



# **A Comparative Analysis of Productivity in Agri-food and Other Industries in Canada**

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Larry Martin and Kate Stiefelmeyer<sup>1</sup>

## Executive Summary

The food industry seems to be perceived by some in the capital markets and government as being a weak performer. As a result, some people question its competitiveness relative to other sectors in attracting capital and labour.

This study was undertaken in part to determine whether this perception is true. It has three parts. The first re-examines the definition of competitiveness and maintains one developed by the Agri-food Competitiveness Council in 1990. It states:

*Competitiveness is the sustained ability to profitably gain or maintain market share*

The second component applies the analytic framework implied by this definition to a comparison of the agri-food processing sector to six others ranging from automobile manufacturing, electronics manufacturing, other transportation manufacturing, and the metals industry. The detailed results are in section 3.0 and summarized in section 4.0. As an overall statement, agri-food processing ranks favourably relative to its competitor industries.

The analysis suggests that, in fact, the agri-food processing sector has been quite competitive. By inference, this means that its competitiveness is sufficient to allow it to compete successfully for labour and capital against other manufacturing industries. The ratios of value added per dollar of wage expenditure and per dollar of sales show that agri-food processors have, over time, had sufficient profitability to maintain or improve their relative position against all the other industries except automobile manufacturing.

Similarly, food processors clearly have been able to match most other industries in developing and investing in capital equipment that at once substitutes for labour and enhances its productivity. Not surprisingly, many of the jobs in the food industry have traditionally been repetitive, dirty and intellectually unstimulating. The data presented here indicate that the industry has been able to generate enough profitability to

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<sup>1</sup>The authors are CEO and Research Assistant at the George Morris Centre

encourage reinvestment in capital equipment that at once reduces drudgery, increases labour productivity, and therefore, increases real wages. And, it was also noted that the industry has increased its share of employment over time.

Perhaps, at the dawn of 2001 when many .com darlings have apparently failed to live up to their promise and the NASDAQ is the only major securities exchange to actually declined, the most obvious appeal of the food industry is its stability. All of the sales, employment and productivity ratios are characterised by considerably greater stability for the agri-food sector than for the other manufacturing industries. This suggests that, despite agriculture's apparent reputation for volatility, the fact is that food processing's performance is much less volatile and much more immune to fluctuations in the underlying business cycle.

# A Comparative Analysis of Productivity in Agri-food and Other Industries in Canada

Larry Martin and Kate Stiefelmeyer<sup>2</sup>

## 1.0 INTRODUCTION

Growth in the Canadian agri-food processing sector is dependent on the sector's competitiveness relative to other sectors in the economy and relative to the agri-food sectors in other countries. The international competitiveness of key segments of the Canadian agri-food sector has received previous research attention. For example, the Agri-Food Competitiveness Council's work in the early 1990's spawned research on the competitiveness of Canadian food processing industries (Martin *et al*, 1992). More recently, Martin *et al* (1999) analysed the international competitiveness of the Canadian hog-pork supply chain.

The sector has undergone considerable structural and technological change in the past decade as a result of the Canada-US Trade Agreement (CUSTA), NAFTA, the 1995 WTO agreement. Much of that structural change was intended to enhance the profitability and competitiveness of the sector relative to others in Canada and the competing industries in other countries, especially the US. But whether the intention has been achieved has not been analysed.

At the same time, Handy *et al* have shown that the net flow of investment capital for the food processing and distribution industries has been negative for Canada relative to the US, and has been becoming increasingly negative over time. In other words, since the beginning of CUSTA, Canadian investment in the US food industry has far exceeded US investment in Canada. This implies that, despite structural adjustment in Canada, it is possible that US competitiveness has increased relative to Canadian because there has been even more structural adjustment there. No analysis has been undertaken to show how the food industries have changed in terms of relative competitiveness and profitability during the decade.

It is important to understand relative competitiveness and profitability. To successfully compete with other sectors for labour and capital, agri-food must be relatively profitable. In turn, to be relatively profitable, the sector's labour and capital productivity needs to be comparable. This two-report series undertakes an analysis to aid in that understanding.

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<sup>2</sup>The authors are CEO and Research Assistant at the George Morris Centre

## 1.2 PROJECT OBJECTIVES

This report focuses on the competitiveness of Canada's agri-food industry relative to other sectors of the Canadian economy. The objectives of the study are:

1. To revisit and revise, if necessary, the definition of competitiveness and characterize the factors that affect relative competitiveness.
2. To apply the definition of competitiveness empirically to the Canadian agri-food processing industry
3. To assess agri-food's competitiveness relative to other sectors of the Canadian economy

In section 2.0, we provide an over view of the definition of competitiveness; relate the concepts of competitiveness, profitability, and productivity; and discuss the methods used in the paper to do the analysis. Section 3.0 contains the empirical analysis, while our conclusions are in section 4.0.

## 2.0 MEASURING COMPETITIVENESS, AND ITS RELATIONSHIP TO PROFITABILITY

Competitiveness is one of those words that has meant different things to different people and is, therefore, often not particularly meaningful. Often it is a substitute for cost - ie some people believe the lowest cost producer has the most competitiveness. However, this implies that the only strategy for competing is a low cost strategy, a point of view that totally ignores differentiation and niche strategies. Others regard it as descriptive of one's behaviour, or attitude, thereby confounding it with "being competitive".

The word came into the Canadian vocabulary with the signing of the Canada US Trade Agreement (CUSTA), because there was great concern about whether Canada could compete against the US in a freer trade environment. Then in 1990/91, the publication of Michael Porter's book and its Harvard Business Review precis, The Competitive Advantage of Nations, brought the conversation to a new level. Subsequent work by Hamel and Prahalad (Competing For the Future) raised the quality of the concept even higher because they, much more so than Porter, focus on non-cost competition.

## 2.1 DEFINING COMPETITIVENESS

Unfortunately, Porter chose not to define competitiveness. He quite correctly notes that it is complex, and difficult to capture in a few words. While this may be true, not defining contributes to a lack of specificity in discussing it, and has likely reduced its usefulness as a concept in guiding either public policy or business strategy.

In 1990, Canada's Agri-Food Competitiveness Task Force did define the word, and suggested the definition could be applied to an individual company, an industry, an industrial sector or a national economy. They said,

*Competitiveness is the sustained ability to profitably gain or maintain market share.*

In expanding on the definition, the Task Force indicated that the following considerations should be associated with it:

- it has three measurable aspects - profits, market share and (sustained) time. So, competitiveness is attained if one is profitable with steady or increasing market share over time.
- the word “profitably” is meant to imply only that profitability is attained from the market place, not from unfair competition, public policy that confers unfair advantage, or subsidies.
- the fact that profitability is used instead of cost explicitly recognizes that there are alternative competitive strategies **and** recognizes that various stages in the supply chain must be profitable.
- underlying the definition is the expectation that, as a result of its actions in the market, a company, industry, sector, or national economy that has maximum competitiveness will be able to attract resources of production - ie labour, capital and new ideas.
- the term focuses on results (profitability, market share), not on behaviour. So, the distinction between one who is competitive and one who has a high degree of competitiveness is that the first displays competitive behaviour, while the second shows results. The two are not necessarily the same. The second person’s competitiveness may have resulted from her or his ability to cooperate.

The last distinction is important in that it implies that an analysis of competitiveness begins with the end - ie has this industry shown a high degree of profitability and an ability to gain market share? If so, or if not, we know something about it’s degree of competitiveness. We don’t know why. This creates the next step - why does it have what ever degree of competitiveness it has? This is the diagnostic step that can allow one to make prescriptions about changes in private business strategy or its application, and/or about public policy as it affects the industry. This definition and approach implies that without knowing how well the industry is doing, it is not useful to know why and provides no basis to figure out how to help it improve or maintain its competitiveness.

Other definitions are similar when all of their underlying concepts are understood. One that has been widely used as a definition of national competitiveness is by the former US Office of Technology Assessment (1991):

*“... the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens” (OTA, 1991).*

The two definitions are very similar. The only way real incomes of a populace can expand over time is if their employers are profitable. Private sector incomes arise from only two sources; wages and profits. Profits translate into income through dividends or increased share values. In the long term, share values reflect profits. So real incomes can only increase if returns before and after wages are rising. When that becomes clear, the definitions are the same.

Others simply say that competitiveness is about nothing more than continuously improving productivity relative to the productivity of others (either others in your product market or others against whom you are competing for resources). We have no issue with that concept. In the final analysis, profitability or expanding real incomes can only occur if productivity increases and can only continue if productivity continues to rise. So all three definitions are part of the same thing.

## **2.2 COMPETITIVENESS, PROFITABILITY AND PRODUCTIVITY**

So, if these definitions are essentially the same, how does one go about measuring them? How do “profitability” and “productivity” converge at a practical level? Let’s address profitability first, and see whether it leads to productivity.

Profitability is a deceptively simple, yet complex concept. At its simplest, it is the excess left after paying costs out of revenue. The problems with profitability start when one tries to measure it:

- The most obvious issue is that there are several and arbitrary ways to account for long term capital assets.
- Second, publically reported profits are calculated to optimize tax treatment.
- Third, despite the idea of “generally accepted accounting principles”, the truth is that there are often many ways to do the same thing. So, no two accounting statements are calculated in precisely the same way.
- Fourth, in attempting to make inter-industry comparisons (as we must do in this study), the vast majority of firms are not publically traded, and do not provide financial statements.
- Fifth, even where they are publically traded, many firms operate in more than one industry but generally report on a consolidated basis.

Considering all these issues, it would appear impossible to obtain a reliable measure of an industry’s profitability from profit data.

This led researchers at the George Morris Centre, several years ago (Martin *et al*, 1992), to consider using value added as a proxy for profits. By definition, value added is the difference between an industry’s total revenue (value of shipments, as reported by Statistics Canada and the US Commerce Department) and its cost of raw materials. So, for food manufacturing industries, value added is the difference between their selling prices (ie “wholesale’ prices) multiplied by the units sold, less the cost of raw materials from farms, packaging and energy. If there were no labour or capital cost,

value added would be profits. So, they approach being the same. An attractive aspect of value added as a proxy is that it provides information on the progress of industries that are attempting to move away from a low cost orientation toward differentiation: if differentiation is successful, then margins increase and this will be clear by expressing value added as a percentage of sales.

In fact, since Canada and the US also report the cost of labour and management, they can also be deducted. However, we believe it is more revealing to use these data as denominators, for two reasons. First, to do meaningful inter-industry comparisons, one needs to scale the data to something comparable. Reporting value added or value added less payments for labour and management for two industries is meaningless by itself because of differences in the scales of the industries. Reporting value added per dollar of expenditure on wages and salaries, or per employee gives a similar basis for comparison. Moreover, using value added as the first proxy for profits, and then showing it relative to expenditure on wages and salaries gives a second proxy: if value added per dollar of wages and salaries is rising, then the industry is generating more dollars after its payment for raw materials and labour to pay for capital, equipment and knowledge.

The second reason for using employment or labour payments as denominators is that the resulting ratios are a representation, at an industry level, of true labour productivity. Macro measures of labour productivity use GNP or GDP - ie total output per worker. If GDP per worker is rising, then we assert that labour productivity is rising. At a macro level, this is acceptable because GDP nets out the contributions at various levels of each industry. But for an individual manufacturing industry or sector, use of an overall measure of output (such as sales - ie, value of shipments) to measure labour productivity can be misleading. Industry sales per worker may be rising or falling simply because raw material prices may be rising or falling. By expressing value added per worker, the raw material markets are removed from the equation. The result is the true measure of the manufacturing industry's contribution, and then the contribution of workers to it.

This leaves one final vexing issue about the measures. It is that, while the foregoing explains the standard concept of labour productivity, it nevertheless says more about capital productivity than labour productivity. If an accounting firm provided each employee with an abacus to do their calculations, then the number of numbers processed in a day would be small. Labour productivity would be low. If the same firm replaced the abacus with a pentium3 computer, the number of numbers processed in a day would be hugely increased. Labour productivity would be far higher.

But what does this say about the quality or true underlying productivity of the worker? Other than in the second case the worker would need to learn computer skills, it says nothing. The difference in labour productivity in the two cases is almost totally a function of the capital base with which the worker has to work. All measures of labour productivity say much more about capital productivity than about workers.



## 2.3 METHODS

Following from the foregoing discussion, this study uses value added as a first approximation for profitability of processing industries because it represents the revenue that is excess to that required to pay for raw materials. To undertake inter-industry comparisons with other industries in Canada, or the same industries in the US, three sets of ratios are developed for each:

- Value added per dollar of sales. This indicates the gross margin of the subject industry relative to the comparators. An increase in the ratio indicates that margins are rising and, in industries with a competitive structure, suggest that the industry's product mix is changing toward being less of a commodity. A decline in the ratio may indicate that the industry's products are being commoditized, that non-raw material costs are declining, and/or that competitive pressure from others in the supply chain are increasing.
- Value added per dollar of expenditure on wages and salaries. This is the second approximation for profitability. If this ratio is rising, the industry is generating additional revenue after paying for labour, management and raw materials to pay for capital and knowledge.
- Value added per worker. This is "labour productivity". If it rises, it means the industry is generating more output per worker. It should be correlated with the previous ratio over time, but will be affected by differences in wage and salary levels in the industry and its comparators. It likely says more about "capital productivity" because investment in plant, equipment, and technology have a material effect on the ability of workers to perform either because of the quality of equipment and technology, or because of economies of size. Especially in some of the food processing industries where unit manufacturing costs are highly correlated with scale of operation, failure to invest in world scale plants means that labour productivity is limited.

Productivity ratios are measured relative to Canadian manufacturing in general. In this area, various two and three-digit SIC (Standard Industrial Classification) industries are compared to the agri-food sector. These are defined in detail in Section 3.0

The ratios span the period from 1981 to 1997. Statistical providers have not yet released the 1998 data. Our fundamental hypothesis is that structural adjustments caused by or exacerbated by the Canada US Trade Agreement, and subsequent economic pressures have altered the competitiveness of Canadian processing industries. Hence the main comparison is between the pre-and post free trade situations. As will become obvious, the tardiness of their release causes one to want to see more. There are good reasons to expect changes in the two missing years that may be positive for the Canadian sector or negative to it. The data are from Statistics Canada.

### **3.0 CANADIAN AGRI-FOOD INDUSTRY VERSUS OTHER CANADIAN MANUFACTURING INDUSTRIES**

In this section we compare the Canadian agri-food industry to six other manufacturing industries in the Canadian economy. These industries are chosen as comparitors due to their variability as a group, based on factors such as demand, development of the industry, and the potential for them to be competitors with agri-food for capital.

The following is a list of the industries that were chosen to be compared with the Canadian agri-food industry, along with their designated SIC codes

<u>Industry</u>	<u>SIC Code</u>
Food	10
Electric and Electronic Products	33
Primary Metals	29
Paper and Allied Products	27
Primary Textiles	18
Transportation Equipment (excl. Motor Vehicles)	32(excluding SIC 323)
Motor Vehicle Industry	323

Although the Motor Vehicle Industry (SIC 323) is essentially a sub-sector of the transportation industry, we have chosen to compare it on its own due to its growth and development in recent years.

### **3.1 SECTORS DEFINED**

See Appendix 1 for a list of the products that are manufactured in the industries that we have chosen to analyze, along with the corresponding standard classification codes (SIC).

## 3.2 CANADIAN INDUSTRY PROFILES

The growth characteristics of Canadian manufacturing industries are shown in the following several Figures. The graphs are constructed using 1981 to 1997 data.<sup>3</sup> This section starts with three general descriptors of the industries; sales, employment and wages & salaries. These general descriptors are followed by three performance indicators; value added per dollar of sales, value added per dollar of wages & salaries, and value added per employee. Value added per employee is also commonly used as a good indicator of productivity. For purposes of labelling these graphs, the industries have been assigned shorter labels as indicated in the following list.

- Agri-Food Processing                      Ag Food
- Transportation Equipment                Transport
- Motor Vehicle                                MV
- Primary Textiles                            PT
- Electric and Electronic Products        Elec
- Paper and Allied Products                Paper
- Primary Metals                              PM

### **SALES**

Sales is referred to as value of shipments by Statistics Canada, and comprises revenues received or receivable from all products shipped by that industry. As can be seen in the Figures, sales by agri-food are greater than for any of the selected industries except automobiles, which exceeded agri-food after 1994. Agri-food showed steady growth over the entire 20 years, and accelerated growth after the Canada-US Trade Agreement. However, a number of the industries experienced even more rapid growth in sales after CUSTA. Overall, only the motor vehicle and transport industries had greater absolute growth in sales than agri-food during this period.

Another characteristic of these data is that sales by agri-food are less volatile and less affected by the underlying business cycle than any of the other industries. As the remainder of the data are shown, it will become obvious that this is a defining characteristic. It is also ironic in that agriculture is generally regarded as risky and volatile, yet sales by Canadian food companies show the most stable growth trend. The only competitor for this leadership is primary textiles, whose sales stability is also associated with no growth

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<sup>3</sup>All graphs in Section 3 are constructed from data received from the Canadian Annual Survey of Manufactures.

## FIGURES 1A & 1B: Comparison of Sales in the Canadian Manufacturing Industry

Figure 1A:

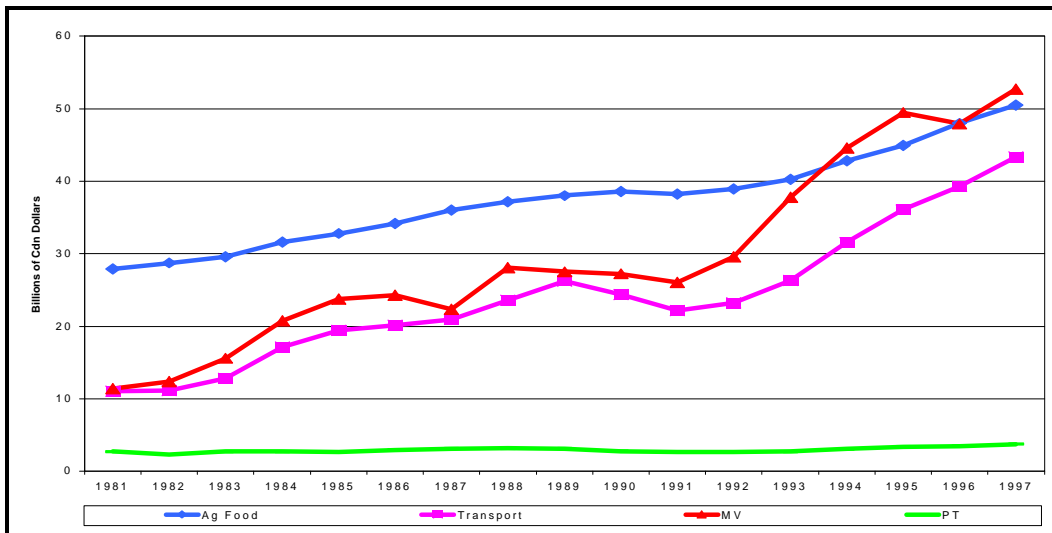
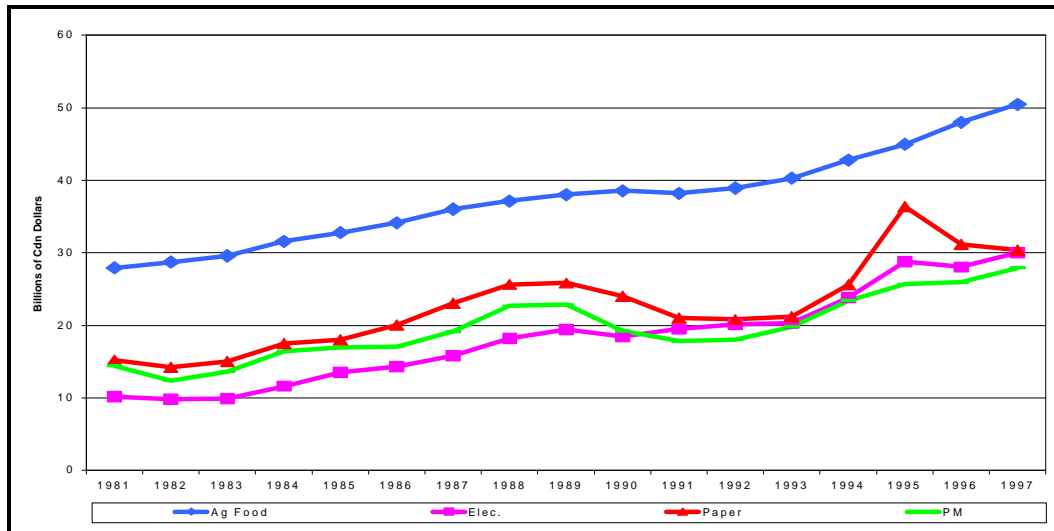


Figure 1B:

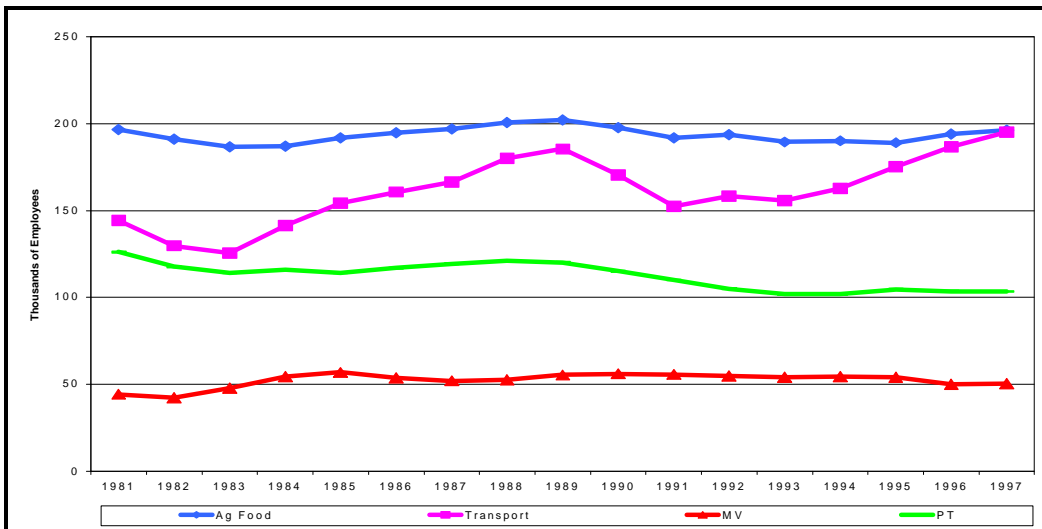


## EMPLOYMENT

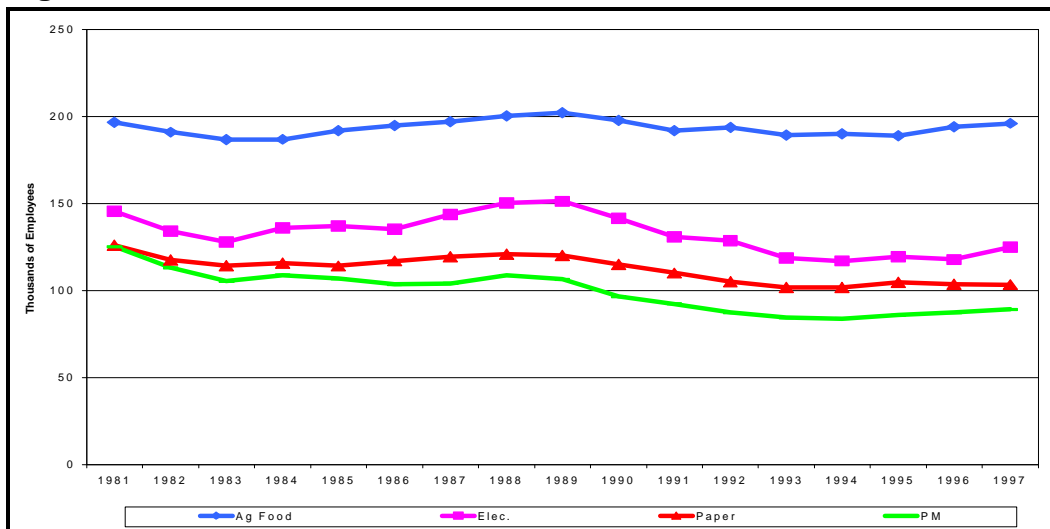
Employment includes all employees, both administrative and production workers, both full and part time, who are registered on the payroll of the manufacturing establishment. The data show first that the two decades were a period during which capital was substituted for labour in these industries since the employment trends are generally down while output generally doubled or tripled. Second, agri-food is the largest employer of the seven industries at just under 200,000 employees, and that its employment has remained relatively constant over the past two decades. In fact, it has gained or held its own against all the others, except transportation equipment manufacturing.

**FIGURES 2A & 2B: Comparison of Total Employment Figures in Canadian Manufacturing Industries**

**Figure 2A:**



**Figure 2B:**

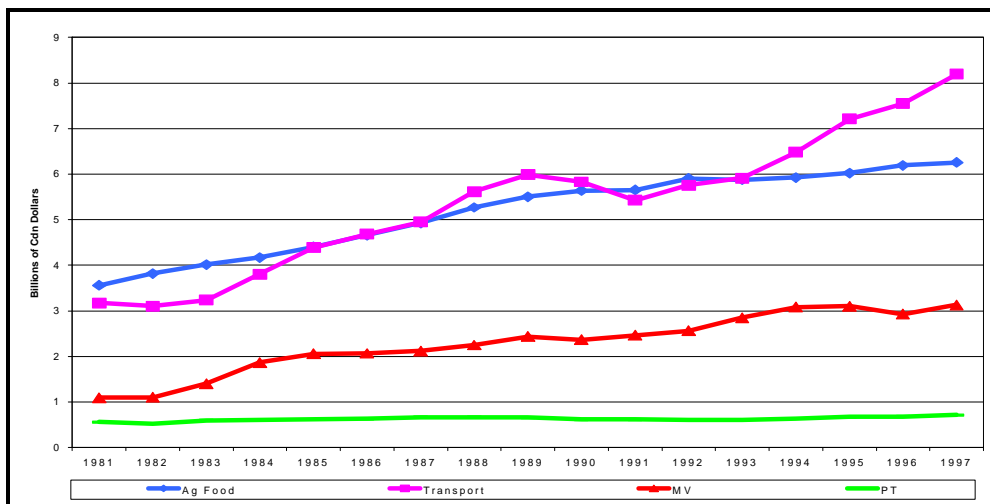


## WAGES & SALARIES

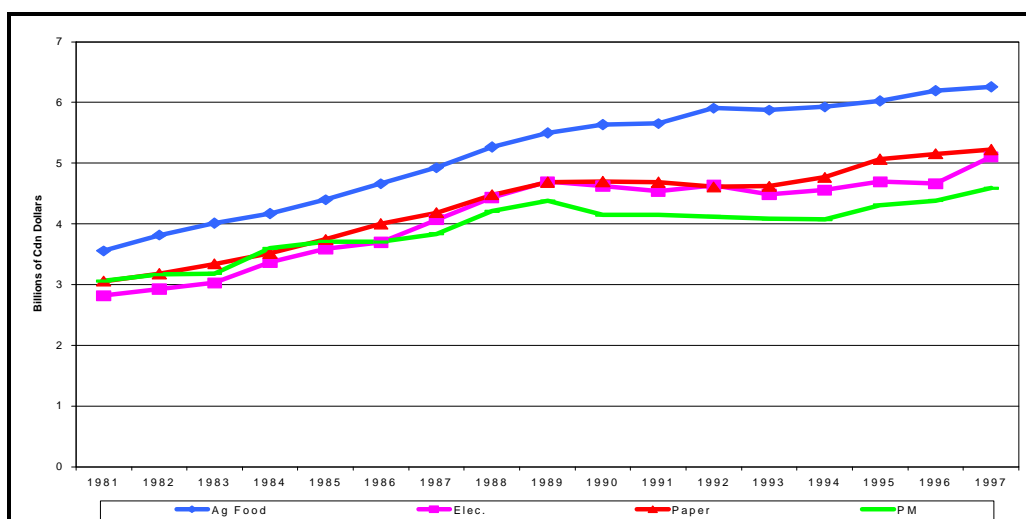
Wages and salaries is comprised of the gross earnings of both administrative and production workers in the course of the calendar year. This expenditure also includes all forms of compensation paid to employees. The data show that agri-food is one of the largest sources of wages and salaries in the economy at over \$6 billion per year. Second, agri-food's wage expenditures have generally increased in proportion to the number of employees. As with the number of employees, transportation equipment manufacturing has increased significantly relative to agri-food, while the textile industry has clearly declined. Finally, with the exception of the textile industry, wage expenditures by agri-food showed the most stable growth indicating the sector's strong contribution to the economy during periods of both high growth and recession.

**FIGURES 3A & 3B: Comparison of Total Expenditure on Wages & Salaries of Canadian Manufacturing Industries**

**Figure 3A:**



**Figure 3B:**



The next several figures contain the comparisons of the value added ratios for the industries. General trends are noted with each comparison, and a detailed discussion of each industry follows.

### **VALUE ADDED PER DOLLAR OF SALES**

Value added per dollar of sales is the proportion of an industry's sales that is contributed by the industry. In other words, it is the amount of value that the industry adds above the cost of the raw materials it uses. By comparing value added as a proportion of total sales across industries, we get a picture of their relative margins and how those margins have changed over time. If the ratio increases, it means the industry has more to pay labour and capital. As an overview, comparing the pre- and post-CUSTA periods,

- agri-foods margins, at about 40%, are generally lower than most industries
- all the industries experienced pressure on their margins in the second half of the past decade,
- but agri-food appears to have increased them relative to most other industries in the later period - ie the differences are less pronounced for those with higher margins in the later period. This reflects a bundle of goods in agri-food with more value added in the later period from agri-food manufacturers.
- most industries had lower or roughly the same margins after 1989, while agri-food initially increased its margins and then lowered them. The general reduction reflects the much greater competition with the US which, in turn, has been one reason for a lower Canadian inflation rate during the post-CUSTA period. In the case of agri-food, the decline in margins after 1992 is likely a reflection of increased retail competition from Club stores and, especially, from the introduction of major store brands.

## FIGURES 4A & 4B: Comparison of Value Added per Dollar of Sales of Canadian Manufacturing Industries

Figure 4A:

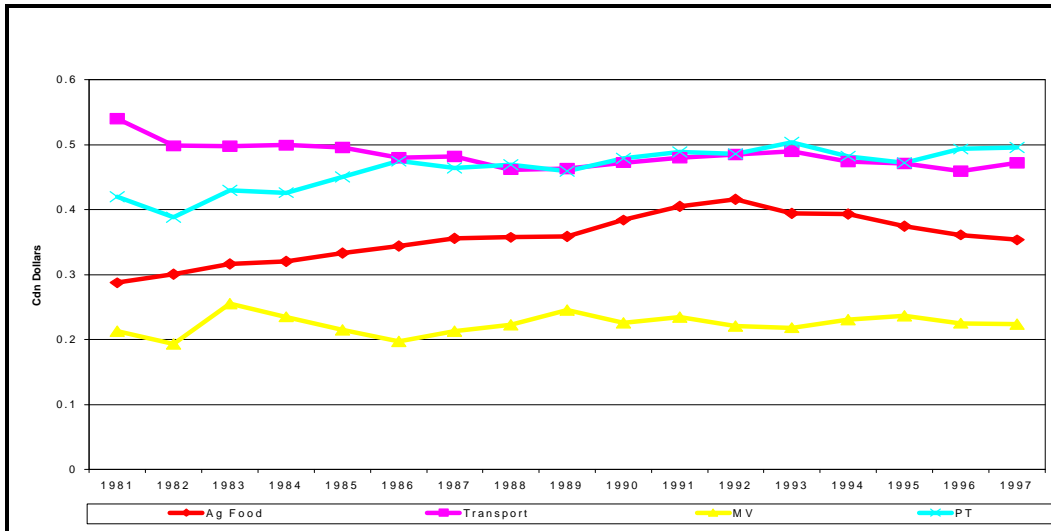
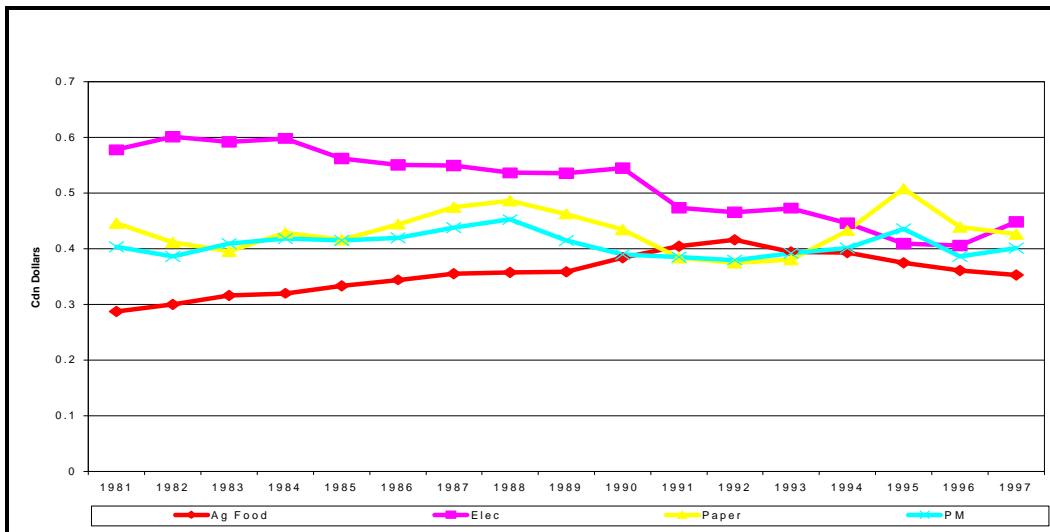


Figure 4B:



These data contain two interesting surprises. First, while agri-food's ratios are among the lower of the comparators, it is somewhat surprising that they are not markedly lower when one considers the comparators: electronic equipment, heavy transportation equipment, and automobiles are here. These are the "glamour" industries of manufacturing, industries which, when viewed by many investors have been much more attractive than food. Yet their margins are not markedly different than agri-food's. Second, despite tremendous pressure from an increasingly concentrated retail industry



in the latter half of the 1990's, agri-food is one of only two industries in the comparisons that have higher margins at the end of the period than it did at the beginning. This reflects a major transformation of the industry's products over this period from one that produces fairly basic products to one that provides a much higher degree of value added

**VALUE ADDED PER DOLLAR OF WAGES & SALARIES**

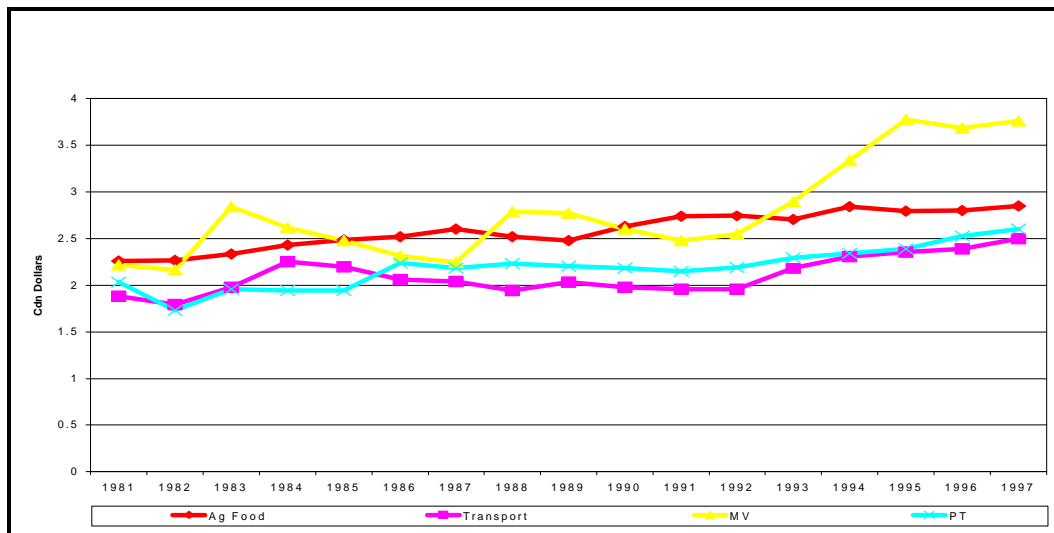
Value added per dollar of wages and salaries is the ratio of an industry's value added to its expenditure on production workers and management/administrative employees. This is an economic productivity ratio. It is, literally, the amount of value added produced per dollar of expenditure on wages and salaries. The higher the ratio, the greater the labour productivity, and the more that is left to pay for capital.

Looking at Figures 5A and 5B, the following trends appear:

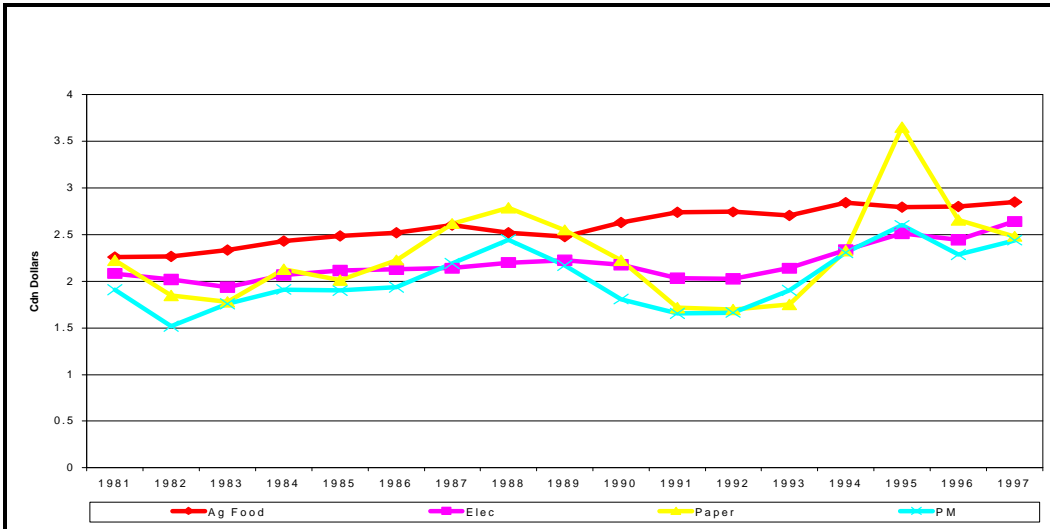
- agri-food has shown steady improvement in the ratio over time.
- agri-food has the most stability in its ratio over time.
- agri-food gained relative to the other industries in the first half of the 1990's, but fell back in the second half.

**FIGURES 5A & 5B: Comparison of Value Added per Dollar of Wages & Salaries of Canadian Manufacturing Industries**

**Figure 5A:**



**Figure 5B:**



Overall, value added per dollar of expenditure on wages and salaries in the agri-food sector grew consistently during the period, was generally higher than any of the other industries except automobile manufacturing, and was by far the most stable.

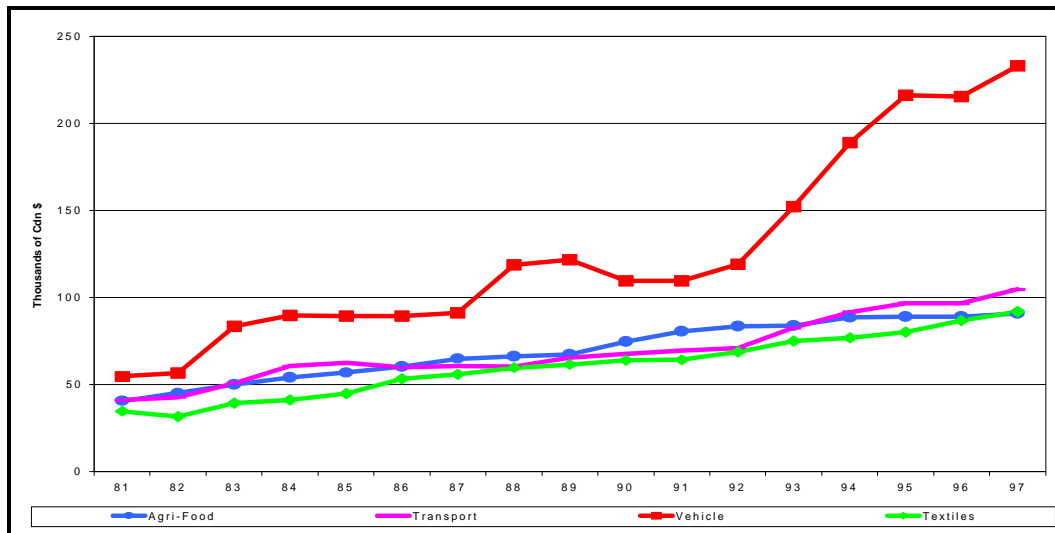
#### **VALUE ADDED PER EMPLOYEE**

Value added per employee is a productivity ratio for all employees in the industry. Again the highlights are:

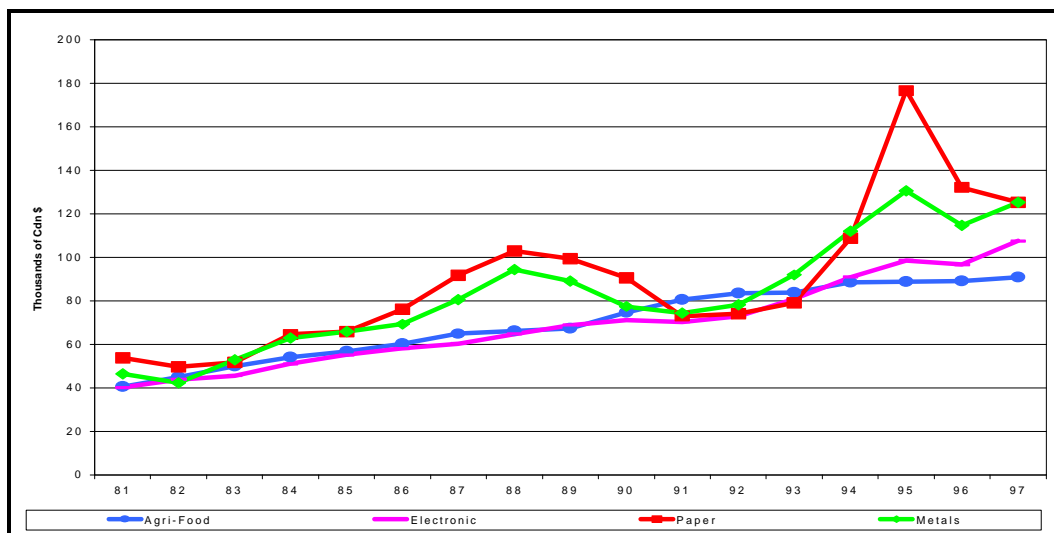
- the agri-food sector experienced steady growth in labour productivity,
- it enjoyed a relative spurt in growth in the early 1990's
- it's growth is much more stable than the other industries.
- it gained relative to the other industries during the early part of the decade, but lost ground in the later years, especially against the automobile industry
- because of the cyclical nature of the other industries' productivity and major adjustments in some agri-food industries, it is not reliable to forecast forward from these data. Not having data beyond 1997 is problematic here.

**FIGURES 6A & 6B: Comparison of Value Added per Employee of Canadian Manufacturing Industries.**

**Figure 6A:**



**Figure 6B:**



More detailed discussion of the data for each industry is contained in Appendix 2

## 4.0 Conclusions

This study began with three objectives:

- To revisit and revise, if necessary, the definition of competitiveness
- To apply the definition of competitiveness empirically to the Canadian agri-food processing industry
- To assess agri-food's competitiveness relative to other sectors of the Canadian economy

To satisfy the objectives, we undertook a brief review of the literature on the definition and measurement of competitiveness, then applied a framework of productivity measurement to data from the agri-food processing industry and six other manufacturing industries in Canada. The following conclusions are offered from the study.

### ***Definition of Competitiveness***

Alternative definitions were addressed and the conclusion is that, while the words may vary, all are variations on the same theme. That theme is that competitiveness is revealed through relative profitability and market share over time. Hence we maintain the definition provided by the Agri-Food Task force on Competitiveness in 1990 that:

*Competitiveness is the sustained ability to profitably gain or maintain market share.*

Because it is so similar, another acceptable definition is one developed by the US Office of Technology Assessment, which states:

*“... the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens”.*

We would add the words *sector, industry or firm* after *nation* in the first line.

What is important about these definitions is that they imply a number of characteristics about competitiveness:

- it has three measurable aspects - profits, market share and (sustained) time. So, competitiveness is attained if one is profitable with steady or increasing market share over time.
- the word “profitably” is meant to imply only that profitability is attained from the market place, not from unfair competition, public policy that confers unfair advantage, or subsidies.
- the fact that profitability or real incomes is used instead of cost explicitly recognizes that there are alternative competitive strategies **and** recognizes that various stages in the supply chain must be profitable.

- underlying the definition is the expectation that, as a result of its actions in the market, a company, industry, sector, or national economy that has maximum competitiveness will be able to attract resources of production - ie labour, capital and new ideas.
- the term focuses on results (profitability, market share), not on behaviour. So, the distinction between one who is competitive and one who has a high degree of competitiveness is that the first displays competitive behaviour, while the second shows results. The two are not necessarily the same. The second person's competitiveness may have resulted from her or his ability to cooperate.

***Applying the Definition***

In applying the definition to an analysis of productivity of the agri-food and other manufacturing industries in Canada, the definition needs to be translated to measurable variables. This is done in the paper by defining market share and productivity as the relevant variables. Productivity in manufacturing is reflected in its value added which can be measured as ratios of number of employees, wage expenditures, or sales to obtain information about relative performance. It is argued in the paper that these ratios are proxies for profitability.

The analysis consists of these productivity ratios applied to agri-food processing and the following industries during the period from 1981 -1997<sup>4</sup>:

- |                                    |           |
|------------------------------------|-----------|
| • Transportation Equipment         | Transport |
| • Motor Vehicle                    | MV        |
| • Primary Textiles                 | PT        |
| • Electric and Electronic Products | Elec      |
| • Paper and Allied Products        | Paper     |
| • Primary Metals                   | PM        |

The following conclusions result from the analysis:

- sales by agri-food are greater than for any of the selected industries except automobiles
- only the motor vehicle and transport industries had greater absolute growth in sales than agri-food during this period.
- sales by agri-food are less volatile and less affected by the underlying business cycle than any of the other industries
- agri-food is one of the largest sources of wages and salaries in the economy at over \$6 billion per year
- agri-food's wage expenditures have generally increased in proportion to the number of employees
- with the exception of the textile industry, wage expenditures by agri-food

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<sup>4</sup>The market share analysis is best applied to major commodity groups and is in the second paper of this sequence.

showed the most stable growth

- while agri-food's ratio of value added to sales is among the lower of the comparators, it is not markedly lower when considering that several of the comparators are the "glamour" industries of manufacturing
- agri-food is one of only two industries in the comparisons that have higher margins at the end of the period than at the beginning
- value added per dollar of expenditure on wages and salaries in the agri-food sector grew consistently during the period, was generally higher than any of the other industries except automobile manufacturing, and was by far the most stable
- the agri-food sector experienced steady growth in labour productivity
- it's growth is much more stable than the other industries.

### ***Competitiveness of the Agri-food Processing Sector***

The food industry seems to be perceived by some in the capital markets and government as being a weak performer. However, this analysis suggests that, in fact, it has been quite competitive with a range of other manufacturing industries in Canada. By inference, this means that it's competitiveness is sufficient to allow it to compete successfully for labour and capital against other manufacturing industries. The ratios of value added per dollar of wage expenditure and per dollar of sales show that agri-food processors have, over time, had sufficient profitability to maintain or improve their relative position against all the other industries except automobile manufacturing.

Similarly, food processors clearly have been able to match most other industries in developing and investing in capital equipment that at once substitutes for labour and enhances its productivity. Not surprisingly, many of the jobs in the food industry have traditionally been repetitive, dirty and intellectually unstimulating. The data presented here indicate that the industry has been able to generate enough profitability to encourage reinvestment in capital equipment that at once reduces drudgery, increases labour productivity, and therefore, increases real wages. And, it was also noted that the industry has increased its share of employment over time.

Perhaps, at the dawn of 2001 when many .com darlings have apparently failed to live up to their promise and the NASDAQ is the only major securities exchange to have actually declined, the most obvious appeal of the food industry is its stability. All of the sales, employment and productivity ratios are characterised by considerably greater stability for the agri-food sector than for the other manufacturing industries. This suggests that, despite agriculture's apparent reputation for volatility, the fact is that food processing's performance is much less volatile and much more immune to fluctuations in the underlying business cycle.

Nothing is perfect, and the one issue that seems apparent from the analysis is manifested by agri-food's relatively lower ranking on value added per unit of labour than on value added per dollar of expenditure on wages. This result can only occur if average wages in the sector are lower than in the competitor sectors. In turn this means that the sector will need to invest even more in plant and equipment in an effort

to enhance labour productivity. Otherwise, it will face increasing difficulty in attracting and holding labour in the future.

## **Appendix 1: Manufacturing Sectors Defined**

### **SIC 10: Food**

- SIC 101: meat and poultry products
- SIC 102: fish products
- SIC 1031: canned and preserved fruits and vegetables
- SIC 1032: frozen fruit and vegetables
- SIC 1041: fluid milk and other dairy products
- SIC 1051: cereal grain flour
- SIC 1052: prepared flour mixes and cereal foods
- SIC 1053: feed
- SIC 106: vegetable oil mills
- SIC 107: bakery products
- SIC 1081: cane and beet sugar
- SIC 1082: chewing gum
- SIC 1083: sugar and chocolate products
- SIC 1091: tea and coffee
- SIC 1092: dry pasta products
- SIC 1093: potato chips, pretzels and popcorn
- SIC 1094: malt and malt flour

### **2.SIC 33: Electric and Electronic Products**

- SIC 331: small electrical appliances
- SIC 332: major appliances
- SIC 333: electric lighting
- SIC 334: record players, radio, tv receivers
- SIC 3351: telecommunication equipment
- SIC 3352: electronic parts and components
- SIC 336: office, store, and business machines
- SIC 337: electrical industrial equipment
- SIC 338: communications and energy wire and cable
- SIC 339: other electrical products, i.e. batteries

### **3. SIC 29: Primary Metals**

- SIC 291: primary steel
- SIC 292: steel pipe and tubes
- SIC 294: iron foundries
- SIC 295: non-ferrous metal smelting and refining
- SIC 296: aluminum rolling, casting, and extruding
- SIC 297: copper rolling, casting and extruding
- SIC 299: other metal rolling, casting and extruding

#### **4. SIC 27: Paper and Allied Products**

- SIC 271: pulp and paper, i.e. pulp, newsprint, paperboard, building board
- SIC 272: asphalt roofing
- SIC 273: paper box and bag i.e. corrugated boxes, folding cartons, lunch bags
- SIC 279: other converted paper products including, stationary, coated and treated paper

#### **5. SIC 18: Primary Textiles**

- SIC 181: man-made fibre and filament yarn
- SIC 182: spun yarn and woven cloth
- SIC 183: broad knitted fabric

#### **6. SIC 32(excluding SIC 323): Transportation Equipment**

- SIC 321: aircraft and aircraft parts
- SIC 324: truck and bus body and trailer, commercial and non-commercial trailers, and mobile homes
- SIC 325: motor vehicle parts and accessories, including engine, wheel, brake, plastic parts
- SIC 326: railroad rolling stock
- SIC 327: shipbuilding and repair
- SIC 328: boatbuilding and repair
- SIC 329: other transportation equipment

#### **7. SIC 323: Motor Vehicle**

- SIC 3231 motor vehicles and car bodies



## **Appendix 2: Manufacturing Industries Discussed**

### **1. Electrical and Electronic Products<sup>5</sup>**

This industry contains a relatively large number of establishments, 1516 in 1997 but at times reaching up to 1600 plants.

As can be seen from Figure 1, the electrical industry has a relatively low sales average compared to the food industry, although there is an upward trend in sales and the average annual growth rate of sales in this industry is 7.3%.

There is a slight downward trend in the number of employees in this industry throughout the last 2 decades, (Figure 2). Growth in employee numbers did occur around 1993-1995 and again in 1997.

Wages in the electrical industry were continuing smoothly along an upward trend until they dipped in the early 1990's, (Figure 3), which resulted from the decrease in employees and not in the average wage rate per hour which remained on a steadily increasing path and averaged \$13/hour throughout the 1980's and 1990's. Value added per dollar of sales has shown a prominent trend downward since 1981 and only began to show signs of improvement in 1996, (Figure 4). The average annual growth rate of value added per dollar of sales in this industry is -1.43%, but even so, this industry boasts the highest average value added per dollar of sales of all the industries being examined in this paper, at 51.6 cents/dollar of sales.

Value added per dollar of wages kept steady around \$2.00-2.20 in the 1980's and has since taken an upward trend, (Figure 5), it has averaged an annual growth rate of 1.6%.

Although value added per employee is quite low compared to the other industries being examined, (Figure 6), there is a strong, steady, upward trend with an average growth rate of 6.4%.

### **2. Primary Metals<sup>6</sup>**

The value of sales in the primary metals industry is relatively low compared to the food industry, at only 52.2% of food industry sales. There was a strong upward trend in sales in the 1980's but a large dip occurred in the early 1990's, and that same 'dip and improve' cycle has occurred again since. These dips are not large enough to offset the annual average growth rate, it continues to remain positive at 4.74%.

The primary metals industry is not a large employer compared to the other industries, and since the early 1980's has shown a slight but steady downward trend in total number of employees, (Figure 2), with 1981 employing the greatest number of employees and in 1994 it employed the least amount.

This industry possesses the highest annual average wage rate per hour, at \$18.40, and 63.5% greater than average wage rate in the food industry, even though total wage and salary expenditure dipped in the early 1990's and only began to recover in 1995.

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<sup>5</sup>The Standard Classification for this cluster of industries in Canada is 33.

<sup>6</sup>The Standard Classification for this cluster of industries in Canada is 29.

Value added per dollar of sales has hovered around \$0.40 over the past two decades, (Figure 4), just slightly exceeding the food industry. This hovering action is proved by looking at the annual average growth rate of only 0.09%.

When looking at Figure 5, the value added per dollar spent on wages and salaries in the primary metals industry seems to look quite erratic, but it is clearly staying in the \$1.50 and \$2.50 boundaries, and averages a rate of \$2.02 during the past couple decades. The average annual rate of growth of value added per dollar spent on wages and salaries since 1981 in this industry is 2.33%.

The value added per employee shows a clear upward trend with a few bumps along the way. The average value added per employee for the time period examined is \$83,000.00, \$13,000 greater than in the food industry. Value added per employee has shown a strong growth rate of 7.10% since 1981 which indicates a strong growth in productivity in this sector.

### **3. Paper and Allied Products<sup>7</sup>**

At an average of \$23 billion, sales in the paper and allied products industry are relatively low compared to the food industry, roughly 60% of agri-food's sales values. But this industry has shown an overall upward trend since 1981 with an annual average growth rate of 5%.

The total number of employees in this industry has continued to decrease since 1981, from 12,000 to 10,000. It employs roughly half the amount as the food industry, but occupies only 21% of the number of establishments, averaging around 680 establishments compared to an average of 3200 establishments in the food industry.

Total expenditure on wages and salaries has shown a strong upward trend, (Figure 3). This industry averages a \$17.25 per hour wage rate for production workers, which is approximately 45% higher than in the food industry.

As seen in Figure 4., value added per dollar of sales in the paper industry remains above the food industry except in 1991 and 1992. The average rate of value added per sales dollar in this industry is \$0.43, this has remained fairly steady over the years with a growth rate of only 0.07%.

Value added per dollar spent on wages and salaries is another story, and has almost always remained below the food industry, but peaks erratically up in 1995, averaging \$2.27 per dollar spent on wages and salaries. Although the absolute figures are below the food industry figures, the annual average growth rate of the paper industry boasts 2.65% against the food industry's 1.51%.

Value added per employee takes the same hike in 1995 as it did in value added per dollar spent on wages and salaries. Productivity in this industry is almost always greater than in the food industry and averages \$89,00 per employee, \$20,000 more than the food industry. Value added per employee has shown a strong growth rate at an average of 7.33% per year.

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<sup>7</sup>The Standard Industry Classification for this cluster of industries is 27.

#### **4. Primary Textiles<sup>8</sup>**

The primary textiles industry can boast the lowest average value of sales, at \$2.95 bil., compared to the other industries being examined in this paper. This value of sales is only 7% of agri-food industry's sales values, which boasts the highest figures. Sales in this industry have remained consistently steady as seen in Figure 1., and have grown on average 2.38% annually.

This industry can also boast the smallest number of production workers and total employees, only 13% of the food industry's employees, although not the smallest number of establishments. Therefore these establishments must be quite small. This helps to explain why this industry has the lowest productivity of the seven industries being examined. With a large number of establishments but a small number of employees, it would be difficult to take any advantage of economies of scale and therefore productivity is low, averaging \$60,000 per employee. Although, you can see in Figure 6 that it has shown a slight upward trend, and is in fact growing at 6.4% per year.

Again this industry can boast the lowest, this time in total expenditure on wages and salaries, which could naturally be due to the small number of employees. But this industry also has the lowest average hourly wage rate for production workers at \$11.40 per hour, just under the food industry's hourly rate of \$11.70.

Value added per dollar of sales shows the industry in a new light, see Figure 4., averaging \$0.46 per dollar. This value is just under the motor vehicle industry and is consistently \$0.10 above the food industry. Value added per dollar of sales has remained quite steady, with an average annual growth rate of 1.14%.

Value added per dollar spent on wages and salaries is consistently lower in primary textiles than the food industry and is also consistently, but slowly, growing at a rate of 1.76% per year.

#### **5. Transportation Equipment<sup>9</sup>**

Value of sales in the transportation equipment industry has shown a strong upward trend and an average annual growth rate of 8.8%, (Figure 1). The value of sales in this industry are relatively low, at an average of \$24 billion, compared to the food industry.

This industry employs the largest number of production workers, at an average of 118,000, but falls short of the food industry in total # of employees, ( Figure 2).

Total expenditure on wages and salaries has shown a very strong upward trend and has increased by \$5 billion since 1981, which suggests rising wage rates considering that total employment has not grown by such an amount. The average hourly wage rate for production workers in this industry over the past two decades is \$14.44 and it continues to grow.

Relatively speaking, value added per dollar of sales in the transportation equipment industry is quite high compared to the food industry, averaging \$0.48 per dollar,

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<sup>8</sup>The Standard Industry Classification for this cluster of industries is 18.

<sup>9</sup>The Standard Industrial Classification for this cluster of industries is 32, excluding SIC 323.

(Figure 4). But it has been trending down slightly over the years, with an annual average growth rate of -0.80%.

The industry does not fare well with value added per dollar spent on wages and salaries, and is seen in Figure 5 with a low value compared to the other industries being examined. It averages \$2.10 of value added per dollar spent on wages and salaries and is growing slowly at 1.95% per year.

Value added per employee is growing much more strongly at 6.2% per year and is quite even with the food industry, averaging around \$69,000 of value added per employee.

## **6. Motor Vehicle**<sup>10</sup>

Sales in the motor vehicle industry have shown a very strong trend upward and began to surpass sales in the food industry in 1994. The average sales value for the industry, \$29.5 bil, is much smaller than the food industry's average but the annual growth rate of sales in the motor vehicle industry is 10%, compared to 3.5% in the food industry.

Employment in the motor vehicle industry is relatively low, in fact it is the second lowest in this group of industries, and it possesses the least number of establishments.

Total wage and salary expenditure shows a continuous upward trend ( Figure 3.), with an average rate of expenditure at \$2.4 billion. Although it is not the highest, the average hourly rate of production workers in this industry, at \$18.30, comes a close second behind the primary metals industry and swamps the average rate of \$11.70 in the food industry.

Value added per dollar of sales has remained constant at an average of \$0.22, see Figure 4, the lowest in this series of industries, and the only industry to fall below value added per dollar of sales in the food industry.

On the other hand, value added per dollar spent on wages and salaries in the motor vehicle industry boasts the highest among all the others, with an average of \$2.80 and an average annual growth rate of 3.95%, more than double the growth rate of the food industry.

Productivity in the motor vehicle industry boasts the highest average value at \$126,00 per employee and the highest average annual growth rate of 10.4%, exactly double that of the food industry. Productivity in this industry swamps all the other industries.

## **7. Food Industry**<sup>11</sup>

The value of sales in the food industry has shown a strong upward trend in the past two decades. It has only begun to be surpassed in value of sales by the motor vehicle industry in 1994. Sales in the food industry have grown from \$28 billion in 1981 to \$50 billion in 1997, with an average annual growth rate of 3.5%.

Employment in the food industry has been steady around 140,000 production

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<sup>10</sup>The Standard Industrial Classification for this cluster of industries is 323.

<sup>11</sup>The Standard Classification for this cluster of industries in 10.

workers and just under 200,000 in total employees. This employee base is the largest amongst the industries being discussed, and the food industry also possesses the largest number of establishments compared to this group of industries.

Total expenditure of wages and salaries have increased steadily since 1981, almost doubling in value. The average hourly wage rate for production workers has increased from \$8.00 per hour to \$14.00 per hour, with a total average of \$11.70, which is the second lowest hourly rate in this group of industries.

Value added per dollar of sales increased steadily until 1992 and since has decreased. Relative to the other industries, the food industry is lagging in value added per dollar of sales with an average of \$0.35 and an average annual growth rate of 1.37%.

The food industry improves in value added per dollar spent on wages and salaries compared to value added per dollar of sales. Value added per dollar spent on wages and salaries has shown a slight upward trend with a growth rate of 1.51% per year. Compared to the other industries in this discussion, the food industry has fared well.

Productivity on the other hand is another story, although productivity has steadily increased, it has done so at only 5% per year. Value added per employee averages \$60,000 in the food industry, roughly equal to the value added per employee in the primary textiles, transportation equipment, and electronic & electric products industries.

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