Canadian Food Processors and Retailers: Changes in Concentration and Efficiency Since the Canadian-U.S. Free Trade Agreement

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The passage of the 1989 Canada-United States Free Trade Agreement (CUSFTA) caused or corresponded to broad changes in the Canadian food industries. The Canadian retail grocery industry became more concentrated as chain grocery stores increased their share of sales and many independent grocery stores exited the industry. However, as retail food-price indices have been growing more slowly than the general consumer price index over the period studied, retailers did not appear to exercise excessive market power. The concentration of Canada's food-processing industries neither increased nor decreased on the whole following CUSFTA. Since CUSFTA (and subsequently since the 1994 passage of NAFTA) there has been rapid growth in two-way U.S.—Canada trade in processed food. In most cases following CUSFTA, real processor prices have declined and productivity has significantly increased. The results lead the researchers to conclude that present food-industry concentration is not a public-policy concern and consumers are benefiting from increased trade and competition and the accompanying industry changes.

Increased concentration in the food industries can have positive or negative implications for consumers. Negative impacts from increased concentration include the potential elimination of certain brands of products and retailing options as well as higher prices due to the exercise of market power. On the other hand, increased concentration can result in economies of size in production, distribution, and retailing which can contribute to lower processor and consumer prices. In recent years, concentration has increased in Canada's food-retailing industry, while concentration changes at the food-processing level have been mixed.

The freer trade which came about with the 1989 Canadian-U.S. Free Trade Agreement (CUSFTA), and was subsequently strengthened with the 1994 North American Free Trade Agreement (NAFTA), appears to have influenced the evolution of Canada's food industries. This paper will use graphical and basic statistical analysis to examine changes in industry concentration, prices, and food-processing labor productivity.

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Review of Literature

Yu and Conner (2002) report that only the airlines and the banking industries have received more empirical concentration-price relationship testing than the grocery industry. Perhaps this sustained food-related interest by North American scholars is partially a result of numerous anti-trust investigations and U.S. Federal inquiries. At the retail level, anti-trust cases have involved ready-to-eat cereal, meat, and dairy products. In August of 1999, the U.S. Departments of Justice and Agriculture, along with the U.S. Federal Trade Commission, signed a Memorandum of Understanding for "Cooperation with Respect to Monitoring Competitive Conditions in the Agricultural Marketplace," and in October of 1999 the Committee on the Judiciary of the U.S. House of Representatives convened a hearing on "Competitive Issues in Agriculture and the Food Marketing Industry." One of the specific agenda items of this hearing was the increasing concentration in the U.S. meat industries.

This section provides a brief review of the literature regarding the impact of industry concentration on prices and profits. Readers interested in a more in-depth review should consider Wen's (2001) assessment, "Market Power in Grocery Retailing: Assessing the Evidence for Canada," or the comprehensive but older review, "Concentration of Ownership in Food Retailing: A Review of the Evidence about Consumer Impact" (Kinsey 1998).

One of the earliest writers on the subject of industry concentration was Harold Demsetz, a former University of Chicago Department of Economics faculty member who later became the Arthur Andersen University of California Los Angeles Chair of Business Economics. His writings on industry concentration reflect the Chicago school of thought, which proposes that profits are higher in concentrated markets because costs are low, not principally because prices are higher. The lower costs result from economies of size and sufficient competition between firms to mitigate market power. An additional factor credited to Demsetz, "the Demsetz critique," is the notion that higher prices may be due to a higher level of services that consumers enjoy, and the higher prices reflect the costs of providing the services.

In 1973 Demsetz published an analysis that used U.S. Internal Revenue Service (IRS) data for 95 three-digit industrial classification groups. He notes that industry concentration was positively related to profit for large firms, but negatively related to the profit for small firms. He concludes that this result is contrary to collusion and oligopoly theory, since higher prices should increase the profits for all firms within an industry. Demsetz (1974) points out that in a concentrated market, the large firms may have low costs due to economies of size or due to certain large company managerial advantages. Demsetz (1995) also shows that the relationship between the level of competition in an industry and the number of firms in an industry is not always a monotonic relationship; it can result in a U-shaped relation where an oligopolistic market structure is more competitive than an industry with a large number of firms or only one firm. Based on this view of concentration, governmental agencies should encourage mergers in industries with low levels of concentration, and discourage mergers where concentration has already eliminated most small firms.

In the years since the Demsetz findings, a large number of analyses have been conducted which focus on industry concentration in the food-industry sector. Three empirical works (Newmark 1990; Kaufman and Handy 1989; Aalto-Setälä 2002) have found a negative relation between concentration and price levels, lending support to Demsetz and the economy-of-size argument. However, two of these works have been challenged in the journals, and numerous published articles counter the Demsetz argument by empirically showing a positive relation between retail grocery concentration and retail grocery prices. These counter arguments rely on oligopoly theory to point out that increases in industry concentration should lead to higher prices and higher profits. This view is known as the "orthodox approach," which postulates that increased concentration fosters easier collusion between the remaining companies to fix prices higher, which then leads to a rise in company profits.

Newmark (1990) conducted an analysis using data from 27 cities in the United States to test the relation between retail grocery prices and concentration. In his review of literature, he notes that five retail grocery studies obtained a positive relation between the price of a grocery basket of items and the degree of concentration (Marion et al. 1977; Hall et al. 1979; Lamm 1982; Meyer et al. 1983; and Cotterill 1986). In Newmark's model the dependent variable was calculated as the price of an average grocery basket of items. The explanatory variables were firm concentration, median income of the households, size of the market, the growth rate of the market, and average size of the retail stores of the city. Contrary to his cited studies, which obtained a significant positive relation between price and concentration in the retail grocery sector, Newmark found that on the whole for the cities considered, the relation between concentration and prices was negative but not significant. He also found a positive and significant relation between household income and retail grocery prices. This last finding is consistent with the Demsetz critique where individuals with higher income may be demanding a greater level of grocery store services.

Yu and Connor (2002) reexamined Newmark's (1990) analysis and concluded that Newmark was in error to state that a negative relation existed between concentration and retail grocery prices. The authors adjusted Newmark's analysis for what they argue are experimental errors and conclude that there is a positive and significant relation between retail concentration and grocery prices.

As with Newmark (1990), Kaufman and Handy (1989) did not find a positive relation between prices and concentration in the grocery industry, and their work was also criticized on empirical grounds. Kaufman and Handy took a somewhat untraditional data-collection approach and randomly selected their basket of food items, rather

than selecting the same food basket for each store. This random selection of a food basket was criticized by Geithman and Marion (1993), and then defended by Kaufman and Handy (1993).

In a more recent study which used unique micro-level Finish grocery market information (including Geographic Information System data), Aalto-Setälä (2002) found both economy-of-size and market-power forces at work. Based on the stores included in his analysis he concluded that "a change of 10 million Euros in quantity sold causes the price level to decrease by about three percent" (p. 213). Regarding market power, Aalto-Setälä states, "both local market share and industry-wide market share have a strong impact on market prices and the power of the retail grocery firm." Like other authors he also found that higher area consumer income had a positive impact on prices.

These three studies—Newmark (1990), Kaufman and Handy (1989), and Aalto-Setälä (2002)—stand against a much larger body of works that support a positive link between industry concentration and prices (Azzam 1997; Azzam and Schroeter 1991; Cotterill 1999; Lopez, Azzam and Lirón-España 2002; among others). For example, a study published in 1979 by Marion et al. had the unusual benefit of rich data as a result of a request by the Joint Economic Committee of the U.S. Congress for detailed supermarket data which would normally not be available to public-sector researchers. These authors conclude that their results "refute the notion that higher profits for dominant firms in concentrated markets are due to efficiency and lower costs."

Other researchers began with the orthodox view that concentration leads to higher prices and higher profits, and later modified their theory to resemble a slightly more complex relationship between concentration, efficiency, and market power similar to the U-shaped relationship proposed by Demsetz. Lopez and Lirón-España (2005) examined industrial concentration in 35 food-processing industries in the United States and found, in contrast to earlier work (Lopez, Azzam, and Lirón-España 2002), that "increases in concentration would result in significant processing cost savings (and Lerner index increases) in nearly all industries and that output prices would decline in nearly 50 percent of the industries, although significantly so in only 20 percent of them." The authors find that the benefits to consumers of industrial concentration depend on the initial level of concentration: output prices will decrease with further concentration in industries with low initial levels of concentration, while output prices will increase with further concentration in industries with high initial levels of concentration.

Regarding the "Demsetz critique," where the demand for higher quality and more services by higher-income consumers leads to greater costs and higher prices, Cotterill (1999) examined U.S. metropolitan grocery store data to test whether a significant relation exists between prices and grocery store services. He reduced 27 store-service variables into five principal component variables and then included these variables in a reduced-form model along with other significant variables including the type of store, the size of the store, whether the supermarket is independent or not, and the presence of an employee labor union. Based on his analysis, Cotterill rejects the Demsetz suggestion that higher prices are associated with higher levels of store service.

Generally, under the structure-conduct-performance (SCP) approach the analysis involves a reduced-form econometric model, with the dependent variable often being a weighted average of grocery prices (e.g. basket). Frequently, additional equations are estimated with grocery store or chain profits as dependent variables. Independent variables are selected to represent structural factors in demand and supply, including market power. Typical independent variables include CR4 (concentration ratio of the four largest firms) or HHI (Herfindahl-Hirschman Index), average store size (to capture any economy of size effects), a measure of income or market growth (to capture a demand component), and grocery store wages often are included as an important supply-cost factor.

For example, Declerck and Sherrick (1991) used SCP analysis and developed a reduced-form model to test the hypothesis that higher food-industry concentration leads to higher industry profits. Their proxy for profit was the price-cost margin (gross revenue less costs, divided by gross revenue). The explanatory variables included the concentration-ratio measures CR4 or CR8, effective minimal grocery store size (estimated as the median size firm), the ratio of advertising expenditure to sales, capital intensity, an index variable to adjust for geography, and the industry growth rate. In their regression

models, some of the variables were also included in quadratic form. Their data came from a survey of manufacturers published by the U.S. Department of Commerce. The authors conclude that concentration is significant in explaining profits, although they do not model the impact of concentration on consumer prices.

The new empirical industrial-organization approach (NEIO) provides an alternative to the SCP approach for analyzing the impact of industry concentration on prices and profits. The NEIO approach estimates a structural model based on oligopoly theory and assumptions regarding conjectural variation. Under this approach researchers arrive at estimable equations from which conclusions can be drawn about the impact of market power as well as economy-of-size effects.

Data and Trends

In recent years the U.S., Canada, and Mexico have been modifying their industrial data classifications in order to harmonize information for comparisons and other purposes. As a result of these changes, the best contiguous period available for analysis of the Canadian food processing sectors is the 1981–1997 period. This period is useful analytically because the Canadian-U.S. Free Trade Agreement (CUSFTA) began in 1989 and the North American Free Trade Agreement (NAFTA) began in 1994. CUSFTA is thus conveniently placed in the study period see its correlation with changes in the Canadian food industry. Although only three years of observations are available after NAFTA, any of its correlations with industry changes may still be discernible. In addition, it is expected to be less influential than CUSFTA because although it included Mexico, it did little to increase CUSFTA's reductions in Canada-U.S. trade barriers.

Nine Canadian food-processing sectors are used in the analysis (Table 1). Since the passage of CUSFTA and NAFTA there have been large increases in processed-food shipments between the U.S. and Canada. To show the growth in processed-food trade, data is presented for several food categories, although there is not a complete match between category definitions. Table 2 shows 1988 and 1997 shipments of processed foods from the U.S. to Canada. The real growth factor (1997 value divided by the 1988 value) in 1981 value (nominal value divided by producer price index) is shown along with an annual growth rate. The growth rates for some sectors were high. For example, the annual growth rate for Canned Vegetables was 28.1 percent.

Table 3 shows Canadian processed-food shipments to the U.S. for 1989 and 1997, with the real growth factor and annual growth rate. As with U.S. shipments to Canada, some growth rates are quite high (e.g., Confectionery, at 20.67 percent). While Canada's export growth rates are generally lower than those of the U.S., Canada's absolute volume of exports is generally larger than U.S. exports, reflecting the large size of the U.S. market. Trade increased in the dairy and poultry sectors despite their relative protection by import quotas and tariffs.

To better understand the two-way trade phenomenon, we examined the data for the subsectors within the dairy category and discovered that the

Table 1. Canadian Food-Processing-Industry Variable Definitions (Nine Industries).

Abbreviation	Numeric code	Industry description
RMEAT	1011	Meat and meat products (except poultry)
POULT	1012	Poultry products
FISH	1021	Fish products
CF&V	1031	Canned/preserved fruits and vegetables
FF&V	1032	Frozen fruits and vegetables
FMILK	1041	Fluid milk
PMILK	1049	Other dairy products
COOK	1071	Cookies
CONF	1083	Sugar and chocolate confections

Table 2. U.S. Processed-Food Shipments to Canada (Selected Sectors 1988 and 1997).

Food category	$Mil U.S. 1988	$Mil U.S. 1997	Growth factor (1997/1988)	Annual % change 1988–1997
Red meat and products	154.7	424.1	2.7	11.86
Poultry and products	98.8	262.4	2.7	11.46
Fish, fresh and prepared	72.2	108.6	1.5	4.64
Chocolate and prepared	24.7	89.0	3.6	15.31
Dairy products	17.4	92.5	5.3	20.41
Canned vegetables	8.7	80.4	9.3	28.10
Frozen vegetables	11.7	37.4	3.2	13.82
Canned fruits	9.64	28.78	2.98	12.92

Source: USDA Foreign Agricultural Service (http://www.fas.usda.gov/ustrade/).

Table 3. Canadian Processed-Food Shipments to the U.S. (Selected Sectors 1989 and 1997).

Food category	$Mil U.S. 1989	$Mil U.S. 1997	Growth factor (1997/1989)	Annual % change 1989–1997
Red meat and products	484.1	775.4	1.60	6.07
Poultry and products	27.4	40.7	1.48	5.05
Fish	891.9	780.8	0.88	−1.65
Vegetables fresh or frozen	104.8	284.9	2.72	13.31
Fruits fresh or frozen	38.1	54.4	1.43	4.55
Dairy products	15.1	54.8	3.63	17.47
Confectionery	18.3	82.1	4.50	20.67

Source: USDA Foreign Agricultural Service (http://www.fas.usda.gov/ustrade/).

rates of annual growth in dairy products shipments were fairly similar between the two countries (10.59 percent Canada to U.S., and 11.29 percent U.S. to Canada). Figure 1 shows shipments of cheese (and curds in the U.S. case) between the countries. Vertical bars represent the years CUSFTA and NAFTA began. While the U.S. cheese industry exported more cheese than did Canada (in millions of dollars U.S.), we assume that different types of cheese are moving across the border as a result of variety price differentials or to fill market niches created with CUSFTA and NAFTA. As shown, exports on both sides increased with the passage of NAFTA.

The Canadian Food-Processing Sector

Figure 2 shows the Herfindahl-Hirshman Index (HHI based upon sales[1]) for the nine Canadian food-processing industries. As before, a vertical bar for 1989 and 1994 represent the year the CUSFTA and NAFTA began. Fluid-milk concentration trends upward throughout the period, while processed-milk

[1] Due to data limitations, the HHI index has not been adjusted for imports and exports. Rude (2003) showed that the adjusted index is normally inferior compared to the unadjusted index and the correlation is very high between them. Thus we can assume the present HHI is a good instrument of its adjusted index.

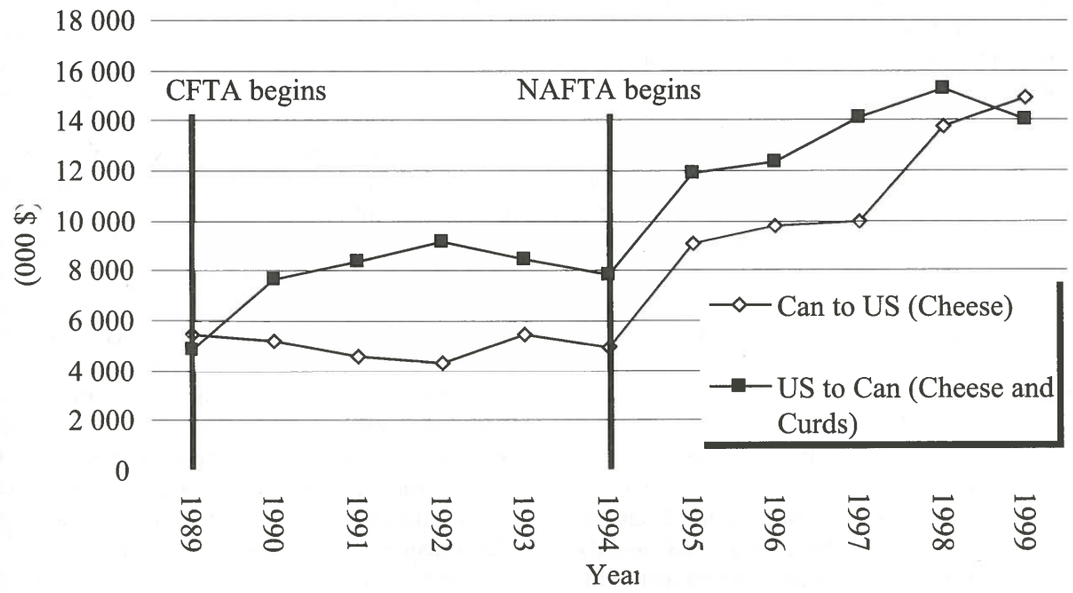

Figure 1. Cheese Shipments between the U.S. and Canada 1989 to 1999.

Source: USDA Foreign Agricultural Service (http://www.fas.usda.gov/ustrade/).

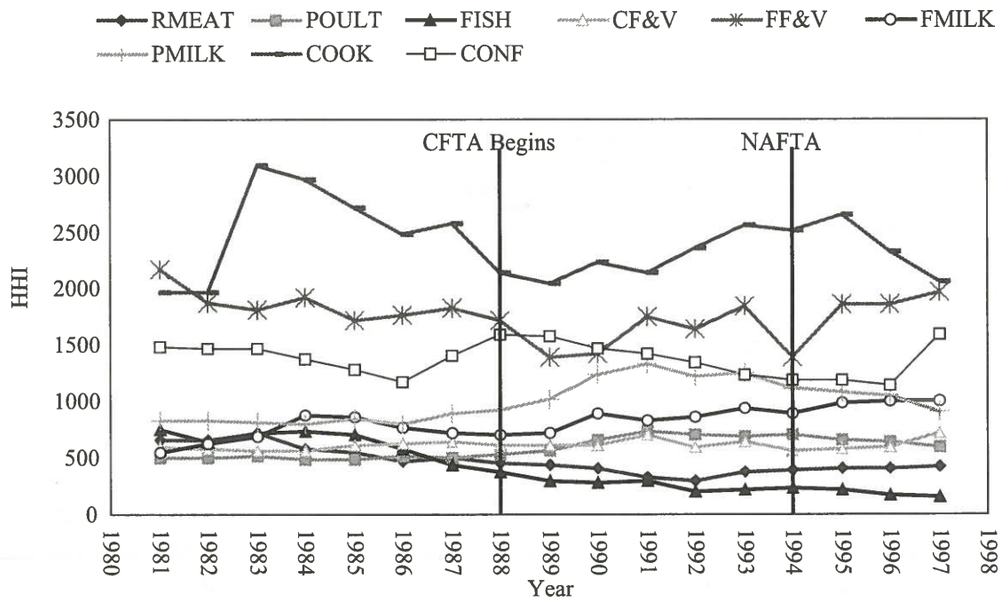

Figure 2. Herfindahl-Hirschman Index for Nine Canadian Food-Processing Sectors.

Source: Statistics Canada.

concentration trends upward until 1991, then trends downward. The frozen fruits and vegetables, cookie, and confectionary industries fluctuate while their overall concentration remains fairly level over the period. The poultry industry experienced a slight increase and then a decrease in its level of concentration. The industry concentration for red meat and fish declined. Based upon inspection of the data, the authors conclude that, on the whole, there do not seem to be overall increases or decreases in food-processor concentration, based upon the nine sectors analyzed.

Retail Concentration

Table 4 presents sales and market share by company for the Canadian grocery market. Loblaw, Canada's largest grocery retailer (sales basis) with 32 percent of the Canadian market, is the 24th largest in world, with a world market share roughly 30 percent that of the world leader, Carrefour of France. The four largest Canadian retailers have 60.05 percent of the total Canadian grocery market. Over the last 14 years a major structural change in the Canadian grocery store industry has been the dramatic increase in the portion of retail food stores owned and operated by chain companies. Figure 3 shows the percentage of all grocery stores that are chain grocery stores by region and for all of Canada.

The largest growth in chain dominance was in the Maritime Provinces, where chain stores increased from 14 percent to 51.8 percent of all retail food stores. In Quebec, chain stores increased from 14.3 percent to 36 percent of all retail food stores. Ontario had the lowest increase, from 28.1 percent to 39.7 percent. Overall for Canada, chains as a percentage of all stores increased from 18.8 percent to 44 percent. In terms of total grocery sales for the same period, chains comprised 54.7 percent in 1989 and 60.7 percent in 2003. Thus chain stores in Canada are nearing two-thirds of all grocery store sales. Since the growth in chain supermarkets has been at the expense of independent grocery stores, one can argue that this is an increase in supermarket concentration. In addition to increasing concentration, most chains employ centralized price setting, which may have a positive effect on prices.

As the percentage of stores and sales controlled by the chain supermarkets has increased, so has the average size of stores. As in other regions of the world, grocery stores in Canada have become larger and increased their number of services. Specialized food departments (bakeries, fresh seafood, etc.) are common, and many grocery stores have pharmacies, banks, and dry cleaning. While average square meters per store is not available, we have calculated the

Table 4. Grocery Sales and Market Share for Canada's Retailers, 2002.

Canadian grocery retailer	Billion $Can	Market share (%)
Loblaw	23,894	32.03
Sobeys	10,960	14.69
Safeway	5,492	7.36
Metro	5,201	6.97
Overwaitea	2,380	3.19
A&P	4,400	5.90
C-Store	3,250	4.36
Costco Food	3,550	4.76
Drug	2,659	3.56
Wal-Mart	2,758	3.70
Co-Op	2,667	3.58
Mass Merc., Indep, others	7,389	9.90
Total	74,600	100.00

Source: *Canadian Grocer* 2003–2004 Executive Report.

average real sales per store. These calculations, in addition to the number of Canadian grocery stores, are plotted across the sample period in Figure 4.

For comparison purposes, the relationship between number and average size was normalized to one in 1981. As shown, the number of stores began to decrease with CUSFTA in 1989, while at the same time real sales per store began to increase at a faster rate. It is important to note the large increase of average store sales made by independent grocery stores compared to chain stores (Figure 5). As chain stores began increasing their market share in 1989, independent grocery stores accelerated their increase in average store sales, more than doubling them by 1997. In contrast, chain stores increased their average store sales less then 30 percent over the same period. Thus CUSFTA appears to have increased the size of independent grocery stores, while the average size of chain stores appears to have been unaffected.

Analysis

For this research we attempted to produce structure-conduct-performance (SCP) models similar to those of Cotterill (1999), Newmark (1990), Yu and Connor (2002), and specifically Declerck and Sherrick (1991). However, due to lack of data and structural changes in many of the studied industries across the temporal range of the data, econometric results were too volatile to be useful. This result was not completely unexpected, as Declerck and Sherrick (1991) and Wen (2001) have noted that SCP models are noted for their lack of robustness. Therefore we identify trends using graphical comparisons and basic statistical analysis. To obtain an overall view of relevant trends, the data for the nine food-processing sectors were normalized to one (dividing all values by their respective 1981 values) and then averaged. Figure 5 displays these trend variables, which are described in the follow-

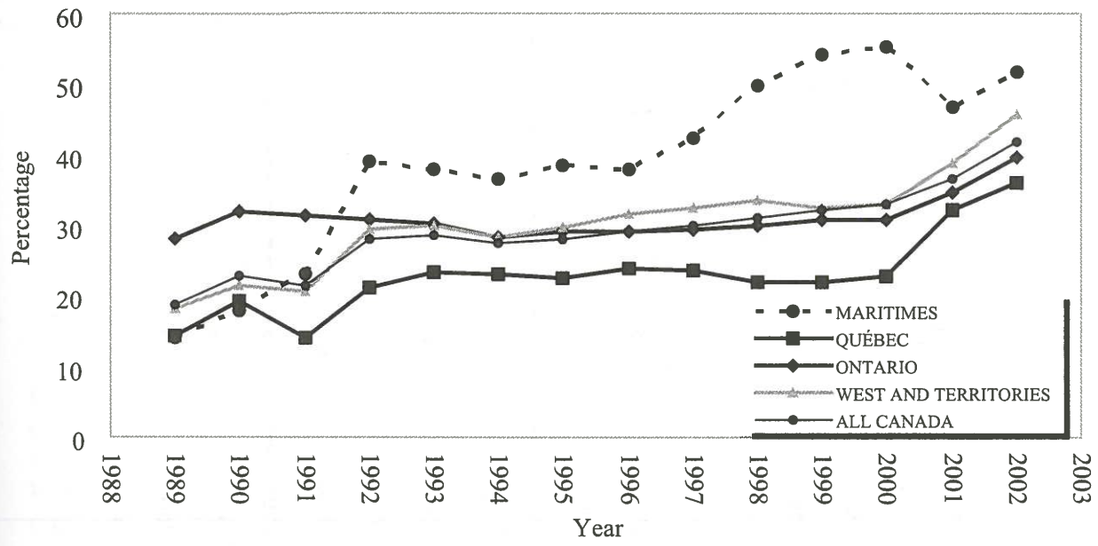

Figure 3. Percentage of Chain Grocery Stores to all Grocery Stores in Canada.

Source: Canadian Grocers, Annual Survey 1990–2003.

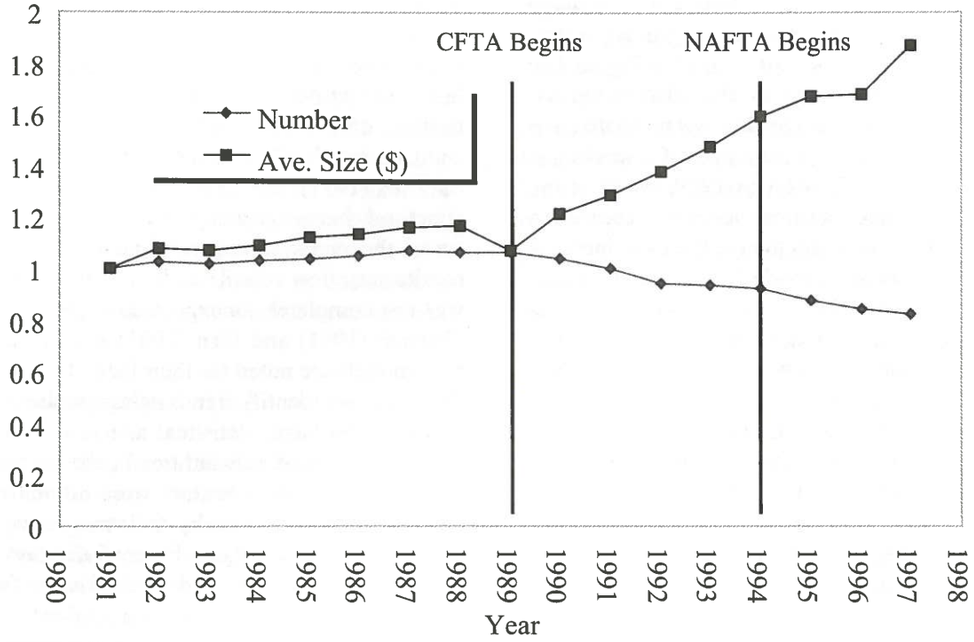

Figure 4. Number and Annual Average Sales per Grocery Store (Real $) in Canada (normalized to 1981 = 1).

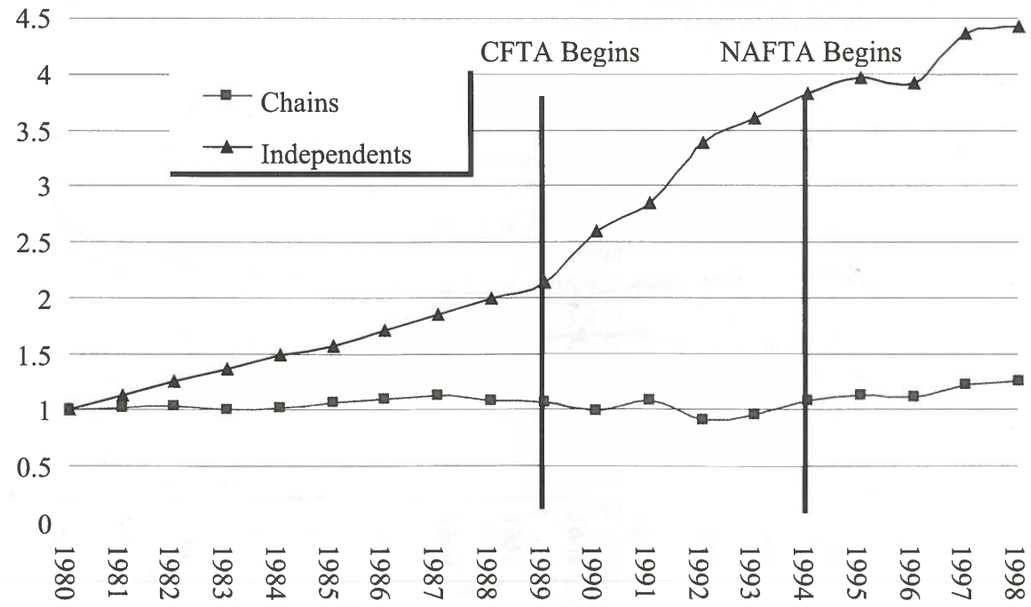

Figure 5. Average sales per Grocery Store type (Real $) in Canada (normalized to 1981 = 1).

ing discussion. The Herfindahl-Hirshman Indices (HHI sales) composite for the nine food-processing sectors oscillates considerably and by the end of the period is close to its initial level.

In Figure 5, the relative retail- and processor-price composite variables are reproduced, normalized to one, and averaged across the nine food-processing sectors. Relative processor and retail prices decreased over time, especially after the passage of the CUSFTA. Although we lack specific data on food-processor profits, we were able to create a proxy for food-processor profits. The variable "Ave. Pr. Net Sales/Sales" is net sales (sales minus salaries, wages, and energy costs) divided by sales. This was calculated for each of the nine sectors (using real values) then normalized to one and averaged over the nine sectors. This profit proxy has increased slightly since CUSFTA. The final variable in the graph represents the change in average size of the processing facilities. Specifically, it is average real sales per processing plant, for each sector, normalized and averaged across sectors. Clearly, since the implementation of the CUSFTA there has been strong growth in the average size of the food-processing plants.

The most interesting aspect of Figure 5 is the pattern of the average processor size and the average processor proxy for profits. Beginning with CUSFTA implementation, both average food-processor size and profits began to increase. On average, these food-processing industries experienced rapid growth in exports to the U.S. In the period since CUSFTA, relative food-processor prices have declined while at the same time average firm real sales have increased. In addition, since the profit proxy variable has also increased during price declines, the Chicago view is supported—that is, profits have increased during a period of declining prices, implying that costs have declined faster than prices.

Especially since the passage of CUSFTA, there has been quite an increase in chain-store dominance in Canada as well as increase in average store size. Thus both retail-level market-power and economy-of-size effects are possible. While our analysis will not allow the separation of these two forces, we note that the relative food prices have on average been consistently decreasing, especially since the CUSFTA. Thus economies of size appear to exist and dominate any market-power price effects which may be present.

In addition to examining time trends for the average of the nine processing sectors, we compared trends across the nine sectors individually. For each of the nine sectors Table 5 presents the HHI, number of firms, processor growth, relative processor price change and relative retail price change. The variable "Firm Growth 81–97" is real sales for each industry in 1997 divided by real sales in 1981. Thus, for example, the real sales of the red-meat sector in 1997 were only 93.6 percent of its 1981 level. At

Table 5. Food Processor HHI, Firm Numbers, Growth, and Price Changes.

Sector	HHI 1997	Degree of concentration	Number of firms 1997	Firm growth 81–97	Relative proc. price change 81–97	Relative retail price change 81–87
COOK	2069	High	32	0.960	1.039	1.020
FF&V	1965	High	37	1.677	0.824	0.871
CONF	1599	Moderate	102	1.154	0.874	0.649
FMILK	1005	Moderate	104	1.244	1.063	0.937
PMILK	905	Low	167	0.960	0.985	0.948
CF&V	711	Low	162	1.231	0.916	0.949
POULT	586	Low	98	1.565	0.726	0.926
RMEAT	427	Low	477	0.936	0.816	0.832
FISH	153	Low	432	1.026	0.925	1.089

the other end of the spectrum, the real sales of the frozen fruits and vegetables processing sector in 1997 was 167 percent of its 1981 level.

The variable "Relative Proc. Price Change 81–97," is the real processor price in 1997 divided by the real processor price in 1981. For example, we can see that for the cookies sector, the real 1997 prices were 3.9 percent higher than the 1981 level. Also shown is a similar variable for the sectors at the retail level. For retail as well as for processors, real prices have declined in seven of nine sectors.

Table 5 is ranked by HHI and, as indicated, two of the nine industries are considered highly concentrated, with HHI of over 1800, and two are considered moderately concentrated with HHI of over 1000 (U.S. Department of Justice and FTC 1997). Table 6 presents the correlation coefficients for the numeric values in Table 5 along with p-values testing the hypothesis of no correlation. The expected negative and statistically significant relation between the number of firms and HHI in an industry is present. The results show that the relation between food-processor industry concentration (HHI) and processor price changes between 1981 and 1997 is not significant. While this is a weak test for market power, it does show that there is not a positive relation between price changes over the 1981 to 1997 period and the 1997 concentration levels. Similar to Lopez and Lirón-España (2005), one might have expected to see a greater 1981 to 1997 price increase in the more-concentrated sectors than in the less-concentrated sectors.

Labor Productivity Analysis

According to Porter (1981), productivity increases in a given industry are often due to increased competition. Heien (1983) concluded that productivity growth in the U.S. Food Processing and Distribution Sectors from 1950–1977 was small in magnitude, but he was later criticized for using aggregated data that concealed different trends across industry sub-sectors. Using a similar productivity measure (Theil-Törnqvist, or Törnqvist indexes) and less-aggregated data from 1958–1982, Lee, Maier, and Lynch (1987) estimates of U.S. productivity growth in the food processing were larger in magnitude than Heien's (1983) estimates but still small compared to U.S. manufacturing in general.

To examine productivity changes which may have been associated with increased competition under CUSFTA, food-processing labor productivity was measured for each year of the study period. For each sector, real sales output was divided by manufacturing labor hours and then regressed against a time-trend variable as well as slope- and intercept-shifting dummy variables corresponding to the beginning of policy changes under CUSFTA (1989).

Table 6. Correlation Coefficients and p-values (in parentheses).

	HHI	Number of firms	Processor growth	Relative proc. price change 81–97	Relative retail price change 81–87
HHI	1				
Number of firms	−0.7703* (0.0152)	1			
Processor growth	0.2312 (0.5494)	−0.5177 (0.1535)	1		
Relative proc. price change 81–9	0.2387 (0.5363)	−0.179 (0.645)	−0.5322 (0.1402)	1	
Relative retail price change 81–87	−0.3037 (0.4269)	0.1667 (0.6682)	−0.1652 (0.6711)	0.3765 (0.3179)	1

* correlation coefficient statistically significant at the 5% level.

Heien (1983) and Lee, Maier, and Lynch (1987) aptly explain why the Törnqvist measures are superior to single-factor productivity measures. However, as Heien (1983) cautions, significant numbers of new products in the industry are not represented in Törnqvist output measures, and thus productivity increases are underestimated. Additionally, although the Törnqvist indexes provide more information by attributing productivity increases to changes in specific factor inputs and allowing interpretation as marginal products, this additional information is not necessary if we are simply concerned with identifying overall productivity changes associated with broad policy change.

In this case, by using real sales output divided by labor hours as a single-factor productivity measure, we have accounted for productivity growth created by new products. Although capital investments or improvements in other factor inputs may have accompanied or facilitated the labor-productivity increases, the disentanglement of these effects is beyond the scope of this study. Increased competition associated with CUSFTA increases the incentive to increase productivity in all factors of production, and accurate labor-productivity data provide a convenient measure for capturing these changes.

Table 7 presents the labor productivity (real output divided by labor hours) time-trend slope coefficient estimates which correspond to the pre-CUSFTA and CUSFTA periods, as well as the slope-shifter dummy-variable coefficient estimates and appropriate p-values. To highlight significant coefficients, in cases where the significance is stronger than 10 percent both the coefficients and p-values are right-hand-side justified.

Six of the pre-CUSFTA labor-productivity slopes are negative, with three of these being negative and statistically significant. Only three sectors have positive pre-CUSFTA labor-productivity trends, and only one of these estimates is significant. The CUSFTA period shifts in productivity are striking. For six of the sectors, the trend-shifter variable is positive and statistically significant, implying that CUSFTA is associated with greater industry output per hour of labor. Although increases in this simple labor productivity may be due to increased output, two (fluid milk and red meat) of the three industries that did not experience real growth over the 1981 to 1997 period registered statistically significant increases in their productivity trend after the inception of CUSFTA. These results support the argument that increased competition under the passage of CUSFTA is associated with increased productivity.

Table 7. Food-Processing Sector Time-Trend Productivity Slopes with CUSFTA Change.

Sector	Pre-CUSFTA productivity		CUSFTA productivity		
	Trend slope	p-value	Time-trend dummy coefficient	p-value (for trend dummy variable)	Trend slope
COOK	−0.0035	0.6170	−0.0026	−0.2900	−0.0062
FF&V	−0.0053	0.4520	0.1464	0.1240	0.1411
CONF	0.0065	0.5910	0.0493	0.0070	0.0559
FMILK	−0.0758	0.0000	0.0859	0.0000	0.0101
PMILK	−0.0043	0.7630	0.0585	0.0070	0.0542
CF&V	0.0026	0.6870	0.0195	0.0340	0.0221
POULT	−0.0184	0.0320	0.0247	0.0280	0.0063
RMEAT	−0.0349	0.0000	0.5948	0.0000	0.5599
FISH	0.0569	0.0000	0.0012	0.9420	0.0580

Conclusions and Implications

The results of this study show that relative Canadian food prices at both the processor and the retail levels have fallen over the 17-year period examined. While definitive tests for market power could not be conducted, the data is consistent with competitiveness, either of the Chicago view (economies of size dominating market power) and/or of the Porter view (increased competition resulting in a productivity increase response).

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