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The Labour Market and the Intrafactor Allocation Mechanism in Canada

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ACKNOWLEDGMENTS

I would like to acknowledge with gratitude my special indebtedness to Dr. John J. Deutsch, Dr. Sylvia Ostry, Dr. D. L. McQueen, Mr. G. W. Bonem, Professors Lowell E. Gallaway and Norman J. Similar, for their valued suggestions which have elevated the over-all quality of the manuscript. At the same time, I assume full responsibility for any remaining errors.

The Dominion Bureau of Statistics was very helpful in supplying the necessary data for this study. My two graduate research assistants, Howard Kaikow and C. H. Wong, helped with data processing, calculations and other details.

I am grateful for the financial support provided for this study by the Economic Council of Canada.

Mahmood A. Zaidi

Minneapolis, Minnesota
- 1967 -

FOREWORD

The Economic Council undertakes staff studies and commission studies from outside authorities in the development of its general research programme for its Annual Reviews. These studies are published under the auspices of the Council although the views expressed in each case are those of the authors themselves. In addition to these staff and special studies and other printed Council documents which are available from the Queen's Printer, the Council will make available, from time to time, studies which, because of their technical and specialized nature, are of interest to only a relatively limited number of specialists in a particular field of research. This is one of these studies. A list of others is available from the Secretary of the Council, P. O. Box 527, Ottawa.

I - INTRODUCTION AND CONCLUSIONS

To attain and sustain economic expansion, a reasonable level of mobility of labor (geographic, industrial and occupational) in the economy is necessary. Economic growth does not necessarily imply that all occupations, enterprises and industries are expanding. Some may expand and prosper, while others contract in importance. Technological progress will tend to favour some occupations and industries over others. Particular enterprises may expand or contract because they are more or less efficient than their immediate competitors. In other cases, the expansion or contraction of enterprises will be more a reflection of what is happening to total demand for the products of the industries to which they belong.

A complex pattern of change of this sort is normal in a growing economy, and mobility of the labor force is needed in order to facilitate it. If there is sufficient mobility, expanding occupations, enterprises and industries will be able quickly to absorb labor and other resources released by other parts of the economy which are contracting.

According to the classical view of the labor market, this process of absorption is largely carried out, in an economy like Canada's, through the price system. Expanding sectors of the economy, needing more workers, tend to raise wages. Contracting sectors tend to do the opposite or, if not that, then at least to raise wages less than the expanding sectors. This should, given adequate mobility of labor, tend to move people from contracting to expanding sectors, and thus enhance the pace of economic growth.

It is well enough recognized that in real life the adjustment process in the labor market is not as neat and simple as this. Other factors besides relative wage movements influence the movement of workers. Moreover, the mobility of workers in response to wage differentials may be impeded by various sorts of barrier: economic barriers, such as the cost of retraining and of moving from one job to another; and noneconomic barriers such as workers' unawareness of higher remuneration available to them elsewhere. Obviously, the real-life adjustment process diverges in some degree from that of the simplest sort of classical model. What is important, for economic policy purposes, is to form some idea of the wideness of the divergence, for one's

assessment in this regard is likely to have a considerable bearing on more than one economic policy question. Suppose, to take an extreme example, that one's assessment were to the effect that the classical adjustment mechanism, operating through wage differentials, was so weak relatively to other factors that its existence could be virtually disregarded. This would have an important impact on manpower policy, which would now not merely have to supplement the classical mechanism of the labor market, but act as a substitute for it in bringing about a sufficient degree of labor mobility from contracting to expanding sectors of the economy. The conclusion might also influence a verdict on "incomes policy" as a means of improving the "trade off" between the economic goals of high employment and price stability. One of the major objections customarily raised to an incomes policy is that it usually attempts to impose simple and easily understood criteria for wage increases -- criteria which if lived up to in practice would impose a strait jacket on the pattern of relative wages and thus on the classical adjustment mechanism.[1] But if the mechanism is judged not to be very effective anyway, this becomes a less weighty objection.[2]

The present study was orginally undertaken for the Economic Council of Canada at a time (1966) when the Council was actively concerned with the question of whether an incomes policy would be a useful device for Canada. But while this was one reason for commissioning the study, it was recognized that the subject matter was of interest in other economic policy connections as well.

Basically, the study addresses itself to the question: How well does the Canadian labor market perform as an allocative mechanism of the classical type? The period of the analysis is from 1953 to 1964. Because of the unavailability of suitable data by occupation, the study is confined to industrial and regional bases. A study of this type was first carried out by Gallaway for the United States.[3] In accordance with the original instructions from the Economic Council, our study closely follows the spirit and, in many ways, the form of his pioneer exploration of the relation between labor mobility and the intrafactor allocation mechanism. The research carried out here also has some implications for the much-discussed "Phillips' curves"

1/ Economic Council of Canada, Third Annual Review: Prices, Productivity and Employment, Ottawa, Queen's Printer, 1966, pp. 153-4.

2/ See especially P. de Wolff's introduction to Wages and Labour Mobility, Organization for Economic Co-operation and Development, Paris, 1965.

3/ Gallaway, L. E., "Labor Mobility, Resource Allocation, and Structural Unemployment", American Economic Review, Vol. LIII, No. 4, September 1963.

for different countries.[1] These curves have been interpreted as demonstrating the existence of a functional relationship between aggregate wage changes and the level of unemployment; not many studies have been undertaken to examine this relationship for individual sectors of an economy.[2]

The mobility of labor in Canada has of course been examined previously, using other techniques. Studies by Anderson and Nickson may be mentioned, inter alia.[3] Our own study is on the whole less notable for the novelty of its conclusions than for the confirmation which it brings, using a different type of test, of the general character of the results obtained in previous studies.

Given the limitations of our data and the time period used, our study is compatible with the following observations. Contrary to a widespread belief about the failure of the labor market as a resource allocation device, our results suggest that, on a regional basis, the labor market does allocate resources fairly efficiently. The same conclusions, unfortunately, cannot be reached on an industrial basis. The results are indicative of obstacles to the mobility of workers between industries. This suggests the value of further study of the institutional features of the Canadian labor market, including governmental and collective bargaining institutions.[4] It also points to a need for close study of various techniques of manpower policy which might improve interindustrial labor mobility.

A useful by-product of the analysis is that it lends itself to a test of the so-called "structural unemployment" hypothesis, according to which high unemployment rates experienced in Canada in the late 1950's and early 1960's were due less to a deficiency of aggregate demand than to structural factors such as changes in technology, the composition of demand, and the location of industry. Our test indicates that structural factors were less important than general demand deficiency.

1/ Phillips, A. W., "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957", Economica, November 1958. A recent Canadian work on this subject is R. G. Bodkin, E. P. Bond, G. L. Reuber and T. R. Robinson, Price Stability and High Employment: The Options for Canadian Economic Policy, Economic Council of Canada, Special Study No. 5, Ottawa, Queen's Printer, 1967.

2/ Hildebrand, G. H. and Delehanty, G. E., "Wage Levels and Differentials" in Prosperity and Unemployment, edited by Gordon and Gordon, John Wiley and Sons, 1966.

3/ Isabel B. Anderson, Internal Migration in Canada, 1921-1961, Staff Study 13, Economic Council of Canada, Queen's Printer, Ottawa. May Nickson, Geographical Mobility in Canada, October 1964-October 1965, Special Labour Force Studies No. 4, Dominion Bureau of Statistics, Ottawa (DBS Cat. #71-508).

4/ Many of these matters are now being systematically studied by the Task Force on Labour Relations. Their findings will be of great interest when published.

The model describing the allocation mechanism, which is implicit in Gallaway's article, is presented in Section II. In Section III the relationships developed in Section II are translated into forms in which they can be empirically tested. The empirical results and the conclusions are presented in Section IV.

II - THE MODEL

According to conventional economic theory, the relative prices (wages) of the factors of production (labor) and changes in these prices (wages) should reflect the comparative scarcities of these factors. To illustrate this classical hypothesis, let us assume that there are two fully employed sectors in an economy in which the following conditions exist:

(1) workers and employers have a perfect knowledge of the market;

(2) workers and employers are rational, the workers maximizing utility, and employers maximizing profits;

(3) perfect mobility exists in the market and there are no movement costs;

(4) workers and employers reach individual decisions concerning actions in the market.

These conditions will lead to an equalization of wage rates in both sectors, since if the wage rate in the first sector, W_1^o, say, is higher than that in the second sector, W_2^o, some workers will shift from sector 2 to sector 1. This will cause the supply curve in sector 1 to shift rightward and that in sector 2 to shift leftward. The adjustment will not stop until the wage rates in both sectors are equal (i.e., W** in Figure 1).

In Figure 1 the following notation is used:

N_i^d = demand for labor in the ith market

N_i^s = supply of labor in the ith market

N_i^* = equilibrium amount of labor in the ith market

W_i = wage in the ith market

W_i^* = equilibrium wage in the ith market, i.e., wage at which $N_i^d = N_i^s$

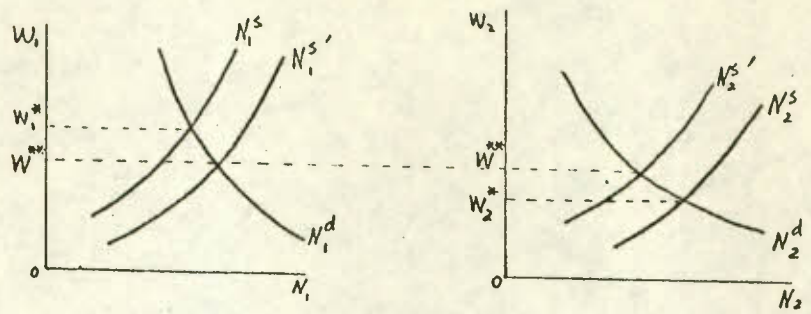


Figure 1

Now let the wage rates be equal in the two markets and suppose that for some reason employers wish to hire less labor at every wage rate in sector 2. Some workers will move from sector 2 to sector 1, causing the supply of labor curve to shift to the right in sector 1, and to the left in sector 2, until equalization of wage rates is again accomplished (W** in Figure 2).

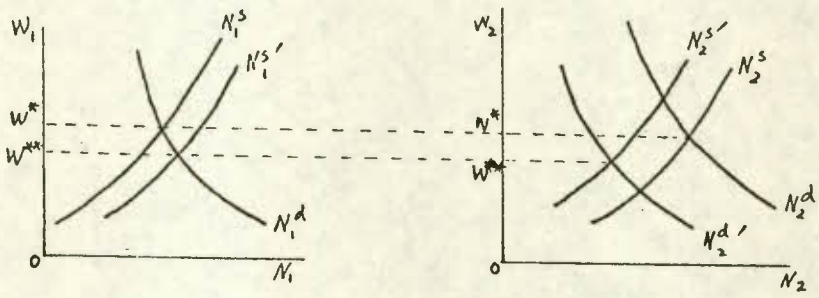


Figure 2

Algebraically, the supply functions of labor can be written as:

$$(2.1) \quad N_1^S = N_1^S (W_1, W_2)$$

$$(2.2) \quad N_2^S = N_2^S (W_1, W_2)$$

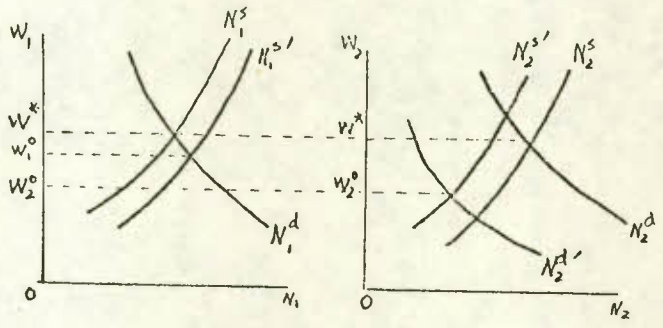
An equilibrium condition is:

$$(2.3) \quad W_1 = W_2$$

Given the demand function for both sectors, equations (2.1) to (2.3) can be solved for W*, the equilibrium value of the wage rate, and N_1^* and N_2^*, the equilibrium quantities of labor.

This concept can be extended to an economy of n sectors. If traditional supply and demand relationships exist in the n sectors, then the logical implications of our assumptions will be an equalization of wage rates in the n sectors.

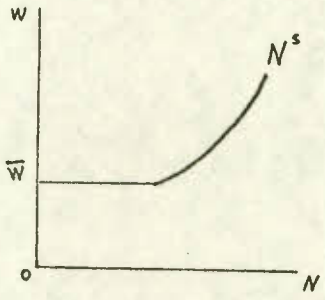
Now assume that some of the assumptions of the competitive model are not satisfied. Let us consider two such possibilities, where wage differentials result owing to economic or noneconomic barriers to mobility. The first possibility is illustrated in the diagram below:



Sector 1 Sector 2

If we assume an initial position of equilibrium in all sectors and introduce an exogenous leftward shift of the labor demand curve in one sector, so long as all the assumptions are not met, there will be wage differentials between the affected sectors and/or involuntary unemployment. As the demand curve in sector 2 shifts leftward, causing the wage rate in the sector to move down, some workers would like to shift to the other sector (unless there is absolute immobility and/or absolute preference for sector 2). However, since all the assumptions are not met, there will be a wage differential (in the diagram, $W_1^o > W_2^o$).

The other possibility is rather an extreme case where we assume the existence of powerful trade unions which prohibit entry into a high-wage sector. The supply curve of labor in this case may look as follows:[1/]



In this situation, either a permanent wage differential or involuntary unemployment, or both, may ensue.

1/ Lest this illustration be misunderstood, it should be pointed out that this is purely illustrative, and should not be thought of as depicting actual conditions in Canada. It is quite well known that, at least in Canada, few unions are in a position to prohibit entry into a sector completely. The closed shop is quite rare. Union shops are more common, but their impact on any sector discussed in this study is not likely to be the same as shown in the diagram.

The situation just described can be considered as an example of non-economic barriers to mobility. Noneconomic barriers can be characterized as having to do with circumstances which cannot be explained in terms of objective opportunity costs. The existence of other types of noneconomic barriers to mobility is likely to give similar results.

In addition to noneconomic barriers to mobility, there can also be some barriers to mobility which are economic in origin and which may cause wage differentials. These barriers may be generated by the private opportunity costs associated with market transfer, but may not be accompanied by involuntary unemployment. Some examples of economic barriers are costs of relocation and retraining. These kinds of barriers are not likely to result in a misallocation of resources, whereas the noneconomic barriers may hamper the efficiency of the labor market as a resource allocation device. In the next section we will try to transform these theoretical conclusions into a form in which they can be empirically tested.

III - SPECIFICATION OF THE MODEL

Gallaway has developed the necessary and sufficient conditions for concluding that the labor market is an efficient allocator of resources among sectors of a market. For a detailed account of these conditions, the reader is requested to consult the original article. In summary form, the conditions are as follows:

(1) sectoral wage rates should have a high positive correlation through time;

(2) sectoral unemployment rates should have a high positive correlation through time;[1/]

(3) no significant change in the distribution of sector wage rates;

(4) the rank order correlation is close to one over time.

The first two conditions are tested by the following statistic:[2/]

$R = \frac{\sigma^2 - \hat{\sigma}_o^2}{\hat{\sigma}_1^2 - \hat{\sigma}_o^2}$ where $\hat{\sigma}_o^2$ measures the variation between two series of numbers, given that the two series are not related; $\hat{\sigma}_1^2$ measures the variation of the same two series when the two are perfectly related, and σ^2 denotes the actual variance of the aggregate series.

1/ See next page.

2/ See next page.

1/ Over any period during which there have been appreciable cyclical variations in economic activity, this involves an assumption that involuntary cyclical unemployment is allocated evenly throughout the various sectors of the economy. It has been argued in some recent writing that this is not in fact the case. See, e.g., Walter Oi, "Labour as a Quasi-Fixed Factor", Journal of Political Economy, Vol. 70, December 1962. Other relevant references include Richard G. Lipsey, "Structural and Deficient-Demand Unemployment Reconsidered"; Arthur M. Ross (ed.), Employment Policy and the Labour Market, University of California, Berkeley, 1965; E. G. Gilpatrick, Structural Unemployment and Aggregate Demand, The Johns Hopkins Press, Baltimore, 1966; S. Ostry and F. T. Denton, An Analysis of Post-War Unemployment, Staff Study No. 3, Economic Council of Canada, Queen's Printer, Ottawa, 1965; P. P. Proulx, "The Composition of Unemployment in Canada", Employment, Unemployment and Manpower, Fifteenth Annual Conference, Industrial Relations Centre, McGill University, 1964, pp. 36-54; J. Vanderkamp, "An Application of Lipsey's Concept of Structural Unemployment", Review of Economic Studies, July 1966; David C. Smith, "The Controversy Over Causes of Unemployment", The Canadian Banker, Summer 1965.

Gallaway, op. cit., p. 699, footnote 5, concedes that cyclical unemployment may have a differential impact on various sectors of the economy. He points out that this will bias his tests in favour of showing an inefficient labor market mechanism. It should be added, however, that the direction of the bias would not be so certain where one reaction to cyclical recessions in the economy was the withdrawal of workers from the labor force (and hence from the unemployment data), and where such withdrawal was not evenly distributed by sectors. I am indebted to Professor Kenneth Strand for bringing this point to my attention.

2/ In deriving the R statistic, Gallaway makes use of a device employed by Solow (Solow, R. M., "Skeptical Note on the Constancy of Relative Shares", American Economic Review, September 1958, Vol. 48, pp. 618-31) in his discussion of the constancy of relative shares. The R statistic can be derived as follows:

Suppose there are two series of numbers, denoted by x and y. The variances for the two series are σ_x^2 and σ_y^2 respectively. The aggregate variance and the covariance of the two series are σ^2_{xy} and Cov (x, y). By statistical theorem we have (3.1) $\sigma^2_{xy} = \alpha_x^2 \sigma_x^2 + 2\alpha_x \alpha_y$ Cov (x, y) + $\alpha_y^2 \sigma_y^2$ where α_x and α_y are weights in the two series. The correlation coefficient between x and y is defined as (3.2) $\gamma_{xy} = \frac{\text{Cov}(x, y)}{\sigma_x \sigma_y}$ where σ_x and σ_y are the square roots of the variances of x and y and are called standard deviations. If the two series are uncorrelated, then $r_{xy} = o$. Equation (3.1) reduces to (3.3) $\hat{\sigma}^2_{xy} = \alpha_x^2 \sigma_x^2 + \alpha_y^2 \sigma_y^2$ where $\hat{\sigma}^2_{xy}$ denotes a predicted variance.

On the other hand, if we assume $r_{xy} = 1$, then (3.4) $\hat{\sigma}^2_{xy} = \alpha_x^2 \sigma_x^2 + 2 \alpha_x \alpha_y \sigma_x \sigma_y + \alpha_y^2 \sigma$.
It is obvious that the more closely correlated the two series, the closer the actual variance (σ^2_{xy}) will be to the predicted variance ($\hat{\sigma}^2_{xy}$) for an assumed γ_{xy} of one.
Expressions (3.3) and (3.4) can be generalized to deal with n series of numbers. The generalized forms are:

(3.3)' $\hat{\sigma}_o^2 = \sum_{i=1}^{n} \alpha_i^2 \sigma_i^2$

(3.4)' $\hat{\sigma}_1^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_i \alpha_j \sigma_i \sigma_j$

where $\hat{\sigma}_o^2$ and $\hat{\sigma}_1^2$ are predicted variances assuming r equal to zero and one respectively.
A precise measure of the extent to which the series are correlated is given by the following expression:

(3.5) $R = \frac{\sigma^2 - \hat{\sigma}_o^2}{\hat{\sigma}_1^2 - \hat{\sigma}_o^2}$

In order to test the hypothesis that R is significantly different from zero, the following statistic, which is approximately normally distributed, was computed:

$$G = \tfrac{1}{2}n \frac{1+R}{1-R} \sqrt{\frac{K(K-1)(n-3)}{2}}$$, where

n = number of observations

k = number of sectors.

If it is found that the calculated value of G is greater than the tabulated value of the normal distribution at the .05 level, R is said to be significantly different from zero.

As far as the third and fourth conditions are concerned, they are necessary because the first two conditions may be satisfied despite the presence of noneconomic barriers. For example, the monopoloid sector may be concentrated at an extreme of the distribution of wage rates. In this case, the first two conditions are satisfied, but the third will be violated. Similarly, the first two conditions are satisfied if relative gains are had only in the monopoloid sector. Here the fourth condition will be violated.

The statistical technique used to test the third and fourth conditions are: (1) the standard deviation as a measure of the dispersion of wage rates, and (2) ranking the sector wage rates in 1964 and then calculating the correlation coefficient in the usual manner. In both cases the 1964 money wage rates are converted into 1953 prices.

IV - EMPIRICAL RESULTS

Before the statistical results are presented, some comments on the data utilized here may be made. The best information available has been utilized throughout this study, and all of the data were supplied by the Dominion Bureau of Statistics. As will be seen in the brief commentary on the sources of the data placed in the form of an appendix at the end of this study, the available statistics leave much to be desired, and it would be somewhat reassuring if we could use the same kind of data as were used by Gallaway in his study for the United States. However, despite some imperfections in the data, the statistics are good enough for the purpose at hand. Moreover, if theoretical relations shine through imperfect data, this should be taken as testimony to the strength of these relationships.

Table 1

Unemployment Rates 1953-64 and Compensation per Employee 1952-64,

by Industry, Canada

Industry	Weight[1](α) (1958)	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
		Unemployment Rate (Per cent)											
Mining, Quarrying, Oil Wells	.04090	4.2	4.7	4.4	4.1	5.6	9.3	8.3	7.0	9.3	9.0	7.7	4.4
Construction	.09556	9.4	14.4	13.2	10.0	13.5	19.0	17.1	20.8	21.1	16.9	15.3	12.8
Manufacturing	.42714	3.1	5.3	4.4	3.2	4.5	7.2	5.9	6.9	6.7	5.3	4.8	4.0
Transportation and Other Utilities	.15626	2.8	4.8	4.3	3.5	4.5	7.0	5.5	6.4	6.6	5.4	5.1	4.5
Trade, Finance and Services	.26038	1.7	2.6	2.6	1.9	2.3	3.7	3.1	3.7	4.1	3.4	3.3	3.1
Forestry, Fishing, Trapping	.01976	11.4	13.0	14.0	13.2	19.7	29.2	25.3	26.9	29.3	26.0	22.6	18.8
Total[2]	1.00000	3.5	5.5	4.9	3.8	4.9	7.9	6.6	7.7	7.9	6.4	5.9	5.0

	Weight[1](α) (1958)	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
		Compensation per Employee (Dollars)												
Mining, Quarrying, Oil Wells	.04090	4,240	4,292	4,286	4,474	4,808	5,023	5,120	5,379	5,666	5,640	5,782	6,022	6,262
Construction	.09556	3,457	3,851	4,005	4,030	4,640	4,893	5,258	4,910	4,791	5,031	5,298	5,574	5,961
Manufacturing	.42714	3,415	3,509	3,627	3,756	3,948	4,168	4,395	4,565	4,683	4,705	4,833	5,000	5,176
Transportation and Other Utilities	.15626	3,908	4,127	4,149	4,286	4,494	4,716	4,993	5,299	5,472	5,723	5,881	6,105	6,332
Trade, Finance and Services	.26038	6,393	6,527	6,616	6,885	7,003	7,396	7,733	7,946	8,202	8,406	8,612	8,852	9,151
Forestry, Fishing, Trapping	.01976	4,148	4,739	3,844	4,787	5,099	5,141	5,441	5,565	5,763	6,133	6,298	6,640	6,908
Total[2]	1.00000	4,320	4,480	4,554	4,729	4,953	5,218	5,490	5,646	5,794	5,925	6,093	6,305	6,545

[1]Weight for 6th series are the same because the weight for each industry is calculated by taking the number of employees divided by the number of total employees in the six industries.

[2]Computed on the basis of 1958 weights.

Source: Unemployment data (C); income data (D).

In order to avoid any distortion in the empirical findings resulting from changes in the relative importance of sectors through time, "fixed" weights (α) of Solow's type have been used.[1/] The procedure employed to construct these weights is described in Appendix A. All of the variances used in determining the R values are calculated on the basis of first differences. This is done to minimize the impact of serial correlation on the R values.

Unemployment and income data for the period 1953-64 and for the six industries, namely: mining, quarrying, oil wells; construction; transportation and other utilities; manufacturing; trade, finance and services; and forestry, fishing, trapping, are summarized in Table 1. Variances for the aggregate series are calculated from these data and compared with the actual variances to determine the R values.

For both the unemployment and income series, the predicted and actual variances, together with R values associated with each series, are presented in Table 2.

Table 2

R Values for Unemployment and Income Series by Industry

Series Used	$\hat{\sigma}_o^2$	$\hat{\sigma}_1^2$	σ^2	R
Unemployment Series	.5915	2.2716	2.1002	.8980*
Income Series	8541.5538	24703.7328	10890.9302	(1) .1454**

* Significant at .05 level.

** Not significant at .05 level.

(1) The results for income series are somewhat baffling. The R statistics for compensation per employee by industry is significant (.94) when levels are used, but it is not significant when first differences are used. This would appear to indicate that there is an unusually large amount of serial correlation in the compensation per employee series.

1/ R. M. Solow, op. cit.

This R value for the unemployment data is statistically significant, while that for the income data obviously is not. Consequently, the first of necessary conditions for concluding that the labor market is an efficient intra-factor allocator of resources on an industrial basis is satisfied, while the second necessary condition is not. Even though the failure to satisfy the second condition makes it unnecessary to test for the third and fourth conditions, it will be useful and informative to examine the dispersion of the distribution of wage rates by industry. The compensation per employee and the relative gains in compensation by industry are given in a tabular form below:

Table 3

Compensation per Employee

and Relative Gains in Compensation, by Industry

	Compensation per Employee		Gain	
	1953	1964	Absolute	Relative[1]
Mining, Quarrying, Oil Wells	$4,292	$5,343	$1,051	- 4.8%
Construction	3,851	5,086	1,235	11.7
Manufacturing	3,509	4,416	907	-17.9
Transportation and Other Utilities	4,127	5,403	1,276	15.5
Trade, Finance and Services	6,527	7,808	1,281	15.9
Forestry, Fishing, Trapping	4,739	5,894	1,555	4.5
Total[2]	$4,480	$5,585	$1,105	--

(1) Computed by comparing the absolute gain in the sector to the over-all absolute gain and expressing the difference as a percentage of the over-all absolute gain.

(2) Computed on basis of 1958 weights.

Source: Table 1.

These data show that between 1953 and 1964 there has been some change in the dispersion of sector wage rates. The largest relative gains were experienced in two sectors (transportation and other utilities; trade, finance and services), and the largest losses were suffered by the manufacturing sector. In order to determine the major sources of losses within the manufacturing sector, the data were further disaggregated into durable and nondurable industries. Unfortunately, the data for durable and nondurable

Table 4

Unemployment Rates 1953-64 and Per Capita Income 1952-64,

by Region, Canada

Region	Weight (α) (1958)	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
						Unemployment Rates (Per cent)							
Atlantic Provinces	.08718	5.5	6.6	6.5	6.0	8.4	12.5	10.9	10.7	11.2	10.7	9.5	7.8
Quebec	.28271	3.8	5.9	6.2	5.0	6.0	8.8	7.8	9.1	9.2	7.5	7.5	6.4
Ontario	.36891	2.1	3.8	3.2	2.4	3.4	5.4	4.5	5.4	5.5	4.3	3.8	3.2
Prairie Provinces	.17191	1.9	2.5	3.1	2.2	2.6	4.1	3.2	4.2	4.6	3.9	3.7	3.1
British Columbia	.08929	4.0	5.2	3.8	2.8	5.0	8.6	6.5	8.5	8.5	6.6	6.4	5.3
Total[1]	1.00000	3.0	4.5	4.4	3.5	4.6	7.0	5.9	7.0	7.2	5.9	5.6	4.7

	Weight (α) (1958)	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
							Per Capita Income (Dollars)							
Atlantic Provinces	.10609	755	781	798	819	884	917	952	994	1,050	1,078	1,123	1,163	1,244
Quebec	.28712	994	1,046	1,059	1,073	1,149	1,204	1,237	1,264	1,309	1,382	1,453	1,502	1,608
Ontario	.34081	1,409	1,459	1,446	1,503	1,594	1,667	1,714	1,770	1,803	1,482	1,930	2,019	2,125
Prairie Provinces	.17400	1,327	1,287	1,106	1,221	1,396	1,311	1,419	1,456	1,527	1,462	1,695	1,764	1,762
British Columbia	.09005	1,434	1,477	1,475	1,538	1,166	1,705	1,695	1,758	1,779	1,812	1,890	1,974	2,079
Yukon and Northwest Territories	.00193	920	960	1,000	1,068	1,387	1,354	1,181	1,205	1,388	1,324	1,282	1,307	1,341
Total[1]	1.00000	1,208	1,239	1,209	1,260	1,363	1,395	1,442	1,486	1,530	1,559	1,662	1,730	1,814

[1]Computed on the basis of 1958 weights.

Source: Unemployment data (A); income data (B).

industries were not available beyond 1959 on a basis consistent with the earlier data, and therefore our results refer only to the period 1953-59. The analysis of the period between 1953 and 1959 suggests that the losses in the manufacturing sector should be mainly attributed to the nondurable manufacturing sector and not to the manufacturing sector as a whole. Whether this is also true for the period between 1953 and 1964 is difficult to say on the basis of the information we have at our disposal for this period.

Regional unemployment and income data are analyzed in a similar fashion for the years 1953-64 for unemployment and 1952-64 for income. The six regions concerned are: Atlantic Provinces, Quebec, Ontario, Prairie Provinces, British Columbia, and Yukon and Northwest Territories. Table 4 presents the basic data used in the analysis.

Again, the predicted variances for the aggregate series were calculated from these data and compared with the actual variance to determine the R values. The results are summarized in Table 5.

Table 5

R Values for Unemployment and Income Series, by Region

Series Used	$\hat{\sigma}_o^2$	$\hat{\sigma}_1^2$	σ^2	R
Unemployment Series	.4086	1.6456	1.5082	.8889*
Income Series	636.7516	2151.9147	1300.6051	.4381*

* Significant at the .05 level.

Both R values are statistically significant at the .05 level, satisfying the first and second of the necessary conditions for demonstrating efficient intrafactor resource allocation.

This necessitates conducting the tests for the third and fourth conditions. With respect to the third condition, the respective standard deviations of the distribution of real wage rates for the years 1953 and 1964 are shown in Table 6.

Table 6

Standard Deviations of the Distribution of Real Wage Rates

Region	σ 1953	σ 1964	Per Cent Change
All regions including Yukon and Northwest Territories	$284	$313	10.20

The percentage changes over this period can probably be regarded as insignificant if we consider that no adjustment in the data has been made to take account of differences in industrial mix between regions. The widening of regional income differentials probably reflect the impact of the widening of industrial differentials. Consequently, the evidence for the United States and Canada appears to satisfy the third of the necessary conditions.

As to the fourth condition, the rank order correlation coefficients between 1953 and 1964 rankings of regional wage rates is 0.943 and is significant at the .05 level. Therefore, the fourth and the last of the necessary conditions can be considered as satisfied.

The last step in our statistical analysis of the U.S. and Canadian data is to apply the statistical technique developed here to the controversy of structural-transformation vs. aggregate demand explanations of high rates of unemployment in both countries in the post-war period. From the reading of the literature on this subject, one gets the impression that in their controversy not all the versions of the argument have been considered. There still exists a lack of clarity on the basic concepts and tests in this debate. By way of a summary we can state that during the latter part of the 1950's an interesting debate took place between "structuralists" and "inadequate demanders". The debate revolved around the question of whether post-war structural changes in technology, final demand, and the location of industry have been chief contributors to high unemployment levels or whether high unemployment rates have been due primarily to insufficient spending relative to the productive capacity of the labor force. This controversy has recently occupied and still occupies many economists in the United States.

As far as we know, the Canadian economists have not been as much concerned with this controversy as their American counterparts. There have been only three Canadian studies in this area.[1] The lack of interest in this field may be due to the fact that the explanations put forward by some economists for the over-all high levels of unemployment in Canada has been found to be satisfactory.[2] Since this controversy, in addition to its concern with the theoretical problems, also has implications for the mix of policies to deal with unemployment problems, it should be enlightening to utilize our R statistic to test the relative merits of the two hypotheses. Application of the R statistic may not only broaden our knowledge about this controversy, but may also provide comparative results and hopefully stimulate further research. If unemployment is not strongly correlated between different sectors in the post-war period, the R value for the 1958-62 period will be lower than that of the pre-1958 period, empirically supporting the structural hypothesis. If the R values are either similar or the R value for the post-1958 period is greater than for the pre-1958 period, empirical evidence in favour of the aggregate demand hypothesis will be established.

The following test statistic, which is approximately normally distributed, was used to see if the R values were significantly different in the two periods:

$$S = \frac{\bar{z}_1 - \bar{z}_2}{\sqrt{\frac{2(n_1 + n_2 - 6)}{(n_1 - 3)(n_2 - 3)\,k\,(k-1)}}}$$ where,

z_i = mean of the ith distribution

n_1 = number of observations, 1958-62

n_2 = number of observations, 1954-57

If the calculated value of S is greater than the tabulated value at the .05 level, then we say that there is a significant difference between the R's for the two periods.

1/ See studies by Ostry and Denton, Proulx, and Vanderkamp mentioned above in footnote 1, page 9. See also the article by David C. Smith mentioned in the same footnote.

2/ C. L. Barber, "Canada's Unemployment Problem", Canadian Journal of Economics and Political Science, February 1962, pp. 88-1023; "Austerity", "The Decline in the Rate of Economic Growth" and "Monetary Policy and Stagnation in the Canadian Economy", all published in Economics: Canada, edited by M. H. Watkins and D. F. Forster, McGraw-Hill Company of Canada, Toronto, 1963.

Table 7

The Comparison of R Values

Data Used	R Value 1954-57	R Value 1958-62
Industrial	.9180	.9212
Regional	.7907	.9442

In Table 7, R values are calculated on both industrial and regional bases, for the two periods 1954-57 and 1958-62. The R values in both instances are larger in the latter period. The difference between the R value for the two periods, however, is not significant at the 5 per cent level for both categories. Therefore, the conclusion suggested by these data is that the aggregate demand hypothesis is a better explanation of the high unemployment rates in Canada than the structural hypothesis.[1/]

Conclusions

The results of this study can now be summarized as follows:

(1) The labor market in Canada is a reasonably efficient intrafactor allocator of labor between regional sectors of that market. At least the labor market is no more inefficient in allocating labor regionally today than it was yesterday.

(2) The labor market does not seem to be an efficient allocator of labor between industries with respect to income.

(3) Our results do not lend support to the "structuralists'" view that high unemployment rates in post-war Canada have been largely due to structural changes in technology, final demand, and the location of industry.[2/]

1/ This conclusion should not be taken, however, as suggesting that further testing of the structuralist hypothesis may not be profitable. Lipsey argues that the appropriate test for one kind of structural unemployment, likely to occur in conjunction with demand-deficient unemployment, is an analysis, not of unemployment, but of increments in demand for labor occurring at similar stages of successive cyclical upswings. Richard G. Lipsey, "Structural and Deficient-Demand Unemployment Reconsidered", Arthur M. Ross (ed.), Employment Policy and the Labour Market, University of California, Berkeley, 1965, pp. 246-252.

2/ This finding seems to be consistent with the remarks of Solow about high levels of unemployment in the United States, and the recent findings of Vanderkamp for Canada. See Solow, R. M., The Nature and Sources of Unemployment in the United States, Wicksell Lectures, 1964. Hamqvist and Wicksell, Stockholm, 1964; Vanderkamp, J., op. cit.

APPENDIX A

Before the sources of the data are summarized, some comments on the statistics collected are in order:

1. Data on the number of full-time equivalent employees by industry are not available for Canada. We use data on the number of employees by industry. This may create some distortion but, to the extent the economic conditions in the two countries are somewhat similar, the use of number of employees should not distort the results seriously. For example, for the U.S. data, the number of full-time equivalent employees and the average number of full-time and part-time employees are roughly the same for the following industries: mining; contract construction; manufacturing; electric and gas utilities; and public services (see Survey of Current Business, June 1945, pp. 17-18 for the U.S. definitions, and Survey of Current Business, July 1964, pp. 29-30 for recent U.S. data). For Canada, we have the following six industrial classifications: mining, quarrying, oil wells; construction; manufacturing; transportation and other utilities; trade, finance and services; and forestry, fishing and trapping. Assuming that somewhat similar situations prevail in the Canadian case, we can use the number of employees rather than the number of full-time equivalent employees in mining, quarrying, oil wells; construction; and manufacturing.

2. Wage data present certain problems. The coverage of data describing money wage rates for various sectors is not complete either temporally or sectorally. Consequently, as a proxy for wage rates, annual income per worker is used in the analysis. This may introduce certain distortions due to differences in the length of the work year in various sectors and the presence of non-wage elements in the income package. Whatever biases are introduced by these distorting factors, however, are likely to weigh the empirical results in favour of a finding that the labor market is an inefficient allocator of resources.

3. Derivation of satisfactory unemployment statistics suffer from the usual problems, e.g., who is in the labor force? who is involuntarily unemployed? In addition to these problems, there is the problem of accounting for temporary layoffs, industrial disputes, part-time workers, etc. (See Report of the Special Committee of the Senate on Manpower and Employment, Ottawa, Queen's Printer, 1961, and President's Committee to Appraise Employment and Unemployment Statistics, Washington, D.C., 1962.)

4. The number of industries used here is small. This is due to the fact that data on total compensation and total employees were not available for identical industries. Data for various industries were, therefore, manipulated to compute compensation per employee. The result of this has been that the number of industries analyzed is somewhat reduced.

5. The derivation of weights (α):

(i) Unemployment rates by industry
The weight for each industry X_i is calculated by taking the number of employees for industry X_i divided by the total number of employees in the N industries.

(ii) Compensation per employee by industry
The weight for each industry X_i is calculated by taking the number of employees in industry X_i divided by the total number of employees in the N industries.

(iii) Unemployment rates by region
The weight for each region is calculated by taking the labor force for all regions.

(iv) Per capita income by region
The weight for each region is calculated by taking the population for that region divided by the population for all regions.

Sources of Data:

(A) Unemployment rates by region, 1953-1965
Data supplied by the Special Surveys Division, Dominion Bureau of Statistics.

(B) Per capita income by region, 1952-1964
National Accounts Income and Expenditure, 1962 and 1964 issues, Catalogue 13-201, Tables 28-29, Dominion Bureau of Statistics.
National Accounts Income and Expenditure, 1926-1956, Catalogue 13-502, Tables 28-29, Dominion Bureau of Statistics.

(C) Unemployment rates by industry, 1953-1965
Data supplied by the Special Surveys Division, Dominion Bureau of Statistics.

(D) Compensation per employee by industry, 1952-1964
National Accounts Income and Expenditure, 1962 and 1964 issues, Catalogue 13-201, Table 22, Dominion Bureau of Statistics.
National Accounts Income and Expenditure, 1926-1956, Catalogue 13-502, Table 22, Dominion Bureau of Statistics.
Employment data supplied by the Labour Division, Employment Section, Dominion Bureau of Statistics.

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