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Research Paper

Measuring industry concentration in Canada's food processing sectors

1990-2001

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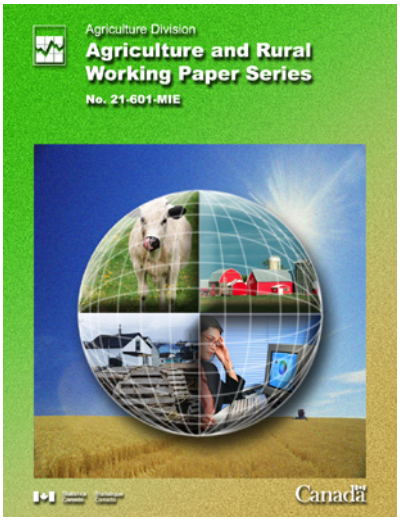

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Note of appreciation: Canada owes the success of its statistical system to a longstanding partnership between Statistics Canada and the citizens, businesses and governments of Canada. Accurate and timely statistical information could not be produced without their continued cooperation and good will.

A paper submitted to Agriculture and Agri-food Canada

I Introduction

A number of recent mergers and acquisitions have raised concerns that the Canadian food-processing sector is becoming more concentrated. To the extent that increased concentration leads to increased market power, or the ability to price profitability above competitive levels, the degree of concentration is a potential public policy problem. There are currently no up-to-date concentration measures for manufacturing industries in Canada.[1] The objective of this study is to provide concentration measures that are up-to-date, more accurately reflect the market within which the price is determined, and use the current industrial classification system.

In 1997 the Standard Industrial Classification (SIC) system was replaced by a new industrial classification system for North America, the North American Industrial Classification System (NAICS). It is appropriate that attempts to measure concentration be based on this new classification system. Regional integration and trade liberalization raise questions of whether a national based concentration measures reflect a relevant market when firms adjust to compete in the North American market. This aspect should also be addressed in this study by adjusting the resulting concentration measures by trade flows to obtain a proxy for the true measure of concentration when the relevant market exceeds the boundaries of Canada's borders.

Since these calculations are very preliminary and there are problems with both the data set and the adjustment to the new classification system, the emphasis of the report will be on reporting the problems encountered, the lessons learned from the exercise, and the strengths and weakness of the available data. Alternative sources of data are considered.

The second section of the report discusses methods to define a relevant market within which to measure concentration. The third section describes alternative measures of concentration and the strengths and weaknesses of each. The fourth section describes the data that was used in this exercise. The fifth section describes the findings for the measurement of concentration for a selection of food processing sectors that align with the new NAICS codes and adjusts these measures for imports and exports. The sixth section describes the limitations associated with calculating the concentration measures in terms of the problems associated with the source data, problems associated with allocating firms to specific industries and problems with the trade data. The seventh section discusses the pros and cons of alternative data sets and possible uses of processing industry data in modeling industry behavior.

II Relevant markets

The appropriate definition of a relevant "market" is one aspect of formulating competition policy, and is a pre-requisite to the calculation of market shares. The approach used in the US Department of Justice *Merger Guidelines* and similar set of

Canadian *Merger Guidelines*[2] is to define the limit of a market as a break in the chain of substitutes by considering cross-price elasticities of demand and supply. These breaks can occur both geographically and across product lines. Demand-side substitution is the basic building block of market definition and is often the biggest constraint on pricing behavior. Geographic markets are defined by determining the location of firms that offer the same products. So the relevant question is "can customers turn to other suppliers"? Transportation costs are the most significant determining factor for geographic markets. The analysis of supply-side substitution explores a situation where there are firms producing products not currently perceived as demand-side substitutes, for the product in question, but which are produced using assets that could readily be reassigned to the production of the relevant product.

The product classifications applied by national statistical agencies rarely conform to the criteria that economists would apply nor do they comply with definitions of relevant markets defined by competition authorities. From a pragmatic perspective a national statistical agency cannot be expected to adjust its market definition on a case-by-case basis. Competition authorities have this luxury because of the confidential data necessary to try a case and make an accurate assessment of potential violations of competition laws. The most important practical step in order to not make mistakes in interpreting concentration measures is to recognize that pitfalls exist and that a one-dimensional indicator is only a rough and ready tool. A proper assessment of concentration uses the information contained in national concentration measures plus other information about the product in question.

Apart from inappropriate specification of product and geographic market boundaries another important consideration is foreign competition. Concentration measures can overstate the potential for market power by failing to take into account the impact of competition from foreign suppliers. A direct adjustment of a concentration measure involves reducing it by the share of imports. Domowitz, Hubbard and Peterson (1988) adjust a concentration ratio by (1 – imports/sales). The approach, taken in this study, employs a modified adjustment used by Dickson and He (1997) that defines a share of production, net of exports, as a proportion of Canadian demand [i.e. (Production – Exports) / (Production – Exports + Imports)]. This adjustment takes exports out of the picture and only considers domestic sales relative to total Canadian consumption including imports. Given a lack of data this adjustment cannot be employed on a firm-by-firm basis, but an industry average adjustment is applied to each firm's sales (see appendix). The adjustment may overcompensate because domestic firms may themselves import the product. Furthermore imports may be less than perfect substitutes for domestic production and the adjustment would overcompensate.

III Measures of concentration

Once the extent of the market has been defined, measures of concentration for the relevant market can be calculated. Industry concentration is typically measured as a function of the market shares of some or all of the firms in a market. Although the total number of firms affects the structure of the industry, the degree of industry inequality

also matters. A *concentration ratio* (CR) is a simple measure that addresses the inequality dimension, by stressing the relative position of the largest firms. This ratio shows the percentage of total sales that are contributed by the largest firms ranked by order of market share. For instance the CR4 measures the market share of the four largest firms, while the CR8 measures the market share of the eight largest firms. Concentration measures have traditionally been measured on the basis of sales, but employment, capacity, value added, or physical outputs have also been used to determine market shares. The concentration ratio is effective in showing the dominance of the top firms, but it does not address the rest of the market nor does it account for the influence of a single firm.

The Herfindahl index is equal to the sum of the squared market shares for all firms in the industry. A good measure of concentration should be inversely related to the number of firms and positively related to the magnitude of size inequalities. The Herfindahl index takes into account both the number of firms and their relative size.

Squaring the share gives a relatively larger weight for large firms than for small firms. For this reason the Herfindahl index is the preferred measure of concentration.[3] However because of problems with the data sources in this study, see below, CR4's are reported in the body of the text and Herfindahl indexes are relegated to an appendix.

IV Data sources

The calculation of the Herfindahl indexes and concentration ratios require sales by individual firms within the selected industry. Tax filer data from the Annual Survey of Financial Statements, Industrial Organization and Finance Division – Statistics Canada, were used to obtain firm level sales. A cautionary note about the Annual Survey of Financial Statements is in order. Prior to 1999 the Annual Survey of Financial Statements was a sample survey with sample sizes of roughly 30,000 – 40,000. The annual survey changed to a census in 1999 when Canada Customs Revenue Agency (CCRA) provided administrative electronic data files that allowed the entire population of more than 1 million enterprises to be tracked. The problems associated with the change in reporting methods are discussed in section VI.

It is necessary to aggregate the micro records into the various industry classifications. Six digit NAICS codes were used to identify firms that fit into each industry grouping (e.g. *bakery products processing and wholesaling*). The problem is that NAICS codes can only be identified back to 1998 and there was no direct way to classify firms for the period from 1990 to 97. Over this period SIC codes were used to identify firms that fit into each industry grouping. This required a system of translation or concordance between NAICS and SIC codes. The process of identifying firms industry grouping by matching NAICS and SIC codes was problematic and these problems are described in detail in section VI.

Trade data is used to adjust the concentration measures for the possible impacts on competition from imports and to take away the influence of exports. Industry Canada's

Strategis database, which provides imports, exports and manufacturing shipments by industry on the basis of NAICS codes, was used to adjust the concentration measures. As explained in Section VI, there were some challenges associated with using the *Strategis* data set in this way.

V Findings

Table 1 describes the CR4s, for a selection of food processing industries that correspond to six-digit NAICS codes, for the period 1993 to 2001. This time period should really be broken into two distinct periods. After 1998 the tax filer sales data was drawn from the entire population for each NAICS code, while prior to 1999 the data was drawn from a sample survey. The results are reported in CR4s because this measure is less sensitive to firm numbers than a Herfindahl index is. Comparisons across the two time periods are nonetheless tenuous because of the significant change in the market size. However, general trends are observable across time as long as the post-1998 structural break is recognized and not interpreted as a change in concentration.

In general the trade adjustment lowered all the concentration measures. This is illustrated graphically in Appendix 2. For supply-managed industries and other sectors where both imports and exports are essentially fixed, such as poultry processing, the adjustment is small and constant across time. The trade adjustment for concentration is largest for tea and coffee processing. However, this is not surprising as all of the raw inputs for this sector are imported, and an increase in imports of the final product should greatly reduce the ability of Canadian based firms to price independently of international markets.

Other sectors where the level of concentration is significantly reduced by the trade adjustment include *frozen foods* (which are primarily fruits and vegetables); *canning, drying and pickling* (solely fruits and vegetables); *sugar manufacturing*; and *rice milling and malt manufacturing*. Canned fruits and vegetables imports are approximately double the value of exports with both growing at the same rate. Although unadjusted concentration rates are declining over time the trade adjustment makes concentration relatively constant. Exports of *frozen foods* are primarily frozen French fries that are one of Canada's fastest growing agri-food exports. Exports are increasing so quickly that although unadjusted concentration is decreasing the trade adjustment reverses this trend. The pricing of these products follows international prices and domestic changes in concentration should not influence pricing considerations. The sugar-processing sector in Canada is highly concentrated. Although imports are growing, the wedge between adjusted and unadjusted concentration has remained relatively constant. This is an instance where many of the imports are made by the same firms, included in the concentration index, and the adjustment may be misleading. The wedge between adjusted and unadjusted concentration ratios for malt processing is constant.

Although data after 1998 should not be compared to earlier concentration measures, for some highly concentrated sectors where the sample would comprise most of the population, the change in data collection did not affect the overall results. Examples of

such sectors include *flour milling*, *breakfast cereals*, *sugar manufacturing*, *animal slaughter* and possibly *frozen food*.

Table 1: Concentration ratios (CR4s) for selected food processing sectors:

NAICS		1993	1994	1995	1996	1997	1998	1999	2000	2001
Flour milling	UA	0.963	0.915	0.936	0.902	0.915	0.856	0.812	0.806	0.781
	A	0.875	0.797	0.844	0.812	0.816	0.771	0.701	0.717	0.696
Malt	UA	0.998	0.998	0.998	0.908	0.914	1.000	0.882	0.848	0.844
	A	0.539	0.487	0.511	0.452	0.404	0.268	0.284	0.423	0.375
Oilseed	UA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	A	0.644	0.688	0.746	0.671	0.705	0.740	0.437	0.533	0.559
Breakfast cereal	UA	0.968	0.971	0.982	0.973	0.969	0.939	0.952	0.965	0.962
	A	0.890	0.876	0.902	0.882	0.866	0.803	0.733	0.730	0.688
Sugar	UA	0.995	0.989	1.000	0.996	0.995	0.998	0.991	0.971	0.983
	A	0.653	0.623	0.653	0.631	0.653	0.665	0.681	0.677	0.650
Frozen food	UA	0.999	0.996	0.995	0.947	0.948	0.860	0.770	0.766	0.779
	A	0.538	0.511	0.541	0.455	0.379	0.552	0.531	0.561	0.584
Canning, pickling and drying	UA	0.827	0.769	0.714	0.757	0.767	0.670	0.483	0.505	0.597
	A	0.523	0.314	0.364	0.346	0.336	0.325	0.333	0.343	0.445
Animal slaughter	UA	0.707	0.610	0.716	0.705	0.729	0.710	0.796	0.788	0.790
	A	NC	NC	NC	NC	NC	NC	NC	NC	NC
Meat processing from carcass	UA	0.551	0.514	0.504	0.491	0.498	0.498	0.251	0.206	0.225
	A	NC	NC	NC	NC	NC	NC	NC	NC	NC
Poultry processing	UA	0.652	0.636	0.785	0.797	0.770	0.745	0.610	0.601	0.616
	A	0.543	0.544	0.728	0.749	0.718	0.689	0.575	0.567	0.560
Coffee and tea	UA	0.975	0.957	0.972	0.981	1	1	0.791	0.797	0.793
	A	0.299	0.0391	0.288	0.349	0.363	0.267	0.341	0.404	0.401

Note: **UA** refers to concentration ratios that were **not** adjusted for trade.
A refers to concentration ratios that were adjusted for trade (see text).
NC this trade adjusted concentration ratio is not adjusted because appropriate trade data is not readily available.

VI Problems associated with the data and limitations of the study

With any empirical study problems arise with data collection and analysis. These problems can be general and specific to the study. In this case the general problems relate to attempts to classify firms to specific industries based on their primary activity. Most firms produce several products so it is necessary to determine the firm's primary activity and choose an arbitrary level of this activity to classify each firm within an industry. Just because a firm was classified to a particular industry does not mean that a significant amount of its non-primary production does not belong in another NAICS classification. So there will always be some misallocation of sales values.

The specific problems in this study are due to the nature of the source data, concordance between classification systems, and the available trade data. These problems are addressed in turn and we will attempt to describe these limitations and try to outline some of the implications they have on the measurement of concentration.

i) Problems with Source Data

The 1999 change in the method of collecting data for the Annual Survey of Financial Statements causes a number of problems. Moving from a survey to a complete census greatly increases the number of observations leading to a large increase in the number of firms and the total market size. Herfindahl indexes are sensitive to firm numbers since all firms are included in the calculation. One consolation is that with a survey the larger firms are included and omitting smaller firms does not necessarily cause a major problem when calculating CR4s. Even with calculating Herfindahl indexes the distortion caused by changing data sets may not be that serious since the larger firms are given relatively more weight than small firms.

We were not able to document the magnitude of the problem created by changing the scope of the data collection because of confidentiality restrictions. We are not even able to give specific examples of the change in the number of firms, in individual industries between 1998 and 1999.

An additional problem associated with the source data relates to different aggregation levels within NAICS. All the concentration measures were calculated at the 6-digit level. However, in some cases data was only available at the 5-digit level. This problem arose with meat processing. The 5-digit level *animal slaughtering and processing* sector disaggregates to 3 major 6-digit NAICS codes: *animal slaughter* (311611), *meat processing from carcass* (311614), and *poultry processing* (311615). The information provided by Statistics Canada included all the firms at the 5-digit level, but only provide a partial disaggregation to 6 digits. The only firms listed at the 6-digit level were those associated with *meat processing from carcass*. In order to get the remaining 6-digit categories the residual had to be allocated between *slaughter* and *poultry processing*. Each individual company had to be researched to find its primary activity. The Survey of Manufacturers (see below) greatly helped with this process.

ii) Problems with Concordance

Aside from the problems associated with the nature of the source data, the categorization of individual firms into industry groupings also proved to be a difficult task. The categorization process raised challenges for updating a complete set of historic concentration indexes based on the new NAICS classification system. The fundamental problem is that there is no simple concordance between the SIC classification system and NAICS.

Statistics Canada does not have one definitive method to derive a correspondence between SIC firms and NAICS firms. There is documentation and software that can provide information on the number of firms that went from a certain SIC classification to each NAICS code, but it does not identify the destination of any specific firm. There are several problems associated with this process. First the SIC data which we would like to match to NAICS is at the company level (SIC-C). However, the concordance provided by Statistics Canada is between NAICS and SIC codes at the establishment level (SIC-E). It is therefore necessary to map SIC-E to SIC-C.[4] The additional step creates uncertainties, adds complexity and put the usefulness of the concordance tables in doubt. Second, the allocation is based on a judgment of what the primary activity of each firm is and how it would match a NAICS category. However, the process is not transparent and documentation is not available so recreating the original concordance as outlined in the software is not practical. A great deal of effort was required to individually align firms according to their primary activity.

Some SIC-C codes aligned well with NAICS. For example, SIC *oilseed processing* (0133) aligned directly with NAICS *oilseed processing* (311224). Likewise SIC *cane and beet sugar processing* (0172) aligned directly with NAICS *sugar manufacturing* (311310). Unfortunately, these two cases were the exception to the rule. What was more common was that firms in a single SIC-C could be split into 3 NAICS codes. For example, the SIC category *flour, prepared flour mixes, and cereal Manufacturing* (0131) is split into *flour milling* (311211), *rice milling and malt manufacturing* (311214), and *breakfast cereal manufacturing* (311230) under NAICS.

iii) Problems with Trade Data

The trade data that are used to adjust industry sales should align with roughly the same industry categorization. Trade data are classified by the international *Harmonized Commodity Description and Coding System* (HS) with a system that tracks individual commodities as they cross the border regardless of the principal activity of the firm that produced them. Therefore it is necessary to develop a concordance between commodity trade flows and industry classifications. Statistics Canada associates the traded commodity's Harmonized System (HS) code with a NAICS code using internal concordances. However, a firm that falls within a given NAICS code possibly produce a good that was exported and classified under another NAICS code. An exact concordance is only possible when the firm’s principle activity matches with the product that is

produced and exported and assigned to a particular NAICS category. The implication is that market shares may be over adjusted.

Also, although Industry Canada provided trade data on a NAICS basis we were not able to obtain NAICS aligned trade data for *animal slaughter* and *meat processing from carcass*.

VII Overall assessment: Alternative data sets and application

This section has three main goals. First, it compares the merits of the data set used in this study with an alternative data set. Then, conclusions are drawn with respect to the accuracy of the concentration measures, and lessons learned from the process of deriving these measures are discussed. Finally, the usefulness of concentration indexes is assessed in the context of measuring market power in a food processing industry model.

i) Merits of alternative data sets

There are alternatives to using the Annual Survey of Financial Statements (ASFS) as a source of data to calculate concentration measures. The Annual Survey of Manufactures (ASM) (see http://www.statcan.ca/english/sdds/2103.htm for a description of this survey) could also be used for this purpose[5]. The ASM covers over 250 manufacturing industries with a target population of approximately 100,000 manufacturing establishments.

One advantage of the ASFS is that it involves actual records from tax filer data. After 1999 the ASFS is a complete census of financial statements prepared by incorporated businesses. In contrast, the ASM is a sample survey of all manufacturing firms making the quality of the information dependent on the quality of the data provided by the individual completing the questionnaire. The ASM estimates for the population are calculated by weighting the survey data. The survey collects data for all the large firms. Sampling is essentially confined to the small and medium sized firms with the probability of being in the sample increasing with firm size. The sampling strategy allows the ASM to capture all but a small percentage of the shipments in the industry, but it does not capture the number and individual sales of small firms. Prior to 1999, the ASFS was also a sample survey and as a result had many of the same limitations of the ASM.

Given that firms may produce goods that apply to several industries, allocation can be a problem. Although Statistics Canada provides software and instructions for concordance between SIC and NAICS data, the process is not completely transparent and will often create difficulties.

In comparison to the ASFS the ASM appears to offer a number of advantages. First, the ASM categorizes firms into the appropriate NAICS. Both data sets have sufficient information to calculate concentration ratios. The *Manufacturing, Construction and Energy* Division is responsible for the compilation and dissemination of the ASM, and

this should provide some comfort as this Division was responsible for calculating Statistics Canada's concentration measures in the past.

Another advantage of the ASM is that most of the data required to model industry behavior is available through this survey. Furthermore, recent additions to the survey such as destinations of shipments can prove useful. Finally, because both the ASM and Industry Canada's trade data are NAICS based, problems associated with adjusting concentration measures for trade are minimized.

ii) Conclusions and lessons learned

In general, the trade adjustment showed a reduction in industry concentration in all sectors examined. Naturally, the spread between the two concentration measures varied according to size of relative imports and exports. These results should be used with caution because of the various problems encountered with the data and the process of deriving the concentration measures.

Although the concentration measures may not be as accurate as desired, the true value of this study comes in the process of obtaining the concentration measures and discovering the limitations of the data.

iii) Use of concentration measures and extensions

Aside from the question of how concentration indices should be measured, the ways in which these measures can be used is important to note. The classical Structure-Conduct-Performance (S-C-P) approach to industrial organization argues that higher concentration leads to increased market power, which in turn affects the performance of the industry. But, on its own the concentration index does not say much other than potentially providing information that can contribute to industry profiles. Practitioners of S-C-P measured the relationship between profitability and concentration indexes to test their theories of one-way causation between concentration and the exploitation of market power. This view of industrial performance is somewhat controversial and economists have developed models in which there are substantial feedback effects between structure, conduct and performance. Approaches like the "new empirical industrial organization" blend microeconomic theory with models of imperfect competition to develop models featuring an explicit cost structure for the industry and behavioral equations that explain pricing.

This approach to measuring market power estimates demand equations for the final product, a cost function for the production structure of the industry – from which input demands are derived and estimated jointly and a behavioral pricing equation (Lerner Index) which combines estimated marginal cost, concentration measures, and other structural variables relevant to pricing decisions. The information for the cost function would require: wage and employment levels; quantity of materials and an appropriate price index; a measure of capital stock or capital services and rental rate for capital; and the quantity of fuel and electricity and an appropriate price index. The quantity of final

production and output price would also be required. The quantity of output could be obtained from the value of shipments if a measure of price is available.

Much of this information is available from the ASM (value of shipments, total operating revenue, total purchases of raw materials, total purchases of energy, gross salaries, and number employees). Although most of the information from the ASM is in expenditure form, careful choice of price indices will allow the quantity measures to be determined. The ASM has the advantage that the information is already allocated to NAICS industries. In addition the ASM provides the first destination of shipments including inter-provincial flows and shipments to the US, Europe, Mexico and Asia Pacific.

The ASFS could also provide a good deal (but not all) of the information necessary to estimate cost functions and input demands for the major food processing industries. The information provided would include sales of goods and services, salaries wages, and employee benefits, and capital assets net. However, the ASFS does not have cost of materials and supplies or capital expenditures net for the period over which NAICS was used. There is an added problem of allocating individual tax filer records to NAICS industry groups.

Appendix 1

Procedure for finding concentration ratios.

1. Concordance of data
   The data from 1990 – 1997 was separated into SIC-C codes (01) and from 1998 and on is separated according to NAICS codes (31).

   A detailed description of this is in the data section of the paper.

2. Determine Market value
   Using tax filer data, total sales from all firms in the 6-digit NAICS codes were summed to find the market value before trade.

3. Find Market Share
   Divide the firm's sales by market value.

4. Find Concentrations
   As described before the CR4 and CR8 are just the sum of the market shares of the top 4 and 8 firms, respectively.

   The Herfindahl squares the market shares of all the firms and sums those.

Finding trade adjusted concentration:

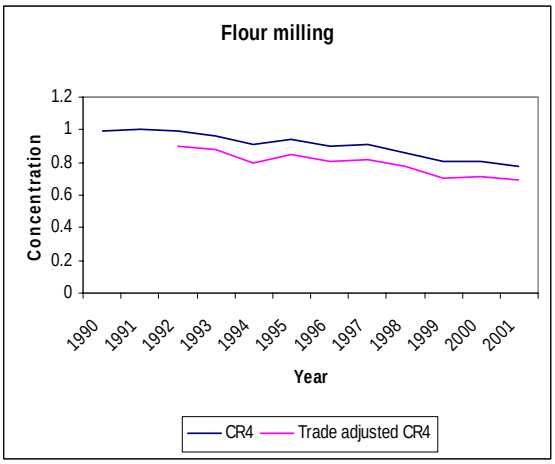
5. Adjust market value
   Using data from Strategis (http://strategis.gc.ca/sc_mrkti/tdst/engdoc/tr_ind.html), which is reported by NAICS code to 1992, reduce the original market value by the amount of exports and add the imports.

6. Find Export intensity
   Since there is not data at the firm level of exports a sector wide export intensity is used. Divide the export amount by the original market value will give a sector market intensity, a percentage of production which goes to export.

7. Adjust Market Share
   Impose the assumption of equal export intensity across all firms. Find the new market share by subtracting assumed exports from the sales value divided by the new trade adjusted market value.

8. Find Trade Adjusted Concentration
   With new market shares you can use the same procedure as before in finding the concentrations.

Appendix 2


Flour milling
Concentration
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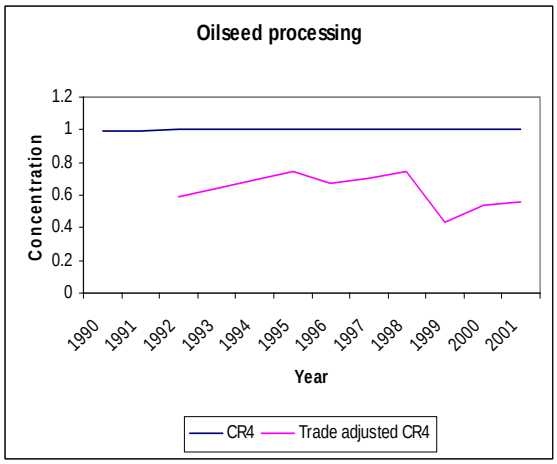
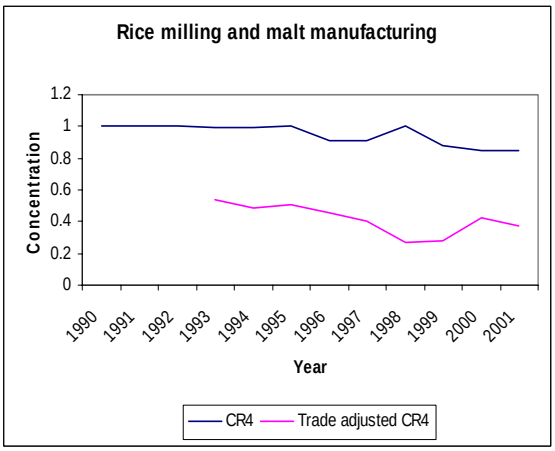
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4
Trade adjusted CR4


Oilseed processing
Concentration
1.2
1
0.8
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4
Trade adjusted CR4


Rice milling and malt manufacturing
Concentration
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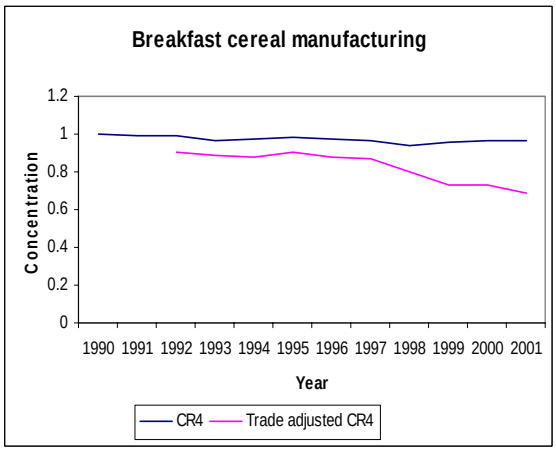
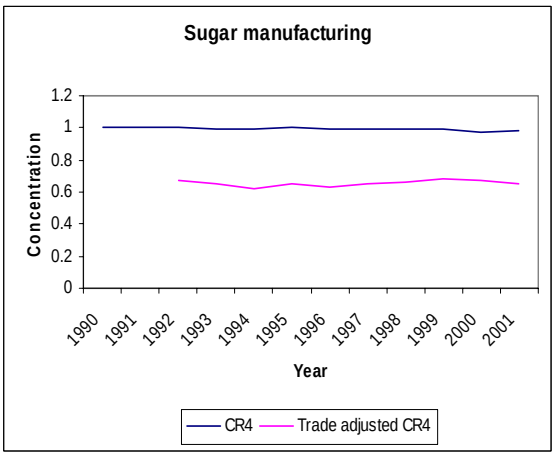
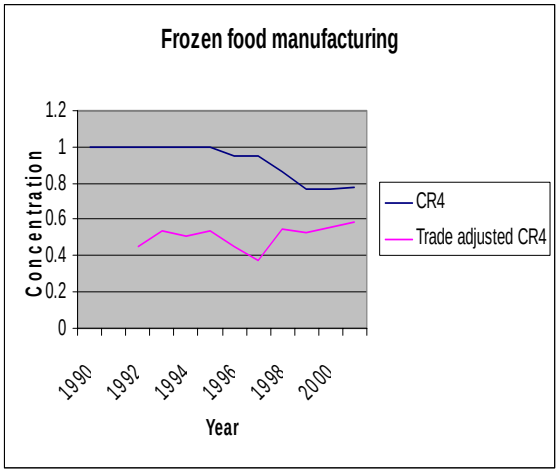
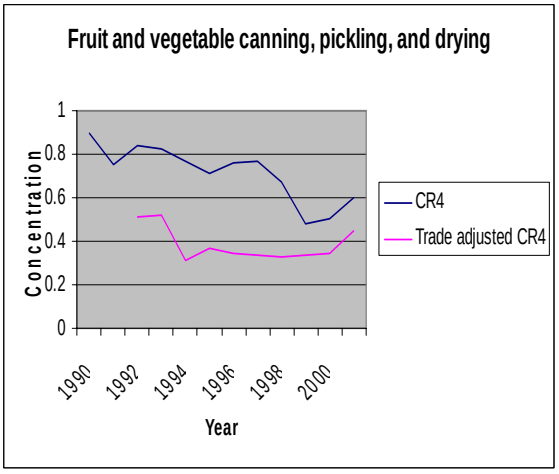
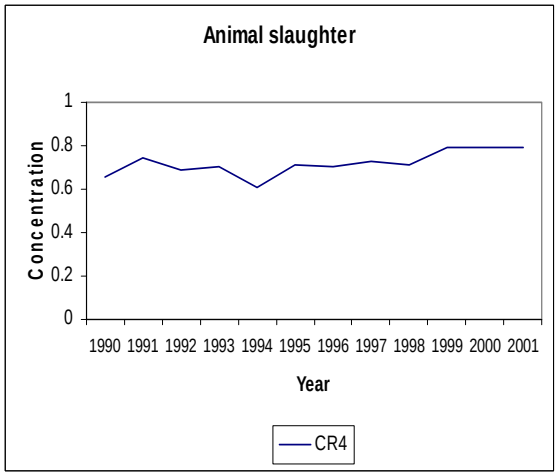
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4
Trade adjusted CR4

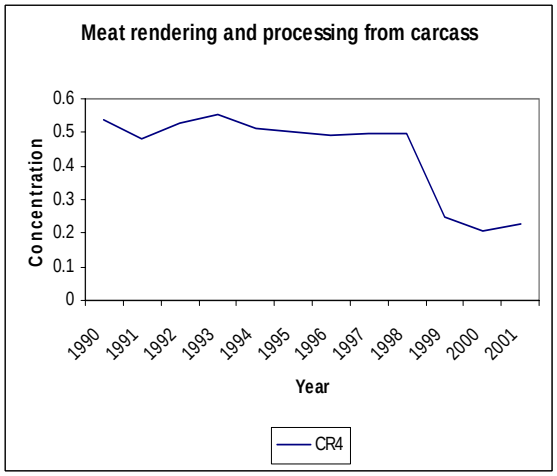

Breakfast cereal manufacturing
Concentration
1.2
1
0.8
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4
Trade adjusted CR4

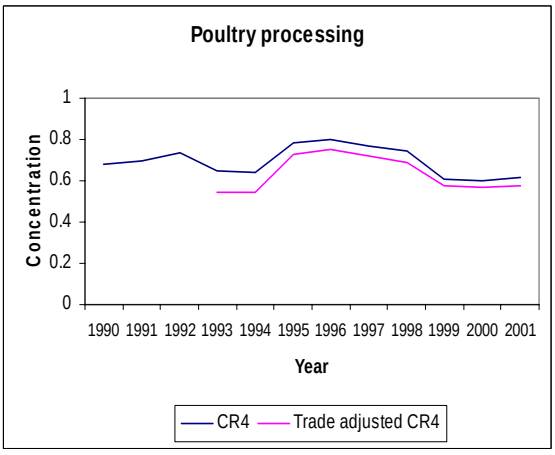

Sugar manufacturing
Concentration
1.2
1
0.8
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4
Trade adjusted CR4


Frozen food manufacturing
Concentration
1.2
1
0.8
0.6
0.4
0.2
0
1990
1992
1994
1996
1998
2000
Year
CR4
Trade adjusted CR4


Fruit and vegetable canning, pickling, and drying
Concentration
1
0.8
0.6
0.4
0.2
0
1990
1992
1994
1996
1998
2000
Year
CR4
Trade adjusted CR4


Animal slaughter
Concentration
1
0.8
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4


Meat rendering and processing from carcass
Concentration
0.6
0.5
0.4
0.3
0.2
0.1
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year
CR4


Poultry processing
Concentration
1
0.8
0.6
0.4
0.2
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
CR4
Trade adjusted CR4

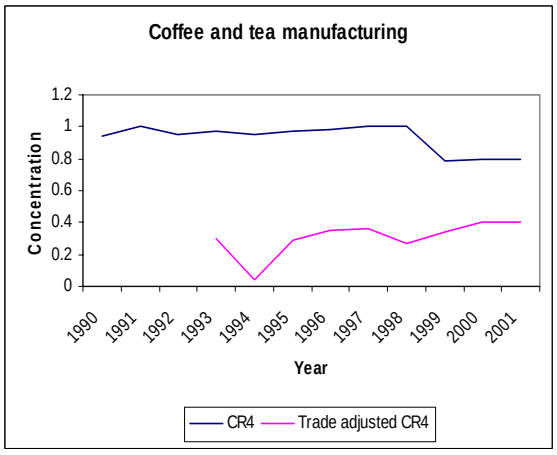

Coffee and tea manufacturing
Concentration
1.2
1
0.8
0.6
0.4
0.2
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year
CR4
Trade adjusted CR4

Table 2: Herfindahl indexes for selected food processing sectors:

NAICS		1993	1994	1995	1996	1997	1998	1999	2000	2001
Flour Milling	UA	0.517	0.413	0.482	0.376	0.383	0.341	0.481	0.351	0.327
	A	0.426	0.313	0.392	0.305	0.305	0.277	0.359	0.278	0.260
Malt	UA	0.516	0.526	0.522	0.332	0.321	0.552	0.376	0.301	0.306
	A	0.151	0.125	0.137	0.082	0.063	0.040	0.039	0.075	0.060
Oilseed	UA	0.782	0.784	0.816	0.489	0.492	0.411	0.934	0.973	0.967
	A	0.325	0.371	0.454	0.220	0.245	0.225	0.459	0.279	0.306
Breakfast cereal	UA	0.311	0.317	0.323	0.316	0.285	0.276	0.440	0.433	0.419
	A	0.263	0.258	0.273	0.260	0.227	0.202	0.260	0.247	0.215
Sugar	UA	0.327	0.322	0.338	0.338	0.355	0.360	0.359	0.348	0.358
	A	0.141	0.128	0.144	0.135	0.153	0.160	0.169	0.169	0.156
Frozen Food	UA	0.437	0.489	0.441	0.432	0.425	0.588	0.384	0.369	0.339
	A	0.126	0.128	0.130	0.099	0.068	0.242	0.183	0.198	0.190
Canning, pickling and drying	UA	0.232	0.282	0.191	0.220	0.235	0.184	0.083	0.089	0.113
	A	0.093	0.047	0.050	0.046	0.045	0.043	0.040	0.041	0.062
Animal Slaughter	UA	0.219	0.126	0.229	0.230	0.293	0.257	0.204	0.204	0.196
	A									
Meat Processing from Carcass	UA	0.127	0.094	0.088	0.084	0.087	0.088	0.024	0.021	0.024
	A									
Poultry Processing	UA	0.153	0.160	0.295	0.314	0.284	0.254	0.164	0.165	0.185
	A	0.107	0.117	0.254	0.277	0.246	0.218	0.146	0.147	0.164
Coffee and Tea	UA	0.287	0.413	0.372	0.388	0.432	0.468	0.265	0.272	0.275
	A	0.027	0.001	0.033	0.049	0.057	0.033	0.049	0.070	0.070

Note: **UA** refers to concentration ratios that were **not** adjusted for trade.
A refers to concentration ratios that were adjusted for trade (see text).

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1.Until relatively recently Statistics Canada measured concentration (CR4s and Henfindahl indexes) based on national data for industries that were defined by the Standard Industrial Classification at the 4-digit level.

2. Douglas West (1994 p.p. 101- 102) describes the principle market definition criterion for Canadian *Merger Enforcement Guidelines.*

3. The Herfindahl index meets a list of seven axioms that are considered desirable properties of any concentration index (see Curry and George). Although a Herfindahl index meets these properties a number of other statistical inequality measures are available. The entropy index (sum of market shares where each share is multiplied by the log (base 2) of its reciprocal) is closely related to the Herfindahl index and also meets these desirable properties and plus facilitates a statistical decomposition. The Gini coefficient that is a numerical measure of a Lorenz curve is primarily concerned with inequality by measuring the departure from perfect equality. One limitation of a Gini coefficient is that with a small number of equal sized firms it would imply perfect equality even though this small number of firms could exercise market power. For the purposes of this study the Herfindahl index is satisfactory.

4. SIC-E relates to establishments (e.g. specific plants), while SIC-C refers to a system for classifying companies and enterprises according to the activity(ies) in which they are engaged. A company or enterprise can be made up of several establishments.

5. One problem with the ASM is that in the tight financial times of the 1990's budget constraints at Statistics Canada, directly affected the breadth of the survey. Nonetheless the survey was continued over this period. During this time period the major players, in each industry were still surveyed, while smaller firms were not required to complete a survey. Recently the content of the survey has been improved and its scope expanded.

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