REGIONAL AND INDUSTRY EFFECTS ON CANADIAN REGIONAL PAY-RATE PERFORMANCE*

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Introduction

A substantial number of studies on Canadian regional income disparities have been based on the relative contributions of industry and of regional effects on pay-rates [1; 6; 7; 8; 10]. These Canadian studies have used the theoretically faulty standardization technique devised by Kuznets [14] and Hanna [11] to produce empirical estimates of the relative contributions of these two effects. This lack of theoretical validity of the method arises because it attempts to measure regional effects on regional pay-rates by imposing national average pay-rates of industries on a specific region's industrial structure; in a general equilibrium setting these imposed pay-rates cannot be in consistent production, and therefore consumption, equilibrium with the existing industrial structure of the region. Similarly, the method attempts to measure structural effects on regional pay-rates by imposing the nation's industrial structure on a specific region's industrial pay-rates; again this imposed industrial structure cannot be in consistent production, and therefore consumption, equilibrium with the existant industrial pay-rates of the region.[1]

The purpose of this paper is to provide an empirical method of accurately estimating these independent effects on Canadian regional income levels, and of estimating interaction effects between region and industry on pay-rate performance.

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[1]For a more precise and complete analysis see Drugge [5].

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Conceptual Framework and Theory

Regional effects are functional in nature since they encompass those economic factors which influence the economic performance of all industries in a region, measured in this study by hourly pay-rate performance. Theoretically, regional effects can occur if regions differ only in respect to factor endowments, with sufficient market imperfections to impede factor price equalization through interregional factor mobility or commodity trade [3]. Alternatively, the efficiency of technologies may differ[2] in the two regions, giving rise to the observed regional patterns of pay-rates [2; 3].

Industry effects may be viewed as a structural phenomenon predicated on the assumption that specific industries are uniformly high- or low paying, regardless of regional location. Regional average pay-rate performance can then be affected through a regional industrial structure which is weighted towards the uniformly high- or low-paying industries. These differences in industrial pay-rates may be attributable to variations in age, race, and sex and composition of the labour force in industries, and in particular to variations in skill levels required by different industries. Thus, differences in pay-rates between industries may be viewed as originating in imperfections in production or factor markets, or based upon a sustained competitive advantage held by a specific subset of industries [4].

Interaction between regional and industry effects may produce a combined influence on pay-rates; this effect originates from regions which economically are more (or less) suited to an industry, and industries which are more (or less) suited to a particular region. These combined regional and industry effects are multiplicative in nature, so that they cannot be decomposed into their elemental regional and industry components.

Interaction effects are conceptually important, for their presence precludes assuming that specific industries produce high or low pay-rate performance regardless of regional locale. Secondly, the presence of interaction effects indicates that industry pay-rate performance reflects a regional effect, and that regional pay-rate performance reflects an industry effect. For example, a region may possess an industrial structure which is composed of low-paying industries; however, the low pay-rate performance of

[2]Differences in interregional production functions raise the issue as to why technology is not transferable [3: 253-254]. One reason may be that the technology is embodied in immobile natural resources. Specific differences in elasticities of substitution or efficiencies of technology between regional production functions may cause factor prices to diverge as factor mobility occurs [2].

these industries may not be solely due to interindustry imperfections in factor and product markets. A regional effect due to relative abundance of labour may in fact be attracting a structure of low-paying labour intensive industries to the region [3:253; 9:353].

A conceptual construct can be used to display the nature of regional and industry effects, and the way they may influence regional average pay-rates. This construct also provides a framework for understanding the basic pay-rate patterns that require statistical identification and estimation in this study.

Assume a two-region, two-industry matrix of hourly pay-rates as indicated in X_1:

		Region	
		X	Y
X_1 = Industry	A	5	10
	B	5	10

This matrix indicates the "pure" regional effects case; differing inter- or intraregional industrial composition (measured for example by value added or employment weights) if applied to the hourly pay-rates in the matrix cannot affect average pay-rates in regions X and Y.

Matrix X_2 indicates the "pure" industry effects case:

		Region	
		X	Y
X_2 = Industry	A	5	5
	B	10	10

In this case regional effects do not exist; the only source of regional differences in average pay-rates must arise from differing interindustry weights in the two regions. It should be noted that the statistical presence of industry effects only indicates a conceptual possibility for industrial structure to effect average regional pay-rates; each region could possess the same industrial structure, or weights could cancel across the two regions.

In addition to technical and mobility considerations noted above, demand factors affecting the marginal revenue product of labour may also contribute to both regional and industrial variability of pay-rates through differences in locational access to markets from regions [15:87] or through differentiated products which have varying unit values in the same industry [3:250].

The conceptual framework developed in this section indicates that statistical tests for the presence of regional, industry and interaction effects on pay-rates are required for data representative of Canadian regions and industries, combined with a method

of decomposing this data matrix into these three constituent elements.

Model Specification

To provide tests of statistical significance on industry, regional and interaction effects, and to provide a method of decomposing hourly pay-rates into these constituent elements, a two-way fixed effects multiplicative analysis of variance model[3] indicated in (1) was applied to the 814 observations in a 13 x 7 data matrix.

$$Y_{ij} = \upsilon + \alpha + \beta + \alpha\beta + e \qquad (1)$$

where Y_{ij} = observation in cells

υ = grand mean

α =row effect

β = column effect

$\alpha\beta$ = interaction effect

e = error term

Two functional forms based on unlogged and logged data were applied to this non-additive specification to ascertain whether phantom interaction effects were being produced from the original data.

The null hypothesis was tested:

Ho : Aj = 0 for all j,

where j = row, column and interaction treatments; and

A = effects for all j.

Data

In order to test for the presence of interaction effects, each data cell must contain two or more observations on pay-rate by industry and region. These cell replications were obtained by pooling data over the period 1971 to 1973, based on the use of dummy variable regression analysis, with 1973 as the base year.[4] This technique indicates whether average pay-rate performance by industry differed in a statistically significant way over the years 1971 to 1973. If the means of average pay-rates in an industry did not differ significantly, the data were pooled over the appropriate years to provide additional observations in each cell.

Appendix 1 indicates the number of observations obtained for each industry and region using the pooling technique on the mining and logging industries in the primary industry grouping, and for five primary manufacturing and six secondary manufacturing industries [17; 18; 19]. Observations on pay-rates were drawn at the three digit level. Limitations of provincial data on industrial pay-rates required the compilation of the ten provinces into seven regional groupings, based upon their geographical proximity and known relative income levels. The provincial groupings were as follows:

1. Newfoundland, Prince Edward Island, New Brunswick,
2. Nova Scotia
3. Quebec
4. Manitoba - Saskatchewan
5. Ontario
6. Alberta
7. British Columbia

Finally, in order to estimate pay-rate differences between regions in real terms, hourly money wage rates were deflated by consumer price indices available for major metropolitan centres in each region.[5]

[3]The fixed effects model draws inferences from the data actually presented; in a random model inferences are drawn from a sample of a potentially larger set. The assumption of a two-way fixed effects model are: (a) the errors e_{ijk} are normally distributed with expectation of zero for each cell in the matrix; (b) the errors e_{ijk} have exactly the same variance σ_e^2 for each cell; (c) the errors e_{ijk} are independent within and across cells. See Scheffé [16].

[4]The appropriate regression equation can be represented by:

$$Y_i = B_{i1} + B_{i2} X_{i2} + B_{i3} X_{i3} + e_i$$

where Y_i = pay-rate i^{th} industry.

B_{i1} = mean, industry i, 1973.

B_{i2} = difference in means, industry i, 1973 and 1972.

B_{i3} = difference in means, industry i, 1973 and 1971.

X_{i2} = 1 if year is 1972, 0 otherwise.

X_{i3} = 1 if year is 1971, 0 otherwise.

The pooling procedure produced a sample size of 814 observations, with a varying number of observations in cells.

[5]See Appendix 2 for sources and methods.

Results

The unlogged functional form of the model produced the greatest explanatory power, with highly significant "F" statistics produced for column, row, and interaction effects (Table 1), so that H_1 : $A_j \neq 0$ for all j. The presence of statistically significant row (industry) and interaction effects establishes that a conceptual basis exists for industry structure to affect regional pay-rate averages.[6]

The contribution of the three effects to explained variances are provided in Column 5 of Table 1[7] and indicates that industry effects comprise a larger ratio of the explained variance ($W^2_{r/y}$ = 0.24) than does regional effect ($w^2_{c/y}$ = 0.20); while explained variance related to the interaction effect is $W^2_{rc/y}$ = 0.04.

Table 1

FIXED EFFECTS TWO-WAY ANALYSIS OF VARIANCE, NON-ADDITIVE MODEL, SEVEN REGIONS AND PRIMARY, PRIMARY MANUFACTURING AND SECONDARY MANUFACTURING INDUSTRIES, CANADA

Source	(1) Sum of Squares	(2) Degrees Freedom	(3) Mean Square	(4) F Ratio	(5) Contribution to Explained Variance
Rows	131.12	12	10.93	34.05*	0.24
Columns	107.32	6	17.89	55.73*	0.20
Interaction	48.78	72	0.68	2.11*	0.04
Error	283.05	723	0.32		
TOTAL	519.27	814			

* Significant at the 0.1 percent level.

Table 2 contains the estimated common row vector of the 13 x 7 matrix of pure regional effects,[8] as measured by the dollar dif-

[6]Additionally, statistical significance of industry effects does not demonstrate economic significance.

[7]The method of estimating the contribution of each effect to explained variance is as follows:

$$\text{est. } w^2_{r/y} = \frac{\text{ss rows - (r-1)ms error}}{\text{ms error + ss total}}$$

$$\text{est. } w^2_{c/y} = \frac{\text{ss columns - (c-1)ms error}}{\text{ms error + ss total}}$$

$$\text{est. } W^2_{rc/y} = \frac{\text{ss interaction - (r-1) (c-1)ms error}}{\text{ms error + ss total}}$$

(See William L. Hays [12; 512-514].)

[8]$E_{Rj} = \bar{X}_{cj} - \bar{\bar{X}}$

where E_{Rj} = regional effects, region j.

$\bar{X}_{cj}$ = column mean of pay-rates, region j.

$\bar{\bar{X}}$ = grand mean.

Table 2

ROW VECTOR OF REGIONAL EFFECTS, PRIMARY, PRIMARY MANUFACTURING AND SECONDARY MANUFACTURING INDUSTRY EXPRESSED IN DOLLAR PER MAN-HOUR DIFFERENCE FROM NATIONAL AVERAGE PAY-RATE, AND AS PERCENTAGE OF NATIONAL AVERAGE PAY-RATE

	Newfoundland Prince Edward Island New Brunswick	Nova Scotia	Quebec	Ontario	Saskatchewan Manitoba	Alberta	British Columbia
$ per man-hour	-0.580	-0.508	-.272	.218	0.008	0.334	0.628
Percent of national average pay-rate	82	85	92	107	100	110	119

ference between the hourly pay-rate in each region and the national average pay-rate. On this basis, the average pay-rate in Newfoundland-New Brunswick-Prince Edward Island is $0.580 below the national average, while British Columbia's regional effect produces an average pay-rate is $0.628 above the national average. Notably, the provincial groupings of Newfoundland, Prince Edward Island and New Brunswick, Nova Scotia and Quebec constitute the below-average pay-rate regions of the country.

The estimated common vector of the 13 x 7 matrix of pure industry effects[9] is presented in Table 3. Of the thirteen industries included, five have average hourly pay-rates below the national average (negative industry effects), led by the textile and furniture industries; the mining and non-metallic industries have the largest positive industry effects.

Table 3

COLUMN VECTOR OF INDUSTRY EFFECTS, PRIMARY, PRIMARY MANUFACTURING AND SECONDARY MANUFACTURING INDUSTRIES, EXPRESSED IN DOLLARS PER MAN-HOUR DIFFERENCE FROM NATIONAL AVERAGE PAY-RATE, AND AS PERCENTAGE OF NATIONAL AVERAGE PAY-RATE

Industry	$ Per Man-Hour	Percent of National Average Pay-Rate
Mining	0.933	280
Non-Metallic	0.462	140
Metal Fabrication	0.393	112
Chemical	0.317	110
Printing	0.316	110
Pulp and Paper	0.307	109
Logging	0.275	108
Transport	0.066	102
Food and Beverage	-0.069	98
Wood	-0.364	89
Miscellaneous	-0.374	89
Furniture	-0.499	85
Textile	-0.830	75

Table 4 provides the 13 x 7 matrix of estimated pay-rates effects stemming from interaction relationships between specific

[9] $E_{Ii} = \bar{X}_{ri} - \bar{\bar{X}}$

where E_{Ii} = industry effects, industry i.

$\bar{X}_{ri}$ = row mean of pay-rates, industry i.

$\bar{\bar{X}}$ = grand mean.

Table 4

MATRIX OF INTERACTION EFFECTS, PRIMARY, PRIMARY MANUFACTURING AND SECONDARY MANUFACTURING INDUSTRIES, SEVEN REGIONS, CANADA
(Dollars Per Man-Hour)

Industry	Nfld. P.E.I. N.B.	Nova Scotia	Quebec	Ontario	Manitoba Saskatchewan	Alberta	B.C.
I. Primary Industry							
Mining	.26244	-.12884	-.22040	.01459	.18740	.18637	-.00828
Logging	-.04067	-1.09337	.24004	.53336	.26932	-.47832	1.08412
II. Primary Manufacturing Industries							
Food and Beverage	-.19138	-.28740	.29409	.20567	.11294	-.08209	-.02779
Wood	-.16801	-.18243	-.30630	-.31517	.24912	.17956	.53091
Pulp and Paper	.33708	.61132	.02167	-.10037	-.13795	-.20403	-.08490
Non-Metallic	-.21842	-.25951	-.00946	.17750	.17134	.22312	.07490
Chemical	.07044	.18544	.09628	.02786	-.14132	.24446	-.51201
III. Secondary Manufacturing Industries							
Miscellaneous	-.01333	.35936	.04219	-.08393	-.09490	-.06393	-.09447
Textiles	.02441	.25501	.22288	.02933	-.30055	-.26613	-.63354
Furniture	.12447	-.25048	.00713	-.00424	-.22540	.20862	-.08321
Metal Fabrication	-.26256	.06814	.08236	.12984	-.17228	-.09086	.02253
Transport	-.04340	.23040	-.14231	.39750	-.36504	-.37985	-.15817
Printing	-.27545	-.16031	.54056	.54486	-.08454	-.06648	.46191

regions and industries. Interaction effects[10] for a specific row in Table 4 displays which regions produce pay-rate performances above or below that expected in a specific industry.[11]

Interaction effects in each *column* of Table 4 indicate specific industries which perform above or below the expected pay-rate for that region. Outstanding examples of industries with large positive interaction effects are the logging industry of British Columbia ($1.084), the pulp and paper industry of Nova Scotia ($0.611) and the printing industries of Ontario and Quebec ($0.545 and $0.541, respectively). The largest negative interaction values are present in the logging industry of Nova Scotia ($-1.093) and the textile industry of British Columbia ($-0.633).

In order to more precisely determine the source and nature of regional, industry, and interaction effects, the same model was applied to the industrial subgroupings of primary, primary manufacturing, and secondary manufacturing industries contained in the seven regions. The statistical results of these tests (Table 5) again lead to the rejection of the null hypothesis Ho : Aj = 0, and also indicate that column (regional) effects are the major contributor to explained variance in the primary and primary manufacturing industries in Canada, while the row (industry) effects predominate as an explanatory variable in the secondary manufacturing group. The statistical significance of interaction effects is at the ten percent level in this latter industrial grouping, compared to significance at the 0.1 percent level in the primary and primary manufacturing sectors. The greater explanatory power of column (regional) effects in the natural resource related industries suggests that market imperfections affecting interregional factor mobility or pervasive interregional differences in production functions are particularly prevalent in this subgroup of industries. The

[10] $E_{T}ij = \bar{X}_{ij} - \bar{\bar{X}} - E_{R}j - E_{I}i.$

where $E_{T}ij$ = interaction effect, industry i, region j.

$\bar{X}_{ij}$ = cell mean industry i, region j.

$\bar{\bar{X}}$ = grand mean.

$E_{R}j$ = regional effect, region j.

$E_{I}i$ = industry effect, industry i.

[11] For example, the logging industry, as indicated in Table 3 has a national average hourly pay-rate $0.275 above the all industry average; when the industry is located in British Columbia its hourly pay-rate is augmented by $1.08 through interaction effects (see Table 4). The logging industry of Nova Scotia, however, has a large negative interation effect of -1.09; these divergent interaction effect are a major contributing factor to British Columbia's logging industry ranking as the highest paying industry in the nation, while Nova Scotia's logging industry has the second lowest pay-rate of any industry in the nation.

greater row (industry) effects in the secondary manufacturing sector indicates substantial market imperfections in interindustry factor mobility as compared to the natural resource grouping.

Table 5

FIXED EFFECTS TWO-WAY ANALYSIS OF VARIANCE, NON-ADDITIVE MODEL, PRIMARY, PRIMARY MANUFACTURING, AND SECONDARY MANUFACTURING INDUSTRIES CANADA

Source	(1) Sum of Squares	(2) Degrees of Freedom	(3) Mean Square	(4) F Ratio	(5) Contribution to Explained Variance
		Primary Industries			
Rows	5.09	1	5.09	23.00*	0.12
Columns	21.06	6	3.51	15.86*	0.52
Interaction	4.86	6	0.81	3.66*	0.09
Error	8.85	40	0.22		
		Primary Manufacturing			
Rows	35.73	4	8.93	24.69*	0.14
Columns	55.46	6	9.24	25.55*	0.22
Interaction	21.61	24	0.90	2.49*	0.05
Error	133.50	369	0.36		
		Secondary Manufacturing			
Rows	66.09	5	13.22	46.27*	0.33
Columns	44.83	6	7.47	26.16*	0.23
Interaction	11.99	30	0.40	1.40**	0.05
Error	89.69	314	0.28		

*Significant at the 0.1 percent level.
**Significant at the 10 percent level.

Industry Structure Effects

Because of the statistical significance of industry and interaction effects indicated in Table 1, estimates of the contribution of industry structure on regional average incomes were calculated, using weights based on the percentage employment in each industry in the region.[12] Procedures were adopted to isolate the structural effects independently originating from industry and interaction effects:

(1) Industry effects presented in Table 3 were multiplied by the specific region's percentage employment in each industry. The results were summed for each region and divided by

[12] This procedure differs significantly from the Hanna method which imposes the national industrial structure on each region's industrial pay-rates.

the sum of employment weights, providing a pay-rate effect originating solely from industry effects for a specific region.[13]

(2) Interaction effects specific to each region and industry provided in Table 4 were multiplied by the percentage employment in the industry for that region. These results were summed for the region and divided by the sum of employment weights to obtain the effects on regional pay-rates originating from interactions.[14]

The resultant impact on each region's pay-rates originating from industry and interaction effects respectively and their combined structural effect is presented in Table 6.

Statistical Results and Interpretation

The estimates of regional and industry structure effects obtained in this study and displayed in Table 6 cannot be compared to results based upon Hanna's technique, because of that method's demonstrated lack of theoretical validity.[15] The data presented in Table 6 can be used to test the conventional hypothesis that Canada's low income regions suffer from unfavourable industrial structures as opposed to functional regional problems. Also, the data can be used to establish the theoretical point made in this paper that pay-rate performance of a particular industry may vary so substantially across regions that it cannot be unequivocally categorized as a desirable or undesirable element of industry structure.

$$[13] I_W = \sum_{i=1}^{13} E_{Ij}.N_j / \Sigma N_j$$

where I_W = weighted average industry effects, region j.

E_{Ij} = industry effects region j.

N_j = employment industry i as a percentage of employed workers, region j.

$$[14] T_W = \sum_{i=1}^{13} E_{Tj}.N_j / \Sigma N_j$$

where T_W = weighted average interaction effects, region j.

E_{Tj} = interaction effects region j.

N_j = employment industry i as a percentage of employed workers region j.

[15] Studies by Green [10:22] and the Economic Council of Canada [6:67] assign 66 percent and 80 percent of the total differential in interregional wage differences to regional effects, respectively.

Table 6

REGIONAL AND STRUCTURAL SOURCES OF PAY-RATE VARIATION, SEVEN REGIONS, CANADA
Dollars per Man-Hour

Region	Nfld. P.E.I. N.B.	Nova Scotia	Quebec	Ontario	Manitoba-Saskatchewan	Alberta	British Columbia
A. Regional Effect	-0.580	-0.508	-0.272	0.218	0.008	0.334	0.628
B. Structural Effects	0.183	0.088	0.030	0.251	0.253	0.334	0.365
C. 1. Industry	0.123	0.160	-0.057	0.097	0.215	0.314	0.066
2. Interaction	0.060	-0.072	0.087	0.154	0.038	0.020	0.299
D. Net Regional and Structural Effects	-0.397	-0.420	-0.240	0.469	0.265	0.668	0.993

Source: Appendix 3.

A comparison of lines A and B of Table 6 indicates that the regions encompassing Newfoundland, Prince Edward Island, Nova Scotia and Quebec experience the lowest average pay-rate performance due to functional or regional factors. The empirical evidence presented in Table 6 demonstrates that these regions do not suffer from industry structures which produce negative industry effects. The high income regions of Ontario, Alberta and British Columbia not only benefit from large and positive regional effects; they also have more positive pay-rate effects from their industrial structure than the low income regions. The large interaction structural effect ($0.299) in British Columbia demonstrates an important theoretical point; its favourable industrial structure is unique to that province. Alberta, however, generates positive structural effects from industries in the more conventional sense, in that it has an industrial structure which possesses average pay-rates above the national all-industry average. The structural effects evident in Quebec's case do not support the hypothesis that its low average pay-rates are largely generated by an unfavourable industrial structure [7: 126].

Appendix 3 identifies in detail the specific industries in each region which are the significant contributors to structural effects. Comparisons based on Appendix 3 indicate that the largest negative industry effect in the nation occurs in Quebec's food, beverage, and textile industries, with the largest negative interaction effects occuring in the food, beverage, and logging industries of Nova Scotia.[16] Alberta's and Manitoba-Saskatchewan's mining industries produce the largest positive industry effect, while British Columbia's logging and wood industries produce the largest positive interaction effects.

Summary and Conclusions

By decomposing pay-rates into their basic regional, industry, and interaction constituents, isolation of regional/structural effects on pay-rates was obtained for each region contained in this study. Additionally, by using the industry and interaction component of each region's pay-rates, structural effects independently arising from these two distinct sources were obtained for every region. In particular, the presence of interaction pay-rate effects indicates that specific industries or subgroups of industries cannot be generally identified as consistently inferior or superior in pay-rate performance, and notably, these interaction effects are more prevalent in the natural resource industries. Further research is required into these industries to determine whether supply side technical factors, or demand oriented revenue effects are the major explanatory source of notable regional and interaction influence on their pay-rate performance.

[16]Intra- and interregional comparisons can be made because employment weights by regions have been standardized.

The substantial regional effects on pay-rate levels, particularly in the resource related industries of Canada, raises the question of whether they originate from differing regional factor endowments in association with market imperfections or regional differences in production functions. If endowment differences are important, what long-term factors and short-term market imperfections are the major impediments to factor mobility and hence factor price equalization?

If sustained wage-rate differences are related to regional production functions that differ in terms of efficiencies of technology or elasticities of substitution [2] then empirical efforts to verify their presence and relative importance will prove useful. This is particularly true if the parameters on these technical characteristics can cause factor mobility to exacerbate regional factor price differences.

References

1. Auer, Ludwig. *Regional Disparities of Productivity and Growth in Canada.* Ottawa: Ministry of Supply and Services, 1979.
2. Batra, R. and G. Scully. "Technical Progress, Economic Growth, and the North-South Wage Differential", *Journal of Regional Science,* 12 (1972), 375-386.
3. Bradfield, Michael. "Necessary and Sufficient Conditions to Explain Equilibrium Regional Wage Differentials", *Journal of Regional Science,* 16 (1976), 247-255.
4. Cullen, D.E. "The Interindustry Wage Structure, 1899-1950", *American Economic Review,* 46 (1956), 353-369.
5. Drugge, S. "A Theoretical Critique of the Standardization Method of Estimating Regional Effect and Industry Structure as Sources of Interregional Income Variations", *Canadian Journal of Regional Science,* III, 1 (1980), 93-99.
6. Economic Council of Canada. *Living Together: A Study of Regional Disparities.* Ottawa: Ministry of Supply and Services, 1977.
7. Economic Council of Canada. *Second Annual Review: Towards Sustained and Balanced Economic Growth.* Ottawa: Queen's Printer, 1965.
8. Economic Council of Canada. *Twelfth Annual Review: Options for Growth.* Ottawa: Information Canada, 1975.
9. Goldfarb, R. and Anthony Yezer. "Evaluating Alternative Theories of Intercity and Interregional Wage Differentials", *Journal of Regional Science,* 16 (1976), 345-363.

10. Green, A.G. *Regional Aspects of Canada's Economic Growth.* Toronto: University of Toronto Press, 1971.
11. Hanna, F.A. *State Income Differentials 1919-1954.* Durham: Duke Univerisity Press, 1959.
12. Hays, William L. *Statistics for the Social Sciences.* Second Edition. New York: Holt, Reinhart and Winston, Inc., 1973.
13. Johnston, J. *Econometric Methods.* Second Edition. New York: McGraw-Hill, 1972.
14. Kuznets, S., Ann Ratner Miller and Richard Easterlin. *Population Redistribution and Economic Growth, United States, 1870-1950: Analysis of Economic Change.* 2. Philadelphia: The American Philosophy Society, 1960.
15. Perloff, Harvey S. *et al. Regions, Resources and Economic Growth.* Baltimore: The Johns Hopkins Press, 1960.
16. Scheffé, H. *The Analysis of Variance.* London: Wiley and Sons, 1959.
17. Statistics Canada. *Canadian Forestry Statistics, 1974.* Ottawa: Min- of Industry, Trade and Commerce, 1976.
18. Statistics Canada. *General Review of the Mineral Industries, 1974.* Ottawa: Minister of Industry, Trade and Commerce, 1976.
19. Statistics Canada. *Manufacturing Industries of Canada 1971, 1972, 1973.* Ottawa: Information Canada.

Appendix 1

NUMBER OF OBSERVATIONS ON HOURLY WAGE RATES, BY REGION AND INDUSTRY, POOLED DATA, 1971-73

	Nfld. P.E.I. N.B.	N.S.	Que.	Ont.	Man.- Sask.	Alta.	B.C.	Total
Mining	6	3	3	6	3	3	3	27
Logging	6	3	3	6	3	3	3	27
Food and Beverage	15	10	16	17	16	10	13	97
Wood	17	9	20	13	20	16	18	113
Pulp and Paper	7	4	12	9	12	6	6	56
Non-Metallic	6	3	12	7	12	6	5	51
Chemical	10	6	18	12	22	9	10	87
Miscellaneous	5	3	16	8	16	7	7	62
Textile	4	3	20	8	25	5	8	73
Furniture	4	2	5	6	5	4	5	31
Metal Fabrication	7	4	11	13	11	9	9	64
Transport	6	6	14	11	16	8	12	73
Printing	11	6	6	12	6	6	6	53
TOTAL	104	62	156	128	167	92	105	814

Appendix 2

INTER-CITY INDEXES OF RETAIL PRICE DIFFERENTIALS, 1971-73*
Winnipeg = 100

Deflators	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
1971	1.11	1.04	1.04	1.05	1.04	1.02	1.00	1.01	1.00	1.05
1972	1.09	1.06	1.05	1.06	1.03	1.01	1.00	1.02	1.01	1.06
1973	1.08	1.07	1.06	1.07	1.02	1.01	1.00	1.02	1.02	1.07

*The data on inter-city price indexes were based on 1971 data with Winnipeg = 100. Data were only available for 1971 and 1975, with the base the all-city average for the 1975 data. Therefore, the data for 1972 and 1973 were interpolated on the basis of the consumer price index changes over these years, and the base Winnipeg = 100 was maintained.

Source: Statistics Canada, *Prices and Price Indexes, Jan. 1975* (Ottawa: Information Canada, 1975), Table 14; and Statistics Canada, *Prices and Price Indexes, March 1975* (Ottawa: Information Canada, 1975), Table 14.

Appendix 3

HOURLY PAY RATE INDUSTRY AND INTERACTION EFFECTS, WEIGHTED BY EMPLOYMENT*
PRIMARY, PRIMARY MANUFACTURING AND SECONDARY MANUFACTURING
INDUSTRIES, SEVEN REGIONS, CANADA

	Nfld., P.E.I. and N.B.		Nova Scotia		Quebec	
	Industry	Interaction	Industry	Interaction	Industry	Interaction
I. Primary Industries						
Mining	4.285	0.124	13.350	-1.842	5.816	-1.373
Logging	3.193	-0.129	1.206	-5.128	1.003	0.936
II. Primary Manufacturing Industries						
Food and Beverage	-2.282	-0.437	-2.241	-9.312	-10.720	4.558
Wood	-3.177	-.534	-2.223	-1.115	-2.471	-2.080
Pulp and Paper	6.990	7.572	3.077	6.125	3.378	0.238
Non-Metallic	1.253	-0.273	1.119	-0.628	1.859	-0.036
Chemical	0.654	0.046	0.515	0.302	2.209	0.673
III. Secondary Manufacturing Industries						
Miscellaneous	-0.512	-0.068	-0.338	0.323	-1.787	0.201
Textiles	-0.299	-0.007	-2.016	0.628	-8.795	2.362
Furniture	-0.369	0.155	-0.484	0.243	-2.652	0.037
Metal Fabrication	1.568	-0.416	1.646	0.285	3.815	0.796
Transport	0.028	-0.001	1.033	3.620	0.554	-1.200
Printing	0.925	-0.255	1.324	-0.672	2.101	3.595

Appendix 3 (cont'd)

	Ontario		Man.-Sask.		Alberta		British Columbia	
	Industry	Interaction	Industry	Interaction	Industry	Interaction	Industry	Interaction
I. Primary Industries								
Mining	4.873	0.076	16.486	3.311	25.092	5.010	7.170	-0.061
Logging	.026	0.005	0.511	5.359	5.274	-0.980	3.704	15.589
II. Primary Manufacturing Industries								
Food and Beverage	-0.981	2.918	1.852	3.030	-1.541	-1.829	-1.799	-0.321
Wood	-1.244	-1.078	-1.856	1.270	-3.486	1.720	-11.280	16.442
Pulp and Paper	2.309	-0.755	-2.885	-1.296	0.841	-0.559	3.796	-1.049
Non-Metallic	2.150	0.825	1.548	-0.472	2.779	1.341	1.299	-0.210
Chemical	2.225	0.196	0.556	-0.248	1.233	0.953	0.635	-1.029
III. Secondary Manufacturing Industries								
Miscellaneous	-2.403	-0.537	-0.570	-0.144	-0.736	-0.012	-0.473	-0.119
Textiles	-4.497	0.159	-1.185	-0.429	-0.962	-0.301	-0.747	-0.570
Furniture	-1.894	-0.015	-1.708	-0.772	-1.057	0.442	-0.593	-0.099
Metal Fabrication	5.509	1.818	3.411	-1.493	3.277	-0.758	2.303	0.132
Transport	1.257	7.600	0.643	-3.559	0.448	-2.591	0.325	-0.781
Printing	2.427	4.184	2.663	-0.761	0.196	-0.412	1.292	1.889

*Employment weights are standardized as a ratio of the labour force in each region.