STAFF STUDY No. 3

An Analysis of Post-War Unemployment

by Frank T. Denton *and* Sylvia Ostry

prepared for the Economic Council of Canada

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AN ANALYSIS OF POST-WAR UNEMPLOYMENT

This analysis of post-war unemployment was undertaken in order to estimate a feasible utilization ratio of the labour force to be used as a basis for calculation of potential output to 1970.[1/]

I - THE COMPONENTS OF POST-WAR UNEMPLOYMENT

Certain features of change in the level and pattern of unemployment can be clarified by an examination of its components. From one point of view[2/] it is convenient to divide unemployment into two major types: demand-deficient and non-demand-deficient unemployment. According to this typology, demand-deficient unemployment arises whenever there is a gap between the over-all demand for labour and the total labour supply. Such unemployment is usually associated with business recessions and may, in such circumstances, be termed short-term inadequate demand unemployment. However, a more persistent deficiency of demand, lasting beyond short-term business fluctuations, may produce sustained unemployment called here long-term inadequate demand unemployment.

The second major type, non-demand-deficient unemployment, stems not from a gap between over-all labour demand and supply, but essentially from a mismatching between demand and supply. In a dynamic economy, firms and workers are constantly adjusting to changes in price and to opportunities for employment or income. Many of these adjustments are relatively minor and the resulting unemployment is of short duration. Other types of change, reflecting more fundamental "structural" shifts in the economy -- introduction of new products, major technological innovations, depletion of natural resources -- involve long-run declines in employment opportunities for certain occupations, industries or areas. Unemployment will rise in

1/ The first version of this paper was completed in April 1964. For use of the utilization ratio in the calculation of potential output see B.J. Drabble, Potential Output, 1946 to 1970, Staff Study No. 2, Economic Council of Canada, Ottawa: Queen's Printer, 1964.

2/ Unemployment terminology is, at the present time, in a rather unsettled state. The taxonomy proposed here was simply that considered most appropriate to the analysis. The distinction made between the two main types of unemployment is not meant to imply that they are necessarily independent in a causal sense. Cf. N.J. Simler, "The Structuralist Hypothesis and Public Policy," American Economic Review, December 1964, especially pp. 996-998 and Robert M. Solow, The Nature and Sources of Unemployment in the United States, Wicksell Lectures, Stockholm, 1964, p. 28.

such occupations, industries and areas while the surplus labour is in process of adjusting to the changed structure of demand.[1] The concept of non-demand-deficient unemployment embraces unemployment stemming from both these types of change -- the relatively minor short-run changes and the fundamental longer-run changes -- as well as from changes arising from variations in climate and other seasonal factors. One may, then, distinguish three categories of non-demand-deficient unemployment:

1. Frictional -- short-duration unemployment arising from the movement into the labour force of new entrants or re-entrants and from the movement of workers from one job to another.
2. Structural -- long-duration unemployment arising from structural changes in the character of the demand for labour which require transformation of labour supply, a time-consuming process.
3. Seasonal -- arising from the variations in climate and other seasonal factors which affect production, consumer buying habits, and labour force entries and exits.

In Table 1, estimates of the major components of unemployment are presented for each year since 1946. Although a brief definition of each item is included in the Note to the Table, and a full description of estimation techniques is provided in Appendix A, some comment on each of these components will help to clarify the later analysis.

Minimum Frictional and Structural Unemployment

It is impossible, given the approach adopted in this paper, to estimate structural unemployment separately.[2] Hence, in Table 1 combined estimates of frictional and structural unemployment are provided. Essentially these represent the "observed" post-war minimum taking into account, however, the effects of the changing age-sex composition and the growth in the nonagricultural share of the labour force over the post-war years. The minimum frictional and structural component of unemployment thus represented, as may be seen from Table 1, between 1.3 and 1.5 per cent of the labour force over the post-war years. It is important to underline that these minimum estimates include not only the short-term frictional unemployment which arises from

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[1] The ease or difficulty of adjustment will vary with the nature of the structural change, the speed of change and the personal characteristics of the individual involved. The institutional environment is also a matter of some importance. One characteristic of structural unemployment is its longer-than-average duration (see below, pp. 15-16). In cases of extreme difficulty of adjustment, structural unemployment will shade into unemployability.

[2] Indeed there does not exist, at the present time, a theoretical basis for the estimation, in absolute terms, of structural unemployment.

Table 1

Major Components of the Unemployment Rate, Annual Averages 1946-63

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963(2)
Total unemployment rate(1)	3.8	2.6	2.6	3.3	3.8	2.6	3.0	3.0	4.6	4.4	3.4	4.6	7.1	6.0	7.0	7.1	5.9	5.5
Minimum frictional and structural	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Minimum seasonal	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9
Short-cycle	1.2	0.1	0.1	1.0	1.3	0.2	0.4	0.3	2.1	1.4	0.3	1.0	2.5	0.4	1.2	1.1	0.2	0.7
Irregular	-0.1	0.0	0.0	-0.1	0.1	-0.1	-0.1	-0.1	-0.3	0.1	0.1	-0.2	-0.1	0.0	-0.2	0.0	0.0	-0.1
Residual	0.6	0.3	0.2	0.0	0.2	0.1	0.2	0.3	0.3	0.4	0.5	1.2	2.1	3.0	3.5	3.6	3.2	2.5

Note: Minimum frictional and structural - Historically observed minimum taking into account changes in age-sex composition and growth of the nonagricultural labour force.
Minimum seasonal - Seasonal component when over-all nonseasonal rate is at minimum.
Short-cycle - Measured in relation to the lowest point of unemployment in the short unemployment cycle.
Irregular - Arising from random disturbances and minor statistical discrepancies.
Residual - Remainder of total when above four components are subtracted.

(1) Total unemployment rates from 1946 to 1952 inclusive are estimates incorporating adjustment for Newfoundland and for timing of the Labour Force Survey which was conducted only quarterly before November 1952.

(2) Estimates of components for 1963 are preliminary.

Source: Based on data from Dominion Bureau of Statistics Labour Force Survey.

job shifting and movements into and out of the labour force, but also long-duration, hard-core structural unemployment as it existed over this period. Moreover, they represent an average of widely varying rates for different groups in the working population and different regions in the country. This is illustrated in Table A-5 for different age and sex groups. Thus, the historically observed minimum frictional and structural component was not 1.3 or 1.5 per cent for teenage males, but 3.5 or 4 per cent, while that for adult females was less than 1 per cent. Unfortunately, it proved impossible in the time available to calculate historical minimum frictional and structural estimates for each region in Canada, but the published over-all unemployment rates may be used, in an approximate fashion, to illustrate a similar phenomenon, i.e., that levels of frictional and especially structural unemployment vary widely from region to region. Thus, during the years 1950-53, when the Canada rate averaged roughly 3 per cent, the regional rates were as follows:

Unemployment Rates, 1950-53 Averages

Atlantic	Quebec	Ontario	Prairies	British Columbia
5.6	3.7	2.1	1.9	3.9

Of course, the variation in regional rates shown above is not due entirely to variation in structural unemployment -- undoubtedly other components of unemployment, especially seasonal unemployment, are more severe in some areas than in others (primarily because of differences in industry "mix"). But a good deal of this regional variation, shown above, even when the all-Canada rate is low, stems from the fact that structural problems are more severe in some parts of the country, especially, as these data clearly illustrate, in the Atlantic region. In summary, then, the estimates of average minimum frictional and structural unemployment, as presented in Table 1, are constructed on a base of widely varying components across the country as well as within the working population.

Minimum Seasonal Unemployment

The estimates of the minimum seasonal component in Table 1 represent the "pure" seasonal component when the over-all, nonseasonal rate is reduced to its minimum. The extent of seasonal variation increases in absolute terms as the unemployment level rises. But, for reasons given in Appendix A, our concern here is with the contribution of seasonal factors to the level of unemployment when the slack in the labour market has been reduced to a minimum, and in this sense the rates in Table 1, varying from 0.8 to 1.1 per cent, are estimates of the contribution of seasonal factors to unemployment during the post-war years.

Short-Cycle Unemployment

The short-cycle component in any given year is an estimate of the average difference between the actual unemployment rate in that year and the rate at the lowest point of the short unemployment cycle. As may be observed, it varies from close to zero (during years in which the lowest point is located) to as much as 2.5 per cent during recession years. The average contribution of short-cycle unemployment over the 18 post-war years was close to 0.9 per cent.[1/]

Irregular Component

This small component, arising from random occurrences or minor statistical discrepancies, is, on average, over the year, close or equal to zero: it is included for the sake of completeness.

Residual

As Table 1 shows, in the early post-war years, the above-named components pretty well exhausted total unemployment. The residual -- i.e., what was left over when the estimated frictional and structural, seasonal, cyclical, and irregular components were subtracted from the over-all annual rate -- was generally small and of little significance.[2/] Such was clearly not the case in later years. Between 1956 and 1957 the residual jumped from 0.5 to 1.2 per cent and climbed rapidly each year after that, moderating only in 1962 and apparently dropping again in 1963.[3/] Even in 1963, however, the residual was estimated at something over 2 per cent of the labour force, a rate well above the virtually negligible levels of the earlier years. Obviously before we can arrive at an estimate of a feasible potential utilization ratio of the labour force over the next few years -- or, to put it in the more usual manner, an estimate of a feasible minimum unemployment rate -- some examination of the post-1957 development is essential.

1/ The cyclical component in 1963 was more difficult to distinguish and the precise division between it and the residual should be regarded with some caution.

2/ Note, however, the level in 1946, a year of post-war transition, when the residual was rather higher than in the later part of the decade. But note, too, how quickly it "melted away".

3/ See footnote 1/ above.

II - POST-1957 "RESIDUAL": LONG-TERM INADEQUATE DEMAND OR STRUCTURAL UNEMPLOYMENT?

The nature and source of the rising level of what we have termed "residual" unemployment since the latter years of the 1950's has been a topic of considerable controversy and discussion in both Canada and the United States where similar developments have been apparent.[1/] The chief question which concerns us here is whether or not the observed rise in the residual represents a significant increase in structural unemployment.[2/] It must be stressed at the outset that one cannot estimate in quantitative terms the effects of structural change on unemployment. It is, in other words, not possible to answer the question "What proportion of the post-1957 residual unemployment represents structural unemployment?" However, it was possible, within the limits of the time and resources available, to test empirically for the presence of symptoms of growing structural maladjustment in the economy. Evidence of such symptoms can indicate whether structural changes have been contributing significantly to the higher levels of unemployment in recent years in this country, i.e., whether there has been a significant increase in structural unemployment.

The main hypothesis underlying our test has been that if rapid and widespread structural changes in the economy have been causing a rise in the unemployment rate,

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1/ For discussion of the American situation see, for example, the Joint Economic Committee Report, "Higher Unemployment Rates, 1957-60: Structural Transformation or Inadequate Demand"; L.E. Gallaway, "Labour Mobility and Structural Unemployment", American Economic Review, Sept., 1963; Proceedings of Subcommittee on Employment and Manpower (Clark Committee) of the Committee on Labor and Public Welfare, United States Senate, Part 5, statements of Walter W. Heller, Charles C. Killingsworth, John Diebold and Leon H. Keyserling; Exploring the Dimensions of the Manpower Revolution, selected readings compiled for the Clark Committee; Otto Eckstein, "Aggregate Demand and the Current Unemployment Problem", in Arthur M. Ross (editor), Unemployment and the American Economy, New York, 1964; R.A. Gordon, "Has Structural Unemployment Worsened?" Industrial Relations, May, 1964; Margaret S. Gordon, "U.S. Manpower and Employment Policy", Monthly Labor Review, November, 1964; Simler, op.cit.; Solow, op.cit.; Robert Evans Jr., "The Case for Structural Unemployment" (mimeographed); Barbara R. Berman, "An Approach to an Absolute Measure of Structural Unemployment" (mimeographed -- presented at The Conference on Unemployment, Boulder, Colorado, June, 1964) and (with David E. Kaun) "Characteristics of Cyclical Recovery and the Measurement of Structural Unemployment", (mimeographed -- presented at the Annual Meetings of the American Statistical Association, Chicago, December, 1964); Richard Lipsey, "Structural Transformation versus Deficient-Aggregate-Demand Theories of Unemployment" and "The Problem of Structural Unemployment" (mimeographed -- presented at Boulder Conference).
When the earlier version of this present paper was completed in April, 1964, no Canadian studies of the structural unemployment problem had been published. Since that time the Proceedings of the McGill Industrial Relations Conference on Employment, Unemployment and Manpower have been published (Montreal, 1964) containing a number of papers on or related to this topic. See especially Pierre-Paul Proulx, "The Composition of Unemployment in Canada" and Harry G. Johnson, "Employment Theory and Public Policy in the North American Context."

2/ Professor Solow has put the case very succinctly, referring to the United States: "The proposition I want to establish is not that there is no structural unemployment ... nor even that there is only a little. It is that there has been no substantial increase in the amount of structural unemployment." op. cit., pp. 18-19.

then unemployment should be more heavily concentrated in those sectors in which the adverse effects of structural transformation have been strongest.[1] Most observers are agreed that the crux of the structural transformation thesis is that there has been taking place in the economy an immense shift in demand from goods to services, accompanied by much more rapid technological change in the goods-producing than the service-producing industries. The effect of these developments, it is claimed, has been seriously to diminish the job opportunities of male manual workers and greatly enhance the importance of white-collar and service jobs, especially those for women and those requiring relatively high levels of education and training. The workers displaced by these fundamental structural changes in the economy are, for a variety of reasons -- lack of training, inadequate education, inappropriate place of residence, and so forth -- unable to fit into the new jobs being created by the expanding sectors. It is a case, in other words, of basic incompatibility, of trying to match round pegs and square holes. During the process of transforming the labour supply to the changed structure of demand and the new technology, higher levels of unemployment will be evident in the economy.

Under the circumstances described above, one would expect the rising unemployment to be concentrated among the groups most vulnerable to structural displacement. (These groups, under the best of circumstances, tend to have higher-than-average unemployment rates so that structural maladjustment would result in greater concentration of unemployment.) If all of the post-1957 increase in unemployment had been of a structural nature -- and this is an extreme version of the thesis -- then this excess supply should be roughly balanced by excess demand for other kinds of labour, i.e., by serious shortages and bottlenecks at various points in the economy. Under such circumstances, rapid inflation would be evident, caused by excess demand in some parts of the goods market as well as strong pressure on factor prices in the bottleneck sectors of the factor market.[2] Such was clearly not the case in recent years and this version of

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[1] Since there has been no rigorous and detailed exposition of the structuralist case, especially as it applies to Canada, in some cases it is difficult to identify these disadvantaged groups or sectors. See below, regression analysis of component unemployment rates.

[2] There would not be offsetting price reductions in the surplus factor markets since factor prices are much less flexible in a downward than an upward direction: cf. Charles L. Schulze, "Recent Inflation in the United States", Joint Economic Committee, Study Paper No. 1, Washington, 1959.

the structuralist hypothesis can be rejected without further investigation. In the less extreme version, if a deficiency of aggregate demand has accompanied the growing structural maladjustment in the economy, the concentration effects on unemployment should still be apparent, but evidence of severe strain and bottlenecks will not be perceived until unemployment declines to a lower level than it has in any year since 1957. The bottlenecks will appear, however, at a level of unemployment higher than the "bottleneck-inducing" level of the earlier post-war period. It is apparent that this version of the structuralist hypothesis does not easily lend itself to empirical testing. However, one aspect which may be explored is the extent and nature of concentration of unemployment among particular groups in the labour force.

One of the problems involved in evaluating the evidence on the changing incidence of unemployment, however, is that unemployment is never spread evenly across the working population, but always affects some groups disproportionately and, further, the incidence of unemployment is affected by variations in the general level of unemployment. The reasons for this are complex, having to do with a variety of factors, some institutional, such as employer and union policies, and some primarily economic, stemming from a host of complicated interrelationships between the level and composition of output, on the one hand, and the operation of the labour market, on the other. Because the incidence of unemployment is responsive to the level of unemployment, confirmation of the structuralist hypothesis must rest on evidence of significant "independent" changes in incidence, i.e., changes not associated with variations in over-all unemployment rates.

In order to test the hypothesis outlined above, two main types of analysis were undertaken. The first, regression analysis, utilized data from the Dominion Bureau of Statistics Labour Force Survey. By means of regression analysis, the changing incidence of unemployment was examined from three vantage points:

(a) in terms of a summary measure of dispersion by region, age-sex and industry;

(b) group by group for each region, age-sex group and industry; and

(c) in terms of a measure of duration.

A summary of the results of the regression analysis is presented in Table 2 and described below. Further material is provided in Appendix B.

The second type of analysis, which consists of charting and observing changes in the distribution of unemployment, utilized data from the National Employment Service

and the 1951 and 1961 Censuses, as well as the Labour Force Survey. The Charts are presented in Appendix C, and a brief description of the main findings is included in the text below.

Regression Analysis

(a) Indexes of dispersion

Indexes of dispersion of unemployment[1/] among workers classified by region, age and sex group and industry, were calculated for each year of the period 1950-63 or, in the case of industries, 1953-63, since data for the earlier years were not available. These indexes measure changes in the distribution or dispersion of component unemployment rates about the over-all average rate. They will remain constant as long as the absolute change in the unemployment rate is the same for all of the component groups and the total rate. They will rise when the absolute increases are greater for the high-unemployment components as, for example, under conditions of equal percentage changes in unemployment rates or when the increase in unemployment is concentrated in sectors originally having higher-than-average rates. The latter condition is that postulated by the structuralists, but since the indexes will be affected by changes in the level of over-all unemployment (except under unlikely circumstances, such as identical absolute changes in all rates) simple inspection of these indexes over the period covered will not reveal whether there has been a significant autonomous change in the incidence of unemployment. Hence, the dispersion indexes were regressed against the level of unemployment (over-all national rate) and a linear trend variable, the latter to allow for autonomous change.[2/] The results are summarized in Table 2, Part A.

It will be seen from Table 2 that there was a marked increase in the concentration of unemployment (measured in absolute terms) over the period under consideration. Each of the three dispersion indexes rose substantially: the regional index

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1/ See Table 2, footnote (5). For description and use of the indexes see Joint Economic Committee, "Higher Unemployment ...", op. cit., pp. 21-22, 49-52.

2/ The use of linear trend in the regression equations was designed to test for gradual and cumulative change in the indexes over the period studied. Several alternate hypotheses are plausible: for example, that there was an abrupt change after 1957 or that the trend was nonlinear (i.e., that the rate of change either increased or decreased over the period) or that some combination of these developments took place. In Appendix B a list is provided of the different equations which were fitted not only with these data for the dispersion indexes but with the data for the component unemployment rates and the percentages of long-term unemployment. The results of these various equations did not differ in any marked degree from those presented in Table 2. For reasons of simplicity of presentation, it was decided, therefore, to concentrate only on the one form of equation.

Table 2

Regression Analysis of Unemployment, Selected Results[1]

		I	II	III	IV	V	VI
		Actual Average		"Expected" Average 1960-63[3]	Ratio of Actual to "Expected" 1960-63	Significance Test for Variables in Regression Equation[4]	
		Base[2] Period	1960-63			National Unemployment Rate Significant?	Trend Significant?
A. Dispersion indexes[5]							
Regions	(1950-53=100)	100.0	192.6	182.7	1.05	Yes*	No
Age-sex groups	(1950-53=100)	100.0	239.9	224.1	1.07	Yes*	No
Industries	(1953-56=100)	100.0	160.1	169.8	.94	Yes*	No
B. Selected unemployment rates							
By region:							
Atlantic provinces	(14.8)	5.6	10.5	10.7	.98	Yes*	No
Quebec	(36.4)	3.7	8.3	7.9	1.05	Yes*	No
Ontario	(27.1)	2.1	4.8	5.2	.92	Yes*	No
Prairie provinces	(11.1)	1.9	4.1	3.5	1.17	Yes*	No
British Columbia	(10.6)	3.9	7.6	8.1	.94	Yes*	No
By age and sex group:							
Males 14-19	(13.4)	6.7	15.4	14.0	1.10	Yes*	Yes*
Males 20-24	(13.6)	4.8	10.9	11.4	.96	Yes*	No
Males 25-44	(33.9)	2.6	6.3	6.6	.95	Yes*	No
Males 45-64	(22.1)	2.8	6.4	6.3	1.02	Yes*	No
Males 65 and over	(2.3)	3.0	5.3	4.7	1.13	Yes*	No
Females 14-19	(5.5)	4.0	8.3	7.0	1.19	Yes*	No
Females 20 and over	(9.2)	1.6	2.6	2.7	.96	Yes*	No
By industry group:							
Agriculture	(3.6)	0.7	2.2	1.2	1.83	Yes*	Yes*
Forestry, fishing, etc.[6]	(8.9)	12.9	26.2	23.1	1.13	Yes*	No
Mining	(1.7)	4.3	8.0	6.7	1.19	Yes	No
Manufacturing	(23.0)	4.0	5.9	7.0	.84	Yes*	Yes*
Construction	(22.8)	11.7	18.4	19.0	.97	Yes*	No
Transportation, etc.[7]	(7.7)	3.9	5.9	6.3	.94	Yes*	No
Trade	(10.3)	2.5	4.2	3.9	1.08	Yes*	No
Service, etc.[8]	(14.9)	2.0	3.3	3.0	1.10	Yes*	No

C. Per cent long-term unemployed[9]		22.7	34.5	40.8	.85	Yes*[10]	No
Over-all national unemployment rate	1950-53	3.0	6.4	-	-	-	-
	1953-56	3.8					

Note: The figures in brackets in Section B are 1960-63 averages of the percentage which the component unemployment is of total unemployment. In the case of industries, the percentages do not add to 100 because of the exclusion of persons seeking work for the first time.

(1) All basic data are from the Dominion Bureau of Statistics Labour Force Survey.

(2) The base period for the analysis of unemployment by industry was 1953-56; in all other cases it was 1950-53.

(3) The "expected" averages were calculated from fitted regression equations. They are estimates of what the averages would have been if there had been no changes since the base period other than the actual increase in the over-all national unemployment rate. For details see Appendix B.

(4) The standard two-tail t-test was used. A "yes" indicates that the coefficient of a variable is significant at the 5 per cent level and an asterisk indicates that it is also significant at the 1 per cent level. A "no" indicates absence of significance at the 5 per cent level. The national unemployment rates used in the regression equations for component rates were standardized to eliminate the effects of changes in the composition of the labour force (see Appendix B). In other cases the actual national rates were used.

(5) The unemployment rate for the component group was subtracted from the Canadian rate and the absolute difference multiplied by the component group's labour force: the summed products were divided by the Canadian labour force and the resulting series converted to index form.

(6) Includes hunting and trapping.

(7) Includes communication and public utilities.

(8) Includes finance, insurance and real estate.

(9) Number of persons seeking work for four months or more as a percentage of the total unemployed.

(10) The year-to-year change in the unemployment rate was also included as an independent variable in the regression equation for long-term unemployed. Its coefficient is not quite significant at the 5 per cent level.

almost doubled between 1950-53 and 1960-63; the index based on age-sex groups better than doubled over the same period; the industry index rose by 60 per cent over the somewhat shorter period since 1953-56. But almost all of this rise is associated with the change in the over-all level of unemployment between the beginning and end of the period. Thus estimates of averages of these indexes for 1960-63, as calculated from the regression equations on the assumption of no change other than the actual increase in the national unemployment rate since the base period, are very close to the actual averages of these indexes in 1960-63 (column III). This comparison may be more easily appreciated by expressing the relationship between actual and estimated averages as a ratio (column IV). Thus, as may be seen, regional and age-sex concentration of unemployment was, in 1960-63, slightly greater than "expected" (the ratio of actual to "expected" was slightly greater than one) while industrial concentration was a little less than "expected" (the ratio was a little less than one). Given the nature of the data and the simplicity of the methodology, it would be unwise to attribute great importance to the precise levels of these and the other ratios in Table 2. Also because the structuralist hypothesis has never been rigorously formulated, there is no guide to a precise "critical" level of such ratios. Under such circumstances an element of judgment must enter into the evaluation of these results. In the case of the dispersion indexes, the ratios appear sufficiently close to one to conclude that there is no sign of a significant autonomous rise in the absolute dispersion of unemployment by industry, age-sex group, or region. This view is further strengthened by observation of column VI where it may be seen that in none of the three cases was the coefficient for trend statistically significant.

(b) Selected unemployment rates

The concentration or dispersion indexes are summary measures of incidence and consequently reveal nothing about the movement of particular rates of unemployment. In order to discover whether the workers in specific labour force groups have suffered significant increase (or decline) in the proportion unemployed relative to the proportion of the total labour force which is unemployed, unemployment rates for a number of selected groups were regressed against the national unemployment rate and time, in the same manner as above. The results in Part B of Table 2, are presented in the same form as those for the dispersion index analysis. Since the method of presentation has already been described, and in order to avoid a further lengthy description, we shall concentrate our attention on column IV, although the reader may wish to examine more closely the rest of the table as well as the additional material in Appendix B.

Turning first to the results for unemployment by region, it may be seen that the ratios of actual to "expected" unemployment rates are less than one for the Atlantic region, Ontario and British Columbia, and more than one for Quebec and the Prairies. Presumably, under conditions of structural maladjustment, some of these ratios should be greater than, some less than, one; i.e., actual unemployment in some regions should be higher, in others lower, than that which might be expected given no change other than the rise in the national rate. The important questions are which would the structuralists predict would be higher (or lower) and by how much? Unfortunately, as is the case with many other aspects of the structuralist hypothesis, the regional implications have not been carefully spelled out so that the answers to these questions are by no means clear. However, it seems a fair interpretation of the view that proponents of structuralism would predict a ratio well above one for the Atlantic region and Quebec (higher for the Atlantic than Quebec) and well below one for Ontario and the Prairies (possibly lower for Ontario than the Prairies). The prediction for British Columbia is more uncertain; although adopting a simple rule of thumb (as do many of the more popular versions of the thesis) that "above-average means more structural", British Columbia would be a candidate for a moderately high ratio.

The difficulty of evaluating the precise levels of these ratios has already been discussed. Bearing this in mind, we may assess the results of the analysis of regional unemployment in the light of the abbreviated "reconstruction" of structuralism outlined in the preceding paragraph. The predictions are contradicted in three out of five regions, especially so in the Atlantic region which is the case most often cited in the structuralist argument. Only in Ontario and Quebec do the ratios conform to structuralist expectations. In the latter instance, the ratio is so close to one that probably it can be rejected as providing acceptable evidence of increased structural maladjustment. This might also be said in the case of Ontario, but even if one were to regard the ratio of .92 as signalling the approach of increasing strain and bottlenecks, the plausibility of such an interpretation is reduced by the fact that the coefficient of the trend variable in the equation for Ontario is not statistically significant (see column VI, Table 2).

Among the age-sex groups tested, teenagers of both sexes and men 65 years of age and over appear to have experienced somewhat higher unemployment rates in 1960-63 than would be "expected" in the absence of change other than the rise in the national rate over the period examined. Again, there is no guide as to the "critical" level of

these ratios. In the case of males 14-19, however, the fact that trend was statistically significant at the 1 per cent level must be taken into account. There has been a great deal of concern expressed about the teenage unemployment problem in recent years and, indeed, unemployment rates for the 14-19 age group of males have been persistently and distressingly high. This present analysis lends limited support to the view that the rise in male teenage unemployment rates in the years following 1957 may be a symptom of a growth in structural unemployment. In the case of teenage women and men 65 years and over, data problems loom so large (the groups are small, as the figures in brackets in Table 2 indicate, and dominated by marginal participants) that it would be more difficult to justify a similar conclusion on the basis of the results presented here. Moreover, it is of interest to note that an alternative explanation of both the higher teenage and older-worker unemployment rates is that they are, in large part, a consequence of prolonged demand-deficiency in the labour market.[1/]

The structuralist thesis is most often -- and most clearly -- expressed in terms of its industrial manifestations.[2/] As has been described earlier, the structuralists argue that the combined effects of rapid technological change and demand shifts in the economy bear most heavily on workers in secondary industry. Indeed, the displaced blue-collar worker in these industries is the very prototype of the structurally unemployed. The expanding trade and service sectors, on the other hand, are the fortunate beneficiaries of structural change. An unprecedented increase in demand, a lagging rate of technological change, and a highly elastic supply of (primarily female) labour, have ensured a rapid and substantial increase in employment in these two industrial sectors. This is the familiar picture presented by the structuralists and the implications for the present analysis are clear. Secondary industry -- manufacturing and construction -- should exhibit ratios of actual to "expected" unemployment well above one. Trade and service, on the other hand, would be most unlikely to show signs of any "autonomous" increase in unemployment over the last decade.

1/ Cf. Solow, op. cit., p. 28, in reference to the teenage unemployment rates, and Simler, loc. cit., who presents a similar argument about older workers.

2/ One of the best statements to be found is by Killingsworth, in his testimony before the Clark Committee, op. cit.

As may be seen from Table 2, results of the regression analyses of unemployment by industry provide little support for the structuralist view. The actual unemployment rates for manufacturing and construction were not higher but somewhat (and in the case of manufacturing, a good deal) lower than "expected". It should be noted, too, that for manufacturing the coefficient of trend was significant at the 1 per cent level and negative (see Appendix B). The ratios for trade and service, on the other hand, are both somewhat above one, and this fact, while probably not significant in itself, should be considered in conjunction with the results for secondary industry in view of the structuralist argument described above.[1/]

There is some suggestion, however, in the ratios for the primary industries in Table 2, that there has been some increase in structural unemployment in this sector, especially in agriculture. The ratio of actual to "expected" unemployment in agriculture is the highest in Table 2 and the trend was statistically significant at the 1 per cent level. However, the numbers involved are very small: the agricultural unemployed have constituted in recent years only between 3 and 4 per cent of the total unemployed in Canada. Increased structural unemployment in agriculture, while a problem in itself, has very little effect on the national rate and cannot provide an explanation for the growth in the "residual" since 1957.[2/]

(c) Proportion of long-term unemployment

One aspect of the structuralist view is that long-duration or "hard-core" unemployment has been growing more important or more serious in recent years. Although statements about hard-core unemployment are usually couched in rather vague and general terms, in point of fact the duration aspect of unemployment is of central importance to structuralism. Workers who have been displaced by structural change will experience greater-than-average difficulty in shifting into new employment, and hence experience a longer-than-average period of job-seeking. These are the round pegs for which there are only square holes. Or, to put it another way, the structuralists suggest that persons who lose employment because of technological change or other structural developments and who, for a variety of reasons, are "mismatched" to the

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1/ It has been suggested by Solow, however, (op. cit., pp. 39-40) that workers displaced by structural changes in manufacturing may secure casual and intermittent employment in trade or service and hence appear in the unemployment statistics for these latter two industries. Unfortunately, we have too little information on worker mobility among industries to check this point.

2/ It should be pointed out that the decline in agricultural employment has been less rapid over the past few years than in the earlier post-war period. One possible contributing factor to this development may have been the relative scarcity of suitable job opportunities in the nonfarm sector. Cf. B.J. Drabble, op. cit., Section II, 2, and John Dawson, "Changes in Agriculture to 1970", Staff Study No. 11, Economic Council of Canada, Ottawa: 1964, Section IV.

available job openings, will remain "stuck" in the unemployed pool for long periods of time and hence both enlarge the size of that pool and increase the average length of stay in the pool. Thus, one symptom of growing structural unemployment should be an increase in the average duration of unemployment. But since the duration "mix" varies with the level of unemployment, one must test for an independent rise in average duration or, as is done here, an autonomous rise in the share of long-term unemployment (defined here as four months or over). Thus, the long-term proportion of total unemployment was regressed against the national unemployment rate and time.[1/] As may be observed in Part C of Table 2, the ratio of the actual to the "expected" average share for the years 1960-63 was well below one. One must conclude that there are certainly no signs of an increase in "hard-core" unemployment over the period under observation other than that associated with the rise in over-all unemployment during these years.

The results of the regression analysis have been reviewed piece by piece, as it were, and we have stressed throughout that, in the absence of a rigorously specified testable model of structuralism, an element of judgment is unavoidably involved in the interpretation of this or that particular result. A step-by-step approach is a required stage in the discussion, of course, but a final evaluation of the validity of the hypothesis must rest on an over-all view of the evidence. This is so because of limitations in both data and methodology which deprive any one result of the strength necessary for bearing the whole weight of "proof". Looking at the range of evidence presented in Table 2, one may detect a sign here or there of a possible growth in structural problems but the over-all impression is that the structuralist argument has received no strong positive support.[2/] On the basis of the regression analysis one must conclude that signs of a significant growth in structural unemployment in the years following 1957 are absent.

1/ The year-to-year change in the unemployment rate was also included as an independent variable in the regression equation for long-term unemployment (see Appendix B). Cf. Simler, op. cit., Solow, op. cit., and Berman, op. cit., for other analyses of long-duration unemployment.

2/ There is another way of evaluating these results. Given the occurrence of random events in the real world and the presence of random sampling error in the data, it can be argued that, purely as a consequence of chance, the structuralist predictions about individual ratios (i.e., whether they would be above or below one) should be correct in roughly half the cases even if the structuralist hypothesis is itself not correct. The reader may perform this exercise himself and he will find, in fact, that the results in Table 2 conform to structuralist predictions in approximately half the cases -- taking into account the one or two instances in which these predictions are open to some doubt. Plausible evidence of increasing structural unemployment would require a considerably higher proportion of "correct" predictions and/or substantially higher (or lower) levels of ratios for particularly sensitive component groups or sectors. Such evidence is clearly lacking.

Lorenz Curves

One further piece of evidence has been prepared in connection with this examination of the changing incidence of unemployment. A useful graphic device for illustrating the distribution of unemployment is the Lorenz Curve.[1] In Appendix C a series of charts representing the distribution of unemployment by various characteristics is presented in the form of Lorenz Curves. Each chart includes two curves, one each for a period preceding and following 1957 in order to assess whether and to what extent unemployment has become more or less unevenly distributed in recent years.

Charts C-1 and C-2 are based on National Employment Service registrations data for 101 occupations and 109 local labour market areas respectively. Chart C-3 is based on census data for 236 counties and census divisions in 1951 and 238 such units in 1961. A criticism which has been levelled at many of the studies of the nature of post-war unemployment is that they utilize data "for very broadly and loosely defined labor force groups (whereas) the expected adverse employment impact of structural transformation would fall upon rather narrowly defined labor force groups".[2] Thus, it was considered a matter of some importance to explore data of a more detailed character than that provided by the Dominion Bureau of Statistics Labour Force Survey.[3] In addition, however, Charts C-4, C-5 and C-6, based on Survey data, provide supplementary illustrative material.

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[1] A Lorenz Curve -- or cumulated frequency curve -- depicts the relationship between cumulated values of two variables. It is most often used in studying income distribution. For an example of its use in the examination of unemployment composition, see Clarence D. Long, "Prosperity Unemployment and its Relation to Economic Growth and Inflation", American Economic Review, May 1960, pp. 158-160. A more general discussion of its broader application in economic analysis may be found in G.B. Hainsworth, "The Lorenz Curve as a General Tool of Economic Analysis", Economic Record, October 1964.

[2] Robert Evans Jr., op. cit., p. 6. Cf., however, Solow, op. cit., p. 42.

[3] There is, on the other hand, a disadvantage involved in using detailed statistics for some types of analysis (although not for Lorenz Curves) in that interoccupational and geographic mobility rates are higher, the finer the classification of the labour force. Movement of persons, who are subject to frequent periods of unemployment, from one specific occupation to another or from one labour market area to another can shift the distribution of unemployment and mask the impact of structural maladjustment. Movement between broad occupational divisions or broad regions is less frequent. (Cf., however, footnote 1/, p. 15.) In this regard it should be noted that age, sex, and education groups are examples of labour force categories for which intergroup mobility is of no consequence. Of course, for any group, movement out of the labour force itself is another form of "escape" from structural displacement and estimates of "hidden unemployment" should, ideally, accompany this study. Unfortunately, time did not permit exploration of this aspect of the problem.

The charts in Appendix C are pretty well self-explanatory. It may be seen that in no case was a marked rise in concentration evident. In three instances -- unemployment by age and sex, by region and by occupation -- a slight increase in the degree of inequality is indicated. In the remaining three -- unemployment by local office area, by county and census division and by industry -- the reverse was true. In general then there has been no marked change in the distribution of unemployment, whether by very detailed or relatively broad categories, in the years following 1957, when compared with the earlier post-war period. The Lorenz Curve approach, therefore, confirms and strengthens the conclusions derived from the regression analysis.

III - ESTIMATE OF POTENTIAL LABOUR FORCE UTILIZATION RATIO OR MINIMUM UNEMPLOYMENT RATE

On the basis of the foregoing analysis, it would appear that most of the increase in "residual" unemployment in the latter 1950's and early 1960's stemmed from growing slack in the economy, i.e., a growth of demand-deficient unemployment. This type of unemployment may be dealt with by means of general policies designed to stimulate the over-all level of demand. On the other hand, non-demand-deficient unemployment is more intractable, requiring selective, market-oriented manpower policies, which are designed to shift resources among alternative uses and bear fruit more gradually. Thus, in seeking an estimate of feasible potential labour force utilization -- or minimum unemployment -- over the balance of this decade, one must focus attention on the non-demand-deficient components of unemployment. These have to be accepted more or less as "given" for the present, and hence they form the basis for the following estimate:

1. Minimum frictional and structural unemployment	1.6%
2. Minimum seasonal unemployment	1.0%
3. Minimum "slack"	0.4%
Minimum unemployment	3.0%
or Potential labour force utilization	97.0%

The suggested minimum frictional and structural rate of 1.6 per cent is calculated on the assumption that the estimated historical frictional and structural rate for each age and sex group in the nonagricultural labour force will not change

markedly over the next few years[1] but that the age-sex composition of the labour force will change in the manner and to the extent described in our labour force projections.[2] The seasonal component, which represents the level of seasonal unemployment at a high level of employment, is derived from the historical analysis of post-war data (Table 1), and is based on the assumption that no marked changes in seasonality will occur over the next few years. The minimum "slack" component is based on the historically "observed" minimum of demand-deficient unemployment during the post-war period and is included so as to provide for some degree of flexibility in the operation of an economy as geographically widespread, diversified, and complex as the Canadian. Thus, the estimated short-term minimum unemployment rate is 3 per cent.

Several points deserve underlining at this stage in the discussion. First, it must be noted that this figure of 3 per cent is an annual average unemployment rate; i.e., it would be higher in the winter season and lower in the summer months. Second, this rate is a national average; it would be composed of regional rates which vary to some degree. Third, it should be emphasized that the 3 per cent annual rate represents the rate in a year of high activity within the short-term cycle. But while short-cycle movements away from this minimum would occur during recessions, persistent deviations would signal a significant decline in the labour force utilization ratio. Finally, it is obvious that this potential level of utilization of the labour force can be more readily maintained if there exist selective market-oriented employment policies to deal with the especially stubborn unemployment problems[3] and also to

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1/ This assumption involves two implications. It implies, as stated, that the "bottleneck-inducing" level of unemployment is expected to be no higher over the balance of the decade than it is today and, further, that today it is no higher (following from the analysis of the residual) than it was during the earlier post-war period. Thus, to put it another way, the assumption implies that the bottlenecks associated with the minimum unemployment rate between now and 1970 will be no more severe than those which were generated by that level of unemployment in the earlier post-war period.

2/ See Frank T. Denton, Yoshiko Kasahara and Sylvia Ostry, "Population and Labour Force Projections to 1970", Staff Study No. 1, Economic Council of Canada, Ottawa, 1964. The effect of these projected changes in labour force composition (and of a rough estimate of the shift out of agriculture) is very small.

3/ Such policies, if successful, would reduce the minimum frictional and structural rate for particular groups in the labour force. A striking example of what can be achieved is apparent when the British and Canadian rates of teenage unemployment are compared. Teenage unemployment rates in Britain are scarcely higher than adult rates; in Canada since the war they have been consistently as much as two or three times as high. While there are cultural factors involved, the British achievement is largely attributable to a comprehensive programme directed specifically to young workers and consisting of a national vocational guidance programme, an active youth employment service and a broad programme of apprenticeship and other formal vocational training. Many similar examples may be cited from the experience of other European countries. In all cases these specific policies have been instituted under conditions of high levels of over-all demand.

relieve undue strain and pressure at particular points in the economy. Such selective measures are desirable in bringing about a generally more efficient use of manpower resources as well as reducing above-average unemployment rates.[1/]

IV - BACKGROUND CONDITIONS INFLUENCING MINIMUM UNEMPLOYMENT

The estimate of minimum unemployment does not, of course, represent a once-and-for-all estimate. It is derived from recent historical experience and will not necessarily be appropriate in the longer run future as conditions change. In particular, the following background conditions are among the most important determinants of the minimum unemployment level at any given time and in any particular country:

- the composition of the labour force with respect to age, sex, region, occupation, industry and class of worker;
- the degree of seasonality of employment and labour force;
- the rate of structural transformation, in particular, changes in technology and the composition of demand;
- the rate of growth of labour force;
- the voluntary mobility rates of workers;
- the legal and social factors which affect the extent of turnover in labour markets such as, for example, apprenticeship regulations, statutory job protection, etc.

Thus, the estimate of minimum unemployment presented here will change if there are marked changes in the composition of the labour force. For example, an increase in the rate of labour force growth would increase the number of new entrants, most of whom probably do not move directly into employment but experience some period of work-seeking and hence raise the rate of short-term frictional unemployment. Further, an acceleration of the rate of technological change could lead to a higher rate of displacement of labour and this, by placing greater strain on the adjustment mechanism of the labour market, might result in a higher rate of structural unemployment unless accompanied by appropriate labour market policies. Such examples are cited only to underline that in projecting an historical minimum unemployment rate very far into the future one must take into consideration these important background factors.

1/ See First Annual Review, Economic Council of Canada, Ottawa, 1964, Chapter VIII, for a discussion of labour market policy in Canada.

V - CONCLUSION

The estimation of a minimum unemployment rate in this study has been made without reference to associated price effects. The approach has been essentially a technical one: the decomposition of the historical unemployment rates into designated components; the reassembling of selected components into an estimate of a feasible minimum. There are, of course, other approaches to a definition of minimum unemployment, in particular those which stress the relationship between employment goals and price stability in terms of the "trade-off" between unemployment and price change. Such approaches will yield an estimate of minimum unemployment (the problem posed in this paper) given a quantitative estimate of the policy-makers' preference function. Further exploration of this line of analysis would be most useful.[1/] It is fully recognized that the approach adopted in this paper is a limited one, but perhaps it will serve the purpose of stimulating discussion and analysis in this important problem area.

1/ See, in this regard, G.L. Reuber, "The Objectives of Canadian Monetary Policy, 1949-61, Empirical "Trade-Offs" and the Reaction Function of the Authorities", Journal of Political Economy, April 1964 and The Objectives of Monetary Policy, working paper prepared for the Royal Commission on Banking and Finance, Queen's Printer, Ottawa, 1962. Professor Reuber estimates the trade-offs between employment and prices and also attempts to quantify the optimum combination of each, i.e., to define quantitatively a "rational" preference function. Further references to the literature are given in these studies.

APPENDIX A

NOTES ON THE DECOMPOSITION OF THE UNEMPLOYMENT RATE

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These notes describe the procedures used in decomposing the annual post-war unemployment rates.

The original series used in the study are monthly unemployment rates derived from Dominion Bureau of Statistics Labour Force Survey data. (Unless otherwise noted, rates rather than actual numbers of unemployed were used in all of the calculations described below.) Monthly data were not collected prior to November 1952 and for the earlier period a special set of estimates was used. These were obtained by interpolating between the (more or less) quarterly survey dates. They also incorporate an estimate for Newfoundland which was not included in the Survey until October 1949.[1/]

All series were seasonally adjusted in monthly form and then combined into quarterly averages for subsequent calculations. The method of seasonal adjustment used is the well-known Census Method II.[2/]

Short-Cycle Component

The starting point here was the so-called "trend-cycle" series provided by the Census Method II seasonal adjustment programme. In order to eliminate the effects of longer run trends, a fourth-degree trend line was fitted to the series and the deviations from this line were calculated and plotted. Short-cycle troughs were then located by inspection of the plotted deviations. The minimum values for the period between the observed trough dates were obtained by interpolation (or assumed constant at the ends of the series) and the short-cycle component calculated as the distance above the interpolated minimum.

The use of the particular type of polynomial to eliminate trend needs a word of comment. Several types were tested before making a choice. The selection is, of course, an arbitrary one. However, experimentation indicates that the final estimates of the short cycle are relatively insensitive to the degree of trend polynomial, at least up to polynomials of the fifth degree.

1/ The interpolated estimates are preliminary figures arising out of some work being carried out jointly by Frank T. Denton and S.F. Kaliski, the latter of Carleton University, Ottawa.

2/ For a description of the method, see Julius Shiskin, Electronic Computers and Business Indicators, Occasional Paper 57, National Bureau of Economic Research, Inc., 1957. This paper appears also in the October 1957 issue of the University of Chicago Journal of Business.

The last two years of the series, and particularly the last year, 1963, present some special problems since the cyclical movement is much harder to identify. The estimate of the short-cycle component for 1963 should be viewed with caution.

Minimum Frictional and Structural Component

The annual averages of the short-cycle component were subtracted from the annual averages of the original trend-cycle series. This was done separately for each of the various age and sex groups. The resulting series was then smoothed by taking a three-year moving average and the minimum post-war average located. Using the method described below, the seasonal component of this minimum value was calculated for each group and subtracted, leaving what may be termed the "bench-mark" estimate of the minimum frictional-structural component.

The bench-mark represents the lowest "observed" post-war level of the unemployment rate in each group, after elimination of short-cycle, irregular (see below), and seasonal components. It might have been assumed constant for all years. Letting U_f^* stand for minimum frictional-structural unemployment (people, not the rate) and L for labour force, this would amount to assuming

$$(1) \qquad \frac{U_f^*}{L} = k$$

where k is a constant. But unemployment, or at least the measured kind with which we are concerned here, is primarily a nonagricultural phenomenon. Therefore, a more satisfactory assumption is

$$(2) \qquad \frac{U_f^*}{N} = k$$

where N is the nonagricultural labour force. Multiplying both sides by $\frac{N}{L}$, we have

$$(3) \qquad \frac{U_f^*}{L} = k\left(\frac{N}{L}\right) = u_f^*$$

Thus, the minimum frictional-structural unemployment rate, u_f^*, may be regarded as roughly proportional to the ratio of nonagricultural labour force to total labour force. Estimates of these ratios were obtained or calculated from available data and used to project the minimum frictional-structural bench-mark to every year of the period. The series so obtained for the various age-sex groups were then weighted by the labour force in each group and summed to obtain the over-all estimate of the minimum frictional-structural component for each year. The over-all estimate thus takes account of two factors: the changing age-sex composition of the labour force and the shift from agriculture to nonagriculture.

Minimum frictional-structural components for age and sex groups are presented in Table A-5.

Seasonal Component

The seasonal deviation for each quarter was calculated by subtracting the seasonally adjusted unemployment rate from the unadjusted rate. The seasonal level for the quarter was then calculated as the difference between the actual seasonal deviation in that quarter and the minimum (i.e., largest negative) deviation for the year. The observed minimum varies from one year to the next and minimum values to be associated with intervening months were obtained by interpolation. Finally, the seasonal levels for the four quarters of each year were averaged to yield the average annual seasonal level.

The average annual seasonal level varies with changes in the over-all unemployment rate. (Indeed, the method of seasonal adjustment used here, like most other methods in common use, assumes a relationship of proportionality, although the ratios are allowed to change over time.) Now, seasonal variation has two aspects: to some extent it contributes to the amount of annual unemployment, and to some extent it represents merely the allocation of a given amount over the four quarters of the year. It is the first aspect which is of greatest interest here. We are concerned primarily with the components of annual unemployment rather than with its calendar distribution.

The distinction is important. Suppose that the economy has an average annual unemployment rate of 6 per cent. Roughly speaking, the rate might be 4 per cent in one half of the year and 8 per cent in the other, or 2 and 10, 6 and 6, etc. A 6 per cent average rate could be maintained with many different seasonal patterns. But this is not so at full employment. At full employment there is little room for seasonal re-allocation. Unemployment has been pushed to its minimum level in every part of the year and the seasonal unemployment which remains is a true component of the annual figure.

It is argued, then, that seasonality as a component of the annual rate must be measured when total unemployment is at its lowest annual level. During much of the post-war period unemployment has been well above minimum levels so that, except for a few of the early years, direct measurement would be out of the question. The device used here for getting around this difficulty is the following. The average annual seasonal level, calculated in the manner described above, is regarded as a function of the total unemployment rate and time. Letting u stand for the total annual unemployment rate, u_s for average seasonal level, and t for time,

$$(4) \qquad u_s = a_0 + a_1 u + a_2 t + a_3 t^2$$

This equation can be fitted by least squares. The minimum value of u_s can then be found from the equation given the minimum value of u. Let u_s^* and u^* be these minima. Now u_s^* is a component of u^*. The only other component is what we have termed above "minimum frictional-structural unemployment". Thus, $u^* = u_s^* + u_f^*$. Equation (4) may now be used to write

$$(5) \qquad u_s^* = \frac{a_0}{1-a_1} + \frac{a_1}{1-a_1} u_f^* + \frac{a_2}{1-a_1} t + \frac{a_3}{1-a_1} t^2$$

Once the minimum frictional-structural component has been determined, equation (5) can be used to calculate the corresponding seasonal component.

Irregular Component

This is a small component included merely for the sake of completeness. It represents the net effect of random or irregular occurrences during the year plus any minor statistical discrepancies. It is calculated as the difference between the annual average of the trend-cycle series and the annual average of the original series.

Residual Component

As the name implies, this is what is left after deducting from the total unemployment rate the four components discussed above.

Additional Note on Seasonal Calculations

Equation (4) was fitted to 1946-63 data for both sexes, all ages combined. An alternative equation was also fitted to 1946-62 data. In this equation, u was broken into two parts: u_1, representing short-run movements, and formed by combining the short-cycle and irregular components described above, and u_2 representing the remainder. The two estimated equations are:

$$(6) \qquad u_s = \underset{}{.0841} + \underset{(15.1)}{.2915u} + \underset{(3.4)}{.0469t} - \underset{(3.3)}{.0024t^2}\ ; \qquad \bar{S} = .072;\ \bar{R}^2 = .977$$

$$(7) \qquad u_s = \underset{}{.0967} + \underset{(9.5)}{.2840u_1} + \underset{(5.6)}{.2901u_2} + \underset{(2.2)}{.0450t} - \underset{(1.4)}{.0022t^2}\ ; \qquad \bar{S} = .077;\ \bar{R}^2 = .976$$

The numbers in brackets are the ratios of the estimated coefficients (ignoring signs) to their standard errors and $\bar{S}$ and $\bar{R}^2$ stand for the standard error of estimate and the coefficient of determination (both corrected for degrees of freedom). It will be observed that the coefficients of u_1 and u_2 in equation (7) are very close to each other and to the coefficient of u in equation (6). Thus, there would have been little advantage in using equation (7) rather than equation (6) and the latter was used as a basis for calculating the minimum seasonal component. Equations similar to equation (6)

were also fitted for various age and sex groups and the results are presented in Table A-6. It will be noted that in nearly all cases the equations perform very well, as indicated by the values of $\overline{S}$ and $\overline{R}^2$.

It is of interest to note that in nearly every case the coefficients of t and t^2 in Table A-6 are statistically significant on the basis of the standard t-test at the 5 per cent level or better. Some caution is warranted, but the evidence does suggest that there has been a real reduction in the seasonal content of unemployment since the mid-1950's, following an earlier rise.

A comparison of estimated minimum and actual seasonal levels for the various age and sex groups is provided in Table A-4. It will be observed that in recent years the actual levels have been much higher than the minimum levels.

Table A-1

Total Unemployment Rates, by Age and Sex, Annual Averages, 1946-63

(Percentage of labour force)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total both sexes	3.8	2.6	2.6	3.3	3.8	2.6	3.0	3.0	4.6	4.4	3.4	4.6	7.1	6.0	7.0	7.2	5.9	5.5
Males	4.2	2.9	2.8	3.6	4.2	2.8	3.2	3.4	5.1	4.9	3.8	5.3	8.2	7.0	8.2	8.4	6.9	6.4
14-19	6.7	5.3	6.7	8.4	8.1	6.3	6.7	7.2	10.0	10.1	8.1	11.2	16.7	14.3	16.3	16.6	14.5	14.0
20-24	7.0	4.6	4.3	5.3	6.3	3.9	4.7	4.9	7.6	7.2	5.7	8.1	12.5	10.4	12.2	11.8	9.9	9.6
25-44	3.7	2.4	2.0	2.9	3.4	2.1	2.6	2.8	4.4	4.1	3.2	4.5	7.0	5.9	7.0	7.4	5.7	5.2
45-64	3.0	2.2	2.1	2.6	3.4	2.4	2.7	2.8	4.3	4.2	3.3	4.2	6.7	5.8	6.9	7.3	6.0	5.4
65 and over	3.8	2.9	2.8	3.3	3.9	2.5	3.0	3.1	3.7	4.2	3.4	4.4	5.1	5.2	4.8	6.0	5.6	4.8
Females	2.4	1.7	1.8	1.9	2.4	2.1	2.2	1.6	2.6	2.6	1.9	2.3	3.6	3.0	3.6	3.8	3.3	3.3
14-19	3.3	3.0	2.8	3.7	4.8	4.3	4.3	2.8	5.4	5.0	4.3	4.6	7.4	6.8	8.6	9.0	7.9	7.8
20 and over	2.0	1.4	1.6	1.5	1.9	1.6	1.8	1.3	2.0	2.1	1.5	1.9	2.9	2.3	2.7	2.8	2.5	2.5

Note: All rates are based on Dominion Bureau of Statistics Labour Force Survey data. Rates for years prior to 1953 have been adjusted to allow for variations in the timing and frequency of the Survey. Rates for years prior to 1950 also include an estimated allowance for Newfoundland which was not covered by the Survey until October 1949.

Table A-2

Estimated Short-Cycle Components, by Age and Sex, Annual Averages, 1946-63

(Percentage of labour force)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total both sexes	1.2	0.1	0.1	1.0	1.3	0.2	0.4	0.3	2.1	1.4	0.3	1.0	2.5	0.4	1.2	1.1	0.2	0.7
Males	1.3	0.1	0.1	1.2	1.5	0.3	0.5	0.4	2.4	1.7	0.4	1.2	3.0	0.5	1.5	1.4	0.1	0.9
14-19	2.3	0.1	1.0	2.8	2.2	0.6	0.7	1.0	4.3	3.5	0.8	2.4	5.4	0.8	2.1	2.1	1.2	2.7
20-24	2.2	0.2	0.4	1.9	2.6	0.4	0.8	0.6	3.7	2.6	0.8	2.3	5.0	0.8	2.3	1.6	0.2	1.7
25-44	1.6	0.4	0.2	1.3	1.5	0.2	0.4	0.4	2.3	1.4	0.4	1.1	2.6	0.3	1.4	1.5	0.2	0.9
45-64	0.9	0.0	0.1	0.6	1.2	0.2	0.4	0.3	1.9	1.5	0.3	0.8	2.6	0.5	1.5	1.2	0.3	0.4
65 and over	0.7	0.2	0.1	1.1	1.5	0.2	0.6	0.3	1.7	1.4	0.4	1.2	1.7	1.5	0.7	1.4	0.4	0.3
Females	0.8	0.1	0.2	0.1	0.6	0.3	0.6	0.1	1.1	1.0	0.2	0.3	1.1	0.1	0.6	0.5	0.1	0.3
14-19	1.9	0.8	0.2	0.4	1.3	0.8	1.3	0.2	2.6	2.1	0.5	0.3	2.0	0.4	1.7	1.4	0.2	0.9
20 and over	0.6	0.0	0.3	0.1	0.4	0.2	0.5	0.2	0.9	0.9	0.2	0.4	1.1	0.1	0.4	0.4	0.0	0.3

Table A-3

Estimated Unemployment Rates Excluding Short-Cycle and Irregular Components, by Age and Sex, Annual Averages, 1946-63

(Percentage of labour force)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total both sexes	2.7	2.6	2.5	2.4	2.4	2.5	2.6	2.8	2.8	2.9	3.1	3.8	4.7	5.6	6.0	6.1	5.8	4.9
Males	2.0	2.9	2.7	2.6	2.5	2.6	2.8	3.1	3.1	3.2	3.4	4.4	5.4	6.4	7.0	7.1	6.7	5.6
14-19	4.5	5.3	5.6	5.8	5.8	5.9	6.2	6.4	6.6	7.0	7.6	9.5	12.0	14.2	14.9	14.8	13.8	11.6
20-24	5.1	4.5	3.9	3.6	3.5	3.7	4.0	4.5	4.4	4.4	4.7	6.2	8.0	9.6	10.3	10.3	9.7	8.1
25-44	2.2	2.0	1.8	1.7	1.8	2.0	2.2	2.5	2.5	2.5	2.7	3.6	4.6	5.5	5.9	5.9	5.4	4.3
45-64	2.1	2.2	2.1	2.1	2.2	2.2	2.4	2.6	2.6	2.7	3.0	3.6	4.4	5.2	5.8	6.1	5.9	4.9
65 and over	3.2	2.9	2.5	2.3	2.3	2.4	2.4	2.4	2.5	2.6	2.8	3.2	3.6	4.0	4.3	4.7	4.8	4.5
Females	1.5	1.6	1.7	1.8	1.9	1.8	1.7	1.5	1.5	1.6	1.7	2.0	2.5	2.9	3.1	3.2	3.2	3.1
14-19	1.5	2.0	2.5	3.1	3.5	3.6	3.1	2.7	2.8	3.1	3.5	4.3	5.4	6.5	7.1	7.4	7.5	7.2
20 and over	1.4	1.4	1.4	1.4	1.5	1.5	1.3	1.2	1.2	1.2	1.3	1.6	1.9	2.2	2.4	2.5	2.4	2.3

Table A-4

Seasonal Levels, Actual and Minimum, by Age and Sex, Three-Year Averages, 1946-63

(Percentage of labour force)

	1946-48		1949-51		1952-54		1955-57		1958-60		1961-63	
	Actual	Minimum	Actual	Minimum	Actual	Minimum	Actual	Minimum	Actual	Minimum	Actual	Minimum
Total both sexes	1.1	0.8	1.2	1.0	1.3	1.1	1.6	1.1	2.2	1.1	2.0	1.0
Males	1.3	0.9	1.4	1.1	1.6	1.3	2.0	1.3	2.8	1.2	2.5	1.1
14-19	2.1	1.9	2.8	2.2	2.9	2.4	3.6	2.4	5.1	2.1	4.2	1.6
20-24	2.0	1.1	2.1	1.5	2.4	1.8	3.0	1.9	4.6	1.8	3.9	1.4
25-44	1.1	0.7	1.2	0.9	1.5	1.0	1.8	1.1	2.7	1.1	2.5	1.1
45-64	0.9	0.8	1.2	1.0	1.5	1.2	1.7	1.3	2.6	1.2	2.3	1.0
65 and over	1.1	0.8	1.2	0.9	1.2	1.0	1.4	1.0	1.7	0.8	1.5	0.6
Females	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.1
14-19	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.5	0.7	0.5	0.6	0.4
20 and over	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.4	0.2	0.4	0.2

Table A-5

Minimum Frictional-Structural Components, by Age and Sex,

Three-Year Averages, 1946-63

(Percentage of labour force)

	1946-48	1949-51	1952-54	1955-57	1958-60	1961-63
Total both sexes	1.4	1.4	1.4	1.4	1.5	1.5
Males	1.4	1.4	1.4	1.5	1.5	1.6
14-19	3.5	3.5	3.6	3.9	4.1	4.1
20-24	2.0	2.1	2.2	2.3	2.4	2.4
25-44	0.9	0.9	1.0	1.0	1.0	1.1
45-64	1.2	1.2	1.3	1.3	1.3	1.4
65 and over	1.4	1.4	1.4	1.4	1.4	1.5
Females	1.2	1.3	1.4	1.4	1.4	1.4
14-19	2.2	2.2	2.2	2.2	2.2	2.2
20 and over	0.8	0.9	0.9	0.9	0.9	0.9

Table A-6

Estimated Seasonal Equations Based on 1946-63 Data

	Constant Term	Coefficient of u	Coefficient of t	Coefficient of t^2	$\bar{S}$	$\bar{R}^2$
Total both sexes	.0841	.2915 (15.1)	.0469 (3.4)	-.0024 (3.3)	.072	.977
Total Males	.0627	.3149 (16.0)	.0717 (4.3)	-.0037 (4.1)	.087	.981
Males 14-19	.0778	.2813 (13.2)	.1621 (4.9)	-.0099 (6.0)	.165	.976
Males 20-24	-.2342	.3625 (14.4)	.1240 (3.6)	-.0062 (3.4)	.177	.972
Males 25-44	.0713	.3559 (18.4)	.0448 (2.9)	-.0018 (2.2)	.081	.985
Males 45-64	-.0511	.3404 (16.9)	.0851 (6.0)	-.0041 (5.7)	.072	.987
Males 65 and over	.0366	.2814 (11.8)	.0698 (5.8)	-.0041 (6.2)	.062	.945
Total Females	.0535	.0846 (5.3)	.0026 (0.6)	-.0003 (1.2)	.022	.814
Females 14-19	.1367	.0352 (1.6)	.0437 (2.7)	-.0019 (2.1)	.084	.644
Females 20 and over	.1935	.1231 (6.8)	-.0150 (3.3)	.0005 (1.8)	.024	.797

Note: (a) Ratios of estimated coefficients (ignoring signs) to their standard errors are given in brackets.
(b) Values of t go from 1 in 1946 to 18 in 1963.

APPENDIX B

NOTES ON REGRESSION ANALYSIS

APPENDIX B

NOTES ON REGRESSION ANALYSIS

Several types of regression equations were fitted in testing for symptoms of increased structural unemployment. These include the following:

(1) $x = a_0 + a_1 u + a_2 t$

(2) $x = a_0 + a_1 u + a_2 t + a_3 t^2$

(3) $x = a_0 + a_1 u + a_2 D$

(4) $x = a_0 + a_1 u + a_2 t + a_3 D$

where x stands for whatever series was being tested,[1] u for the over-all national unemployment rate, and t for time. D is a dummy "shift" variable with value 0 in every year before 1957 and value 1 in every year after 1957. In 1957 itself, which is treated as a year of transition, D is set equal to 1/2.

In general, the various equations yielded roughly the same results with respect to the ratios displayed in column IV of Table 2. Also, the standard goodness-of-fit measures indicated, on balance, that equation (1) performed at least as well as, and possibly a little better than, equation (3). They indicated also that the gains, if any, from adding an additional term, as in equations (2) and (4), were slight. In view of this, equation (1) was selected for this part of the analysis.

The individual equations of type (1), estimated by least squares, are given in Table B-1. In the case of the equation for duration of unemployment, the first difference of the annual unemployment rate (Δu) is also included as an explanatory variable. The equations for individual industries and for the industry dispersion index were fitted to 1953-63 annual averages, 1953 being the first year for which the required data are available. In all other cases the equations were fitted to 1950-63 annual averages.

In order to eliminate the effects of variations in the over-all unemployment rate resulting from mere changes in the regional distribution of the labour force, "standardized" values of u were used in the equations for individual regions. These were calculated by reweighting the regional unemployment rates in each year on the basis of the 1956 labour force distribution. Similar reweighting was carried out by industry and by age-sex group to obtain standardized values of u for use in the other

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[1] Not all equations were fitted with every set of data.

sets of equations for individual components of unemployment. However, in the case of the dispersion index and duration equations, unstandardized values of u were used. In general, standardization had only a very small effect on the over-all unemployment rate, as can be seen from Table B-2.

Another point should be noted. Since unemployment in each region, industry, or age-sex group is a component of total unemployment, x is necessarily correlated with u in each of the component regression equations on this account alone. If a component is small relative to the total (e.g., the mining industry), the correlation on this account will be negligible. On the other hand, if the component is relatively large (e.g., manufacturing), the correlation will be greater. A way around this difficulty would have been to recalculate u for each equation so as to exclude the component which the equation attempts to "explain". Given the purpose of the analysis, and the fact that for all but three of the twenty components unemployment was less than a quarter of the total in 1960-63 (see Table 2), this refinement was considered unnecessary.

The calculation of "expected" 1960-63 values may be illustrated by an example. From Table B-1, the equation for the Prairie Provinces is:

$$x = .6335 + .4812u + .0517t$$

The variable t in this equation represents all influences operating to raise or lower the trend of the unemployment rate in the Prairie Provinces other than those associated with changes in the national unemployment rate. In order to eliminate the effect of these other influences, we "freeze" t at its base period level, and allow only u to change. The 1960-63 average value of u is 6.395; the 1950-53 value of t is -4.5. Inserting these into the above equation, the 1960-63 "expected" unemployment rate for the Prairie Provinces is: $.6335 + (.4812)(6.395) + (.0517)(-4.5) = 3.478$, or 3.5 to one decimal place, as in Table 2.

Table B-1

Regression Equations for Unemployment Analysis

	Constant Term	Coefficient of u	Coefficient of t	Coefficient of Δu	$\bar{S}$	$\bar{R}^2$	d
A. Dispersion indexes							
Regions (1950-53=100)	31.8846	24.3698 (6.9)	1.2234 (0.9)	-	11.941	.932	1.63
Age-sex groups (1950-53=100)	-9.1247	37.3544 (15.0)	1.4215 (1.5)	-	8.380	.984	1.52
Industries (1953-56=100)	-1.5248	26.4195 (17.1)	-1.2260 (1.8)	-	4.879	.982	2.45
B. Selected unemployment rates							
By region:							
Atlantic provinces	.6398	1.5698 (5.8)	- .0037 (0.0)	-	.908	.886	1.45
Quebec	.5652	1.1801 (16.0)	.0534 (1.8)	-	.248	.986	1.25
Ontario	- .6411	.8818 (17.5)	- .0409 (2.1)	-	.169	.984	1.72
Prairie provinces	.6335	.4812 (7.5)	.0517 (2.1)	-	.216	.953	2.13
British Columbia	- .9475	1.3581 (7.2)	- .0899 (1.2)	-	.636	.900	1.08
By age and sex group:							
Males 14-19	1.3500	2.0379 (20.9)	.1483 (3.8)	-	.328	.993	1.97
Males 20-24	- .6031	1.8047 (19.0)	- .0345 (0.9)	-	.321	.988	1.34

Males 25-44	- .6801	1.0933 (28.8)	- .0266 (1.7)	-	.128	.995	1.39
Males 45-64	- .0879	.9745 (32.0)	.0093 (0.8)	-	.102	.996	1.25
Males 65 and over	1.8525	.4809 (3.8)	.0611 (1.2)	-	.423	.855	2.44
Females 14-19	1.5688	.8869 (4.1)	.0865 (1.0)	-	.736	.856	1.05
Females 20 and over	.5814	.3152 (6.2)	- .0200 (1.0)	-	.170	.881	1.74
By industry:							
Agriculture	- .0721	.2332 (4.1)	.1354 (5.7)	-	.172	.945	1.31
Forestry, fishing, etc.	- .4365	3.8333 (5.5)	.5432 (1.9)	-	2.091	.910	1.40
Mining	1.4858	.8751 (2.7)	.2313 (1.7)	-	.974	.771	1.86
Manufacturing	- 1.0679	1.2396 (21.3)	- .1494 (6.2)	-	.174	.984	2.34
Construction	- .1264	2.9859 (15.9)	- .1054 (1.4)	-	.563	.979	1.95
Transportation, etc.	- .1994	1.0162 (13.9)	- .0577 (1.9)	-	.219	.971	1.37
Trade	.0080	.6169 (9.0)	.0318 (1.1)	-	.206	.953	1.37
Service, etc.	.3179	.4383 (9.7)	.0383 (2.0)	-	.135	.964	2.07
C. Long-term unemployed	3.3560	5.3233 (4.2)	- .6667 (1.4)	-2.2191 (2.1)	3.237	.747	1.38

Note: (a) Ratios of estimated coefficients (ignoring signs) to their standard errors given in brackets.
(b) Values of t go from -6 in 1950 to +7 in 1963.
(c) d stands for Durbin-Watson statistic of autocorrelation in the least-squares residuals.
(d) See Table 2 for other relevant notes.

Table B-2

Annual Average Unemployment Rates Standardized by Region, by Industry, and by Age-Sex, 1950-63

(Unemployment as percentage of labour force)

	Actual[1]	Standardized		
		by Region (5 Regions)	by Age-Sex (7 Groups)	by Industry (8 Industries)
1950	3.60	3.58	3.52	-
1951	2.41	2.40	2.42	-
1952	2.91	2.92	2.89	-
1953	3.00	3.00	2.98	3.15
1954	4.55	4.54	4.51	4.69
1955	4.37	4.35	4.36	4.37
1956	3.41	3.41	3.41	3.41
1957	4.63	4.61	4.61	4.52
1958	7.05	7.05	7.10	6.87
1959	5.99	5.97	6.05	5.87
1960	7.00	6.99	7.09	6.86
1961	7.20	7.17	7.36	7.11
1962	5.92	5.90	6.10	5.93
1963	5.54	5.52	5.66	5.50

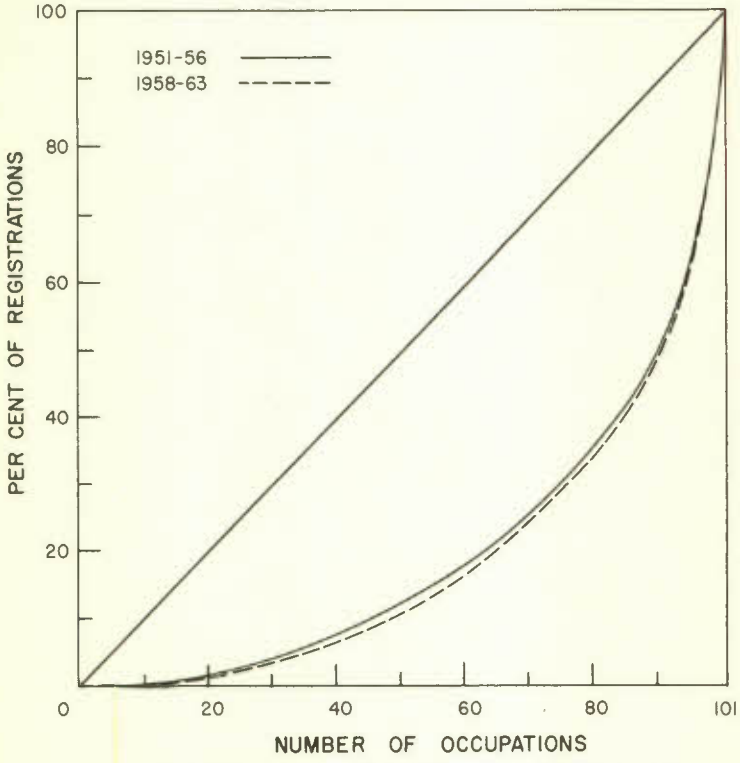
(1) Dominion Bureau of Statistics Labour Force Survey estimates.

APPENDIX C

LORENZ CURVE CHARTS

CHART C-1

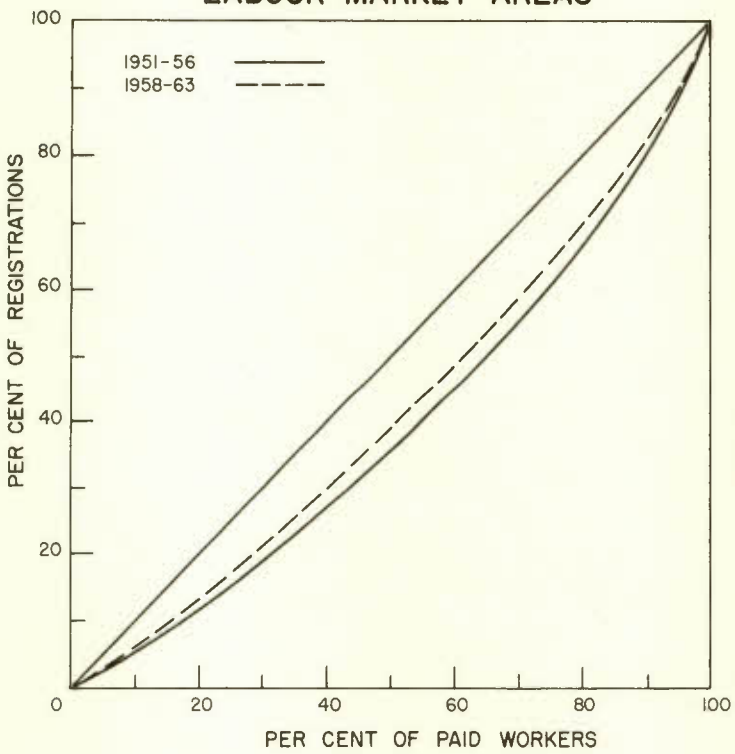
OCCUPATIONS



Persons registered for employment at local offices of the National Employment Service, classified by 101 detailed occupations: 1951-56 and 1958-63

CHART C-2

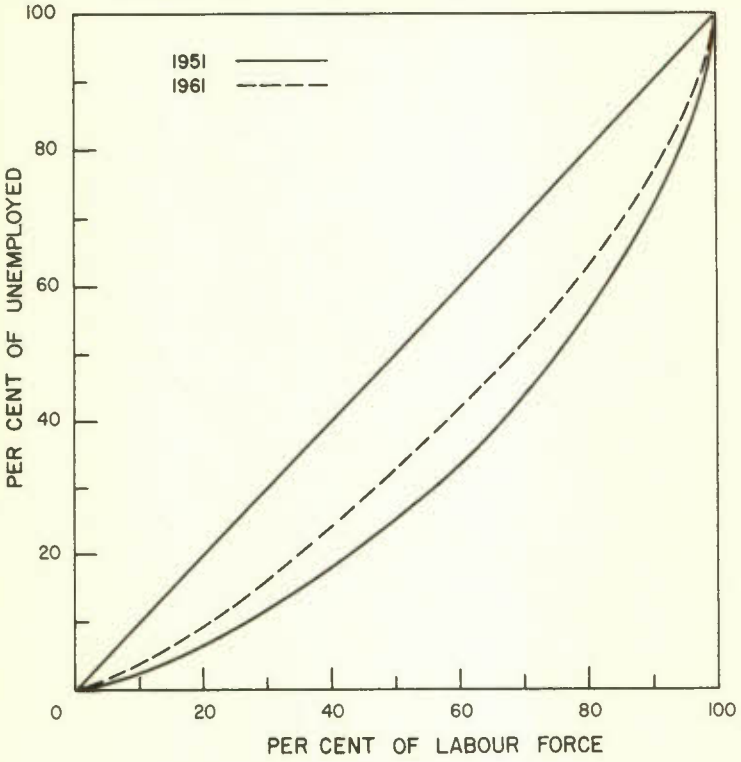
LABOUR MARKET AREAS



Persons registered for employment at local offices of the National Employment Service, classified by 109 labour market areas. Estimates of paid workers by labour market area: 1951-56 and 1958-63.

CHART C-3

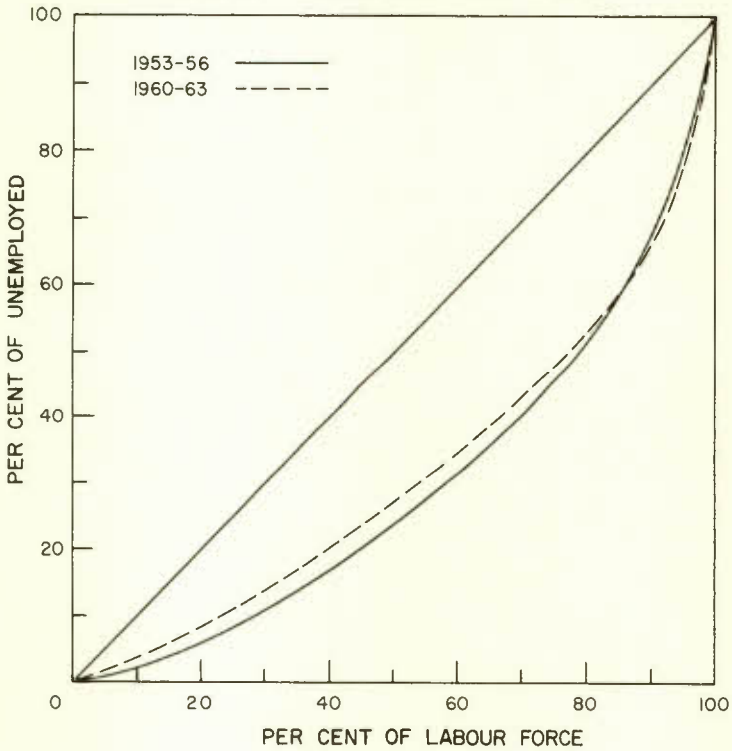
COUNTIES AND CENSUS DIVISIONS



Unemployed males and male labour force (both excluding persons seeking work for the first time) classified by 236 and 238 counties and census divisions in 1951 and 1961 respectively, Census of Canada, 1951 and 1961.

CHART C-4

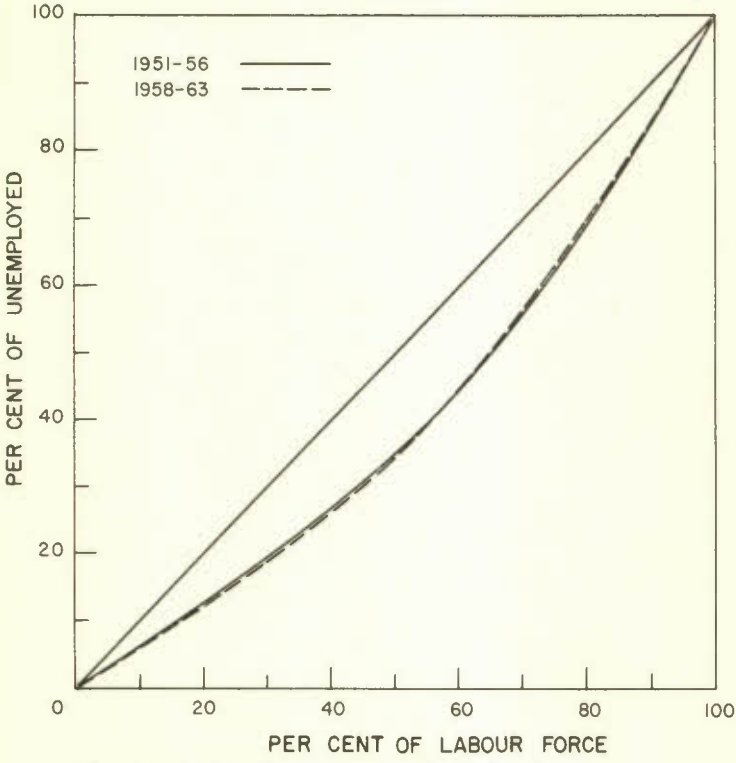
MAJOR INDUSTRY DIVISIONS



Unemployed and labour force classified by 8 major industry divisions; DBS Labour Force Survey, annual averages, 1953-56 and 1960-63.

CHART C-5

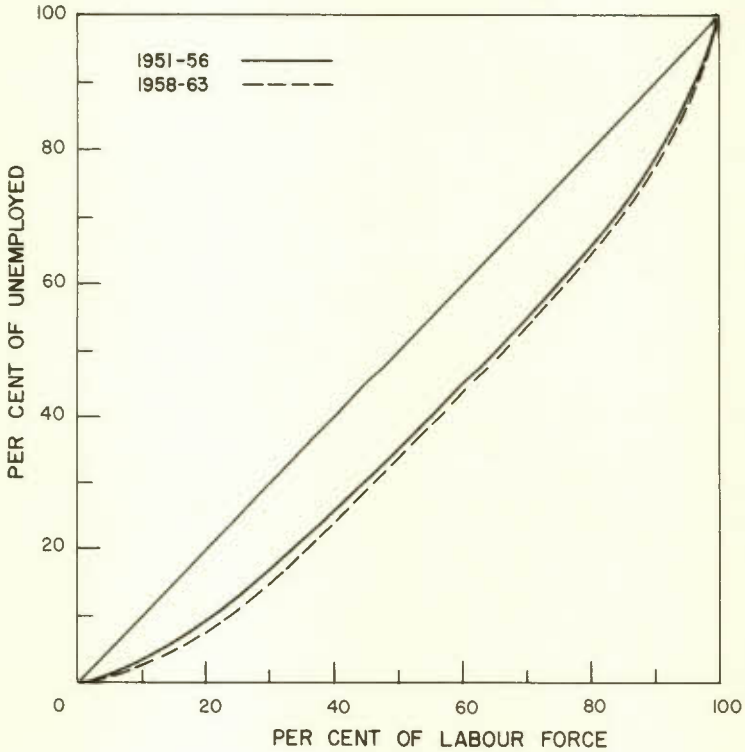
REGIONS



Unemployed and labour force classified by 5 regions:
DBS Labour Force Survey, annual averages, 1951-56 and 1958-63.

CHART C-6

AGE-SEX GROUPS



Unemployed and labour force classified by 14 age and sex groups: DBS Labour Force Survey, annual averages, 1951-56 and 1958-63.

TECHNICAL STUDIES

The following is a list of technical studies which have been prepared as background papers for the First Annual Review of the Economic Council of Canada. They are being published separately and are available from the Queen's Printer, Ottawa. Although they are being published under the auspices of the Economic Council, the views expressed in them are those of the authors themselves.

Staff Studies

1. Population and Labour Force Projections to 1970, by Frank T. Denton, Yoshiko Kasahara and Sylvia Ostry.
2. Potential Output, 1946 to 1970, by B. J. Drabble.
3. An Analysis of Post-War Unemployment, by Frank T. Denton and Sylvia Ostry.
4. Housing Demand to 1970, by Wolfgang M. Illing.
5. Business Investment to 1970, by Derek A. White.
6. Special Survey of Longer Range Investment Outlook and Planning in Business, by B. A. Keys.
7. Canada and World Trade, by M. G. Clark.
8. Export Projections to 1970, by J. R. Downs.
9. Federal Tax Revenues at Potential Output, 1960 and 1970, by D. J. Daly.
10. National Saving at Potential Output to 1970, by Frank Wildgen.
11. Changes in Agriculture to 1970, by John Dawson.

Special Studies

1. Immigration and Emigration of Professional and Skilled Manpower During the Post-War Period, by Louis Parai.
2. A Survey of Labour Market Conditions, Windsor, Ontario, 1964: A Case Study, by G. R. Horne, W. J. Gillen and R. A. Helling.

An Analysis of Post-War Unemployment

by Frank T. Denton *and* Sylvia Ostry

Economic Council of Canada

1964