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Structural Changes and Strategies in the North American Flour Milling Industry

by

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ABSTRACT: The dynamic structural changes in the flour milling industry have resulted in fewer and larger firms, larger plants, and increased concentration. This evolutionary process (ala Porter) typically is achieved through the cumulative impacts of firms exiting, mergers, and new plant construction. Recent free trade agreements can be interpreted as resulting in a structural change in this evolutionary process in a broader geographic context.

The flour milling industries evolved independently in the United States, Canada, and Mexico and were not integrated. Policies, regulations, and the competitive structure of the vertical market system differed across these countries. Exports between countries have been nil; and plants generally ship within their national boundaries and are not being impacted directly by developments in the contiguous country. However, a number of features in the North American Free Trade Agreement could have an impact on strategies and competition in this industry.

This paper has three objectives. First, structural characteristics of the flour milling industries in each country, policies, and other competitive factors are described. Second, important fundamental changes from the U.S./Canada Free Trade Agreement (CUSTA) and the North American Free Trade Agreement are described. Apparent changes in firm level strategies since the CUSTA are highlighted and analyzed.

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A pervasive theme in many agricultural marketing industries is that of consolidation. The dynamic structural changes in these industries have resulted in fewer and larger firms, larger plants, and increased concentration. The purpose of this paper is to describe structural changes in the North American flour milling industry. This paper has three objectives. First, structural characteristics of the flour milling industries in each country policies, and other competitive factors are described. Second, important fundamental changes from the U.S./Canada Free Trade Agreement (CUSTA) and the North American Free Trade Agreement (NAFTA) are described. Apparent changes in firm level strategies in the United States, Canada, and Mexico since the CUSTA are highlighted and analyzed. Structural changes are presented from a panel of data for both the U.S. and Canadian flour milling industries from 1972 to 1990.

Industry Characteristics and Dynamics[1]

The structural dynamics of the wheat flour milling industry likely are typical of many industries within the agricultural marketing system. Demand for wheat flour products generally had minimal (to negative) growth. However, since the early 1980s, demand for milling has increased because of reversal of per capita consumption trends, increasing 3 to 5% per year in per capita consumption. Most important is the apparent renewed recognition of the importance of wheat food products in American diets and the adoption of the Food Pyramid as a dietary program. In addition, since 1986, export flour sales via the Export Enhancement Program (EEP) have expanded, also reversing a negative trend. Almost 8% of the flour output has been destined for export under some form of government assistance program. Because of these two important trends, capacity use has increased to relatively high rates. However, capacity use varies substantially across regions.

The wheat flour milling industry traditionally has been concentrated in market centers typically contiguous to wheat production regions, such as Minneapolis and Kansas City. In making location decisions, firms must choose between being located close to the point of wheat production (i.e., an origin mill) or close to the customer (i.e., a destination mill). A strategic advantage of the former is that the mill would not be dedicated to specific customers or regions. Thus, the number of potential customers for an origin mill, all being located at consumption centers and capable of

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[1]See Harwood et al. and Dahl for recent descriptions of the U.S. milling industry and Government of Canada for a description of the Canadian industry.

receiving by rail, is large.[2] These strategic advantages have to be weighed against transportation and service advantages of locating closer to customers and shipping wheat longer distances. Traditionally, an important rail pricing mechanism referred to as 'transit' partially offset location disadvantages of origin milling. However, the advantage of the transit privilege has gradually diminished since railroad deregulation in the early 1980s.

Another important transportation change that has impacted this industry is the advent of unit train technology in wheat shipments, which was adopted in the early 1980s. Of particular importance is the fact that the cost of shipping wheat by rail, using this technology, decreased relative to the cost of shipping flour and millfeeds. Wheat flour is not compatible with unit train technology since most receivers are only large enough to purchase in single-car shipments. In addition, flour shipments require highly specialized equipment, which have limited alternative uses (e.g., sugar) compared to covered hopper cars that can be used to ship virtually any raw unprocessed (and some processed) commodity. The result of this technical change has the general effect of favoring a transition of the milling industry away from traditional milling centers toward destination markets.

Firms in the wheat flour milling industry originally were family owned and/or owned by local elevator companies integrated forward into flour milling. In addition, most were traditionally single plant firms rather than multi-plant firms. However, in the past several decades, a number of "strategic groups" have become evident in this industry. A strategic group is a cluster of firms with common assets; consequently, strategic decisions often are parallel (Oster, p. 61). These were comprised of the following (Goldberg, 1983):

- Vertically integrated food processors (Pillsbury, Nabisco, General Mills, and International Multifoods)
- Multi-unit flour millers diversified into other grain operations (ConAgra, Cargill, ADM)
- Medium-sized firms that are primarily regional flour producers (e.g., Bay State Milling)
- Small millers with one or two mills in local market niches.

These definitions are used throughout the remainder of this paper as well as the tables and figures. The first group is largely comprised of food processors integrated backward for procurement purposes. The second group is primarily

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[2]See Sosland (1993) for a specific discussion on this point.

commodity firms with operations throughout the grain marketing system, but not integrated forward. The relative importance of each of these groups has changed. Specifically, the multi-unit grain and local niche firms have grown substantially. Each of the other two groups have decreased in relative importance. Through time, firms that were largely food processors who were integrated backward, most likely for strategic procurement purposes, no longer dominate the industry. Though multi-unit grain firms (i.e., those with major operations in other grain marketing sectors) were relatively less important prior to 1980, most of the growth, both in terms of new plants and acquisitions, has come from this group.

Statistical Analysis and Comparison of Market Structure

The structure of this industry has changed. The number of plants operating in the United States has decreased from 280 to 204 between 1974 and 1990, and the average plant capacity has nearly doubled (Table 1).[3] Reduction in the variance in plant capacity, indicated in the coefficient of variation, suggests a general pattern of convergence in both firm and plant size. The number of firms has decreased (Figure 1). The average firm capacity more than doubled during this period, and the number of plants per firm has increased from 1.7 to 2.2. Also, the percent of plants that "grain" (i.e., the second strategic group) firms operate has increased from 14% in 1974 to over 50% in 1990 and 62% in 1992. The percent that "vertically integrated" (i.e., forward as the first strategic group) firms operate has remained at less than 10% (Figure 2) and has declined. Similar behavior has been observed in Canada. The fundamental difference is that as early as 1981, over 50% of the plants in Canada were part of multi-plant operations -- the U.S. industry did not surpass 50% until 1987.

The milling industry has become more concentrated with 4-firm market (capacity) shares increasing from 34% in 1974 to nearly 70% in 1992 (Figure 3). The Herfindahl Index[4] reflects "balance" in the industry and is impacted by both the number and size distribution of firms. A high value of H indicates an unbalanced distribution or a greater likelihood of a dominating market leader. In the United States, H has nearly doubled since 1970.

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[3]All firm and plant data were taken from *Milling and Baking News* annual directory (Sosland). Survey data were available for every year since 1972, except for 1973, 1975, and 1979.

[4]As used in this study the Herfindahl Index is defined as $H = \Sigma S_i^2 \cdot 10{,}000$, where S_i is the market (capacity) share of firm i.

Table 1. Descriptive Flour Industry Milling Statistics

Plants/Firms	United States			Canada		
	1974	1980	1990	1974	1980	1990
Plants						
Number	280	255	204	43	35	30
Average capacity (cwt/day)	3,541	4,212	5,937	4,446	5,763	6,253
Coef. of var: capacity	129	122	99	109	102	97
Firms						
Number	161	140	95	28	21	19
Average firm capacity (cwt)	6,158	7,672	12,534	2,029	8,717	9,203
Coef. of var: capacity	150	137	118	--	--	--
Number of mills	1.7	1.8	2.2	1.5	1.7	1.6
Multiplant (%)	37	42	58	37	51	50
Plants Operated by Firm Type (%)						
Grain	14	15	33	--	--	--
Vertically integrated	9	11	8	--	--	--

H differs substantially across the United States. Figure 4 shows the Herfindahl Index for each of the Census Bureau Regions calculated in 1972 and 1990. In all regions except Montana (MTA), the Herfindahl Index increased through time and, in most cases, nearly doubled. Regions that could be subjected to fairly intense competition, reflecting a large number of similarly sized firms, are the East North Central (ENC), West North Central (WNC), and South Atlantic (S-AH). In these regions, no single market leader can impact margins. The Middle Atlantic (Mid-At) in Figure 5, East South Central (ESC), and Pacific are characterized more by an unbalanced competitive environment where a market leader probably could dominate. Given the identity $H=(V^2+1)/n$, the observed increase in H implies a decreased number of firms or an increased coefficient of variation in firm size (or both). However, the coefficient of variation has decreased (Table 1), which implies that the increase in H is attributable simply to a decreased number of firms.

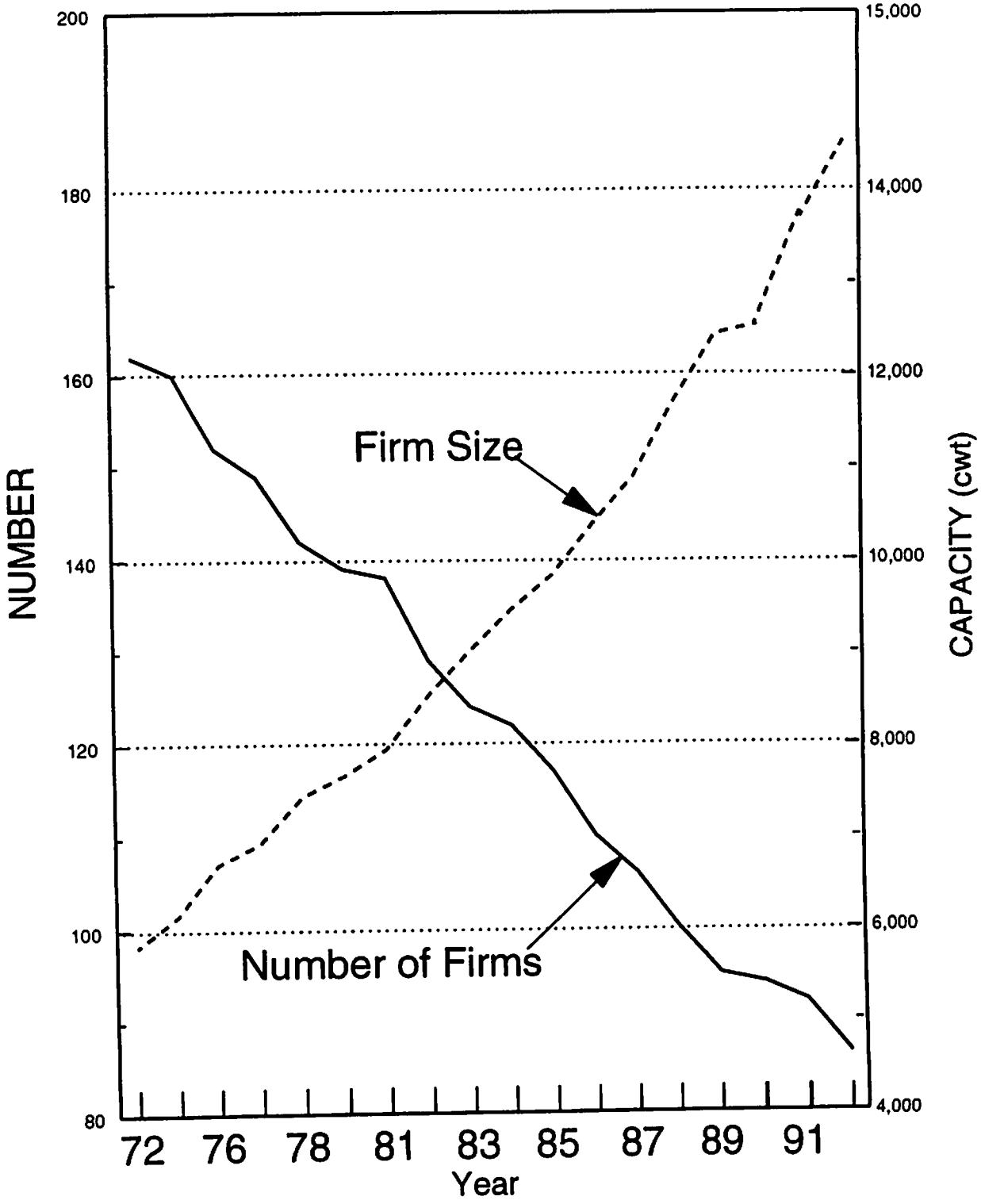


Figure 1. United States Flour Milling Industry: 1972 to 1992.

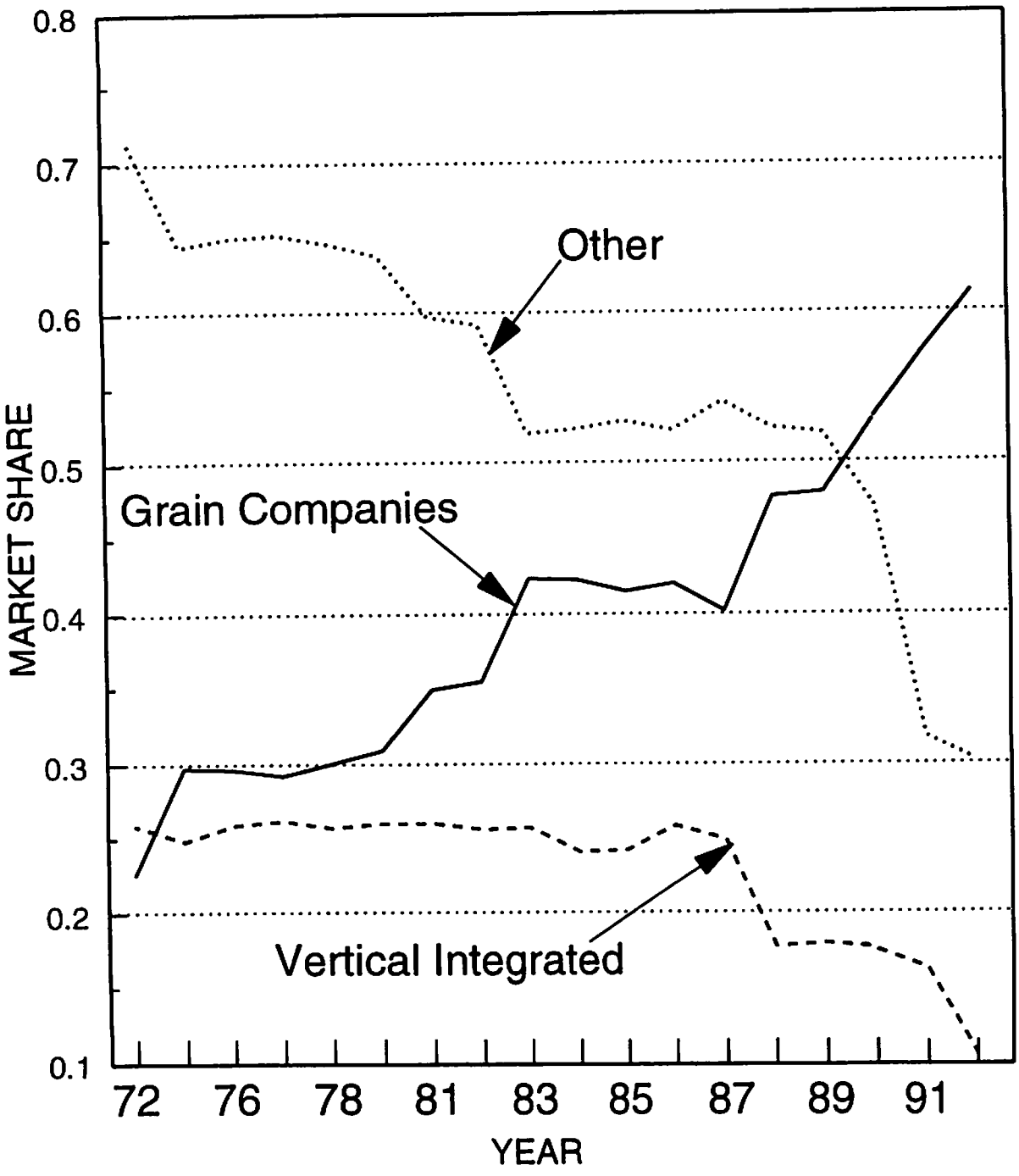


Figure 2. Market Share for Grain Companies and Vertical Integrated Firms: United States

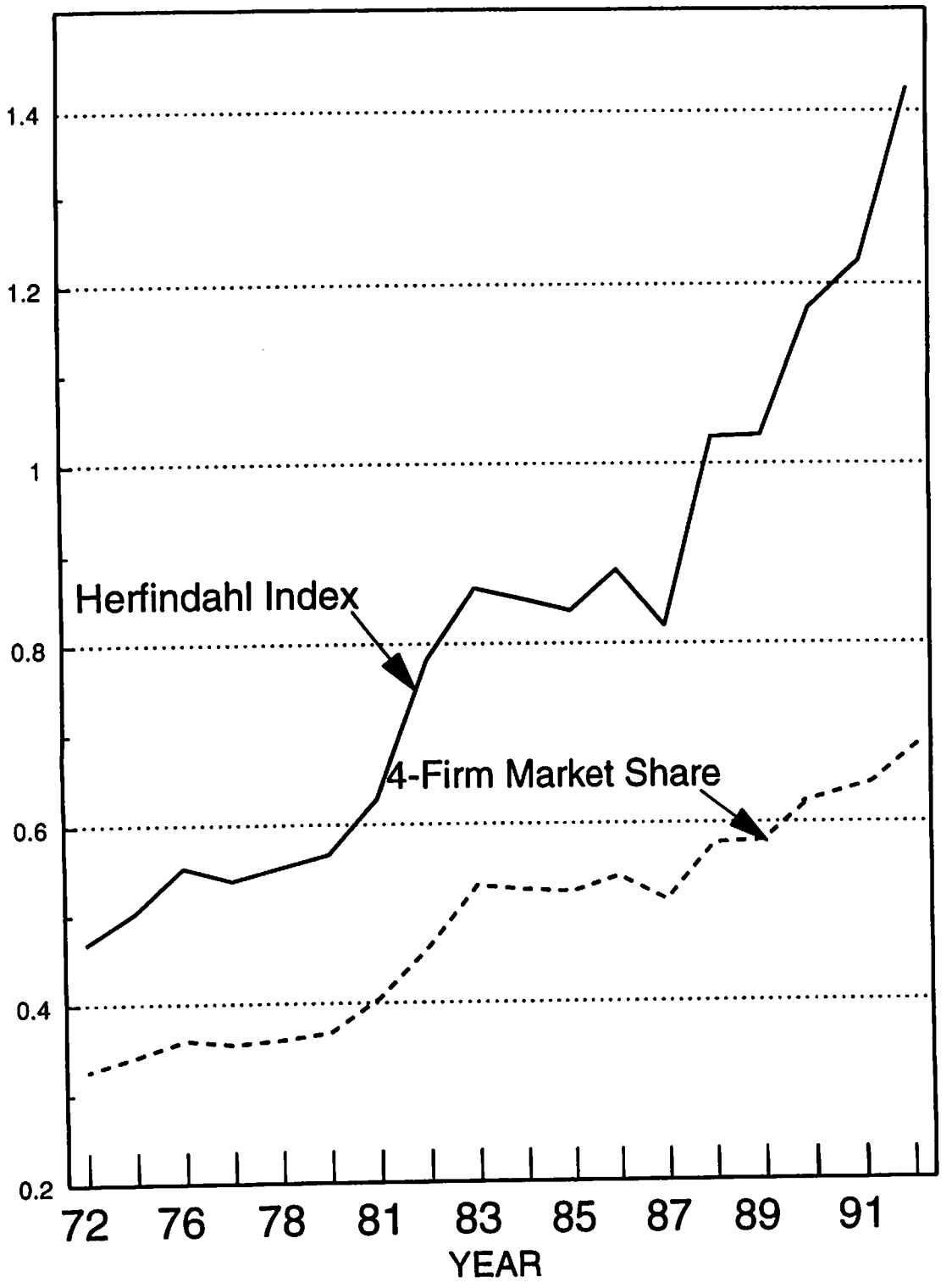
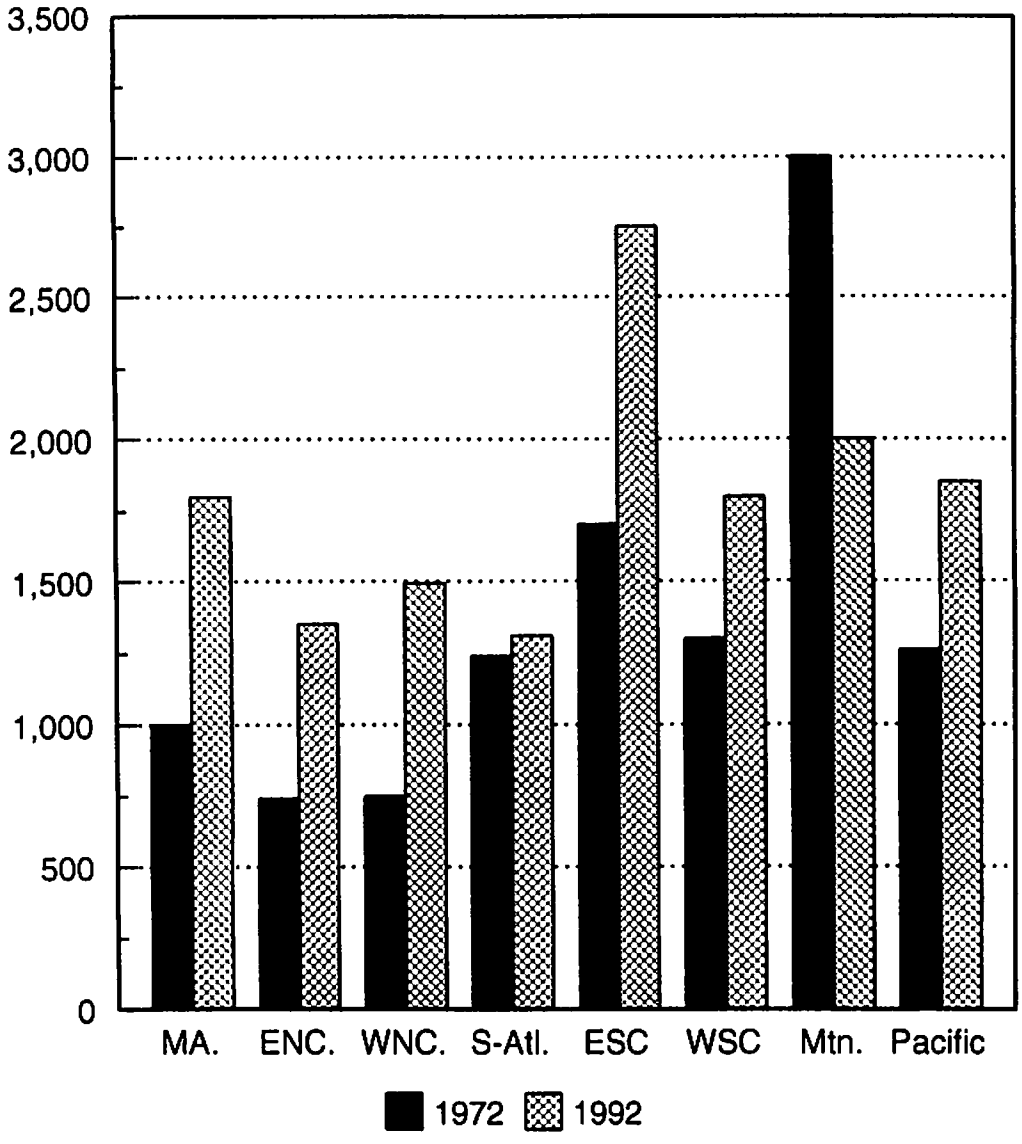


Figure 3. United States Flour Milling 4-Firm Market Share and Herfindahl Index.



MA. Middle Atlantic States: NY, PA, NJ
ENC. East North Central: OH, IN, IL, MI, WI
WNC. West North Central: ND, SD, NE, KS, MN, IA, MO
S-Alt. South Atlantic: DE, MD, WV, VA, NC, SC, GA, FL
ESC. East South Central: KY, TN, AL, MS
WSC. West South Central: OK, AR, LA, TX
Mtn. Mountain: MT, WY, CO, NM, ID, UT, AZ, NV
Pacific. Pacific States: WA, OR, CA, AK, HI

Figure 4. Herfindahl Index for United States Flour Milling Industry, by Census Bureau Regions for 1972 and 1992.

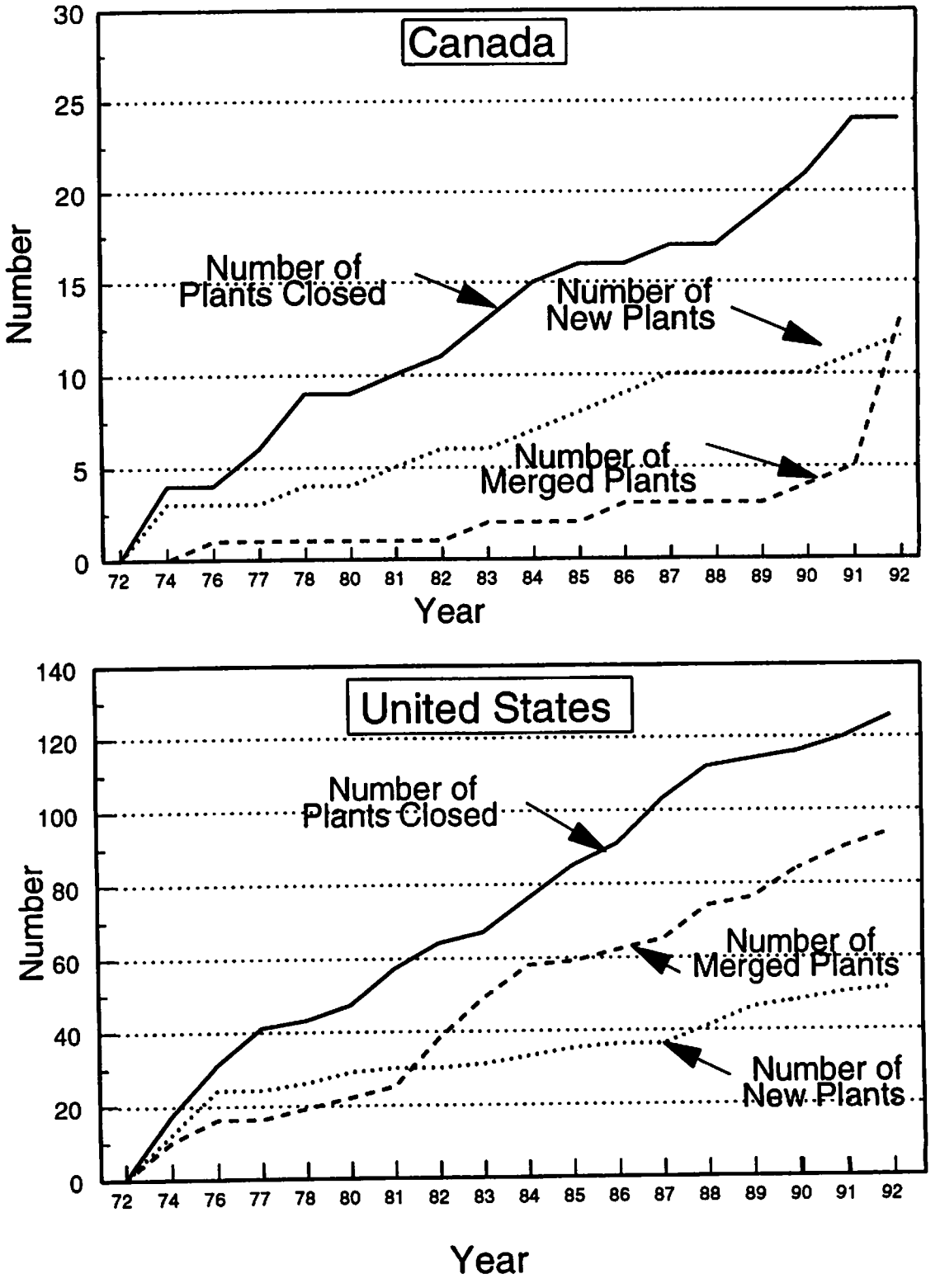


Figure 5. Number of Flour Milling Plants Closed, Merged, and Opened for Canada and United States.

Important differences in the Canadian industry are highlighted. Most important is that the Canadian flour milling industry is more concentrated. The largest three firms have controlled about 75% of the capacity since the late 1970s. The industry operates at about 70% of capacity. For a U.S. milling firm to be integrated into baking would be rare, for Canadian milling firms often are integrated into baking. In fact, in some regions of Canada, milling firms[5] own and operate a large proportion of the baking capacity.

The cumulative rate of entry, exit, and merger/acquisitions are shown in Figure 5 for the United States and Canada.[6] More detailed information about the characteristics of these are shown in Table 2. For comparison, characteristics are also shown for "other" (i.e., those that did not close, exit, or merge). These results suggest several observations. First, in both countries, those that exited were abnormally small for plant and firm capacity and had small market shares, regionally and nationally. Second, in the United States, existing multi-plant firms typically built new plants. However, capacity of these firms was not even close to average for the industry.

Another observation is that "grain" firms were the acquiring firms in 60% of the U.S. mergers. The average acquired plant capacity in the United States was nearly double the industry average; and in Canada, this exceeded the industry average. These suggest that smaller, inefficient plants exited rather than having been acquired. Those plants and firms that were acquired were larger. The capacity and number of plants the acquiring firm operated were about double that of the acquired firm. The acquiring firm's market share was substantially greater than that of the acquired firm in the United States and 5 times greater in Canada.

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[5]This is well known, however, the extent that firms are integrated forward into baking (or baking backward into milling) is very difficult to document.

[6]A companion paper (Wilson and Wilson) developed a multinomial model of entry, exit, and acquisition decisions in the U.S. flour milling industry. Results of that study indicate that a number of factors are important in this evolution. One of these is the high probability of exit, or being acquired for smaller plants. The probability of acquiring another plant increases with the acquiring firm's market share. In addition, the probability of being acquired increases with the growth rate of the acquired firm's market share. This is contrary to other research, and suggests that to be acquired, the firm must have demonstrated some success. In general, multi-plant economies did not seem to be an important motive for merging nor did growth in industry output or market power. Capacity use had an important positive influence on firms' entering regions with new plants. Real milling margins have declined through time, which has reduced the rate of new entrants.

Table 2. Plant Characteristics: Exited, New, and Merged (1972-1990)

Characteristics	United States					
	Exited	New	Others	Acquired Plants	Acquiring Firms	Acquired Firms
Number	112	40	--	80	--	--
Average plant capacity (cwt/day)	1,308	2,764	4,662	7,174	--	--
Percent						
Grain Firms	5	13	19	61		
Vertically integrated	4	0	10	8		
Firms						
Capacity	12,383	22,074	42,011		111,657	49,195
Number of mills	2.4	3.4	5.3		13	5
Market share (CBR)	3	6	6		22	17
Market share (U.S.)	1	2	3		10	4

Characteristics	Canada					
	Exited	New	Plants	Acquired Other	Acquiring Firms	Acquired Firms
Number	20	10	--	4	--	--
Average plant capacity (cwt/day)	2,715	4,202	5,697	6,975	--	--
Percent						
Grain Firms	--	--	--	--		
Vertically integrated	--	--	--	--		
Firms						
Capacity	16,580	10,737	22,160		39,595	6,975
Number of mills	2.8	1.8	2.9		5.5	1
Market share (CBR)	--	---	--		25	3
Market share (U.S.)	11	7	12		20	6.5

The correlation coefficients between acquiring and acquired firm characteristics in the United States are shown in Table 3.[7] The fact that all are positive suggests that firms in a merger have similar characteristics. This would refute the notion that large firms necessarily buy out small firms, however measured. The correlation between market shares of the two firms in the merger are among the highest. The fact that the market share correlation within the Census Bureau Regions (CBR) exceeds that measured in the United States suggests that mergers were made to increase market share within a region.

Table 3. Correlation of Acquired and Acquiring Firm Characteristics: United States (N=80)

		Acquiring Firms			
		Number of Plants	Capacity	Market Share (U.S.)	Market Share (CBR)
Acquired Firms	Number	.18	.20	.16	.36*
	Capacity	.28*	.30*	.27*	.40*
	Mkt Share (U.S.)	.23*	.25*	.24*	.40*
	Mkt Share (CBR)	.12*	.12	.13	.81*

*Indicates significant at the 10% level.

Free Trade Agreements and Flour Milling

The United States and Canada have been operating under a free trade agreement (CUSTA) since 1989, and the NAFTA is being negotiated. Both of these could have important impacts on the structure of the North American flour milling industry.

U.S./Canada Free Trade Agreement At the time of the agreement in 1989, trade in the wheat value chain was regulated as follows: wheat and flour sales to Canada required import licenses from the Canadian Wheat Board (CWB) and were generally restrictive. Wheat-base, value-added product shipments from the United States to Canada had tariffs, ranging from 0 to 10%. Wheat and flour shipments from Canada to the United States were subjected to tariffs, which would be reduced because of CUSTA, but benefitted from subsidized rail shipments to eastern markets.

[7]Due to the low number of mergers in Canada, these were not calculated.

Tariffs also were imposed on cereals and bakery mixes and all other products free of tariffs.

Before CUSTA, a two-price system operated in Canada, raising prices Canadian mills paid relative to third country sales. However, wheat prices were fixed, and all mills paid the same price with adjustments for transportation. Thus, mills and bakers were not able to or did not have to compete on procurement strategies. In anticipation of freer trade, the two-priced system was replaced in 1989 with what was to be defined as a North American price, based on cash prices at the Minneapolis Grain Exchange.

Now mills and other end-users are not treated identically throughout year. They must compete, to some extent, on pricing and procurement. The combination of these events set in motion a series of events, leading to major structural changes in North American milling.

North American Free Trade Agreement Though still under negotiation, the terms of this agreement are apparent. In anticipation of the incompatibility of the Mexican procurement regime under NAFTA, major changes already have been adopted. Conasupo was the import agency, in part to protect a system of domestic prices that exceeded U.S. and world values. Mills were restricted to purchase all the Mexican wheat crop through an agreement called "Concurrence" at the higher domestic prices. Since this had to occur before importing wheat, storage and financing costs were inflated, and quality was highly uncertain. Bread prices were regulated, and flour was an administered function of the wheat and bread markets.

Conasupo made imports on account of the industry and sold to the industry at a predetermined price structure. Flour imports were unrestricted but were subject to a 15% tariff. Other products either had 10% or 15% tariffs. From a competitive perspective, 1) firms were treated equally in procurement, a crucial area of competition; and 2) product imports were increasingly becoming favored relative to local processing. In fact, during the late 1980s flour and product shipments from the United States to Mexico grew rapidly (Krause, Wilson, and Dooley).

The principal features of the proposed NAFTA regarding the milling sector is that a tariff (15%) would replace wheat import licenses (and, therefore, Conasupo).[8] That tariff and those on all wheat value-added products would be reduced over a 10-year period (generally). Domestic wheat production is expected to fall because of reduced prices.

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[8]Private sector purchases already have replaced functions of Conasupo. However, a newly created agency, Aserca, which is intended to intervene during the transition period until NAFTA is ratified has absorbed some of these functions.

Competitive Issues and Recent Structural Changes

The combined impact of these changes along with changes otherwise occurring in these industries set in motion a series of strategic changes that are redefining the North American flour industry. The apparent strategies of principal firms in each country are discussed below.

Canada Concurrent with negotiation of the CUSTA, a merger was proposed between Ogilvie and Maple Leaf Mills, the largest milling firms in Canada to increase scale and reduce costs and to be defensive against potential entry of U.S. firms. However, the government of Canada rejected the merger largely on antitrust grounds. The major issue was the appropriate geographic scope of competition for antitrust purposes. Almost immediately, a series of structural changes were announced, including ADM acquisition of Weston Soo Line Mills in September, 1990, and Ogilvie in May, 1992; and Maple Leaf Mills and ConAgra announced a venture to jointly operate their eastern mills in June, 1992. The result of these cumulative changes was for an increase in H in a newly defined region encompassing Eastern Canada and the contiguous U.S. regions from less than 1,000 in 1989 to over 1,200 in 1992 (Figure 6).

United States Pillsbury was the largest milling firm in the early 1970s, however, following its acquisition by Grand Met, it began divesting from this industry (and apparently all other commodity type industries). Cargill bought four Pillsbury mills for $100 million in June, 1991, and ADM entered a joint venture and assumed management of the other four other Pillsbury mills ($68.5 million) in March, 1992.

These structural changes reveal some of the firm's strategies. First, this industry has become an industry that commodity companies dominate, a trend that began in the late 1970s. These firms have limited potential to integrate forward, which would result in their competing against their customers. Most firms in this industry are now integrated backward, thereby raising entry costs for potential new entrants. This is especially true if, as a result of integration, the firms can improve their logistical efficiency and quality control.

Second, because of these acquisitions and new ventures, firms are competing to dominate particular regions, causing the higher values of H in a number of regions (Figure 7). Cargill dominates California (Figure 7), ADM the midwest and Pacific North West, and ConAgra the East.

All U.S. firms are trying to penetrate the Mexican market because of the excess capacity that exists in the south central part of the United States. Sustainability of

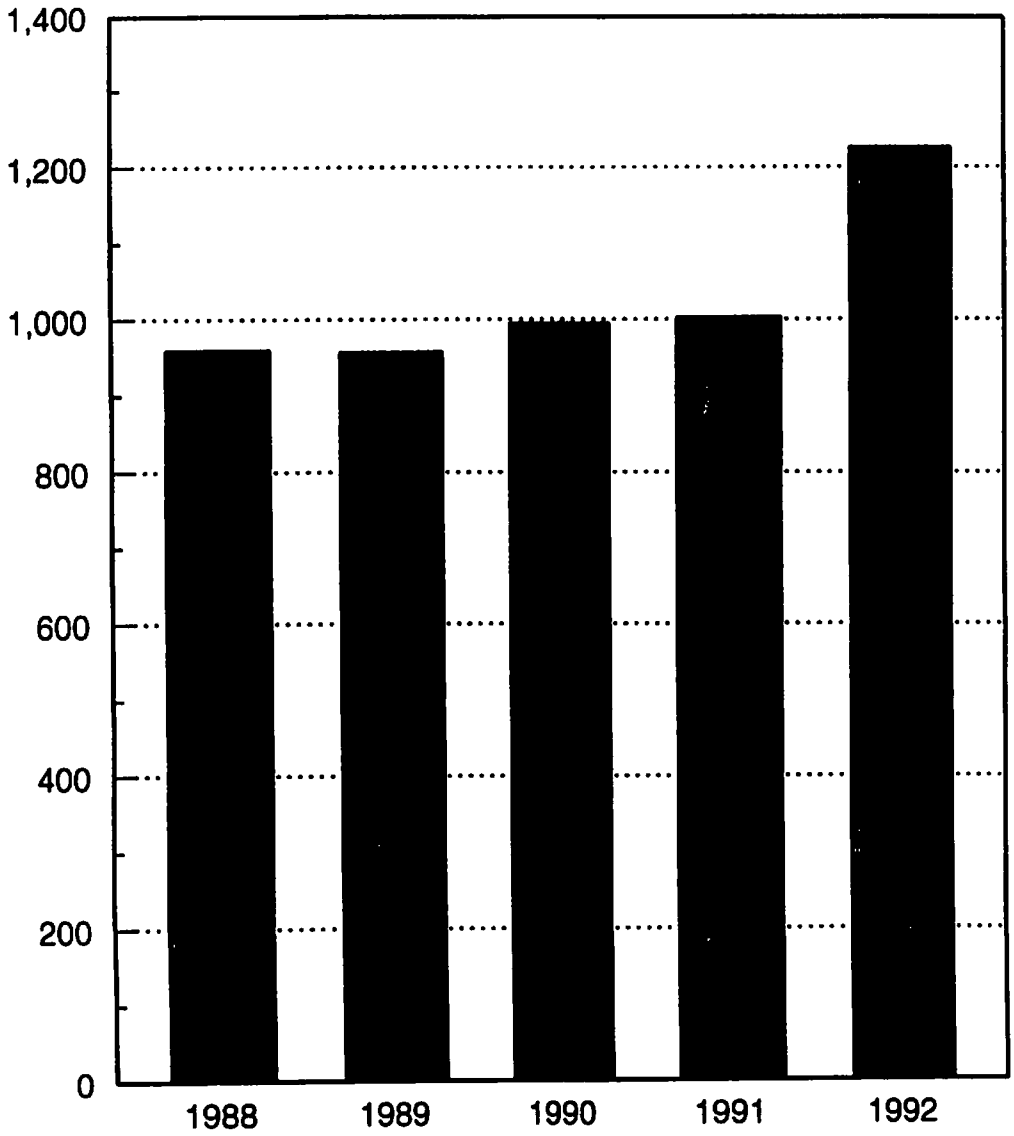

Figure 6. Herfindahl Index for the North American Flour Milling Industry: Provinces of Quebec and Ontario, Canada and the New England and Middle Atlantic Census Bureau Regions, United States

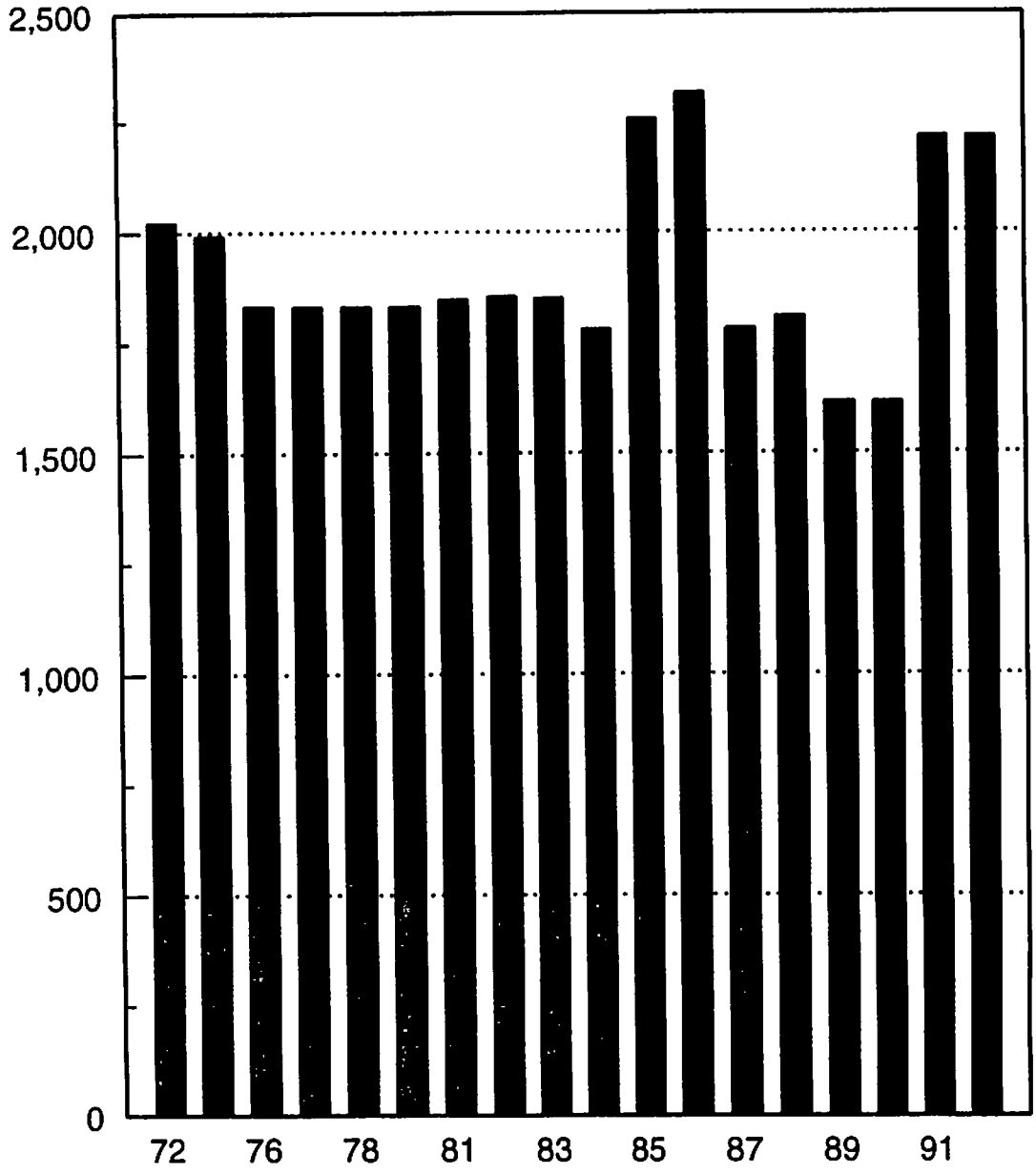

Figure 7. Herfindahl Index for California Flour Milling Industry

this strategy, however, ultimately depends on whether railroads promote long hauls of flour or wheat shipments. Long haul wheat shipment has been the longer term trend elsewhere in North America.

Mexico The largest bakery and milling company in Mexico is Bimbo, which controls a large percentage of the bakery market. Bimbo has expanded and entered into joint ventures with Keebler and Sara Lee, in both cases, to distribute (Keebler and Sara Lee) products. They have built a new state-of-the-art mill to serve the Mexico City market and acquired one in Veracruz for imported wheat. Thus, both backward and forward vertical integration are important elements of longer term strategies in Mexico. This gives a disadvantage to U.S. mills, trying to penetrate into these markets.

An important component of Mexican firm strategies is its technology. The Mexican milling industry is relatively antiquated and underused with low levels of productivity (see Table 4). They have not adopted computerized control systems, quality control, or other technical improvements which have been adopted elsewhere in North America.

Mexican mill strategies are likely as follows. First, improve milling and logistical efficiency for wheat imports and product distribution. Firms will undoubtedly have to improve productivity or else be disadvantaged relative to U.S. mills with excess capacity seeking to expand flour exports.[9] Besides the potential logistical advantage of wheat imports, being able to procure wheat from multiple sources is a strategic advantage. However, wheat production practices in Mexico vary in quality, mills are having to implement elaborate quality control processes to compete with imported flour.

Table 4. Productivity Comparisons in Milling Industries Between Mexico and the United States

	Mexico	United States
Capacity Utilization	58%	85%
Average Size	40,000 mt/year	90,000 mt/year
Labor Productivity	375 mt/year	900 mt/year

[9]For reference, the idle capacity in the United States is sufficient to serve 80% of the Mexican market.

Conclusions

A pervasive theme throughout the agricultural marketing industries is that of consolidation. A combination of firms exiting and mergers and acquisitions explain this. Understanding this dynamic evolution of industry structure is important for understanding forces that impact competition in these industries. This paper describes the dynamic evolution of the wheat flour milling industry.

The flour milling industries evolved independently in the United States, Canada, and Mexico. Policies, regulations, and the competitive structure of the vertical market system differed drastically across these countries. Exports between countries have been virtually nil, and plants generally ship within their national boundaries without being impacted directly by developments in the contiguous country. However, features of the CUSTA and NAFTA are having important impacts of the structure of the industry.

This industry has four important strategic and structural observations. First, although the number of firms and plants have decreased, plant and firm capacity has increased. The number of multi-plant firms and firms in the "Grain" strategic group also have increased. Second, the geographic boundaries among these firms are becoming blurred. However, each is gaining dominance in particular regions. Third, procurement is becoming a major element of strategy for both Canadian and Mexican mills, an area previously protected because of their agricultural policies. Finally, the extent of integration varies in the three countries: U.S. firms largely integrated backward and which Canadian and Mexican firms integrated forward.

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