of the product mix is observed across all quota categories in almost every year. The effect is particularly large in the fiber upper category where the unit-value index rose 79 percent in the first year of the OMA with increased product quality accounting for slightly over one-third of the increase. During the period 1977–81 increased quality accounted for 14.0 percent of the increase in the average price of leather footwear, 1.9 percent.

\(^\text{10}\)Total imports from Taiwan for the product categories used in this paper were 153 million pairs of shoes in 1976, 158 million in 1977, and 116 million in 1978. The quantity increased from 115 million in 1981 to 175 million in 1982. Similarly, the main quantity effect of the OMA with Korea appears in 1978. Imports in 1977 were 54 million pairs and in 1978 they fell to 28 million pairs. They then increased gradually to 42 million in 1981 and jumped to 89 million pairs in 1982.
for plastic footwear, and 26.8 percent of the increase for shoes with fiber uppers.

In the first year after the OMA expired, unit-value indexes and the quality-adjusted price indexes dropped substantially with quality-adjusted prices falling between 10 and 20 percent across the three categories. Imports of both leather and plastic shoes declined in quality due to substitution into lower-priced products, reversing the trend over the 1977–81 period. Quality in the fiber upper category continued to increase after the OMA expired.

A comparison of the magnitude of quality change in the non-OMA years (1974–77 and 1981–82) and OMA years (1977–81) reveals an important difference: in each of the three quota categories the average annual rate of quality change was greater when the OMA was in effect. The average annual rates of growth in quality during this period were 2.5, 0.43, and 8.0 percent for the three quota categories, respectively. This compares with averages of −1.4, −0.1, and 2.2 percent when the OMA was not in effect. This indicates a shift into the relatively more expensive products during the OMA period. In addition, the magnitude of the quality change across quota categories is consistent with the predictions based on the relative prices in table 1. Quality change is largest for shoes with fiber uppers and smallest for plastic shoes.

Table 3 reports a similar price decomposition for U.S. footwear imports from Korea. Over the eight-year period the average price of non-athletic leather shoes rose 8.4 percent per year with approximately one-fifth of the increase due to upgraded product mix. In the second quota category quality change was responsible for 40 percent of the increase in average price. Most of the upgrading occurred between 1974 and 1975, before the OMA was in effect, as a result of a substantial shift toward higher-priced leather athletic shoes. During the quota period the trend is similar to that seen for Taiwan. Unit-value indexes increase substantially in both categories, rising over 30 percent in the first year alone. Increased product quality was responsible for 32.0 percent of the rise in the average price of non-athletic leather footwear between 1977 and 1981 and 12.0 percent for other footwear. For the Korean categories the quotas were not always binding in the latter two years. Consistent with this, the growth in the unit-value indexes and growth in quality was substantially smaller than in the first two years of the OMA. 11

The average annual rate of growth of quality for the non-athletic leather shoe category was 5.5 percent between 1977 and 1981, but −2.4 percent in

11 The competitiveness of the Korean industry began to deteriorate in 1980 due largely to rising input prices [International Trade Commission (1981, p.41)]. However, the decline was reversed for both quota categories in 1982 when total Korean footwear export to the United States increased by over 100 percent from 1981 levels. In addition, the 'other' category was affected by substitution into the unrestrained rubber footwear category. By making slight changes in the product, Korean exports could be reclassified as rubber shoes. This possibility reduces the incentives to upgrade the constrained products and may be responsible for the small negative trend in quality from 1978 to 1981.
the other years. As was the case with imports from Taiwan, there was substantial recomposition of the product mix toward relatively more expensive products over the period 1977–81. In addition, the magnitude of the annual growth in quality is large relative to the quality growth for either leather or plastic shoes from Taiwan. This is consistent with the pattern of relative prices reported in table 1. This growth, however, is less than that for shoes with fiber uppers for Taiwan.

The rate of growth in quality for the Korean ‘other’ category was 1.8 percent per year for 1977–81 but a large 10.5 percent for the non-OMA years. This unexpected result is solely due to the growth in quality of 40.1 percent between 1974 and 1975. This large growth was due to a major shift into higher-priced leather athletic footwear.

4.2. Country substitution

While an examination of individual quota categories is useful for measuring the effect of substitution among products it provides no information on the impact of substitution among supplying countries. Average prices differ substantially across supplying countries and substitution among countries is potentially an important source of variation in an aggregate unit-value index for footwear imports. Over the period 1974–82 imports from Hong Kong, Taiwan, and Korea had average prices of 1.65, 3.40, and 5.79 dollars per pair of shoes, respectively. Imports from the remaining four countries, Mexico, Brazil, Spain and Italy, had average prices of 6.45, 7.25, 8.67, and 9.07 dollars per pair, respectively. While prices varied over time, the ranking of these seven countries from least to most expensive was very stable. If the OMAs on Taiwan and Korea lead to increased imports from the more expensive supplying countries, then aggregate unit value indexes will rise. If Hong Kong gains in importance then an aggregate unit value will tend to fall.12

Table 4 reports annual rates of growth in the unit-value index constructed for imports from the seven major footwear suppliers to the United States. The growth in the unit-value index is then disaggregated into growth in quality-adjusted prices ($\Delta P^*$) and total growth in quality ($\Delta q$). The quality growth is then disaggregated into a component due to the changing mix of countries, changing mix of products, and an interaction term.

On average, the unit-value index for U.S. non-rubber footwear imports grew 7.3 percent per year with changing quality responsible for a 1.6

12 The average country prices quoted in the text also reflect differences in the mix of products being exported to the United States. Of the 70 products in this study, Taiwan produces 46, Korea 49, Italy 50, and Spain 43. Hong Kong, Brazil, and Mexico produce 25, 24, and 29 different products, respectively. Together, Taiwan, Korea, Italy, and Spain account for approximately 85 percent of the total value of imports in the sample in any year. Changes in the mix of imports from these four countries will be responsible for the vast majority of the country mix effects discussed below.
Table 4
Sources of price change in U.S. non-rubber footwear imports from major trading partners (average annual rates of growth).

<table>
<thead>
<tr>
<th>Year</th>
<th>Unit-value index $\Delta P^*$</th>
<th>Total quality $\Delta q$</th>
<th>Country mix $\Delta q^c$</th>
<th>Product mix $\Delta q^p$</th>
<th>Interaction term $\Delta q^d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974–75</td>
<td>0.067</td>
<td>-0.013</td>
<td>-0.043</td>
<td>0.044</td>
<td>-0.014</td>
</tr>
<tr>
<td>1975–76</td>
<td>-0.012</td>
<td>-0.099</td>
<td>-0.115</td>
<td>-0.049</td>
<td>0.065</td>
</tr>
<tr>
<td>1976–77</td>
<td>0.097</td>
<td>-0.066</td>
<td>-0.077</td>
<td>-0.061</td>
<td>0.072</td>
</tr>
<tr>
<td>1977–78</td>
<td>0.269</td>
<td>0.108</td>
<td>0.111</td>
<td>0.076</td>
<td>-0.079</td>
</tr>
<tr>
<td>1978–79</td>
<td>0.134</td>
<td>0.012</td>
<td>0.025</td>
<td>-0.002</td>
<td>-0.011</td>
</tr>
<tr>
<td>1979–80</td>
<td>0.006</td>
<td>-0.102</td>
<td>-0.103</td>
<td>-0.050</td>
<td>0.051</td>
</tr>
<tr>
<td>1980–81</td>
<td>0.089</td>
<td>0.040</td>
<td>0.028</td>
<td>0.055</td>
<td>-0.043</td>
</tr>
<tr>
<td>1981–82</td>
<td>-0.066</td>
<td>-0.010</td>
<td>-0.018</td>
<td>-0.052</td>
<td>0.060</td>
</tr>
<tr>
<td>Average 1974–82</td>
<td>0.073</td>
<td>-0.016</td>
<td>-0.024</td>
<td>-0.005</td>
<td>0.013</td>
</tr>
<tr>
<td>Average 1977–81</td>
<td>0.125</td>
<td>0.015</td>
<td>0.015</td>
<td>0.020</td>
<td>-0.020</td>
</tr>
</tbody>
</table>

Countries included: Brazil, Hong Kong, Italy, Korea, Mexico, Spain, and Taiwan.

percentage point decline per year. Total quality growth was negative in all years in which the OMA on imports from Taiwan and Korea was not in effect and positive for three of the four periods in which the OMA was in effect. Over 1977–81 the unit-value index grew at an average annual rate of 12.5 percent and growth in quality was responsible for one-tenth of the total increase.

The decomposition of the growth in import quality is reported in the last three columns of table 4. A negative sign for $\Delta q^d$ ($\Delta q^p$) implies that the composition of the import bundle shifted toward the less expensive products (supplying countries). On average the changing mix of countries had a negative effect on product quality equal to 2.4 percent per year. The average quality effect of the changing mix of products was also negative but much smaller, equal to 0.5 percent per year.

By comparing the period when the OMA was in effect with the non-OMA period a sharp distinction emerges. For the years 1974–77 and 1981–82 when the OMA was not in effect, there was a decline in total quality in every year. In addition, the effect of changing country mix was negative in every year implying substitution into the lower-priced supplying countries. The quality component due to product mix was also negative in three of the four years. The large positive interaction term in three of the four years indicates that the growth in imports was concentrated in the lower-priced products from the lower-priced supplying countries.

During the OMA period the pattern is reversed. On average, over 1977–81

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13The decline in quality from 1979 to 1980 was primarily due to a large decline in imports from Italy as a result of changing fashion.
the country mix and product mix effects were positive and the interaction was negative. The import bundle became more heavily concentrated in higher-priced products and these products were primarily imported from the more expensive countries.  

The one outlying year during which the OMA was in effect is 1979–80. The decline in quality was primarily due to a decline in imports of shoes from Italy as a result of changes in fashion which were unrelated to U.S. trade policies. This shift, however, does tend to reduce the total measures of quality change over the OMA period.

5. Summary and conclusions

In his study of VERs, Feenstra (1985) emphasizes that price changes must be corrected for quality adjustment when assessing the impact of quotas on welfare. The traditional welfare loss from the quota is partially offset by the rise in quality. However, as shown by Santoni and VanCott (1980), the welfare loss due to the increased cost of the higher quality level remains. In general, the quota leads to an inefficient increase in the quality of imports in addition to the decrease in the quantity of imports.

In examining U.S. footwear imports from Taiwan and Korea evidence of upgrading of the import bundle was found in all quota categories in virtually every year the OMA was a binding constraint. The effect of the upgrading on the average price of imports varied substantially across quota categories. The largest average annual rates of growth in quality between 1977 and 1981 were 5.5 percent for imports of non-athletic leather shoes from Korea and 8.0 percent for shoes with fiber uppers from Taiwan. Quality growth was responsible for 32.0 and 26.8 percent of the measured increase in the unit-value indexes for the two categories. On the other extreme, virtually no quality upgrading was observed for imports of plastic shoes from Taiwan. The measured quality increase was particularly pronounced in the first year of the OMA. In four of the five quota categories the substitution toward more expensive footwear was reversed in the first year after the OMA expired.

The observed pattern of upgrading across categories is consistent with the range of product prices within each category. As the range of prices increases the importance of upgrading as a source of price change rises. This indicates that upgrading may be reduced by defining quota categories to include

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^To the extent that relatively low cost countries excluded from the sample, such as Philippines, Singapore, China, and Thailand, gained importance during the OMA period then the measured rates of quality improvement are biased upward. However, despite large increases in U.S. imports from these countries, their share of imports is so small (2.2 percent of value in 1980), that they would have virtually no impact on the reported figures. If interest focused on the effect of country substitution for a single seven-digit product category then exclusion of these countries could be important.
products with similar prices. Footwear quota categories were based on the dominant material used in production which resulted in substantial price variation within some categories.

The reduction in footwear imports from Korea and Taiwan during the OMA years led to further increases in the average price of footwear imports as products from more expensive supplying countries played a larger role in the total import bundle. During the period when the OMA was not in effect the quality of U.S. imports from the seven major supplying countries declined 4.7 percent per year as lower-priced products from Korea and Taiwan increased in importance. The trend was reversed when the OMA was in effect with total quality rising 1.5 percent per year. Overall, upgrading was responsible for 12 percent of the rise in import prices in 1977–81 and 40 percent of the rise in the first year of the OMA.

It should be emphasized that these figures represent the portion of total price change which is due to a changing mix of products and supplying countries. This mix can change for reasons other than the imposition of the OMA, such as demand shifts due to changing fashions or supply shifts unrelated to the OMA, although the OMA appears to be the major factor at work during this period. The observed pattern of upgrading before, during, and after the OMA is largely consistent with the theoretical predictions of Falvey (1979).

In an empirical study of the VER on Japanese automobiles, Feenstra (1985) also finds evidence of quality upgrading. During the first year of the VER the price of U.S. imports of Japanese cars rose a total of 19.8 percent. Six percentage points, or 30 percent of the total price rise, was attributable to a higher-quality import bundle. During the first year of the footwear OMA, quality upgrading was responsible for 9.8 and 39.2 percent of the total rise in the price of imports from Taiwan and Korea, respectively. When country substitution is included, increased quality is responsible for 40 percent of the rise in imported footwear prices during the first year of the OMA. Even though the importance of quality upgrading diminishes in the later years of the OMA the evidence of inefficient distortion of the trade pattern appears strong.

Finally, the empirical results support Pearson’s (1983) conclusion that OMA s are ineffective in protecting the domestic industry because they fail to prevent substitution into non-controlled supplying countries. To the extent that domestic production is concentrated in higher quality products, upgrading of the import bundle may further undercut the effectiveness of the OMA.

References


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