# The Impact of the Canada-U.S. Hog/Pork Trade Dispute on the Composition of U.S. Pork Imports

**Bruno Larue and Jean-Philippe Gervais**

Trade theorists have demonstrated that different trade policy instruments have different effects on the quality and source of imports. Countervailing duties (CVDs), like specific tariffs, should induce quality upgrading. However, the magnitude and timing of the quality adjustments are influenced by the credibility of the duties that can be legally contested and modified after annual administrative reviews. Index numbers are used to assess the timing and magnitude of the product mix and country mix substitution effects in U.S. pork imports in response to the U.S. CVDs on Canadian exports of live hogs and fresh, chilled, and frozen pork.

The theoretical effects of trade barriers on the volume, composition, and source of imports have been thoroughly investigated by trade theorists (Das and Donnefeld 1987, 1989; Krishna 1987; Falvey 1979). Unfortunately, the body of empirical studies on this subject, while growing rapidly, is not yet as rich. Larue and Lapan (1992, 335) cite the inaccurate measurement of trade barriers and the scarcity of data on the quality of goods as potential reasons for the limited volume of empirical research about the effects of trade policy instruments on the quality of goods.[1] Nevertheless, very interesting empirical results have been generated, especially for a few nonagricultural industries. Feenstra (1984, 1988) has analyzed the relationship between the composition of U.S. imports of cars and trucks and the imposition of voluntary export restraints (VERs) on Japanese exports. Aw and Roberts (1986) have investigated the effects of VERs on the quality and source of U.S. imports of nonrubber footwear. In a recent paper, de Melo and Winters (1993) extend the analysis of Aw and Roberts (1986) by focusing on the composition of exports of a VER-targeted exporter to restricted and unrestricted markets. The empirical evidence emerging from these footwear studies and Feenstra's confirm theoretical expectations about policy-induced quality upgrading (in restricted markets) and country substitution. Several theoretical models also predict that specific tariffs should encourage shifts toward higher quality/more expensive products, while ad valorem tariffs should be neutral.[2] Larue and Lapan's (1992) theoretical model identifies a negative relationship between the magnitude of export subsidies and product quality, which they use to explain the observed negative correlation between the number of complaints about U.S. wheat quality and variations in the Export Enhancement Program.

In the context of policy-induced quality variations, it is tempting to conjecture that a countervailing duty (CVD) is equivalent to a specific tariff. After all, imposing a specific tariff of \$t/unit on two imported varieties of the same product brings about the same reduction in the relative price of the more expensive variety ($p_1/p_2 > p_1 +$

Bruno Larue is associate professor in the Département d'Économie Rurale, Université Laval, Ste-Foy, Québec, Canada. Jean-Philippe Gervais is graduate research assistant, Department of Economics, Iowa State University, Ames, Iowa.

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[1] Because of data scarcity problems, product differentiation in empirical studies is more often than not handled by the Armington assumption, which postulates that goods can be differentiated by country of origin. Given that many countries often produce different categories of the same products (e.g., different classes of wheat), the Armington assumption is always realistic. Davis (1995) provides a clear exposition about the (more general) Lancaster-Ladd approach and the (the empirically more popular) Armington approach to product differentiation. He also derives conditions under which the two approaches can be reconciled.

[2] Most studies of the effects of trade policies and quality conclude that quotas and specific tariffs induce increases in product quality. However, some studies, such as Krishna's (1987), found ambiguous effects.

$t/p_2 + t$, if $p_1 > p_2$), which will in turn trigger a substitution effect skewing the composition of imports toward the more expensive variety. However, it would be wrong to conclude from this simple argument that the two instruments will affect imports in the same manner. In reality, they differ in at least two important ways. First, CVDs, unlike import tariffs, are applied in a very discriminatory manner and are expected to cause trade diversion as well as trade reduction. Second, Leamer (1988, p. 53) rightly points out that "the permanence (or lack of) of a barrier may have a major effect on the responses that are made." Because CVDs can be legally contested and because they have high probability of being traded for voluntary exports restraints (Bhagwati, 1988, pp. 52–53), it is safe to argue that considerable uncertainty surrounds the life expectancy and future levels of CVDs. The uncertainty can have repercussions on the timing of the quality adjustments as expectations-driven changes in quality may precede the announcements of legal decisions. It is also possible that contractual or production constraints can hinder the speed at which importers, exporters, and producers react to announcements.

Trade theory tells us the CVDs on Canada's exports to the United States could have raised the unit cost of U.S. imports through (1) a pure inflationary effect, (2) a substitution effect between cheaper and more expensive pork categories, and (3) a trade diversion effect by which imports from the cheapest source are substituted by imports from more expensive sources. However, trade theory does not provide information about the timing and the magnitude of these various effects. Consequently, it is the objective of this paper to analyze empirically the effects of the Canada-U.S. hog/pork dispute on the composition of U.S. pork imports.

The next section provides a short review of the pork dispute between Canada and the United States. Elements about the theoretical foundation of policy-induced quality variations are exposed in the third section. This is followed by a discussion on methodological and data issues, which is in turn followed by a presentation of empirical results. A summary of the results and their implications make up the concluding section.

## The Canada-U.S. Pork Dispute: A Chronology

In November 1984, the U.S. International Trade Administration (ITA) of the U.S. Department of Commerce (DOC) received a petition from the National Pork Producers Council (NPPC). The NPPC argued that federal and provincial income support programs available to Canadian pork producers gave them and exporters of live swine and fresh, chilled, and frozen pork an unfair advantage over their American counterparts. The ITA found that "certain benefits provided to Canadian producers and exporters of live swine by 22 federal and provincial programs constituted subsidies" and consequently were countervailable (USTRD 1993, p. 23). On June 17, 1985, the DOC ordered the U.S. Customers Service to administer CVDs of 9.7¢ Can./kilo on live swine imports and 12.2¢ Can./kilo on fresh, chilled, and frozen pork imports from Canada.[3] On August 1, 1985, the U.S. International Trade Commission (ITC) ruled that Canadian pork exports did not cause or did not threaten to cause injury to the U.S. pork industry. Consequently, the CVD on Canadian pork was abrogated, but the one on Canadian hogs was upheld.

On January 5, 1989, the NPPC requested that another investigation be undertaken by presenting a petition asking the DOC to apply one of the amendments enacted under the Omnibus Trade and Competitiveness Act of 1988, which states that primary agricultural product subsidies are deemed to be automatically passed through to producers of the processed agricultural products. The NPPC was concerned by the fact that pork imports from Canada had increased since 1985 and claimed that the limited coverage of the CVD on Canadian hogs was responsible for the observed phenomenon. The ITA ruled that the demand for the raw product was "substantially dependent" on the demand for the processed products and concluded that subsidies encouraging the production of live swine also benefited pork processors (USTRD 1993). As a result, beginning on May 8, 1989, a CVD of 7.7¢ Can./kilo was imposed on Canadian exports of fresh, chilled, and frozen pork, and on July 18, 1989, the DOC issued its final determination and raised the CVD to 7.9¢ Can./kilo. In December 1989, Canada responded by challenging the admissibility of U.S. duties on Canadian pork under GATT and demanded that two Chapter 19 (of the Canada-U.S. Trade Agreement) dispute panels be established to investigate the subsidy determination and the threat of injury. Several months later, a GATT panel ruled that the CVD was not in accordance with the obligations of the United States under GATT; it asked that the duty either be re-

[3] On the issue of CVD setting for vertically related products, Moschini and Meilke (1992) argue that it cannot be optimal to set duties on the raw and processed products at the same level.

imbursed to Canada or be properly calculated and, if lower, that the difference be reimbursed to Canada. On March 8, 1991, the binational subsidy panel reported that Canada's tripartite program was countervailable but the Québec's ASRA program was not. The DOC was forced to lower the duty on Canadian pork to 3¢ Can./kilo. The Canada-U.S. pork dispute reached its final chapter early in 1991, when the binational injury panel issued its finding that there was no threat of injury. A request to establish an Extraordinary Challenge Committee to review the decision of the binational injury panel was dismissed on June 14, 1991, and the United States decided to abide by the GATT ruling a month later. The CVD on Canadian pork has been eliminated, but the one on hogs is still subject to administrative reviews.

## Quality Changes and Countervailing Duties

Falvey's theoretical results (1979) about policy-induced quality variations provide the theoretical foundation for the following empirical analysis and are briefly reviewed in this section. The intuition behind Falvey's model is that different trade policy instruments will affect differently the relative prices of closely related products subject to the same policy treatment. Differences in relative prices should in turn bring about changes in the demand for the related goods. Let us first assume that a country has two excess demands, $E_1$ and $E_2$, for two varieties of a given differentiable product such that:[4]

(1)
$$E_i(p_1,p_2,m) = D_i(p_1,p_2,m) - S_i(p_1,p_2,r), \quad \forall_i = 1,2,$$

where $D_i$ and $S_i$ represent the domestic demand and supply for variety $i$, $p_i$ is the domestic price for variety $i$, $\mathbf{r}$ is a vector of input prices, and expenditures on both varieties are represented by $m = \Sigma p_i D_i$. It follows that a proportional change in the excess demand function for variety $i$ can be expressed as:

(2)
$$dE_i/E_i = \epsilon_{i1}\, dp_1/p_1 + \epsilon_{i2}\, dp_2/p_2,$$

where $\epsilon_{i1} = (\epsilon_{i1}^{c} - w_1\epsilon_{im})\beta_i - \eta_{i1}\gamma_i$, $\epsilon_{i2} = (\epsilon_{i2}^{c} - w_2\epsilon_{im})\beta_i - \eta_{i2}\gamma_i$. The $\epsilon_{ij}^{c}$'s represents the compensated demand elasticities, while the expenditure elasticities and the supply elasticities are respectively denoted by $\epsilon_{im}$ and $\eta_{ij}$. The $\beta_i$ and $\gamma_i$ are defined as the relative domestic demand and supply in terms of imports ($\beta_i = D_i/E_i$, $\gamma_i = S_i/E_i$), and the expenditure share of variety $i$, $w_i$, is equal to $p_iD_i/m$. The effect of a policy change on the relative excess demands can be represented by:

(3)
$$dE_1/E_1 - dE_2/E_2 = (\epsilon_{11} - \epsilon_{21})\, dp_1/p_1 - (\epsilon_{22} - \epsilon_{12})\, dp_2/p_2.$$

From equation (3) it can be readily seen that taxing only variety 1 reduces its relative import demand, while taxing variety 2 has the opposite effect. Though simple, this point is of crucial importance in the analysis of the Canada-U.S. hog/pork dispute because the application of the CVD on Canadian pork exports was restricted to fresh, chilled, and frozen cuts. The substitution effect from targeted to nontargeted product varieties may offset the substitution effect within the class of targeted product varieties, especially when targeted and nontargeted varieties are closely related. Clearly, these potentially conflicting substitution effects have important empirical implications, which will be dealt with in the next section.

To analyze the effect of a common tariff such that $t = dp_1 = dp_2$, we start by dividing equation (3) by $dp_1/p_1$, which can simply be regarded as a positive constant. Falvey (1979, p. 1108) derives his quality upgrading result by assuming that income effects are negligible and that the two varieties are "close enough" substitutes for the following identity to hold:

(4)
$$\epsilon_{11} + \epsilon_{12} \approx \epsilon_{22} + \epsilon_{21}.$$

After inserting the above restriction and defining $\delta$ as the relative change in prices $(dp_2/p_2)/(dp_1/p_1)$, Falvey's result emerges:

(5)
$$(dE_1/E_1 - dE_2/E_2)/(dp_1/p_1) = (\epsilon_{11} - \epsilon_{21})(1 - \delta).$$

The term $(\epsilon_{11} - \epsilon_{21})$ is negative as the own effect of a price increase is expected to dominate its cross effect. Furthermore, if good 1 is the high quality variety and good 2 the low quality variety such that $p_1 > p_2$, the imposition of a CVD will have a relatively larger inflating effect on $p_2$ than on $p_1$ since $p_1/p_2 > (p_1 + t)/(p_2 + t)$. This effect on relative prices makes the second component on the right hand side of equation (5) unambiguously negative and establishes Falvey's classic quality upgrading result. However, this result is not perfectly robust. Even if the restriction depicted by equation (4) is maintained along with $1 - \delta < 0$, it can be shown that quality downgrading can occur. By expanding the import demand functions to consider potentially different income effects across variet-

[4] The two-variety case is used strictly to simplify the theoretical exposition. In the empirical analysis, we use twelve categories of fresh, chilled, frozen, and canned pork products.

ies, (5) can be rewritten in a more general manner as:

(6)

$$(dE_1/E_1 - dE_2/E_2)(dp_1/p_1) = [\epsilon_{11}{}^c\beta_1 - \epsilon_{22}{}^c\beta_2\delta + \epsilon_{12}{}^c(\beta_1\delta - \beta_2)] + [(w_2\delta + w_1)(\beta_2\epsilon_{2m} - \beta_1\epsilon_{1m})] + \eta_{22}\gamma_2\delta - \eta_{11}\gamma_1 + \eta_{21}\gamma_2 - \eta_{12}\gamma_1\delta.$$

The sign of the above equation is generally ambiguous. To make this point more evident, let us suppose that domestic demands are entirely fulfilled by imports ($D_i = E_i$, $S_i = 0$). This removes the supply response to policy changes and simplifies (6) such that:

(7)

$$(dE_1/E_1 - dE_2/E_2)(dp_1/p_1) = [\epsilon_{11}{}^c - \epsilon_{22}{}^c\delta + \epsilon_{12}{}^c(\delta - 1)] + [w_2\delta + w_1)(\epsilon_{2m} - \epsilon_{1m})].$$

Now it is easy to see that it would not take a large differential in income elasticities to reverse the substitution-driven quality upgrading effects when $\delta$ does not exceed one by much.[5] Thus, a CVD may not induce quality upgrading, particularly when the CVD is relatively small and the varieties do not differ very much in price.[6] This potential reversal of Falvey's result further justifies an empirical investigation about the direction and magnitude of policy-induced quality variations in the composition of U.S. pork imports.

The above discussion has shown how the pure inflationary effect of a specific CVD can be exacerbated or partially offset by changes in the composition of imports toward more or less expensive items.[7] As mentioned earlier, an important difference between an import tariff and a CVD is that the latter is usually applied to the exports of a small subset of countries. Such discrimination encourages the substitution of products originating from nontargeted countries for imports coming from the targeted sources. Given that by definition a bona fide CVD implies subsidized exports, the country substitution effect should also magnify the unit cost of imports. The next section describes the methodology used to measure the respective effects of the product mix and country mix substitution effects on the unit cost of U.S. pork imports.

## The Methodology and Data

The difficulties associated with an empirical analysis of the effects of trade policy on the composition of imports revolves around the availability of data. The hedonic regressions used by Feenstra (1984, 1988) are appealing but require long time series about the characteristics of the products, and such series are not available for pork products. An alternative procedure featured in Aw and Roberts (1986, 1988) and borrowed by de Melo and Winters (1993) uses index numbers to measure the contribution of quality changes to price variations caused by changes in policy.[8] With this approach, the growth in the unit cost of imports is decomposed into a pure inflationary effect and a quality effect brought about by changes in the composition of the import bundle. It might be easier to think of the last component as the one reflecting the changes in the weights placed on the individual prices entering the unit cost of imports and to consider the pure inflationary component as a measure of the growth in the individual prices.

Different kinds of indices have been developed in the index numbers literature, which has provided much of the theory behind cost-of-living and productivity measurements. Diewert (1993a, p. 64) recommends the use of superlative price or

[5] Note that when $\delta$ approaches one from above, the limit of equation (7) is $(\epsilon_{11}{}^c - \epsilon_{22}{}^c) + (\epsilon_{2m} - \epsilon_{1m})$ for the two-variety case. It is clear that small differences in price and income elasticities can induce either a fall or a rise in the relative demand of good 1. For the case at hand, it is not too unrealistic to entertain the possibility that certain pairs of fresh chilled, and frozen cuts might not differ very much in price while exhibiting different expenditure elasticities.

[6] Bark and de Melo (1987) investigated the potential for quality downgrading from a different perspective. They demonstrate that a seemingly perverse quality mix response is possible if exporting firms have goals other than profit maximization. However, minimizing foreign exchange losses is not likely to be as compelling a goal for firms as profit maximization in the case of the Canadian pork industry.

[7] The results derived so far highlight the incentives motivating consumer behavior. At the firm level, it can be shown that quality upgrading is a natural response to a specific tariff. For simplicity, let quality be a continuous variable and let the domestic price be an increasing function of quality such that $P = P(q)$, $\partial P/\partial q > 0$, $\partial^2 P/\partial q^2 < 0$. Furthermore, suppose the cost function, $C$, is increasing in both $q$, and $Q$ the quantity exported. Profits can then be defined as $\pi = [P(q) - t]Q - C(q,Q) - F$, where $t$ is a specific tariff and $F$ represents fixed costs. It is easy to show that under profit maximization, the sign of $dq/dt$ is the same as the sign of $(\partial^2 C/\partial Q^2 q - \partial P/\partial q)$. This implies that when the marginal cost $(\partial C/\partial Q)$ increases faster than price $(P)$ as quality goes up, the firm reacts to a tariff by upgrading its product quality. Intuitively, a tariff can be regarded as a penalty on the volume of exports that forces the firm to export fewer but more expensive goods.

[8] Given that the objective of this paper is to decompose the growth in unit values of U.S. pork imports into true price changes and product mix/country mix import composition changes, the methodology outlined in Aw and Roberts (1986, 1988) is followed. Unlike de Melo and Winters (1993), who analyzed the effects of a policy instrument on the targeted country's exports in restricted and unrestricted market, we limit our analysis of the targeted exporter (Canada) to the restricted market (United States). This decision was motivated by the following facts: (1) Canada's pork exports to the U.S. make up over 90% of its total pork exports, and (2) Canada's exports to Japan are subject to very tight contract specifications regarding quality that leave very little room for quality variations.

quantity indices to decompose a value ratio into price and quantity components. Superlative indices have the advantage of being approximately consistent in aggregation (Diewert 1978, p. 253), which implies that they are consistent with the optimizing behavior of consumers or producers without imposing too stringent restrictions on the functional form of the underlying utility/production function. Diewert (1981, p. 186) defines a price index $P$ as superlative if it is exact for a unit cost function (such as a Translog cost function) that can provide a second order differential approximation to an arbitrary twice continuously differentiable unit cost function. Furthermore, Diewert (1993b, p. 87) states that the choice of a price index belonging to the superlative class is not critical since all known superlative index number formulae approximate each other to the second order when each index is evaluated at an equal price and quantity point. Following Aw and Roberts (1986, 1988), we rely on the Törnqvist price index to evaluate the pure inflationary component of the variations in unit import values.

U.S. pork imports are made up of different cuts coming from different sources. As a result, unit import values change whenever the composition/quality of the import bundle changes, even when the prices of the individual cuts remain stable. The substitution effect favoring more expensive/higher quality cuts in the growth of unit import values is measured as the difference between two index numbers: the growth in an aggregate price index, $\Delta P(t)$, whose magnitude is influenced by pure inflationary and composition effects, and a Törnqvist price index $\Delta P^*(t)$, constructed to measure only the pure inflationary component in the growth of the unit cost of the import bundle. The difference $\Delta P(t) - \Delta P^*(t)$ captures the increase in price of the aggregate import price that can be attributed to changes in the composition or quality of imports. Furthermore, the proportion of the total variation in the aggregate price index caused by quality variations, $\Delta q(t)$, can be decomposed into a product (or variety) substitution main effect, $\Delta q^v(t)$, a country substitution main effect, $\Delta q^c(t)$, and a product-country substitution interaction effect, $\Delta q^{vc}(t)$ through the construction of partial Törnqvist indices. The following expression illustrates the relationship between a change in the unit cost of imports and a change in import composition, resulting from product mix changes and/or country mix changes:

$$\Delta P(t) - \Delta P^*(t) = \Delta q(t) = \Delta q^c(t) + \Delta q^v(t) + \Delta q^{vc}(t). \tag{8}$$

The growth in the aggregate price index can be defined as:

$$\Delta P(t) = \ln P(t) - \ln P(t-1), \tag{9}$$

$$\text{where } P(t) = \frac{\sum_{v=1}^{V}\sum_{c=1}^{C} V_{vc}(t)}{\sum_{v=1}^{V}\sum_{c=1}^{C} Q_{vc}(t)}.$$

$V_{vc}(t)$ is the value of U.S. imports of product variety $v$ coming from country $c$.[9] $Q_{vc}(t)$ is the quantity of U.S. imports of variety $v$ coming from country $c$. As noted by Chinloy (1980), unit value indices of the kind defined above provide biased estimates of price increases because of improper aggregation. This aggregation problem over different product categories and different countries implies that the effects of price variations are intertwined with the effects of changes in the composition of U.S. pork imports. The Törnqvist price index accurately measures price increases and must be subtracted from the growth rate in the unit value of imports to obtain an estimate of the inflationary impact of changes in the composition of imports. The Törnqvist price index is defined as:

$$\Delta P^* \equiv \sum_{v=1}^{V}\sum_{c=1}^{C} W_{vc}(t)\,\Delta P_{vc}(t), \tag{10}$$

where

$$W_{vc}(t) \equiv \frac{1}{2}\left[\frac{V_{vc}(t)}{\sum_{v=1}^{V}\sum_{c=1}^{C} V_{vc}(t)} + \frac{V_{vc}(t-1)}{\sum_{v=1}^{V}\sum_{c=1}^{C} V_{vc}(t-1)}\right]$$

and

$$\Delta P_{vc}(t) \equiv \ln\left[\frac{V_{vc}(t)}{Q_{vc}(t)}\right] - \ln\left[\frac{V_{vc}(t-1)}{Q_{vc}(t-1)}\right].$$

[9] In this section, the term *variety* is used as a synonym for pork cuts or for groups of fairly homogeneous pork cuts. The recording of trade data in most countries is based on a coding system that supports different levels of aggregation. Typically, the higher the number of digits in the product code, the narrower the product definition and hence the more homogeneous the bundle.

The index $\Delta q(t)$ measures the effect of an overall quality change on the unit value of the aggregate import bundle. A positive $\Delta q(t)$ can be interpreted as a sign of quality upgrading brought about by the substitution of more expensive for less expensive product varieties. While "gross" changes in the composition of the import bundle toward more or less expensive products are interesting results by themselves, further analysis is required to determine the source of these "gross" changes. We construct an index capturing the product mix effect, $\Delta q^v(t)$, and another one measuring the country mix effect, $\Delta q^c(t)$, to disentangle the effect of a switch to different product varieties from the effect of a switch to different suppliers on the unit cost of imports. These new indices are derived in a manner not unlike the one used to generate $\Delta q(t)$; they too are computed as the residual between two index numbers.

$$(11)\quad \Delta q^i(t) \equiv \Delta P(t) - \Delta P_i^* \text{ for } i = v \text{ or } c,$$

where $\Delta P_i^*$ is the Törnqvist partial price index for characteristic $i$. This share-weighted measure of the growth in unit-value indexes defined over each category of characteristic $i$ is constructed according to the following formula:

$$\Delta P_i^* \equiv \sum_i Wi(t)\, \Delta P_i(t),\ Wi(t) \equiv \frac{1}{2}$$

$$\left[ \frac{\sum_j V_{ij}(t)}{\sum_i \sum_j V_{ij}(t)} + \frac{\sum_j V_{ij}(t-1)}{\sum_i \sum_j V_{ij}(t-1)} \right]$$

and

$$\Delta P_i(t) \equiv \ln \left[ \frac{\sum_j V_{ij}(t)}{\sum_j Q_{ij}(t)} \right] - \ln \left[ \frac{\sum_j V_{ij}(t-1)}{\sum_j Q_{ij}(t-1)} \right].$$

Here $\Delta q^c(t)$ measures the effect of a change of suppliers, treating all varieties as homogeneous. A positive $\Delta q^v(t)$ implies substitution toward more expensive varieties. By the same token, $\Delta q^v(t)$ measures the effect of a change in varieties treating all suppliers as homogeneous. A positive $\Delta q^c(t)$ indicates that imports are increasingly coming from more expensive suppliers. The interaction term $\Delta q^{vc}(t)$ can be derived by subtracting both $\Delta q^c(t)$ and $\Delta q^v(t)$ from $\Delta q(t)$. The interaction effect is needed to correct for the overestimated measure of quality variation associated with the sum of the main effects when there is substitution toward more expensive varieties and more expensive suppliers.

The above methodology is powerful in decomposing variations in unit import costs into pure inflationary and quality or composition effects, but it also has weaknesses. The main one is the impossibility of isolating the effect of trade policy instruments on the unit cost of imports from the effects caused by other changes in the economic environment. This flaw could be likened to what econometricians refer to as the "missing variables" problem. The gravity of this problem clearly depends on the importance of the factors "included" in relation to those left out. In the case of U.S. pork imports, it is difficult to downplay the impact of the CVDs on Canadian exports given that the U.S. market is by far the most important destination for Canadian pork exports and that Canada is the largest foreign supplier of pork products to the United States. Furthermore, there has not been any other "major" phenomenon (like a disease outbreak) affecting either the U.S. import demand or the excess supply functions of the major exporting countries.

The data set needed to accommodate the chosen methodology has been graciously provided by the Foreign Agricultural Service of the U.S. Department of Agriculture. The data set is made up of annual series on the values and quantities of twelve product categories of pork imports. The period covered starts in 1982 and ends in 1993. Figure 1 shows the variations in the values of U.S. pork imports by source over the sample period. The top line shows the evolution of total U.S. pork imports, while the bottom lines track the value of Canada's and Denmark's pork exports to the United States. Total U.S. pork imports and U.S. pork imports from Canada and Denmark follow similar trends. They rose between 1982 and 1987, and particularly in 1985 because of the CVD on Canadian exports of live hogs, which encouraged the substitution of pork imports for imports of live hogs. U.S. pork imports dropped drastically in 1989 and have remained fairly stable since. While a volume reduction in U.S. total pork imports for the 1989–91 period is consistent with the expected effects of the CVDs, the relative stability of Canada's market shares is somewhat surprising.

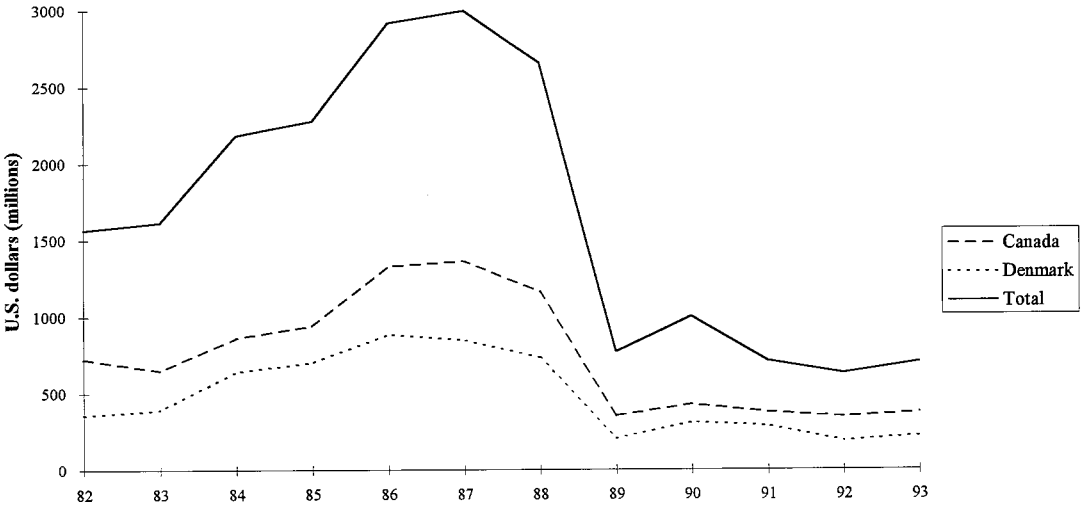


**Figure 1. The Value of U.S. Pork Imports by Source**

For the purpose of constructing the various indices discussed above, it is important to include enough product varieties (or groups of cuts) and exporting countries to allow for precise and meaningful cross-product and cross-country substitution effects. However, the number of product varieties and exporting countries to be included in the analysis must also reflect practical considerations. Disaggregated data series on bilateral trade flows are notorious for containing a high proportion of zeros. Frequent zeros on the volume and value of imports for product $i$ from country $j$ are problematic because they make it necessary to rely on imputed prices to replace missing prices. Such practice may adversely affect the validity of the constructed indices, and for that reason it was decided to work with twelve categories of pork imports coming from the six most important suppliers: Canada, Denmark, Sweden, Finland, Hungary, and Poland.[10] The twelve product categories can be regrouped into four classes: fresh and chilled pork, frozen pork, smoked pork, and canned pork. Figure 2 provides an overview of the relative importance of each class over time. Canned products are definitely on the decline, while the converse seems to hold for smoked and frozen pork. The share of the fresh and chilled pork class fluctuates around 35%. It is noticeable from a glance at figure 2 that the share of fresh and chilled pork imports and the share of frozen pork imports move in opposite directions, especially after 1988. This phenomenon suggests that there is a high degree of substitution between these two classes of pork products.

Almost all U.S. imports of fresh and chilled pork originate from Canada. Canada's share has fluctuated around 99% between 1982 and 1993, except for temporary falls in 1987 and 1990 when Canada's exports accounted for 75% and 85% of U.S. imports. The U.S. market for imported frozen pork products is more diversified. Historically, Denmark has been the dominant player, with a share varying around 65%. Canada is the second largest supplier, with a slowly declining share that appears to be converging toward 30%. Canada is the dominant exporter of smoked pork. Its share of the U.S. market oscillated around 60% until 1988 but rose dramatically to exceed 90% by 1990. Since then, it has remained in the neighborhood of 85%. Canada's spectacular gain in market share in that segment of the U.S. pork import market began at about the same time a CVD was imposed on Canadian export of other pork products. The market for imported canned pork is increasingly dominated by Denmark. Denmark's prominence was achieved mostly at the expense of Eastern European countries. Canada is a small exporter of canned pork to the United States.

## Empirical Results

The empirical evidence presented in this section is organized according to a hierarchy by which the

[10] The use of imputed prices was also acknowledged in the studies of the effects of voluntary export restraints on the footwear trade. De Melo and Winters (1993) constructed five broadly defined product categories to minimize the proportion of imputed prices in their price series. In contrast, Aw and Roberts (1986) used seventy product categories coming from seven sources. As a result, 8.9% of their prices were imputed. In spite of rather broadly defined product categories and a limited number of exporting countries, the high degree of concentration in the U.S. pork import market makes for a higher proportion of imputed prices (13.9%). Fortunately, the dominance of Canada and Denmark also makes imputed prices potentially less harmful because the weights on these prices are very small.

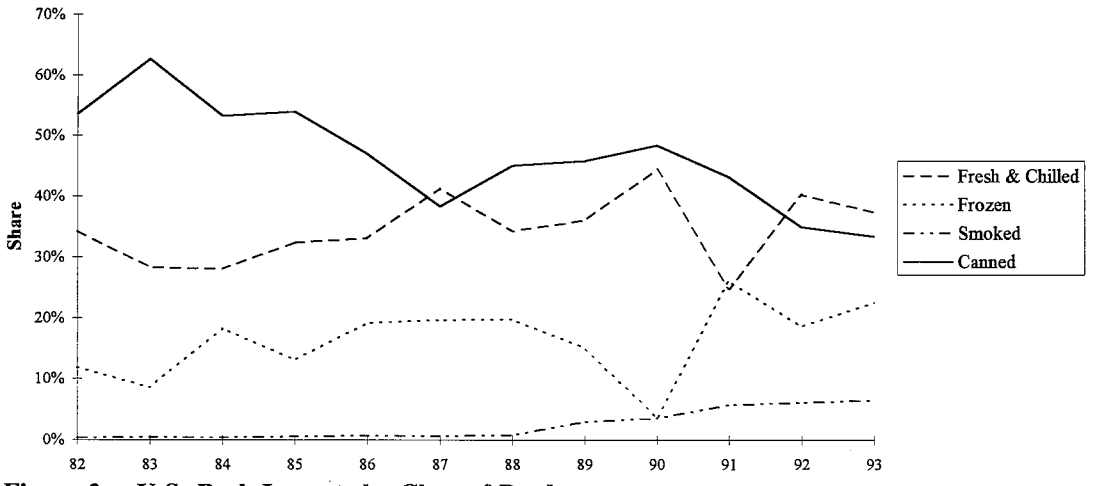


**Figure 2. U.S. Pork Imports by Class of Products**

composition of U.S. pork imports is gradually widened. At first we restrict our attention to U.S. imports from the targeted country with the intent to characterize Canada's response to the CVDs. The first set of indices is limited to U.S. imports of pork products targeted by the CVDs and supplied by the targeted country. The product definition is then enlarged by pooling Canadian exports of targeted and nontargeted pork products. The next set of results relaxes the restriction on the origin of U.S. imports but excludes categories of pork products that were not targeted by the CVDs. The last set of indices is constructed from pooling targeted and nontargeted products coming from targeted and nontargeted sources. This pooling allows for a substitution effect between targeted and nontargeted U.S. pork imports that may exacerbate or mitigate the likely-inflationary composition changes taking place within the groups of pork products targeted by the CVD.[11] The tables in which the results are reported contain annual indices as well as averages over periods of interest to better characterize potential policy responses in terms of direction, size, and timing. It might be useful to recall that duties on Canadian exports of fresh, chilled, and frozen pork products were administered during a month and a half in 1985 and over a twenty-six-month period starting in May 1989 and ending in July 1991. CVDs on Canadian exports of live hogs were first imposed in 1985 and are still being administered.

Tables 1a and 1b show the decomposition of Canada's export price index into a pure inflationary price variation effect and an effect attributed to product composition changes, which is also referred to as a quality effect. Two product definitions are used in table 1a. The first one pools U.S. imports of fresh, chilled, and frozen pork from Canada, while the second one takes into account only three groups of frozen pork cuts. The results derived for the broader product definition identify a period of quality upgrading between 1986 and 1988, which is followed by a series of negative and positive quality variations that do not seem to be correlated with the imposition of the CVD on pork products. Consequently, the policy-induced quality upgrading hypothesis is not supported by the empirical evidence derived from Canadian exports when the latter include only fresh, chilled, and frozen products. The results for frozen pork are more in line with our expectations, as the timing and magnitude of the substitution effect toward more expensive cuts follow more closely the dates at which the CVDs on Canadian hogs and pork were imposed. It is worth noting that the largest inflationary change in composition occurred between 1985 and 1986. The positive figures recorded between 1988 and 1991 tend to be small. These results suggest that once confronted by the alternatives of processing and exporting and not exporting, Canada responded to the imposition of the CVD on live hogs in 1985 by substituting pork exports for live hogs exports and by substituting more expensive frozen products for less expensive frozen products. It would also appear that the ad-

[11] The influence of this substitution effect on the unit cost of imports will be negative if nontargeted products tend to be cheaper than targeted products. However if the nontargeted groups include mostly higher value-added products, we can expect the unit cost of imports to rise. In this case, the wide range of prices within each class of pork products makes it impossible to determine whether this substitution effect will reduce or increase the unit cost of imports.

**Table 1a. Sources of Price Changes in Canada's Exports of Fresh, Chilled, and Frozen Pork to the United States**

| | Aggregate Index ΔP | | Tornqvist Index ΔP* | | Quality Change Δq | |
|---|---|---|---|---|---|---|
| Year | fresh and frozen | frozen alone | fresh and frozen | frozen alone | fresh and frozen | frozen alone |
| 1982–83 | −0.0693 | −0.0378 | −0.0702 | −0.0378 | 0.0009 | 4.2 E-06 |
| 1983–84 | −0.0058 | −0.0365 | −0.0065 | −0.0365 | 0.0007 | 6.6 E-06 |
| 1984–85 | −0.0159 | −0.0484 | −0.0188 | −0.0343 | 0.0030 | −0.0141 |
| 1985–86 | 0.0646 | 0.0643 | 0.0703 | 0.0509 | −0.0058 | 0.0134 |
| 1986–87 | 0.0122 | 0.0392 | 0.0108 | 0.0392 | 0.0013 | −2.4 E-06 |
| 1987–88 | −0.0569 | −0.0754 | −0.0595 | −0.0754 | 0.0027 | 7.6 E-06 |
| 1988–89 | 0.0167 | 0.0308 | 0.0171 | 0.0294 | −0.0005 | 0.0013 |
| 1989–90 | 0.1058 | 0.1250 | 0.1084 | 0.1243 | −0.0027 | 0.0007 |
| 1990–91 | −0.0215 | −0.0432 | −0.0223 | −0.0439 | 0.0008 | 0.0008 |
| 1991–92 | −0.0227 | −0.0094 | −0.0220 | −0.0104 | −0.0007 | 0.0009 |
| 1992–93 | 0.0211 | −0.0037 | 0.0108 | −0.0058 | 0.0032 | 0.0021 |
| Average 1982–93 | 0.0026 | 0.0004 | 0.0023 | −0.00002 | 0.0003 | 0.0005 |
| Average 1984–88 | 0.0010 | −0.0050 | 0.0007 | −0.0049 | 0.0003 | −0.0002 |
| Average 1988–91 | 0.0337 | 0.0433 | 0.0344 | 0.0366 | −0.0008 | 0.0009 |

justments made to the composition of the export bundle between 1985 and 1986 left little room for further substitution toward more expensive products during the 1989–91 interval.

Table 1b shows the decomposition of the growth rate of the price index of U.S. imports of all four classes of pork products from Canada between 1982 and 1993. Though more pronounced, the same basic pattern of quality variations found for fresh, chilled, and frozen pork cuts in table 1a emerges again. Over the 1982–93 interval, the aggregate price index grew at an average rate of less than 1% per year, and the average Törnqvist index, at the bottom of the second column, is approximately of the same magnitude. Consequently, it can be inferred that Canadian export prices grew at a slow rate between 1982 and 1993 and that the growth in the aggregate price index was not affected by changes in the composition of the export bundle. As a matter of fact, the quality index suggests that changes in composition have had, on average over the sample period, a deflationary effect on the aggregate price index of U.S. pork imports from Canada. However, it is interesting to see that substantial inflationary quality changes were registered as early as 1984–85, that is, shortly before the beginning of the hog/pork trade dispute between Canada and the United States, and maintained their momentum until 1987–88. For 1984–85 and 1986–87, the substitution toward more expensive pork products implicit in the growth in the quality index accounts for 77% and 54% of the growth in the aggregate price index. The decline of this price index in 1987–88 would have been almost twice as large if it had not been for the change in the composition of Canada's export bundle that took place during that year. Quality variations over 1988–92 were negative but extremely small and had essentially no impact on the aggregate price index of U.S. pork imports from Canada. These results confirm the conclusions derived from table 1a. It is the 1985 CVD on exports of live hogs, and not the 1989 CVD on fresh, chilled, and frozen pork products, that promoted a substitution effect in Canadian pork exports toward more expensive products.

**Table 1b. Sources of Price Changes in Canada's Exports of All Four Classes of Pork to the United States**

| Year | Aggregate Index ΔP | Tornqvist Index ΔP* | Quality change Δq |
|---|---|---|---|
| 1982–83 | −0.0904 | −0.0807 | −0.0098 |
| 1983–84 | −0.0995 | −0.0415 | −0.0580 |
| 1984–85 | 0.0367 | 0.0083 | 0.0284 |
| 1985–86 | 0.0497 | 0.0539 | −0.0042 |
| 1986–87 | 0.0544 | 0.0253 | 0.0292 |
| 1987–88 | −0.0182 | −0.0324 | 0.0142 |
| 1988–89 | 0.0299 | 0.0374 | −0.0075 |
| 1989–90 | 0.1016 | 0.1019 | −0.0003 |
| 1990–91 | −0.0226 | −0.0223 | −0.0003 |
| 1991–92 | −0.0244 | −0.0242 | −0.0002 |
| 1992–93 | 0.0262 | 0.0195 | 0.0067 |
| Average 1982–93 | 0.0039 | 0.0041 | −0.0002 |
| Average 1984–88 | 0.0307 | 0.0138 | 0.0169 |

Quality upgrading as a response to a trade distortion on the part of a targeted exporter was observed by Aw and Roberts (1986) and de Melo and Winters (1993) in their analyses of voluntary restraints on footwear exports and by Mintz (1973), who documented quality upgrading in the composition of U.S. imports following the imposition of import quotas on dairy products, meat, and sugar. The peculiar aspects of our results rest with the timing of the quality variations in relation to the dates on which the CVDs on live hogs and pork were imposed and with the lack of robustness when the export product definition is enlarged beyond frozen products. It could be that contractual obligations or the quality upgrading caused by the first CVD left little room for further upgrading in the fresh and chilled class of pork products between 1989 and 1991. Also, the adjustments costs for exporting firms (e.g., further-processing equipment and employee training) might have been too high, in light of the uncertainty about the scope and height of the CVDs, to warrant a major change in the composition of their exports. However, optimistic expectations about Canada's ability to export to the United States could also explain why the 1989 CVD did not have much impact on the composition of Canada's pork export. Hysteresis on the part of Canadian exporters is totally consistent with an expectation of a short-lived CVD, which is not very far-fetched considering the rather short history of the 1985 CVD on Canadian pork exports and the dispute settlement provisions of the Canada-U.S. Trade Agreement whose implementation had just begun (January 1989). Aw and Roberts (1986, p. 54) use a similar argument to explain the drop in their quality index prior to the elimination of the voluntary export restraints on footwear imported by the United States.

Tables 2a and 2b report indices about the decomposition of the unit cost of U.S. pork imports from all major sources. This enlarged country dimension in the definition of U.S. pork imports allows for richer demand-side effects than when only one exporter is considered. More specifically, partial Törnqvist indices separate the inflationary effect of switching suppliers from the inflationary effect of purchasing more expensive/higher quality pork products. Table 2a reports indices based on a subset of U.S. pork imports restricted to groups of fresh, chilled, and frozen pork cuts. The averages appearing at the bottom of the table for the 1988–91 and 1982–93 intervals provide valuable insights about the impact of the second wave of CVDs. As expected, the highest growth in the unit cost of imports coincides with the 1985 and 1989 imposition of CVDs. The increase in the unit cost of the import bundle is particularly spectacular between 1989 and 1990. Accordingly, the average of $\Delta P$ (the aggregate price index) over the period encompassing the second phase of the pork trade dispute is much higher than when it is computed over the entire sample, as indicated by the last two entries in the first column of table 2a. The magnitude of the difference between these two averages (0.0342 versus 0.0015) reflects the large proportion of Canadian exports in U.S. imports of fresh, chilled, and frozen pork. The 1988–91 and 1982–1993 averages reported in the "Quality Change" column reveal that the increases in the unit cost of imports were not uniquely caused by pure inflationary pressures. The computed $\Delta Q$ indices indicate that gross changes in the composition of imports also

**Table 2a. Sources of Price Changes in U.S. Imports of Fresh, Chilled, and Frozen Pork from Major Exporters**

| Year | Aggregate Index $\Delta P$ | Tornqvist Index $\Delta P^*$ | Quality change $\Delta q$ | Country subst. $\Delta q^c$ | Product subst. $\Delta q^v$ | interaction $\Delta q^{cv}$ |
|---|---|---|---|---|---|---|
| 1982–83 | −0.0820 | −0.0703 | −0.0117 | −0.0166 | −0.0083 | 0.0132 |
| 1983–84 | 0.0002 | −0.0210 | 0.0213 | 0.0002 | −0.0018 | 0.0229 |
| 1984–85 | −0.0184 | −0.0188 | 0.0005 | 0.0175 | 0.0007 | −0.0177 |
| 1985–86 | 0.0783 | 0.0822 | −0.0039 | −0.0009 | 0.0001 | −0.0031 |
| 1986–87 | 0.0117 | 0.0088 | 0.0029 | 0.0022 | −3.8 E-05 | 0.0007 |
| 1987–88 | −0.0534 | −0.0566 | 0.0032 | 0.0011 | −0.0006 | 0.0027 |
| 1988–89 | 0.0126 | 0.0143 | −0.0017 | −0.0068 | 0.0017 | 0.0068 |
| 1989–90 | 0.0995 | 0.0741 | 0.0254 | 0.0220 | 0.0269 | −0.0235 |
| 1990–91 | −0.0094 | −0.0077 | −0.0017 | −0.0016 | −0.0018 | 0.0017 |
| 1991–92 | −0.0307 | −0.0137 | −0.0170 | −0.0139 | −0.0161 | 0.0130 |
| 1992–93 | 0.0084 | 0.0012 | 0.0073 | 0.0056 | 0.0062 | −0.0045 |
| Average 1982–93 | 0.0015 | −0.0007 | 0.0022 | 0.0008 | 0.0007 | 0.0011 |
| Average 1988–91 | 0.0342 | 0.0269 | 0.0073 | 0.0045 | 0.0089 | −0.005 |

**Table 2b. Sources of Price Changes in U.S. Imports of All Four Classes of Pork from Major Exporters**

| Year | Aggregate Index $\Delta P$ | Tornqvist Index $\Delta P^*$ | Quality change $\Delta q$ | Country subst. $\Delta q^c$ | Product subst. $\Delta q^v$ | interaction $\Delta q^{cv}$ |
|---|---|---|---|---|---|---|
| 1982–83 | −0.0569 | −0.0685 | 0.0117 | 0.0235 | 0.0128 | −0.0246 |
| 1983–84 | −0.1052 | −0.0432 | −0.0620 | −0.0344 | 0.0040 | −0.0316 |
| 1984–85 | 0.0232 | −0.0035 | 0.0267 | 0.0370 | 0.0082 | −0.0185 |
| 1985–86 | 0.0539 | 0.0678 | −0.0140 | −0.0303 | −0.0105 | 0.0268 |
| 1986–87 | 0.0289 | 0.0158 | 0.0131 | 0.0058 | 0.0058 | 0.0015 |
| 1987–88 | −0.0244 | −0.0339 | 0.0095 | −0.0055 | 0.0045 | 0.0105 |
| 1988–89 | 0.0315 | 0.0127 | 0.0188 | 0.0438 | 0.0035 | −0.0285 |
| 1989–90 | 0.0911 | 0.0949 | −0.0038 | 0.0087 | 0.0034 | −0.0159 |
| 1990–91 | −0.0244 | −0.0112 | −0.0112 | −0.0042 | −0.0142 | 0.0072 |
| 1991–92 | −0.0288 | −0.0185 | −0.0102 | −0.0019 | −0.0154 | 0.0071 |
| 1992–93 | −0.0068 | −0.0156 | 0.0088 | 0.0158 | 0.0085 | −0.0155 |
| Average 1982–93 | −0.0014 | −0.0003 | −0.0011 | 0.0053 | 0.0010 | −0.0074 |
| Average 1988–91 | 0.0334 | 0.0321 | 0.0013 | 0.0161 | −0.0024 | −0.0124 |

contributed to the observed increases in the unit cost of imports during the period coinciding with the imposition of the duties. For example, over a quarter of the sharp unit cost increase that took place between 1989 and 1990 can be attributed to changes in the composition of the import bundle.

Inflationary changes in the composition of the import bundle could be caused by a shift toward more expensive suppliers and/or a shift toward more expensive/higher quality items. The decomposition of the gross composition effects associated to the quality index $\Delta q$ into country and product substitution indices is most useful. That the average of the index number $\Delta q^c$ for the 1988–91 period is much larger than its counterpart computed over the whole sample indicates that a substitution toward more expensive sources occurred when CVDs were in effect. The product substitution index $\Delta q^v$, which by construction measures the unit cost variations brought about by the substitution effect between groups of more or less expensive products, also tends to be higher during the 1988–91 period. This empirical evidence supports the quality upgrading and trade diversion hypotheses that were motivated by our discussion about the theoretical effects of CVDs. It can be concluded that the second and more successful attempt by the United States at restricting Canadian exports of fresh, chilled, and frozen pork was effective at diverting Canadian exports, but that this outcome was accompanied by a change in product composition that contributed to raising the unit cost of imports. Because CVDs are set according to some institutional guidelines and not according to a welfare criterion, it is likely that the quality upgrading observed is inefficient from a welfare perspective.

The summation over product categories required in the construction of the relevant indices reported in table 2b covers all categories of pork products. The analysis based on this wider product definition complements the above discussion because the changes in composition due to substitution between targeted and nontargeted pork products are allowed to influence the response of the unit cost of imports to a CVD. This additional substitution effect is likely to make the U.S. import cost function more concave and should reduce the inflationary pressures caused by the CVDs. This becomes clear when comparing the last rows of tables 2a and 2b. Still, the largest increase in the aggregate price index $\Delta P$ occurs between 1989 and 1990, and the 1985–86 increase in the unit cost of imports remains noticeable. These inflationary pressures coincide with the dates at which the CVDs were imposed. Between 1986 and 1989, the inflationary effects of gross composition variations captured by $\Delta q$ are positive and quite large, especially between 1988 and 1989. Also noticeable is the gross composition effect for 1984–85 which exceeds even the growth rate of the aggregate price index for that year. These composition adjustment in U.S. pork imports occurred right at the beginning of the first and second phases of the Canada-U.S. hog/pork dispute. Moreover, these composition adjustments ($\Delta q$) in U.S. pork imports coinciding with the 1989–91 CVDs are much more noticeable when imports from all sources are taken into account than when only imports from the country targeted by the policy are considered. This implies that the measured composition adjustments have been more influenced by the various substitution effects conditioning the response of the im-

porter than by the actions taken by the targeted exporter to cope with the CVD.

The modest inflationary gross composition changes recorded for all classes of pork imports hide a modest inflationary product substitution effect but a strong trade diversion effect. The comparison of the 1988–91 averages of $\Delta q$ in tables 2a and 2b illustrates the offsetting nature of the substitution effect between targeted and nontargeted products in relation to the inflationary gross composition effects that take place between targeted pork products. The average quality change between 1988 and 1991 reported in table 2a is almost six times the size of its counterpart in table 2b. However, the trade diversion effects are much stronger when targeted and nontargeted products are considered, as pictured by the comparison of the 1988–91 averages of $\Delta q^c$ in tables 2a and 2b. This contrast can be attributed to the stable dominating position of Canada in the U.S. import market for fresh and chilled pork over the entire sample period and to the stable and dominating position of Denmark in the U.S. market for frozen pork after 1985. The peculiarly large country substitution effects early on in the sample (1982–83, 1984–85) correspond to major natural repositioning in the U.S. import market for frozen pork. This event follows a temporary disease-related market share adjustment totally unrelated to changes in trade policy. The other large estimated country mix effects of 1989–90 and 1991–92 can be regarded as legitimate responses to the imposition and the elimination of the second CVD on Canadian pork. Finally, the quality upgrading effect between pork products targeted by the CVDs, as depicted by the 1988–91 average $\Delta q^v$ in table 2a, vanishes when the product definition of imports is enlarged. This indicates that the substitution between targeted and nontargeted products more than offsets the inflationary effects of the substitution toward more expensive cuts that took place within the targeted classes of pork products.

## Conclusion

The purpose of this paper is to analyze the effects of the Canada-U.S. hog/pork dispute on the composition of U.S. pork imports from Canada and from all major suppliers. Of special interest are the timing and magnitude of the changes in product quality and source in relation to particular events or phases of the dispute. Index numbers are used to dichotomize the growth in aggregate price indices of various definitions of U.S. pork imports into a pure inflationary effect and a product composition/quality effect. Trade theory suggests that countervailing duties (CVDs) raise the unit cost of imports directly through a pure inflationary price effect and indirectly by encouraging imports of more expensive/higher quality products. Because CVDs are typically applied on a subset of products and countries, they induce composition changes in the import bundle favoring nontargeted products and nontargeted suppliers. To investigate these related issues, partial Törnqvist indices are constructed to decompose the inflationary effects of the changes in composition into product mix and country mix effects.

Our investigation is conducted at four levels of aggregation. The narrowest definition of U.S. pork imports from which our price and quality indices are constructed is restricted to the targeted exports of fresh, chilled, and frozen pork originating in the targeted country. This definition of U.S. imports of Canadian pork is then enlarged to include several groups of smoked and canned pork products. The third and fourth product definitions use the same aggregation schemes over product classes as the first two but include the targeted country as well as other major exporters. The comparison of the indices when only Canadian exports are considered with the indices based on a wider country composition enables us to infer that import demand adjustments were mostly responsible for the inflationary changes in the composition of the import bundle and that changes in the composition of Canada's export supply had very little effect. We also show that quality adjustments in Canadian exports vary by class of products. Quality upgrading within the frozen class appears to be more closely related to the imposition of the CVDs on Canadian pork exports. However, substitution toward more expensive groups of products, when wider product definitions of Canadian exports to the U.S. are used, occurred right after the imposition of the first CVD on Canadian exports of live hogs. Unlike the substitution of pork exports for exports of live hogs, this composition effect on pork products was not easily predictable. It reveals a significant relationship between the marginal rate of transformation between pork products and the price of live hogs.

Responses to the second CVD on Canadian pork exports are more consistent with expectations when U.S. imports from Canada and from other sources are pooled. Nevertheless, the results from the decomposition of quality variations into product mix and country mix substitution effects are not perfectly robust to variations in the number of categories of pork products considered. The relatively small country-mix effects when only groups

of fresh, chilled, and frozen pork cuts are considered reflect Canada and Denmark's respective dominance in the fresh and chilled and frozen pork markets. By the same token, the relatively large inflationary country substitution effect when all categories of pork products are considered indicates that the substitution that took place between targeted and nontargeted pork products created a trade diversion phenomenon.

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