SPECIAL STUDY No. 22

The Trade-Off between Inflation and Unemployment: Some Explorations of the Recent Evidence for Canada

by

S. F. Kaliski

prepared for the
Economic Council of Canada

THE TRADE-OFF BETWEEN INFLATION AND UNEMPLOYMENT: SOME EXPLORATIONS OF THE RECENT EVIDENCE FOR CANADA

Prepared for the

Economic Council of Canada

by

S. F. Kaliski

November 1972

Although this Study is published under the auspices of the Council, the views expressed are those of the author.

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price: $1.50 Catalogue No. EC22-2/22

Price subject to change without notice

Information Canada
Ottawa, 1972

CONTENTS

PREFACE

Five years ago the Economic Council published what one could legitimately claim to be a definitive study of the "trade-off" between price changes and unemployment in Canada up to the mid-1960's.[1] That study reviewed the existing body of theory, examined in detail all the known empirical work on Canadian trade-offs, and went on to provide and test new and improved estimates for Canada and some comparative ones for other countries.

What follows is on a much more modest scale. It does not aspire to be either a successor to *Special Study No. 5* or a revision of it. It is rather a brief report on the present state of the subject which appears to be somewhat unsettled. Hence, if this paper has any value, it is as an exploratory rather than as a definitive work. It has, moreover -- as exploratory work often is -- been overtaken by events, at least to some extent.

The first section of the paper is an attempt to report on some recent developments in the theoretical literature underlying the trade-off. Some of this is very recent indeed and, perhaps for that reason, still seems somewhat difficult and obscure. It suggests clearly enough, however, that while temporary trade-offs between wage and price changes and unemployment may well be observed, such trade-offs are unlikely to persist, or, at least, remain unchanged over longer periods.

It seems natural to inquire whether the trade-offs estimated in *Special Study No. 5* have suffered from such a lack of stability. The discussion in Chapter 2 suggests rather strongly that they have and, indeed, that equations of the sort estimated in that study may well fail to yield any statistically significant relations between wage changes and unemployment in the 1960's or the latter part of that period.[2]

---

[1] R. G. Bodkin, E. P. Bond, G. L. Reuber, and T. R. Robinson, *Price Stability and High Employment: The Options for Canadian Economic Policy, An Econometric Study*, Economic Council of Canada, Special Study No. 5 (Ottawa: Queen's Printer, 1967), hereafter referred to as *Special Study No. 5*.

[2] This is perhaps the only strong empirical result in this Study.

The Trade-Off: Some Explorations

In the circumstances, the obvious procedure might seem to have been to attempt to "improve" upon the trade-off equations, in the sense of devising ones that would better fit the extended period, or part of it. This was not done for several reasons. First, the task had already been accomplished: for Canada, by Cragg, Taylor, Zaidi, Vanderkamp, Turnovsky,[1] and perhaps many others whose work has escaped the writer's attention; for other countries, by many times that number of researchers. Second, trade-off relationships have been included in a number of econometric models of Canada,[2] and there is every reason to suppose that they will there be constantly scrutinized and improved upon along with the models themselves. There is no question, moreover, that it is, in principle,[3] best to study the trade-off in the context of the larger system of which it forms part. Finally, and most important, both theory and experience suggest that one's success in finding a trade-off to fit the data is likely to be temporary unless one can include all (or enough) of the shift parameters of the relation.

---

[1]J. G. Cragg, "Internal Factors and Canadian Inflation", N. Swan and D. Wilton (eds.), *Inflation and the Canadian Experience* (Kingston: Queen's University Industrial Relations Centre, 1971), pp. 201-22; fragments of L. O. Taylor's and M. A. Zaidi's recent work are reported in Discussion in that same volume, pp. 19-30 -- the remainder, so far as I know, remains unpublished; J. Vanderkamp, "Wage Adjustment, Productivity and Price Change Expectations", *Review of Economic Studies* 39(1), no. 117(January 1972):61-70; S. J. Turnovsky, "The Expectations Hypothesis and the Aggregate Wage Equation: Some Empirical Evidence for Canada", *Economica* 39, no. 153(February 1972):1-17. The last two papers are discussed further in Chapter 4.

[2]On this, see Ronald G. Bodkin, "Wage and Price Formation in Selected Econometric Models" in Swan and Wilton, *op. cit.*, and elsewhere. See Chapter 5 below for a further discussion of this paper.

[3]This deliberately begs the question of whether the advantage of properly considering the simultaneous determination of the variables entering the trade-off relationship might not be offset by the greater danger of misspecification in a complete model. It also does not examine whether the trade-offs are properly integrated into, and compatible with, the model as a whole.

The strategy adopted in this Study was, in fact, to turn directly to an examination of some of these shift parameters. This does not make for a neat or finished paper, especially since many of the results are highly tenuous. In Chapter 3 the question of the regional, occupational, industrial, duration, and age-sex structure of unemployment and its impact upon the trade-off is examined. Chapter 4 is a report upon some very tentative exploration of the nature of, and changes in, expectations. Chapter 5 reports upon some attempts to examine the trade-off within the context of some econometric models. The Study ends with a brief, but perhaps overextended, conclusion.

ACKNOWLEDGMENTS

I gratefully acknowledge the encouragement and support given me by the Canada Council and the Institute for Economic Research, Queen's University, Kingston, who, jointly with the Economic Council of Canada, financed this Study.

Heather Werry, Alex Fowlie, Paul King, Michael Kennedy, and Philip Smith, in turn, carried out the computations.

Keith Newton of the Economic Council commented most helpfully on an earlier draft and helped to revise it.

CHAPTER 1

SOME ANALYTICAL FOUNDATIONS

1. Introduction

It has already been suggested that this paper will not attempt to present a novel or updated theory of the trade-off. No satisfactory theory is ready yet, though there is widespread agreement that a better theory is needed, and there are hints as to how it should be developed.[1] It would seem from these hints and from the criticism directed at previous analyses that, when a really adequate theory emerges, it will be a matter of taste whether or not to call it trade-off theory. Very broadly, it appears that a satisfactory theory will deal with the disequilibrium dynamics of interrelated goods and labour markets. Its full elaboration will almost certainly stress the relative speeds of adjustment of prices and quantities in these markets under different conditions. This clearly foreshadows a rather large and complex system for which earlier notions of the trade-off are, at best, a convenient shorthand. There is reason to think, moreover, that the simpler and more definite of these notions were wrong in some respects. From this point of view, the sections that follow are simply a discussion of the empirical aspects of analytical error or misspecification. We discuss, in some proximate fashion, shifts in the trade-off because we do not know how to specify a more complete and adequate system from which they arise.

---

[1] See, e.g., C. C. Holt et al., *The Unemployment-Inflation Dilemma: A Manpower Solution* (Washington: Urban Institute, 1971), and "Manpower Proposals for Phase III", *Brookings Papers on Economic Activity* 3(1971):703-22, esp. note 1; R. M. Solow and J. E. Stiglitz, "Output, Employment, and Wages in the Short Run", *Quarterly Journal of Economics* 82, no. 4(November 1968):537-60; and R. M. Solow, *Price Expectations and the Behaviour of the Price Level* (Manchester: Manchester University Press, 1970); J. Tobin, "Inflation and Unemployment", *American Economic Review* 62, no. 1(March 1972):1-18.

Neither will this section attempt a review of the analytical literature. If the view put forward above is accepted, it is too early for a really worthwhile review. It is certainly too early for an up-to-date one; the literature is pouring out at a rate that would frustrate any such endeavour. And quite recent reviews are readily available.[1]

2. The Steady-State Trade-Off

What follows then is quite simply a discussion of some particular pieces of analysis intended to motivate and clarify the empirical work that follows.[2] The selection is eclectic, partial, and largely determined by accidents of chronology and, no doubt, by limitations of personal knowledge, taste, and understanding. In order to impose some organization on what follows, it takes the rather arbitrary form of a critique of the notion of a steady-state trade-off.

It has been the practice of writers on the quantitative and policy aspects of the trade-off to present, as part of their results, tables or charts of "steady-state trade-offs" and/or to make statements as to what level of unemployment would need to be maintained in order to achieve a stable price level, or what price level changes would accompany "full employment".[3] Such tables and charts are not the result of a separate estimation procedure; they are produced simply by computational manipulations of the underlying equations relating wage changes to unemployment and other variables, and price changes to wage changes and other variables. Each of these equations is first converted to a "steady-state"

---

[1]See, e.g., K. W. Rothschild, "The Phillips Curve and All That", *Scottish Journal of Political Economy* 63, no. 3(November 1971): 245-80; and S. F. Kaliski, "Is the Phillips Curve Still With Us?", N. M. Swan and D. Wilton (eds.), *Inflation and the Canadian Experience* (Kingston: Queen's University Industrial Relations Centre, 1971). My own views have certainly been altered by what I have read since and by my reaction to it.

[2]Many of these notions are taken up again later in a more empirical context.

[3]See, e.g., *Special Study No. 5*, Tables 6.3, 6.4, Figures 6.5-6.7, and p. 172.

form by assuming constant rates of change in wages and prices and a constant level of unemployment over time (this implies that current values of the left-hand variable equal any lagged values that form part of the explanation). The two equations are then solved simultaneously, and particular "realistic" or "interesting" values of all variables but price changes and unemployment are substituted. Finally, the values of "steady-state" price changes corresponding to particular constant levels of unemployment are calculated.[1]

---

[1]To add concreteness, consider the following simple example.

Let the initial equations be:

(1) $\dot{w}_t = a + bu_t + c\dot{w}_{t-1} + dX_t$, and

(2) $\dot{p}_t = e + f\dot{w}_t + g\dot{p}_{t-1} + hZ_t$,

where $\dot{w}$ and $\dot{p}$ stand for percentage changes in wages and prices, respectively; u is the percentage of the Labour Force unemployed; and X and Z are all other explanatory variables in the wage and price equations, respectively. Let a ... h be constant coefficients and the subscripts t and t-1 designate current and lagged values of variables, respectively. Now, assume that

$$\dot{w}_t = \dot{w}_{t-1} = \dot{w},$$

$$\dot{p}_t = \dot{p}_{t-1} = \dot{p},$$

$$u_t = u_{t-1} = u,$$

and set X and Z at the constant levels $\bar{X}$ and $\bar{Z}$. We can now rewrite (1) and (2) as the steady-state equations

(1') $\dot{w} = \frac{1}{1-c}(a + bu + d\bar{X}) \equiv K_1 + Bu$, say, and

(2') $\dot{p} = \frac{1}{1-g}(e + f\dot{w} + h\bar{Z}) \equiv K_2 + F\dot{w}$, say.

Now solve (2') using (1'):

(3') $\dot{p} = K_2 + F(K_1 + Bu) \equiv K_3 + FBu$, say.

Now, pairs of corresponding "steady-state" values of $\dot{p}$ and u can be calculated. If the alternative values of $\bar{X}$ and $\bar{Z}$ are chosen, this changes only K_3 and thus changes $\dot{p}$ by a constant amount for all given values of u.

From the beginning, "steady-state" statements of this sort attracted criticism.[1] The essence of this criticism was that the underlying statistical relationships were not, in fact (and, indeed, *could* not be), estimated under anything like the postulated steady-state conditions. On the contrary, these equations were estimated for historical periods during which all the variables involved exhibited considerable fluctuations. Like all statistical relationships, moreover, they continue to hold (predict) only so long as their "setting", remains relatively unaltered. There is thus no presumption that calculations based upon such relationships could yield sensible "steady-state" solutions. Indeed, there are a number of reasons to presume that they could not.

Before these reasons are taken up in more detail, the nature of the objection must be made quite clear, lest it appear carping or trivial. The objection is not merely that "things might change". The most obstinate defender of the stable trade-off would cheerfully concede that they might! Indeed, writers in the steady-state trade-off tradition would frequently speculate upon how one might shift the trade-off to make it more favourable, or provide alternative trade-off curves corresponding to different "external environments" by assuming different parametric values for some of the variables in their equations.[2] The nontrivial objection is not just that things are likely to change, but that they are likely to change *because* of the assumptions being made to perform the steady-state trade-off calculation.

---

[1]See, e.g., R. G. Lipsey, "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957: A Further Analysis", *Economica* 27(February 1960):1-31, esp. 30, 31; H. C. Eastman, *The Economic Council's Third Annual Review - An Evaluation* (Montreal: Private Planning Association, 1966); S. F. Kaliski, Review of Perry's, *Unemployment, Money Wage Rates, and Inflation,* in *Journal of Political Economy* 75, no. 1(February 1967):110-11.

[2]See, e.g., *Special Study No. 5*, pp. 172ff. It is not intended to imply that the authors of *Special Study No. 5*, or of similar studies, were unaware of the more serious objections, although one may wonder if they took them seriously enough.

3. The Larger System

The most general reason for believing that there is a difficulty of this sort can be put very briefly. The several variables included in the wage and price equations can be said, with some exceptions, to be jointly determined in a larger system and thus to occur only in certain specific combinations of values. One cannot, in general, hold some of them constant and vary others. Moreover, certain variables excluded from the equations, but not independent of those included, are also jointly determined within that larger system. Their values (or their relations with the included variables), too, are part of the "setting" to be assumed unchanged. But it may, again, be logically inconsistent to assume this.

This question of the impact of the larger system is addressed quite directly in Chapter 5, where it is discussed in more detail and given some empirical content. The remainder of the present section is devoted to some more detailed consideration of the question of whether, if unemployment and price and wage changes took on some set of repetitive values, this, in itself, would lead to a change of particular specified variables which would effect a shift in the trade-off. These variables might be grouped into two sets: the structure of unemployment and expectations.

4. The Structure of Unemployment

Questions relating to the structure of unemployment or, more broadly, the structure of the economy arise because any simple macroeconomic model is an oversimplification. It proceeds as if there were one output, one sort of labour, one wage, and one price, whereas, in fact, there are, of course, many. In this more complex situation "the unemployment rate" is an *average* rate of unemployment, and it may matter what individual rates are averaged and how they are dispersed around the average.

The question of dispersion, a pure aggregation effect, has the longer history in the literature.[1] the point is that, since the Phillips curve relating wage

[1]See Lipsey, "The Relation between Unemployment...", for the classic statement of it.

changes to unemployment rates becomes flatter at higher rates of unemployment,[1] starting from any point of average unemployment, the small (or negative) wage changes associated with higher unemployment rates in some sectors of the labour market do not compensate for the large increases associated with lower unemployment rates in other sectors. Thus, if the labour market is segmented, a given average rate of unemployment is associated with larger wage rises if the several specific unemployment rates of which it is composed are widely scattered than if they are closely clustered around it.

Now, in practice, the labour market is clearly differentiated along occupational and geographic lines and, some would add, by industry, age, sex, and race as well. If, for whatever reason, the dispersion of these specific unemployment rates at given average rates of unemployment alters, the Phillips curve will shift. One of the reasons for the dispersion of unemployment rates, and for alterations in it, is that different sectors of the economy have specific cycles with different timing and amplitude. If the cycle is eliminated and average unemployment held at some constant level, the dispersion associated with that average rate is clearly likely to be different than it was when that rate occurred in an expansion or a contraction of the cycle. The wage change equation and, with it, the trade-off, may thus be said to be unstable, not only in the sense that one believes that it has altered from time to time but also in the technical sense that if one picks a particular point on the curve and remains there rather than move along the curve, as the economy has done over the period of estimation, this, in itself, will cause the curve to shift. None of the manipulations that convert the initially fitted equations to a steady-state trade-off are a safeguard against this.

Another suggestion that the "historical Phillips curve" might be unstable relies upon structural changes in the economy and the downward rigidity of money

---

[1]It is perhaps worth noting that this hypothesis about the shape of the curve does not depend upon any downward rigidity of wages, though, if there is such rigidity, it clearly affects both the shape and position of the curve in the region of high unemployment. The hypothesis is based upon the fact that unemployment, being confined to positive values, is a biased indicator of excess supply of labour. A number of statistical studies have tended to confirm this hypothesized shape.

wage rates. During a recession, when there is a general excess supply of labour, the structure of relative wage rates is not adjusted to the structural changes that occur in the economy. As the recovery progresses and specific shortages of labour develop, it becomes necessary to readjust this structure by raising the wages of the scarce workers. Thus the low unemployment rates of the recovery period are accompanied by a temporary spurt of wage inflation that would be more evenly spread over time if unemployment did not fluctuate.[1]

A broader structural consideration argues that, at any given moment, some of the unemployed are not really "effective" excess supply of labour. These chronically jobless persons -- because of a lack, deterioration, or obsolescence of skills; unfavourable geographic location; or permanent prejudice -- do not really affect the functioning labour market. Clearly, the larger the fraction of the unemployed that falls into this category of "structurally unemployed", the tighter is the labour market at a given average rate of unemployment.[2,3]

---

[1]See B. R. Bergmann and D. E. Kaun, *Structural Unemployment in the United States* (Washington: G.P.O., 1967).

[2]G. L. Perry, "Changing Labor Markets and Inflation", *Brookings Papers in Economic Activity* 3(1970):411-41, has recently extended this argument to suggest that various categories of unemployed may have a differential impact on wage changes, depending upon what their productivity and hours of work would be if they were working. This is sometimes said to be a point in the arithmetic of aggregation but seems really to be a broader point in the structure of unemployment. (See S. F. Kaliski and N. Swan, "Corrected Unemployment Rates and the Phillips Curve: A Comment", unpublished, 1972; and Chapter 3 below.)

However one takes Perry's point, it serves as a reminder that there are no rigidly compartmentalized labour markets or sharply differentiated types of labour but rather overlapping and imperfectly substitutable ones. This means that the consideration of dispersion and structure above should be extended to take into account the degree of substitutability of labour of different sorts.

[3]To put the matter another way, if one embraces aggregate policies designed to achieve a specified level of unemployment, this will generate more inflation if more of the unemployment is structural. R. G. Lipsey, "Structural and Deficient Demand Unemployment Reconsidered", A. M. Ross (ed.), *Employment Policy and the Labour Market* (Berkeley: University of California Press, 1965).

Again, one might argue that, if unemployment were set at a particular level, there would no longer be so much doubt about whether particular persons were structurally unemployed or merely temporary victims of the business cycle, and structural adjustments could more readily be made. This would be particularly true if the constant unemployment rate were rather low.[1]

There is much more that could be said about the impact of steady unemployment rates on structure, but the preceding should serve to convey some of the flavour of the sort of consideration being put forward. It should also provide some analytical foundation for Chapter 3, which examines the empirical impact of changes in dispersion and structure on Canadian trade-offs. The focus of that section, incidentally, is not on the steady-state trade-off, since this has never been observed, but rather on whether alterations in structure and dispersion of unemployment, however caused, are likely to have led to a shifting of the estimated trade-offs.

5. Expectations

Another line of attack on the steady-state trade-off, and a much more prominent one recently, focuses upon the implications of repetitive values, not of unemployment, but of changes in money wages and prices. The minimal argument is that labour supply (demand) as a function of money wages is not invariant to people's expectations as to the future course of prices. In steady-state trade-off, when prices and money wages have been changing at some particular rate for an indefinite time, that change will tend to be extrapolated into the future. It seems likely that, if participants in the labour market expect prices to rise at some positive rate, a given degree of excess demand in the market, as represented by an unemployment rate, will give rise to a larger percentage change in money wages than if prices were expected to rise by less or not at all. Thus each trade-off has, as an important aspect of its historical setting, the state of price expectations that prevailed at the time.

---

[1]See, e.g., Holt et al., *The Unemployment-Inflation Dilemma...*, on ways in which prolonged high employment may lead to a rehabilitation of the chronically unemployed.

If one settles on any point on that trade-off, that state of expectations is, of course, likely to change to conform ultimately to the rate of change of prices read off the trade-off. Thus any trade-off curve may be said to contain only one stable point, that at which the rate of change of prices indicated by the trade-off corresponds to the expectations that prevailed during the period when the relation held. If one picks any other point, this will ultimately lead to a change in expectations and a shift in the trade-off. One might now designate a long-run trade-off curve as a locus of all the stable points on the several transitory or historical trade-off curves.[1] Most recent observers, concentrating on the steady-state evolution of price expectations, agree that these long-run curves appear to be steeper than the short-run curves they connect, but there is no logical necessity for them to be so in a more complete system that takes adequate account of all adjustments.[2]

A stricter version of the "expectations" criticism[3] argues that labour supply and demand are, in fact, functions of real (or relative) wages. Money

---

[1]See John F. Chant, "The Costs of Alternative Approaches to the Adjustment of Inflationary Expectations" (unpublished) for an elegant statement of this proposition.

[2]See Holt et al., *The Unemployment-Inflation Dilemma...*, 23-27. Clearly the adjustments mentioned above, under structure, are relevant here, as are speeds of adjustment of prices and quantities in various markets mentioned in the introductory paragraph.

An earlier study, which ignores price expectations and concentrates on the other adjustments, argues that long-run curves are flatter for the United States. See G. L. Perry, *Unemployment, Money Wage Rates, and Inflation* (Cambridge, Mass.: M.I.T. Press, 1966); and a review of it by Kaliski, *Journal of Political Economy* 75, no. 1 (February 1967):110-11. *Special Study No. 5* argues that one cannot tell whether the long-run curves will be steeper or flatter than short-run ones (p. 178).

[3]This version is usually associated with the names of Milton Friedman (see, e.g., "The Role of Monetary Policy", *American Economic Review* 58, no. 1(March 1968):1-17); and E. S. Phelps (see, e.g., *Microeconomic Foundations of Employment and Inflation Theory* (New York: Norton, 1970)), but it has other adherents.

wages are relevant only to the extent that price (wage) changes are unanticipated. Now, define a long run in which steady-state inflation is extrapolated with certainty. The trade-off curve relevant to this run is vertical (parallel to the axis showing the rate of change in money wages) at the "natural rate of unemployment" -- the frictional rate corresponding to no excess demand for labour. At this unemployment rate, the real wage remains constant and the money wage changes at whatever rate the prevailing fully anticipated rate of price inflation (deflation) dictates. One can reduce this unemployment, which is, by assumption, voluntary, only by fooling workers into believing that real (relative) wages are rising. Since they always project past inflation,[1] this can only be done by a continual acceleration of the rate of inflation.

This is not the place to offer a detailed criticism of this more extreme version.[2] Suffice it to say that its relevance to non-steady-state situations is unclear; that it abstracts from the structure of the economy, imperfections, and price rigidities; and that some studies suggest that the long run may correspond to a very long period of time.[3]

The empirical aspects of changes in expectations on the trade-off are taken up in Chapter 4, though once again, of course, the context is that of historically estimated trade-offs, not of steady-state ones.

To sum up, this chapter has offered some general remarks on the limitation of the concept of the trade-off as a summary of those aspects of macroeconomics having to do with analysis of the relation between unemployment and inflation. The basic aim is to provide some analytical underpinnings for the empirical work to follow. To lend some unity to the discussion, much of it was cast into the form of a critique of the steady-state trade-off.

---

[1]Note that this is not a particularly "rational" thing to do out of steady state, but an extrapolation of the acceleration leads to substantially the same conclusion.

[2]For such criticisms, see, e.g., Solow, *Price Expectations...*; Tobin, "Inflation and Unemployment"; A. Rees, "The Phillips Curve as a Menu for Policy Choice", *Economica* 37, no. 147(August 1970):227-38.

[3]Solow, *Price Expectations....*

CHAPTER 2

SHIFTS IN THE TRADE-OFF

1. Introduction

The several pieces of analysis considered in the previous chapter suggest that any particular observed trade-off between price changes and unemployment, even when it can be firmly estimated for some period, is perhaps unlikely to hold or, at least, to remain unchanged over longer periods. Instability is particularly likely to be found if there were important changes in the structure of labour markets and of unemployment, in the extent of economic fluctuations, in the strength and mix of stabilization and subsidiary policies, in the nature of expectations as to price changes, or, indeed, in any of the relevant major features of the economy.

Now, one might suspect that some such changes are likely to have occurred since the early 1950's. More specifically, there can be little doubt that the relevant features of the Canadian economy during all or part of the 1960's have been rather unusual. The economy has, over most of the decade, experienced an unprecedented "prolonged recessionless expansion",[1] albeit from a relatively low level of activity. Perhaps, as a result, it has been alleged that we have experienced an inflation unlike any previous and that there has been a revolution in expectations.[2] In addition, the authorities have introduced a number of new policies, some aimed at improving the organization of the labour market, some at combatting regional and personal inequality in employment opportunities, some at altering expectations, etc.[3]

---

[1]Economic Council of Canada, *Performance and Potential: Mid-1950's to Mid-1970's* (Ottawa: Information Canada, 1970), p. 55.

[2]There is some evidence for these propositions, which is discussed in greater detail in Chapter 4.

[3]The new Departments of Manpower and Immigration and of Regional Economic Expansion, and the Prices and Incomes Commission are some organizational expressions of these new ventures. For a discussion of manpower policy, see Economic Council of Canada, *Eighth Annual Review* (Ottawa: Information Canada, 1971), Chapters 6-8.

One would hope that some of these might be beginning to have a measurable impact. Again, Canadian and U.S. rates of unemployment diverged to a rather unusual degree in the late 1960's, although the price levels continued to move largely in parallel. This, too, could well affect the Canadian trade-off in view of the strong interdependence of the two economies, widely recognized, and reflected in some Canadian trade-off equations.

In view of all these indications that the trade-off relationship may have changed, it seems best to start by inquiring whether, in fact, it has done so. The regressions fitted in *Special Study No. 5* were selected for this purpose not only because they are perhaps the most carefully tested[1] and certainly the best known of the Canadian equations, but also because they had previously demonstrated considerable stability. Not only did they remain stable and yield good predictions within the sample period, they also remained invulnerable to being extended to a much longer period including some prewar years,[2] and for two further years of the postwar period,[3] at least so far as formal stability tests were concerned.

The question then was whether these equations were capable of bearing the additional strain of being extended for a further two or three years to bring them as nearly as possible up to the present. To answer it, these equations were subjected to two standard tests used also by previous researchers.[4] The first consists of fitting the regressions for the period as a whole and

---

[1]G. L. Reuber, "Comment: The Specification and Stability of Estimated Price-Wage-Unemployment Adjustment Relationships", *Journal of Political Economy* 76, no. 4, pt. II (July-August 1968):750-54, esp. pp. 751, 752.

[2]*Ibid.*, pp. 753-54; *Special Study No. 5*, Chapters 5 and 7.

[3]W. M. Scarth, "The Accuracy of an Aggregate 'Phillips Curve' Approach for Exploring General Wage Increases in Canada, 1965-1967", esp. Ch. III (B.A. Thesis, Queen's University, Kingston, 1968).

[4]*Special Study No. 5*, Chapters 5 and 7; Scarth, "The Accuracy of an Aggregate 'Phillips Curve' Approach...", Ch. III.

for various subperiods and applying a formal statistical test -- the Chow test -- to decide whether the two equations for each pair of subperiods are, taken as a whole, significantly different from one another.[1] The second amounts to forecasting the value of the dependent variable, on the basis of the equations fitted for the original period and the actual values of the determining variables, and comparing these forecasts with the actual values observed and with certain "naive projections".

2. Comparison of Original and Re-estimated Equations

The first of these tests was applied to the period from the first quarter of 1953 to the third quarter of 1969, inclusive.[2] The latter of these dates was quite simply the last observation available when work on this section was begun, while the former was the beginning of the preferred[3] postwar period included in *Special Study No. 5*.

One problem, of a very common sort, was encountered with this test; for periods corresponding exactly to those in *Special Study No. 5*,[4] the results of the regressions did not correspond exactly to those in the original.[5] Since the data used in the original study are no longer available, it is not possible to provide a reconciliation of the results. Repeated checks have failed to discover any errors in our data, calculations, or procedures followed, however. It seems likely, therefore, that the differences are attributable to other causes. Some of these might be:

[1]Very loosely, the Chow test compares each of the coefficients of one regression to the corresponding coefficients of another. By reference to the standard errors of the coefficients and the known distribution of the test statistic, one is able to say how probable it is that the observed differences taken all together are a result of chance. See *Special Study No. 5*, pp. 93, 94, 114-116, for a more detailed description and references.

[2]Hereafter, 1953-*1* to 1963-*3*, etc.

[3]The longer period 1949 to 1965 was also tried in the *Study* but proved unsatisfactory. See *Special Study No. 5*, p. 125.

[4]The periods involved are 1953-1 to 1965-2 and two subperiods 1953-*1* to 1960-*4* and 1961-*1* to 1965-*2*.

[5]Scarth, "The Accuracy of an Aggregate 'Phillips Curve' Approach...", Ch. III, reports the same difficulty, and one encounters such reports in a great many replications of statistical fits.

1. Data revisions -- some have undoubtedly occurred since the original study and would have had to be included to preserve the continuity of series even if the original data could be ascertained.[1]

2. The weighting base of the Consumer Price Index was changed in 1961, and overlapping series are available for 1957 to 1960. Care was taken to calculate all percentage changes from the same series. But the exact point at which one switches from one series to the other is arbitrary. The point chosen in this Study may well differ from that used in the original work.

3. The details of computer programs used and, in particular, of the rules for rounding figures are capable of making a difference in the results.[2]

All that can be said for certain is that, as a result, no doubt, of some combination of these reasons, the regression equations obtained differ in detail from those published in *Special Study No. 5*.[3] The comparative

---

[1]But, thanks to the kindness of the Dominion Bureau of Statistics (now Statistics Canada), it was possible to avoid incorporating the very latest revision of the National Accounts. This is one reason for not attempting to extend this work beyond the third quarter of 1969, when the unrevised quarterly data ceased to be available.

[2]See Scarth, "The Accuracy of an Aggregate 'Phillips Curve' Approach...", Appendix D.

[3]Some recent work by Rowley and Wilton suggests that least-squares regression equations in which the left-hand variable is an overlapping four-quarter wage change are likely to have a particular form of autocorrelated error term not readily detected by reference to the Durbin-Watson statistic. This autocorrelation may lead to a substantial underestimate of the standard errors of the regression coefficients. If this is so in the case of the original and refitted regressions presented here, they, in fact, fit less well than they appear to, and any discrepancy between them requires less explanation. See J.C.R. Rowley and D. A. Wilton, "Wage Determination: The Use of Instrumental Variables", Queen's University, Institute for Economic Research, Discussion Paper No. 34, and elsewhere.

results are shown in Table 2.1 for the wage change equations and in Table 2.2 for the price change equations. It may be worth noting that each of the re-estimated wage change equations has somewhat lower R^2 and *D.W.* coefficients than the original. The t values for the coefficients of each of the Canadian explanatory variables are also lower in the re-estimated versions than in the original, but those for U.S. wage changes are higher. The two estimates of the price change equation are very similar, with the re-estimated regression characterized by somewhat higher R^2 and *D.W.* statistics.[1]

The discrepancies revealed by the above comparison mean that, strictly speaking, it is not the original regressions of *Special Study No. 5*, but rather re-estimated regressions with the same general specifications, that are being extended to the latter 1960's and subjected to Chow tests. This distinction might be of some importance because there is some evidence that the re-estimated regressions might be less stable.

Thus the original work reports only one shift significant at the 5 per cent level when the four wage change equations and the price change equation shown are fitted separately to the subperiods 1953-60 and 1961-65. When a similar test is applied to the re-estimated equations, the results are significant at the 5 per cent level in two cases and at the 1 per cent level in one.

[1]Note that, since both *D.W.* statistics exceed 2, the higher one suggests a larger, not a smaller, possibility of (negative) autocorrelation in the residuals. But neither deviation from 2 is significant.

Table 2.1

REGRESSIONS EXPLAINING $\dot{w}_t$, THE RATE OF CHANGE IN WAGES, OVER THE PERIOD 1953-65: COMPARISON OF ORIGINAL EQUATIONS SELECTED FOR FURTHER WORK IN *SPECIAL STUDY NO. 5* AND RE-ESTIMATED VERSIONS

Equation No.	Constant	$\dot{p}^*_t$	$(u^*_t)^{-2}$	$(Z/Q)^*_{t-2}$	$\dot{w}^*_{us_t}$	$\dot{w}_{t-4}$	R^2	D.W.
(5.1)	-4.32	0.487	18.4	0.0618	0.291	-0.116	0.847	1.62
		[6.42]	[2.96]	[3.16]	[2.51]	[3.02]		
(5.1)A	-4.31	0.38	10.18	0.054	0.43	-0.091	0.84	1.47
	[2.57]	[5.02]	[1.54]	[3.09]	[3.94]	[2.29]		
(5.3)	-5.05	0.537	25.6	0.0775	--	-0.140	0.825	1.42
		[6.95]	[4.35]	[3.96]		[3.54]		
(5.3)A	-4.78	0.46	22.36	0.068	--	-0.12	0.78	1.12
	[2.49]	[5.50]	[3.34]	[3.46]		[2.75]		
(5.5)	0.761	0.512	29.2	--	0.409	-0.122	0.812	1.40
		[6.20]	[5.09]		[3.40]	[2.91]		
(5.5)A	0.80	0.43	22.92	--	0.50	-0.099	0.80	1.28
	[2.53]	[5.28]	[4.08]		[4.27]	[2.29]		
(5.7)	1.65	0.602	44.5	--	--	-0.161	0.764	1.12
		[6.94]	[11.5]			[3.61]		
(5.7)A	1.80	0.54	41.57			-0.140	0.72	0.96
	[7.21]	[6.01]	[10.03]			[2.83]		

(cont'd.)

Table 2.1 (concl'd.)

Note: Variables are defined as follows:

$\dot{w}_t$ — Percentage change in average hourly earnings in manufacturing, Canada.

$\dot{w}_{t-4}$ -- $\dot{w}_t$ lagged four quarters.

$\dot{w}^*_{us}{}_t$ -- Percentage change in U.S. average hourly earnings in manufacturing.

$\dot{p}^*_t$ — Percentage change in Consumer Price Index.

$(u^*_t)^{-2}$ -- Reciprocal of weighted average percentage level of unemployment, squared.

$(Z/Q)^*_t$ -- Four-quarter moving average of ratio of corporate profit to output, manufacturing.

All variables marked · are percentage changes from four quarters earlier; all those marked * are averages of the value of the underlying variables over the past four quarters. The averages are calculated with equal weights, except for unemployment. See *Special Study No. 5*, pp. 121-123, for a fuller explanation.

Other symbols: R^2 -- coefficient of determination, uncorrected. In view of the difficulty in calculating the degrees of freedom in time series, uncorrected coefficients seem preferable. However, coefficients corrected for the number of explanatory variables in the regression make it easier to assess whether the addition of a variable improves the fit. For this reason, corrected coefficients are used in some tables in this Study.

D.W. -- Durbin-Watson statistic.

A -- following an equation number indicates the re-estimated, not the original version.

Figures in brackets are *t*-statistics.

Source: *Special Study No. 5*, Table 5.1, p. 124; computer print-outs.

Table 2.2

REGRESSION EXPLAINING $\dot{p}_t$, THE RATE OF CHANGE IN PRICES, OVER THE PERIOD 1953-65: COMPARISON OF ORIGINAL EQUATION SELECTED FOR FURTHER WORK IN *SPECIAL STUDY NO. 5* AND RE-ESTIMATED VERSION

Equation No.	Constant	$\dot{w}_t$	$\dot{f}_t$	$\dot{p}_{t-1}$	R^2	*D.W.*
(5.36)	-0.622	0.199 [3.53]	0.0998 [2.97]	0.817 [15.6]	0.865	2.04
(5.36)A	-0.66 [3.02]	0.20 [3.86]	0.095 [3.08]	0.838 [17.36]	0.88	2.07

Note: Variables are defined as follows:

$\dot{w}_t$ -- Percentage change in average hourly earnings in manufacturing, Canada.

$\dot{f}_t$ -- Percentage change in import price deflator.

$\dot{p}_{t-1}$ -- $\dot{p}_t$ lagged one quarter.

All variables marked · are percentage changes from four quarters earlier; all those marked * are averages of the value of the underlying variables over the past four quarters. The averages are calculated with equal weights, except for unemployment. See *Special Study No. 5*, pp. 121-123, for a fuller explanation.

Other symbols: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

A -- following an equation number indicates the re-estimated, not the original version.

Figures in brackets are *t*-statistics.

Source: *Special Study No. 5*, pp. 145, 146; computer print-outs.

The details are shown in Table 2.3. It is perhaps worth noting that, for all the wage change equations, the *F* values, whether or not indicating a shift, are higher for the re-estimated regressions.[1] The opposite is true for the price change equation.

Table 2.3

TESTS FOR SHIFTS IN THE REGRESSION COEFFICIENTS OF WAGE AND PRICE CHANGE EQUATIONS, 1953-65: COMPARISON OF ORIGINAL AND RE-ESTIMATED VERSIONS

Equation No.	*F* Ratio from Equation	Critical Values for *F* Ratio, at Significance Level of: 5%	1%	Conclusion
(5.1)	2.42	2.35	3.32	Shift (at 5% level)
(5.1)A	3.29			Shift (at 5% level)
(5.3)	2.15	2.45	3.51	No Shift
(5.3)A	2.55			Shift (at 5% level)
(5.5)	1.93	2.45	3.51	No Shift
(5.5)A	3.68			Shift (at 1% level)
(5.7)	0.05	2.59	3.80	No Shift
(5.7)A	0.13			No Shift
(5.36)	0.86	2.59	3.80	No Shift
(5.36)A	0.46			No Shift

Note: Here, and elsewhere, the null hypothesis of no significant change is rejected whenever the calculated value of the test statistic exceeds the critical value.

Source: *Special Study No. 5*, Tables 5.3, 5.8; worksheets.

[1]This is also true for the one other wage change regression re-estimated (5.2).

3. Results of an Application of the Chow Test to the Re-estimated Equations

So much for the correspondence between the original and the re-estimated regressions. The final part of this chapter will report upon some forecasting tests based upon the original equations. What follows immediately deals with an application of the Chow test to the re-estimated ones. For this purpose, the period was extended to the third quarter of 1969, inclusive, and regressions were estimated for the period as a whole and for each of six subperiods: 1953-*1* to 1965-*2*, 1953-*1* to 1960-*4*, 1961-*1* to 1969-*3*, 1965-*3* to 1969-*3*, 1953-*1* to 1967-*3*, and 1967-*4* to 1969-*3*.[1] The first four of these reflect the main period and subperiods of *Special Study No. 5*; the last two correspond to a rough dating of the drifting apart of the Canadian and U.S. unemployment rates noted above.[2]

The resulting regressions are shown in Tables 2.4 and 2.5; and the Chow test results, in Table 2.6. The latter show quite dramatically the instability of the wage change equations over the 17 years; every test tried proves to be significant at the 1 per cent level.[3] The price change equation shows a shift significant at the 5 per cent level if broken at 1965-*2* or 1967-*3*, but not when broken at 1960-*4*.[4]

---

[1]The italicized number following the dash indicates which quarter of the year is included in the subperiod.

[2]See Chapter 3 below for a more detailed discussion.

[3]This result holds also for equation (5.2)A, not shown in the tables. But whatever their other peculiarities, the equations for 1961-69 do not appear to be unstable. Of the five tests tried for a break at 1965-*2*, only one was significant at the 5 per cent level.

[4]The test for the period 1961-69 also shows no significant shifts.

To confine one's comments on the instability of the regression equations simply to the results of the Chow tests, however, is to understate the results to the point of being misleading. An examination of Table 2.4 reveals that in only one case is the coefficient of the unemployment variable in any regression, starting in 1961 or later and running until 1969, significant at the conventional levels. This is perhaps fortunate, since most of these coefficients have entirely unbelievable signs and magnitudes as well. The one coefficient that might be described as statistically significant (Equation (5.5)A, 1967-*4* to 1969-*3*) is as unbelievable as any. In short, it does not appear possible to estimate a relationship between wage changes and unemployment on these specifications for the 1960's (and specified subperiods) without the earlier data. The relation between wage changes and price changes, too, becomes insignificant for the 1960's, as is shown in Table 2.5. But, here, while the coefficients are no longer reliable, they do at least remain sensible, with one exception.

It may be thought that the insignificance of the results just described for the wage and price change regressions is the necessary consequence of considering runs of data as short as those for the several subperiods designated. It is worth noting, however, that the regressions do not fall apart in the same way for the quite short subperiods 1953-60 and 1961-65. Only the period 1967-69 is much shorter than the second of these.

Nor is it obvious that problems of intercorrelation of the explanatory variables are any more severe in the more recent periods; the correlation between the unemployment variable and each explanatory variable, except lagged wages, is distinctly lower for 1961-69 than for 1961-65, for instance. For 1965-69 two correlation coefficients are higher and two lower, compared to both 1953-60 and 1961-65. The one clear increase in intercorrelation is the very high correlation between unemployment and U.S. wage changes for 1967-69. The full matrix of simple correlation coefficients between unemployment and other explanatory variables is shown in Table 2.7.[1]

[1]Such simple comparisons are, of course, of limited validity.

Table 2.4

REGRESSIONS EXPLAINING $\dot{w}_t$, THE RATE OF CHANGE IN WAGES, OVER THE PERIOD 1953-69 AND SUBPERIODS

(t-statistics in brackets)

Equation No.	Period	Constant	$\dot{p}^*_t$	$(u^*_t)^{-2}$	$(Z/Q)^*_{t-2}$	$\dot{w}^*_{us_t}$	$\dot{w}_{t-4}$	$\bar{R}^2$	D.W.
(5.1)A	1953-1 to 1965-2	-4.306 [2.57]	0.383 [5.02]	10.180 [1.54]	0.054 [3.09]	0.427 [3.94]	-0.091 [2.29]	.819	1.47
	1953-1 to 1960-4	-6.380 [3.22]	0.364 [4.478]	2.711 [0.43]	0.067 [3.16]	0.615 [4.47]	-0.053 [1.38]	.885	1.66
	1961-1 to 1965-2	1.216 [0.27]	-0.181 [0.23]	67.578 [2.49]	0.025 [0.39]	-0.498 [1.06]	-0.269 [0.78]	.679	2.71
	1953-1 to 1969-3	0.527 [0.32]	0.751 [8.73]	19.571 [3.50]	-0.011 [0.69]	0.797 [6.97]	-0.030 [0.52]	.833	0.99
	1965-3 to 1969-3	-3.927 [0.75]	2.073 [1.43]	-25.329 [0.45]	0.051 [1.26]	0.140 [0.16]	-0.138 [0.33]	.702	2.11
	1961-1 to 1969-3	-1.141 [0.54]	1.112 [2.97]	1.417 [0.106]	0.011 [0.59]	0.651 [2.62]	-0.004 [0.02]	.906	1.95
	1953-1 to 1967-3	2.026 [1.39]	0.615 [9.25]	34.220 [6.91]	-0.014 [0.920]	0.399 [3.39]	-0.114 [2.53]	.827	1.07
	1967-4 to 1969-3	-51.19 [1.13]	5.057 [1.52]	495.46 [0.98]	0.024 [0.15]	3.765 [0.90]	-1.218 [1.11]	.571	2.70

(cont'd.)

Table 2.4 (cont'd.)

Equation No.	Period	Constant	$\dot{p}^*_t$	$(u^*_t)^{-2}$	$(Z/Q)^*_{t-2}$	$\dot{w}^*_{us_t}$	$\dot{w}_{t-4}$	R^2	D.W.
(5.3)A	1953-1 to 1965-2	-4.784 [2.49]	0.464 [5.50]	22.361 [3.34]	0.068 [3.46]	--	-0.123 [2.75]	.761	1.12
	1953-1 to 1960-4	-9.611 [4.00]	0.541 [5.85]	14.338 [1.92]	0.115 [4.73]	--	-0.121 [2.62]	.804	1.04
	1961-1 to 1965-2	3.193 [0.77]	0.453 [0.88]	46.509 [2.50]	-0.015 [0.30]	--	-0.070 [0.24]	.676	2.74
	1953-1 to 1969-3	-1.718 [0.80]	0.995 [9.51]	30.69 [4.30]	0.025 [1.22]	--	0.059 [0.80]	.705	0.67
	1965-3 to 1969-3	-3.794 [0.77]	2.272 [3.53]	-33.001 [1.33]	0.055 [1.68]	--	-0.157 [0.40]	.727	2.11
	1961-1 to 1969-3	-0.942 [0.41]	1.632 [4.70]	-18.508 [1.55]	0.021 [1.05]	--	0.172 [0.81]	.889	1.92
	1953-1 to 1967-3	1.096 [0.70]	0.643 [8.92]	42.145 [8.83]	0.005 [0.32]	--	-0.128 [2.60]	.793	0.93
	1967-4 to 1969-3	-11.937 [1.00]	3.266 [1.26]	48.015 [0.59]	0.153 [2.43]	--	-1.550 [1.56]	.598	2.42

(cont'd.)

Table 2.4 (cont'd.)

REGRESSIONS EXPLAINING $\dot{w}_t$, THE RATE OF CHANGE IN WAGES, OVER THE PERIOD 1953-69 AND SUBPERIODS

(t-statistics in brackets)

Equation No.	Period	Constant	$\dot{p}^*_t$	$(u^*_t)^{-2}$	$(Z/Q)^*_{t-2}$	$\dot{w}^*_{us_t}$	$\dot{w}_{t-4}$	$\bar{R}^2$	D.W.
(5.5)A	1953-1 to 1965-2	0.801 [2.53]	0.430 [5.28]	22.922 [4.08]	--	0.495 [4.27]	-0.099 [2.29]	.785	1.28
	1953-1 to 1960-4	-0.230 [0.56]	0.318 [3.45]	11.470 [1.76]	--	0.830 [6.01]	-0.039 [0.89]	.847	1.42
	1961-1 to 1965-2	2.937 [2.65]	0.078 [0.19]	64.439 [2.57]	--	-0.389 [1.07]	-0.165 [0.77]	.700	2.83
	1953-1 to 1969-3	-0.590 [1.77]	0.780 [10.49]	17.996 [3.54]	--	0.771 [7.16]	-0.026 [0.46]	.835	0.97
	1965-3 to 1969-3	0.222 [0.054]	1.299 [0.97]	-0.201 [0.003]	--	0.759 [0.99]	-0.216 [0.50]	.688	1.70
	1961-1 to 1969-3	0.037 [0.05]	1.130 [3.06]	2.084 [0.16]	--	0.681 [2.83]	-0.049 [0.26]	.909	1.87
	1953-1 to 1967-3	0.719 [2.14]	0.640 [10.49]	32.653 [7.03]	--	0.359 [3.28]	-0.114 [2.54]	.827	1.04
	1967-4 to 1969-3	-57.022 [2.90]	5.378 [2.55]	562.401 [2.82]	--	4.342 [3.06]	-1.151 [1.40]	.711	2.78

(cont'd.)

Table 2.4 (concl'd.)

Equation No.	Period	Constant	$\dot{p}^*_t$	$(u^*_t)^{-2}$	$(Z/Q)^*_{t-2}$	$\dot{w}^*_{us_t}$	$\dot{w}_{t-4}$	$\bar{R}^2$	D.W.
(5.7)A	1953-1 to 1965-2	1.801 [7.21]	0.543 [6.01]	41.566 [10.03]	--	--	-0.140 [2.83]	.704	0.96
	1953-1 to 1960-4	1.678 [4.28]	0.577 [4.71]	43.146 [7.52]	--	--	-0.143 [2.36]	.654	0.72
	1961-1 to 1965-2	1.954 [3.14]	0.337 [1.03]	45.085 [2.59]	--	--	-0.128 [0.60]	.697	2.62
	1953-1 to 1969-3	0.888 [2.53]	0.941 [9.89]	35.483 [5.93]	--	--	0.056 [0.76]	.703	0.66
	1965-3 to 1969-3	3.464 [1.38]	2.442 [3.60]	-46.693 [1.86]	--	--	-0.401 [1.04]	.688	1.51
	1961-1 to 1969-3	1.419 [2.58]	1.714 [5.05]	-19.013 [1.59]	--	--	0.099 [0.50]	.888	1.76
	1953-1 to 1967-3	1.591 [7.101]	0.634 [9.59]	43.108 [11.74]	--	--	-0.128 [2.63]	.796	0.94
	1967-4 to 1969-3	-4.848 [0.28]	5.025 [1.36]	-15.190 [0.13]	--	--	-0.929 [0.65]	.104	1.57

Note: $\bar{R}^2$ -- coefficient of determination, corrected.

D.W. -- Durbin-Watson statistic.

All other variables are defined in Table 2.1.

Source: Worksheets.

Table 2.5

REGRESSIONS EXPLAINING $\dot{p}_t$, THE RATE OF CHANGE IN PRICES, OVER THE PERIOD 1953-69 AND SUBPERIODS

Equation No.	Period	Constant	$\dot{w}_t$	$\dot{f}_t$	$\dot{p}_{t-1}$	$\bar{R}^2$	D.W.
(5.36)A	1953-1 to 1965-2	-0.657 [3.02]	0.202 [3.86]	0.095 [3.08]	0.838 [17.36]	.877	2.07
	1953-1 to 1960-4	-0.653 [2.19]	0.192 [2.66]	0.122 [2.34]	0.819 [13.66]	.882	2.14
	1961-1 to 1965-2	-0.334 [0.68]	0.154 [1.04]	0.035 [0.72]	0.865 [4.84]	.808	1.66
	1953-1 to 1969-3	-0.344 [2.25]	0.133 [3.56]	0.085 [2.59]	0.822 [17.78]	.917	2.12
	1965-3 to 1969-3	1.460 [2.27]	0.119 [0.99]	0.190 [1.06]	0.308 [1.06]	.484	2.19
	1961-1 to 1969-3	0.061 [0.27]	0.097 [1.12]	-0.0016 [0.03]	0.822 [5.55]	.912	2.36
	1953-1 to 1967-3	-0.583 [3.20]	0.190 [4.32]	0.091 [2.91]	0.828 [18.66]	.905	1.90
	1967-4 to 1969-3	4.080 [2.18]	-0.029 [0.143]	0.424 [1.53]	-0.153 [0.25]	.071	1.41

Note: $\bar{R}^2$ -- coefficient of determination, corrected.

D.W. -- Durbin-Watson statistic.

All other variables are defined in Table 2.2.

Source: Worksheets.

Table 2.6

TESTS FOR SHIFTS IN THE REGRESSION COEFFICIENTS OF WAGE AND PRICE CHANGE EQUATIONS, 1953-69

Equation No.	Periods Compared		*F* Ratio from Equation	Critical Values for *F* Ratio, at Significance Level of: 5%	1%	Conclusions
(5.1)A	1953-*1* to 1960-*4*	1961-*1* to 1969-*3*	9.44	2.27	3.15	Shift (at 1% level)
	1953-*1* to 1965-*2*	1965-*3* to 1969-*3*	9.01	2.27	3.15	Shift (at 1% level)
	1953-*1* to 1967-*3*	1967-*4* to 1969-*3*	8.28	2.27	3.15	Shift (at 1% level)
	1961-*1* to 1965-*2*	1965-*3* to 1969-*3*	1.05	2.53	3.71	No Shift
(5.3)A	1953-*1* to 1960-*4*	1961-*1* to 1969-*3*	19.02	2.38	3.36	Shift (at 1% level)
	1953-*1* to 1965-*2*	1965-*3* to 1969-*3*	22.80	2.38	3.36	Shift (at 1% level)
	1953-*1* to 1967-*3*	1967-*4* to 1969-*3*	20.16	2.38	3.36	Shift (at 1% level)
	1961-*1* to 1965-*2*	1965-*3* to 1969-*3*	2.72	2.60	3.86	Shift (at 5% level)
(5.5)A	1953-*1* to 1960-*4*	1961-*1* to 1969-*3*	9.73	2.38	3.36	Shift (at 1% level)
	1953-*1* to 1965-*2*	1965-*3* to 1969-*3*	7.85	2.38	3.36	Shift (at 1% level)
	1953-*1* to 1967-*3*	1967-*4* to 1969-*3*	10.14	2.38	3.36	Shift (at 1% level)
	1961-*1* to 1965-*2*	1965-*3* to 1969-*3*	0.76	2.60	3.86	No Shift
(5.7)A	1953-*1* to 1960-*4*	1961-*1* to 1969-*3*	16.53	2.52	3.66	Shift (at 1% level)
	1953-*1* to 1965-*2*	1965-*3* to 1969-*3*	21.42	2.52	3.66	Shift (at 1% level)
	1953-*1* to 1967-*3*	1967-*4* to 1969-*3*	19.09	2.52	3.66	Shift (at 1% level)
	1961-*1* to 1965-*2*	1965-*3* to 1969-*3*	2.34	2.73	4.11	No Shift
(5.36)A	1953-*1* to 1960-*4*	1961-*1* to 1969-*3*	1.40	2.52	3.66	No Shift
	1953-*1* to 1965-*2*	1965-*3* to 1969-*3*	2.92	2.52	3.66	Shift (at 5% level)
	1953-*1* to 1967-*3*	1967-*4* to 1969-*3*	3.11	2.52	3.66	Shift (at 5% level)
	1961-*1* to 1965-*2*	1965-*3* to 1969-*3*	2.27	2.73	4.11	No Shift

Source: Worksheets.

Table 2.7

CORRELATION COEFFICIENTS BETWEEN $(u_t^*)^{-2}$ AND OTHER EXPLANATORY VARIABLES IN THE WAGE CHANGE EQUATIONS, VARIOUS SUBPERIODS, 1953-69

Variable/ Period	1953-65	1953-60	1961-65	1953-67	1953-69	1965-69	1961-69	1967-69
$\dot{p}_t^*$	-.44	-.55	.84	-.15	-.13	-.41	.74	.72
$(Z/Q)_{t-1}^*$	.87	.88	.84	.71	.61	.004	.03	.66
$\dot{w}_{us_t}^*$	.79	.75	.53	.75	.58	.79	.35	-.97
$\dot{w}_{t-4}$	.62	.56	.39	.61	.55	.66	.52	.50

Note: Variables are defined as follows:

$(u_t^*)^{-2}$ -- Reciprocal of weighted average percentage level of unemployment, squared.

$\dot{p}_t^*$ -- Percentage change in Consumer Price Index.

$(Z/Q)_t^*$ -- Four-quarter moving average of ratio of corporate profit to output, manufacturing.

$w_{us_t}^*$ -- Percentage change in U.S. average hourly earnings in manufacturing.

$\dot{w}_{t-4}$ -- $\dot{w}_t$ lagged four quarters.

Source: Worksheets.

It follows from what has just been said that it is not possible to make any direct comparisons between trade-offs for the 1950's and those for the 1960's. One can, however, compare the regressions for the periods 1953-65 and 1953-69 as a whole. The results are indecisive. For equations (5.1)A and (5.3)A, the coefficient of $(u_t^*)^{-2}$ and the constant are larger for the longer period, indicating higher wage changes for a given level of unemployment, neglecting the other variables. For (5.5)A and (5.7)A, the opposite result holds.

A more consistent result is the larger influence of price changes and, where they are included, changes in U.S. wages on wage changes in Canada.

The price change equation, in contrast, shows a smaller influence of given changes in wages, import prices, and past prices, but a higher constant for the longer period.

Despite the scepticism expressed earlier about "steady-state" trade-offs based upon such equations as the preceding, some readers may find them a convenient summary of the discussion just preceding. A comparison of such trade-offs for "non-inflationary conditions"[1] for 1953-65 and 1953-69 is presented in Table 2.8. This is a counterpart of Table 6.4 in *Special Study No. 5*, but differs substantially from it.

It will be seen that the unemployment rate "required" for price stability is, in all cases, higher for the longer period. Price level changes associated with given rates of unemployment are also higher for the longer period except those for rates of unemployment of 5 per cent or more estimated on the basis of equation (5.3)A. In these senses, the trade-off may be said to have deteriorated.

---

[1]The reader may wonder why the trade-offs for "inflationary conditions", which might be thought more relevant, were not chosen instead. The answer is twofold: first, each equation includes periods of both sorts and so is no more relevant to the one than to the other; second, the implicit assumptions involved in calculating a "steady-state trade-off" from equations such as these are thought to be so arbitrary that the calculation is a mere example of quite uncertain relevance to the real world, whatever its explicit assumptions.

Table 2.8

ESTIMATED PRICE-CHANGE/UNEMPLOYMENT TRADE-OFFS
BASED ON ESTIMATED TRADE-OFF RELATIONSHIPS:
COMPARISON OF PERIODS 1953-65 AND 1953-69

Unemployment Rate $(u^*)_t$ (% Labour Force)	Steady-State Rate of Change of Consumer Prices $(\dot{p}_t = \dot{p}_{t-1})$[1]							
	Period							
	1953-65	1953-69	1953-65	1953-69	1953-65	1953-69	1953-65	1953-69
	(5.1)A		(5.2)A		(5.3)A		(5.7)A	
	(Per cent per year)							
2.5	0.68	3.95	-0.23	3.96	4.22	11.85	12.78	12.80
3.0	-0.33	2.43	-0.65	3.05	1.72	6.17	7.31	7.41
4.0	-1.33	0.91	-1.18	1.92	-0.77	0.53	1.86	2.06
5.0	-1.80	0.21	-1.50	1.24	-1.92	-2.08	-0.66	-0.42
6.0	-2.05	-0.17	-1.71	0.78	-2.55	-3.49	-2.03	-1.76
7.0	-2.21	-0.40	-1.86	0.46	-2.92	-4.35	-2.85	-2.57
8.0	-2.31	-0.55	-1.96	0.22	-3.17	-4.90	-3.39	-3.10
Implied Unemployment Rates Required for a Constant Consumer Price Level								
$\dot{p}_t = 0$	2.81	5.48	2.29	9.18	3.59	4.16	4.67	4.78

[1] With $\dot{f}_t = 0$; $\dot{w}_{us_t} = 3.2$ and $(Z/Q)^*_{t-2} = 97.75$, $\dot{w}_t = \dot{w}_{t-4}$, based upon price change equation (5.36)A and wage change equation.

Source: Worksheets.

4. Extrapolation of the Original Equations through 1969

Another impression of the continuing adequacy of the trade-off, which has the advantage of being free from the vagaries of re-estimation, can be obtained by extrapolating the original equations of *Special Study No. 5* through 1969. The results of such an extrapolation of the wage and price change equations are shown in Table 2.9.[1] The predictions are in each case obtained by applying the estimated coefficients of the original equations to the "observed" values of those explanatory variables which they include. In the case of the wage change equations, which, on previous showing, were not only particularly prone to shift but also distinctly different as between the original and re-estimated versions, the results are compared with those of three naive models suggested in *Special Study No. 5*. The first of these (5.22) repeatedly predicts the mean of the dependent variable for the sample period, as originally estimated; the second (5.23) predicts that the percentage change in wages for the current quarter will be the same as that for the previous quarter; and the third (5.24) predicts that it will be the same as that for the corresponding quarter a year earlier. Finally, the fourth naive model (5.25) predicts that the percentage wage change in the current quarter will equal the average of the changes in the preceding four quarters.[2]

Two observations about the predictive power of the wage change equations emerge clearly from Table 2.9: first, judging by the root mean square deviation, all four of them perform no better than the three naive predictions, excluding the first and crudest; second, all four wage change equations underestimate every actual wage change between the third quarter of 1966 and the third quarter of 1969, inclusive.

The price change equation is characterized by a much smaller deviation between actual and predicted values and shows no equally systematic tendency to under- or overestimate, although overestimates predominate.

---

[1]This can be compared to Tables 5.4 and 5.9 in the original study, on which rest the predictive power of equations based upon the 1953-60 subperiod.

[2]*Special Study No. 5*, p. 131.

Table 2.9

PREDICTIVE POWER OF ORIGINAL FITTED REGRESSIONS OF WAGE AND PRICE CHANGES FOR 1953-1 - 1965-3, OVER THE PERIOD 1965-3 TO 1969-4

Quarter	Actual Wage Change ($\dot{w}_t$)	Predicted Wage Change ($\hat{\dot{w}}_t$)							
		Regression Models				Naive Models			
		(5.1)	(5.3)	(5.5)	(5.7)	(5.22)	(5.23)	(5.24)	(5.25)
1965-3	4.109	4.786	5.329	4,103	4.686	3.799	4.760	4.501	4.174
-4	5.512	5.229	5.727	4.730	5.312	3.799	4.109	3.171	4.759
1966-1	5.407	5.374	5.882	4.959	5.589	3.799	5.512	4.657	4.947
-2	5.537	5.730	6.258	5.405	6.101	3.799	5.407	4.760	5.141
-3	6.847	6.136	6.612	5.912	6.568	3.799	5.537	4.109	5.826
-4	6.472	5.922	6.311	5.862	6.448	3.799	6.847	5.512	6.066
1967-1	6.673	5.583	5.830	5.811	6.290	3.799	6.472	5.407	6.382
-2	6.361	5.260	5.434	5.581	5.984	3.799	6.673	5.537	6.713
-3	7.254	4.815	4.887	5.309	5.623	3.799	6.861	6.847	6.815
-4	7.251	4.655	4.659	5.248	5.495	3.799	7.254	6.472	7.010
1968-1	6.255	4.837	4.695	5.400	5.410	3.799	7.251	6.673	6.905
-2	7.721	5.091	4.739	5.591	5.248	3.799	6.255	8.861	7.121
-3	7.469	5.253	4.730	5.597	4.925	3.799	7.721	7.254	7.174
-4	7.976	5.741	5.091	5.840	4.873	3.799	7.469	7.251	7.355
1969-1	9.051	5.941	5.348	5.883	4.942	3.799	7.976	6.255	8.054
-2	7.791	6.243	5.792	5.753	4.863	3.799	9,051	7.721	8.072
-3	11.313	6.768	6.401	6.001	5.113	3.799	7.791	7.469	9.033
-4	4.612	6.881	6.633	5.799	4.995	3.799	11.313	7.976	8.192

Source: Worksheets.

Table 2.9 (concl'd.)

Deviations of Actual from Predicted Wage Change ($\dot{w}_t - \hat{\dot{w}}_t$)								Price Change		
Regression Models				Naive Models				Actual	Predicted	Deviation
(5.1)	(5.3)	(5.5)	(5.7)	(5.22)	(5.23)	(5.24)	(5.25)	($\dot{p}_t$)	$\hat{\dot{p}}_t$ (5.36)	($\dot{p}_t - \hat{\dot{p}}_t$)
-0.677	-1.220	0.006	-0.577	0.310	-0.651	-0.392	-0.065	2.476	2.193	0.282
0.284	-0.215	0.783	0.199	1.713	1.403	2.342	0.753	2.939	2.638	0.301
0.032	-0.475	0.448	-0.182	1.608	-0.105	0.750	0.459	3.476	2.911	0.565
-0.193	-0.721	0.133	-0.564	1.738	0.130	0.778	0.396	3.786	3.583	0.204
0.711	0.235	0.935	0.279	3.048	1.310	2.738	1.022	3.900	3.927	-0.027
0.550	0.162	0.611	0.025	2.673	-0.375	0.960	0.407	3.902	4.111	-0.209
1.090	0.843	0.861	0.383	2.874	0.200	1.266	0.290	3.030	4.190	-1.160
1.601	1.427	1.280	0.877	3.062	0.188	1.324	0.148	3.322	3.393	-0.071
2.439	2.367	1.945	1.631	3.455	0.393	0.407	0.439	4.029	3.784	0.246
2.596	2.593	2.004	1.757	3.452	-0.270	0.779	0.242	3.801	4.212	-0.411
1.419	1.560	0.856	0.845	2.456	-0.996	-0.417	-0.650	4.537	3.917	0.620
2.630	2.982	2.130	2.473	3.922	1.466	0.860	0.601	4.115	4.810	-0.695
2.215	2.739	1.872	2.544	3.670	-0.252	0.215	0.295	3.586	4.379	-0.793
2.235	2.884	2.136	3.103	4.177	0.507	0.724	0.620	4.191	4.082	0.109
3.110	3.702	3.168	4.109	5.250	1.075	2.796	0.997	3.817	4.762	-0.945
1.348	1.999	2.038	2.928	3.992	-1.260	0.070	-0.280	4.773	4.250	0.543
4.545	4.912	5.312	6.180	7.514	3.522	3.844	2.280	4.893	5.865	-0.972
-2.269	-2.022	-1.188	-0.383	0.813	-6.701	-3.364	-3.580	4.510	4.713	-0.203
Sum of Squared Deviations										
74.528	90.502	69.410	94.188	219.532	68.015	54.748	22.846			5.815
Root Mean Square Deviations										
2.036	2.243	1.944	2.880	3.492	1.945	1.745	1.127			0.568

The Trade-Off: Some Explorations

These test results thus tend to confirm those presented earlier on the basis of re-estimated equations. The original wage change equations no longer seem to fit the data very satisfactorily (although the price change equation appears to continue to hold tolerably well),[1] and the trade-off seems to have become more unfavourable.[2]

[1]No explicit tests of the price equation against naive projections were attempted.

[2]These results are qualitatively unaltered if one substitutes the original equations based upon the period of best fit, 1953-60, for those of 1953-65.

CHAPTER 3

THE STRUCTURE OF UNEMPLOYMENT

1. Introduction

The previous chapter has provided some empirical verification of the proposition that trade-off relations and Phillips curves may be rather unstable over moderately long periods. One of the reasons for such instability relates to changes in the structure of unemployment. There are really two aspects related to this matter. The first concerns Lipsey's[1] demonstration, more recently refined by Archibald,[2] that, for any given average level of unemployment, the aggregate Phillips curve is higher, the larger the scatter of the component rates in the individual markets of which the aggregate (average) is composed. The second relates to the question of structural unemployment[3] or, more broadly, the structure of unemployment. If that structure has, in the relevant sense, deteriorated, then a given unemployment rate will represent a tighter labour market than

---

[1]R. G. Lipsey, "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957: A Further Analysis", *Economica* 27(February 1960):1-31.

[2]G. C. Archibald, "The Phillips Curve and the Distribution of Unemployment", *American Economic Review* 59, no. 2(May 1969):124-34; and "The Structure of Excess Demand for Labor", in E. S. Phelps (ed.), *Microeconomic Foundations of Employment and Inflation Theory* (New York: Norton, 1970), pp. 212-23.

[3]See, e.g., John Vanderkamp, "An Application of Lipsey's Concept of Structural Unemployment", *Review of Economic Studies* 33(3), No. 95 (July 1966):221-26.

before -- more of the unemployed do not constitute excess supply of a relevant sort, or their weight in the market may be less.[1]

The structure of unemployment classified by region, industry, occupation, and duration is studied to discover what systematic relations there were between average unemployment rates on the one hand, and the several specific rates comprising the structure and their dispersion, on the other. One important question is whether there were any shifts in these relations.

Age-sex composition was not initially studied, for several reasons. First, despite Perry's success,[2] which came to light after this work had been completed, the writer remains unconvinced that this is a classification of labour structure relevant to questions of market behaviour.[3] Second, comprehensive unemployment data by age and sex are not regularly published by Statistics

---

[1]G. L. Perry, "Changing Labor Markets and Inflation", *Brookings Papers in Economic Activity* 3(1970):411-41, argues that such a deterioration has indeed taken place in the United States, basing his argument not on structural unemployment, as such, but upon the necessity of weighting the impact of the unemployed on wage changes, by the productivity, hours, etc. they would have if they were employed. The point turns out to be of lesser generality than its superficial plausibility has led many to suppose (see S. F. Kaliski and N. Swan, "Corrected Unemployment Rates and the Phillips Curve: A Comment", unpublished, 1972), but it is clearly relevant.

An important theoretical consideration raised in the discussion of Perry's work by Solow and by Schultz (Perry, "Changing Labor Markets...", pp. 442-48), concerns the relevance of measures of scatter, also used by Perry, where the markets in question are neither homogeneous nor compartmentalized, but deal in imperfectly substitutable labour. Unfortunately, this came to my attention after most of the work on this paper had been completed.

[2]I share the scepticism expressed by Solow and others, in discussion of Perry's paper, as to what the success of models containing such ex-post specifications really proves (Perry, "Changing Labor Markets...", pp. 442-48).

[3]But in view of the well-known deficiencies of the occupational classification, one is a little hard put to argue that it is a far worse indicator of relevant attributes of skill, experience, etc.

Canada. A set of monthly data by broad age-sex group was published after the body of this chapter was completed, however, and these are examined in the appendix.

It should be confessed at the outset that what follows is impressionistic in the extreme. No questions are asked about the determinants of the various structures examined.[1] Worse but related, the dates at which breaks in the various relations are looked for are not arrived at from independent information. Instead, they come from a cursory graphic examination of the data that enter into these relations themselves. The reason for resorting to this circular procedure is that the rather vague reasons which lead one to look for changes in structure or in dispersion, changes in demand for a subgroup's product, the impact of technical change, the economy's response to government policy, etc., provide only the broadest clues as to dating.

2. Canada and the United States

One might start with the broadest possible framework, considering Canada as a region of North America, and return to the observation that Canadian and U.S. unemployment rates diverged to an unusual degree from the beginning of 1967 until recently.[2] Since the two economies are clearly linked, this suggests that the external environment has become more inflationary. Any oversimplified or truncated Canadian trade-off that neglects such variables as American wage and price changes, or treats them as parameters, would therefore be likely to shift. Expectations, too, may be affected by conditions south of the border.

Unfortunately, there was at the beginning of 1967 an alteration in U.S. survey reporting practices. This was said to result in minor changes, however, at least in the aggregate.[3] However that might be, one would think that, in itself, this statistical change would be more likely to result in a once-and-for-all

---

[1]My colleague N. M. Swan is currently examining regional unemployment in a more comprehensive fashion.

[2]See Economic Council of Canada, *Performance and Potential: Mid-1950's to Mid-1970's* (Ottawa: Information Canada, 1970), Chart 6.

[3]U.S. Bureau of Labor Statistics, *Employment and Earnings*, February 1967, pp. 5ff. According to the Bureau, the impact on the average 1966 rate of unemployment was only 0.1 percentage point.

shift in the relative level of the two series than in a progressive drifting apart, with the U.S. rate falling absolutely as well as in relation to the Canadian one, which rose.

To test the proposition that there had, in fact, been a change in the relation between the two rates, the seasonally adjusted monthly unemployment rate for Canada was regressed upon that for the United States. Selected results for January 1953 to April 1970[1] are shown in Table 3.1. Briefly, the original time series yield a reasonable and apparently well-fitting relation between the two rates. This is improved by the introduction of a shift in January 1967 and further improved by a trend starting thereafter.[2] The results would seem to indicate that the Canadian rate has typically moved by the same percentile as the American but was on average lower by 0.5 per cent. In January 1967, this difference in levels was eliminated (possibly, in part, for statistical reasons), and thereafter the Canadian rate rose on average by 0.03 per cent per month in relation to the American.

Taken seriously, the first half of Table 3.1 seems to tell a plausible enough story, showing evidence of both a statistical adjustment and change in structure.

[1]All the results reported in this chapter are based on data starting in 1953, or with the first available observation if later, terminating at the last observation available when the particular piece of work was begun. When this seemed worthwhile, the work was subsequently updated. The particular relation reported was updated to September 1970 for some sample calculations, with no noticeable change.

[2]A trend starting in October 1967, instead, yielded practically identical results.

Table 3.1

REGRESSION OF CANADIAN ON U.S. UNEMPLOYMENT RATES
SEASONALLY ADJUSTED MONTHLY DATA, 1953-70

Constant	U_{us}	Shift	Trend	$\bar{R}^2$	*D.W.*	ρ
		I. Original Data				
0.473	0.940			.673	0.18	
[2.11]	[20.60]					
-0.513	1.106	1.03		.747	0.27	
[2.19]	[24.39]	[7.84]				
-0.524	1.108	0.499	0.028	.757	0.28	
[2.29]	[24.94]	[2.31]	[3.09]			
		II. Autoregressive Transformation				
4.400	0.180			.022	2.11	.97
[6.26]	[2.38]					
0.386	0.377	0.030		.101	1.82	.88
[7.52]	[4.86]	[0.60]				
0.386	0.379	0.016	0.001	.097	1.82	.88
[7.50]	[4.96]	[0.18]	[0.19]			

Note: U_{us} - U.S. unemployment rate, monthly, seasonally adjusted.
Shift - 1953 to 1966 = 0; 1967 on = 1.
Trend - 1953 to January 1967 = 0; February 1967 = 1, etc.
$\bar{R}^2$ - coefficient of determination, corrected.
D.W. - Durbin-Watson statistic.
ρ - coefficient of (first-order) autocorrelation.

Source: Dominion Bureau of Statistics, *Canadian Statistical Review*, Cat. No. 11-003; U.S. Department of Commerce, *Survey of Current Business*, various years.

Unfortunately it is far from clear whether one is entitled to take it seriously. All the results based upon original data are characterized by *D.W.* statistics, indicating a high probability of positive autocorrelation in the residuals.[1] When this autocorrelation is eliminated by transforming the data,[2] the apparent significance of the regression declines sharply, as one would expect. What is far more damaging, however, is that while the relation between the two unemployment rates remain significant at the 95 per cent level of confidence, values of the coefficients are greatly changed and no longer believable. The shift and trend variables cease to exert any influence.

One is tempted to argue that all of this is scarcely surprising since, with the elimination of seasonality by prior adjustment and of much cyclical fluctuation by an autoregressive transformation, there are few possibilities of co-variation left. Be that as it may, one is not entitled to rely upon the untransformed relation either and is forced to conclude that the evidence of a change in the relation is inconclusive, at best.

3. Regions of Canada

The general patterns of relative severity of unemployment by region are familiar from earlier work.[3] The question here is simply whether this pattern and the dispersions of unemployment rates resulting from it have altered recently. There would appear to be some evidence that they have.[4]

---

[1]Throughout this Study, the autoregressive transformations are based upon the Hildreth-Lu method. This procedure selects, within a specified range and in steps of specified size, that autoregressive coefficient (p) which comes closest to yielding uncorrelated residuals. See C. Hildreth and J. Y. Lu, *Demand Relations with Autocorrelated Disturbances*, Michigan State University Agricultural Experimental Station, Technical Bulletin 276, November 1960.

[2]Especially Frank T. Denton, *An Analysis of Interregional Differences in Manpower Utilization and Earnings*, Economic Council of Canada Staff Study No. 15 (Ottawa: Queen's Printer, 1966).

[3]See Economic Council of Canada, *Performance and Potential*, pp. 37-39, for additional discussion.

[4]With relations as ad hoc as these, of course, this is very likely to be a sign of misspecification.

The data themselves suggested some possibility of a change beginning with 1969, and this was investigated more formally, using seasonally adjusted[1] monthly data on unemployment rates for Canada and the five regions for 1953 through 1970. The unemployment rate in each region was regressed on that for Canada and, in order to avoid spurious correlation, on that for Ontario. A shift beginning in January 1969 and a trend starting at that date were both tried. The latter invariably gave better results in those equations which were statistically the most defensible -- i.e., regressions of other regions on Ontario, transformed when necessary to avoid autocorrelation of residuals.[2] This would suggest that the change, if any, took place gradually over the past two years rather than occurring as a once-and-for-all shift in the regional pattern. For all regions but the Atlantic, it would appear that the trend was statistically significant at the 5 per cent level and that it represented a deterioration in their relative positions, compared with that of Ontario. It will readily be appreciated that with a period as short as two years, one cannot tell permanent shifts in the regional patterns from "special circumstances".[3]

The detailed regression results are presented in Tables 3.2 and 3.3. The former contains the more familiar relation of each region to Canada as a whole; the latter, the statistically more defensible one of each region to Ontario.

The results based upon original data on the relation of the several regional unemployment rates to those for Canada and for Ontario are largely consistent

[1]The decision to use seasonally adjusted data implies that one has relinquished the hope of investigating regional seasonal patterns and changes in them. This is, indeed, the case. The subject is of considerable interest but too large in scope to be incorporated here. Moreover, if the change in seasonal patterns is at all recent, the usual method of detecting seasonality will not permit one to isolate it.

[2]The introduction of either trend or shift into the regressions did not noticeably affect the simple regression coefficients estimated between the regional and Canadian (Ontario) unemployment rates, or their standard errors.

[3]Again, see Economic Council of Canada, *Performance and Potential*, pp. 37-39.

and in agreement with earlier work. But they are characterized by quite unsatisfactory Durbin-Watson statistics. When the problem of autocorrelation is corrected by transforming the variables, the results for Canada are little affected.[1] The most marked change is in the regression for British Columbia, where the slope declines somewhat and the constant changes sign and loses significance.

The results for Ontario, unfortunately, are less stable under transformation. The slopes all decline sharply in value, and the constants rise. As a result, the picture that emerges is no longer consistent with that for Canada. The slope in each regional equation is lower with respect to Ontario than it is with respect to Canada, although the slope for Ontario with respect to Canada is little more than 0.8. Roughly speaking,[2] this would imply a smaller relative amplitude of fluctuations in unemployment rates for each of the other four regions relative to Ontario than relative to the country as a whole, in spite of the fact that Ontario's fluctuations are smaller than the national average. Worse yet, British Columbia and Quebec have slopes larger than one with respect to Canada, but smaller than one with respect to Ontario.[3]

---

[1]Except, of course, for reduced R^2's and t values.

[2]It must be stressed that this interpretation of the magnitude of the slope coefficient as an indicator of the relative amplitude of fluctuations is very rough indeed. It is strictly correct only if all the fluctuations are exactly coincidental. This is certainly not the case, and much more refined time-series analysis would be needed to permit one to comment in detail on questions of levels, lags, and relative amplitudes.

[3]This result appears to be a genuine statistical effect rather than some peculiarity of the Ontario figures. Neil Swan, using rather different concepts of nonseasonal unemployment, ran into the same phenomenon when he corrected for autoregression and got rid of the "error in variable" problem involved in the Canada regressions by two-stage least squares (unpublished). Any above-average difference in phase between unemployment fluctuations in Ontario and those in the other regions of the country could, however, account for the phenomena reported. As an additional check, the other four regions were regressed on Quebec. Once more, the autoregressive transformation resulted in a sharp reduction of slopes to values that remain statistically significant but are not believable.

Table 3.2

REGRESSION OF REGIONAL UNEMPLOYMENT RATES ON RATE FOR CANADA
SEASONALLY ADJUSTED MONTHLY DATA, 1953-70

Region	Constant		Canada		Shift January 1969		Trend January 1969=1		R^2	*D.W.*	ρ
	Coeffi-cient	*t*	Coeffi-cient	*t*	Coeffi-cient	*t*	Coeffi-cient	*t*			
Atlantic	0.910	[3.32]	1.506	[28.49]	-1.329	[6.03]			.794	0.54	--
	0.984	[1.54]	1.483	[12.37]	- .990	[2.13]			.423	2.44	0.750
	0.746	[1.33]	1.541	[14.31]			-0.108	[3.51]	.492	2.36	0.704
British Columbia	-0.960	[4.72]	1.333	[34.23]	0.195	[1.20]			.849	0.58	--
	0.136	[0.28]	1.108	[12.39]	0.272	[0.78]			.423	2.23	0.750
	0.204	[0.43]	1.091	[12.00]			0.032	[1.21]	.426	2.23	0.750
Ontario	-0.401	[5.36]	0.818	[56.66]	-0.249	[4.14]			.938	0.83	--
	-0.398	[2.84]	0.817	[30.41]	-0.206	[1.91]			.814	2.21	0.587
	-0.422	[2.90]	0.820	[29.16]			-0.011	[1.35]	.804	2.23	0.600
Prairie	-0.062	[0.53]	0.631	[27.91]	0.407	[14.32]			.796	0.843	--
	-0.057	[0.26]	0.631	[15.16]	0.364	[2.18]			.533	2.13	0.579
	-0.017	[0.09]	0.614	[15.72]			0.035	[3.24]	.577	2.09	0.544
Quebec	0.551	[5.66]	1.210	[66.30]	0.427	[5.44]			.953	0.917	--
	0.567	[3.32]	1.209	[37.01]	0.362	[2.75]			.869	2.32	0.536
	0.597	[3.18]	1.207	[33.29]			0.015	[1.51]	.847	2.36	0.577

Note: R^2 -- coefficient of determination, uncorrected.
D.W. -- Durbin-Watson statistic.
ρ -- coefficient of (first-order) autocorrelation; dashes mean that no transformation has been carried out.

Source: Dominion Bureau of Statistics, *Canadian Statistical Review*, Cat. No. 11-003; and DBS, *Seasonally Adjusted Labour Force Statistics 1953-1969*, Cat. No. 71-201.

Table 3.3

REGRESSION OF UNEMPLOYMENT RATES OF OTHER FOUR REGIONS ON RATE FOR ONTARIO
SEASONALLY ADJUSTED MONTHLY DATA, 1953-70

Region	Constant Coefficient	Constant t	Ontario Coefficient	Ontario t	Shift January 1969 Coefficient	Shift January 1969 t	Trend January 1969=1 Coefficient	Trend January 1969=1 t	R^2	$D.W.$	ρ
Atlantic	2.396	[7.85]	1.637	[20.70]	-0.852	[3.07]	--	--	.671	0.50	--
	4.688	[8.14]	1.018	[7.23]	-0.695	[1.27]	--	--	.202	2.21	0.750
	4.604	[8.06]	1.045	[7.35]	--	--	-0.059	[1.42]	.204	2.22	0.750
British Columbia	0.055	[0.27]	1.531	[28.86]	0.609	[3.28]	--	--	.799	0.724	--
	2.760	[6.50]	0.800	[7.70]	0.491	[1.22]	--	--	.223	1.87	0.750
	2.818	[6.73]	.771	[7.41]	--	--	0.065	[2.12]	.234	1.86	0.750
Prairie	0.525	[4.17]	0.696	[21.35]	0.606	[5.30]	--	--	.697	0.833	--
	1.809	[6.14]	0.358	[4.96]	0.431	[1.54]	--	--	.113	2.28	0.750
	1.860	[6.42]	0.344	[4.64]	--	--	0.053	[2.51]	.129	2.30	0.750
Quebec	1.623	[10.55]	1.349	[33.83]	0.808	[5.78]	--	--	.848	0.850	--
	3.823	[11.08]	0.773	[9.16]	0.477	[1.45]	--	--	.289	2.20	0.750
	3.880	[11.38]	0.750	[8.85]	--	--	0.053	[2.13]	.297	2.19	0.750

Note: R^2 — coefficient of determination, uncorrected.
$D.W.$ -- Durbin-Watson statistic.
ρ -- coefficient of (first-order) autocorrelation; dashes mean that no transformation has been carried out.

Source: Dominion Bureau of Statistics, *Canadian Statistical Review*, Cat. No. 11-003; and DBS, *Seasonally Adjusted Labour Force Statistics 1953-1969*, Cat. No. 71-201.

Obviously, the clarity of the results is marred by this instability of the regressions between the other regions and Ontario to autoregressive transformation. Nevertheless, the one finding of particular interest persists. In 1969 and 1970, unemployment rates in Ontario and the Atlantic Provinces appear to be higher, and those in the other three regions lower, in relation to the national average, than before. Some of these changes appear to be statistically significant.

One would expect that the changes in the regional patterns of unemployment just described might produce corresponding changes in the relation between the overall level of unemployment and the dispersion of regional unemployment rates. This is not quite certain, however, nor is the direction of change, since three of the changes -- those for the Atlantic Provinces, the Prairies and British Columbia -- tended to move observations closer to the average, and the remaining two -- those for Ontario and Quebec -- to move further away from it. To check on the net result, a regression of the unweighted variance of regional unemployment rates on their (simple) mean[1] was fitted, and a shift or trend was introduced in January 1969. The results shown in Table 3.4 suggest that there has been a decline in variance for given values of mean unemployment after 1968 and that a trend captures this effect better than a shift.[2] In trend form, the change remains significant even after an autoregressive transformation of the data.

It is worth noting, parenthetically, that while the value of the variance is certainly dependent upon that of the mean, the correlation is far from perfect, even with data in original form. It follows that something might be gained by including a measure of regional dispersion in Phillips curve regressions in order to capture the aggregation effect.[3]

[1]There is some ambiguity in the literature as to whether simple or weighted measures of dispersion are more appropriate for regional analysis. See, e.g., S. E. Chernick, *Interregional Disparities in Income*, Economic Council of Canada Staff Study No. 14 (Ottawa: Queen's Printer, 1966), p. 14.

[2]An analysis of residuals suggested that there was some danger of spurious results because the relationship was nonlinear. The introduction of a squared mean term, however -- either instead of, or in addition to, the linear relation -- did not alter the results.

[3]See the discussion on pp. 5 and 6 above and articles cited on p. 35 above.

Table 3.4

REGRESSION OF THE VARIANCE OF REGIONAL UNEMPLOYMENT RATES ON THEIR MEAN, SEASONALLY ADJUSTED MONTHLY DATA, 1953-70

Constant		Mean U		Shift January 1969		Trend January 1969=1		R^2	$D.W.$	ρ
Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t			
-2.735	[7.31]	1.287	[19.60]	-1.290	[4.27]			.648	0.50	--
-4.202	[4.65]	1.538	[10.04]	-0.990	[1.52]			.326	2.29	0.774
-4.234	[5.02]	1.563	[10.74]			-0.131	[2.79]	.354	2.27	0.753

Note: R^2 -- coefficient of determination, uncorrected.
$D.W.$ -- Durbin-Watson statistic.
ρ -- coefficient of (first-order) autocorrelation; dash means that no transformation has been carried out.

Source: Dominion Bureau of Statistics, *Canadian Statistical Review*, Cat. No. 11-003; and DBS, *Seasonally Adjusted Labour Force Statistics 1953-1969*, Cat. No. 71-201.

4. Occupation and Industry

The results for occupations and industries are shown in Tables 3.5 to 3.7 and can be reported upon rather briefly. The quarterly average unemployment rates for each occupational and industry group were regressed on the average unemployment rate for Canada (including those who have never worked).[1] To avoid problems of spurious correlation, the other groups were also regressed on the specific rates for the Craftsmen group[2] and for Manufacturing, respectively. The results are largely what one would expect and are consistent between the two sorts of regression. The rates for Labourers, Transportation, and Craftsmen show above-average -- and those for the other occupational groups, below-average -- amplitudes of fluctuations.[3] Of the industry groups, Construction shows much-above-average fluctuations; Primary Industries, Transportation, and Manufacturing, about-average; and Trade and the Service Industries, much-below-average.

The fit of the regressions appears good, perhaps because of the inclusion of seasonal influences in the explanation. The Durbin-Watson statistics are not entirely satisfactory, but it was not thought worthwhile to correct for autocorrelation in view of the limited interest of the results, from the point of view of this Study. There were no indications of changes in structure and none were formally tested for.

The relations between the variances of occupational and industrial unemployment rates and their means are shown in Table 3.7. It will be seen that the correlation is very high; and the seasonal effects, few of which are significant, appear to contribute little to this result. This would suggest that there is little to be gained by including measures of occupational and industrial scatter in Canadian trade-off equations.

---

[1]The classification of unemployed persons by industry and occupation is based upon their last employment and so leaves out those who have never had a job. Thus total unemployment includes, in addition to the several occupational or industrial categories, a residual class of "never worked".

[2]Craftsmen, production process and related workers.

[3]See fn. 2, p. 42 above, for qualification of this statement.

Table 3.5

REGRESSION OF UNEMPLOYMENT RATES OF VARIOUS OCCUPATION GROUPS ON THOSE FOR CANADA, AND FOR CRAFTSMEN, ETC., QUARTERLY DATA, 1961-1 TO 1970-3

Occupation Group	Constant	U_{Canada}	Seasonal Dummies Q^1	Q^2	Q^3	R^2	D.W.
Office and Professional	0.274 [2.49]	0.320 [14.43]	-0.182 [1.89]	-0.034 [0.44]	0.226 [2.95]	0.900	0.652*
Transportation	-1.334 [4.13]	1.512 [23.18]	1.031 [3.63]	0.468 [2.03]	-0.381 [1.69]	0.977	1.480
Service and Recreation	1.230 [5.41]	0.636 [13.85]	-0.461 [2.31]	-0.283 [1.74]	0.004 [0.03]	0.890	1.346
Primary	0.471 [1.71]	0.883 [15.90]	2.046 [8.46]	-0.181 [0.93]	-1.309 [6.80]	0.977	1.405
Craftsmen, etc.	-0.549 [1.98]	1.342 [23.995]	0.552 [2.27]	-0.243 [1.23]	0.407 [2.10]	0.977	1.499
Labourers	1.861 [2.32]	2.677 [16.55]	3.528 [5.01]	-0.135 [0.24]	-2.530 [6.52]	0.969	0.855*

(cont'd.)

Table 3.5 (concl'd.)

Occupation Group	Constant	$U_{Craftsmen}$	Seasonal Dummies Q^1	Q^2	Q^3	R^2	$D.W.$
Office and Professional	0.446 [4.32]	0.230 [13.92]	-0.281 [2.69]	0.030 [0.38]	0.315 [3.93]	0.894	0.701*
Transportation	-0.412 [1.06]	1.069 [17.07]	0.651 [1.65]	0.795 [2.63]	0.017 [0.06]	0.960	1.210
Service and Recreation	1.716 [6.33]	0.431 [9.91]	-0.543 [1.98]	-0.129 [0.62]	0.152 [0.72]	0.829	1.215
Primary	0.977 [3.54]	0.631 [14.24]	1.798 [6.45]	0.003 [0.02]	1.070 [4.98]	0.972	0.954*
Labourers	3.506 [4.05]	1.890 [13.62]	2.864 [3.28]	0.445 [0.66]	-1.827 [2.72]	0.956	0.529*

Note: R^2 -- coefficient of determination, uncorrected.

$D.W.$ -- Durbin-Watson statistic. One asterisk indicates less than 1 per cent chance that residuals are not autocorrelated; two asterisks indicate more than 1 per cent chance. Those with no asterisk fall in the indeterminate range.

Q^i -- quarterly dummies.

Figures in brackets are t-statistics.

Source: Dominion Bureau of Statistics, *The Labour Force*, Cat. No. 71-001.

Table 3.6

REGRESSION OF UNEMPLOYMENT RATES OF VARIOUS INDUSTRY GROUPS ON THAT FOR CANADA, AND FOR MANUFACTURING, QUARTERLY DATA, 1961-1 TO 1970-3

Industrial Group	Constant	U_{Canada}	Seasonal Dummies Q^1	Q^2	Q^3	R^2	D.W.
Primary Industries	-0.103 [0.330]	0.994 [15.73]	1.929 [7.01]	0.325 [1.46]	-1.067 [4.88]	0.971	1.329
Manufacturing	0.124 [0.56]	0.930 [20.79]	-0.416 [2.13]	-0.357 [2.26]	-0.122 [0.79]	0.958	1.172
Construction	-3.006 [3.90]	3.193 [20.54]	4.259 [6.29]	-0.185 [0.34]	-1.841 [3.42]	0.978	1.534**
Transportation and Utilities	-0.235 [0.73]	0.986 [15.06]	1.017 [3.57]	-0.092 [0.39]	-0.484 [2.13]	0.955	0.699*
Trade	0.048 [0.305]	0.629 [19.608]	0.158 [1.134]	0.224 [1.98]	0.332 [2.99]	0.958	1.559**
Service	0.829 [5.47]	0.421 [13.78]	-0.332 [2.50]	-0.219 [2.03]	0.075 [0.71]	0.894	1.096

(cont'd.)

Table 3.6 (concl'd.)

Industrial Group	Constant	$U_{Manufacturing}$	Seasonal Dummies Q^1	Q^2	Q^3	R^2	D.W.
Primary Industries	0.141 [0.35]	0.976 [11.39]	2.565 [7.65]	0.746 [2.60]	-0.988 [3.43]	0.951	0.778*
Construction	-2.488 [2.45]	3.202 [15.02]	6.165 [7.39]	1.139 [1.60]	-1.551 [2.16]	0.961	0.977*
Transportation	0.049 [0.11]	0.958 [10.60]	1.669 [4.72]	0.330 [1.09]	-0.411 [1.35]	0.920	0.785*
Trade	0.133 [0.68]	0.635 [15.37]	0.525 [3.25]	0.483 [3.50]	0.392 [2.82]	0.934	0.883*
Service	0.973 [4.83]	0.404 [9.56]	-0.043 [0.26]	-0.037 [0.26]	0.103 [0.73]	0.810	0.865*

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic. One asterisk indicates less than 1 per cent chance that residuals are not autocorrelated; two asterisks indicate more than 1 per cent chance. Those with no asterisk fall in the indeterminate range.

Q^i -- quarterly dummies.

Figures in brackets are *t*-statistics.

Source: Dominion Bureau of Statistics, *The Labour Force*, Cat. No. 71-001.

Table 3.7

REGRESSION OF THE VARIANCES OF OCCUPATION AND INDUSTRIAL UNEMPLOYMENT RATES ON THEIR MEAN AND MEAN SQUARED, QUARTERLY DATA, 1961-1 TO 1970-3

Equation				Seasonal Dummies				
Occupations	Constant	Mean U	(Mean U)^2	$Q1$	$Q2$	$Q3$	R^2	$D.W.$
(1)	-28.388	7.593	--	2.059	-2.291	2.487	.952	1.47
	[8.66]	[14.82]		[0.66]	[1.02]	[1.08]		
(2)	-21.665	7.597	--	2.203	-1.919	4.780	.961	1.98**
	[7.83]	[14.63]		[0.74]	[0.92]	[2.01]		
(3)	0.258	--	0.425	4.695	-0.227	1.804	.979	1.09
	[0.228]		[23.30]	[2.37]	[0.15]	[1.22]		
(4)	0.128	0.037	0.423	4.634	-0.239	-1.781	.979	1.09
	[0.03]	[0.03]	[6.49]	[2.16]	[0.16]	[1.06]		
Industries								
(1)	-38.642	9.884	--	-1.358	-4.642	5.725	.913	1.55**
	[8.10]	[11.61]		[0.27]	[1.28]	[1.57]		
(3)	-6.497	--	0.626	1.599	-1.916	0.871	.983	1.68**
	[5.30]		[29.17]	[0.78]	[1.23]	[0.56]		
(4)	-12.210	-5.435	0.925	6.044	0.062	2.231	.993	1.88**
	[3.99]	[6.36]	[18.76]	[3.86]	[0.056]	[1.90]		

Note: R^2 -- coefficient of determination, uncorrected.

$D.W.$ -- Durbin-Watson statistic. One asterisk indicates less than 1 per cent chance that residuals are not autocorrelated; two asterisks indicate more than 1 per cent chance. Those with no asterisk fall in the indeterminate range.

Q^i -- quarterly dummies.

Figures in brackets are t-statistics.

The two variables (not the dummies) of (1) were subjected to autoregressive transformation.

Source: Dominion Bureau of Statistics, *The Labour Force*, Cat. No. 71-001.

The fit seems even better if the square of mean unemployment is substituted for the mean[1] and, in the case of industries, the result of including both is even better.

5. Duration

There is no clear correspondence between the duration of unemployment and "structural" or "chronic" unemployment.[2] One might suppose, with Holt,[3] that prolonged unemployment will lead to a lowering of a job-seeker's aspirations and thus, in the aggregate, exert a more depressing effect on wages than shorter unemployment of the same magnitude. But it is far from clear whether the impact on individual aspirations of long uninterrupted unemployment is any more shattering than that of repeated shorter spells of unemployment interspersed with brief job-holding and loss of work. Yet the two patterns would show a very different structure of unemployment by duration. And the really long-term unemployed may well cease to affect the labour market at all. Those on temporary layoff may also exert no direct pressure on the market since they are not seeking work. But employers laying off men may well simultaneously cancel their vacancies. Thus a given level of unemployment, more of which is in the form of layoffs, might well represent no tighter labour market than if more of the unemployed sought work and vacancies were correspondingly higher.

---

[1] In the case of occupations, this improvement may be illusory, since the increase in the coefficient of multiple correlation is accompanied by a decline in the Durbin-Watson statistic.

[2] See G. P. Penz, *Structural Unemployment, Theory and Measurement*, Canada Department of Manpower, Ottawa, 1969, for one point of view on this general question. More recently, Hall concluded from a study of American data that: "Chronic inability to find a job is not a problem faced by a significant number of people when the economy is at full employment. The real problem is that many workers have frequent short spells of unemployment." R. E. Hall, "Why Is the Unemployment Rate So High at Full Employment", *Brookings Papers on Economic Activity* 3(1970):369-402, esp. p. 387.

[3] C. C. Holt, "Job Search, Phillips' Wage Relation, and Union Influence", Phelps, *Microeconomic Foundations...*, pp. 53-123 and elsewhere.

In spite of this lack of clarity[1] as to the connection between duration of unemployment and the trade-off, some analysis of the duration structure of unemployment was carried out. The author's general predilection is to view "very long" and "temporary" unemployment as leading to a more unfavourable trade-off at a given level of unemployment than "medium-term" unemployment. He is less clear whether the category of "more than six months" in Canadian data represents "very long" unemployment.

In any event, it turns out that the relations between unemployment of various durations, like those between occupation and industry groupings, reveal little that is novel or of particular interest to this Study. Selected regressions are shown in Tables 3.8 and 3.9. Both use average quarterly data for 1953 to 1969. The first show regressions of the number of unemployed in each duration category on total unemployment, seasonal dummies, and a time trend; the second, regressions of the percentage of all unemployed in each category on the unemployment rate and time series variables.

The absolute number of persons on temporary layoff and in each category of work-seekers[2] increases with the total of the unemployed. The constants in the original equations are positive for layoffs and for those seeking work for less than a month, suggesting that the unemployed in these two categories decline as a fraction of the total as the total number of unemployed increases. For those seeking work for four to six months and for more than six months, the constants are negative. They are indeterminate[3] for those seeking work for one to three months, and become so for those on layoffs and those seeking more than six months under autoregressive transformation needed to reduce autocorrelation in the residuals.

---

[1]And, in part, it must be confessed, because it was done when I thought the link was clearer.

[2]These are (1) under one month, (2) one to three months, (3) four to six months, and (4) more than six months.

[3]Unfortunately, from the point of view of the clarity of this particular piece of interpretation, the regressions upon which these comments are based were fitted with quarterly dummies. Thus it is possible for the constants to be positive for some quarters and negative for others.

Since the number of unemployed is not a very convenient indicator of tightness in the labour market, another set of regressions was run, relating the percentage distribution of unemployment by duration category to the unemployment rate. The results, to the extent that they are comparable, are largely consistent.[1] Those on temporary layoff and those seeking work for less than a month each become a smaller fraction of the unemployed as the unemployment rate increases. The fraction of all unemployed seeking work for one to three months appears to be unaffected by the unemployment rate. Those seeking work for each of the two longer periods become a larger fraction of the total as the rate rises.[2]

Neglecting the spurious correlation involved, the two sets of relations fit rather well. For some categories, the fit is improved or not much reduced by the introduction of leads and lags which, formally at least, free the regressions from spurious correlation. Most of the trends tried proved insignificant in both sorts of regressions.[3] Table 3.8 suggests a gradual increase in the number seeking work for less than a month, exactly offset by the gradual decline in the number of those seeking for four to six months. In Table 3.9 there is some (uncertain) evidence of a gradual decline in the relative importance of layoffs and increase in the relative importance of those seeking work for over six months, at given rates of unemployment.

Finally, Table 3.9 shows that the median number of months in unemployment is positively related to the unemployment rate, and, even more strongly so, to the rate lagged a quarter.

---

[1]Apart from the fact that they contain different explanatory variables, the two sets of equations suffer from difficulties of spurious correlation with opposite biases.

[2]The relation of the fraction seeking work for six months or more to the unemployment rate does not persist after autoregressive transformation, however.

[3]So also did some tentative indications of a shift after 1967 in the regressions pertaining to the number on layoff and seeking for over six months.

Table 3.8

REGRESSION OF THE DISTRIBUTION OF UNEMPLOYMENT, BY DURATION, ON TOTAL UNEMPLOYMENT, QUARTERLY DATA, 1953-69

Dependent Variable Number	Constant	Time Trend 1953-I=0	Seasonal Dummies Q^2	Q^3	Q^4	Total Number Unemployed	$\bar{R}^2$	D.W.	ρ
On Layoff	19.18	--	-13.02	-11.95	-10.35	0.036	.78	0.97*	--
	[6.41]		[7.35]	[5.81]	[5.52]	[5.97]			
	8.32	--	-14.23	-5.44	-5.96	0.051	.89	2.50	.584
	[2.78]		[5.42]	[2.03]	[3.13]	[5.44]			
U_{t+1}	20.64	--	-21.14	-20.39	-23.91	0.045	.87	2.49	.360
	[13.30]		[16.21]	[15.76]	[11.99]	[5.97]			
Seeking: less than 1 month	24.16	0.34	1.66	8.99	25.46	0.13	.80	1.86**	--
	[3.92]	[5.36]	[0.44]	[2.03]	[6.35]	[9.53]			
1-3 months	28.78	--	-52.67	-35.12	-30.57	0.36	.97	1.74**	--
	[4.84]		[14.93]	[8.57]	[8.18]	[30.02]			
4-6 months	-30.32	-0.33	30.27	2.29	-6.17	0.28	.94	2.01**	--
	[5.22]		[8.61]	[0.54]	[1.63]	[21.94]			

(cont'd.)

Table 3.8 (concl'd.)

over 6 months	-41.80 [6.57]	--	33.51 [8.89]	35.44 [8.10]	21.31 [5.34]	0.19 [14.27]	.78	0.89*	--
	-9.64 [1.50]	--	30.18 [5.04]	10.89 [1.81]	2.61 [0.63]	0.12 [5.50]	.64	1.53	.631
U_{t-1}	-0.051 [0.02]	--	-24.68 [9.93]	-1.77 [0.90]	2.55 [1.27]	0.17 [14.11]	.87	1.64**	.600

Note: $\bar{R}^2$ -- coefficient of determination, corrected.

D.W. -- Durbin-Watson statistic. One asterisk indicates less than 1 per cent chance that residuals are not autocorrelated; two asterisks indicate more than 1 per cent chance. Those with no asterisk fall in the indeterminate range.

Q^i -- quarterly dummies.

ρ -- coefficient of (first-order) autocorrelation; dashes mean no transformation has been carried out.

U_{t-1} -- Unemployment lagged one quarter.

U_{t+1} -- Unemployment leading by one quarter.

Figures in brackets are *t*-statistics.

Source: Dominion Bureau of Statistics, *The Labour Force*, Cat. No. 71-001.

Table 3.9

REGRESSION OF THE PERCENTAGE DISTRIBUTION OF UNEMPLOYMENT, BY DURATION, AND THE MEDIAN NUMBER OF MONTHS UNEMPLOYED ON THE UNEMPLOYMENT RATE QUARTERLY DATA, 1953-69

Dependent Variable Percentage	Constant	Time Trend 1953-1=0	Seasonal Dummies Q^2	Q^3	Q^4	U_{Canada}	$\bar{R}^2$	D.W.	ρ
On Layoff	15.98	-0.04	-4.49	-4.46	-3.71	-0.90	.41	0.70*	--
	[11.55]	[3.10]	[5.79]	[4.82]	[4.48]	[5.17]			
	4.305	0.004	-4.97	-1.75	-1.77	-0.51	.46	2.37**	.738
	[1.098]	[0.53]	[4.27]	[1.11]	[2.48]	[2.15]			
Seeking: less than 1 month	37.60	--	-1.22	3.27	7.62	-2.25	.84	1.78**	--
	[19.26]		[1.07]	[2.42]	[6.30]	[8.85]			
1-3 months	41.85	--	-13.15	-8.94	-6.94	0.14	.81	1.62**	--
	[25.93]		[14.01]	[7.99]	[6.94]	[0.65]			
4-6 months	6.60	--	9.59	-0.93	2.65	1.67	.91	1.82**	--
	[5.06]		[12.65]	[1.03]	[3.28]	[9.81]			

(cont'd.)

Table 3.9 (concl'd.)

over 6 months	-2.81 [1.45]	0.06 [3.74]	9.20 [8.46]	10.97 [8.48]	5.57 [4.81]	1.34 [5.49]	.61	0.66*	--
	1.79 [1.27]	0.01 [1.08]	6.04 [3.93]	1.32 [0.91]	-2.21 [2.38]	-0.30 [0.96]	.80	1.21*	.759
Median no. of mos. unemployed U_{t-1}	0.99 [7.10]	--	0.71 [8.70]	0.25 [2.54]	-0.06 [0.74]	0.16 [8.77]	.79	1.69*	
	1.28 [25.37]	--	-0.23 [4.93]	-0.47 [12.18]	-0.35 [9.04]	0.20 [20.52]	.94	1.43	

Note: $\bar{R}^2$ -- coefficient of determination, corrected.

D.W. -- Durbin-Watson statistic. One asterisk indicates less than 1 per cent chance that residuals are not autocorrelated; two asterisks indicate more than 1 per cent chance. Those with no asterisk fall in the indeterminate range.

Q^i -- quarterly dummies.

ρ -- coefficient of (first-order) autocorrelation; dashes mean no transformation has been carried out; a number indicates that the dependent variable and U, only, have been transformed.

U_{t-1} -- Unemployment lagged one quarter.

Figures in brackets are t-statistics.

Source: Dominion Bureau of Statistics, *The Labour Force*, Cat. No. 71-001.

6. Conclusions

What, then, can one conclude from this rather lengthy discussion of the structure of unemployment? First, it would appear that relatively high (and rising) unemployment rates in Canada might in recent years have been associated with lower (and declining) American unemployment rates than before. Statistical difficulties render this finding uncertain, however. Given the close connection between the two economies, this may well have resulted in an upward movement in any simple-minded Canadian trade-off including only domestic variables. But the trade-offs examined in the previous chapter include American wage changes explicitly and so would not be vulnerable to such a shift.

Second, there is some evidence that the scatter as well as the mean (or weighted mean) of regional unemployment rates might be worth including in the trade-off. But the evidence suggests that this variance declined lately for given mean values, and that should improve the trade-off, if anything. Similarly, the decline that the regressions show recently in the relative unemployment in the Atlantic region, often cited as the principal site of structural unemployment, should, if anything, improve the trade-off.[1] The deterioration in the relative position of Quebec may serve to offset this, however.

Tentative as these indications are, they are the most definite ones discovered of any impact of changes in the structure of unemployment on the trade-off. No change was found in either occupational or industrial structure. The difficulties of interpreting the impact of the composition of unemployment by duration on the trade-off have already been mentioned. One might argue that if there were a decline in the fraction of the unemployed on temporary layoff and an increase in those seeking more than six months, these would qualitatively offset one another, since neither group has much impact on wages. Alternatively, one might stick with the simple hypothesis of declining aspirations and argue that both these trends would cause the trade-off to drift downward. The almost exact trend replacement of

[1]It is possible, of course, that there is now as much or more structural unemployment in the Atlantic region although its total unemployment rate has genuinely moved towards the average.

those seeking four to six months by those seeking less than a month might push up the trade-off.

In brief, one might conclude that this chapter has shown no good reason to suppose that the trade-off has altered because of changes in structure of unemployment. One would be on even stronger ground if one argued that it has shown no reason to suppose that the trade-off might have deteriorated because of such changes.

APPENDIX TO CHAPTER 3

Age-Sex Groupings

The recent publication of a set of monthly unemployment figures by broad age group and sex[1] makes it possible to investigate this category. The case for doing so is that, whether or not age-sex characteristics of workers are, in fact, related to their technical qualifications as productive agents, they are perceived to be so related and hence relevant to the workers' ability to obtain employment, even when the labour market is generally tight.[2]

The work reported upon in this Appendix, in somewhat abbreviated form, parallels closely that reported in the body of Chapter 3:

(1) Unemployment rates for each age-sex group were regressed upon those for the whole labour force and for prime-age males (25-44), and the existence of trends was tested for.

(2) The variance of age-sex specific rates was also related to their simple mean and to the overall rate, and the possibility of a trend in that relationship was investigated.

(3) Some very crude experimental work was undertaken to examine the importance of changes in labour force participation as a response to varying economic conditions.

---

[1]Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Ottawa, May 1971. All calculations reported are based upon seasonally adjusted monthly data for 1954 to 1970, inclusive.

[2]The writer still has some reservations about this case, but they are not strongly enough held to encourage him to resist majority professional opinion to the contrary. Dr. Sylvia Ostry, who feels strongly that the age-sex classification is relevant, has urged the inclusion of this section.

The Trade-Off: Some Explorations

1. Regressions based upon the original seasonally adjusted unemployment rates appeared to show statistically significant relationships between each age-sex specific unemployment rate and the total or prime unemployment rates. The two sorts of relations were largely consistent. Trends, too, appeared to be significant in each case, typically without much affecting the other coefficients. All regressions were characterized by positive autocorrelation of the residuals, as revealed by the Durbin-Watson statistics. The results are shown in Tables A-3.1 and A-3.2.

When the data were transformed to correct for autocorrelation, the set of regressions on the total unemployment rate was virtually unaffected,[1] except in its apparent goodness of fit, as comparison of Tables A-3.1 and A-3.3 will show. This set of regressions suggests that unemployment rates for all male groups under 45 fluctuate more, over the cycle, than they do for the total labour force.[2] For those under 25, the amplitude of fluctuation is nearly twice as large. For males over 45 and females under 20, the amplitude of fluctuations is somewhat smaller than for the total; for other females, it is substantially smaller.

At given rates of total unemployment, rates for teen-age males and for all females have been increasing; those for the other male groups, declining. Most rates of change are rather low, say, .02 to .05 percentage points per year, but the increases for teen-age males and for females 20-24 are of the order of an eighth of a percentage point per year and those for teen-age females of the order of a quarter of a percentage point. These trends suggest that, if one were to calculate an hour-and-wage-weighted unemployment rate for Canada, it would turn out that, here, as in the United States, a given total unemployment rate now corresponds to a tighter labour market than before.[3] Unfortunately, the set of regressions on the prime male rate -- which is, in

---

[1]The one exception is for females 14-19. The coefficient of the total unemployment rate is no longer unaffected by the introduction of a trend. The "without trend" coefficient is substantially different from that in the original equation.

[2]See body of Chapter 3 for qualifications of this interpretation.

[3]See Perry, "Changing Labor Markets...", pp. 411-48. To my knowledge, there are no Canadian data to perform such a calculation.

principle, freer of spurious correlation[1] -- does not transform quite so neatly, as a comparison of Tables A-3.2 and A-3.4 shows. The regressions for teen-age males and for all female groups transform well enough[2] and are largely consistent with what has just been reported, given the relation between the two explanatory variables. For the two remaining male groups, however, the coefficients of both unemployment and trend are drastically lowered by the transformation, and the trends cease to be significant.

2. The results of regressing the variance of the age-sex specific unemployment rates on their weighted and unweighted means are shown in Table A-3.5. So far as these two variables are concerned, they are remarkably consistent and stable to transformation. They suggest a very close correlation between the two variables, even after excluding the autocorrelation, so that including the variance as well as the mean in this dimension is unlikely to contribute much to one's wage equation. There is some indication of a trend of some .1 to .15 percentage points per annum in the variance at given levels of average unemployment, but the sign of this differs between the two sets of equations.

3. It is widely believed that, for some age-sex groups, an important or even major part of the adjustment to changing employment conditions takes the form of shifting into and out of the labour force rather than of altered employment status within the labour force. Such forms of adjustment could explain, in part, the low amplitude in the employment cycles of some groups reported above. Since labour force participation, as such, is not of interest here, it seemed permissible to short-cut the procedure by relating the number of persons in each labour force age-sex group directly to the total (or prime) unemployment rate and a trend. This last is intended to do double duty in isolating secular changes in both labour force participation and population.

---

[1]See body of Chapter 3 for an elaboration of this point.

[2]There is, once more, some ambiguity about the coefficient for teen-age females, with and without trend.

Table A-3.1

REGRESSION OF AGE-SEX SPECIFIC UNEMPLOYMENT
RATES ON THE TOTAL UNEMPLOYMENT RATE FOR CANADA
SEASONALLY ADJUSTED MONTHLY DATA, 1954-70

Age-Sex Group	Constant		U_{total}		Trend		R^2	$D.W.$
	Coefficient	t	Coefficient	t	Coefficient	t		
Male								
14-19	2.11	7.56	2.06	38.98			0.88	0.82
14-19	0.97	3.89	2.09	48.88	0.009	10.42	0.92	1.26
20-24	-1.54	8.42	1.98	57.09			0.94	0.95
20-24	-1.24	6.25	1.97	58.30	-0.003	3.55	0.95	1.01
25-44	-1.06	9.26	1.13	52.29			0.93	0.84
25-44	-0.57	5.72	1.12	65.43	-0.004	11.17	0.96	1.36
45+	0.10	1.05	0.94	52.03			0.93	0.55
45+	0.21	2.05	0.93	52.39	-0.001	2.51	0.93	0.56

(cont'd.)

Table A-3.1 (concl'd.)

Female								
14-19	2.78	5.76	0.86	9.45			0.31	0.23
14-19	-0.07	0.24	0.94	20.02	0.02	23.69	0.82	0.89
20-24	0.92	4.22	0.49	11.82			0.41	0.81
20-24	-0.09	0.53	0.52	16.92	0.008	13.04	0.68	1.50
25-44	0.82	8.56	0.27	14.97			0.53	0.80
25-44	0.48	5.24	0.28	18.07	0.003	8.64	0.65	1.09
45+	0.67	5.47	0.23	9.90			0.33	0.59
45+	0.19	1.71	0.24	12.66	0.004	9.75	0.54	0.86

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

The 5 per cent significance levels for t and *D.W.* are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Table A-3.2

REGRESSION OF AGE-SEX SPECIFIC UNEMPLOYMENT RATES
ON THE PRIME MALE (25-44) UNEMPLOYMENT RATE
SEASONALLY ADJUSTED MONTHLY DATA, 1954-70

Age-Sex Group	Constant		U_{prime}		Trend		R^2	D.W.
	Coefficient	t	Coefficient	t	Coefficient	t		
Male								
14-19	4.97	15.31	1.62	24.81			0.75	0.62
14-19	2.55	8.69	1.77	36.59	0.02	13.66	0.87	1.26
20-24	0.81	4.07	1.64	41.28			0.89	0.75
20-24	0.20	0.84	1.68	42.77	0.004	4.22	0.90	0.83
45+	1.17	13.03	0.79	43.72			0.90	0.80
45+	0.83	7.89	0.81	46.47	0.002	5.26	0.92	0.94

(cont'd.)

Table A-3.2 (concl'd.)

Female								
14-19	4.72	11.05	0.52	6.10			0.16	0.21
14-19	0.80	2.87	0.77	16.78	0.03	23.32	0.77	0.84
20-24	1.86	9.48	0.33	8.33			0.26	0.70
20-24	0.38	2.16	0.42	14.61	0.01	14.02	0.62	1.42
25-44	1.28	14.55	0.20	11.09			0.38	0.63
25-44	0.73	8.12	0.23	15.61	0.004	10.19	0.59	0.97
45+	1.12	10.48	0.15	7.05			0.20	0.50
45+	0.43	4.00	0.19	11.05	0.005	10.71	0.49	0.80

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

The 5 per cent significance level for t and *D.W.* are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Table A-3.3

REGRESSION OF AGE-SEX SPECIFIC UNEMPLOYMENT RATES
ON THE TOTAL UNEMPLOYMENT RATE FOR CANADA
SEASONALLY ADJUSTED MONTHLY DATA, 1954-70

(Autoregressive transformation)

Equation	Age-Sex Group	Constant		U_{total}		Trend		R^2	D.W.	ρ
		Coefficient	t	Coefficient	t	Coefficient	t			
	Male									
1	14-19	2.54	5.00	1.98	20.76			0.68	2.19	0.59
2	14-19	1.15	3.15	2.06	33.38	0.009	6.81	0.85	2.01	0.37
3	20-24	-1.23	3.83	1.92	31.87			0.83	2.11	0.54
4	20-24	-0.97	2.86	1.92	33.77	-0.003	1.97	0.85	2.08	0.51
5	25-44	-0.83	3.89	1.09	27.09			0.79	2.29	0.59
6	25-44	-0.51	3.67	1.11	46.93	-0.004	8.00	0.92	2.06	0.32
7	45+	0.76	3.17	0.81	18.52			0.63	2.35	0.80
8	45+	0.91	3.36	0.81	19.26	-0.002	1.40	0.65	2.34	0.79

(cont'd.)

Table A-3.3 (concl'd.)

	Female									
9	14-19	4.69	4.35	0.58	3.22			0.05	2.56	0.90
10	14-19	0.24	0.49	0.89	10.68	0.02	12.43	0.56	2.15	0.56
11	20-24	1.002	2.51	0.47	6.33			0.17	2.34	0.59
12	20-24	-0.08	0.37	0.51	13.12	0.008	9.99	0.56	2.05	0.25
13	25-44	0.77	4.19	0.28	8.20			0.25	2.26	0.61
14	25-44	0.43	2.94	0.29	11.61	0.003	5.49	0.44	2.11	0.45
15	45+	0.71	2.80	0.22	4.70			0.10	2.44	0.71
16	45+	0.20	0.95	0.24	7.01	0.004	5.20	0.26	2.29	0.57

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

ρ -- coefficient of (first-order) autocorrelation.

The 5 per cent significance level for t and *D.W.* are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Table A-3.4

REGRESSION OF AGE-SEX SPECIFIC UNEMPLOYMENT RATES
ON THE PRIME MALE (25-44) UNEMPLOYMENT RATE
SEASONALLY ADJUSTED MONTHLY DATA, 1954-70

(Autoregressive Transformation)

Age-Sex Group	Constant		U_{prime}		Trend		R^2	D.W.	ρ
	Coefficient	t	Coefficient	t	Coefficient	t			
Male									
14-19	3.37	7.28	1.63	21.82	0.02	7.84	0.71	2.07	0.43
20-24	4.39	4.13	0.90	8.87	0.001	0.15	0.28	2.22	0.90
20-24	4.36	7.17	0.93	9.27			0.30	2.20	0.88
45+	3.51	6.04	0.35	7.76	-0.002	0.47	0.23	2.40	0.92
45+	3.28	10.16	0.35	7.83			0.23	2.40	0.92

(cont'd.)

Table A-3.4 (concl'd.)

Female									
14-19	2.32	3.82	0.49	5.30	0.03	8.76	0.31	2.26	0.68
20-24	0.50	2.10	0.40	10.35	0.01	10.06	0.46	2.06	0.30
25-44	0.76	4.95	0.22	9.03	0.004	5.82	0.33	2.17	0.52
45+	0.54	2.70	0.17	5.49	0.005	5.22	0.19	2.29	0.61

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

ρ -- coefficient of (first-order) autocorrelation.

The 5 per cent significance level for t and *D.W.* are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Regression without trend was fitted only where the trend was not significant.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Table A-3.5

REGRESSION OF THE VARIANCE OF AGE-SEX SPECIFIC UNEMPLOYMENT RATES ON THEIR MEAN AND ON THE TOTAL UNEMPLOYMENT RATE FOR CANADA SEASONALLY ADJUSTED MONTHLY DATA, 1954-70

(Original and Autoregressive Transformation)

Equation	Constant		Mean U		U_{total}		Trend		R^2	$D.W.$	ρ
	Coefficient	t	Coefficient	t	Coefficient	t	Coefficient	t			
1	-11.80	23.12	4.32	49.49					.92	0.99	
2	-11.20	22.89	4.40	53.19			-0.010	5.54	.93	1.13	
3	-12.02	13.98	4.35	29.85					.82	2.16	.51
4	-11.31	14.73	4.41	34.53			-0.01	3.43	.86	1.99	.43
5	- 9.84	18.53			4.42	43.95			.91	1.01	
6	-11.33	20.99			4.46	48.35	0.012	6.34	.92	1.21	
7	- 9.39	10.65			4.34	26.15			.77	2.06	.50
8	-11.08	13.63			4.41	32.20	0.012	4.12	.84	2.09	.39

Note: R^2 -- coefficient of determination, uncorrected.

$D.W.$ -- Durbin-Watson statistic.

ρ -- coefficient of (first-order) autocorrelation.

The 5 per cent significance level for t and $D.W.$ are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Few of the groups exhibit any marked or reliable sensitivity to employment conditions on this test, at least after autocorrelation has been eliminated. But the results, shown in Tables A-3.6 and A-3.7, suggest that males 25-44 and 45 and over, and females 14-19 and 25-44, may do so.[1] For what they are worth, these results suggest that teen-age women leave the labour force when unemployment increases,[2] while all other groups enter it. In the former case, we may speak of "disguised unemployment"; in the latter, of "additional workers" -- though this is strange nomenclature for prime-age males.

These results are certainly tenuous enough. It is, however, possible to use them to illustrate how one might proceed with the analysis if the results were stronger. Let us start with the teen-age females. The argument here is that in any period of below-full employment of the labour force -- say, when the overall unemployment rate exceeds 3 per cent[3] -- there is, in addition to measured unemployment of the group, some disguised unemployment caused by withdrawals from the labour force. This can be calculated by substituting in the appropriate regression in Table A-3.6, equation (10), and subtracting the observed labour force figures from the results. One would expect that, if one calculated an "inclusive" unemployment rate for the group as a sum of "measured" and "disguised" unemployment divided by the group's "potential" labour force at 3 per cent overall unemployment,[4] this would show a closer relation to the overall rate and a larger relative amplitude of fluctuations.

---

[1]Even for these groups the most reliable coefficients are not all significant at the customary levels. Moreover, the prime-age males are (insignificantly) sensitive only to average unemployment, not to their own.

[2]For a much more careful analysis of youth participation rates, see Nicole Gendreau, "Youth Participation in the Labour Force: 1953-70", *Notes on Labour Statistics, 1971*, Statistics Canada, Cat. No. 72-207 (Ottawa: Information Canada, March 1972), pp. 9-21, which appeared after this paper was written.

[3]All but three months of the 1954-70 period had below-full employment by this definition.

[4]In principle, this rate too should be adjusted to have reference to the potential labour force. But since the total labour force is quite insensitive to overall unemployment, this hardly matters.

Table A-3.6

REGRESSION OF AGE-SEX SPECIFIC LABOUR FORCE GROUPS
(IN THOUSANDS OF PERSONS) ON THE TOTAL UNEMPLOYMENT RATE
FOR CANADA, SEASONALLY ADJUSTED MONTHLY DATA, 1954-70
(Original and Autoregressive Transformation)

Equation	Age-Sex Group	Constant		U_{total}		Trend		R^2	D.W.	ρ
		Coefficient	t	Coefficient	t	Coefficient	t			
	Male									
1	14-19	325.90	62.20	-4.88	5.45	0.88	46.24	0.92	0.41	
2	14-19	297.19	22.99	-0.34	0.17	0.93	14.81	0.52	2.45	0.82
3	20-24	451.02	36.23	-7.64	3.59	1.43	31.71	0.84	0.02	
4	20-24	67.20	0.63	-0.13	0.12	3.17	6.22	0.16	2.19	0.99
5	25-44	1,963.49	28.13	17.72	1.49	2.42	9.54	0.31	1.92	
6	25-44	1,963.97	25.36	17.70	1.35	2.42	8.57	0.27	2.10	0.09
7	45+	1,395.40	353.69	3.01	4.47	2.52	175.62	0.99	1.01	
8	45+	1,398.67	210.80	2.44	2.19	2.52	100.69	0.98	2.35	0.50

(cont'd.)

Table A-3.6 (concl'd.)

	Female									
9	14-19	220.44	65.47	-3.50	6.08	0.86	70.33	0.96	0.56	
10	14-19	212.38	29.05	-2.18	1.85	0.87	28.27	0.80	2.24	0.72
11	20-24	232.86	21.43	-7.46	4.01	1.42	35.91	0.87	0.02	
12	20-24	-170.73	1.56	1.65	1.54	3.15	6.05	0.16	2.48	0.99
13	25-44	448.49	55.47	2.80	2.03	2.65	90.09	0.98	0.15	
14	25-44	435.59	19.14	2.97	1.32	2.75	18.53	0.63	2.51	0.92
15	45+	229.04	28.55	-0.49	0.36	2.74	93.88	0.98	1.67	
16	45+	227.91	24.07	-0.37	0.23	2.74	79.34	0.97	2.04	0.16

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

ρ -- coefficient of (first-order) autocorrelation.

The 5 per cent significance level for t and *D.W.* are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Table A-3.7

REGRESSION OF AGE-SEX SPECIFIC LABOUR FORCE GROUPS
(IN THOUSANDS OF PERSONS) ON THE PRIME MALE (25-44)
UNEMPLOYMENT RATE, SEASONALLY ADJUSTED MONTHLY DATA, 1954-70

(Original and Autoregressive Transformation)

Age-Sex Group	Constant		U_{prime}		Trend		R^2	D.W.	ρ
	Coefficient	t	Coefficient	t	Coefficient	t			
Male									
14-19	323.79	68.68	-4.43	5.71	0.86	44.45	0.92	0.42	
14-19	295.57	26.68	-0.04	0.03	0.93	14.54	0.52	2.45	0.82
20-24	451.28	40.43	-7.60	4.14	1.40	30.53	0.84	0.02	
20-24	71.41	0.67	-0.68	0.97	3.16	6.23	0.17	2.18	0.99
25-44	2,066.36	32.52	-1.71	0.16	2.38	9.11	0.31	1.89	
25-44	2,084.55	29.63	-4.92	0.43	2.36	8.11	0.26	2.07	0.09
45+	1,396.60	392.89	2.75	4.70	2.53	172.90	0.99	1.04	
45+	1,402.16	238.41	1.76	1.87	2.52	99.13	0.98	2.35	0.49

(cont'd.)

Table A-3.7 (concl'd.)

Female									
14-19	217.08	70.31	-2.83	5.57	0.85	66.87	0.96	0.55	
14-19	208.97	32.52	-1.52	1.60	0.86	26.77	0.79	2.26	0.73
20-24	232.42	23.87	-7.29	4.54	1.39	34.63	0.87	0.03	
20-24	-159.61	1.45	-0.11	0.15	3.15	6.02	0.15	2.48	0.99
25-44	453.27	61.67	1.87	1.55	2.65	87.72	0.98	0.15	
25-44	444.02	20.70	1.34	0.86	2.75	18.17	0.62	2.51	0.93
45+	227.33	31.29	-0.17	0.14	2.74	91.54	0.98	1.67	
45+	226.48	26.44	-0.10	0.07	2.74	77.27	0.97	2.04	0.16

Note: R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

ρ -- coefficient of (first-order) autocorrelation.

The 5 per cent significance level for t and *D.W.* are 1.96 and 1.58 (1.56 when there are only two variables), respectively.

Source: Dominion Bureau of Statistics, *Seasonally Adjusted Labour Force Statistics, January 1954-December 1970*, Cat. No. 71-201 (Ottawa: Information Canada, May 1971).

Table A-3.8

MEASURED, DISGUISED, AND INCLUSIVE UNEMPLOYMENT RATES FOR FEMALES 14-19, ANNUAL AVERAGES, 1954-70

Year	Unemployment Rates		
	Measured	Disguised	Inclusive
		(Per cent)	
1954	5.66	-4.75	0.91
1955	4.96	0.26	5.22
1956	3.99	-0.97	3.03
1957	4.39	1.55	5.94
1958	7.04	4.42	11.46
1959	6.54	4.30	10.84
1960	8.45	2.16	10.61
1961	8.68	2.31	10.99
1962	7.23	5.19	12.42
1963	7.24	6.28	13.52
1964	7.02	4.62	11.64
1965	6.65	2.55	9.20
1966	6.58	-1.71	4.87
1967	7.59	-2.63	4.96
1968	8.27	-1.78	6.49
1969	8.99	-0.42	8.57
1970	11.14	2.63	13.77

Source: Appendix text.

A summary of the unemployment calculation is shown in Table A-3.8. The results for disguised unemployment may not strike one as particularly sensible, inasmuch as they frequently show negative values when overall unemployment was considerably in excess of 3 per cent. It should be borne in mind, however, that they result from subtracting, from the results of an only moderately well-fitting equation in which trend plays an appreciable part, actual figures, not alternative values from the same equation.[1] If, now, the "inclusive" unemployment rate for teen-age females is substituted for the measured rate in equation (10) of Table A-3.3[2] the results are:

$$(10') \quad U^* = -1.53 + 1.53U_{total} + 0.023T$$
$$[0.69] \quad [4.25] \qquad [2.51]$$
$$R^2 = .10, \quad \rho = .70, \quad D.W. = 2.33$$

where T = time trend.

This satisfies the prediction of a more reliable relation with overall unemployment and a larger relative amplitude when the additional reaction of withdrawal from the labour force is included with unemployment. But the overall goodness of fit declines.[3] If one were to take these results quite seriously, one might say that, while the unemployment rate of teen-age females appears to vary less over the cycle than that of the labour force as a whole, this is attributable to the fact that these women

---

[1]The results of a calculation using two expected values from the same equation at different rates of unemployment would, of course, be perfectly well-behaved but even further abstracted from observation.

[2]The choice is not arbitrary: the trend again turned out to be significant and the autoregressive transformation was needed. But the results are again rather unstable both to the introduction of the trend and to transformation.

[3]Somewhat similar results are obtained by reference to regressions in which the prime unemployment rate is the measure of labour market conditions, but here the t value attaching to the coefficient of prime unemployment actually declines (to 2.76) with the substitution of the "inclusive" rate as the dependent variable.

leave the labour force in time of heavy general unemployment. Once this adaptation is taken into account,[1] the fluctuation is some 1.5 times as large for teen-age females as for the labour force as a whole.

Similar illustrative calculations were performed for the other three groups and are reported very briefly. In this case one expects the "disguised unemployment" to be predominantly negative, as it turns out to be. The interpretation of this correction is that measured unemployment exaggerates the degree of slack in the given age-sex group, since, if there were overall full employment, some members of that group would leave the labour force. One would expect that if the "corrected" unemployment were substituted for the measured, the "exaggerated" relative amplitude shown by referring the measured unemployment rate to the total rate would decline. This is, indeed, what happens in all three cases;[2] for men 45 and over, the decline is very slight (from .81 to .77), and the significance of the coefficient of the overall goodness of fit declines but remains satisfactory.

For men 25-44, the decline is to an unbelievable .41, and this coefficient is exceeded by its standard error. In the third case, that of women 25-44, the coefficient declines to .04, and its standard error is some ten times that. The overall fit of the latter two equations is very bad indeed. Clearly not even illustrative interpretations can be made on the basis of this set of calculations. One might wish to say that this is as it should be, since, as Table A-3.6 indicates, these last two groups, unlike the first two, did not, in the first place, show a significant labour force adaptation to overall unemployment.

---

[1]Some underlying assumptions are needed, of course, to make the change in employment status and that in labour force status additive. The simplest model would picture the requirements for various age-sex groups as rather rigidly complementary, so that the overall (prime) rate of unemployment not only indicates the general degree of slack in the economy, but also the quantity of employment available to each age-sex group. Clearly, one would need a more sophisticated model, and a set of calculations that took account of interdependence, to really come to grips with these phenomena.

[2]See Table A-3.3, equations 8, 4, and 14, for the original regression. Similar results are obtained with prime male unemployment as the explanatory variable.

CHAPTER 4

A CHANGE IN EXPECTATIONS

1. Introduction

In Chapter 2 some evidence was presented suggesting rather strongly that the trade-off relationship estimated earlier for the postwar period no longer held. It also appeared that, if one could speak of a trade-off in more recent years at all, this trade-off was less favourable than it had been.

In Chapter 3 the structure of unemployment, in various dimensions, was examined to see if changes in it could account for a deterioration in the trade-off. With one minor exception, no changes of the requisite sort were found.

In the present chapter, the question is raised as to whether expectations might have altered in such a way as to account for the deterioration observed. Much current discussion clearly assumes that this is, indeed, the case. There is, moreover, a strong analytical tradition, already reported upon, which suggests that the trade-off relation becomes, in a fundamental sense, unstable as soon as expectations come to correspond fully to actualities. Without prejudging that issue, one can hold that expectations with respect to future changes in wages and/or prices are an important parameter of the trade-off that might well alter when they do.

2. Evidence from the Re-estimated Equations

Some evidence relevant to this question of a shift in expectations has already been reported in Chapter 2, although no stress was then laid on this interpretation. It will be recalled that, in each of the wage change equations shown in Table 2.4, the coefficient of $\dot{p}_t^*$ was higher for the period 1953 to 1969 than for either 1953-65 or 1953-60, and it was still higher for 1961-69. (A summary is provided in Table 4.1.) This rise in coefficient would result in an upward shift in the relation between wage changes and unemployment at any positive rate of change in prices.

Table 4.1

COEFFICIENTS OF THE PRICE CHANGE VARIABLE ($\dot{p}_t^*$)
IN WAGE CHANGE REGRESSIONS
VARIOUS PERIODS 1953 TO 1969:
SUMMARY

Period	Range of Coefficients
1953-1965	0.38 to 0.54
1953-1960	0.33 to 0.58
1953-1969	0.75 to 1.00
1961-1969	1.12 to 1.71

Source: Table 2.4.

It will be recalled that these coefficients are the partial derivatives of the four-quarter percentage change in wages ending in the current quarter, with respect to the average of the four four-quarter percentage changes in prices ending in the same quarter. While the latter is not nowadays regarded as the ideal form of function of past prices to test expectations,[1] it is clearly relevant to them. One might interpret the complement of this coefficient as indicating the degree of money illusion in the labour market -- roughly the extent to which current changes in goods prices are disregarded in bargaining for money wages or in determining the supply of, and demand for, labour. Alternatively, one might view the coefficient as indicating the (Hicksian) elasticity of expectations with respect to price changes, without money illusion. Only the second interpretation can make literal sense of coefficients exceeding unity. These would then indicate explosive price expectations.[2]

On either interpretation, the results in Table 4.1 suggest that in the 1950's, and for the whole period 1953-65, only about one-third or one-half of recent price changes was reflected in changes in money wages. In the 1960's, however, price changes found a magnified reflection in wage changes. The heroically simple lag assumptions of the model must be borne in mind in any such interpretation.

[1]Most recent work uses some form of longer distributed-lag function.

[2]But not necessarily a wage-price spiral if the coefficient of wage changes in the price change equation is sufficiently below unity.

3. Evidence from Other Studies

Recently, however, a study using more acceptable techniques has served largely to confirm the results just reported. In a recent paper,[1] Professor Vanderkamp, among other things, estimates some wage change[2] equations in which the vacancy rate (V_t) or the reciprocal of the unemployment rate (U_t^{-1}), the first difference in that variable ($V_t - V_{t-1}$) or ($U_t^{-1} - U_{t-1}^{-1}$), deviation of productivity from its trend (R), and expected change in prices $\dot{p}_t^e$, are explanatory variables. $\dot{p}_t^e$ is based[3] upon a geometrically declining distributed lag: $\dot{p}_t^e = \Sigma\ (1-\eta)\eta^i \dot{p}_{t-i}$, with η experimentally set at 0.7.[4] Vanderkamp's original equations were fitted for 1949 to 1968. At the writer's request, he was kind enough to obtain results also for the 1950's and the 1960's, separately. All these are summarized in Table 4.2. Considering all the differences in the periods covered and in specifications of equations, the coefficients of the price change term are remarkably close to those reported earlier, especially for the whole period and the second part of it.[5] Professor Vanderkamp reports that his other equations responded in a similar fashion.

There is yet another largely independent piece of evidence on changes in expectations. To the extent that it is relevant, it tends to confirm the evidence cited above. Its direct relevance, however, is to the money market, not the labour market; and it has turned out, in the context of this Study, to be largely a digression on a particular piece of methodology. It is, therefore, reported in very abbreviated form in an Appendix to this Chapter.

---

[1] John Vanderkamp, "Wage Adjustment, Productivity and Price Change Expectations", *Review of Economic Studies* 39, no. 117 (January 1972):61-70.

[2] The variables are four-quarter percentage differences or averages, as in Chapter 2, but the wage series is the "average wage" for industrial composite rather than for manufacturing.

[3] In the version reported here.

[4] Only the final 10 terms of this summation were, in fact, considered. They accounted for nearly all of the changes.

[5] The coefficients for the first part are higher in Vanderkamp's work. But his subperiod is longer and adds some highly inflationary years.

Table 4.2

VANDERKAMP'S "ESTIMATED WAGE ADJUSTMENT" INCLUDING A DISTRIBUTED-LAG PRICE TERM ($\dot{p}_t^e$)
VARIOUS SUBPERIODS, 1949 TO 1969

Period	Constant	U_t^{-1}	$(U_t^{-1}-U_{t-1}^{-1})$	R_t	$\dot{p}_t^e$	R^2	*D.W.*	η
1949-68	2.289 (0.376)	1.055 (1.101)	16.549 (3.051)	0.431 (0.066)	0.913 (0.069)	.878	1.119	0.7
1949-59	0.74 (0.59)	3.6 (1.3)	16.1 (3.3)	0.54 (0.08)	0.87 (0.08)	.92	n.a.	0.7
1960-69	2.15 (0.66)	-2.3 (2.6)	13.8 (13.1)	0.11 (0.15)	1.54 (0.28)	.85	n.a.	0.7

Note: $\dot{w}_t$ -- dependent variable: four-quarter percentage change in average wage (industrial composite).

U_t^{-1} -- reciprocal of quarterly average unemployment rate.

R_t -- deviation of output per man from trend.

$\dot{p}_t^e$ -- geometrically declining distributed lag of past prices, $\eta = 0.7$.

R^2 -- coefficient of determination, uncorrected.

D.W. -- Durbin-Watson statistic.

η -- weighting value for the price expectations equation on p. 85 of text.

Figures in parentheses are *standard errors* of variables.

Source: J. Vanderkamp, "Wage Adjustment, Productivity and Price Change Expectations", *Review of Economic Studies* 39(1), no. 117 (January 1972):61-70, Table II; and Vanderkamp, correspondence.

4. The Nature of Inflation

The evidence just presented suggests that there may, indeed, have been a break in expectations of labour market participants sometime during the postwar period, with the more recent period characterized by less money illusion and/or a higher, possibly higher than unitary, elasticity of expectations. Much recent popular discussion has assumed this to be the case, and the terminology of expectations and of "inflationary psychology" has been much heard of until very recently. It has also been very generally taken for granted that the inflation recently experienced has been different in character than that of earlier periods. Clearly, it would not be surprising if these two phenomena were connected. Indeed, the methodology of most statistical studies of expectations assumes them to be based upon (relatively) recent experience.

A recent paper by Swan *et al.* forcibly draws attention to the ways in which recent Canadian inflation has been different: "What is unusual about Canada's recent inflation, in the international context, is neither its level nor its duration, but rather the acceleration in the rate which appears to have taken place in the 1960's."[1] They go on to suggest that the recent period was also one of unusually long continuous inflation (13 years), in the context of Canadian history but not by recent international standards. Finally, the variability of inflation appears to have been smaller since 1953 than before, in both Canada and the United States.

Swan and Wilton's contention as to the length of continuing inflation is supported by all the indexes they have examined -- Wholesale Prices, Consumer Price Index (CPI), and the Implicit Deflator of the GNE. Their finding as to the variability of inflation is based upon the standard deviation of the first two of these. Finally, their findings as to acceleration are based upon the annual changes in the CPI, which were as large as those for

---

[1]N. Swan, D. Wilton, and W. R. Needham, "Introduction: Inflation in Canada, A Cause For Concern", N. Swan and D. Wilton (eds.), *Inflation and the Canadian Experience*, p.2.

the previous year or larger, for seven of the eight possible comparisons between 1960 and 1969. This acceleration was slow[1] but remarkably steady. The Deflator and the Wholesale Price Index show no clear acceleration.

There is little more to be said about the Swan and Wilton account as economic history. But it is worthwhile pausing to examine its relevance for labour market expectation. It seems likely that, to the extent that participants in the labour market form their expectations on the basis of statistical indicators rather than upon direct experience,[2] it is the Consumer Price Index that they watch and the annual changes in it that they find most meaningful.[3] Their recent expectations, therefore, might well be based upon a perception of a continuous, mild, steadily but slowly accelerating inflation. Now, one objection to the expectations hypothesis of the Friedman-Phelps sort has always been that, while people might well be expected to form firm expectations in a steady-state inflation and act upon them, what they in fact usually experience is a succession of price changes in different directions and of very different magnitudes.[4] It might be that this objection does not apply to recent Canadian experience, at least as perceived by the actors. Moreover, coefficients of more than one, on averages of past prices, mentioned above, would be a rational enough adaptation to an experience of accelerating inflation.[5]

Taken as a description of realities rather than of perceptions, the above account of recent inflation is arbitrary in three ways. First, as already

---

[1] 0.5 per cent per year, on average.

[2] They may not. See S. F. Kaliski, "Price Changes - Fact and Opinion", 1963, unpublished.

[3] The direct experience, at least of suppliers of labour, is also largely with consumer prices.

[4] See, e.g., R. M. Solow, *Price Expectations and the Behaviour of the Price Level* (Manchester: Manchester University Press, 1970); S. F. Kaliski, "Is the Phillips Curve Still With Us?", in Swan and Wilton, *Inflation*....

[5] Although their point estimates are clearly too much over one, given the rate of acceleration.

indicated, it chooses a particular index of inflation, the CPI. Second, it concerns itself only with 12-month average changes in that index. Third, of all possible 12-month averages, it chooses those for calendar years.

Some account has already been given of what happens if one relaxes the first of these assumptions; the inflation remains mild and continuous but no longer accelerates. The third assumption is easily enough relaxed by calculating 12-month averages of monthly price changes, centred, in turn, on each month of the year. If one does this for 1953 to May 1970, the impression of (virtually) continuous inflation persists. Only 5 of the 109 average percentage monthly changes calculated are negative. Two of these are centred on January and February 1953 and, therefore, include data for 1952. The mean of the average changes centred on each month in turn, shown in Table 4.3, is certainly positive and is larger for the 1960's than for the 1950's. The absolute dispersion is also larger for the later period, but the relative dispersion[1] is certainly smaller. It is not clear how this affects the confidence with which expectations may be held. All of these measures differ little between calendar years and the "artificial years" centred on other months.

The count of seven accelerations for 1961-69 is towards the upper range of counts for all possible 12-month averages[2] but not an extreme figure.

---

[1]As measured by the standard deviation and the coefficient of variation, respectively.

[2]The last column of Table 4.3 is that comparable to Swan and Wilton's count. The mean value of the 12 counts in that column is 6.16.

Table 4.3

TWELVE-MONTH-AVERAGE MONTHLY CHANGES IN THE CONSUMER PRICE INDEX
1953-70 AND SUBPERIODS

Period Centred On	1953-70 Mean (M)	S.D.	V= S.D. M	No. of Accelerations (Out of 18)	1953-60 Mean (M)	S.D.	V= S.D. M	No. of Accelerations (Out of 8)	1961-69 Mean (M)	S.D.	V= S.D. M	No. of Accelerations (Out of 9)	No. of Accelerations (Out of 8) (1)
January	.17	.21	1.22	11	.10	.14	1.42	4	.23	.25	1.07	7	7
February	.17	.21	1.21	9	.10	.14	1.35	3	.23	.25	1.08	6	6
March	.17	.21	1.21	10	.10	.13	1.36	5	.23	.25	1.07	5	5
April	.17	.21	1.20	10	.10	.13	1.27	4	.24	.25	1.04	6	6
May	.17	.21	1.20	10	.10	.14	1.30	3	.23	.25	1.10	7	6
June					.11	.14	1.28	4	.23	.25	1.09	8	8
July					.11	.14	1.27	2	.24	.26	1.08	6	6
August					.11	.14	1.33	4	.24	.26	1.08	7	6
September					.12	.15	1.30	2	.24	.26	1.07	6	6
October					.12	.16	1.34	3	.25	.26	1.06	6	5
November					.12	.16	1.37	3	.25	.26	1.06	7	6
December					.11	.15	1.33	5	.25	.26	1.06	8	7

(1) Including only the eight comparisons wholly internal to the period 1961-69. All the other counts include a comparison of the first year in the period with the previous year.

Source: Dominion Bureau of Statistics, *Canadian Statistical Review*, Cat. No. 11-003.

It seemed interesting to be able to say something about comparisons of average price changes for periods shorter than 12 months. One would expect that the shorter the averaging period, the more periods there would be of declining or unchanging prices and the less evidence of steady acceleration. Unfortunately, in order to carry out the experiment, it is necessary to adjust the CPI for seasonality, and the smoothing involved makes the results imperfectly comparable. It may be worth reporting, however, that results for six-month and nine-month averages, centred on each month in turn, still give a strong impression of continuous inflation.[1] But there is also little evidence of acceleration; indeed, for no subperiod shown in Table 4.3 does the rise in prices exceed[2] that in the previous period in more than half the comparisons.[3]

5. Conclusion and Summary

It would appear from several pieces of evidence that the coefficient of price changes in the wage change equation has risen, and this would make for a deterioration in the trade-off in any period of positive price changes, such as that recently experienced.

It is tempting to interpret this change in the coefficient of price changes as an alteration in the elasticity of expectations, such as might reasonably arise from a decade's experience with continuous, mild, possibly accelerating, inflation. The coefficients, which exceed unity, are not incompatible with such an interpretation. The fact that the relation between wage changes and unemployment seems weak or nonexistent during the 1960's might also be interpreted as evidence for the strong expectations hypothesis.[4] Two recent

---

[1]More accurately, there are only two cases of prices declining on the average, both for six-month averages. But there are a substantial number of cases of no change.

[2]As distinguished from *both* equaling and falling below.

[3]Seasonal adjustment may be partly responsible here. For 1961-69, at least, the 12-month averages of price changes also show fewer accelerations if based upon seasonally adjusted data than if based upon raw data.

[4]See Chapter 1 for an exposition of this.

studies, the one by Vanderkamp and another by Turnovsky[1] suggest that the expectations hypothesis might, indeed, be applicable to all of Canadian postwar experience.

It must be stressed, however, that tempting as the expectations interpretation is, it is based upon the flimsiest of evidence:

1. No attempt was made in this Study, or in any of the Canadian literature known to the writer, to fit the best possible "wage change equation" for the 1960's.[2] The results cited are simply a by-product of testing earlier, or longer, regressions for stability.

2. All the evidence cited, but not all that was presented by Turnovsky, is capable of several interpretations. For instance, there is no way of distinguishing whether the lagged prices are a guide to expectations or simply represent a process of "catching up" to past price changes,[3] e.g., through collective bargaining. Yet the difference may be important for both analysis and policy.

3. The two Canadian "Expectations" studies agree that the coefficient attaching to price expectations is not significantly different from unity. But they are not in agreement on whether there is a relation between wage changes and unemployment. Vanderkamp finds "the parameters of ... U_t^{-1} ... on the whole small and not very significant".[4] In Turnovsky's work they are invariably large and significant. It is not clear that the latter result is compatible with the strong expectations hypothesis, at least without additional assumptions.

---

[1]S. J. Turnovsky, "The Expectations Hypothesis and the Aggregate Wage Equation: Some Empirical Evidence for Canada", *Economica* 39, no. 153(February 1972):1-17. Turnovsky's period is 1949 to 1969.

[2]In my view such an attempt is premature until the underlying analysis is far better sorted out than at present and would inevitably degenerate to an exercise in "ex-post specification".

[3]Turnovsky, "The Expectations Hypothesis...", p. 5.

[4]Vanderkamp, "Wage Adjustment...", p. 65.

4. The Canadian results are in striking contrast to U.S. studies, most of which find coefficients for the price change term in wage equations considerably below unity. Turnovsky draws attention to this inconsistency, but his resolution of it is unconvincing to this writer.[1]

[1]The resolution is "that, unlike the United States, Canada is heavily dependent upon foreign trade. This tends to make the economy more competitive and hence to make it conform more closely to the neoclassical assumptions. This in turn suggests that the coefficient of price and wage expectations should be nearer unity for Canada". Turnovsky, "The Expectations Hypothesis...", p. 16.

Now there is no question that dependence on foreign trade makes the Canadian economy more competitive than it would be in isolation. But I know of no serious study which concludes that the Canadian economy is more competitive than the American.

APPENDIX TO CHAPTER 4

Relation between Interest Rates and Price Changes

In a recent study, R. J. Gordon successfully fitted a wage change equation for the United States, including an Almon-lag price expectations term.[1] Gordon's procedure was to obtain the weights by regressing interest rates on price changes in the manner suggested by Almon and then use the resultant weighted average of present and past price changes as a variable in the wage change equation. While the analogy between the money and labour markets seemed somewhat far-fetched, the procedure had attractions because of the difficulty of calculating the lag patterns simultaneously with other information from the same data.[2]

The basic model involved in this approach is to treat a money interest rate as a sum of a (constant) real rate of interest and a component related to price expectations. Gordon reports[3] that the inclusion, in addition, of a velocity-of-money variable greatly improved the fit of his regressions. The experimentation with this technique on Canadian data undertaken for this Study can be briefly summarized as follows:

1. Some initial experimentation with nearly all the interest rates on securities and conventional mortgages reported in the *Bank of Canada Statistical Summary* indicated, as expected,[4] that most of the results were very similar. Rather arbitrarily, three-month Treasury Bills and five-to-ten-year Government of Canada bonds were selected for further work with lags and auto-

[1]R. J. Gordon, "The Recent Acceleration of Inflation and Its Lessons for the Future", *Brookings Papers on Economic Activity* 1(1970):8-47.

[2]Zvi Griliches, "Distributed Lags: A Survey", *Econometrica* 35, no. 1(January 1967):16-49.

[3]Gordon, "The Recent Acceleration of Inflation...", p. 37, in criticism of earlier work by W. P. Yohe and D. S. Karnosky, "Interest Rates and Price Level Changes, 1952-69", Federal Reserve Bank of St. Louis, *Review* 51, no. 12(December 1969):18-38.

[4]For 1953-70 the correlation coefficients between the nine rates (six-month Treasury Bills and Finance Company Paper were not available for the whole period; all other Government of Canada Securities, McLeod,Young,Weir's Provincials, Municipals, and Industrials, and Conventional Mortgages were included) ranged from .89 to .99.

regressive transformations. The dependent variable was thus monthly data on interest rates. The explanatory variables were monthly percentage changes in the CPI and the ratio of money GNE[1] to currency and deposits.

2. The inclusion of the income velocity of money made only a minor contribution to the Canadian equations. With some frequency, this variable, whether included as a distributed-lag or as a current variable, was insignificant and/or had the wrong (negative) sign.

3. The work was not helpful in supplying a definite weighting pattern for the price variable. Lags ranging from 12 to 30 months and polynomials of different degrees[2] seemed to fit the data about equally well, while yielding markedly different average lags and distributions of weights.

4. The sum of the weights of the price terms was not very sensitive to these changes or to the introduction of the velocity variable. For the period as a whole, it ranged from about .63 to .88 in the several equations using various lag formulations and interest rates.[3] The constants accompanying these results are believable as real interest rates, ranging from about 2 per cent for three-month Treasury Bills to about 3.5 per cent for Government of Canada bonds longer than 10 years.[4, 5]

---

[1]Interpolated to construct monthly observations. The quarterly change in the implicit deflator of the GNE, similarly interpolated, was used as an alternative price change variable with results that were largely consistent.

[2]Only lags of 12, 18, 24, and 30 months were, in fact, tried, and only second-, third-, and fourth-degree polynomials, with and without the first-degree term being constrained to zero.

[3]Corrected to an annual price change basis. The range for the implicit deflator was somewhat larger, from .58 to .91.

[4]One of the chief drawbacks of introducing the velocity variable is that it changes many of these constants to less believable, and often insignificant, values.

[5]Nothing in these equations provides an answer to the question of whether Canadian interest rates are endogenously determined within the country. If the U.S. Treasury Bill rate is introduced as a variable into a sample equation explaining the Canadian Treasury Bill rate, it raises R^2 from .47 to .87 and makes all other explanatory variables insignificant.

5. The apparent fit of the equations is moderately satisfactory (R^2 typically .5 to .6), but their residuals are highly autocorrelated (*D.W.* ranges from 0.03 to 0.13).

6. If one divides the period at the end of 1960 or of 1964, there are always significant differences between the subperiods.[1] The price terms for the earlier period have a much lower sum of weights than those for the latter. Some of the former are insignificant or negative, and some of the latter exceed unity.

7. If one corrects for the autocorrelation by transforming, the entire relationship vanishes,[2] with no variable significant and no R^2 higher than 0.02.[3]

Because of these disappointing results and because, in the meantime, the work of Vanderkamp and Turnovsky became available, this approach was not pursued further.

---

[1]This was done for five-to-ten-year Government bonds, only.

[2]This experiment was tried on three-month Treasury Bills and five-to-ten-year bonds only.

[3]It is an odd aspect of Gordon's work that he does not attempt a transformation, although his *D.W.* = 0.62 cnly. In other parts of his work, Gordon is more meticulous about autoregressive transformations and warns of dangers of being misled by results obtained without them. See his "Problems in Predicting the Rate of Inflation", a more detailed paper read to the Econometric Society, December 1969.

CHAPTER 5

TRADE-OFFS AND MODELS: A CONFLICT

1. Introduction

One of the analytical questions raised above was that of the legitimacy of isolating the wage-price subsystem for separate examination. To recall briefly, it was argued that the several variables involved -- wage changes, price changes, productivity, profits, and unemployment -- would be endogenous variables in any reasonably comprehensive model of the Canadian economy.[1] That is to say, their values would not be parameters determined outside the system that one is considering, but would rather be jointly determined within it.

This much, I think, is scarcely controversial. No one, when he is speaking carefully, talks of the right-hand variables in the wage change equation as causal of the wage changes.[2] It is clearly a matter of a more or less reliable association. Now the practical point involved is this: Some of the variables whose values are taken as parameters to calculate the trade-off are, in fact, jointly determined not only with those whose values are being calculated, but with many others. The normal procedure for solving an econometric model is to solve for the values of all endogenous variables, given the values of those exogenous (given) to the system. In a well-specified model there is a unique solution. Thus, in principle, the several points on a trade-off curve must correspond to different sets of values of the exogenous variables of the system. If the partly endogenous "parameters" of the trade-off were really to remain unchanged, therefore, we could, in general, observe only one triplet of values of unemployment, price change, and wage change. The conceptual experiment of observing various pairs of values of unemployment and price change, say, at given values of profit and productivity, is conceptually invalid except in very special

---

[1]Foreign (U.S.) wages and prices would almost certainly be exogenous, and import prices are likely to be so -- at least, with fixed exchange rates.

[2]The matter may be more controversial when it comes to the price equation.

circumstances.[1] Moreover, to the extent that the trade-off is (even within its own limitations) incompletely specified -- say, because it omits some variables that should, in principle, be considered, but whose influence was minor during the period of estimation -- it may be unstable even in these special circumstances.[2]

To repeat, all this would, I think, be uncontroversial as stated. What is arguable is the practical significance of this consideration. What difference would it make to the values obtained whether one examined the trade-off from a solution of a whole system or from a solution of the price-wage-unemployment subsystem arbitrarily taken out of its context? The question requires further specification -- e.g., what changes in exogenous variables are permissible -- before it can be answered. But some clues to answers can be provided. It was initially hoped to provide some answers by using an actual econometric model to simulate some experimental results, but circumstances seem to make that impractical for the moment.[3]

---

[1]Roughly speaking, if it is possible to change some exogenous variable that affects, directly or indirectly, the values of those variables between which one is calculating the trade-off, but not the values of any arguments in the trade-off equations treated as parameters. Since these two sets of trade-off variables are, by assumption, both particularly closely connected and jointly determined, such an exogenous variable is likely to be hard to find. But note that this suggests that the trade-off may be sensitive to which of the truly exogenous variables change in value -- a point to which we shall be returning.

[2]E.g., variables omitted from the trade-off equations because they were not significant, say, may have been so because they did not vary sufficiently or because they were correlated with variables included. In the first case, their values are treated as parametric; in the second, it is their relation with the included variables that is so treated.

[3]Briefly, some of the well-known Canadian policy-analysis models are fixed exchange rate models, and their relevance to current conditions is uncertain. Moreover, the model initially considered for experimentation -- RDX1 -- is now generally considered obsolete, and its successor RDX2 is not yet available for work of this sort. TRACE, too, is in a similar process of transition, and CANDIDE is not yet ready.

It was therefore decided, following Bodkin,[1] to examine the relevant aspects of available solutions of several Canadian models.

The three econometric models of the Canadian economy considered in the final version of Bodkin's paper,[2] TRACE,[3] RDX1,[4] and the Tsurumi[5] model were so examined.

2. The Trade-Off in Three Models of the Canadian Economy

The Tsurumi model does not contain a trade-off of the Phillips-Curve type among its structural relations. Bodkin did compare the results of three

[1]Ronald G. Bodkin, "Wage and Price Formation in Selected Econometric Models", N. Swan and D. Wilton (eds.), *Inflation and the Canadian Experience* (Kingston: Queen's University Industrial Relations Centre, 1971), pp. 87-120.

The procedure, however, is different from Bodkin's whose introductory contention "...that this admitted simplification [calculation of a tradeoff curve from a wage-price sub-sector] is one of the useful abstractions of current macro-economic theory... which...does not do excessive violence to the 'facts' of 'real world' experience" (88) is not tested in his paper, since either a trade-off or a complete solution is reported for any given model. For a comparison one needs both.

Some of J. A. Sawyer's comments on Bodkin in the *Inflation* volume (pp. 123-26) are very much in the spirit of this chapter.

[2]Swan and Wilton, *Inflation...*, pp. 89-98. In his original paper Bodkin also considers a series of "Government of Canada Econometric Models", but derives no trade-offs from them.

[3]N. K. Choudhry, Y. Kotowitz, J. A. Sawyer and J.W.L. Winder, "TRACE 1969, An Annual Econometric Model of the Canadian Economy" (Toronto: University of Toronto, Institute of Quantitative Analysis of Social and Economic Policy, Working Paper No. 6908, October 1969 and *The TRACE Econometric Model of the Canadian Economy* (Toronto: University of Toronto Press, 1972). I am grateful to Dr. Sawyer for allowing me to see pre-publication proofs of the book.

[4]J. F. Helliwell et al., *The Structure of RDX1*, and the *Dynamics of RDX1*, Bank of Canada Research Studies Nos. 3 and 5, respectively.

[5]H. Tsurumi, "A Four-Sector Econometric Model of the Canadian Economy", Institute for Economic Research, Queen's University, Discussion Paper No. 8, 1969, and unpublished papers. I am grateful to Professor Tsurumi for giving me access to his papers.

simulations with this model but was able to secure only (essentially) two[1] pairs of associated eight-year averages of unemployment rates and price level changes.

The other two models both give some opportunity to compare the trade-off impact of different policies. The RDX1 results permit the calculation of trade-offs between unemployment and inflation using mixes of monetary and fiscal policies that keep foreign exchange reserves constant or permit them to change at a specified rate. The general result is that the slopes of the trade-off curve, at two historically given levels of unemployment and inflation, depend upon both the detailed specification of the fiscal policy (the distribution of government expenditure between wages, transfers, and other objects) and the exact nature of the balance-of-payments constraint.[2] Thus quite minor differences in the exogenous variables seem, in this model at least, capable of shifting the simulated "trade-off relation". It would be surprising indeed if these changes in detailed policy specifications were to change the variables

---

[1]One of these pairs corresponds both to Tsurumi's "control" simulation, in which the discount rate for 1969-75 fluctuates between 5.39 per cent and 6.57 per cent, and to a policy simulation Tsurumi carried out for Bodkin in which the rate is kept at 4.3 per cent. Both price level and unemployment are, in fact, the same each year in the two situations (Tsurumi, "Four Sector Model..." Tables 5, 7, 9; Papers, Tables 5, 6).

Bodkin comments: "this simulation reinforces slightly one's faith in the trade-off curve as an analytical device for summarizing the information contained in an econometric model of this type." (p. 97.) Presumably this is because a policy change that leaves unemployment unaffected also has no impact on the price level. I should have thought that all that one could conclude from this result is that unemployment and price levels (and many other variables) in the Tsurumi model are very insensitive to the discount rate.

[2]S. F. Kaliski, "Is the Phillips Curve Still with Us?" in Swan and Wilton, *Inflation...*, p. 18. The numerical values of slopes quoted in that paper are not precisely accurate since they refer to percentage point -- rather than to percentage -- changes in the price level. But this in no way affects the validity of the point being made.

treated as parameters in the "subsector" trade-off equations in such a way as to approximate accurately these shifts of the trade-off in response to policy specification.[1]

The TRACE results permit the above point to be made in somewhat greater detail; the authors report upon three simulations initiated in 1957, 1960,and 1964, respectively. The years represent a variety of both employment conditions and exchange rate regimes. In each case, the control solution is an "ex post forecast... generated by a free run on each base year". The three policy experiments investigate the results of applying in the base year only: (1) an increase in government nonwage expenditure offset by a personal tax increase; (2) an increase in this expenditure without tax offset or change in money supply; and (3) an increase in the money supply.[2]

In Table 5.1 we show the simulated "trade-off" point corresponding to the control solution in the year after each initiation and the corresponding point for each of the three policies.[3] One can think of these as two points on each of three policy-specific trade-off curves. The control point is common to the three and corresponds to a zero-intensity application of each policy, whereas the other points correspond to a unit-intensity application of each policy.[4] Some interpolation by inspection should satisfy the reader that the three policy-specific trade-off curves in general diverge, sometimes quite considerably; indeed, some of the "slopes" are positive.

---

[1]Unfortunately, neither RDX1 nor the TRACE results available to this date made it possible to check upon this conjecture. Indeed, we were unable to split off trade-off equations from RDX1 without making assumptions more arbitrary than seemed warranted: Equation 85 is near enough a standard wage change equation but the price equations are much more complicated.

[2]*The TRACE Econometric Model*..., p. 87.

[3]The period after initiation of policy, after which observations are taken, is, of course, arbitrary. The year following is the closest one can get to an "impact multiplier" whilst basing one's calculations on the simulation results.

[4]A unit here is 2 per cent of nominal GNP for expenditure, and 5 per cent of money supply for monetary expansion, *The TRACE Econometric Model*..., p. 103.

Table 5.1

TRACE SIMULATION TRADE-OFFS:
RESULTS OF POLICY EXPERIMENTS ONE YEAR AFTER INITIATION --
VALUES OF UNEMPLOYMENT AND PERCENTAGE CHANGE IN GNE DEFLATOR

Base Year	Policy	u	$\dot{p}$
		(Per cent)	
1957	Control	5.56	2.92
	1	5.61	3.16
	2	5.39	3.44
	3	5.54	2.83
1960	Control	7.21	0.28
	1	7.14	0.56
	2	6.88	0.71
	3	7.18	0.22
1964	Control	4.90	3.00
	1	4.84	3.52
	2	4.54	3.80
	3	4.85	3.01

Note: u -- Unemployment rate.

$\dot{p}$ -- Percentage change in GNE Deflator from previous year.

For an explanation of policies 1, 2, 3, see text.

Source: *The TRACE Econometric Model...*, Ch. 4.

Thus, once again, the simulated trade-off relation is sensitive to what exact policies are followed. This time, however, the policies themselves are unconstrained and considered one at a time. The resulting trade-off thus results simply from the structural equations approximating the economy and is not, as in RDX1, a result of a policy dilemma stemming from an attempt to achieve three objectives with two policies as well.

The price-wage-unemployment subsector of the TRACE model is relatively easy to sever from the model, and Bodkin does so sever it.[1] He derives a steady-state trade-off equation linking percentage changes in the deflator of business nonagricultural output $\dot{p}_B$ to the reciprocal of the rate of unemployment (u^{-1}), the rate of change of productivity ($\dot{A}$) and the percentage rate of change in Canadian-dollar import prices ($\dot{p}_i$). The last two are, as usual, treated as parameters of the trade-off:

$$(5)\quad \dot{p}_B = 0.01935 + 0.12042u^{-1} - 1.17661\dot{A} + 0.54796\dot{p}_i .$$

[1] Swan and Wilton, *Inflation...*, p. 90, Equation (5). See that paper for assumptions made to obtain the equation. TRACE has been revised slightly since Bodkin used it, but neither the wage change nor the price change equation was affected.

It would have been interesting to compare the results of the policy experiments, using only this trade-off equation, with those of the full simulation. Unfortunately, the endogenous values of $\dot{A}$ and $\dot{p}_i$ corresponding to the three policy experiments of the TRACE model are not readily available. It is, however, possible to carry out quite extensive comparisons between the control simulations and the results from equation (5), using, for each year, actual values of $\dot{p}_i$ and $\dot{A}$ from published statistics and the value of u simulated by the model. These comparisons are shown in Tables 5.2 to 5.4 below.

Table 5.2

COMPARISON OF SIMULATION AND SEVERED TRADE-OFF PREDICTIONS OF CHANGES IN THE PRICE LEVEL FOR THE SAME LEVEL OF UNEMPLOYMENT, 1958-66

(Base year for simulation: 1957)

	$\dot{A}$	$\dot{p}_i$	u	$\dot{p}_B$	$\dot{p}_B$	(5)-(4)	(6)÷(4)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				(Per cent)			
1958	3.68	1.50	5.56	0.60	3.13	2.53	425.23
1959	3.66	-0.59	3.72	0.54	1.57	1.03	189.26
1960	2.57	0.99	5.38	1.70	0.58	-1.12	- 65.87
1961	4.28	3.04	6.09	0.55	-0.38	-0.93	-169.69
1962	3.20	4.10	4.00	3.43	0.96	-2.46	- 71.91
1963	3.29	2.93	4.67	2.24	2.38	0.14	6.27
1964	3.38	1.24	5.30	0.91	1.21	0.30	32.47
1965	2.09	0.44	5.76	1.81	0.92	-0.89	- 49.15
1966	2.13	1.84	5.83	2.50	1.91	-0.58	- 23.30

Note: $\dot{A}$ -- Rate of productivity change.

$\dot{p}_i$ -- Percentage change in Canadian-dollar import prices.

u -- Unemployment rate.

$\dot{p}_B$ -- Percentage change in deflator of business nonagricultural output.

Cols. (1) and (2), calculated from published statistics (DBS); Col. (4), solution of equation (5) in text; Cols. (3) and (5), TRACE simulation results; Col. (6), absolute difference between equation solution and simulation; and Col. (7), percentage difference between equation solution and simulation.

Source: Dominion Bureau of Statistics, *National Accounts*; and DBS, *Aggregate Productivity Trends, 1946-1967*; and simulation, *The TRACE Econometric Model...*, Table 6.

It will be seen that there are, for most years in all three simulations, very considerable differences between the predicted price changes at given levels of unemployment obtained from the simplified trade-off and those obtained from the full-model simulation. It is not clear whether there is any tendency for one set of results to be persistently higher or lower. It is clear that they diverge.

Table 5.3

COMPARISON OF SIMULATION AND SEVERED TRADE-OFF PREDICTIONS OF CHANGES IN THE PRICE LEVEL FOR THE SAME LEVEL OF UNEMPLOYMENT, 1961-66

(Base year for simulation: 1960)

	u	$\dot{p}_B$	$\dot{p}_B$	(3)-(2)	(4)÷(2)
	(1)	(2)	(3)	(4)	(5)
			(Per cent)		
1961	7.21	0.24	0.00	-0.24	-100.00
1962	4.90	2.87	2.54	-0.33	- 11.43
1963	5.47	1.86	2.77	0.90	48.53
1964	5.95	0.67	1.39	0.72	108.31
1965	6.27	1.64	0.92	-0.73	- 44.21
1966	6.17	2.38	2.09	-0.30	- 12.44

Note: u -- Unemployment rate.

$\dot{p}_B$ -- Percentage change in deflator of business nonagricultural output.

Cols. (1) and (3), TRACE simulation results; Col. (2), solution of equation (5) in text; Col. (4), absolute difference between equation solution and simulation; and Col. (5), percentage difference between equation solution and simulation.

Source: Simulation, *The TRACE Econometric Model...*, Table 7.

Table 5.4

COMPARISON OF SIMULATION AND SEVERED TRADE-OFF PREDICTIONS OF CHANGES IN THE PRICE LEVEL FOR THE SAME LEVEL OF UNEMPLOYMENT, 1965 AND 1966

(Base year for simulation: 1964)

	u	$\dot{p}_B$	$\dot{p}_B$	(3)-(2)	(4)÷(2)
	(1)	(2)	(3)	(4)	(5)
			(Per cent)		
1965	4.90	2.18	1.78	-0.40	-18.37
1966	4.64	3.03	2.94	-0.08	- 2.80

Note: u -- Unemployment rate.

$\dot{p}_B$ -- Percentage change in deflator of business nonagricultural output.

Cols. (1) and (3), TRACE simulation results; Col. (2), solution of equation (5) in text; Col. (4), absolute difference between equation solution and simulation; and Col. (5), percentage difference between equation solution and simulation.

Source: Simulation, *The TRACE Econometric Model...*, Table 8.

3. Conclusions

We conclude first that, as one might have suspected, trade-offs appear to be sensitive to the exact exogenous (policy) variables that are changing or being manipulated. This is true whether one considers a simple choice among unrestricted policies (TRACE) or policy mixes satisfying a specified constraint (RDX1). In the latter case, the trade-off is only partly a result of the structure of the model (economy) and partly a reflection of a policy dilemma.

It would also seem that, in the one case in which we were able to compare the two, the trade-off results obtained are very different in practice, depending upon whether one generates them by using the full model or confines one's attention to a truncated price-wage-unemployment subsector.

Both these conclusions are based upon relatively few results, which were not particularly designed to test the conjectures advanced. They must, therefore, remain tentative until they are more thoroughly tested.

CHAPTER 6

CONCLUSIONS AND RESEARCH IMPLICATIONS

1. An examination of the wage change equations estimated in *Special Study No. 5* suggests that however well these may have fitted in their sample period, and for some years afterwards, they are no longer satisfactory. It is not even clear that equations of that general form can satisfactorily fit recent data.

The trade-off seems now to be less favourable than the equations fitted for 1953-65 would predict.

2. An examination of the structure of unemployment, admittedly a very rough one, fails to reveal any changes capable of accounting for a deterioration in the trade-off.

3. It would appear, both from this Study and from others, that price changes are now more fully reflected in changes in wages than was the case in the earlier period. Since the 1960's have been a period of rising prices, this could account for the deterioration observed in the trade-off.

It is plausible, given the nature of inflation in the 1960's, that this change represents a shift in expectations. If this interpretation is correct, it is further possible that these expectations now take the form of extrapolating fully, or even in an accelerating fashion, the price changes of the recent past. The evidence for this interpretation is not compelling, however.

4. General considerations suggest that the trade-off or price-wage-unemployment subsector ought to be part of a larger model of the economy. Some preliminary tests suggest that it makes a practical difference in the results whether one solves the trade-off equations in isolation, or the model as a whole. Moreover, the use of whole models permits the exploration of a richer set of possibilities than the use of trade-offs alone. In particular, whole models permit one to study the different price and employment implications of different policies and policy mixes. They make it clear, too, that trade-offs may arise from policy dilemmas as well as from the structure of the economy.

5. By its nature, this is a critical Study, not a new contribution to the bag of policy tools. If it has practical implications, these are largely for research strategy. One might, perhaps, draw the following implication from this Study:

(a) The impact of a persistently successful stabilization policy is unlikely to be predicted well by any statistical relationship derived from a period when such a policy did not apply.

(b) It would be unwise to rely upon the permanence or stability of particular trade-offs fitted in the usual fashion. It is, moreover, doubtful if we yet have the analytical basis for fitting trade-offs possessing these desirable properties.

(c) It is a moot question whether trade-offs, as such, are still worth the bother of fitting. A number of complete econometric models of the economy are now in use and, to the extent that these portray accurately enough the relevant features of the economy, they may well give better, or at least richer, answers to the trade-off question.[1]

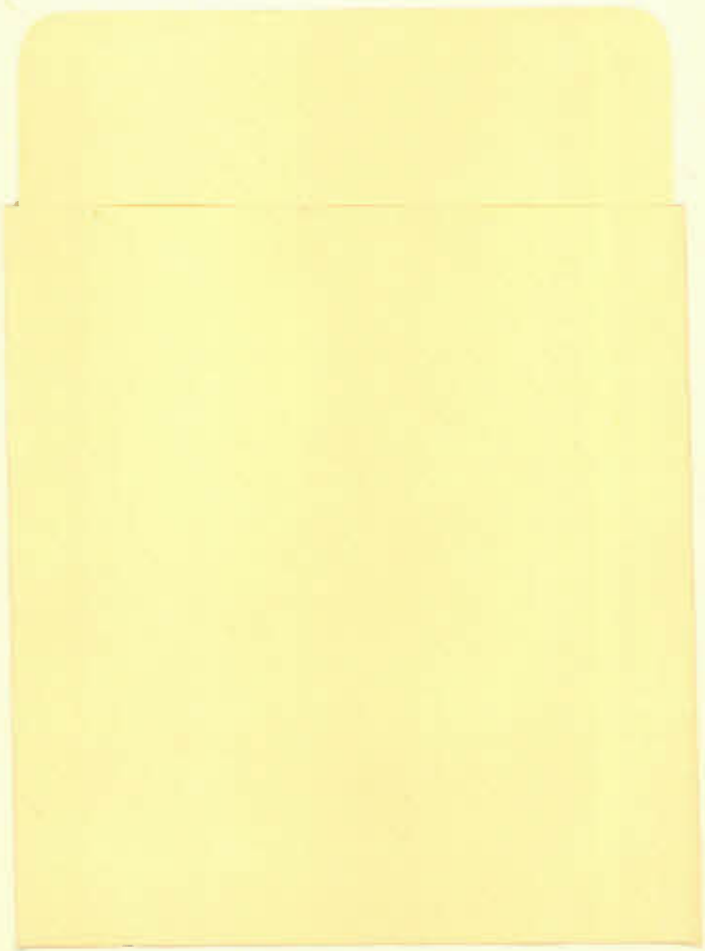
(d) Not surprisingly, different aggregate demand policies are likely to face trade-off problems of different severity. Policy dilemmas are likely to add to "the" trade-off problem, or to lead to other trade-offs between goals not having their roots in the structure of the economy. The study of various policies and combinations of policies, including some highly specific ones, from this point of view may well prove rewarding.

(e) Changes in the structure of the economy -- especially perhaps in the structure of the demand for, and supply of, labour -- and in labour market institutions can lead, and probably from time to time have led, to shifts in the trade-off. Changes in expectations have the same capacity. It is likely to be worthwhile to keep a continuous surveillance over such changes and to devise supplementary policies to avoid unfavourable alterations and to produce favourable ones.

---

[1]This is not a plea for a dogmatic commitment to such models, however. Their conceptual superiority is no guarantee of better answers in practice, given their greater vulnerability to misspecification. It may well be that once we have a sounder analysis of the trade-off problem, it will be easier, cheaper, and quicker to design special-purpose trade-off models than to modify appropriately econometric models of the whole economy.

LIST OF TABLES



The Trade-Off between Inflation and Unemployment: Some Explorations of the Recent Evidence for Canada

by S. F. Kaliski

Economic Council of Canada