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# The Impact of Subsidies, Storage, and Exchange Rates on Exports of Canadian Fresh Carrots to the United States

**Ralph E. Bierlen and David Blandford**

Canadian exports of fresh carrots to the United States have increased substantially in recent years. The depreciation of the Canadian dollar against the U.S. dollar has been a major factor. Canadian government subsidies also may have had an impact by accelerating the construction of cold storage facilities. These have permitted the marketing period to be extended. However, an analysis of costs and returns suggests that cold storage of carrots is commercially profitable. Storage capacity would probably have increased without government aid. The returns to storage and the change in exchange rates are the primary factors contributing to the expansion of Canadian exports.

The United States and Canada are the largest international trading partners in the world. In recent years, goods worth approximately 150 billion U.S. dollars have crossed the border annually between the two nations. Roughly 75% of Canadian exports go to the United States, while 22% of U. S. exports go to Canada. Prior to the late 1970s, imports from Canada were not perceived as a major problem in the United States. However, with a continued appreciation of the U.S. dollar against the Canadian dollar, the U.S. merchandise trade deficit with Canada has grown. In 1985, the \$20 billion deficit meant that only Japan had a larger trade surplus with the United States (CEA).

Several U.S. industries have been affected by increased competition from Canadian imports. One is the fresh carrot industry. From mid July to mid November, producers in Quebec and Ontario compete in U.S. markets with producers in the Northeast and Midwest. Since 1978, Canadian exports of fresh carrots to the United States have roughly doubled, and are now in excess of 60 thousand metric tons. This represents about 10% of U.S. fresh carrot production. In the last two Canadian marketing years (August-July), the volume of Canadian carrot exports to the United States has surpassed U.S. exports to Canada, reversing the historical U.S. trade surplus.

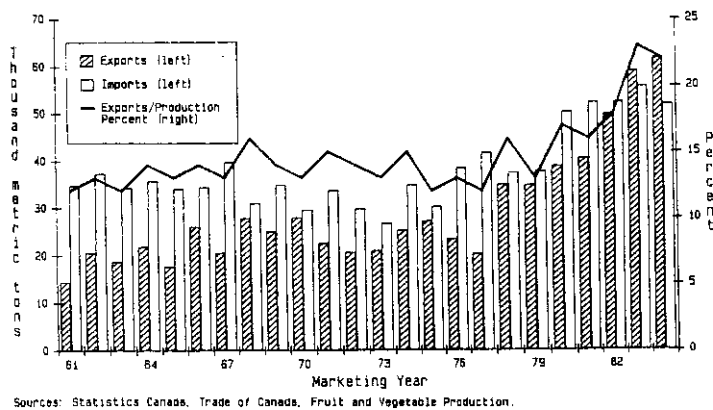
As a result of the increased competition, allegations have been made that higher Canadian exports (virtually all of which are to the United States) are the result of government subsidization. Canadian producers receive various forms of assistance through provincial and federal government programs. This paper examines whether government subsidization has had a significant impact on the competitive position of Canadian carrots in U.S. markets and has caused the increase in imports, or whether the import growth is due to other factors.

## Changes in Exports

Between 1961 and 1978, Canadian imports and exports of fresh carrots displayed no consistent trend (Figure 1). Exports (during the fall and winter period) were usually about 25 thousand metric tons, and imports (during the spring and early summer) were about 35 thousand tons. Since the 1978 marketing year, both imports and exports have increased substantially. In 1984, exports exceeded 60 thousand and imports 50 thousand metric tons. Exports have grown particularly rapidly. Exports now represent over 60% of domestic production, compared to around 40% prior to 1978 (Figure 1). Strong export growth has turned Canada into a net exporter of fresh carrots. Between 1979 and 1984, from 82 to 99% of Canadian imports crossed the border into New York State (U.S. Department of Commerce).

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**Figure 1. Canadian Trade in Fresh Carrots**

The bulk of Canadian production takes place in Ontario and Quebec and is harvested from late July to early November. Carrots are placed into storage during this period and are withdrawn first from unrefrigerated storage and then from cold storage during the remainder of the marketing year. There is no year-to-year carryover of carrots. In the early 1970s, less than 20% of each season's production was stored. In recent years, this proportion has been between 35 and 40%. As a result of the increase in storage capacity, the marketing year has been extended through March.

The strong growth in exports of Canadian carrots, both in total and over an extended marketing period, have contributed to the perception that the growth is the result of "unfair" competition. It has been suggested that Canadian provincial and federal government subsidies are the primary reason why Canadian carrots are increasingly competitive in Northeast and U.S. markets.

### Government Subsidies

In Canada, government programs at three levels may provide subsidies to carrot producers: federal government programs, provincial government programs, and joint federal-provincial programs. Canadian government programs are of four types: credit, grants, crop insurance, and price stabilization. Both the federal and provincial governments offer agricultural credit. Many programs are grants for specific purposes, e.g., tile drainage or cold storage facilities, that do not have to be repaid. There are joint federal-provincial crop insurance programs, and under the federal agricultural stabilization act, producers are guaranteed a return on named com-

Data on expenditures under some government programs are not readily available. Reasonably complete information exists for federal expenditures and for the programs operated by the provincial government of Ontario. Annual expenditures on fresh carrots under those programs for which data could be obtained for recent years are given in Table 1. These expenditures are expressed as a percentage of grower receipts and production costs. Estimates of production costs were derived from yearly production budgets (Bierlen).

With the exception of years such as 1982 when payments were made under the agricultural stabilization program, government subsidies appear to be relatively modest. For the years shown, they have been generally less than 4% of receipts and 7% of production costs. Since government subsidies are not targeted specifically toward exports their effect upon trade is not clear. Subsidies may have contributed to increased production, although this depends on whether subsidy payments have changed the returns from the production of carrots relative to alternative crops. Since many of the subsidies provided are not specific to carrots, they may have contributed to the maintenance of income and asset values in eastern Canadian agriculture in general, without much effect upon the output of carrots. Their effect upon the level of exports is unlikely to have been large. This tentative conclusion is reinforced when the size of government subsidies is compared with other factors affecting producer returns from exports.

### Storage

As indicated above, the marketing period for Canadian carrots has been increasing. Prior to the 1970s, most Canadian exports had ceased by January. Because of the increased use of refrigerated storage in Ontario and Quebec, carrots are now exported through March and often into April.

The expansion of storage capacity has not been entirely due to market forces. Both the Canadian government and the governments of Quebec and Ontario introduced programs in the 1970s which contribute one-third to one-fourth of the capital costs of storage construction. During 1974-85, federal expenditures on the construction of storage facilities in Ontario and Quebec for all fruits and vegetables averaged just over 800 thousand Canadian dollars per year. Although only partly used by carrot producers, these expenditures probably affected the rate of expansion of carrot storage capacity. Nevertheless, if storing carrots is a profitable

**Table 1. Government Subsidies to Canadian Carrot Producers (\$ Canadian)**

	Ontario			
	Estimated subsidy (\$1,000)	Proportion of		Production costs
		Receipts	percent -	
1976	76.5	1.6		2.1
1979	274.5	3.3		NA
1980	306.3	3.9		NA
1981	504.5	4.3		6.5
1982	1,678.2	16.2		16.3
1983	761.0	3.3		NA
1984	406.8	4.1		NA

	Quebec			
	Estimated subsidy (\$1,000)	Proportion of		Production costs
		Receipts	percent -	
1976	77.9	1.5		1.3
1979	261.2	2.7		2.9
1980	677.4	3.6		5.6
1981	534.4	4.0		5.2
1982	1,462.3	14.6		15.1
1983	216.9	1.3	1.4	2.8 NA
1984	161.7			

NA = Not available.

Source: Bierlen.

in storage probably would have occurred anyway. In order to examine this proposition, the commercial profitability of storing carrots in Ontario and Quebec is evaluated.

Gross returns from storage were estimated using price and removals data with an adjustment for losses due to spoilage. Monthly Montreal and Toronto terminal market prices were converted to constant dollars for the period 1970-85 to determine the monthly sales price premium from storage (Agriculture Canada). A representative pattern of removals was calculated from monthly storage statistics for Ontario and Quebec (Statistics Canada) over the\* 1970-71 to 1984-85 period. Net returns were calculated for typical carrot storage structures in Ontario and Quebec by subtracting estimates of fixed and variable storage costs (for further details see Bierlen).

The average annual net return in November 1985 dollars for a representative storage structure in Ontario for the 1970-85 period, emptied in an average manner, is roughly \$10,000, representing a rate of return on investment of roughly 5% (Table 2). The corresponding net return for the Quebec structure is roughly \$17,000, or a rate of return of over 8%. The principal reasons for the difference in returns are larger average size of the representative Quebec structure, and slightly higher prices obtained for sales in the Montreal market.

These estimates do not include family labor costs and assume a constant packer margin. Because of the increase in cull rates, packing margins probably increase throughout the storage season, with the result that net returns would be reduced. Despite this limitation, the estimates suggest that storage facilities in both Quebec and Ontario are paying propositions, even for sales in the domestic market. A government construction grant would reduce capital costs and increase profits, but a carrot storage facility can be built and operated profitably without direct government aid. Although the promotion of storage by the federal and provincial governments may have increased the rate of construction of storage facilities, storage capacity would probably have increased in any case because of its profitability.

### The Exchange Rate

The returns to storage presented were based on the assumption that sales would be made in the Canadian domestic market. If higher returns can be obtained from sales in the United States, then this would provide an incentive both to increase production and to store carrots for export. A major factor affecting the returns from export sales has been the exchange rate. After 1976, when the two

**Table 2. Average Annual Return to Storage for Representative Ontario and Quebec Carrot Storage Structures, 1970-85**

	Ontario	Quebec
A. Gross Returns (net of losses from spoilage)	55,508	68,638
B- Annual Fixed Costs	28,032	30,036
C. Annual Variable Costs	17,846	21,326
D. Net Returns	9,630	17,276
E. Rate of Return on Investment*	5.1	8.5

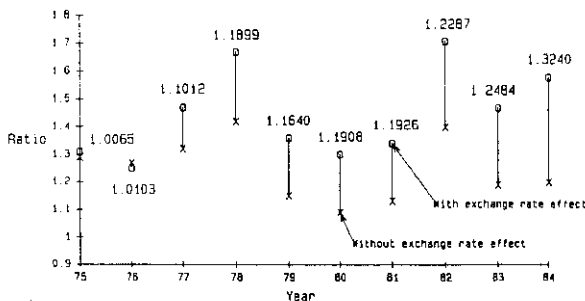
\* Annual net return divided by initial capital costs.  
Source: Bierlen.

dollars were roughly on par, the Canadian dollar depreciated steadily against the U.S. dollar. In 1985, the Canadian dollar was worth just over 73 U.S. cents (CEA).

**Effect on Sales Prices**

In order to evaluate the importance of the change in the exchange rate, a comparison is made of the price that Canadian carrots could receive in the United States to their price in Canada. Figure 2 contains the ratio of the November price of carrots in the Buffalo terminal market relative to those in Toronto for the period 1975—84. The x's represent the price ratios without the exchange rate effects (with the two currencies at par), and the o's denote the price ratio including the change in the exchange rate. The actual average monthly exchange rate (Canadian dollars per U.S. dollar) is noted above the o's.

Even without considering the exchange rate effect, Buffalo prices are roughly 10 to 40% above those in Toronto. When the exchange rate is taken into account, the November average Buffalo wholesale prices (Canadian \$) are up to 70% greater



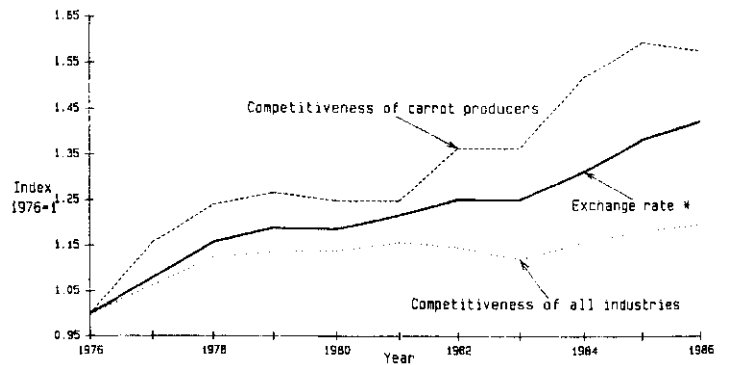
Sources: Agriculture Canada, Fruit, Vegetable and Honey Crop and Market Report; IMF, Financial Statistics; N.Y. State, Dept. of Agric. and Markets, Buffalo Produce Market Report.

**Figure 2. Buffalo November Carrot Prices Relative to Toronto Prices**

**Effect on Competitiveness**

The existence of a price premium for sales of Canadian carrots in the United States will not necessarily change the volume of trade. The movement in the exchange rate may reflect differential rates of inflation between countries. If domestic inflation in Canada is higher than in the United States, the Canadian dollar may depreciate against the U.S. dollar but the relative competitiveness of the industries in the two countries may be unaffected.

In order to determine if this has been the case, indices of relative industrial competitiveness are compared to changes in the exchange rate (Figure 3). An index for Canadian industry as a whole is calculated from the ratio of the two countries' domestic producer price indices multiplied by the exchange rate. An index of competitiveness for carrots is constructed from production cost indices for carrots in the two countries. Unfortunately, the avail-



Source: Bierlen, R.W., The causes of increased exports of fresh carrots into the U.S. \* \$Can per \$US

**Figure 3. The Exchange Rate and Canadian Competitiveness**

bility of production cost data for this comparison is limited. A reasonably long time series exists only for Texas and Quebec. As a consequence, the index was calculated for these two regions with 1976 as base year. Missing years for Quebec (1977-78, 1984-85) were estimated by linear interpolation. The indices shown in Figure 3 suggest that the competitiveness of Canadian industry as a whole has improved consistently against U.S. industry since 1976, but not to the extent that the depreciation of the Canadian dollar would suggest. Part of the output price advantage created by currency depreciation has been offset by a higher rate of increase in input costs in Canada than in the United States. The situation for carrots has been exactly the opposite. The rate of increase in production costs in Canada has been less than that in the United States, further enhancing the competitive edge provided to Canadian producers by the depreciation of the currency.

This conclusion is dependent on the data used, and in particular the production cost characteristics of the two regions. Both of the regions are relatively high-cost areas. Quebec costs are higher than those in Ontario. Costs in Texas are higher than in New York and California (see Bierlen). However, the absolute cost levels are not in themselves significant for the analysis of competitiveness. What is important is how costs have changed through time, and whether these changes are reasonably representative for the industries in the two countries as a whole. Since Texas producers use irrigation and custom harvesting, their costs are probably less representative of northeastern or midwestern producers than of other southern or western producers. The increased cost of energy, in particular, has probably had a greater impact on irrigated production than on nonirrigated production. As a consequence, the index of relative competitiveness based upon Quebec and Texas figures probably does not provide a reliable estimate of changes in the competitive position of Canadian and northern U.S. producers. If data were available to make the calculations, this index would probably have increased at a slower rate than the carrot index in Figure 3. However, it is unlikely that the qualitative conclusion which may be drawn from the chart would be different. The competitive position of Canadian producers has probably improved significantly relative to all U.S. regions as a result of the depreciation of the Canadian dollar.

### Effect on Returns

The importance of the exchange rate in the incentive to export can be evaluated by comparing the

returns from shipment to Canadian markets versus the United States for a recent marketing year (1985-86). Two major Canadian carrot growing regions are used for this comparison: Ste. Clotilde, Quebec and Bradford, Ontario. The costs for producing, storing, packing and transporting carrots were estimated for each of the regions. Monthly returns were calculated for shipments to a nearby Canadian wholesale market (Montreal for Ste. Clotilde and Toronto for Bradford) and to a major U.S. market (Buffalo). By subtracting net returns for shipments to Canadian markets from the Buffalo net returns, the additional profit from shipping to Buffalo can be determined.

The estimates are summarized in Table 3. The effect of the difference in exchange rates on sales prices in the two countries is large, ranging from over \$2 to \$3.51 (Canadian) per bag. The exchange rate accounts for virtually all the additional return of between \$0.62 (2%) to \$3.09 (37%), which can be realized from shipping to U.S. rather than Canadian markets. This clearly demonstrates that it was more profitable to ship to Buffalo than to Montreal or Toronto in 1985/86, and that the difference was largely attributable to the difference in exchange rates.

### Exchange Rate Compared to Subsidies

From Table 3 and the information on the size of subsidies in Table 1, a rough comparison of subsidies for Canadian producers is made with the market premium from selling in the United States. Table 4 presents this comparison using available 1986 figures.

The first column contains estimated production costs for Quebec and Ontario in Canadian cents per pound. These costs were derived from the production budgets used in Table 1. The second column is a "representative" subsidy level derived by averaging the yearly estimates of government subsidies for 1980-84. The third column gives the average seasonal premium for selling in the United States (Buffalo market) rather than in a nearby Canadian market (Montreal or Toronto) from Table 3. The final two columns of Table 4 express the subsidies and the U.S. market premiums relative to production costs. They demonstrate that the government subsidy is relatively small (5-8%) but that the premium from exporting to the United States is large (57-107%).

This premium is due primarily to the difference in currency values and the returns to storage. It is possible that producers would not receive all the sales premium from exports. Part of the additional

**Table 3. Comparison of Costs and Returns of Shipping Carrots from Ste. Clotilde, Quebec and Bradford, Ontario to U.S. and Canadian Markets in 1985-86 (Canadian \$ per master container<sup>1</sup>)**

	Market price <sup>2</sup>	Gross returns			Net returns	
		Exchange rate premium	Realized price	Total costs <sup>3</sup>	Net return	Buffalo Advantage <sup>4</sup>
Ste. Clotilde to Montreal (Oct)	4.56		4.56	6.58	-2.02	
Ste. Clotilde to Buffalo (Oct)	5.83	2.14	7.97	7.42	0.55	2.57
Bradford to Toronto (Oct)	6.18		6.18	5.92	0.26	
Bradford to Buffalo (Oct)	5.83	2.14	7.97	6.70	1.27	1.01
Ste. Clotilde to Montreal (Dec)	7.26		7.26	7.20	0.06	
Ste. Clotilde to Buffalo (Dec)	8.00	3.16	11.16	8.05	3.11	3.05
Bradford to Toronto (Dec)	8.84		8.84	6.46	2.38	
Bradford to Buffalo (Dec)	8.00	3.16	11.16	7.25	3.91	1.53
Ste. Clotilde to Montreal (Jan)	8.94		8.94	7.51	1.43	
Ste. Clotilde to Buffalo (Jan)	8.58	3.49	12.07	8.37	3.70	2.27
Bradford to Toronto (Jan)	10.65		10.65	6.73	3.92	
Bradford to Buffalo (Jan)	8.58	3.49	12.07	7.53	4.54	0.62
Ste. Clotilde to Montreal (Feb)	8.25		8.25	7.82	0.43	
Ste. Clotilde to Buffalo (Feb)	8.68	3.51	12.19	8.68	3.51	3.08
Bradford to Toronto (Feb)	9.97		9.97	7.00	2.97	
Bradford to Buffalo (Feb)	8.68	3.51	12.19	7.80	4.39	1.42

<sup>1</sup> 24 x 2 pound bags with net weight of 50 pounds.

<sup>2</sup> Buffalo price in U.S. dollars.

<sup>3</sup> Sum of production, packing- transportation and storage costs. For shipments to Buffalo, the U.S. tariff is included.

<sup>4</sup> Difference between returns from shipment to Buffalo and comparable Canadian market. Source: Bierlen.

profit may be retained by shippers and handlers. Even under the conservative assumption that producers receive only 50% of the extra returns for shipment to the United States, the market incentives for Canadian producers are likely to be of far greater significance in influencing exports than government subsidies.

## Conclusions

Since 1976, the U.S. dollar has appreciated by roughly 30% against the Canadian dollar. This has resulted in a sizable exchange rate premium when Canadian carrots are shipped to the United States, Carrots sold in Buffalo, as opposed to Montreal or

**Table 4. Comparison of the relative size of Canadian government subsidies and premiums for sale in U.S. market (Canadian cents per pound)**

	Production cost (1)	Average government subsidy (2)	U.S. market sales premium (3)	Percentage of production cost	
				Subsidy	Sales premium
Ontario	4.04	0.31	2.3	8.5	57
Quebec	5.16	0.28	5.5		107

Sources: (1) Estimate for 1986 for Ontario and 1985 for Quebec.

(2) Average of subsidies for 1980-84 from Table 1.

(3) Average Buffalo advantage for October through February for 1985-86 season from Table 3 on a per pound basis.

toronto, yield substantially higher net returns in Canadian dollars. An index of relative competitiveness based upon data for Quebec and Texas suggests that the change in the exchange rate has had a substantial effect upon the competitive position of Canadian producers. For the two regions analyzed, the value of the dollar has changed the competitive position of carrot producers more than for Canadian industry as a whole. In comparison to the effects of the exchange rate,

"• government subsidies are relatively small even if the upper end of the estimates is assumed. Subsidies may be important, but they provide no direct incentive for shipment to the United States as opposed to Canada. Subsidies may have contributed to increased supply in Canada and, hence, increased exports to the United States. They may have accelerated the rate of construction of storage facilities, which have been an important factor in extending the marketing period for Canadian carrots in the domestic market and in the United States. Estimates of costs and returns demonstrate that storing carrots in Canada is profitable. The necessary incentives for building storage are in place and storage can be operated profitably without government subsidies. Although government aid has been provided for storage, storage would probably have increased even without such aid.

The magnitude of the exchange rate premium (up to 40%) has to be considered the primary incentive to export carrots to the United States. When some U.S. markets are just a short distance away and net returns substantially exceed those in domestic markets, the incentive for redirecting shipments to the United States is large. Although the costs of exporting are higher than selling domesti-

cally, the returns from selling in the United States are as much as 37% higher than selling in Canada. Overall, the results indicate that the increase in exports of carrots from Canada to the United States is unlikely to have been due to "unfair competition," as has been alleged by some groups in the United States. The Canadian government has provided some aid to producers through subsidized credit, income stabilization programs, and other measures. However, exchange rate changes and the return to storage have probably been the major factors influencing Canadian exports of carrots to the United States, not government subsidies.

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