

**STRUCTURAL CHANGE IN THE
CANADIAN MANUFACTURING SECTOR
1970 - 1990**

by

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Abstract

This paper investigates structural change at the national and the regional level in five broadly defined sectors of the Canadian economy--the natural-resource-based, the labour-intensive, the scale-based, the product-differentiated, and the science-based sectors. Three aspects of change are examined. First, changes in the importance of each sector over the last twenty years are traced. Second, the amount of internal change within each sector--changes in the importance of individual industries in each sector and the nature of job turnover within industries are examined. Finally, the extent to which wage differentials have widened over time is examined.

Key Words: structural change, manufacturing industries, diversification, job change, inter-regional and intra-sectoral wage gap.

SUMMARY

This paper investigates structural change at the national and the regional level in five broadly defined sectors of the Canadian economy--the natural-resource-based, the labour-intensive, the scale-based, the product-differentiated, and the science-based sector. Industrial policy has been broadly directed at supporting the expansion of the scale and product-differentiated sectors through increased access to North American markets. The science-based sector has increasingly received attention as the sector with attractive future prospects. The labour-intensive sector has been subject to increasing amounts of offshore competition and the natural-resource sector may no longer be as attractive as it once was because of both changes in technology and increasing offshore competition.

Three aspects of change are examined. The first section tracks changes in the importance of each sector over the last twenty years. The second section examines the amount of internal change within each sector--changes in the importance of individual industries in each sector and the nature of job turnover within industries. The third section examines the extent to which wage differentials have widened over time. The findings are:

1) Overall Structural Change

- a) The labour-intensive sector has lost market share steadily over the last twenty years while all the other sectors have grown. Changes in the distribution of employment are relatively small, take place slowly and have not sped up in the 1980s. Structural change is not seen to be very important when measured at this level.
- b) At the regional level, Quebec has experienced the largest decline in its share of total employment devoted to the labour-intensive sector. The Prairies experiences a large decline in the natural-resource sector and an increase in the product-differentiated sector.
- c) Three regions have diversified their industrial sectors--British Columbia, the Prairies and Quebec.

2) Intra-Sectoral Changes

- a) The change that is taking place within sectors overshadows the shifts that are taking place across sectors. Within broadly-defined industrial sectors, individual industries change their relative importance. But not all of the change is restricted to the declining labour-intensive sector. Restructuring appears to be taking place in the natural-resource and product-differentiated sectors as jobs are shifted across industries and between growing and declining firms within industries.

b) The pace of change has quickened in the 1980s. There is a larger amount of employment shifting taking place within industries in each sector. The rates of job gain and job loss at the firm level are also higher in the 1980s. The increase is largest in the natural-resource-based, labour-intensive, and product-differentiated sectors.

3) Wage rate changes

a) Inter-sectoral wage rate differences have widened in the 1980s. Labour-intensive, natural-resource, and product-differentiated industries have fallen behind the scale-based and science-based sectors.

b) Cross-regional differences within the same sectors have declined thereby suggesting an increasing integration of labour markets in Canada.

c) The offsetting effect of increasing inter-sectoral differences and decreasing inter-regional differences has had varying effects on different regions. Ontario has moved from being above the national average in the highest paying sector to about the national average. The Maritimes has moved up toward this national average. Quebec has fallen behind in more sectors than it has improved. British Columbia has experienced dramatic gains in some industries and losses in others and, in this sense, has developed increasing inter-sectoral wage polarity.

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Introduction

The process of globalization is opening up economies that have long been protected and subjecting them to new competitive forces. This process has been accompanied by trade liberalization which has placed additional pressures on industries causing some to decline and others to grow. Contributing to the globalization pressures is the emergence of dynamic new export-oriented economies in Asia that are forcing adjustments on countries in both North America and Western Europe. These forces are seen to be putting greater pressure on the industrial structure of many countries than ever before and to be accelerating the pace of change.

While the process of globalization and the importance of competitiveness have only been introduced to the lexicon of public policy debates recently, Canada has known these forces for much of the post-war period. As a small open economy with considerable foreign investment, Canada has been adapting continuously to changing patterns of international trade and has been sensitive to the importance of the international transfer of technologies. Structural change has been taking place continuously in Canada throughout the post-war period as successive tariff reductions have reduced the protection enjoyed by Canadian industries. GATT rounds of tariff reductions, the US-Canada free trade pact, and the North American Free Trade Pact have led to successive reductions in tariffs that have increased export opportunities for some industries and increased competition from imports for others.

Industrial policy in Canada has in various forms been directed in large part at facilitating growth in Canada's scale-based industries since they are seen to provide high-paying jobs. More recently, greater stress has been placed on the future of high value-added knowledge-based industries--science-based industries. The labour-intensive sectors are seen to have little future as they have to vie increasingly with low-wage imports from abroad. The old strategy of reliance on resource-based industries is also commonly seen to be problematic because of a decline in the price of resources relative to other goods and services.¹

This paper examines the extent to which the structure of the Canadian manufacturing sector has been adapting and changing. It investigates the direction, magnitude, and the pace of this change both for Canada and for five Canadian regions over the period 1970-1990.² The five regions examined are the Maritimes, Quebec, Ontario, the Prairies, and British Columbia (B.C.).

Industrial Structure

The structure of the economy consists of the framework on which the productive process relies. It has many characteristics. It is most often associated with the nature of the industries in

¹ See Economic Council (1992).

² The amount and the pace of structural change for the Canadian manufacturing sector in the 1970s has been extensively studied [eg. Baldwin and Gorecki (1990)].

which production takes place and is measured by the distribution of production across industry types. But there is much more to structure. Structure is also determined by the type of production units, by the markets used to effect exchange, by the quality of inputs used in the production process. Structure may be changing if some industries are in decline. It can also change if the size of firms or their nationality is changing, or if the quality of the labour force is being altered.

Structural change is defined here as permanent or long-run change in the characteristics that define the framework of the economy. These changes may affect either the entire economy or only a particular sector of it. To examine change, this paper looks first at the distribution of employment across different sectors of the Canadian manufacturing sector, then at its distribution across regions.³ Our examination of interindustry structural change focuses first on the extent to which the distribution of employment across industries has changed in Canada and in different regions over the last twenty years. It asks which of five sectors experience growth or decline in Canada and in different regions, whether the most important sectors decline in size, whether the ranking of different sectors changes, and whether there is a difference in the pattern and amount of change across regions.

The paper then examines the extent to which a change in structure has been associated with or has influenced industry characteristics both at national and regional levels. In particular, the implications of structural change on industrial diversity and wages are examined. The effects of changes on industry characteristics are compared and contrasted across different regions, between regions and at the national level.

The Industrial Framework

Structural change must be set with a framework or taxonomy. For the purposes of this paper, the manufacturing sector is aggregated into five major sectors. These five categories are: natural-resource-based, labour-intensive, scale-based, product-differentiated, and science-based industries. The five groups are defined on the basis of the primary factors affecting the competitive process in each activity. For the resource-based sector, the primary factor affecting competition is access to abundant natural resources. For the labour-intensive sector, it is labour costs. For scale-based industries, it is the length of production runs. For differentiated goods, it is tailoring production to highly varied demand characteristics. For science-based industries, it is the rapid application of scientific advance.

The five classifications are initially taken from a taxonomy developed by the OECD (1987) to investigate structural change in its member states.⁴ For the purpose of this paper, a similar classification was adopted in order to facilitate international comparisons. The OECD

³ All information came from Census of Manufactures which collects data at the establishment level.

⁴ See also OECD (1992).

concordance was verified and modified with a discriminant analysis⁵ that uses some fifty industry characteristics to test the validity of the concordance.

The first set of variables used in the analysis captures the extent to which economies of scale are important. This set includes the average size of a plant, the average size of a firm, a measure of scale economies derived from the estimation of a production function using cross-sectional plant micro data, industry concentration, the capital-labour ratio, and the relative productivity of small versus large plants. The second set of variables captures the importance of research and development expenditures--the ratio of R&D employment to total employment and the ratio of R&D expenditure to sales. In the latter case, current expenditure, capital expenditure, intramural and extramural expenditures are all employed separately. To capture product differentiation, advertising/sales ratios and the number of products produced are used. A third set of variables measures the importance of trade. These include export-to-production ratios, import-to-domestic market ratios, the importance of intra-industry trade, and tariff rates. Wage rates are included to discriminate between industries on the basis of wage costs. The ratio of sales to value added is used to capture resource industries where materials make up the preponderance of total costs. A final set of variables includes foreign ownership, the variability of demand, unionization, profitability, inward diversification, and consumer and producer good binary variables.⁶

The discriminant analysis correctly classified 155 of the 167 four digit industries to the OECD classification. The misclassified industries were then carefully examined and reclassified in most instances. For example, sawmills is a small scale natural resource type industry in many OECD countries. In Canada, characteristics such as plant size, economies of scale, wage rates and other industry characteristics in the sawmill industry cause this industry to resemble other scale-

⁵ Given a set of observations containing one or more quantitative variables and a classification variable defining groups of observations, discriminant analysis is concerned with classifying each observation into one of the groups. More formally, a matrix X of order $n \times m$ is given, where n is the number of observations and m is the number of variables. Furthermore, suppose X is partitioned into r subgroups: $X = [X_1, X_2, \dots, X_r]$, where X_i is of order $n_i \times m$, and $n_1 + n_2 + \dots + n_r = n$. As an example, the X matrix may be thought of as a matrix of observations of n industries with m characteristics (variables) such as average plant size, market share, concentration, wages per production worker, etc.; n industries are classified into subgroups such as n_1 natural-resource based industries, n_2 labour-intensive industries, n_3 scale-based industries, n_4 product-differentiated industries, and n_5 science-based industries ($n_1 + n_2 + n_3 + n_4 + n_5 = n$). Discriminant analysis enables one to find a set of characteristics (variables) that differentiate optimally between the subgroups and thus to decide on which subgroup an individual industry should be assigned. For further details and methods of discriminant analysis, see Van de Geer (1971).

⁶ For a discussion of the variables and their definitions, see Baldwin and Gorecki (1986).

based industries more than industries in the natural-resource-based sector. Appendix A contains the listing of industries classified to each sector and the share of employment in 1980.

Table 1 provides a select set of industry characteristics for the five sectors. These include plant size, concentration, foreign ownership, indices of wage rates and capital-labour ratios, the sales-to-value added ratio, the advertising-to-sales ratio, the number of products, the R&D-to-sales ratio, and the trade position. Natural-resource-based industries are primarily processors of domestic raw materials with a high ratio of sales to domestic value-added. The labour-intensive industries have low capital-labour ratios, pay low wages, possess small plants and are protected by high tariff rates. Scale-based industries are characterized by large plants, high capital-labour ratios, and high wages. Product-differentiated industries have high advertising-to-sales ratios, produce a large number of products, and spend more on R&D. Science-based industries are the high-tech industries with high R&D ratios and with a large percentage of the workforce in scientific and professional occupations. They also have large plants, high concentration and high foreign ownership.

Structural Change in the Manufacturing Sector in Canada and Across Regions

This section examines the extent to which some sectors dominate others and how the relative importance of the different sectors has been changing. Changes can be measured by shifts in the distribution of either outputs or inputs between industries within the manufacturing sector. For the purpose of this paper, we shall rely principally on shifts in the distribution of employment because we are principally concerned with employment issues--which sectors are generating jobs and the characteristics of those jobs. Share of employment in each of the sectors for Canada and for the five major regions is presented for the years 1970, 1980 and 1990 in Table 2.

In 1970, scale-based industries are the dominant manufacturing sector in Canada, followed by labour-intensive, natural-resource-based, product-differentiated and science-based industries--with 31.6, 25.5, 24.9, 10.0, and 8.1 percent of all manufacturing production workers, respectively (Table 2). Between 1970 and 1990, the labour-intensive sector declines, while the natural-resource-based, scale-based, product-differentiated, and science-based sectors grow (Table 2). The share of employment in labour-intensive industries declines from 25.5 to 20.9 percent. The natural-resource-based sector grows from 24.9 to 26.2 percent; the product-differentiated sector grows from 10.0 to 12.0 percent; the science-based sector grows from 8.1 to 9.2 percent; and the scale-based sector grows only marginally from 31.6 to 31.7 percent. The relative position of labour-intensive and natural-resource-based industries changes by 1990. The former, which was second, falls to third place; the latter, which was third, becomes the second largest employer.

Thus Canada moves towards natural-resource-based, scale-based, product-differentiated, and science-based industries; and away from labour-intensive industries over the period. This change is divided about equally between the 1970s and 1980s. It is more or less continuous and there is little evidence of any increase in the pace of change.

Although the direction of change between 1970 and 1990 is unmistakable, the direction of the changes is not the same every year. The signs of annual changes in the share of employment were examined (not presented here). The lack of long continuous sequences of similar signs indicates that few industries in the manufacturing sector of Canada exhibit continuous growth or decline. The longest sequence can be found in the product-differentiated sector. In the mid-1980s, the product-differentiated sector in Canada grows continuously for six years. Thus, long-term trends are difficult to discern because of the amount of variance around the trend. Prognostications about future trends based on only one or two years evidence are likely to be unreliable.

There are considerable differences in the industry structure of different regions. In 1970, natural-resource-based industries are the most dominant sector in the Maritimes and the Prairies where their share of employment is 43.9 and 38.7 percent, respectively (Table 2). The largest sector in Ontario and BC is the scale-based sector with 34.4 and 49.5 percent of employment, respectively. Quebec's industrial structure, on the other hand, is dominated by labour-intensive industries, which have 38.3 percent of employment in 1970.

Between 1970 and 1990, all regions experience a change in the distribution of employment. The labour-intensive sector, which ranks second as of 1970 in Canada, declines in all regions except BC. The greatest decline occurs in Quebec--from 38.3 to 29.7 per cent.

The natural-resource-based sector, which ranks third as of 1970 in Canada, increases its share of employment in the eastern and central regions but declines in the west. The decrease in the Prairies is particularly large--from 38.7 to 32.8 per cent.

Except for B.C. and the Maritimes, changes in the share of the scale-based sector are relatively small. It declines from 39.6 to 35.5 percent in the Maritimes, and 49.5 to 42.9 percent in BC.

The product-differentiated sector grows in all regions. The growth is particularly large in the Western provinces--from 9.9 to 14.4 percent in the Prairies and from 5.9 to 9.3 per cent in B.C.

The science-based sector, which has the smallest share of employment in 1970 at the national level, grows in all regions. The largest increase--3.3 percentage points--occurs in the Prairies.

Despite these changes, the dominant industry in each region as of 1970 remains unchanged at the end of 1990. At the end of 1990, natural-resource-based industries remain dominant in the Maritimes and the Prairies; labour-intensive industries remain dominant in Quebec, and scale-based industries are the most important in Ontario and BC.

Nevertheless, much of the employment change results in a broad increase in diversification. In Quebec, the decline in the labour-intensive sector is accompanied by an increase

in all other sectors. The natural-resource-based, scale-based, product-differentiated, and science-based sectors all grow (Table 3). In the Prairies, the first and second largest sectors--natural-resource-based and labour-intensive sectors--decline, while the third most important sector in 1970--scale-based--and two sectors of less importance experience dramatic growth (Table 3). BC experiences a decline in the dominance of its scale-based and natural-resource-based sectors and increases in the less important product-differentiated, labour-intensive, and science-based sectors (Table 3). Thus in BC, the Prairies and Quebec, the structural changes result in diversification away from the dominant industry to other sectors.

The pattern in the other regions is mixed. In Ontario, the importance of the third most important sector in 1970--the natural-resource-based sector--increases and so do the smaller product-differentiated and science-based sectors. The labour-intensive sector declines. The importance of the scale-based industries in Ontario remains essentially unchanged (Table 3). In the Maritimes, growth occurs in the dominant natural-resource-based sector and in the smaller product-differentiated and science-based sectors at the expense of scale-based and labour-intensive sectors (Table 3).

As is the case with Canada, the regional changes are neither continuous nor large when measured on an annual basis. The signs of the annual change in employment shares were examined (not presented here). Few sectors in any region exhibit long periods of decline or growth with the notable exception of Quebec's labour-intensive, Ontario's natural-resource-based and product-differentiated sectors, and the Prairies' natural-resource-based and science-based sectors. Since 1973, the labour-intensive sector in Quebec declines almost continuously. In the 1980s, there is a long period during which the natural-resource-based sector grows in Ontario and declines in the Prairies; the product-differentiated and science-based sectors continuously grow in Ontario and the Prairies, respectively.

It is clear that while structural change is taking place everywhere, regions differ both in their reliance on only one or two sectors and the extent to which that reliance is changing. There are several summary statistics that can be used to measure a region's industrial diversification. A herfindahl index, calculated from employment shares, reveals the degree to which a region is specialized in a small number of sectors. Defined as the sum of the square of employment shares across five sectors, this index potentially varies from a limit of .2, which occurs when there is an equal percentage of employment in the five sectors, to 1, when a region is completely concentrated in one sector. The values of the herfindahl index of industrial specialization are presented in Table 4 for 1970 and 1990.

The region with the highest specialization and the least diversification in 1970 is the Maritimes, with an index value of .36 (Table 4). Between 1970 and 1990, the degree of specialization in the Maritimes remains approximately unchanged. British Columbia, with the second highest level of specialization (.36), experiences a decline of some 14 percent over the period. The Prairies, whose index is .27 in 1970, experiences a decline of 13 percent. Quebec, whose index is .27 in 1970, declines close to 11 percent over the period. Ontario, which has the

lowest level of specialization in 1970 (.24), remains essentially unchanged over the period. Thus, three of the five regions diversify their industrial structure over the period.

A second measure used here to capture the amount of change over the period is a "dissimilarity index". It is one-half the sum of the absolute value of the employment share differences of each sector between the beginning and ending year of the period. It captures the amount of employment share transferred from declining to growing industries during the period. It takes on a value of zero when no change occurs and 100 when 100 per cent of employment is shifted from one group to another.

The dissimilarity index is calculated by using changes in employment shares between 1970 and 1990. Dissimilarity indices are calculated between 1970 and 1990 both for Canada as a whole and for each region (Table 4). The change in Canada over this twenty-one year period is 4.52 percentage points of employment. The Prairies experience the largest shifts in employment share (about 10 percentage points) followed by Quebec (about 9 percentage points). The least amount of long-run change occurs in the Maritimes and Ontario. The change in the distribution of employment in the Maritimes and Ontario is about 5 and 3 percentage points of employment, respectively. The total amount of employment share transferred in BC is about 7 percentage points.

In conclusion, British Columbia, the Prairies, and Quebec experience the most change during this period. In Quebec, labour-intensive industries are in decline. In the Prairies, it is the natural-resource sector that is declining and the product-differentiated and the science-based sectors that are growing. In B.C., it is the scale-based sector that declines while the product-differentiated and the labour-intensive sectors grow.

Intra-Sectoral Change

Structural change then has broadly responded to industrial policy which has focused on obtaining increased access for Canadian industries to North American markets for scale and science-based industries while reducing tariff protection in the labour-intensive sector. Moreover, the intersectoral changes have been gradual and quite small when measured on an annual basis.

These results should not be interpreted to mean that structural change is unimportant. Intersectoral shifts generally are not large. There is much more change taking place within sectors (see Baldwin and Gorecki, 1990). This change can be measured both by looking at shifts going on among industries within sectors and at changes going on within industries among firms. We deal with each of these in turn.

a) Intra-sectoral shifts in employment distributions

Employment change across industries within each of the five industrial sectors is measured using a dissimilarity index (Table 5). It is calculated using the employment of industries within each of the five sectors. The value of the index, therefore, captures the amount of labour

reallocation that is taking place among industries within each sector. When calculated on an annual basis, between 2.6 and 3.1 per cent of the share of production workers is being shifted annually in the 1970s within each sector. This increases in all but the product-differentiated sector in the 1980s (column 3). Over the period 1970 to 1990, the greatest cumulative change (21.8%) occurs in the science-based sector, the least (11.0%) occurs in the product-differentiated sector. The other three sectors each shift about 18 percent of employment share from declining to growing industries.

Dissimilarity indices for each sector are presented by region in Tables 6 and 7. Table 6 contains the average of dissimilarity indices calculated annually for the period 1970 to 1988. It measures average short-run change. Table 7 contains the dissimilarity index calculated by comparing end years 1970 and 1988. It measures long-run change.

At this level of aggregation, reallocation shifts between 3 and 7.6 percentage points of employment share annually. Over the eighteen year period from 1970 to 1988, between 6 and 37 percent is shifted.

Science-based industries generally experience the most change in their distribution of employment; the scale-based industries experience the least. Not only does the natural-resource-based sector decline in the west, there is more internal shifting going on among natural-resource-based industries in British Columbia and the Prairies than in the east. Similarly, the Prairies gain more market share in the product-differentiated and science-based sector and have more employment share shifting within these sectors than is the case for these sectors in other regions. The Maritimes loses share in the scale-based sector and has one of the highest amounts of internal reallocation. In each of these cases then⁷, particularly large sectoral changes in share are associated with large amounts of internal reallocation across industries within the sector.

When we compare regions, there is considerable variability in the rankings of the amount of intra-sectoral shifting among industries. British Columbia ranks high in terms of change within science-based and labour-intensive sectors. Quebec and Ontario each rank low in terms of the amount of change within each of the five sectors. The Maritimes differs little from Ontario and Quebec, except in the product-differentiated and the science-based sectors which are relatively unimportant in the Maritimes. The same is true of the Prairies.

b) Intra-sectoral job growth and decline

The dissimilarity index captures change at the industry level in the distribution of employment. Within industries, there is also considerable change as the more successful firms

⁷ The exception is Quebec. It experiences the greatest percentage point decline in its labour-intensive sector but its internal rate of change among industries in this sector is no higher than in other provinces.

grow and the less successful firms decline. Job-turnover measures can be used to capture this aspect of structural change.

Job-turnover measures capture the degree to which employment is growing in some firms and declining in others. Other studies (Baldwin and Gorecki, 1990) demonstrate that this dimension of change is far greater than the amount of net employment change. Moreover, it accounts for the majority of job change--far more than intersectoral shifts in the distribution of jobs (Baldwin and Gorecki, 1993).

Three measures of job change are estimated for each of the five sectors. The job-gain rate is the number of additional jobs created by growing⁸ firms divided by base year employment in all firms. The job-decline rate is the number of jobs lost in declining firms divided by base year employment in all firms. The total turnover rate, called the excess rate, is defined as the sum of job growth and job decline minus the absolute value of the net change in jobs. It is the total change in excess of that which is required to facilitate net change. It is defined net of employment change so as to correct for differences in total turnover across time periods that may simply result from differences in net growth rates. Mean annual job turnover rates for the 1970s and for the 1980s are presented in Table 8 using counts of production workers.

As has been previously demonstrated, a considerable shifting of jobs occurs as the result of firm growth and decline. Even in sectors where net employment change is negative, there is still substantial job gain. In the labour-intensive sector in the 1970s, the job-loss rate is 10.4 percent per year; but job-gain rates average 8.1 percent.

In total, the highest turnover occurs in the labour-intensive sector; but product-differentiated industries follow closely behind. The lowest rates of total turnover occur in the scale-based sector.

More important than the levels of job turnover is the fact that the pace and nature of job turnover has changed over the last decade. Compared to the 1970s, rates of both job gain and job loss are higher in the 1980s. The total rate of change corrected for net employment decline is also generally higher in the 1980s. Structural change at the firm level has sped up during the 1980s. The variances of the annual job-gain and job-loss rates, not reported here, have also increased. Not only has the amount of change increased, but the economy has become more volatile.

The pattern of change is graphically depicted in Figures 1 to 6. Figure 1 contains rates of job loss for the natural-resource-based, the labour-intensive, and the product-differentiated sectors. The upward trend in job-loss rates in all three sectors is evident. Job-loss rates climb throughout the 1970s, peak at very high levels in the depth of the 1982 recession but do not return to the levels of the 1970s at any subsequent point in the decade. The demand side of the labour market has led to higher churning levels during the 1980s.

⁸ Growth and decline are defined in terms of the number of production workers reported.

This increase in churning is not simply due to sudden declines in total employment. As Figure 3 demonstrates, these same three sectors also experience an increase in job-gain rates in the 1980s. Jobs are being lost and created at record high rates during the peak years of 1984 to 1988. Internal restructuring is occurring that is associated with internal competition within these sectors.

Rates of job loss and job gain for the scale-based and the science-based sectors are presented in Figures 2 and 4 respectively. The upward trend is less pronounced in both cases.

Total turnover clearly increases for the natural-resource-based, the labour-intensive and the product-differentiated sectors (Figure 5). It also tends to be slightly higher for the scale-based and the science-based sectors--but the increase is less for both these sectors than for the former three.

The growth sectors--scale and science-based--whose expansion has been at the heart of industrial policy then have been subject to little increase in the pace of internal change. The labour sector, which has been in decline, has not only lost overall market share; but it has also been subjected to increased internal change as the distribution of employment both across industries and across firms has changed. The resource-based and the product-differentiated sector have also both experienced an increase in the pace of restructuring at the firm level.

Structure and Wage Differentials

The nature of structural change is of interest primarily because of the way in which it is associated with industry characteristics such as wage rates.⁹ Changes in industrial structure that expand opportunities in the highest wage sectors are regarded as beneficial. Changes that lead only to an expansion of low-wage opportunities may foreshadow declines in living standards. This section examines the existence of intersectoral and interregional wage differentials and the pattern of their change between 1970 and 1990.

Several questions are of interest. The first is the extent to which wages paid in different sectors converge over time. The second is the extent to which differences in regional structure contribute to differences in average wages. The third is the extent to which changes in industry structure at the regional level contribute to improvements in average wages.

In order to calculate wage differentials, average remuneration per production worker is calculated from the Census of Manufactures for each 4-digit industry between 1970 and

⁹ For previous work that looks at either inter-industry or cross-regional wage rates, see Economic Council of Canada (1977), Gera and Grenier(1991), Swan and Serjak (1991), Economic Council of Canada (1991, ch. 8)

1990 and the mean for each of the five sectors is estimated.¹⁰ The mean for each sector and each region is then indexed relative to a base of 100.

The base used for comparison of intersectoral and interregional wage rates differs depending on the question that is being asked. When intersectoral wage differentials within a region are being examined, the highest paying sector in each region is chosen as the base (Table 9). An examination of how sectoral wages differ over time allows conclusions to be drawn about the extent to which differentials within regions exist and whether they have changed. Previous studies have found considerable divergences in wages across sectors, thereby suggesting less than perfect substitution in terms of skills and worker characteristics across industries. At issue here is the extent to which these differentials have been declining or getting bigger and how much they differ by region.

When interregional wage differentials are being examined--such as differences in the wage of the labour-intensive group across Canadian regions--then the wage rate for the labour-intensive sector in all of Canada is chosen as the base (Table 11). A comparison here permits conclusions about the extent to which a sector pays similar wages across different regions, irrespective of whether cross-sector differences exist within regions. If national labour markets have improved over time, we should expect to see declining differentials at the sector level.

When the extent to which all industrial sectors in different regions are converging to a common level is examined, the base chosen will be the highest paying sector in Canada (Table 12). Throughout the period from 1970 to 1990, this is the scale-based sector in Canada. Cross region/sector comparisons using this base allow us to draw conclusions about the size of all differentials that stem both from sectoral and from regional differences and whether they have been increasing or declining over time.

a) Intra-regional wage differentials.

The first issue examined is the size of the wage gap across industrial sectors within regions and changes in the size of the gap that have accompanied restructuring.

Substantial differences within each Canadian region exist in the wage being earned in the different industry sectors. At the national level, the scale-base sector has consistently paid the highest wage throughout the period; the labour-intensive sector has paid the lowest (Table 9). More importantly, the gap between the lowest and the highest paid sector has widened. Between 1970 and 1990, the lowest wage sector moves from paying 66.8% to 62.0% of the highest wage sector. The wage gap, therefore, increases from 33.2% to 38.0%.

¹⁰ This is calculated as the weighted mean. We also used weighted hourly earnings and found most of the conclusions of this section remained the same. Tables using hourly earnings are included in Appendix B.

The labour-intensive sector is not the only one to suffer from an increased wage gap with the scale-based sector. Two other sectors have seen their wage rate decline in relative terms over the period. The product-differentiated sector, which starts from about the same relative position as the science-based sector in 1970 (86.9%), falls to 77% of the scale-based sector by 1990. The natural-resource-based sector falls from 81.9% to 78.7% of the scale-based sector. Thus, three of the four non-scale based sectors experience an increase in the wage gap over the last two decades.

It is only in the science-based sector, the smallest national sector, where a slight improvement in relative position occurs--going from 86.1% in 1970 to 87.2% in 1990 of the scale-based average.

In order to give a better appreciation of the implications of this increasing divergence in wages, the real wage¹¹ is plotted in Figure 7 for each of the five sectors (see also Table 10). Real wages increase in all sectors during the 1970s. During the 1980s, income in the scale-based and science-based sectors continues to increase, though they both peak in the last half of the decade. The natural-resource-based, product-differentiated and labour-intensive sectors decline in real terms throughout the decade.

This pattern is generally found in all regions. The relative wage in labour-intensive industries declines almost everywhere. As a result of the decline in the labour-intensive sector, the wage gap between the highest paying and the lowest paying sector increases over time across all regions. The relative wage in the labour-intensive sector declines in the Maritimes from 62.9% to 61.3% of the scale-based sector; in Quebec, from 64.7% to 60.4%; in Ontario, from 70.8% to 65.8%; in the Prairies, from 76.0% to 65.4%; and in B.C., from 77.5% to 59.1% (Table 9).

Declines are also experienced in most regions in the relative wage of the product-differentiated and natural-resource-based sectors. The one exception to the general pattern of sector wage rate declines occurs in the science-based sector. Here the relative wage increases in the Maritimes, Quebec and Ontario but decreases in the Prairies and in B.C.

As a result of all these changes, the Prairies and B.C. suffer the greatest increase in the inter-sectoral wage rate differential. Natural-resource-based relative wage declines are particularly large here. So too are the declines in the relative wage of the product-differentiated sector in these two regions. Finally, it is in these two regions where the relative wage of the science-based sector declines rather than increases.

b) Intra-sectoral wage differentials.

The second issue examined is the extent to which wage differentials exist across industries in different regions and whether the gap has narrowed or widened.

¹¹ The national consumer price index is used as deflator.

Intra-sectoral wage differentials do not show the same divergence over time as do the intra-regional differentials. Indeed, there is a general convergence within each sector across regions (Table 11). For example, the relative wage rate of the natural-resource-based sector tends to increase if it is less than the national average for the resource sector in 1970 and to decrease if it is above. The same is true of the labour-intensive, the scale-based, the product-differentiated, and the science-based sectors. The main exception occurs in B.C., where the average wage of the natural resource-based and the scale-based sectors are above the national average wage rate of these sectors in 1970 but experience an increase in their relative wage rate and where the average wage of the science-based sector starts below its national average in 1970 and subsequently declines. Once again, this is evidence of increasing wage rate dispersion in British Columbia.

The cross-regional convergence in industry wages brings the Maritime sectors much closer to the national average. There are gains of 8 percentage points in the scale-based sector, 8 percentage points in the product-differentiated sector, 10 percentage points in the natural-resource-based sector, 12 percentage points in the labour-intensive sector, and 20 percentage points in the science-based sector.

In 1970, Ontario wages were generally higher than the national average in all sectors. Between 1970 and 1990, the size of Ontario's lead declines in all sectors by 2 to 3 percentage points. By 1990, four of the five sectors in Ontario are within 2 percentage points of the national average. Only in the labour-intensive sector is the Ontario wage rate still above the national mean.

All sectors in the Prairies also move close to the national average for their respective sectors until the deviations in 1990 have become relatively minor--second only to those of Ontario in terms of the cumulative differential taken across all sectors.

The relative wage in Quebec moves up in all sectors with the exception of the scale-based sector. The wage in its natural-resource-based sector moves to the national average in this sector and that of its science-based sector moves ahead of the national average in the same sector. The relative wages in its labour-intensive, product-differentiated and scale-based sectors remain below the national average in the same sectors by between 6 and 10 percentage points.

c) Inter-sectoral and inter-regional wage differentials.

Our comparison of wage rate changes across sectors and regions has revealed two opposite trends. Differences across industry sectors within regions have been increasing; differences within industry sectors across regions have been decreasing. The net effect of these opposing forces is presented in Table 12 where the industry average wage rate in each sector is compared to the national average for the highest paying sector--the scale-based sector.

For the Maritimes, the strong convergence of its sectoral wage rates toward the national average is sufficient to offset the relative decline in the natural-resource-based, labour-intensive,

and product-differentiated sectors. The Maritimes' sectors generally experience an increase in their wage rate relative to the national scale-based average. Despite this improvement, the gap in the Maritimes' most important industry--natural resources--is still some 40 percentage points by 1990. But the gap in its scale-based sector, its second most important industry, has moved from 12.0 to only 4.1 percentage points by 1990.

By contrast, four of the five sectors in Quebec fall behind over the period. In two of its dominant sectors--the labour-intensive and the natural-resource-based industries--there is 4 percentage point and 1 percentage point decline, respectively. The product-differentiated sector declines by 7 percentage points. Only in the science-based sector is there an increase.

As a result of this general convergence, Ontario suffers large losses in all but its science-based sector. Its scale-based sector falls by some 3.2 percentage points. Its labour-intensive, resource-based and product-differentiated sectors decline by 7.3 to 11.6 percentage points.

In the Prairies and British Columbia, the relative wage of the scale-based sector improves relative to the national average for this sector but the relative wage falls for most other sectors. The Prairies experience a greater decline in their natural-resource-based sectors; B.C. experiences a greater decline in its labour-intensive sector.

In conclusion, despite the tendency of national labour markets to converge at the sectoral level across regions, increasing differentials across sectors means there is greater overall inequality at the end than at the beginning of the period.

d) The Relationship between Structure and Wage Rates

While relative wages are changing over the last two decades, so too are relative employment shares. (Table 12) The strength of a region's industrial structure depends on the extent to which it concentrates on high wage paying sectors; its long-term health depends on whether it is increasing the employment share of these industries.

The Maritimes generally has a wage structure which is below that of the other regions. This is exacerbated by its industrial structure. The largest percentage of employment is concentrated in the natural-resource-based sector, which along with the labour-intensive sector has the lowest relative wage both in 1970 and 1990. Moreover the changes that have occurred in structure have exacerbated the Maritimes' position. Employment share declines in the scale-based sector where there is less of a wage rate disadvantage and increases in the natural-resource-based sector where the disadvantage is greatest in 1990.

Quebec's industrial structure also contributes to its overall wage gap in manufacturing. Some 38 percent of its employment is in the labour-intensive sector, which has the lowest relative wage rate in 1970. However, in Quebec changes in structure have had a beneficial effect. The low wage labour-intensive sector loses considerable share. The sectors gaining share all have higher relative wages in 1990 than the labour-intensive sector.

Ontario experiences much less change in the share of the five sectors and, therefore, structural shifts are less important here. Nevertheless, the change that occurs here has been beneficial in that it consists mainly of a reduction in the importance of the low wage labour-intensive sector.

Structural change in the Prairies and B.C. produces mixed results. The low-wage labour-intensive sector declines in the Prairies. But the share of employment also declines in the natural-resource-based sector while it increases in the product-differentiated sector. Unfortunately, the latter has developed an even bigger wage gap by 1990 than the natural-resource-based sector and thus substitution into this sector does not help the relative wage position of the Prairies. In British Columbia, employment share decreases in the scale-based sector; but this is the sector with the largest wage rate advantage. Most of the growth in British Columbia occurs in the product-differentiated and the science-based sector, two areas with the lowest relative wages.

Conclusion

The topic of structural change has gained recent attention as explanations are sought for the length of the 1989-92 recession. The long-wave theorists have argued that the Canadian economy is going through a radical restructuring that has prolonged the recession but which bodes well for future economic growth, although its short-run consequences are unfortunate.

Adequately describing structural change is difficult because it has many dimensions. Not all dimensions yield the same story. The most commonly measured dimension of structural change is the distribution of employment or output in different sectors. But structural change can also be measured by investigating the change taking place within sectors or within industries.

When the employment distribution for five major sectors is employed to examine structural change over the last two decades, there is little indication of a dramatic change in circumstances. It is true that the sector said to be most in need of restructuring--the labour-intensive sector--has lost ground in all regions; but the amount of employment share that was transferred is relatively small--only about 4 per cent over twenty years at the Canada level. All other industries have gained small amounts of employment share. Moreover, the change in employment distribution appears to be continuing in the 1980s at about the same pace it followed in the 1970s.

When the employment distribution for industries within the five major sectors is examined at the regional level, the story changes only slightly. There is broad diversification in most regions. Changes in the importance of sectors in most regions mirror the national trends. The one exception is the natural resource sector which declines in B.C. and the Prairies but grows in importance in eastern Canada. But similar trends of sectoral adjustment should not be interpreted to imply that adjustment was equally severe in all regions. Larger than average declines are found in the labour-intensive sector in Quebec and the natural-resource sector in the Prairies. The

severity of adjustment differs by region. Nevertheless, it is still the case that employment shares at the regional level do not suggest that the pace of adjustment has increased in the 1980s.

A different picture of structural change is produced when more detail is introduced into the analysis. When shifts in industry shares within broadly defined sectors or shifts in relative shares of firms within industries are examined, far more change is seen to be occurring. Moreover, the pace of change has increased in the 1980s compared to the 1970s. This is more than just an increase in volatility due to increasingly severe recessions. The pace of change has increased in the labour-intensive, natural-resource-based, and product-differentiated sectors. Only one of these sectors is in broad decline--the labour-intensive sector. In the 1980s, the pace has increased in the extent to which employment share is being redistributed among industries in the same sector and also in the number of jobs being lost due to company decline and the number of jobs being gained by growing firms within each industry.

The most dramatic evidence of a major structural shift is provided by the evidence on inter-industry wage differentials. While there has been a convergence of wages across regions, inter-sectoral differences both for Canada and for specific Canadian regions have been widening. The end result has been to increase the gap in wages between the worst off and the best off sector. The labour-intensive sector, which loses employment share, also falls behind in terms of relative wages. But so too do both the natural-resource-based and the product-differentiated sectors. Even though these sectors increase their share of total employment, their wages fall relative to the scale-based sector. Like the labour-intensive sector, they also are characterized by an increase in internal restructuring.

The net result of these wage-rate changes varies from region to region. The Maritimes has seen its sectoral wage rates catch up to the scale-based sector--the best paying sector in Canada. But Quebec has generally fallen behind. Ontario has lost its national lead. British Columbia has seen the greatest divergence develop between the top and the bottom sectoral wage rates.

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