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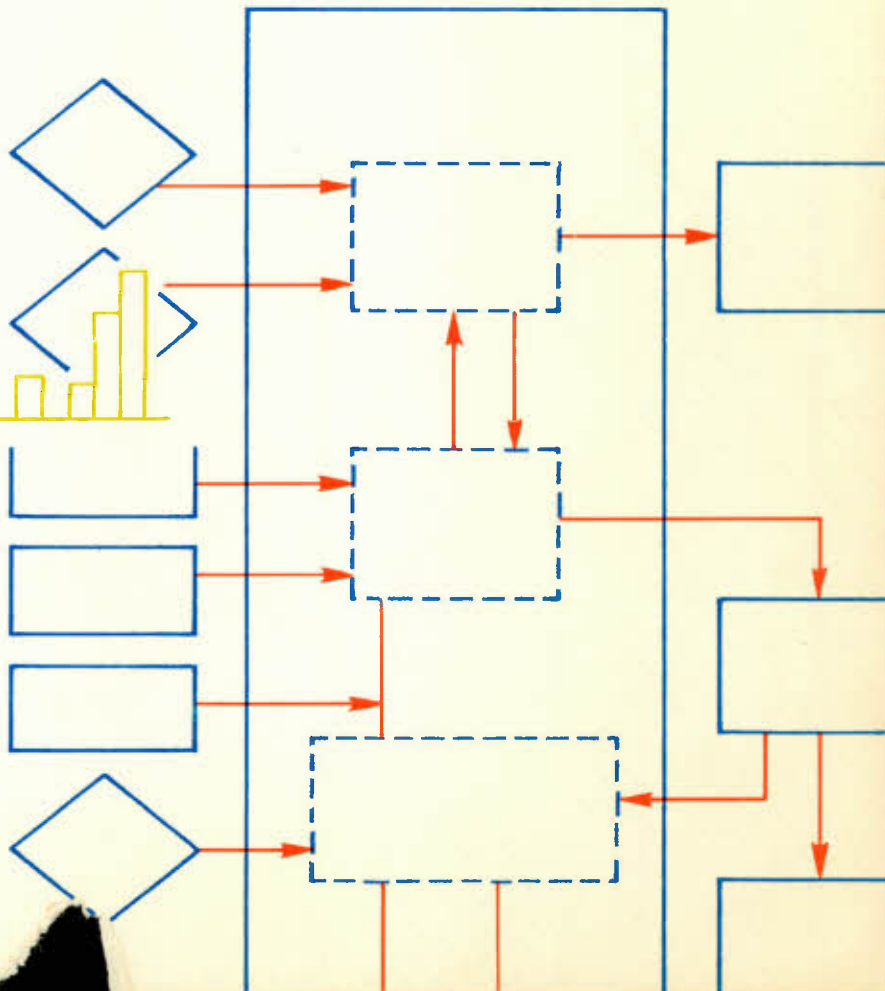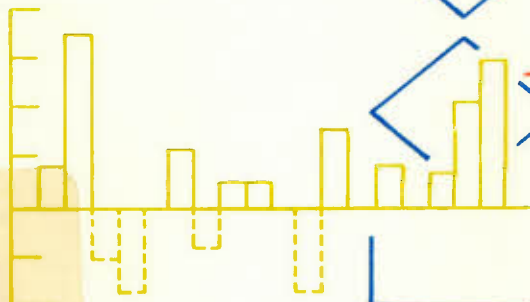# Conseil économique du Canada

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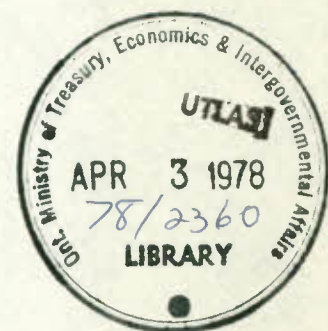Case Postale 527, Ottawa K1P 5V6

DISCUSSION PAPER NO. 105

Growth and Unemployment in
Eastern Canada

by

Neil Swan

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available by the Economic Council of Canada,
in limited number and in the language of pre-
paration, to interested individuals for the
benefit of their professional comments

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RÉSUMÉ

Le Québec et la région de l'Atlantique connaissent des
taux de chômage beaucoup plus élevés que le reste du Canada, les
Etats-Unis et l'Europe de l'Ouest, depuis au moins une génération.
On retrouve généralement deux explications possibles de ce problème.
La première, formulée par les tenants de la tradition néoclassique
suggère que le caractère saisonnier et les problèmes tant structurels
que frictionnels du marché du travail de l'est du Canada sont
responsables de l'écart observé dans le chômage. La seconde en
attribue la responsabilité à la faiblesse de la demande de produits
de la région, surtout en ce qui a trait aux exportations de produits
manufacturés à destination du reste du pays ou de l'étranger.

Ces thèses demeurent partielles, puisque la réalité
comporte des situations en contradiction avec les résultats prévus
par chacun de ces modèles. L'auteur du présent document s'efforce
donc de concevoir un modèle qui se conforme davantage aux faits
observés. Tout en retenant des éléments des deux théories précé-
dentes, le modèle offre en outre la possibilité d'introduire la
notion de chômage chronique additionnel résultant de pressions
exercées en vue d'atteindre la parité salariale avec le reste
du Canada.

Le modèle met en évidence le fait que plusieurs
politiques visant à corriger les inégalités régionales, bien que
différentes en apparence, présentent des similitudes au plan
analytique quant à leur mode d'opération. Trois exemples semblent
spécialement intéressants. D'abord, si les paiements de péréquation
réduisent les inégalités de revenu sans modifier les inégalités
de chômage, les programmes du ministère de l'Expansion économique
régionale, M.E.E.R., vont également s'attaquer aux inégalités de
revenu et se révéler impuissants face au chômage. De cette pro-
position découle le corollaire suivant: si le M.E.E.R. connaît un
certain succès dans sa lutte contre le chômage, il en ira de même
des paiements de péréquation. Ensuite, si le M.E.E.R. et la péré-
quation peuvent en fait réduire le chômage, une politique fiscale
conçue au niveau local devrait y parvenir, grâce au même mécanisme,
mais ce, sujet à une réserve importante. Finalement, quelle que
soit l'interprétation que l'on offre de la façon dont le M.E.E.R.
et les paiements de péréquation sont sensés combler les écarts de
revenu et de chômage, il semble bien que la seule voie qu'il soit
possible d'emprunter pour solutionner complètement à long terme
les problèmes de chômage de la région de l'Est passe par une
amélioration de la productivité relative de cette région.

Outre cette communion de perspective que le modèle
a permis d'établir entre des politiques disparates en apparence,
le modèle a également servi à démontrer qu'aucun mouvement
d'émigration ne résoudrait le problème du chômage dans l'est du
Canada, bien que cela soit concevable dans le cas du Québec.

Les résultats présentés dans ce document de travail font partie des travaux de recherche qui ont servi de toile de fond au rapport de concensus publié l'année dernière par le Conseil économique de Canada sous le titre "Vivre ensemble : une étude des disparités régionales". L'étude offre un cadre de référence théorique qu'il est possible d'emprunter pour évaluer la cohérence et la rationalité des recommandations touchant le chômage et la productivité que contient ce rapport.

SUMMARY

For a generation or more, Quebec and the Atlantic region have had sharply higher unemployment rates than the rest of Canada, the United States, and Western Europe. Two explanations have generally been given for this problem. One, in a neoclassical tradition, suggests that seasonality, and structural and frictional problems in the labour market of Eastern Canada, account for the unemployment difference. The second sees the cause as weakness in demand for products from the region, especially exports of manufactured products to the rest of the country or the rest of the world.

The paper argues that these explanations can only be part of the story, for each is contradicted by some of the observed data. A model is developed which is in closer conformity with observation. It incorporates elements of both the above theories, but also allows for additional chronic unemployment, caused by pressure to attain wage parity with the rest of Canada.

The model implies that several apparently different policies towards regional disparities are analytically similar in the way they operate. Three examples seem especially significant. First, if equalization payments reduce income disparities but not unemployment disparities, the programs of the Department of Regional Economic Expansion (DREE) will also reduce income disparities but not unemployment disparities; conversely, if DREE reduces unemployment, so will equalization payments. Second, if DREE and equalization can in fact reduce unemployment rates, the same mechanism that permits them to do so will also make unemployment rates sensitive to locally generated fiscal policy, subject to one important reservation. Third, under almost any interpretation of how DREE or equalization payments affect income and unemployment disparities, it seems likely that the only way of achieving a complete long-run cure to the Eastern region's unemployment problems would be an improvement in relative productivity there. Apart from this common perspective on apparently disparate policies, the model also implies that no amount of out-migration, even if it were conceivable in the case of Quebec, would solve the unemployment problem in Eastern Canada.

The work reported in this Discussion Paper is part of the research that was done in connection with an Economic Council consensus document, published last year, and entitled "Living Together: A Study of Regional Disparities". It provides one possible theoretical framework for evaluating the consistency and reasonableness of the recommendations on unemployment and productivity that were made in that document.

INTRODUCTION

        For a generation or more, Quebec and the Atlantic region
have had sharply higher unemployment than the rest of Canada, the
United States, and Western Europe. The gap persists in recessions
and booms, and predates the worldwide trend to greater generosity
of unemployment insurance.[1] Within the eastern region, unemploy-
ment is consistently and significantly higher in comparable sub-
labour markets than it is elsewhere.[2] Nor can seasonality explain
more than a part of the problem.[3]

        We should like to suggest that there is much that is
puzzling in this situation. Reasonably conventional explanations
do not appear fully satisfactory.

        Consider, for example, the hypothesis that the problem
is explained by the natural rate of unemployment being higher than
elsewhere. The explanation is undoubtedly correct on Friedman's
definition of the natural rate:

                "At any moment of time there is some level
                of unemployment that is consistent with equilibrium
                in the structure of real wage rates. At that level
                of unemployment, real wages are tending on the
                average to rise at a "normal" secular rate, i.e.,
                at a rate that can be indefinitely maintained so
                long as capital formation, technological improve-
                ments, etc., remain on their long-run trends."[4]

It would be difficult to maintain that real wages have not risen,
over the last generation in Eastern Canada, at a "normal" secular
rate, and that the structure of real wages has not been in rough
equilibrium in the Friedman sense, since market imperfections are
specifically included among the forces relevant to equilibrium:

                "... many of the market characteristics that
                determine its [i.e., the natural rate's] level
                are man-made and policy-made. In the United
                States, for example, legal minimum wage rates,

the Walsh-Healy and Davis-Bacon acts, and the
strength of labor unions all make the natural
rate of unemployment higher than it would other-
wise be."[5]

The natural rate hypothesis will not be very useful, however, for

explanation or policy-making, unless it is distinguishable from

alternatives such as unemployment because of chronic demand weak-

ness, due to export failure or otherwise.

While it is hard to document precisely, the necessary

extra restrictions needed by the natural rate theory to distinguish

it from competitors seem commonly to concern its implications for

the micro functioning of labour markets. Higher natural rates

than other places are attributed to higher propensities to quit in

similar circumstances, to lesser efficiency or effort by job

seekers in the process of searching for work, to reservation wages

that are higher than elsewhere in relation to the marginal produc-

tivity of the worker after a given lapse of search time (greater

"fussiness"), and so forth.[6] In judging the explanatory power of

this version of natural rate theory, we may consider one prediction

that is often made with it: that there will exist an equilibrium

inverse relationship between unemployment and vacancy rates and

that this relationship will be further out from the origin in labour

markets where the "natural" rate of unemployment is higher. Esti-

mation of such a relationship for Eastern Canadian regions does

typically show it to be further from the origin than in the rest

of Canada. This suggests that differences in natural rates do

exist, but, on the other hand, the curves for Eastern Canada are

not displaced far enough to account for all the extra unemployment

in the region.[7] Moreover, it is not certain whether the estimated unemployment-vacancy relationships are identified. Identification requires that each relationship not shift, and that demand vary enough to permit observation of several points on the curve. As demand varies up and down, the unemployment rate will go down and up, and the vacancy rate up and down, tracing out the inverse relationship between them. Suppose, however, that demand pressure happens to vary among regions at a particular time, but that, contrary to the natural rate hypothesis, all regions have the same unemployment-vacancy relationship. Cross-sectional data ought then to trace out such a negatively sloped relationship, and thereby, confirm the absence of differences in "natural" rates of unemployment. On the other hand, if "natural" rate differences do exist, and demand pressure differences do not, the cross-sectional observations will reveal the locus of pairs of unemployment and vacancy rates in each region that are consistent with a level of demand pressure that has the same, constant, value in each region. One *possibility* for obtaining such a locus is to define excess demand as the gap between the vacancy and unemployment rate, giving

$$\text{excess demand} = \text{constant} = (\text{vacancy rate} - \text{unemployment rate})_i$$

with $i = 1 \ldots$ number of regions, i.e., a line of positive (45°) slope in vacancy rate/unemployment rate space. More generally, a positively sloped locus would be expected.[8] Now cross-sectional data show a negative slope (the unemployment rate is relatively high, when the vacancy rate is relatively low). On the other hand, the fit is far from perfect.

We conclude that on the particular formulation of the "natural" rate hypothesis in terms of relationships between unemployment and vacancy rates, both our own evidence and that of others point only to partial truth of the hypothesis. It seems there is also some truth in the "demand pressure" hypothesis.

An alternative form of the natural rate hypothesis is that real wages are held too high in Eastern Canada to permit full employment. As Friedman points out, however, real wages rise steadily through time, so that the hypothesis has to be reframed as real wages being held too high *relative to their full-employment trend path*, in the East but not elsewhere (if real wages were held rigidly constant in the East, unemployment would disappear in very short order; as real wages elsewhere rose the region would swiftly become an extremely profitable place to locate production). In this "trend path" form the natural rate hypothesis is one way of characterizing the theory developed in this paper, although the particular method chosen for rendering the hypothesis non-tautological leads to conclusions that are not typically associated with natural rate theory.

Let us consider more directly now the hypothesis that the unemployment problem in Eastern Canada is one of demand weakness.[9] It has some attractive features, but is also flawed as a complete explanation of what is going on.[10] There can be little question that the intermittent demand weakness that comes with cycles impacts more severely on the East, and over the years that adds up to more unemployment than average. Like seasonality, however, this cannot explain all the problems. On the other hand, secular weakness of demand, that

persists even in booms, is as hard as the natural rate hypothesis to admit as a complete explanation. How can demand be weak when employ-ment has grown 70 per cent in Quebec in twenty-five years, a rate of growth nearly twice as fast as in the United States, for example, and far faster than in Saskatchewan and Manitoba, where unemployment is not a problem? Even in the Atlantic, demand has grown enough to absorb 47 per cent more labour in the last two-and-a-half decades, again a better performance than the United States. On the natural rate hypothesis these observations are trivial to explain, but extraordinarily difficult on a secular demand weakness view. That version of the secular demand weakness theory that argues for a failing export base is faced with similar difficulties. Why, in Quebec, was an export base growth better than that of France, in terms of realized employment growth, inadequate to keep unemployment down?

The pattern of migration and its relation to lack of change in unemployment rates is also difficult to reconcile with the demand or structural view of unemployment, but not with the natural rate view. If unemployment rates are at their natural level, migration would not be expected to change them other than marginally.[11] But if demand weakness is the problem, removing some of the labour supply by out-migration should relieve it. Yet the Atlantic region has had massive out-migration, with no apparent effect on its unemployment problem.[12] If one could keep the demand for labour steady in the Atlantic and Quebec while reducing the supply by out-migration, the unemployment rate should drop to the "natural" level. But the evidence of the Atlantic region suggests

that labour demand is not independent of labour supply, just as it would not be in a world of natural unemployment rates.

We shall not in this paper argue that cyclical, seasonal and micro labour market differences are unimportant in explaining the Quebec/Atlantic problem. We believe the contrary. But we shall argue that a further source of secular unemployment is likely to exist, in the form of a tendency for real wages to be held, by institutional forces to be specified, at a level higher than the full employment marginal product of labour. This idea is far from new, but an extensive development of a model that accommodates this possibility does resolve a number of the problems alluded to above, concerning the difficulty of accepting either demand weakness or a narrowly specified version of natural rate theory as the exclusive source of Eastern Canada's unemployment. Beyond this, the model implies, somewhat surprisingly, that several apparently different policies towards regional disparities are analytically similar in the way they operate. They stand or fall together. Three examples of this seem especially significant. First, if equalization payments reduce income disparities but not unemployment disparities, the programs of the Department of Regional Economic Expansion will also reduce income disparities but not unemployment disparities; conversely, if DREE reduces unemployment, so will equalization payments. Second, if DREE and equalization can in fact reduce unemployment rates, the same mechanism that permits them to do so will also make unemployment rates sensitive to locally generated fiscal policy, subject to one important reservation. Third, under almost any interpretation of

how DREE or equalization payments affect income and unemployment disparities, it seems likely that the only way of achieving a complete long-run cure to the Eastern region's unemployment problems would be an improvement in relative productivity there. Apart from this common perspective on apparently disparate policies, the model also implies -- as does any natural rate theory -- that no amount of out-migration, even if it were conceivable in the case of Quebec, would solve the unemployment problem.

We begin with theory, and then use a simple graphical version of the model to analyse disparities and possible cures for them. Testing of the model is not included in this paper; the model is empirically based only in the sense that it can explain, in a general way, several of the empirical phenomena alluded to that are hard to explain with standard models, e.g., the coexistence of rapid employment growth and high rates of unemployment, and the apparent powerlessness of migration to cure disparities. But detailed testing is in progress, and the results of it will be presented in a later paper.

THEORY

A region is defined as an area which has its own government with taxing, spending and borrowing powers, but no independent monetary authority, and with enough of a community feeling that its residents feel themselves sharply distinct from outsiders. The conditions imply, for example, that Quebec province is a region but Quebec City is not.

We consider in turn the behaviour of households, of the regional government, and of firms in the region. We model asset

stocks and the associated flows in some detail, because some authors
have seen equilibrating adjustments in these as key elements for
understanding some of the differences between a regional and a
national economy.[13] We also make the model dynamic, because some
important processes are possible in a growing world but not in a
static one,[14] and because slow but long-persisting interregional
migration can be handled satisfactorily only in a model of con-
tinuous growth.[15] Such migration is characteristic of the Canadian
scene. Finally, we consider a government sector, and at two levels,
as essential even at the theoretical level, and therefore bring it
in from the beginning. All this makes for some complexity, but
we believe that the gain in explanatory power and policy relevance
makes it worthwhile.

Households

Money inflows into households will equal outflows if
we adopt a convention of treating cash accumulation as an outflow.
Inflows include wages, denoted Nw where N is employment and w is
the wage rate (in constant dollars as are all monetary variables
unless otherwise stated), profits (π), interest income, equal to
the interest rate r times the real holdings of bonds issued by
firms and held by households (B_{FH}) and bonds issued by the regional
government and held by households (B_{GH}), and finally, transfers
to households from outside the region, (T_H), a variable that in-
cludes old-age pensions paid by the national government, unemploy-
ment benefits, etc. We abstract from all other sources of income
and assets, except cash. Money outflows are for consumption (C),
bond accumulation ($\dot{B}_{GH} + \dot{B}_{FH}$, where a dot indicates a time deriv-
ative), taxes to the regional government (T), and to the national

government (T_C), and for accumulation of cash balances ($\dot{M}_H$). We thus obtain our first equation:

(1) $Nw + \pi + r(B_{FH} + B_{GH}) + T_H = C + \dot{B}_{GH} + \dot{B}_{FH} + \dot{M}_H + T + T_C$

Households accumulate bonds and cash as time goes by. We assume that some stable relationship between the two kinds of bonds held is maintained:

(2) $B_{FH} = \theta\,(B_{GH})$;

and that cash balance requirements are proportional to income:

(3) $M_H = k_H(Nw + \pi + r(B_{FH} + B_{GH}) + T_H)$.

Total saving is taken as a fraction "s" of total income, with s possibly being a function of the interest rate:

(4) $\dot{B}_{GH} + \dot{B}_{FH} + \dot{M}_H = s(Nw + \pi + r(B_{FH} + B_{GH}) + T_H)$

Regional Government

Money inflows consist of taxes T, transfers to the regional government from government outside the region, T_G, new debt issue to households ($\dot{B}_{GH}$) and to outside the region ($\dot{B}_{GX}$). All debt is assumed to be consols. Outflows are for goods and services (G), for interest payments on outstanding debt ($r(B_{GH} + B_{GX})$), and for accumulation of cash balances ($\dot{M}_G$). Regional government transfers to persons or firms are assumed zero. We then have:

(5) $T + T_G + \dot{B}_{GH} + \dot{B}_{GX} = G + r(B_{GH} + B_{GX}) + \dot{M}_G$

We suppose that cash balances needed are proportional to spending on goods and services.

(6) $M_G = k_G G$

and that taxes of each government are proportional to regional output, Y.

(7) $T = \tau_R Y$

(8) $T_C = \tau_C Y$

Firms

Some money inflows are obtained from sales of consumption goods (C), of goods and services to governments (G to the regional government and G_C to the national government), and of goods for export from the region to the rest of the nation or the world, XP_X/P, where X is the quantum of exports, P_X is an index of export prices and P the index of regional prices. Other cash flows come from subsidies paid to firms by the national government (T_F), and new issues of bonds to regional households $(\dot{B}_{FH})$ and outside the region $(\dot{B}_{FX})$. Notice that firms as a whole do not receive cash from sales of investment goods, the cash associated with these sales is already included as part or all of $\dot{B}_{FH} + \dot{B}_{FX}$. Money outflows are made for wages, profits, imports $(FP_F/P$, where F is the quantum of imports, and P_F a price index of imports, and all importing is assumed to be done by firms), interest charges on outstanding debt $(r(B_{FH} + B_{FX}))$, and accumulation of cash balances $(\dot{M}_F)$. This gives:

(9) $C + G + G_C + XP_X/P + T_F + \dot{B}_{FX} + \dot{B}_{FH} = Nw + \pi + FP_F/P$
$$+ r(B_{FH} + B_{FX}) + \dot{M}_F$$

The supply of output is made up of regional output (Y),
plus imports FP_F/P, and it is allocated to consumption, government
goods and services, exports and capital accumulation ($\dot{K}$). Thus:

(10) $\quad Y + FP_F/P = C + G + G_c + XP_X/P + \dot{K}$

Cash balance requirements are taken as proportional to
regional output, i.e.:

(11) $\quad M_F = k_F Y$

Next we suppose that firms' asset balance sheets show
zero net worth, i.e., that bonds are issued only in order to finance
capital accumulation or to obtain working cash balances. This
gives:

(12) $\quad K + M_F = B_{FH} + B_{FX}$

Consider now the determination of total output supplied
as a function of product prices and factor costs. We build up
aggregate supply and input demand functions by aggregating from
the behaviour of individual firms.

Let there be m identical firms, each one with a production
function with neutral technical change and with first increasing and
then decreasing returns to scale.[16] We use lower case letters to
indicate micro variable values, e.g., "y" is output per firm. The
micro production function is:

(13) $\quad y = e^{gt} f(k,n)$, where "g" is the rate of technical change.

The marginal product conditions are:

(14) $r = e^{gt} f_k$

(15) $w = e^{gt} f_n$

Let the number of firms be equal to the number of entre-preneurs. The supply of entrepreneurs is assumed homogeneous of degree unity in the labour supply,[17] N_s, and positively responsive to the ratio of profit income in a firm to the value of output in a firm:[18]

(16) $m/N_s = \emptyset ((y - kr - nw)/y)$, $\emptyset'$ positive.

The definitions of aggregate variable values are:

(17) $Y = my$

(18) $K = mk$

(19) $N = mn$

In principle one can eliminate y, k, n and m from equations (13) to (19) and leave three equations in the remaining variables. We have not been able to do this for a general production function and obtain results we can work with, and so have made use of the Cobb-Douglas form. It is assumed that this is an adequate approxi-mation in the relevant range, even though it does not display increasing returns at small output levels. We conjecture, but cannot prove, that our key results are not critically dependent on a particular choice of functional form. Writing $f(k,n) = Ck^a n^b$, $a+b < 1$, C a constant, and putting $\mu = 1/(1-a-b)$, $A = C^\mu a^{a\mu} b^{b\mu}$ $\phi(1-a-b)$ we can derive:[19]

(20) $Y = AN_s e^{g\mu t} r^{-a\mu} w^{-b\mu}$

(21) $K = aY/r$

(22) $N = bY/w$

Exports, Imports, and External
Capital Supply

In a small open economy, in the long run, the proportion of output diverted to the export market will depend on the ratio of the prices of exportables to the local price level. It may also depend on the amount of subsidy granted by the national government to firms who set up production facilities for exportables in the region. Since most of T_F will be given with this in mind, we may suppose that the proportion of output exported will depend on T_F/Y. Therefore:

(23) $X/Y = X(P_X/P, T_F/Y)$, with both partial derivatives positive.

Imports as a fraction of total domestic output will depend inversely on the relative price of importables, so:

(24) $F/Y = F(P_F/P)$

The interest rate charged the region's borrowers will be a positive function of the current interest charges relative to output, so:

(25) $r = f((B_{FX} + B_{GX})r)/Y$

This is the external supply curve of capital.

Equilibrium in the Labour Market

We shall postulate that real wages in the region can be subject to several types of pressure. First, there is the standard

classical market mechanism, that the rate of change of real wages
may be sensitive to the unemployment rate, giving $\dot{W}/W = f(u) + \dot{P}/P$, $f_u \leqslant 0$, $f(u^*) = 0$, where u^* is the "natural rate". Second,
we extend the neoclassical mechanism to add that the rate of change
of real wages at any given unemployment rate could be positively
sensitive to the generosity of income maintenance programs ("ℓ", for
"largesse"), so that $\dot{W}/W = f(u, \ell) + \dot{P}/P$, $f_\ell \geqslant 0$. Third, we suppose
that actual money wages (W) may rise more rapidly the lower are
actual wages in the region relative to actual wages outside it,
denoted $\bar{W}$, i.e., $\dot{W}/W = f(u, W/\bar{W}, \ell) + \dot{P}/P$, with $f_{W/\bar{W}} \leqslant 0$. We
refer to this as the operation of "wage parity" forces. Relative
money wages rather than relative real wages are used on the grounds
that the institutional forces responsible for this particular source
of regional wage pressure take cognizance of relative money wages
rather than real. Unions bargaining systemwide do not allow for
interregional living cost differentials; the federal Treasury Board
makes no such allowance in setting systemwide rates for federal
employees; public debate on the appropriate level of minimum wages
often refers to similar minima in other regions but rarely to living
costs; finally, individuals in their own bargaining, in the non-
unionized sector, would likely find it considerably easier to point
to regional differences in the money wage for their own work than to
real wage differences. The strength of wage parity forces may depend
on several variables associated with relevant institutional phenomena,
two prominent ones being the proportion of the labour force unionized,
n_u, and the proportion of the labour force in federal employment,
n_f. Thus, we have $\dot{W}/W = f(u, W/\bar{W}, \ell, n_u, n_f) + \dot{P}/P$, with f_{nu}, $f_{nf} \geqslant 0$.
Denote ℓ, n_u, n_f by the vector v, and we arrive at

(26) $\dot{W}/W = f(u, W/\overline{W}, v) + \dot{P}/P$, with f_u, $f_{W/\overline{W}} \leqslant 0$

$$f_v \geqslant 0$$

The following special cases may be of interest:

-- $f_{W/\overline{W}} = 0$, $f_u < 0$, is the classical case

where real wages adjust to ensure full

employment

-- $f_u = 0$, $f_{W/\overline{W}} < 0$, is a pure parity case,

where unemployment adjusts to whatever level

is consistent with parity demands; it has a

Keynesian flavour to it.

Bearing in mind that the unemployment rate, u, can be found

when employment, N, is known, the model is now complete, consisting of

equations (1) to (12) and (20) to (26), for the nineteen variables M_H, M_F,

M_G, B_{GH}, B_{GX}, B_{FH}, B_{FX}, Y, K, N, C, X, F, T, T_c, w, P, π and r. The full model, and

definitions of all variables, are summarized for convenience in Appendix C.

We now focus on using the model to explain two types of

"regional disparity" -- lower-than-average relative wages and a

higher-than-average unemployment rate. In order to highlight what

the model has to say on these, we shall simplify it down to two

equations in these two variables, thereby enabling a graphical

exposition to be utilized.

The cost of this simplification is that it is necessary to take the

rate of interest as being given to the region, i.e., there is an infinitely elas-

tic supply of funds available at some interest rate r. We believe it can be

proved that the conclusions would be changed in magnitude, but not in size, if r

were allowed to vary according to equation (25), but have been able neither to

prove this, nor to develop a simple graphical presentation for this general case.

We shall be studying a situation where disparities are chronic, in the sense that wages in the region are a constant fraction, less than unity, of wages outside, and unemployment is higher than outside, in order to highlight which changes would bring about convergence or divergence from a stable position. Some of these changes could occur spontaneously, some could be policy driven.

Derivation of a Simple Graphical Solution to the Model

In Appendix B we use several equations[20] to derive one equation for the regional price level relative to the price level outside, as an inverse function of a variable which is the sum of three elements, the surplus of taxes over governments' spending on goods and services in the region as a fraction of gross provincial product $(\tau - \gamma)$, the negative of transfers from the federal government to firms and/or households in the region $(\bar{t})$, also as a fraction, and a term Ω, which is a function of several system parameters. The equation is

(27) $\quad P/P_X = \beta^{-1} [\tau - \gamma - \bar{t} + \Omega]$, where "$\beta$" is a function, with
$$\beta^{-1'} < 0$$

Multiplying (20) and (22), and recalling that $w \equiv W/P$ we obtain

$$N = N_s A b e^{g\mu} t_r^{-a\mu} (P/W)^{1+b\mu}$$

Consider now the expression $1 - N/N_s$.

If we abstracted completely from seasonal and cyclical variations in unemployment, and from the generation of frictional unemployment via the job search process, $1 - N/N_s$ would be the unemployment rate, as determined by the long-run secular forces being modeled here. While we wish to focus on secular problems in the paper, it is perhaps as well to retain in mind other important causes of regional differences in unemployment by the device of adding to the secular unemployment determined by the model a term for the other possible types of unemployment. Call

the sum of seasonal, cyclical, and frictional unemployment u*, and we shall have total unemployment, u, given by

$$u = u* + 1 - N/N_s.$$

Eliminating N/N_s from these last two equations we obtain

(28) $$W = P \left[\frac{bAr^{-a\mu}}{1-u+u*}\right]^{\frac{1}{1+b\mu}} e^{(g\mu/(1+b\mu))t}$$

We suppose that the exogenous variable $\bar{W}/P_X$, the real wage outside the region, grows at rate δ, so that

(29) $$\bar{W}/P_X = e^{\delta t},$$

and that inflation outside is at rate q, so that

(30) $$\dot{P}_X/P_X = q$$

On multiplying (27) and (28) we obtain

$$W/P_X = \beta^{-1}(\tau-\gamma-\bar{t}+\Omega) \left[\frac{bAr^{-a\mu}}{1-u+u*}\right]^{\frac{1}{1+b\mu}} e^{(g\mu/(1+b\mu))t}$$

and using (29) to eliminate P_X this becomes

$$W/\bar{W} = \beta^{-1}(\tau-\gamma-\bar{t}+\Omega) \left[\frac{bAr^{-a\mu}}{1-u+u*}\right]^{\frac{1}{1+b\mu}} e^{\left(\frac{g\mu}{1+b\mu} - \delta\right)t}$$

Since we are studying the case where disparities are chronic, $W/\bar{W}$ must be constant, so that this last equation tells us that real wage growth will be the same inside and outside the region, i.e., that $\delta = g\mu/1+b\mu$ and that, under these conditions

(31) $\quad W/\bar{W} = \beta^{-1}(\tau-\gamma-\bar{t}+\Omega) \left[\dfrac{bAr^{-a\mu}}{1-u+u^*}\right]^{\frac{1}{1+b\mu}}$

From (29) and (30) $\dot{\bar{W}}/\bar{W} = \delta+q$, and from (31) we then obtain $\dot{W}/W = \delta+q$. Moreover, (27) and (30) imply that $\dot{P}/P = q$. Substituting these last two results into (26) we obtain
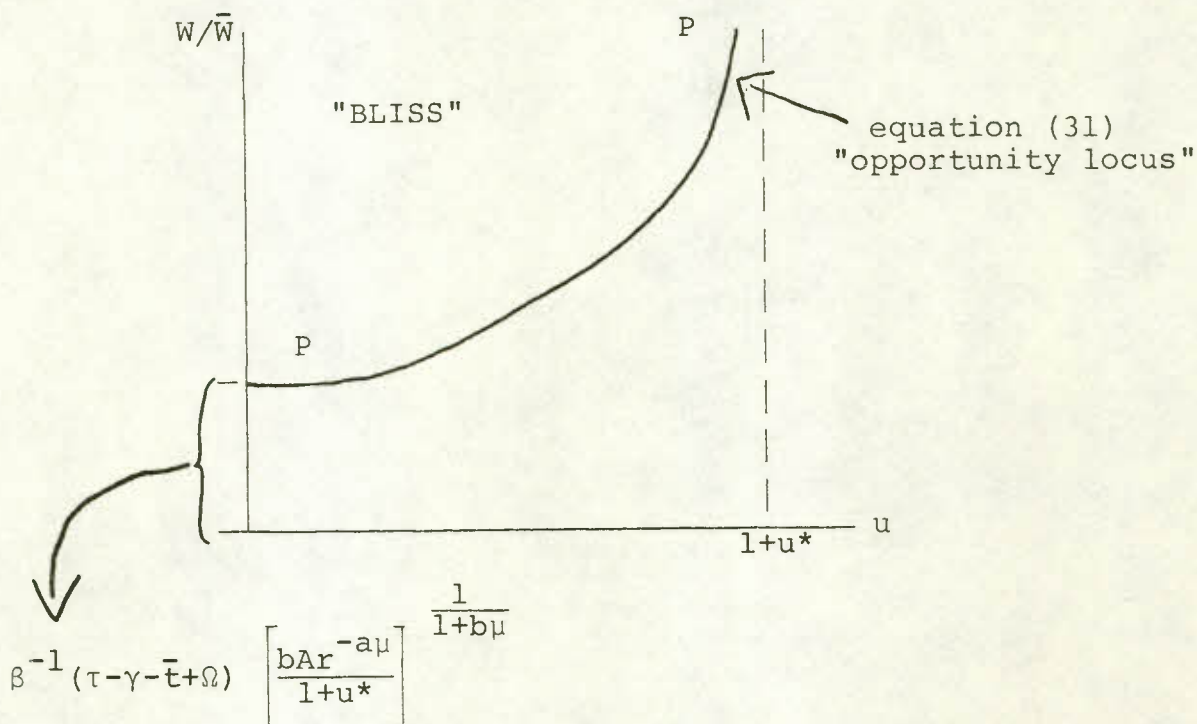
(32) $\quad \delta = f(u, W/\bar{W}, v)$

Equations (31) and (32) form the basis of our graphical analysis of a "chronic disparity" steady state.

Equation (31), the Opportunity Locus

This is an upward sloping locus in $(W/\bar{W}, u)$ space:-

Chart 1

There is an asymptote at $1+u^*$, and the intercept on the relative wage axis has the value indicated. High relative

wages and low unemployment lie in a "bliss" region at the upper left; this is where the region would like to be. For any <u>given</u> relative wage rate the curve PP shows the unemployment rate that is <u>feasible</u>. PP gives the opportunity cost of improving one disparity -- wages -- in terms of the worsening of the other -- unemployment, and is therefore labelled the "opportunity locus".

What changes move the opportunity locus towards bliss? Since the asymptote is at $1+u^*$, any reduction in u^*, i.e., in frictional, seasonal, or cyclical unemployment will do so, as expected. Since the intercept on the vertical axis has the value

$$\beta^{-1}(\tau-\gamma-\bar{t}+\Omega) \left[\frac{bAr^{-a\mu}}{1+u^*}\right]^{\frac{1}{1+b\mu}}$$

the latter result is confirmed, and in addition, since $\beta^{-1'} < 0$, a movement towards bliss can occur if $\tau - \gamma$ falls, i.e., if a smaller government surplus or larger deficit occurs, if $\bar{t}$ rises,[21] i.e., if transfers to persons or firms go up, and if Ω falls (a complex issue). In addition, the β function itself could shift. That means that an increased propensity to export (or reduced propensity to import) at any given set of relative prices, moves the region closer to bliss. Finally, PP can shift as a result of changes involving the square bracketed term; the most interesting is a rise in A, which could occur for example because of an increase in total factor productivity at the firm level or because of a greater "propensity to entrepreneurship" among the population. Both of these move the curve towards bliss. The effect of r, the rate of interest paid by the region on external borrowing, is not easily deduced, since it enters also into Ω in a complex way.[22]

One surprising and important result is that the rate of migration enters only through its influence on Ω, which changes because a change in $\dot{N}_s/N_s$ changes Ω (see Appendix B). A change in the migration rate moves the opportunity locus, but only in a once-for-all fashion; the region does not <u>steadily approach</u> bliss if migration proceeds steadily. It is not even certain that the once-for-all shift is in the direction of bliss. Labour mobility cannot therefore be relied upon to cure disparities in this model, even in the indefinitely long run.

Equation (32), The Bargaining Balance Locus

Since $f_u \leqslant 0$ and $f_{W/\bar{W}} \leqslant 0$, (32) is in general a downward sloping curve. At one limit, when $f_{W/\bar{W}} = 0$, it is a vertical line passing through a "natural" rate of unemployment, whose level is sensitive to the elements in v, e.g., income maintenance programs, unionization. At the other limit, it is a horizontal line, passing through a relative wage level as close to parity as institutional forces can make it, the degree of closeness again depending on the elements in v. In general we have a curve BB as below:-

Chart 2

W/$\bar{W}$

B

B

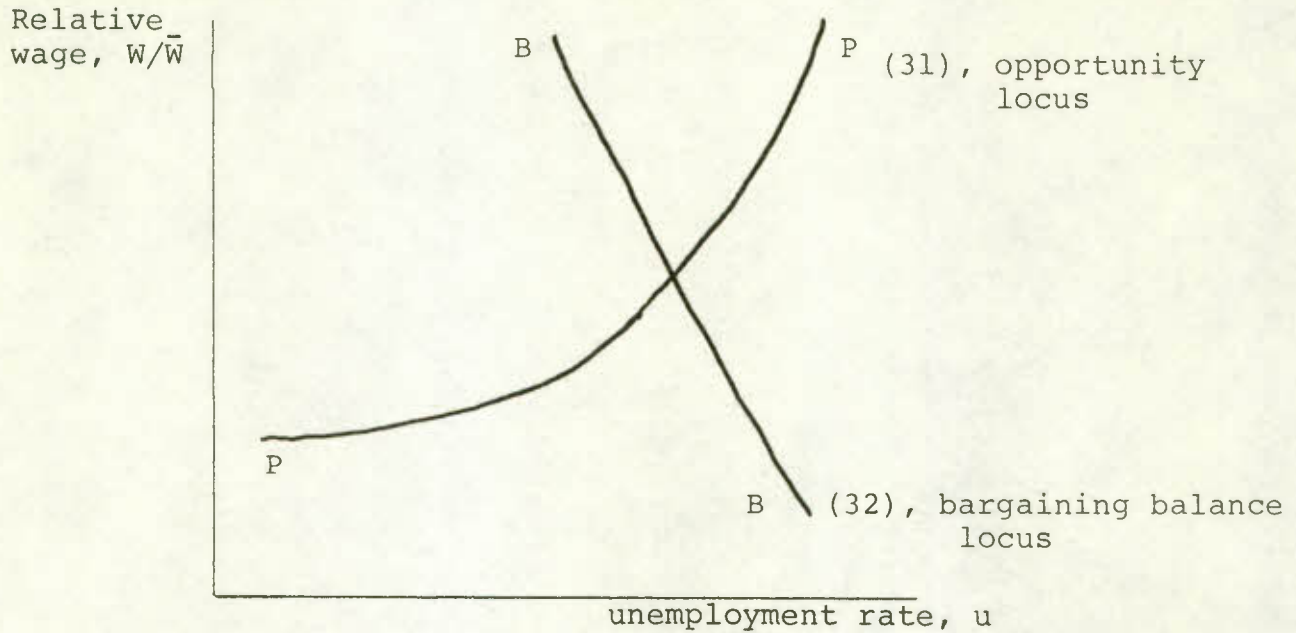equation (32), bargaining balance locus

u
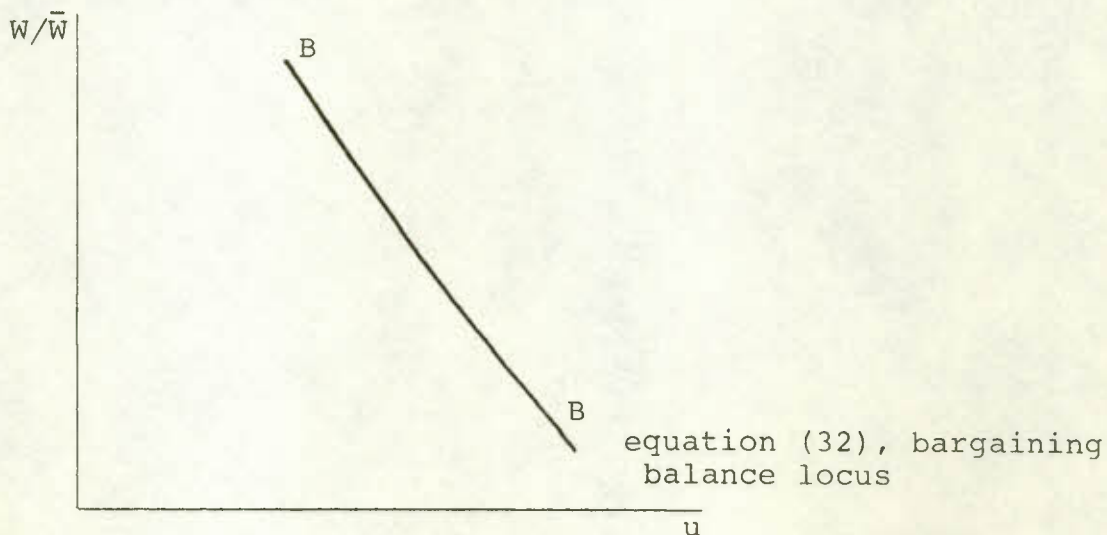
Curve BB has been labelled the "bargaining balance locus", since it shows that any reduction in unemployment, conceived of as exogenously presented to the participants in the wage-setting process, will strengthen wage parity forces that tend to push wages up, and weaken competitive forces that tend to pull them down, and lead to a new "balance of bargains" in which wages are higher.

Any rise in the variables in the vector v will shift BB upwards, e.g., a greater relative size for the federal government, which automatically gives parity to its own employees, will raise the relative wage that can be insisted upon at any given unemployment rate, and shift BB upwards, as will a rise in unemployment insurance benefits, which makes such insistence less costly in terms of any resulting unemployment.

ANALYSIS OF DISPARITIES AND
THEIR CURES

Chart 3 below juxtaposes both curves. We use it to investigate a number of policies and processes that influence disparities, beginning with actions of the federal and regional governments, then looking at the process of out-migration, at institutional and other changes in the labour market, and finally at the role of changing interregional productivity differentials.

Chart 3

Relative
wage, $W/\bar{W}$

B   P   (31), opportunity
                     locus

P

B   (32), bargaining balance
                     locus

unemployment rate, u

Federal Actions

Some federal policies are undertaken deliberately to
reduce either income or unemployment disparities or both, others
reduce or increase them as side effects. In the first group are found
equalization payments and shared-cost programs, expenditures by the
Department of Regional Economic Expansion, and relocation of federal
activities.

Equalization payments are the biggest program, and
enter our model as the main component of the variable T_G. This is
not present in either equation (31) or (32), but it nevertheless may
affect (31) indirectly, by facilitating increased regional govern-
ment spending without the financing problems normally associated
with that. Indeed, that is the aim of equalization. Thus,
increased equalization probably will induce a rise in γ and/or a
fall in τ in equation (31), shifting the opportunity locus upwards,
reducing the unemployment rate and raising relative wages. The
same is true of shared-cost programs.

Expenditures by DREE are partly to help regional govern-
ments, e.g., to build infrastructure, and partly to induce firms
to locate in the region. The former spending has effects like those
just analysed for T_G, the latter enters the model as an increase in
T_F, which in turn increases $\bar{t}$. In (31) $\bar{t}$ enters directly, and also as part of Ω,
but from the definition of Ω in Appendix B it seems virtually certain that PP shifts
up, the same kind of effect as for T_G. In this case, however, there is an additional
effect, in that the function $\beta^{-1}(P/P_X)$ contains T_F/Y as an argument
(see equation (23)), and this fact augments the upward shift of PP.
What is happening here is that there is a direct effect of T_F on
spending, for it transfers income to entrepreneurs in the region, and
an indirect effect through increasing the proportion of output that is
exportable at a given level of regional wage rates (through equation
(23)). On both counts aggregate output rises, lowering unemployment
and raising relative wages.

Relocation of federal activities increases γ in
equation (31), causing PP to shift up. That would certainly have
favourable effects on output and employment, if it were not for
a side effect of the same policy, that affects the position of the
bargaining balance locus. Since the federal government pays
national rather than local wages, parity forces are strengthened,
shifting BB up. The net effect is certainly to raise wages,
but with both curves shifting up, unemployment could rise or
fall. Decentralization improves incomes, but has an uncertain
effect on unemployment.

The federal government has in recent years instituted
a series of large improvements to income maintenance programs. If

the demand-generating effects of these expenditures in each region
are offset by extra federal taxes levied in the region equation (31)
does not change ($\bar{t}$ would rise, but τ would rise enough to offset
the effect). The assumption of an offset is surely correct for the
nation as a whole, but not for each region in it. In a poor, high
unemployment region, such as we are analysing, transfers will rise
more than tax collections, i.e., $\bar{t}$ will rise more than τ. This is
well known for the case of unemployment insurance, but it is also
true for the Canada Assistance Plan, Old Age Pensions and probably
the Canada Pension Plan. It is possible that the national govern-
ment becomes less generous in transfers to a poor region's govern-
ment as a consequence of increased transfers to persons in that
same region, so that T_G drops below what it would otherwise be, but
this seems unlikely. Thus, $\bar{t}$ rises without a corresponding shift
in τ, and PP on this account shifts up, generating higher wages and
lower unemployment. In effect, the impact of income maintenance
programs diverts part of a given level of national aggregate demand
into poorer regions. But this is not the whole story. Two other
changes occur in Chart 3. First, u* rises, for there is much evidence
now that unemployment insurance has increased search time,[23] thereby
increasing the frictional component of unemployment. That shifts
curve PP out and downwards, an opposite shift to the one just con-
sidered. But over and beyond this, the disutility and loss of in-
come associated with unemployment is decreased, strengthening wage
parity forces -- an effect that occurs only in low-income regions,
unlike the search effect, which occurs everywhere. Curve BB shifts
up. The total effect cannot therefore be predicted without quanti-
tative analysis, for the aggregate demand effect tends to raise

wages and lower unemployment, the search effect to raise unemploy-
ment and lower wages, and the parity effect to raise unemployment
and raise wages.

Equalization and DREE have analytically identical effects.
But although they both raise income and reduce unemployment, they
both require continuing permanent transfers to the region. There is
presumably a limit to how much can be annually transfered, and there-
fore a limit to this method of reducing disparities. Government de-
centralization would have analytically identical effects if local
wages were paid (so that curve BB did not shift), and would then have
the advantage of being virtually costless to the nation. The poor
region would become better off and more fully employed by specializing
in the export of national public goods. But since local wages are not
paid, the effects on unemployment are uncertain, and given the lower
productivity of low-income regions, the payment of national wage rates
makes decentralization another kind of subsidy. All in all, it is
readily conceivable that these federal policies, taken as a group,
could never eliminate unemployment disparities, because the cost to
the rest of the nation would be too high to accept. What then can
the region do from its own resources?

Regional Actions

Regional government spending appears as one of the
determinants of γ, and regional government taxes as a determinant
of τ, both in equation (31). A policy of running a permanently
larger deficit or smaller surplus, as a fraction of regional out-
put, will shift curve (31) up, reducing unemployment and raising
income. But there are limits to this. They can be seen by examining

equation (5) a little further. Suppose first that the regional government makes no distinction between whether its bonds are held in the region (B_{GH}) or abroad (B_{GX}). Then we may add the two and call the total B, regional government bonds outstanding. In long-run dynamic equilibrium all aggregate dollar variables will be growing at a constant rate (called ρ in Appendix B). Thus, each endogenous variable in equation (5) will take the form of a constant multiplied by $e^{\rho t}$. If we substitute from (6) for $\dot{M}_G$ and for T from (7) the endogenous variables in the equation will be B and Y, and putting $B = \hat{B}e^{\rho t}$ and $Y = \hat{Y}e^{\rho t}$, where $\hat{B}$ and $\hat{Y}$ are constants, we obtain:

$$(33) \quad \frac{\hat{B}}{\hat{Y}} = \frac{1}{\rho - r} \left\{ \frac{G}{Y} (1 + k_G) - \tau_R - T_G/\hat{Y} \right\}$$

Consider first a fast growth region, such that $\rho > r$ (this is quite possible, since ρ includes population growth as well as productivity improvement). A positive level of outstanding debt as a fraction of regional output now requires government spending plus cash balance accumulation to exceed the sum of regional taxes collected and national transfers to the regional government, in the long run. Moreover, a regional fiscal policy, which is an increase in the absolute value of $G/Y - \tau_R$, will require an increase in the long-run ratio of bonds outstanding to regional output. If this can be done by increasing internally held debt, B_{GH}, there is little problem in pushing type 1 policies all the way to full employment. But it can be shown that some increase in externally held debt will have to occur, and this sets a limit to regional fiscal policy.[24] The limit is reached when $\dfrac{B_{FX} + B_{GX}}{Y}$ reaches the point at which interest rates charged to the region begin rising sharply.[25]

In a slow-growth region, such that $\rho < r$, equation (33) shows that, if any outstanding bonds exist, tax collections plus national transfers will have to exceed government spending plus cash balance accumulation in the long run. A fiscal expansion now requires a cut in bonds outstanding. That will mean a temporary <u>rise</u> in taxes or <u>cut</u> in spending -- to pay off outstanding bonds -- followed by a later larger tax cut or spending rise, made possible as a result of less need to make interest payments on debt. Both the likelihood and magnitude of fiscal expansion with such conditions attached seem very small.

Thus, regional fiscal policies are likely to be feasible in the long run if the growth rate of the economy is higher than the real rate of interest, but they will be limited in their total scope.

Out-Migration

Out-migrants solve their own income and unemployment problems. But what of the stayers? In a situation where income and unemployment disparities have been longstanding one would expect a steady out-migration, with its long-run rate depending negatively on regional income and positively on regional unemployment. To see its effects, suppose an initial equilibrium in Chart 3 with no out-migration permitted. Then the gates are opened. Two effects occur, one being that the rate of population growth in the region slows down. In equation (31) that appears as a change in Ω which causes PP to shift in an unknown way, since population growth enters Ω in a complex fashion. Whichever way PP does shift the effect is to alter the rate of unemployment and the level of relative wages, and that will cause further shifts in out-migration, shifting PP again, and so on. If the process converges, a point will be reached at which

relative income and the rate of unemployment are different for the stayers than without the out-migration, though we do not know if they will be better or worse. Notice that nonconvergence is a possibility only in the case where the initial out-migration makes disparities worse, therefore accelerating out-migration it-self; we do not pursue here this possibility of "immiserizing" out-migration. The second effect to consider is that a slow rate of population growth may reduce frictional unemployment, for with fewer new entrants per period to the labour force, it may be easier to match jobs and workers. If so, u* falls, shifting curve PP up-wards. Thus, two forces move PP, the direction of one of them being unknown, and the end result is uncertain. What is clear, however, is that the effect can be, and probably is, once-for-all, in the sense that in steady state there is a stable level of in-come and unemployment disparities in the presence of continuous migration. There is no tendency for migration to eliminate the disparities, however long the process of migration is allowed to go on. By the same token, an increased rate of assistance to migration will cause only a once-for-all shift in the position of PP, that may or may not be in the right direction.

Labour Market Changes

A large portion of interregional differences in unem-ployment may be due to frictional problems in the labour market. Certainly a large part is due to seasonality. Labour market policy might focus on reducing these types of unemployment. That means a reduction in u*, shifting curve PP upwards in Chart 3.

The effect is to lower unemployment, but not as much as one might expect, because incomes rise as well. This is a surprising result.

Analytically, the policies to reduce friction in the labour market have the same effects as the aggregate demand changes earlier considered.

It should also be possible to affect the operation of the labour market by provincial minimum wage policies and federal wage policies. Permitting regional minimum wages to fall relative to elsewhere, and/or having the federal government pay local rates rather than national, will shift BB down. That will lower unemployment, but at the cost of lower relative wages.

Interregional Productivity Differentials

Two important parameters in the model have not yet been considered, A and b. An increase in either will shift PP so as to reduce both types of disparities. The parameter A essentially reflects the level of average productivity in the region, or rather, the level of the growth path along which productivity is rising. The parameter b is a measure of the labour intensity of production as of a given wage/rental ratio. Policy is unlikely to be able to influence the latter, but it might affect the former. Moreover, since we know that productivity is higher outside the region than inside, it should be possible to raise it by means not available outside, because they have already been exploited outside. It is still possible to be pessimistic and maintain that the presently poor regions are inherently less productive than the rich ones. But that is a difficult case to make, when productivity everywhere doubles every generation. If Quebec is inherently less productive than Ontario, how did it manage by 1970 to be more productive

than Ontario was in 1960, and how can one explain that it will be far more productive than Ontario is today, by the turn of the century?

CONCLUSIONS

On the theory developed in this paper, many current regional policies are similar, in that they all involve channeling funds into the region, through equalization, DREE, borrowing by the province itself to finance fiscal policy, etc. There is likely to be a limit reached to what is achievable this way, and it may be reached before disparities are eradicated. The model implies also that policies involving the labour market -- reducing frictional, seasonal and cyclical unemployment -- will work, and might, somewhat paradoxically, reduce disparities in wage rates at the same time. Other labour market policies would permit one to trade-off more income disparity for less unemployment disparity, e.g., having the federal government pay local rather than systemwide rates. The model's most surprising result is that it suggests that a major unexploited method for reducing unemployment disparities is closing the gap in productivity between high and low unemployment regions. This is precisely the converse of a more traditional view, which sees productivity improvements in a region like Eastern Canada as dangerous because they may temporarily raise unemployment. The lesson of the theory here is that productivity improvements in Eastern Canada are a bit like the medical practice of inoculation. Just as inoculation may cause a weak temporary dose of the disease (but may not) in return for immunity from a serious attack, so the effect of productivity

improvement may be to cause a weak temporary rise in unemployment
(but may not) in return for a long-run reduction in the serious-
ness of unemployment.

But one cannot entirely rule out the possibility that
a region is intrinsically less productive than elsewhere, in the
sense that its growth path permanently lies at a lower level. If
so, and if parity forces persist, the model implies that a part of
the unemployment disparities may be ineradicable. Even
the institutional device of a separate money and central bank for
the region could only work if it weakened parity forces. The
writer's view is that it would do so, provided the name of the
money was changed, but it is not popular these days to place
major policy reliance on the kind of assumption of money illusion
that such a belief involves.

APPENDIX A

Derivation of Equations (20), (21) and (22)

We have the following equations, in notation whose meaning has already been explained in the main text:

(A1) $\quad y = Ck^a n^b e^{gt}$

(A2) $\quad r = ay/k$

(A3) $\quad W/P = by/n$

(A4) $\quad m = N_S \phi \{ (y - kr - nW/P)/y \}$

(A5) $\quad Y = my$

(A6) $\quad K = mk$

(A7) $\quad N = mn$

Substituting (A2) and (A3) into (A4) we obtain:

(A8) $\quad m = N_S \phi (1-a-b)$

Substituting (A2) and (A3) into (A1), and recalling the definition of aggregate Y, we obtain:

$$\text{(A9)} \quad Y = \left(\frac{a}{r}\right)^{\frac{a}{1-a-b}} \left(\frac{bP}{W}\right)^{\frac{b}{1-a-b}} m e^{\frac{g}{1-a-b}t} C^{\frac{1}{1-a-b}}$$

Substituting for m from (A8) we obtain:

$$\text{(A10)} \quad Y = \left(\frac{a}{r}\right)^{\frac{a}{1-a-b}} \left(\frac{bP}{W}\right)^{\frac{b}{1-a-b}} N_S \phi (1-a-b) e^{\frac{g}{1-a-b}t} C^{\frac{1}{1-a-b}}$$

Now substitute $\mu = 1/(1-a-b)$, into (A10), put $w = W/P$ and define an appropriate constant "A", and equation (20) is obtained.

From equations (A2), (A3) and the definitions of aggregates in (A5), (A6), and (A7), we have $r = aY/K$ and $w = bY/N$. These are the same as equations (21) and (22).

APPENDIX B

In long-run dynamic equilibrium with growth rate ρ, for any aggregate dollar variable Z growing at rate ρ we shall have $\dot{Z} = \rho Z$. Moreover, all aggregate dollar variables will grow, in real terms, at a rate equal to the sum of the rate of population growth $(\dot{N}_S/N_S)$ and growth of real wages, which can be seen from equations (20) and (22) to be $g\mu/(1+b\mu)$ when the rate of interest and the rate of unemployment have reached constant values, as they must for long-run dynamic equilibrium to exist (we assume rather than prove existence). Thus $\rho = g\mu/(1+b\mu) + \dot{N}_S/N_S$.

Define the following aggregate dollar variables:

(B1) $Z_1 = Nw + \pi$

(B2) $Z_2 = B_{FH} + B_{GH}$

(B3) $Z_3 = B_{FH} + B_{FX}$

(B4) $Z_4 = G + G_C + XP_X/P - FP_F/P$

Then equations (1), (3), (4), (9), (10), (11) and (12) may be written as:

(1)' $Z_1 + (r-\rho)Z_2 + T_H = C + \rho M_H + T + T_C$

(3)' $M_H = k_H(Z_1 + rZ_2 + T_H)$

(4)' $(\rho-sr)Z_2 + \rho M_H = sZ_1 + sT_H$

(9)' $C + Z_4 + T_F + (\rho-r)Z_3 = Z_1 + \rho M_F$

(10)' $Y = C + \rho K + Z_4$

(11)' $\quad M_F = k_F Y$

(12)' $\quad K + M_F = Z_3$

One may now eliminate by a tedious process of substitution the variables M_F, M_H, C, Z_3, Z_1, and Z_2 (it can be done in this order), to obtain a single equation in Z_4.

This equation is

$$\left[(1 - \rho k_H) + \frac{r - \rho - \rho r k_H}{\rho - sr + \rho r k_H} (s - \rho k_H) \right] \left[Y(1 - r k_F) + T_F + T_H - Kr \right]$$

$$= Y - \rho K - Z_4 + T + T_e$$

Note that in dynamic equilibrium $K/Y = a/r$ from equation (21). Also define γ, $\beta(P/P_X)$, τ and $\bar{t}$ as follows:-

$$\frac{Z_4}{Y} = \frac{G + G_C}{Y} + \frac{XP_X/P - FP_F/P}{Y}$$

$$= \gamma + \beta(P/P_X)$$

$$\frac{T + T_C}{Y} = \tau \ , \ \frac{T_F + T_H}{Y} = \bar{t}$$

In writing $\beta(P/P_X)$ we are implicitly assuming that P_X and P_F are in a constant relationship to one another: this is analytically very convenient, and not damaging to the essence of the analysis.

Then the equation following (12)' on this page can be written

$$\beta(P/P_X) = \tau - \gamma - \bar{t} + a - a\rho/r + r k_F + (s - \rho k_H) \left(\frac{s(\rho - r) + \rho r k_H}{\rho - sr + \rho r k_H} \right)$$

$$(1 + \bar{t} - a - r k_F)$$

Writing Ω for the last four terms on the right, we have

(B5) $P/P_X = \beta^{-1}[\tau - \gamma - \bar{t} + \Omega]$, which is equation (27) in the main text.

APPENDIX C

For convenience, we present here definitions of endogenous variables, exogenous variables, and parameters, and a complete listing of the equations of the model.

Endogenous Variables

Monetary asset variables,
in constant dollars

B_{FH} : bonds issued by firms and held by households

B_{GH} : bonds issued by government and held by households

B_{GX} : bonds issued by government and held by outside the region

B_{FX} : bonds issued by firms and held by outside the region

M_H : cash balances held by households

M_F : cash balances held by firms

M_G : cash balances held by government

Flow variables, in units
of "goods per unit time"

Y : aggregate output

C : consumption expenditure

X : exports

F : imports

T : tax collections by the regional government

T_C : tax collections by the outside (central) government

π : aggregate profits

y : output per firm

Factor input variables

K   :   stock of capital goods

N   :   stock of employed labour

k   :   stock of capital goods per firm

n   :   stock of employed labour per firm

Price type variables

P   :   regional price level

w   :   regional wage level in constant dollars

W   :   regional wage level in current dollars

r   :   rate of interest on the (constant dollar) bonds of the region

Other variables

m   :   the number of firms

u   :   the unemployment rate

The equations to explain these 25 variables are (1) to (19) together with (23) to (26) of the main text, and two definitions, one for the unemployment rate and one for the money wage. Exogenous variables and parameters are listed after the equations below, a first group consisting of those appearing in these equations, in the order they appear, a second group consisting of those in Appendices A and B, in the order they appear. Some of the latter appear in the main text.

Equations of the Model

(1) $Nw + \pi + r(B_{FH} + B_{GH}) + T_H = C + \dot{B}_{GH} + \dot{B}_{FH} + \dot{M}_H + T + \dot{T}_C$

(2) $B_{FH} = \theta (B_{GH})$

(3) $M_H = k_H(Nw + \pi + r(B_{FH} + B_{GH}) + T_H)$

(4) $\dot{B}_{GH} + \dot{B}_{FH} + \dot{M}_H = s(Nw + \pi + r(B_{FH} + B_{GH}) + T_H)$

(5) $T + T_G + \dot{B}_{GH} + \dot{B}_{GX} = G + r(B_{GH} + B_{GX}) + \dot{M}_G$

(6) $M_G = k_G G$

(7) $T = \tau_R Y$

(8) $T_C = \tau_C Y$

(9) $C + G + G_C + XP_X/P + T_F + \dot{B}_{FX} + \dot{B}_{FH} = Nw + \pi + FP_F/P$
$$+ r(B_{FH} + B_{FX}) + \dot{M}_F$$

(10) $Y + FP_F/P = C + G + G_C + XP_X/P + \dot{K}$

(11) $M_F = k_F Y$

(12) $K + M_F = B_{FH} + B_{FX}$

(13) $y = e^{gt}f(k,n)$

(14) $r = e^{gt}f_k$

(15) $w = e^{gt}f_n$

(16) $m/N_s = \emptyset ((y - kr - nw)/y)$, $\emptyset'$ positive

(17) $Y = my$

(18) $K = mk$

(19) $N = mn$

Note: Equations (13) to (19) are reduced in Appendix A, using a Cobb-Douglas production function, to three equations in the aggregate variables Y, K, N, which appear as equations (20), (21) and (22) in the main text.

(23) $X/Y = X(P_X/P, T_F/Y)$

(24) $F/Y = F(P_F/P)$

(25) $r = f((B_{FX} + B_{GX})r)/Y$

(26) $\dot{W}/W = f(u, W/\bar{W}, v) + \dot{P}/P,$ with $f_u, f_{W/\bar{W}} \leqslant 0$

$$f_v \geqslant 0$$

(C1) $u = u^* + 1 - N/N_s$

(C2) $W = Pw$

Exogenous Variables and Parameters

In equations (1) - (19),
(23) - (26), (C1) - (C2)

T_H	:	constant dollar expenditures on transfers to households in the region by the central government
k_H	:	ratio of cash balances to income for households
s	:	savings ratio for households
T_G	:	constant dollar expenditures on transfers to the regional government by the central government
k_G	:	ratio of regional government's cash balances to regional government's expenditures
τ_R	:	regional government tax collections as a fraction of regional output

τ_c : central government tax collections as a fraction of regional output

P_x : extra-regional price of exportables

P_F : extra-regional price of importables

k_F : ratio of firms' cash balances to firms' output

g : rate of neutral technical change in each firm

N_s : labour supply, assumed to grow at a constant rate

T_F : constant dollar transfers per unit time by the central government to firms in the region

$\bar{W}$: money wages outside the region

v : a vector of exogenous variables which includes:-

  ℓ : a variable measuring the generosity of income maintenance programs

  n_u : the proportion of the regional labour force unionized

  n_f : the proportion of the regional labour force which is employed by the central government

u^* : the sum of frictional, seasonal and cyclical unemployment, expressed as a rate, and averaged over a long period of time.

In Appendix A

C : constant pre-multiplying the Cobb-Douglas production function of a firm

a : exponent of capital in the Cobb-Douglas production function of a firm

b : exponent of labour in the Cobb-Douglas production function of a firm

μ : defined as the value of $1/(1-a-b)$

A : a constant, whose value is $C^{\mu} a^{a\mu} b^{b\mu} \emptyset (1-a-b)$

In Appendix B

ρ : the growth rate of aggregate output, or real expenditure, variables in the system, actually equal to the sum of the labour force growth rate, $\dot{N}_s/N_s$ and $g\mu/(1+b\mu)$

γ : expenditure by both regional and central government as a fraction of output, i.e., $(G + G_C)/Y$

τ : tax collections by both regional and central government as a fraction of output, i.e., $(T + T_C)/Y$

$\bar{t}$: transfers by the central government to households and firms in the region, i.e., $(T_F + T_H)/Y$

Ω : a constant in the case that r is constant, otherwise a variable, and defined as:-

$$(s - \rho k_H) \left[\frac{s(\rho-r) + \rho r k_H}{\rho-sr + \rho r k_H} \right] (1 + \bar{t} - a - r k_F)$$

FOOTNOTES

1 See Economic Council of Canada, Living Together: A Study of Regional Disparities (Ottawa: Supply and Services Canada, 1977), especially pp. 49-50.

2 See Economic Council, Living Together, Chapters 6 and 7, especially Table 7-3. S. F. Kaliski, "Structural Unemployment in Canada: Towards a Definition of the Geographic Dimension", Canadian Journal of Economics, I, 3, August 1968, can be interpreted as showing that interregional variation in unemployment rates, though dominated by intraregional variation, remains significant and important.

3 See Economic Council, Living Together, p. 53, and R. Beaudry, "Le chômage saisonnier et l'explication des disparités interrégionales de chômage au Canada", Economic Council of Canada Discussion Paper No. 84, 1977.

4 M. Friedman, "The Role of Monetary Policy", American Economic Review, March 1968.

5 M. Friedman, "The Role".

6 F. Lazar, "Regional Unemployment Rate Disparities in Canada: Some Possible Explanations", Canadian Journal of Economics, X, 1, February 1977, stresses seasonality and turnover; while W. Thirsk, Regional Dimensions of Inflation and Unemployment, A Research Report Prepared for the Prices and Incomes Commission (Ottawa: Information Canada, 1973), comments "... Quebec and the Atlantic area tend to have above-average unemployment rates in large part because of the relative inefficiency with which their labor markets operate", (p. 111).

7 W. Thirsk, Regional Dimensions, analyses such curves, along with much else, and concludes "... at least two thirds of the unemployment differential between Ontario and the Quebec-Atlantic region is attributable to greater labor market inefficiency in the latter area, while the residual third reflects inadequate aggregate demand diffusion related to rigidity of the interregional wage structure", (p. 129).

8 I.e., in equilibrium at a given level of demand pressure, defined by variables other than unemployment and vacancy rates, both unemployment and vacancy rates should be higher in a region with a higher natural rate of unemployment, than they are in a region with a low natural rate.

9 The hypothesis has been maintained by A. Raynauld, Mémoire soumis au Comité sénatorial permanent des finances nationales, le 9 juin 1971, who notes "... on peut déduire que si le chômage est plus aigu dans certaines provinces que dans d'autres, une politique de stimulation de la demande globale différenciée selon les provinces est désirable", (P. 3) and by F. C. Miller, "The

Case for Regional Fiscal Policy in Canada", mimeo, presented
to the June 1971 Meetings of the Canadian Economics Association.
Strictly speaking neither author is necessarily suggesting
that aggregate demand weakness is responsible for average rates
of unemployment being higher in Eastern Canada, for one could
argue the need for a regionalized stabilization policy, the
topic of these papers, even if the average rate of unemployment
were the same as elsewhere, on the grounds that fluctuations
about the average rate were more severe in Eastern Canada. Advo-
cacy of regionalized stabilization policy would not then imply
a belief in aggregate demand as a cause of interregional dif-
ferences in average unemployment rates. But the context of
both papers makes it clear to this writer that demand is con-
sidered secularly weak by the authors, in the sense that the
excessive rise in unemployment caused by excessive demand weak-
ness in recession is not offset by a correspondingly excessive
demand strength in booms. The case for demand weakness in the
secular sense is also argued in Economic Council, Living To-
gether, Chapter 6.

10 Structural unemployment is another hypothesis that fails to fit
    certain important facts, e.g., why unemployment is persistently
    higher in Montreal than in Toronto; why twenty-five years has
    been inadequate to at least noticeably reduce structural unemploy-
    ment.

11 As a result of second-order job/people matching effects.

12 See Economic Council, Living Together, especially Chapter 9.

13 See T. Scitovsky, Money and the Balance of Payments (Chicago:
    Rand McNally and Company, 1970).

14 Such as the continuous issue of debt to finance a permanently
    growing government deficit, as in C. L. Barber, Theory of Fiscal
    Policy as Applied to a Province, a study prepared for the Ontario
    Committee on Taxation (Toronto: Queen's Printer, 1967).

15 G. H. Borts and J. L. Stein, Economic Growth in a Free Market
    (New York and London: Columbia University Press, 1964) find
    this necessary also.

16 We shall later arrive at constant returns for the relationship
    between aggregate output and aggregate inputs of capital and
    labour, but we cannot have them at the level of the firm, because
    the second-order maximum conditions would not hold.

17 This ensures that big economies have proportionately more entre-
    preneurs than small ones, e.g., the United States will have more
    than Prince Edward Island.

18 This is so that the number of entrepreneurs will not change
    simply as a result of greater productivity in the economy.

19 See Appendix A.

20 Along with the assumption that the extra-regional ratio of prices of exportables to prices of importables is constant.

21 $\bar{t}$ enters Ω, but it seems likely from guesstimated orders of magnitude of the relevant parameters that $\bar{t} - \Omega$ will rise if $\bar{t}$ rises.

22 One would of course expect a rise in r to move PP away from "bliss".

23 See for example C. Green and J.-M. Cousineau, Unemployment in Canada: The Impact of Unemployment Insurance, Economic Council of Canada (Ottawa: Supply and Services Canada, 1975) and Herbert G. Grubel, Dennis Maki and Shelley Sax, "Real and Insurance-Induced Unemployment in Canada", Canadian Journal of Economics, May 1975.

24 Adding equations (1), (5) and (9) we obtain the balance of regional payments

$$\underbrace{(T_H + T_G + T_F + G_C - T_C)}_{\substack{\text{national transfers} \\ \text{of money per period} \\ \text{into the region}}} + \underbrace{(XP_X/P - FP_F/P)}_{\substack{\text{trade surplus} \\ \text{or deficit per} \\ \text{period}}} + \underbrace{(\dot{B}_{GX} + \dot{B}_{FX})}_{\substack{\text{issue of new} \\ \text{debt abroad} \\ \text{per period}}}$$

$$= \underbrace{(\dot{M}_H + \dot{M}_G + \dot{M}_F)}_{\substack{\text{annual incre-} \\ \text{ment to cash} \\ \text{balances}}} + \underbrace{r(B_{GX} + B_{FX})}_{\substack{\text{interest pay-} \\ \text{ments on out-} \\ \text{standing debt}}}$$

Lowering unemployment by fiscal policy will raise the price level and reduce the trade surplus or increase the deficit as a percentage of regional output. (This is the long-run dynamic version of the well-known problem of "import leakages" in a short- or medium-run Keynesian model.) It will also raise $\dot{M}_G + \dot{M}_H + \dot{M}_F$. Since the first term on the left will not change, being exogenous, we conclude that:

$$[\dot{B}_{GX} + \dot{B}_{FX} - r(B_{GX} + B_{FX})]/Y \quad \text{must rise.}$$

In growth equilibrium, before the change, we have $B_{GX} = \hat{B}_{GX}e^{\rho t}$, $B_{FX} = \hat{B}_{FX}e^{\rho t}$, where "hatted" symbols are constants, so that the the value of this last expression is

$$(\rho - r) \frac{\hat{B}_{GX} + \hat{B}_{FX}}{\hat{Y}}.$$ If $\rho > r$, the case at issue, a rise in this expression requires a rise in $(\hat{B}_{GX} + \hat{B}_{FX})/\hat{Y}$, i.e., in the ratio of externally held debt to regional income. Q.E.D.

25 See equation (25); sharply enough, for example, that it is no longer possible to cover interest on past debt by issuing new debt at a steady rate each year.

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