REGIONAL UNEMPLOYMENT DISPARITY AND MARKET ADJUSTMENT FAILURE*

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Introduction

Significant disparities of unemployment rates between Canadian regions have resisted solution by a litany of economic policies. Over the period 1953 to 1982, the average unemployment rate in the Atlantic Region exceeded the Ontario average by 4.7 percentage points. During the first five years of that period, the Atlantic Region's unemployment rate was 221 percent of the Ontario average; during the last five years it was 186 percent. It is fair to say that such disparities have also resisted explanation. Empirical observation so strongly suggests lack of labour market clearing in areas such as the Atlantic Region that the theory of regional policy proceeds on the assumption that this is the case, despite a lack of theoretical underpinning. A typical starting point is the presumption that factors operate in a depressed region to prevent market adjusment.[1]

It is the purpose of this paper to provide an explanation for the persistence of excessive unemployment rates in areas such as the

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[1]For example, Jenkins and Kuo [4] and Boadway and Flatters [1] assume that the regional wage level in the Atlantic Region is fixed at too high a level by institutional forces.

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Atlantic Region. To do so, it is necessary to explain the simultaneous failure of two possible avenues of regional adjustment to relatively high unemployment rates: regional wage adjustment; and gross outflows of labour to regions with better employment prospects.

Past efforts to explain lack of regional wage adjustment have largely relied on the notion of an interregional wage structure that does not allow variation in regional wage levels sufficient to clear all labour markets simultaneously. Given that the program is to explain persistent *differences* in unemployment rates, this approach appears sound. However, the hypotheses advanced to explain the linkages between regional wage levels are weak. For example, it has been argued that collective bargaining practices and public sector wage setting import inappropriately high wages into the regions suffering unemployment problems.[2] Swan and Kovacs [8] suggest that workers in the Atlantic Region demand wage parity with their counterparts elsewhere. These explanations lack logical rigour, essentially suggesting that the unemployed price themselves out of work, a notion inconsistent with the aim of explaining involuntary unemployment. The first hypothesis also fails to account for wage rigidity in the large non-union, non-public sector.

A more appealing explanation may be provided by a turnover cost theory of wage rigidity.[3] All Atlantic Region employers run the risk of losing employees to other regions should they offer relatively low wages. If such quits are costly to the firm, the employer has an incentive to go some way in matching wages available elsewhere, even though the existence of involuntary unemployment would allow a wage bill reduction through a wage decrease. The firm must balance any reduction in the wage bill so achieved against the consequent increase in turnover costs as quits respond to a widening of the regional wage differential. A link is then fashioned between regional wage levels, whereby the Atlantic Region wage level may be pulled up by wages elsewhere despite a local excess supply of labour. By placing the responsibility for wage rigidity squarely on the demand side of the labour market, this approach is fully consistent with the notion that the consequent unemployment is involuntary. Moreover, the model is choice-theoretic.

Given a regional wage level too high to clear the market, the explanation of unemployment rate disparity requires an account of the failure of migration flows to equalize those rates. A migration equilibrium between two regions can be reconciled with unemployment rate differences if the higher unemployment rate region also offers a higher wage level.[4] The Atlantic Region, however, suffers both high unemployment and relatively low incomes. Such a result can be produced if the migration equilibrium is amended to include migration costs for those moving from the high to the low unemployment region.[5] These costs establish a barrier to outmigration from the lower wage region, which eliminates gains from migration before unemployment rates are equalized.

These approaches will each provide an explanation for the failure of one of the market adjustment mechanisms that would otherwise operate to alleviate unemployment disparities, but they must be consistent with each other if both are to be invoked simultaneously. However, the migration costs used to explain lack of outmigration of the unemployed appear to be inconsistent with the mobility of the employed required by the turnover cost approach to wage rigidity. It is possible to posit that the employed face better job prospects elsewhere than the unemployed. While there may be empirical support for this, recall that migration responds to wage differences. The wage prospect and/or employment probability elsewhere for an employed individual would have to be significantly higher if such an individual is to expect to have more to gain from migration than an individual currently without employment. It is also possible to assume that migration costs are higher for the unemployed than for the employed. Such costs, however, will primarily be psychic in nature (forgone wages in the sending region are not included in the definition used in this paper). It is difficult to argue that the costs of, for example, separation from family and friends depend on one's employment status. While not necessarily disputing the reasonableness of such assumptions, the following model will show that they are not necessary for the reconciliation of the two approaches, one requiring mobility and the other requiring immobility. Thus, the employed and the unemployed are differentiated in no other way than by their employment status.

The following model reconciles the two explanations of market adjustment failure. It begins with the proposition that migration costs will differ between individuals, although not on average between the employed and the unemployed. Fairly weak restrictions on the distribution of migration costs across individuals will allow the following two results. Even if faced with a queue of job applicants willing to work for less than the going wage, firms find it unprofitable to lower

[2]See Thirsk [9] for a more complete discussion and analysis of this hypothesis.

[3]The turnover cost theory of wage rigidity has been applied to the problem of regional unemployment rate disparity by Stiglitz [7]. Stiglitz's model differs from that offered in this paper in one important respect. It applies in the context of LDC's where high unemployment occurs in the *high* wage region. See also Salop [5].

[4]This is the standard Harris-Todaro [3] paradigm of the development literature.

[5]This technique is used by Jenkins and Kuo [4] and Boadway and Flatters [1].

wages due to the increased quits such a decrease would cause among their more mobile employees. At the same time, high migration costs among some of the unemployed will prevent enough outmigration to increase the employment probability to levels prevailing elsewhere. Additional restrictions on the distribution of migration costs, consistent with those necessary for the two primary results, also allow the model to generate two further stylized facts of regional disparity in the Atlantic Region: lower than average wage levels; and outmigration of both employed and unemployed individuals within the same time period.

The next section outlines the basic model structure, and is followed by an analysis of the migration behaviour of individuals in the high unemployment region and of firm behaviour in that region. Market outcomes are then generated, followed by some concluding observations.

Basic Model Structure

Consider two regions, for concreteness labelled Ontario and the Maritimes. Ontario is assumed large relative to the Maritimes in the sense that economic conditions in Ontario are exogenous to the latter region. The Ontario wage is unaffected by inmigration from the Maritimes and clears the Ontario labour market.

Maritime firms choose profit-maximizing wage offers and employment levels to prevail during the period of analysis. These firms are identical in all respects and undifferentiated in their non-pecuniary characteristics from the workers' point of view. In equilibrium, they will choose identical wage and employment levels and, assuming full information, employees will not move between firms. Unlike the Salop [5] model, wage competition internal to the Maritime region will not generate unemployment. The model subsumes this aspect of turnover behaviour by using a representative firm.

Movement of labour then occurs only between the two regions. It is assumed for now that, should a wage differential exist, the higher wage is paid in Ontario and all migration flows occur from the Maritimes to Ontario. The conditions under which the Maritime wage will be lower than the Ontario wage will be established later.

What follows is a one-period model. The representative firm enters the period with a stock of employees who remain with the firm from the previous period. The unemployment pool is initially nonempty. Decisions are simultaneously made by all agents and the period is then played out accordingly. The question is then simply, will those decisions lead to a clearing of the unemployment pool during the period?

Labour Supply

At the beginning of the period, the stock of labour in the Maritimes is composed of those who remain in employment with the firm from the previous period and individuals who enter the period unemployed. Both types of individuals must decide whether to remain in the region or migrate to Ontario, and base their decisions on the usual Sjaastad [6] human capital calculus. Migration takes place if the utility available in Ontario exceeds the expected local utility by more than the cost of migration. Utility values are monetized as the wages available in the two regions, w_o in Ontario, and w_m in the Maritimes.[6] The cost of migration is some monetary value, m, specific to the individual and measuring both pecuniary and psychic costs. Since psychic costs are influenced by pure location preference, size of family, length of stay in the sending region, and other personal factors, and since such costs may be significant, total migration costs will vary substantially between individuals.

Suppose that migration costs are distributed across the Maritime labour force according to some general density function, f(m). This density function is assumed to apply to both the employed and the unemployed, both groups being regarded essentially as random samples from the same universe, the labour force.[7] For given values of w_o and w_m, a currently employed individual will quit and migrate if:

$$w_o - w_m > m \tag{1}$$

(layoffs are assumed not to occur). Thus, the proportion of employees choosing to quit will be:

$$F(m) \text{ at } m = w_o - w_m$$

[6]The Ontario wage may be treated as an expected wage, that is, the prevailing wage rate scaled by the probability of employment. The results to follow are unaffected by unemployment in Ontario as long as previously employed migrants do not face a lower employment probability in Ontario than do the previously unemployed migrants. Indeed, the results are strengthened if the latter group expects to face a greater difficulty in obtaining employment in Ontario, since this will effectively make them less mobile than their employed counterparts in the Maritimes.

[7]There may be reason to expect that the mean migration cost differs between the employed and the unemployed. A dynamic model is required to analyse the evolution of the distributions of migration costs for the two groups over time. However, flows between labour market states within the Maritimes will serve to homogenize the two groups to some extent. In the absence of this rather complex analysis, it is felt that the most general assumption is one of identical distributions of migration costs for the employed and unemployed. The results to follow are strengthened if the unemployed face a higher mean migration cost. Note that the costs of migration do not include forgone employment in the Maritimes. Note also that in the results of the model migrants will have, on average, lower migration costs than stayers, whatever their employment status prior to migration.

where $F(m)$ is the cumulative distribution function corresponding to $f(m)$. $F(w_o - w_m)$ can also be regarded as the probability that a randomly selected employee will quit, and will be termed the quit function. An initially unemployed individual will migrate to Ontario if:

$$w_o - pw_m > m$$

where p is the probability of obtaining employment in the Maritimes during the period (risk neutrality is assumed). If $L > 0$ is the size of the unemployment pool at the beginning of the period,

$$L[1 - F(w_o - pw_m)]$$

initially unemployed individuals choose to remain in the Maritimes for the duration of the period.

The Firm

The representative Maritime firm produces output according to:

$$g(N), g' > 0, g'' < 0$$

where N is the number of employees. Output price is normalized to $1. Although entering the period with a certain number of employees, quits may require that hiring take place to maintain a desired employment level. The number of quits by employees will equal:

$$F[w_o - w_m)N.$$

The quit function is known to the firm, having been constructed from past events or communicated by employees as a negotiation threat.

New hires impose on the firm costs of search, selection, and training, which will provide an incentive for the firm to respond to possible quits with policies that promote job attachment. Each new hire is assumed to require an instantaneous outlay of $T by the firm, and wages are equal for all employees, regardless of length of employment. This can be regarded as a usual two-period Becker model of firm-specific human capital acquisition, with the acquisition being instantaneous. The cost of new hires is assumed independent of the number of hires in any period, so that the firm has no incentive to delay adjustment to its desired employment level. Thus the firm will make all hires necessary to maintain the chosen employment level within the period, if applicants are available. The analysis can therefore be simplified by treating N as steady state employment level and a single-period model can be used.

The firm, then, chooses a wage offer and an employment level so as to maximize profits. By the steady state requirement, the number of hires equals the number of quits, and the firm's problem is:

$$\max_{w_m, N} \pi = g(N) - w_m N - F(w_o - w_m)NT \qquad (2)$$

subject to:

$$w_m, N \geq 0$$

and

$$F(w_o - w_m)N \leq A,$$

where A is the number of applicants.

The Market

The market outcome is represented by a migration equilibrium for the unemployed and profit-maximizing choices of w and N by Maritime firms. The question then becomes: Under what conditions will unemployment prevail during the period? In other words, is it possible that the number of unemployed who decide to remain in the Maritimes exceeds the number of hires by firms implied by their choice of wage and employment levels?

The employment probability for the initially unemployed, p, is endogenous. Given an Ontario wage and a choice of wage and employment levels, the Maritime firm will suffer:

$$NF(w_o - w_m) \geq 0$$

quits by employees. If M, $0 < M < L$, is the number of initially unemployed individuals choosing to migrate out of the region, then the employment probability for stayers is:

$$p = \frac{kNF(w_o - w_m)}{L - M}$$

where k is the number of Maritime firms. In a more complete model, k would be endogenous. In this model, k is treated as exogenous and arbitrarily set equal to one. Under conditions of freedom of entry and exit, the number of firms in the Maritimes can be controlled through an appropriate choice of fixed costs (see Salop [4]). Attention is then focused on the role of current market participants in the failure of the market adjustment mechanisms, and on the interregional, rather than the intraregional, aspects of the problem.

The proportion of unemployed workers choosing to migrate, M/L, is equal to $F(m)$ at $m = w_o - pw_m$. Assuming strict monotonicity and continuity of $F(m)$, we can write:

$$w_o - pw_m = F^{-1}(M/L). \qquad (3)$$

Substituting for p, and rearranging, we find:

$$w_o - F^{-1}(M/L) = w_m[NF(w_o - w_m)/(L - M)] \quad (4)$$

which implicitly solves for the equilibrium number of migrants,

$$M^* = M(w_m, N)$$

and, therefore, the number of applicants to the Maritime firm, $L - M^*$.

The wage and employment levels in the Maritimes, and therefore the number of vacancies, are determined by the solution to:

$$\max_{w_m, N} \pi = g(N) - w_m N - F(w_o - w_m)NT$$

subject to:

$$w_m, N \geq 0$$

and

$$F(w_o - w_m)N \leq L - M(w_m, N).$$

Forming the Lagrangian,

$$H = g(N) - w_m N - F(w_o - w_m)NT + \lambda[(L - M^*) - F(w_o - w_m)N]$$

the first order conditions are:

$$w_m \geq 0,\ w_m\{-N + f(w_o - w_m)NT + \lambda[-\partial M^*/\partial w_m + f(w_o - w_m)N]\} = 0,$$
$$\text{and} \quad \{-N + f(w_o - w_m)NT + \lambda[-\partial M^*/\partial w_m + f(w_o - w_m)N]\} \leq 0 \quad (5)$$

$$N \geq 0,\ N\{g'(N) - w_m - F(w_o - w_m)T + \lambda[-\partial M^*/\partial N - F(w_o - w_m)]\} = 0,$$
$$\text{and} \quad \{g'(N) - w_m - F(w_o - w_m)T + \lambda[-\partial M^*/\partial N - F(w_o - w_m)]\} \leq 0 \quad (6)$$

$$\lambda \geq 0,\ \lambda[(L - M^*) - F(w_o - w_m)N] = 0,$$
$$\text{and} \quad (L - M^*) - F(w_o - w_m)N \geq 0 \quad (7)$$

The market equilibrium is represented by the simultaneous solution of (4), (5), (6), and (7) for M^*, w_m, N, and λ.

Market clearing in the Maritimes is implied by a strictly positive value for the multiplier, λ, at the solution characterized by the first order conditions. The failure of the market adjustment mechanisms would imply that $\lambda = 0$. Since an analytical solution of the first order conditions is not possible, the following approach is taken. As the remainder of the section will demonstrate, whether the firm is constrained in its hiring depends on the distribution, f(m). It is initially assumed that the firm's hiring constraint is nonbinding. The firm's choice of w and N, and therefore the number of vacancies and the wage differential, will then be exogenous to the unemployed. Restrictions on f(m) are then sought such that the migration equilibrium is consistent with the initial assumption of unemployment.

Suppose, then, that the firm is unconstrained in its hiring, so that the first order conditions become:

$$w_m \geq 0,\ w_m[-N - f(w_o - w_m)NT] = 0, \text{ and } -N + f(w_o - w_m)NT \leq 0 \quad (8)$$

$$N \geq 0,\ N[g'(N) - w_m - F(w_o - w_m)T] = 0,$$
$$\text{and} \quad g'(N) - w_m - F(w_o - w_m)T \leq 0 \quad (9)$$

It is informative to illustrate the role of turnover costs in generating wage transmission through the firm's decision-making process. Suppose that $T = 0$, so that (8) and (9) become:

$$w_m \geq 0,\ w_m[-N] = 0, \text{ and } -N \leq 0 \quad (8')$$

$$N \geq 0,\ N[g'(N) - w_m] = 0, \text{ and } g'(N) - w_m \leq 0 \quad (9')$$

When turnover is costless to the firm, it takes full advantage of the fact that as much labour as it wants is forthcoming at any wage. From (8′), if production is profitable at all (that is, if $N > 0$), $w_m^* = 0$, and, from (9′), employment is pushed to the level which drives the marginal revenue product to zero. Essentially, in the absence of turnover costs, the wage adjusts as far as possible to clear the market. By assumption, market clearing is never obtained, but the wage does all that it can, given the non-negativity constraint, to minimize excess supply of labour. Note also that w_o in no way enters the determination of w_m^*, implying that interregional wage transmission does not occur.

Now suppose that $T > 0$. From (8), the firm pays a positive wage if at $w_m = 0$,[8]

$$-N + f(w_o - w_m)NT > 0$$

or

$$f(w_o)T > 1.$$

Thus, the wage offer is more likely to be positive the larger are turnover costs or the greater the impact of a wage increase on turnover. For interior solutions, the wage is chosen so that:

$$f(w_o - w_m)T = 1.$$

For a given number of employees, the firm uses the wage offer to minimize total labour costs, balancing turnover costs against the wage

[8]The condition $f(w_o)T > 1$ is sufficient but not necessary for a positive wage offer. If the inequality does not hold, a marginal wage increase will increase labour costs. But a discrete increase in the wage may nonetheless reduce turnover costs by more than the consequent increase in the wage bill. The remainder of the paper continues to use the more restrictive conditions required by the sufficient condition.

bill. A positive wage may result, even if the firm faces a queue of applicants willing to work for less. A wage reduction may not be in the firm's best interest.

Note that, for interior solutions, the Ontario wage enters into the determination of w_m^*. Application of the implicit function theorem to the equality versions of the first order conditions yields:

$$w_m^* = w(w_o, T),\ \partial w_m^*/\partial w_o > 0.$$

This result is the wage transmission mechanism, whereby the Ontario wage exerts a direct influence on Maritime wages, operating independently of labour market tightness in the Maritimes.

Although unconstrained in its hiring, the firm may, nonetheless, offer a strictly positive wage and is therefore the source of the failure of wage adjustment to unemployment in the region. We turn now to the behaviour of the unemployed to determine whether the assumption that the firm is unconstrained in its hiring can be made consistent with such behaviour. Quite simply, the firm will be unconstrained if, given the values of w_m^* and N^* determined under the assumption, the number of applicants exceeds the number of vacancies. This will be true if:

$$L[1 - F(w_o - w_m^*)] > N^*F(w_o - w_m^*) \qquad (10)$$

or,

$$\frac{L}{N^*} > \frac{F(w_o - w_m^*)}{1 - F(w_o - w_m^*)}$$

To see why, note that the model will solve for some value, p^*, of the employment probability. We require $p^* < 1$. Now suppose that $p^* = 1$. Then,

$$L[1 - F(w_o - p^*w_m^*)] = L[1 - F(w_o - w_m^*)].$$

But, by condition (10), the number of applicants at $p = 1$ must exceed the number of vacancies, which is inconsistent with $p^* = 1$. Therefore, (10) is a sufficient condition for $p^* < 1$, and unemployment will occur. In principle, a distribution function for migration costs can always be found which satisfies (10). For example, suppose that migration costs in the Maritime population are everywhere greater than the value of the Ontario wage. Since $f(w_o - w_m) = 0$ for all $w_m \geq 0$, the firm will offer a zero wage. Unemployment results, since:

$$\frac{F(w_o)}{1 - F(w_o)} = 0$$

$$< L/N^*$$

for all $L > 0$. Thus, specifying a distribution of migration costs which will yield an unemployment equilibrium is a trivial exercise. However, the assumption that migration costs exceed the value of employment opportunities in Ontario for all Maritime individuals is in itself implausible. Moreover, the consequences of the assumption for other outcomes are also unacceptable on empirical grounds: the Maritime wage equals zero, and no migration of either the employed or the unemployed will be observed.

The specification of f(m) becomes a substantive exercise when a set of stylized facts is to be generated. Suppose that the model is to yield the following outcomes: lack of market clearing through regional wage adjustment; lack of market clearing through outmigration of the unemployed; a Maritime wage below the Ontario wage; and outmigration by both employed and unemployed individuals. These four outcomes place the following restrictions on the distribution of migration costs, respectively:

$$Tf(w_o - w_m) > 1 \text{ at } w_m = 0 \qquad (11)$$

$$F(w_o - w_m)/[1 - F(w_o - w_m)] < L/N \text{ at } w_m = w_m^* \qquad (12)$$

$$Tf(w_o - w_m) = 1 \text{ for some value of } w_m < w_o \qquad (13)$$

$$F(w_o - w_m) > 0 \text{ at } w_m = w_m^* \qquad (14)$$

The question then becomes one of determining whether a plausible density function can be found which simultaneously satisfies these restrictions. For the primary question posed in this paper, the failure of market adjustment, attention is focused specifically on (11) and (12).

The density function, f(m), cannot degenerate to a single value of migration costs, as in Boadway and Flatters [1]. Suppose migration costs were equal across the population and greater than w_o. Then:

$$Tf(w_o - w_m) \leq 1 \text{ for all } w \geq 0$$

and the firm pays a zero wage. Unemployment results, since:

$$F(w_o)/[1 - F(w_o)] = 0/1$$

$$< L/N$$

for $L > 0$, but this result is obtained with a zero wage. Suppose, instead, that migration costs are equal across individuals but less than

w_o, say, m'. The marginal conditions governing wage choice do not apply. Instead, consider a discrete increase in the wage offer from 0 to:

$$w_m = w_0 - m',$$

resulting in the complete elimination of quits. Labour cost savings of \$T per employee are achieved at the expense of an increase of $w_o - m'$ in the wage bill per employee. If:

$$w_o - m' > T$$

the firm pays a zero wage and no production takes place. All individuals, employed and unemployed, migrate to Ontario. Alternatively, if:

$$w_o - m' < T$$

the firm pays the positive wage:

$$w_m^* = w_o - m'.$$

Then:

$$\begin{aligned} F(w_o - w_m^*)/[1 - F(w_o - w_m^*)] &= F(w_o - (w_o - m'))/[1 - F(w_o - m')] \\ &= F(m')/[1 - F(m')] \\ &= 1/0 \\ &> L/N. \end{aligned}$$

Therefore, no unemployment is observed, since full migration of the unemployed takes place.

The density function must therefore have some nondegenerate form. But beyond this, the restrictions (11) to (14) do not restrict the function to be of any particular class. This is reassuring since it immediately suggests that the stylized facts can be generated under fairly general conditions. Two classes of density functions are considered in turn. For each class, the restrictions which (11) to (14) impose on the parameter values are inspected for consistency.

The Uniform Density Function

Suppose that the density function is uniform, so that:

$$\begin{aligned} f(m) &= 1/(m_1 - m_0), \; m_o \le m \le m_1, \\ &= 0 \qquad\qquad\quad, \text{otherwise}, \end{aligned}$$

where the two parameters of the function, m_0 and m_1, are the minimum and maximum migration costs in the population, respectively. Then:

$$F(m) = (m - m_0)/(m_1 - m_0).$$

For this density function, the four restrictions (11) to (14) become:

$$T/(m_1 - m_0) > 1 \text{ at } m = w_o \qquad (15)$$

$$[(w_o - w_m - m_0)/(m_1 - m_0)]\,[1 - (w_o - w_m - m_0)/(m_1 - m_0)]^{-1} < L/N \text{ at } w_m = w_m^* \qquad (16)$$

$$T/(m_1 - m_0) = 1 \text{ at } w_m < w_o \qquad (17)$$

$$(w_o - w_m - m_0)/(m_1 - m_0) > 0 \text{ at } w_m = w_m^* \qquad (18)$$

Consider first the wage choice of the firm. By (15), a positive wage offer will be observed if:

$$m_0 \le w_o \le m_1 \text{ and } T > m_1 - m_0.$$

Since the inequality in condition (15) is unrelated to the firm's wage offer, if it is true that at $w_m = 0$ a wage increase will lower per employee labour costs, then this will continue to be true for all further wage increases until $f(w_o\ w_m) = 0$. Therefore, if positive, the optimal wage is determined as a corner solution where:

$$w_m^* = w_o - m_0.$$

Therefore, if a Maritime wage level is to be observed which is strictly positive but less than the Ontario wage, we require that:

$$w_o > m_0 \text{ and } m_0 > 0,$$

respectively.

Given that the condition for a positive wage offer holds, (16) becomes

$$\begin{aligned} &\{[w_o - (w_o - m_0) - m_0]/(m_1 - m_0)\}\,\{1 - [w_o - (w_o - m_0) - m_0]/ \\ &\qquad (m_1 - m_0)\}^{-1} = 0 \\ &\qquad\qquad < L/N \end{aligned}$$

for $L > 0$. Therefore, if some members of the labour force are unemployed at the beginning of the period, then migration will not eliminate unemployment. Since no employed workers will quit, no vacancies exist and the expected local wage is zero for the unemployed. However, the restrictions already placed on $f(m)$ to obtain a strictly positive wage imply that the amount or outmigration, $LF(w_o)$, of the unemployed will be less than the size of the initial unemployment pool, L.

The uniform density function does not allow an outcome in which both the employed and the unemployed will be observed to migrate, given the parameter restrictions already in place. The corner solution for the optimal wage offer of the firm yields, from (18):

$$[w_o - (w_o - m_0) - m_0]/(m_1 - m_0) = 0.$$

Only the unemployed will migrate out of the Maritimes.

In summary, if unemployment exists initially, the model will generate an outcome in which the firm will maintain a strictly positive wage offer even though faced with unemployed applicants, and in which the unemployed choose to remain in the Maritimes in spite of a relatively low regional wage level if the following restrictions are placed on the parameters of the uniform density function:

i) $m_0 < m_1$
ii) $m_0 < w_o \leq m_1$
iii) $m_1 - m_0 < T$
iv) $m_0 > 0$.

By (i), the distribution cannot degenerate to a single value of migration costs, as was discussed previously. There must be individuals in the population with migration costs less than the Ontario wage and individuals with migration costs greater than the Ontario wage. Turnover costs must be sufficiently important relative to the variance in migration costs. And the minimum cost must be strictly positive. Since these restrictions are not inconsistent with one another, a uniform density function for migration costs can always be found, in principle, which will allow the model to generate the stylized facts, except for the simultaneous outmigration of employed and unemployed individuals.

The Logistic Distribution Function

Suppose that the density function for migration costs is sech,[2] so that:

$$f(m) = (1/b)\{\exp[-(m - a)/b]\}\{1 - \exp[-(m - a)/b]\}^{-2},$$
$$-\infty < M < \infty,\ b > 0.$$

The cumulative distribution function is then logistic:

$$F(m) = \{1 + \exp[-(m - a)/b]\}^{-1}.$$

Restrictions on the two parameters of the distribution, a and b, implied by conditions (11) to (14) are contained in the following specific form of those conditions applying to the logistic distribution:

$$T\{(1/b)[\exp\{-(w_o - a)/b\}][1 + \exp\{-(w_o - a)/b\}]^{-2}\} > 1 \quad (19)$$

$$\{1 + \exp[-(w_o - w_m - a)/b]\}^{-1}\{1 + [1 + \exp\{-(w_o - w_m - a)/b\}]^{-1}\}^{-1}$$
$$= \exp\{(w_o - w_m - a)/b\}]^{-1}\}^{-1}$$
$$< L/N \text{ at } w_m = w_m^* \quad (20)$$

$$T\{(1/b)[\exp\{-(w_o - w_m - a)/b\}][1 + \exp\{-(w_o - w_m - a)/b\}]^{-2}\}$$
$$= 1 \text{ at } w_m < w_o \quad (21)$$

$$\{1 + \exp[-(w_o - w_m - a)/b]\}^{-1} > 0 \text{ at } w_m = w_m^* \quad (22)$$

Condition (19) establishes the relationship between a, b, T, and w_o that will ensure a positive wage offer by the Maritime firm. It essentially requires that, from an initial wage offer of zero, a marginal wage increase will reduce turnover costs by more than the wage bill increase.

Solve:

$$Tf(m) = 1$$

to get:

$$m = a - b\ln\{1/[1 - 2(b/T)]\}$$

or:

$$m = a - b\ln\{1 - 2(b/T)\}.$$

Condition (19) first requires that:

$$b < (1/2)T. \quad (23)$$

For any value of T, (23) restricts the variance of the density function for migration costs, putting a lower bound on the turnover impact of a marginal wage increase. This ensures that there exists a range of the density function within which turnover cost reductions can exceed wage bill increases for wage increments. It is also necessary, given that (23) holds, that the Ontario wage lies within this range. Thus, a strictly positive wage offer requires that:

$$a - b\ln\{1/[1 - 2(b/T)]\} < w_o \leq a - b\ln\{1 - 2(b/T)\} \quad (24)$$

If these restrictions hold, the optimal wage will be chosen so as to set:

$$Tf(w_o - w_m) = 1.$$

Second order conditions establish the optimal wage at:

$$w_m^* = w_o - a + b\ln\{1/[1 - 2(b/T)]\} \quad (25)$$

Referring to (20), outmigration will not eliminate unemployment if:

$$1 - 2(b/T) > 0$$

or:

$$b < (1/2)T \quad (26)$$

From (25), in order to obtain an outcome in which the Maritime wage is less than the Ontario wage, we require:

$$a - b\ln\{1/[1 - 2(b/T)]\} > 0 \quad (27)$$

Finally, no restrictions are necessary to generate an outcome in which both employed and unemployed individuals are observed to migrate, since $F(w_o - w_m)$ is strictly positive for any finite value of the wage differential. Then so too will be $LF(w_o - w_m^*)$ and $NF(w_o - w_m^*)$.

In summary, if we are to observe a strictly positive Maritime wage, a strictly positive level of unemployment in the period, a Maritime wage less than the Ontario wage, and simultaneous outmigration of both employed and unemployed individuals, the following restrictions are placed on a and b:

i) $b < (1/2)T$
ii) $a - b\ln\{1/[1 - 2(b/T)]\} < w_o \leq a - b\ln\{1 - 2(b/T)\}$
iii) $a - b\ln\{1/[1 - 2(b/T)]\} > 0$.

This set of conditions does not place inconsistent restrictions on a or on b. It follows that, in principle, for any positive values of T, L, and w_o, a sech^2 density function for migration costs can always be found which will generate the stylized facts.

Conclusion

If the Maritime firm invests in new employees, it will, up to a point, protect that investment through wage payments that serve to reduce turnover. Since such turnover is induced by the desire of employees to seek opportunities outside the region, the local wage will depend to some extent on outside wages. To generate this outcome, migration costs must be low enough for some employees to yield a net gain from migration if the local wage is zero. It may then be labour cost saving for the firm to maintain a wage higher than the reservation wages of applicants. In other words, the excess supply of labour may fail to drive down the local wage.

If this is the case, the probability of employment is less than one for any of the unemployed who choose to remain in the Maritime region. This is not inconsistent with migration equilibrium and with a local wage below the outside wage if migration costs for some proportion of the population, and therefore of the unemployed, are high enough. Those unemployed remaining in the region face migration costs sufficiently larger than the actual wage differential to imply an equalization of net gains from migration with the expected local wage.

If the behaviour of migration costs is not allowed to differ between the two groups, employed and unemployed, it follows that these costs must vary across individuals within either group. Only then can there simultaneously be migration costs low enough to induce Maritime firms to take heed of possible quits and high enough to prevent complete outmigration of the unemployed. For any class of distribution

functions describing the behaviour of such migration costs, generation of wage rigidity and lack of complete outmigration requires certain restrictions on the parameters of the function. The model above has demonstrated that the restrictions necessary for wage rigidity do not conflict with those necessary for lack of complete outmigration. Moreover, additional restrictions can be placed on the parameters of the distribution functions to yield two other stylized facts of Canadian regional disparity: a lower than average wage in the high unemployment region, and outmigration of both employed and unemployed individuals in any period. The additional restrictions do not conflict with those already established for the primary result—an explanation for the persistence of relatively high rates of involuntary unemployment in a region such as the Atlantic Region.

The results of the model depend critically on the existence of a distribution of migration costs across individuals. Given the nature of such costs, an empirical investigation of f(m) is impossible. It seems entirely plausible, however, that migration costs do, in fact, vary in some significant manner across individuals. Moreover, the results above suggest that the outcome can be had under a wide variety of specifications of the distribution function.

This is not to say that the model is not testable. It suggests that wage developments outside the high unemployment region exert a direct influence on local wages, operating independently of local labour market tightness. The wage transmission mechanism could be tested, then, by imbedding some measure of outside wage developments in a standard regional wage change model such as a Phillips curve specification. Results of recent empirical work on such a specification are consistent with the existence of a direct wage link into the Atlantic Region of Canada from other Canadian regions (see Drewes [2]). Also, although not formally derived above, it should be clear that the higher the turnover cost for a firm in the low wage, high unemployment region, the greater is the incentive for the employer to take account of wage developments outside the region. The wage transmission mechanism might therefore also be tested by examining wage behaviour in different industries in the high unemployment region if those industries can be categorized by size of turnover costs.

As has happened in the macroeconomic literature, the lack of a logically consistent explanation of wage rigidity in the Atlantic Region may lead to the presumption that its high unemployment rate is attributable to natural rate factors. This presumption is reinforced by the very persistence of the problem, in spite of a litany of regional demand stimulation policies. By providing a choice-theoretic model of wage rigidity and involuntary unemployment in a high unemployment, low income region, this paper suggests that policy makers should not rule out the contribution of deficient demand to regional unemployment disparity.

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