

*NUMBER 51 • DECEMBER 1998*

ALBERTA'S LABOUR FORCE AND EMPLOYMENT STRUCTURE  
OVER THE LAST QUARTER CENTURY:  
ASSESSING THE CHANGES

*Edward J. Chambers*  
*Western Centre for Economic Research*  
*University of Alberta*

## **Canadian Cataloguing in Publication Data**

Chambers, Edward J.

Alberta's labour force and employment structure over the last quarter century

(Information bulletin / Western Centre for Economic Research ; no. 51)

ISBN 1-55195-050-2

1. Labour supply—Alberta—History—Statistics. 2. Alberta—Economic conditions—1945—Statistics. I. University of Alberta. Faculty of Business. II. University of Alberta. Western Centre for Economic Research. III. Title. IV. Series: Information bulletin (University of Alberta. Western Centre for Economic Research) ; no. 51

HD5729.A53C52 1998 331.1'1'09712309045 C99-910006-8

## ALBERTA'S HUMAN RESOURCES AND EMPLOYMENT STRUCTURE OVER THE LAST QUARTER CENTURY: ASSESSING THE CHANGES

Over the past quarter century Albertans have lived through a wide range of economic circumstances. These conditions, occurring within a broader context of increased globalization included: the energy and farm price boom of the seventies and early eighties; the National Energy Policy; the crude oil price collapse of 1986; transitions in agriculture such as the increased importance of livestock and specialty crops; the opportunities and required adaptations following the FTA and NAFTA; the resurgent growth in manufacturing in the nineties; the strengthening of knowledge based industries and activities; the downsizing and restructuring of enterprises; and the adjustment to the new fiscal regimes of the provincial and federal governments. While far from complete, this list gives some flavour of Alberta's economic landscape over the past twenty-five years.

More generally Alberta's economic experience can be contrasted with the Canadian over the period. Cyclical ups and downs in Alberta employment differed somewhat from the national job experience. While the Alberta economy grew rapidly from 1976 to 1981, Canadian economic growth was quite sluggish. In Alberta the post-1981 recession which lasted through early 1983 was longer in duration and more severe than the national. Further, while the national economy escaped, Alberta suffered an additional recession following the 1986 crude oil price collapse. The national economy and, from late 1986, the Alberta economy experienced significant growth until early 1990. However, the 1990-91 recession was both deeper and more sustained nationally than in Alberta.

Economies exist for people. Therefore this Bulletin reports on labour force and employment profiles taking stock of the transitions witnessed over almost a quarter century. To do so, the Bulletin addresses five basic questions about the human resources of the province:

- (1) What was the extent of growth and demographic change, particularly gender change, in the labour force?
- (2) What happened to the share of the self-employed in total employment?
- (3) What changes occurred in the relation of full-time to part-time employment?
- (4) How has the sectoral composition of employment changed?
- (5) What evidence does employment behaviour provide about changes in the volatility of the provincial economy and in its degree of diversification?

The primary data source to address these questions is the monthly labour force survey of Statistics Canada. This national survey is the best continuous record of labour force and employment behaviour. The analysis that follows will employ data for the years from 1976 to 1997 for some purposes, while a second, more finely drawn time frame, employs quarterly data through mid-1998. Preliminary analysis of the quarterly data indicated that statistically significant differences were evident in labour force and employment variables between the first and second halves of the period. In evaluating the quarterly data, we have chosen 1988 as the dividing line between the two periods. Accordingly, the first era is from the first quarter of 1976 (1976:Q1) to the

fourth quarter of 1987 (1987:Q4) and the second from the first quarter of 1988 (1988:Q1) to the second quarter of 1998 (1998:Q2). This separation happens to coincide closely to the commencement of the Free Trade Agreement with the United States. While 1988, the year

preceding the FTA, is included in the second period it was apparent at that time that many business enterprises were engaged in planning for opportunities under the proffered FTA.

## (1) GROWTH AND DEMOGRAPHIC CHANGE IN THE LABOUR FORCE

TABLE 1 shows selected components of Alberta labour force change from 1976-86 and 1986-97. There are two important features of the table.

The first is the contrast between the two periods in numbers joining the labour force and in growth rates. In the earlier period from 1976 to 1986, the labour force grew by 425.4 thousand, an increase of 48% or at an annual compounded rate of 3.9%. Much of this rapid growth was supply side driven with many of the baby-boom

generation entering the work force in these years.

In contrast, in the 1986-97 period the labour force grew by 229.9 thousand, an increase of 17% or at an annual compounded rate of 1.5%. A second fact revealed by the table is the changed gender balance of the labour force. In both periods, female additions to the labour force substantially exceeded male numbers with a resulting increase in the female labour force share from 37.5% in 1976 to 43.0% in 1986 to 44.8% in 1997.

**TABLE 1: Selected Components of Alberta Labour Force Change, 1976-97**

<b>Component</b>	<b>1976</b>	<b>1986</b>	<b>1997</b>
Labour Force (000s)	894.5	1319.9	1549.8
Labour Force growth (000s)			
1976-86	-----	425.4	-----
1986-97	-----	-----	229.9
Gender Composition			
Men (000s)	559.9	751.6	856.5
Growth 1976-86	-----	191.7	-----
1986-97	-----	-----	104.9
Women (000s)	335.6	568.3	693.3
Growth 1976-86	-----	232.7	-----
1986-97	-----	-----	125.0
Gender Share (%)			
Men	62.5	57.0	55.2
Women	37.5	43.0	44.8

Source: Statistics Canada and the Western Centre for Economic Research

A detailed description of this trend appears in TABLE 2 which reveals the shifting contribution of the 15-24, 25-44 and 45-64 female age cohorts to the growth of the labour force, the level of the participation rate or PR (i.e. the proportion of the population who declare themselves to be in the labour force), the size of the cohort labour force, and the effects of the change in the participation rate from one reference period to another on cohort sizes. The table shows contrasting trends in

cohort participation. The 15-24 age group experienced a decline between 1986 and 1997 after an increase from 1976 to 1986, while the older age cohorts display continuous and large increases. The table also indicates the substantial effect of these PR increases from reference date to reference date on cohort sizes. Between 1976 and 1986 increases in the PRs of women between the ages of 25 and 64 accounted for 24% of the growth in the entire labour force during that period, and for 43% of the growth in the female labour force.

**TABLE 2: Women's Participation in the Alberta Labour Force by Age Cohort 1976, 1986 and 1997**

<b>Cohort</b>	<b>1976</b>	<b>1986</b>	<b>1997</b>
<b>Women 15-24</b>			
cohort population (000s)	189.3	208.9	193.6
participation rate (PR)	0.629	0.698	0.656
no. in the labour force (000s)	119.1	145.8	127.0
growth due to PR change (000s)	-----	14.4	-8.1
<b>Women 25-44</b>			
cohort population (000s)	246.3	405.5	468.8
participation rate (PR)	0.560	0.766	0.812
no. in the labour force (000s)	137.9	310.6	380.7
growth due to PR change (000s)	-----	85.5	21.6
<b>Women 45-64</b>			
cohort population (000s)	157.5	192.8	272.0
participation rate (PR)	0.475	0.556	0.656
no. in the labour force (000s)	74.8	107.2	178.4
growth due to PR change (000s)	-----	15.6	27.2

Source: Statistics Canada and the Western Centre for Economic Research

The comparable figures for the 1986-1997 period are 21% and 39%. The implications of these changes are profound not only for Alberta's labour supply but also for human resource management in the workplace as well

as for household activities. Further, women dominate volunteerism, and their higher labour force participation rates may constrain the ability of the volunteer sector to meet the increased demands being placed upon it.

## (2) EMPLOYEES (PAID EMPLOYMENT) AND THE SELF-EMPLOYED

Separating paid employees from the self-employed underscores the difference between Alberta's labour force and that in the rest of the country. This section considers the absolute and relative changes provincially in these two

types of employment and compares them with what has occurred nationally. TABLE 3 shows the incidence of self-employment in Alberta to be measurably higher than the national in each of the reference years.

**TABLE 3: Comparative Sources of Employment: Employees and the Self-employed: Alberta and Canada 1976, 1986 and 1997**

	1976	1986	1997
ALBERTA			
Employees (000s)	696	996	1,148
Self-employed (000s)	162	194	308
Ratio of Employees to the self-employed	4.30	5.13	3.73
CANADA			
Employees (000s)	8,571	10,411	11,449
Self-employed (000s)	1,206	1,682	2,488
Ratio of employees to the self-employed	7.11	6.19	4.60

Source: Statistics Canada and the Western Centre for Economic Research

For example, in 1976 there were, on average, 4.30 employees in Alberta and 7.11 employees in Canada for every self-employed person, though the gap between the provincial and national economies closed somewhat in 1986 and 1997 to ratios of 5.13 to 6.19 and 3.73 to 4.60. Since those in self-employment cover the entire economy—both the agricultural and nonagricultural sectors—some of the higher self-employment provincially is explained by the higher relative importance of agriculture in Alberta. However, that fact notwithstanding, self-employment in Alberta was consistently a higher proportion of total employment than that of the nation.

### IS THERE A TRADE-OFF BETWEEN PAID EMPLOYMENT AND SELF-EMPLOYMENT?

The question is often asked, particularly in light of the restructurings, buy-outs, and early retirements of the last decade, if there is any evidence that self-employment has become a substitute for paid employment. The options for those laid off or accepting severance packages of various kinds is not simply a choice between leaving the labour force or going into unemployment, but rather includes the third option of going into business for oneself. There is also little question that small business, of which the self-employed are an important component, has become a larger segment of the economy.

To identify any potential relationship in Alberta and in Canada, we tested the two reference periods, from 1976:Q1 to 1987:Q4 and from 1988:Q1

to 1998:Q2, using seasonally adjusted quarterly average data for employees and the self-employed. Quarterly rates of change in the self-employed were regressed on the numbers in paid employment. For Canada, no statistically significant evidence of a relationship between the two forms of employment existed in either period. Alberta results (reported in Appendix A) were quite different. While in the first period there is no statistically significant relationship, in the second period from 1988:Q1 to 1998:Q2 there is a strong and highly statistically significant negative relationship indicating that declines (increases) in the rate of change of paid

employment are associated with increases (declines) in the rate of change in self-employment. Effectively, over this period, a fall of 1.0% in the quarterly rate of growth of paid employment was associated with an increase of 1.5% in the quarterly rate of growth of self-employment. Of course, because there are about four times as many jobs in paid as in self-employment, a 1.5% increase in the self-employed does not offset in absolute numbers a decline of 1% in paid employment. However, statistical evidence supports the casual observation that, at least in the case of Alberta, the transition into self-employment was an important response to restructuring and downsizing.

### (3) FULL-TIME VS. PART-TIME EMPLOYMENT

Another useful classification of total employment (full and part-time employment combined) shows that Alberta shares some of notable trends in the national labour force. Full-time employment is defined as employment of 30

hours per week or more, while part-time employment covers any remunerative work of at least 1 hour per week. TABLE 4 compares Alberta with Canada.

**TABLE 4: Comparison of Full-time and Part-time Employment: Alberta and Canada 1976, 1986 and 1997**

	<b>1976</b>	<b>1986</b>	<b>1997</b>
<b>ALBERTA</b>			
Full-time employment (000s)	732	988	1,184
Part-time employment (000s)	126	202	272
Ratio of full to part-time employment	<b>5.81</b>	<b>4.89</b>	<b>4.35</b>
<b>CANADA</b>			
Full-time employment (000s)	8,560	10,045	11,291
Part-time employment (000s)	1,217	2,050	2,651
Ratio of full-time to part-time employment	<b>7.03</b>	<b>4.90</b>	<b>4.26</b>

Source: Statistics Canada and the Western Centre for Economic Research

The data indicate that the provincial and national ratios of full to part-time employment in 1986 and 1997 were quite close. In 1976, in Alberta, there were approximately 6 full-time

jobs for every part-time job while nationally the ratio was 7:1.

## GENDER COMPOSITION OF FULL AND PART-TIME EMPLOYMENT

TABLE 1 showed the greatly increased involvement of women in the Alberta labour force. TABLE 5 reports how this more balanced gender composition of the labour force is reflected in full-time vs. part-time jobs with national comparisons. The table reveals for both Canada and Alberta, male dominance of the full-time job market and continued female dominance of the part-time market. In both

jurisdictions the declining ratio of men to women in full time jobs from the initial reference year of 1976 does, however, suggest a somewhat wider range of career opportunities for women. Nevertheless, it is clear that the part-time job market is substantially more significant for women, and effectively dominated by them. For example, in Alberta, for males in both 1986 and 1997 there were between 10 and 11 full-time jobs for every part-time job, while the ratio for women of full to part-time jobs ranged from approximately 2.6 to 2.2.

**TABLE 5: Gender Composition of Full and Part-time Employment 1976, 1986 and 1997**

	<b>1976</b>	<b>1986</b>	<b>1997</b>
<b>ALBERTA</b>			
Full-time (000s)	932	988	1,184
Men (000s)	504	615	735
Women (000s)	228	373	449
Ratio men to women in full-time jobs	<b>2.21</b>	<b>1.65</b>	<b>1.64</b>
Part-time (000s)	126	202	272
Men (000s)	35	58	71
Women (000s)	91	144	201
Ratio men to women in part-time jobs	<b>0.38</b>	<b>0.40</b>	<b>0.35</b>
Ratio of full to part-time jobs for men	<b>14.40</b>	<b>10.60</b>	<b>10.35</b>
Ratio of full to part-time jobs for women	<b>2.50</b>	<b>2.59</b>	<b>2.23</b>
<b>CANADA</b>			
Full-time (000s)	8,560	10,045	11,291
Men (000s)	5,804	6,312	6,846
Women (000s)	2,756	3,733	4,445
Ratio men to women in full-time jobs	<b>2.10</b>	<b>1.69</b>	<b>1.54</b>
Part-time (000s)	1,217	2,049	2,649
Men (000s)	363	620	802
Women (000s)	854	1,429	1,847
Ratio men to women in part-time jobs	<b>0.42</b>	<b>0.43</b>	<b>0.43</b>
Ratio of full to part-time jobs for men	<b>15.99</b>	<b>10.18</b>	<b>8.53</b>
Ratio of full to part-time jobs for women	<b>3.23</b>	<b>2.61</b>	<b>3.70</b>

Source: Statistics Canada and the Western Centre for Economic Research

The preponderance of women in the part-time job market also reflects the fact that they have primary household responsibilities and

continue to devote substantially more hours per week than men to these tasks. It is apparent, both in Alberta and nationally, that the rate of increase



in female part-time employment has exceeded the rate of growth in full-time employment, though it is also true that the growth in the absolute number of full-time jobs held by women substantially exceeded that in female part-time jobs.

#### **IS PART-TIME EMPLOYMENT A SUBSTITUTE FOR FULL-TIME EMPLOYMENT?**

The conventional wisdom is that part-time employment is to some considerable degree an alternative to full-time employment, in part because a shift from one to the other is a means by which employers adjust payroll and production to variations in the market demand for their products. For individual women, part-time employment may be a means of 'testing the waters' in deciding on a subsequent commitment to full-time employment.

To consider the relationship between full and part-time employment, we again examined for men and women quarterly rates of change in seasonally adjusted data for Alberta in the two reference periods 1976:Q1 to 1987:Q4 and 1988:Q1 to 1998:Q2. In both eras, for both sexes, we found a significant statistical relationship between the two categories of employment, with the link strongest for females. The results also indicate that the inverse relationship was greater for both sexes in the second period. For example, in the case of men, a 1% increase in the growth rate of full-time employment was on average

associated with, respectively, a decrease of 1% and 2.8% in these two periods.

For both genders we also tested for the presence of a relationship between the rate of change in the participation rate and part-time employment. This was not significant for men but proved so for women. In the case of women, the decision to enter the labour force may be dependent on the direct availability of part-time job opportunities. For Alberta women, in each of the two periods, rates of change in part-time employment are negatively related to those in full-time employment and positively related to the rate of change in the participation rate at statistically significant levels. The regression results reported in Appendix B indicate a particularly strong relationship in the 1988-98 period. On average, a 1% increase (decrease) in the rate of change of full time employment was associated with approximately a 1.5% decrease (increase) in the rate of change of part-time employment. Also a 1% change in the participation rate was associated with approximately a 0.9% change in the same direction as part-time employment. These findings suggest that in the second period, and particularly for women, part-time employment was indeed a substitute for full-time employment. It is also clear that in the case of women part and full-time employment and participation in the labour force are all closely related. A reasonable interpretation is that for many women entry to the labour force occurs only if a part-time job is on offer.

#### (4) THE COMPOSITION OF EMPLOYMENT BY INDUSTRY SECTOR

This section reports on the industry composition of employment in Alberta and the changes that have occurred over the past quarter century using the reference years 1976, 1986 and 1997. For comparative purposes, the national composition is also considered.

TABLE 6 reports employment shares for both Alberta and Canada. The body of the table contains (1) the shares of annual average employment in each industry; (2) the shares of employment in producing goods and in producing services; and (3) the shares of employment accounted for by the private and public sectors respectively.

Within Alberta, a few job developments of the past quarter century include:

- the decline in agricultural employment;
- the initial decline and subsequent revival of manufacturing;
- the very large share increase in business and personal services;
- the 1986-97 decline in public administration;
- the rise between 1976 and 1986 in service activities and the small decline in that share between 1986 and 1997;
- the sustained rise in the private and decline in the public sector shares of total employment.

**TABLE 6: Alberta and Canada: Employment Shares by Industrial Sector and Activity 1976, 1986 and 1997**

	1976 share	1986 share	1997 share
<b>ALBERTA</b>			
Agriculture	0.137	0.068	0.059
Nonagricultural primary	0.039	0.062	0.057
Utilities	0.009	0.011	0.009
Manufacturing	0.091	0.077	0.093
Construction	0.092	0.059	0.066
Transport, storage, communication	0.074	0.071	0.066
Wholesale, retail trade	0.179	0.191	0.171
Finance, insurance, real estate	0.046	0.052	0.045
Community services*	0.142	0.161	0.160
Business and personal services	0.122	0.175	0.226
Public administration	0.069	0.073	0.048
<b>TOTAL</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>
Employment producing goods	0.368	0.277	0.284
Employment producing services	0.632	0.723	0.716
Private sector employment	0.740	0.759	0.834
Public sector employment	0.260	0.241	0.166

**TABLE 6 (continued): Alberta and Canada: Employment Shares by Industrial Sector and Activity 1976, 1986 and 1997**

	<b>1976 share</b>	<b>1986 share</b>	<b>1997 share</b>
<b>CANADA</b>			
Agriculture	0.049	0.039	0.030
Nonagricultural primary	0.025	0.024	0.021
Utilities	0.012	0.010	0.010
Manufacturing	0.203	0.173	0.155
Construction	0.067	0.054	0.054
Transport, storage, communication	0.076	0.067	0.064
Wholesale, retail trade	0.173	0.180	0.171
Finance, insurance, real estate	0.053	0.057	0.057
Community services*	0.148	0.158	0.171
Business and personal services	0.123	0.168	0.209
Public administration	0.072	0.069	0.057
<b>TOTAL</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>
Employment producing goods	0.355	0.301	0.270
Employment producing services	0.645	0.699	0.730
Private sector employment	0.774	0.796	0.820
Public sector employment	0.226	0.204	0.180

\*includes primarily educational, health and volunteer agency services

Source: Statistics Canada and the Western Centre for Economic Research

TABLE 7 expresses Alberta employment shares as a ratio of the national. A ratio above 1.0 means that the Alberta sector's share of employment exceeds the national, while a ratio less than 1.0 implies that the Alberta sector's share is less than that of the sector nationally. Those Alberta sectors whose ratio has exceeded 1.0 in each of the three reference years are in bold italics, while the Alberta sectors consistently

below the national are in plain italics. Alberta sectors consistently above the national are agriculture, other primary activities which include energy and forestry, construction and wholesale and retail trade. Consistently below the national are manufacturing, and finance, insurance and real estate. Other sectors ranged from above to below the national in the reference years.

**TABLE 7: Ratio of Alberta to National Sectoral Distribution of Employment  
1976, 1986 and 1997**

	<b>1976 ratio</b>	<b>1986 ratio</b>	<b>1997 ratio</b>
Agriculture	<b>2.78</b>	<b>1.74</b>	<b>1.94</b>
Nonagricultural primary	<b>1.57</b>	<b>2.55</b>	<b>2.72</b>
Utilities	0.81	1.05	0.94
Manufacturing	<i>0.45</i>	<i>0.45</i>	<i>0.59</i>
Construction	<b>1.38</b>	<b>1.09</b>	<b>1.24</b>
Transport, storage, communication	0.98	1.06	1.02
Wholesale, retail trade	<b>1.03</b>	<b>1.21</b>	<b>1.00</b>
Finance, insurance, real estate	<i>0.87</i>	<i>0.90</i>	<i>0.78</i>
Community services*	0.95	1.02	0.93
Business and personal services	0.99	1.04	1.08
Public administration	0.95	1.06	0.85
Goods producing employment	1.04	0.92	1.05
Services employment	0.97	1.03	0.98
Private sector employment	0.96	0.95	1.02
Public sector employment	1.15	1.18	0.92

\*primarily employment in educational and health services.

Source: Western Centre for Economic Research

The goods producing sector includes agriculture, nonagricultural primary activities such as energy and forestry, utilities, manufacturing and construction. Declines in construction, manufacturing, and agricultural employment accounted for the dip below 1.0 in 1986. Between 1986 and 1997 the rise in construction and manufacturing employment were particularly important in maintaining and even increasing the relative importance of goods producing activities evident between 1986 and 1997.

In 1997 the employment ratio for the private sector exceeded 1.0 and that in the public sector fell measurably below unity. The transitions from 1976 and 1986 reflect the significant restructuring and downsizing of the public sector occurring in Alberta during the nineties. While both nationally and in Alberta the role of the public sector (measured by employment shares) fell consistently, the fall in the ratio suggests that the sectoral reallocation was considerably stronger in Alberta.

## (5) EMPLOYMENT STRUCTURE, VOLATILITY AND DIVERSIFICATION

Alberta, more often than not, is characterized as a 'boom-bust' economy. Previous analyses by Chambers and Percy, reported in their 1992 book *Western Canada in the International Economy*, used employment data as a major indicator of volatility and found Alberta to be the most volatile provincial economy, and indeed, perhaps the most volatile in North America. Is this changing? Is there evidence that shifts in the labour force and the composition of employment have had any effect on volatility leading to the inference that some added amount of economic diversification has occurred? This is not a trivial question. In the public sector, for example, it means more stable revenue flows and the likelihood of smaller errors in budget estimates.

In the private sector it means a generally more stable environment for human resources management. Effectively, reduced volatility means a lower level of uncertainty for all sectors of the economy.

The portfolio variance approach can be applied to capture how industrial structure affects the variability of employment. Portfolio variance, a concept widely used by financial analysts, has two basic parts: variance and covariance. When employment in a given sector fluctuates a good deal, the sector has high employment variance. In common parlance, it is a 'boom-bust' sector. Other things being equal, the higher employment variance in the sectors of a provincial economy, the higher the variability in aggregate employment.

## BOX 1

Employment portfolio variance was estimated for quarterly natural log differences standardized with respect to the mean quarterly change in each of the 11 sectors. That is each of the 121 elements of this matrix consists of a relative covariance of the following type:

$$\sigma_{ij} = \{1/(n-2)\} [(u_{it} - \hat{u}_i/\hat{u}_i) [(u_{jt} - \hat{u}_j/\hat{u}_j)]$$

where  $n$  is the number of observations. The variables  $u_{it}$  and  $u_{jt}$  are the observed quarterly rates of change in industries  $i$  and  $j$  respectively during quarter  $t$ . The variables  $\hat{u}_i$  and  $\hat{u}_j$  are the mean rates of change.

The 121 individual components are summed to derive the total employment portfolio variance measure as follows:

$$\sigma_P = \sum_j \omega_j \sigma^2 + \sum_{i \neq j} \sum_{j \neq i} \omega_i \omega_j \sigma_{ij}$$

where  $\sigma^2$  represents the employment variance of sector  $j$ ,  $\sigma_{ij}$  is the covariance of employment between sector  $i$  and sector  $j$ , and  $\omega_i$  and  $\omega_j$  are weights that are equal to the average share of each sector's employment in total employment. Each sector contributes to provincial employment portfolio variance through its variance and its covariances with other sectors. The contribution of each industry is weighted by its share in total employment.

TABLE 8 contains a beta measure similar to that used by financial portfolio analysts. The steps in deriving the betas are first to divide the variance and covariance of each employment sector by the portfolio variance, i.e., by total employment variance, thus standardizing the volatility of each sector.. The betas are then equal to the weighted sum of the standardized variance and covariance. A value of beta  $> 1.0$  means that the sector increases portfolio variance; a value of beta  $< 1.0$  means that the sector reduces portfolio variance.

Provincial employment variability is also determined by the degree to which sectoral employment changes move in the same or in opposite directions, i.e. by covariance. Should changes in sectoral employment move in the same direction, the net result is to lower employment stability. Should changes in sectoral employment move in opposite directions, the net effect is make provincial employment more stable.

In sum, lower levels of variance, and greater evidence of negative covariance (rates of sectoral employment change moving on average in opposite directions) indicate more stable levels of provincial employment. A description of the portfolio variance approach is in Box 1. The reader can see that portfolio variance is also influenced by the sector weights. In this analysis,

weights are the share of each sector in total employment averaged over the respective periods, and we estimate below how significant weight changes are to the findings.

### ALBERTA EMPLOYMENT PORTFOLIO VARIANCE

To examine the Alberta experience, two eras are once again considered. The first is from 1976:Q1 to 1987:Q4 and the second from 1988:Q1 to 1998:Q2. Portfolio variance was applied to quarterly rates of change in seasonally adjusted data for the eleven major employment groups.

TABLE 8 contains result for these two eras the results of an employment portfolio analysis. The table shows indexes of variance, covariance and the contribution of each of the eleven sectors to Alberta

employment variability. The first two columns contain indexes of variance, the second two are indexes of covariance, and the third contains a measure of the sector's contribution to total employment variability. The variance and covariance indexes express the ratio of each sector's variance and covariance respectively to weighted average variance and covariance. In the variance column, for example, an index ratio of 4.73 for utilities means that the sector is 4.73 times more volatile than total employment. The covariance index measures the covariance of that sector relative to the weighted absolute covariance average for the all sectors. The beta column is a weighted average of the variance and covariance measures and contains the combined variance and covariance contribution of each sector to total employment variability. If beta is equal to 1.0 then the sector is neutral in its effect

on total employment, i.e., it neither raises nor lowers the variance of total employment. A beta in excess of 1.0 means that the sector raises total employment variability, while a beta less than 1.0 means that the sector reduces overall variance.

TABLE 8 indicates that beta values have declined for all sectors save three: utilities; transportation, storage and communication; and finance, insurance and real estate (FIRE). Together the eight other sectors with lower betas accounted for approximately 85 percent of total employment in 1997. It is also apparent that reduced overall employment variability is the result not only of lower variance in most sectors but also because of the shift from mostly positive to mostly negative covariance. During the first period there were three sectors, while in the second period, nine of eleven displayed negative covariance. Finally, the volatility of the natural resource industry sectors declined, and did not top the volatility list in either era.

**TABLE 8: Sectoral Effects on Alberta Employment Variability**

	Era I			Era II		
	Index Var.	Index Cov.	Beta	Index Var.	Index Cov.	Beta
Agriculture	2.17	-3.11	0.46	1.29	-1.36	0.33
Non-Ag Primary	2.14	2.02	3.17	1.43	-0.86	0.85
Utilities	4.73	0.29	4.78	14.41	-4.10	12.01
Manufacturing	1.07	1.84	2.03	1.27	-0.74	0.77
Construction	1.73	1.94	2.73	1.13	-0.59	0.74
Trans, Stor, Comm	0.78	0.17	0.85	1.56	0.10	1.72
Trade	0.38	0.20	0.48	0.41	-0.32	0.19
FIRE	1.32	-1.93	0.27	1.66	0.59	2.19
Community Serv	0.54	0.07	0.56	0.46	-1.09	-0.34
Bus/Personal Serv	0.58	0.96	1.08	0.41	-1.24	-0.51
Public Admin	0.65	-0.34	0.46	1.47	-2.86	-0.63

Source: Western Centre for Economic Research, University of Alberta

TABLE 8 shows that the overall effect of these changes was to reduce the employment portfolio variance from approximately 0.24 percent to 0.14 percent, a reduction of slightly more than two-fifths. The effect of holding industry weights constant is slight: if industry

weightings of the first era were also applied in the second, Alberta portfolio variance would have resulted in portfolio variance of 0.1436 rather than 0.1364, a difference of approximately one-twentieth.

**COMPARATIVE LEVELS OF EMPLOYMENT  
VARIABILITY: ALBERTA AND CANADA**

A portfolio variance analysis was made of the comparable Canadian data to compare national and provincial levels in the two eras. The employment variability results for the two jurisdictions are also reported in TABLE 9. (Sectoral results for Canada are available from the Western Centre.)

Employment variability in Alberta measured as percent changes per quarter was considerably larger than the national in both periods. However, in the second era Alberta employment variability, though still substantially above the national, declined relatively as well as absolutely.

**TABLE 9: Levels of Quarterly Employment  
Variability: Alberta and Canada (%)**

	<b>1976:Q1- 1987:Q4</b>	<b>1988:Q1- 1998:Q2</b>
Alberta	0.2377	0.1364
Canada	0.0368	0.0284
Ratio of Alberta to Canada	6.46	4.80

Source: Western Centre for Economic Research, University of Alberta



## SUMMARY AND CONCLUSIONS

**This Bulletin evaluates changes spanning three decades in selected characteristics of Alberta's human resources and in their deployment.** These characteristics include the gender composition of the labour force and employment, paid employment and the self-employed, full and part-time employment, the deployment of human resources by industry, and evidence on employment volatility. In examining the evolution of human resources we used reference years drawn from each of the decades together with quarterly data for two eras, one from the mid-seventies to the mid-eighties, and the second from the mid-eighties to 1998.

The answers to the five questions related to employment and the labour force initially posed in this Bulletin are summarized below.

- (1) **The rate of growth in the labour force between 1976 and 1986 was approximately double that between 1986 and 1997.** However, the gender composition evolved substantially over the entire period with the proportion of women increasing from 37.5% to 44.8%. **This growth was attributable in large part to higher labour force participation by women in the 25-44 and 45-64 age cohorts.** These increases accounted for 24% of the growth in the entire labour force and for 43% of the growth in the female labour force during the 1976-86 years. Comparable figures for the 1986-1997 period are 21% and 39%.
- (2) **Self-employment in Alberta was consistently a higher proportion of total employment than nationally.** In 1997 there was 1 person in self-employment for every 3.7 persons in paid employment. In two reference periods, from 1976:Q1 to 1987:Q4 and from 1988:Q1 to 1998:Q2, quarterly rates of change in the numbers of self-employed
- (3) **The relative importance of part-time employment has increased.** Full-time jobs per part-time job in Alberta declined over the reference years from 5.8 to 4.4. The decline was considerably steeper in the country as a whole. There is a substantial gender difference in the make-up of the full and part-time job markets. The full-time market is dominated by males and the part-time market by females. In Alberta, over the three reference years, the number of full-time jobs for every part-time job ranged from a high of 15 to a low of 10. For women, full-time jobs per part-time job ranged from 2.6 to 2.2. **Finally, there is strong statistical evidence of a trade-off between full and part-time employment irrespective of gender.**
- (4) **The sectoral composition of employment was compared with the national for the three reference years. Alberta sectors consistently above the national are agriculture, other primary activities which include energy and forestry, construction, and wholesale and retail trade. Consistently below the national**

were regressed on the numbers in paid employment. For Alberta, in the first period, no statistically significant relationship exists, but in the second there is strong evidence of a trade-off. Declines (increases) in the quarterly rate of growth of paid employment are associated with increases (declines) in the rate of growth of the self-employed. Data for the country as a whole were also tested and no significant statistical evidence of a trade-off found. **The statistical evidence supports the casual observation that, at least in the case of Alberta, the transition into self-employment was an important response to restructuring and downsizing.**

**are manufacturing, and finance, insurance and real estate.** Other sectors ranged from above to below the national in the reference years. The goods producing sector includes agriculture, nonagricultural primary activities such as energy and forestry, utilities, manufacturing and construction. Between 1976 and 1986 the fall in construction and manufacturing employment was particularly important in the decline in the relative importance of goods producing activities during those years, while their growth was important to the relative increase in goods producing employment during the past decade. While both nationally and in Alberta the role of the public sector (measured by employment shares) fell consistently, the sectoral reallocation was considerably stronger in Alberta.

(5) To assess volatility, a portfolio variance analysis was derived from quarterly rates of change in seasonally adjusted data for the eleven major sectoral employment groupings covering the two periods from 1976:Q1 -1987:Q4 and from 1988:Q1 to 1998:Q2. **The analysis indicates that employment volatility in Alberta is falling.** In the later period, variance declined in 8 sectors (together accounting for 85% of Alberta jobs in 1997) while negative covariances rose. **The conclusion is that the absolute level of volatility in Alberta employment declined. Reduced volatility infers increased diversification. Comparisons with national experience also indicate a relative decline in Alberta volatility, though levels still are above those for the country as a whole.**

## APPENDIX A: RELATIONSHIP OF THE SELF-EMPLOYED TO PAID EMPLOYMENT

### JURISDICTION: ALBERTA

#### (a) Regression results for 1976:Q2 to 1987:Q4

Dependent variable: Rate of change in the quarterly average of the seasonally adjusted self-employed

Independent variable: Rate of change in the quarterly average of seasonally adjusted employees

Seasonal adjustment by Bureau of the Census X-11 method

Estimation by Least Squares

R Bar **2	-0.0175
Regression F (1, 39)	0.2064
Significance level of F	0.6518
Durbin-Watson Statistic	1.8533

Variable	Coefficient	Std Error	T-Stat	Significance
Constant	-0.00398	0.00495	-0.8039	0.4256
Employees	0.14875	0.32739	0.4543	0.6517

#### (b) Regression results for 1988:Q1 to 1998:Q2

Estimation by Least Squares

R Bar **2	0.2481
Regression F (1, 39)	14.1967
Significance level of F	0.0005
Durbin-Watson Statistic	1.5763

Variable	Coefficient	Std Error	T-Stat	Significance
Constant	-0.01551	0.00377	-4.11304	0.00019
Employees	-1.45301	0.38563	-3.76785	0.00054

## APPENDIX B: RELATIONSHIP OF PART-TIME TO FULL-TIME EMPLOYMENT

**Jurisdiction:** Alberta

**Gender:** *Male*

**Dependent variable:** Rate of change in the quarterly average of the seasonally adjusted male part-time employment

**Independent variables:**

(1) Rate of change in the quarterly average of seasonally adjusted male full-time employment

(2) Rate of change in the quarterly average of the seasonally adjusted male participation rate

Seasonal adjustment by Bureau of the Census X-11 method

Regression results for 1976:Q2 to 1987:Q4

Estimation by Least Squares adjusted for first order serial correlation as required

R Bar \*\*2                      0.0478

Regression F                      1.7527

Significance level of F              0.1279

Durbin-Watson Statistic            1.7527

Variable	Coefficient	Std Error	T-Stat	Significance
Constant	-0.01512	0.00849	-1.78012	0.08196
Male full-time employment	-1.05070	0.50603	-2.07634	0.04375
Male Particip. Rate	0.06558	0.35906	0.18264	0.85592

Regression results for 1988:Q1 to 1998:Q2

Estimation by Least Squares adjusted for first order serial correlation as required

R Bar \*\*2                      0.2236

Regression F                      6.5048

Significance level of F              0.0037

Durbin-Watson Statistic            2.2441

Variable	Coefficient	Std Error	T-Stat	Significance
Constant	-0.02115	0.00840	-2.5177	0.01615
Male full-time employment	-3.08083	0.89417	-3.4454	0.00140
Male Particip. Rate	-0.20087	0.32238	-0.62308	0.53696

**Jurisdiction: Alberta**

**Gender: Female**

**Dependent variable:** Rate of change in the quarterly average of the seasonally adjusted female part-time employment

**Independent variables:**

- (1) Rate of change in the quarterly average of seasonally adjusted female full-time employment
- (2) Rate of change in the quarterly average of the seasonally adjusted female participation rate

Seasonal adjustment by Bureau of the Census X-11 method

Regression results for 1976:Q2 to 1986:Q2

Estimation by Least Squares adjusted for first order serial correlation where required

R Bar \*\*2                      0.1838

Regression F                      6.1779

Significance level of F              0.0043

Durbin-Watson Statistic    1.7301

Variable	Coefficient	Std Error	T-Stat	Significance
Constant	-0.1742	0.00529	-3.29301	0.00196
Female full-time employment	-0.8381	0.26002	-3.40480	0.00142
Female Particip. Rate	0.5891	0.27265	2.16063	0.03647

Regression results for 1986:Q3 to 1998:Q2

Estimation by Least Squares adjusted for first order serial correlation where required

R Bar \*\*2                      0.5782

Regression F                      28.4184

Significance level of F              0.0000

Durbin-Watson Statistic    1.8829

Variable	Coefficient	Std Error	T-Stat	Significance
Constant	-0.05136	0.00333	-4.55020	0.00005
Female full-time employment	-1.48962	0.20806	-7.15970	0.00000
Female Particip. Rate	0.89741	0.24750	3.62583	0.00084

## REFERENCES

Chambers, E.J. and M.B. Percy, *Western Canada in the International Economy*. University of Alberta Press 1992.

Gruben, W.C. and K.R. Phillips, "Diversifying Texas: Recent History and Prospects", *Economic Review*, Federal Reserve Bank of Dallas, July 1989.

Mansell, Robert and M.B. Percy, *Strength in Adversity: A Study of the Alberta Economy*, University of Alberta Press, 1990.