ON MEASURING THE SOCIAL OPPORTUNITY COST OF PERMANENT AND TEMPORARY EMPLOYMENT IN LABOUR MARKETS WITH MIGRATION

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November 1975

I. Introduction

The principal objective of this paper is to develop a dynamic model of a regional labour market which will enable us to estimate the social opportunity cost of labour. This variable is important for both the economic evaluations of investment projects and the assessment of programs designed to promote employment in slow growth areas.

One of the distinctive features of the model is that it divides the labour force into two groups which on average have quite different employment and unemployment experiences. The first group is termed the permanent employment sector. These people because of either their choice of occupation or seniority are almost never unemployed. The second group is referred to as the temporary employment sector. This segment of the labour force contains those individuals who are either unemployed or are employed in jobs that are not expected to provide continuous employment. People who work in activities of a cyclical or seasonal nature or who have low seniority and thus can expect to experience periodic spells or unemployment are included in this temporary sector both when they are working and when they are unemployed.

Another feature of this labour model is that it allows for interaction between the labour markets within a country. The labour migration flows that take place between these regions are determined by the relative economic opportunities in the regions. One of the regions is characterized by slow economic growth and a high unemployment rate. It is for this type of region that we estimate the social opportunity cost of labour. Data for the Cape Breton Island region of Canada are applied to the labour model developed in this paper to provide an example of how this model can be used to calculate the social cost of labour used in the permanent and temporary sectors. The most important conclusion for this analysis is that the

social cost of filling permanent employment positions is significantly lower than the social cost of filling temporary jobs.

II. Evaluation of the Social Opportunity Cost of Migrants, Permanent and Temporary Jobs

In many empirical studies of interregional migration the relative magnitudes of the overall unemployment rate and the average income level in the two regions are identified as the major determinants of migration.[1] However, these two variables, which are averages for the whole region, may not be descriptive of the unemployment rate or earnings experience of the average potential migrant. We would expect that these regional variables would tend to understate the unemployment experience of the average migrant and overstate the income he can expect to earn in his home region. For the calculation of the social opportunity cost of labour in a region where migration can occur we need to determine the unemployment rate and the earnings experience of the people in the labour market that are potential migrants. In this model the potential migrants to be influenced by these economic variables are identified with the members of the temporary sector of the labour market. Therefore, the unemployment rate of the temporary sector and the average earnings of individuals in this sector are the key parameters used in the determination of migration and the social opportunity cost of labour for the region.

We begin our analysis by accepting the principle that the competitive supply price of labour is the fundamental determinant of the social opportunity cost of labour in a closed economy.[2] However, in an economy which allows for labour mobility any externality that is created by the process of labour migration should also be included in the calculations to reflect the total social cost of labour.[3]

Many slow growth regions are characterized by a high natural growth in their labour force and a large volume of out-migrants accompanied by a reverse flow of new or return in-migrants. In many of these regions in Canada and the U.S.A. large migration flows have existed in both directions for a number of years and the unemployment rates of the slow growth regions have not been significantly reduced relative to the unemployment rates in the areas experiencing the net in-migration. This suggests that the expected money income differentials between these slow growth and high growth areas are due to differences in cost of living, and the location premiums which people on the desirability of living in one region relative to another.[4] When there is a large labour flow in both directions, then for the marginal migrant, there will be an approximate equality between the utility this individual would receive by living in either the slow growth or high growth regions. The relationship between the utility received by a potential migrant located in these two regions can be written as follows:

$$(1) \quad \Psi \; (PW(1-t) + (1-P)(fU(1-t) + V)) = \bar{\Psi} \; (\bar{P}\bar{W}(1-\bar{t}) + (1-\bar{P})(\bar{f}\bar{U}(1-\bar{t}) + \bar{V}))$$

where Ψ is the utility function for the individual who belongs to the temporary employment sector and is a potential migrant from the slow growth region. When the individual is outside of the slow growth region, the same symbols are used to denote the variables but they are distinguished by a "-" sign.

f is the proportion of time while unemployed that an individual expects to collect unemployment benefits in the slow growth region,

P is the proportion of time that a person who experiences some unemployment will spend in employment if located in the slow growth region,

t is the average personal income tax rate for the individual in the slow growth region,[5]

U is the amount of unemployment benefits received each period in the slow growth region,

V is the value the individual places on the leisure time he receives while unemployed in the slow growth region,

W is the wage rate received each period from working in the slow growth region.

The terms inside the utility function of the left hand side of (1) express the supply price of a migrant in the slow growth region. This consists of the net of tax wage income the individual expects to receive while working and the net of tax unemployment benefits plus the value of leisure time that he will receive while unemployed, namely:

(2) Supply Price of a Migrant in Slow Growth Region $= PW(1-t) + (1-P)(fU(1-t) + V)$

In a competitive equilibrium, the wage rate is determined by the demand and supply of labour in the region. In such labour markets, the net of tax market wage is approximately equal to the worker's after tax unemployment insurance payments he receives when not working plus the non-monetary value of his leisure time. On the other hand, wage rates prevailing in some labour markets are inflexible and higher than the market clearing levels because of minimum wage laws, collective bargaining agreements, etc. For individuals in such markets, the net of tax wage income per period will be greater than the total of their after tax unemployment insurance payment plus the value of their leisure time because they

would prefer to work at the high wage. However, at this wage the total labour demanded will be less than the labour supplied. In such a non-competitive labour market the marginal value of a worker's leisure time may be less than the difference between the after tax wage he receives from working and the after tax unemployment insurance benefits he would get when unemployed. The relationship between the wage rate, the unemployment insurance payments, and the value of leisure time can then be expressed as follows:

$$(3) \quad W(1-t) = \beta(fU(1-t) + V) \qquad \text{for } \beta \geq 1$$

β is a coefficient whose value when the wage rate is determined competively is equal to one. When the wage rate is set above the competitive rate, then $\beta > 1$.

Substituting (3) into (2) yields:

$$(4) \quad \begin{array}{l}\text{Supply price of a}\\ \text{Migrant in Slow}\\ \text{Growth Region}\end{array} = \frac{1 + (\beta-1)P}{\beta} W(1-t)$$

Retaining a potential migrant in the slow growth region causes a loss in income taxes that would have been generated if he had moved to the high income area but there is a gain by the amount of any unemployment insurance payments that would have been paid to this person while living in the high income area. The net externality is:

$$(5) \quad \begin{array}{l}\text{Loss in Externalities Arising}\\ \text{from Retaining a Migrant}\\ \text{in Slow Growth Region}\end{array} = \bar{P}\bar{W}\bar{t} - (1-\bar{P})\bar{f}\bar{U}(1-\bar{t})$$

This is a loss to the society resulting from retaining a potential migrant and must be added to private supply price of la-

bour to constitute the social opportunity cost of retaining a migrant in the slow growth region (SOC^M). Hence,[6]

$$(6) \qquad SOC^M = \frac{1 + (\beta-1)P}{\beta} \cdot W(1-t) + \bar{P}\bar{W}\bar{t} - (1-\bar{P})\bar{f}\bar{U}(1-\bar{t})$$

At this stage, it is important to examine the differences between the social opportunity costs of filling permanent and temporary jobs in the slow growth region. A member of the labour force in the temporary sector of the region is willing to tolerate a proportion (1-P) of his total time in a state of unemployed before he will move away from the area. When additional permanent jobs are created, we assume that they will be filled by hiring from the unemployed workers or from individuals employed elsewhere, whose jobs are ultimately filled by the unemployed who by definition are members of the temporary labour force. This will cause an increase in the man-years of permanent work and a decrease in the temporary labour force. If the amount of labour time demanded by jobs that are temporary in nature is not decreased, the proportion of time the temporary labour force spends unemployed (1-P) will fall, and thus will induce a decrease in the flow of net out-migration. In order for the unemployment rate of the temporary sector to return to its previous equilibrium level, the number of potential migrants who would have left but now remain in the region will have to be the same as the number of permanent sector jobs created. This suggests that the social opportunity cost of filling a permanent job for one year is equal to the social opportunity cost of one migrant for one year.[7]

On the other hand, when an additional man-year of employment is created in the temporary sector, 1/P members of the labour force are associated with these activities. The individual employed in this sector expects to remain on average at that particular position less than a year and to collect unemployment insurance for the remainder. Hence the creation of temporary sector jobs will cause (1-P) to fall leading to a decrease in the amount of net out-migration. The reduction in net out-migration will

cause the labour force in the temporary sector to increase through normal labour force growth and thus the unemployment rate eventually will return to its initial level. Furthermore, by increasing temporary sector activities the total number of unemployment is increased leading to an increase in the consumption of leisure time equal to the proportion of time each retained migrant spends unemployed multiplied by the number of retained migrants. The social opportunity cost of filling a man-year of temporary job in the slow growth region (SOC^T) can then be expressed as follows:

$$(7) \quad SOC^T = \frac{1}{P} (SOC^M - (1-P)V)$$

For illustrative purposes consider the following example: Suppose 1,000 jobs are created in the permanent sector which are filled by the temporary sector workers. As is shown in Table 1 (row 3d), the unemployment rate which was previously 40 percent in the temporary sector will now be lower (29 percent) and people who would have migrated out of the region will now not move and those who would not have intended to move back to the region will now return. When migration is determined by the unemployment rate in the temporary sector it will stop when the 1,000 workers who moved from the temporary labour market are replaced and the labour force in this sector has returned to its previous level of 6,250 (column 3, row 3a). The social opportunity cost of creating 1,000 permanent jobs is the cost of retaining 1,000 potential migrants in the region.

On the other hand, suppose 1,000 man-years of temporary employment is created in the slow growth area. The temporary jobs allow the previously unemployed workers or the would-be migrants to remain in the region. The unemployment rate in the temporary sector will now be lower (24 percent) but will rise gradually because of induced migration. When the equilibrium is re-established, the general unemployment rate will have increased to 17.7 percent (column 5, row 4) from 15.4 percent (column 1, row 4), the number

TABLE 1

THE CHARACTERISTICS OF CREATING PERMANENT AND TEMPORARY JOBS IN A SLOW GROWTH REGION

	Initial Situation (1)	1000 Permanent Jobs Created: Immediate Response (2)	1000 Permanent Jobs Created: Final State (3)	1000 Temporary Jobs Created: Immediate Response (4)	1000 Temporary Jobs Created: Final State (5)
1. Total Labour Force	16,250	16,250	17,250	16,250	17,917
2. Permanent Sector: Individuals/Jobs	10,000	11,000	11,000	10,000	10,000
3. Temporary Sector:					
a. Individuals	6,250	5,250	6,250	6,250	7,917
b. Jobs	3,750	3,750	3,750	4,750	4,750
c. Unemployed Workers	2,500	1,500	2,500	1,500	3,167
d. Unemployment Rate	40%	29%	40%	24%	40%
4. Total Unemployment Rate	15.4%	9.2%	14.5%	9.2%	17.7%

of net in-migrants is larger than the man-years of work created. The total unemployed man-years in the region will be increased from the initial situation. The social opportunity cost of 1,000 man-years of temporary jobs is the social cost of retaining 1,667 would-be migrants in the region. It is clear that the creation of temporary jobs results in a significant larger social cost than for the case of an expansion of permanent jobs.

III. The Model of a Dynamic Labour Market Response

To evaluate the full economic impact of either a decline or an increase in an industrial activity on the area, a model should be formulated to incorporate not only the direct and indirect effects over time but also the migration effects on the area. For instance,

the initial impact of a firm's closure will be a reduction of local income and spending due to the fact that the previous wage earners in the company will now become recipients of only unemployment insurance payments or pensions. A further reduction of local jobs and spending will occur because of the decrease in the demand for locally produced goods because of the fall in income. Faced with such a deteriorating economy, some people are expected to migrate out of the area. These people will take their earnings and/or transfer payments with them which will lead to a further reduction of local-income, spending and employment.[8] A similar analysis can be made for an increase in an industrial activity with a reversal of the economic adjustments and impacts described above.

We now consider a regional economy which consists of base and secondary sectors. The base sector refers to those activities which produce goods and services that face a demand that is determined by forces exogenous to the region. The demand for the secondary sector's output is determined by the economic forces within the region. Total employment in the base and secondary sectors are denoted as Q_b and Q_s man-years, respectively. In each sector, there are permanent and temporary jobs. The total man-years of permanent and temporary employment in the economy (J_P, J_T) can be defined as follows:

$$(8) \quad J_p = B_p Q_b + S_p Q_s$$

$$(9) \quad J_T = B_T Q_b + S_T Q_s$$

Where B_p and B_T denote the proportions of the total man-years of employment in the base sector that are permanent and temporary in nature while S_p and S_T indicate the corresponding proportions in the secondary sector.

The total labour force in the permanent and temporary sectors (L_p, L_T) can be defined as follows:[9]

$$(10) \quad L_p = B_p Q_b + S_p Q_s = J_P$$

$$(11) \qquad L_T = \frac{B_T Q_b + S_T Q_s}{P} = \frac{J_T}{P}$$

Because of the possible difference in the time path of economic adjustment for a decline and an increase in base sector activity, they will be treated separately below.

A. The Model for a Decline in Base Sector Activity

In period zero prior to the decline in base activity we assume that there are, respectively, Q_{b0} and Q_{s0} man-years of employment in the base and secondary sectors in the region. We also assume that the total man-years of employment in the base sector (dQ) will be phased out over a number of years. The proportion of the total workers becoming unemployed at the beginning of the j^{th} period is denoted as γ_j. Therefore, the total employment in the base sector in period t can be expressed as:

$$(12) \qquad Q_{bt} = Q_{b0} + (B_P^* + B_T^*) \sum_{j=1}^{t} (\gamma_j dQ) \qquad (t = 1,2,\cdots n)$$

Where B_P^* and B_T^* refer to the proportions of permanent and temporary sector employment in the specific base sector activity that is being altered.

After a period of time there will be an additional impact on the activity in the secondary sector as the workers who have been laid off will now only be receiving unemployment insurance payments (U_b^*) instead of the wages they had been earning (W_b^*).[10] The fall of capital income in this specific activity (dI) may also reduce the local demand for secondary sector activities. Moreover, when migration takes place, migrants would take their total income with them and thus further decrease the demand for secondary sector activities.[11] Let k denote the long-run income multiplier between base and secondary sector activities.[12] This multiplier will likely take several periods to complete its full impact, thus we denote m_i as the proportion of this total multiplier effect that takes place in the i^{th} period following a change in base sector activity. The total employment in the secondary sector by the end of period t (Q_{st}) can be written as follows:

$$(13a)\quad Q_{st} = Q_{s0} + \frac{(k-1)}{W_s(1-t)}\alpha_b \sum_{j=1}^{t}(\gamma_j dI)\sum_{i=1}^{t-j+1} m_i$$

$$+ \frac{(k-1)}{W_s(1-t)}\left[W_b^*(1-t) - fU_b^*(1-t)\right]\sum_{j=1}^{t}(\gamma_j dQ)\sum_{i=1}^{t-j+1} m_i$$

$$+ \frac{(k-1)}{W_s(1-t)} fU_{bs}(1-t)\sum_{j=1}^{t} M_j \sum_{i=1}^{t-j+1} m_i$$

where α_b is the proportion of the capital income that accrue to residents of the slow growth region from the base sector,

M_j is the out-migration flows in the j^{th} period,

U_{bs} is the weighted unemployment benefits received by the unemployed in the slow growth region, it is calculated by $(B_T Q_{b0} U_b + S_T Q_{s0} U_s)/(PL_{T0})$ where U_b and U_s are the unemployment benefits received by the individual who works in the base and secondary sector respectively.

W_s is the wage rate received by the individual who works in the secondary sector in the slow growth region.

The second term in (13a) measures the multiplier impact on the secondary sector of a decrease in capital income from the base sector. The third term measures the multiplier impact of the loss in labour income when workers lose their wages for unemployment insurance, while the fourth term measures the impact on the secondary sector when migrants leave the region and stop spending their income in the region. Let dQ_{sj} denote the combined impact on the secondary sector of the losses of labour income, capital income and income by outmigrants in the j^{th} period (i.e., the sum of the second, third and fourth terms of (13a)), therefore, (13a) can be rewritten as:

$$(13b)\quad Q_{st} = Q_{s0} + \sum_{j=1}^{t} dQ_{sj}$$

To estimate the change in the secondary sector employment in the area, the variables determining the migration flows must be specified. Given the employment conditions in the other regions, it is the current rate of unemployment relative to a normal or equilibrium unemployment rate (1-P*) in the temporary sector and the size of the temporary labour force that determine the size of the flow of migrants from a region. If a simple linear relationship is assumed, the migration flows in the j^{th} period can be estimated as follows:

$$(14) \quad M_j = L_{Tj-1} \cdot b \cdot \left[(1-P_{j-1}) - (1-P^*)\right] \qquad (j = 1,2,\cdots\cdots t)$$

where b is the migration adjustment response to the unemployment rate differential between the actual and the equilibrium unemployment rate in the temporary sector. The problem now is to calculate how the actual unemployment rate in the temporary sector adjusts through time because of the decrease in base and secondary activity and the subsequent migration flows.

By definition, the actual unemployment rate or the proportion of time spent unemployed in the temporary sector is measured by:

$$(15) \quad 1-P_t = \frac{L_{Tt} - J_{Tt}}{L_{Tt}}$$

To measure the incremental impact of a decline in available jobs, the natural growth in the labour force can be assumed to be given. The number of labour force in the temporary sector at period t can then be estimated as:

$$(16) \quad L_{Tt} = L_{T0} - B_p^* \sum_{j=1}^{t} (\gamma_j dQ) - S_p \sum_{j=1}^{t} dQ_{sj} - \sum_{j=1}^{t} M_j$$

The second term of (16) measures the number of individuals who are displaced from permanent employment in the base sector to unemployment in the temporary sector. The third term measures the number of individuals displaced from the permanent portion of the secondary sector into the temporary sector because of

the combined effects of the decline in the base sector's capital income, the switch from wages to unemployment insurance compensation for the workers eliminated from the base sector and the decline in aggregate demand in the region brought about by the subsequent migration of labour. Finally, the last term measures the reduction in the temporary sector labour force when migrants leave the region.[13]

The number of man-years of employment in the temporary sector at period t can be measured by:

$$(17) \quad J_{Tt} = J_{T0} + B_T^* \sum_{j=1}^{t} (\gamma_j dQ) + S_T \sum_{j=1}^{t} dQ_{sj}$$

The second term of (17) indicates the decline in temporary jobs in the base sector that are eliminated with the decline in the specific activity. The last term measures the decline in temporary employment in the secondary sector that results from the combined effects of the decline in capital income and wage income in the base sector as well as loss of transfer payments when migration occurs.

This completes the model which is used to describe the reaction of the labour market in a slow growth region to a decline in base activity. After the values of b,P*, and the initial value of the variables are specified, the equations (13)-(17) can be solved to determine the level of employment, the size of the labour force, and the number of unemployed workers in the temporary sector (X); the level of employment in the secondary sector (Q); and the flow of migrants (M) for each period. The social opportunity cost of releasing workers from the base sector activity after t periods would be equal to the value of the increased leisure time that is enjoyed plus the social opportunity cost of all migrants, minus the gross loss of foregone output in the secondary sectors affected. The expression for the social opportunity cost of labour can be written as follows:

$$(18)\quad SOCL_t = \left(\sum_{j=1}^{t} dX_{bj}\right)V_b + \left(\sum_{j=1}^{t} dX_{sj}\right)V_s + \left(\sum_{j=1}^{t} dM_{bj}\right)(SOC_b^M) + \left(\sum_{j=1}^{t} dM_{sj}\right)(SOC_s^M) + \left(\sum_{j=1}^{t} dQ_{sj}\right)W_s$$

Where the subscripts b and s denote the base and secondary sector.

The net social cost (externality) of eliminating jobs is equal to the present value of the difference between the gross of tax wages paid and the social opportunity cost of labour in all sectors affected directly and indirectly by the change in base sector employment.

B. The Model for an Increase in Base Sector Activity

When there is an increase in base sector activity, the creation of jobs in the initial period may only be a fraction of the total base sector jobs ultimately created out of dQ. Let the proportion of workers employed in period j be denoted as γ_j. Hence the employment in this sector is expressed below:

$$(19)\quad Q_{bt} = Q_{b0} + (B_p^* + B_T^*)(1-\delta)\sum_{j=1}^{t}(\gamma_j dQ) \qquad (t = 1,2,\cdots,n)$$

where δ denote the proportion of created jobs to be filled by directly hiring workers from other regions. These direct hires such as management and highly skilled workers are likely to be fully employed in the sending areas and are therefore assumed to receive the same wages in their new and last jobs, say, W_b^{**}.

The rest of the workers who are hired locally for the newly expanded activities will come from either the unemployed or from employment elsewhere. The hiring of the latter workers will create job vacancies which will be filled again by unemployed workers as well as by workers that were employed in other sectors. If such a chain reaction process is assumed to occur by the end

of one period, the total effect on secondary sector employment by the end of period t can be described as follows:

$$(20a)\quad Q_{st} = Q_{s0} + \frac{(k-1)}{W_s(1-t)}\alpha_b \sum_{j=1}^{t}(\gamma_j dI)\sum_{i=1}^{t-j+1} m_i$$

$$+ \frac{(k-1)}{W_s(1-t)}\left[W_b^*(1-t) - fU_{bs}(1-t)\right](1-\delta)\sum_{j=1}^{t}(\gamma_j dQ)\sum_{i=1}^{t-j+1} m_i$$

$$+ \frac{(k-1)}{W_s(1-t)} W_b^{**}(1-t)\delta \sum_{j=1}^{t}(\gamma_j dQ)\sum_{i=1}^{t-j+1} m_i$$

$$- \frac{(k-1)}{W_s(1-t)} fU_{bs}(1-t)\sum_{j=1}^{t} M_j \sum_{i=1}^{t-j+1} m_i$$

If dQ_{sj} denotes the combined effect of the creation of employment on the man-years of the secondary sector in the j^{th} period, (20a) can be rewirtten as:

$$(20b)\quad Q_{st} = Q_{so} + \sum_{j=1}^{t} dQ_{sj}$$

If directly imported migrants are assumed to be permanently employed, then the size of the labour force and the number of man-years of employment in the temporary sector at period t can be written as:

$$(21)\quad L_{Tt} = L_{T0} - B_p^*(1-\delta)\sum_{j=1}^{t}(\gamma_j dQ) - S_p\sum_{j=1}^{t} dQ_{sj} - \sum_{j=1}^{t} M_j$$

$$(22)\quad J_{Tt} = J_{T0} + B_T^*(1-\delta)\sum_{j=1}^{t}(\gamma_j dQ) + S_T\sum_{j=1}^{t} dQ_{sj}$$

The unemployment rate in the temporary sector in each period is calculated in the same way as (15) and the specification of migration flow remains as (14). The description of the model to evaluate the effect of hiring additional employees on the economy

is now complete. The equations in (14), (15), and (20 - 22) can be solved for each period to determine the level of unemployment, the level of employment in the secondary sector and the flow of migrants.

The calculation of the social opportunity cost of labour for the expansion case (defined positively) is more complicated than for the case of employment elimination. This occurs because new jobs and subsequent vacancies are filled from both the unemployed and the employed in other sectors. It was assumed that the chain reaction process of hiring ultimately from the unemployed will occur within one time period. However, the length of time measured by a period is arbitrarily defined according to what empirical facts suggest is reasonable. If the process of filling job vacancies from the unemployed occurs in a linear fashion then the social opportunity cost of hiring additional workers at period t can be expressed as follows:

$$
\begin{aligned}
(23)\quad SOCL_T = -\{ & \Big[\sum_{j=1}^{t} dX_j - \tfrac{1}{2}(1-u)dX_t\Big]V \\
& + \Big[\sum_{j=1}^{t} dM_j - \tfrac{1}{2}(1-u)b(dJ_{pt-1} + dJ_{Tt-1})\Big]SOC^M \\
& + \Big[(\sum_{j=1}^{t} dQ_{sj})W_s - \tfrac{1}{2}(1-u)(dQ_{st})\Big(\frac{W_bQ_{b0} + W_sQ_{s0}}{Q_{b0} + Q_{so}}\Big)\Big] \\
& - \tfrac{1}{2}(1-u)(1-\delta)\gamma_t(dQ_t)\Big(\frac{W_bQ_{b0} + W_sQ_{s0}}{Q_{b0} + Q_{s0}}\Big) \\
& - \sum_{j=1}^{t}\gamma_t(dQ_t)\delta W_b^{**}\ \}
\end{aligned}
$$

where u denotes the proportion of new hires for a project that were previously in a state of unemployment.

The first term of (23) indicates the value of leisure time generated over t periods after hiring additional workers in the base sector. Because the adjustment process for the filling of

vacancies from the unemployed is assumed to occur in a linear fashion, the portion of leisure time is measured by $\frac{1}{2}(1-u)(dX_t)V$ and should be deducted. All the subsequently created job vacancies are filled by the end of the same period in which they are created, thus, $\frac{1}{2}(1-u)dX_t$ jobs are on average not filled during that period. In other words, if at the beginning of a period the proportion of the workers hired from other jobs is (1-u) but by the end of this period all the positions are filled by those who were unemployed at the beginning of the period, then on average the number of job vacancies created by hiring workers for the new jobs is $\frac{1}{2}(1-u)$ times the number of new jobs filled. The second item measures the social opportunity cost of migrants where the rate of migration has been adjusted for the fact that unfilled job vacancies will slow down the migration response in t^{th} period. The third and fourth items measure the increase of employment in the secondary sectors and the foregone output in both the base and secondary sectors due to the bidding away of workers from these sectors. The last item is the foregone product of the migrants directly hired from other regions.

IV. Empirical Analysis

In this section we apply the models developed above to the case of the Cape Breton Island labour market to measure the social opportunity cost of labour and the labour externality associated with both a decline and an increase in base sector activity. A comparison is made of the social costs of eliminating (or creating) permanent and temporary jobs in the base sector.

A. Nature of Labour Market in Cape Breton Island

The Cape Breton Island labour market has been known for its high unemployment rate and large migration flows. People have moved away in search of work and often return if employment opportunities become available in the region or if they have been unsuccessful in obtaining desirable employment elsewhere. A sizable

two-way migration flow has existed for years between this slow growth region and the rest of the country.[14]

One of the most important factors in the Cape Breton labour market is the expected duration of unemployment in the temporary sector which determines the potential level of migration. In this empirical estimation the temporary labour force is defined as those who have experienced some unemployment over a period of 30 months. Using a ten percent sample of all the individuals who claimed unemployment insurance at least once in Cape Breton Island during the period July 1972 to December 1974, the expected duration of unemployment in the temporary sector is estimated by a probit analysis and found to be about 39.4 weeks when the total unemployment rate is 11.22 percent.[15] This expected duration of unemployment appears substantially higher than the average duration of unemployment insurance claims (23.6 weeks).[16] Hence unemployed workers in Cape Breton Island are expected to spend 60 percent of their unemployed time collecting unemployment insurance payments (i.e., $f = .60$).

On the other hand, the experienced unemployed workers in Cape Breton Island has 1.5 periods of unemployment over the 2.5 years from July 1972 to December 1974.[17] This suggests that the experienced unemployed workers spent about 54 percent of their time in working and 46 percent in not working (i.e., $p = .54$).

The total labour force in Cape Breton Island was about 55,320 persons in January 1976 which can be broken down into 25,707 in the base sector and 29,613 in the secondary sector.[18] The total number of workers who experienced unemployment was estimated to be approximately 33,430 persons which can also be broken down into 16,706 persons in the base sector and 16,724 persons in the secondary sector. Because the proportion of time these people spent employed is only 54 percent, the total jobs available become 9,021 man-years in the base sector and 9,031 man years in the secondary sector.

The amount of permanent employment, obtained by substracting the temporary labour force from the total labour force, is equal to 9,001 man-years in the base sector and 12,889 man-years in the secondary sector. The total jobs available on Cape Breton Island therefore is equal to 39,942 man-years which consists of 18,022 in the base sector and 21,920 in the secondary sector. Thus $B_p = .499$, $B_T = .501$, $S_p = .588$, and $S_T = .412$.

From the same ten percent sample of unemployed workers in Cape Breton Island, the weekly earnings were found to be about $147 in 1976 dollars for those working in the base sector and $139 for those in the secondary sector.[19] The average personal income tax rate for Cape Breton Island is approximately 12 percent.[20]

The long run income multiplier has been estimated at 1.52 for Cape Breton Island.[21] The cumulative effect of indirect impact over time on the region is assumed to be 70 percent, 85 percent, 95 percent for the first three periods and 100 percent for the following time periods.

B. Simulation of Model: (1) Decline in Base Sector Activity.

Suppose there are two employers in Cape Breton Island, the permanent/temporary employment ratios associated with these firms are 80/20 for case A and 20/80 for case B. Both companies have the same capital/labour income ratio in Nova Scotia as a whole, i.e., 30/70. Assume that either company employs 1,000 man-year jobs and they will be phased out over three years. The proportions of workers to be released through time will be 50 percent, 25 percent and 25 percent each year beginning in year one. The workers affected could be expected to receive unemployment insurance benefits of $100 per week instead of a previous wage rate of $150 per week. The impact of either case on the economy of Cape Breton Island can be obtained by solving the system of equations (13)-(17) where the migration adjustment to temporary unemployment rate is assumed to be moderate ($b = .50$)[22] and the

long-run unemployment rate in the temporary sector is about .46.

Table 2 presents the impact of the company's closure on the Cape Breton Island economy. Total out-migration over the 25 years would involve 2,536 workers for case A and 3,251 workers for case B. There are more migrants in case B because this case has a greater proportion of temporary jobs being eliminated.

The total reduction in man-years of employment in the secondary sector over 25 years would also be higher for case B than for case A (1,173 versus 1,019 man-years). This is because more migrants in the former case take their earnings and transfer payments away with them and subsequently cause a further reduction in spending in the local economy.

It should be noted that the number of unemployed workers on Cape Breton Island would first increase substantially as a result of workers being laid-off and then will start to decline because of out-migration. In the final equilibrium the number of unemployed workers in Cape Breton will be smaller than before the company was closed. When compared to the initial situation it is interesting to see that the overall unemployment rate in the final equilibrium for the region will be higher (28.2 percent) for case A where the ratio of permanent to temporary jobs being eliminated is 80/20, and lower (27.5 percent) for case B where the ratio of permanent/temporary jobs is 20/80. This suggests that destroying permanent jobs in the companies will make the overall unemployment in the labour market worse than if a greater proportion of the jobs destroyed are of a temporary nature.

To estimate the social opportunity cost of jobs lost by the company's closure, the value of leisure time (V) and the social opportunity cost of a migrant (SOC^M) must be calculated. According to (6), the variables of $\bar{W}, \bar{U}, \bar{P}, \bar{f}$ and $\bar{t}$ for migrants must first be estimated. We found that the weighted average of wage rates for migrants in the destination areas is about 13 percent higher than that in Cape Breton Island.[23] $\bar{t}$ is therefore expected to be

TABLE 2

ECONOMIC IMPACT OF DESTROYING JOBS ON CAPE BRETON ISLAND WITH ALTERNATIVE ASSUMPTIONS ON EMPLOYMENT STRUCTURES

	Initial State	Final State*	
		A	B
Total Labour Force	55,320	52,788	52,074
Permanent Sector: Jobs	21,890	20,490	21,000
Temporary Sector:			
Individuals	33,430	32,298	31,075
Jobs	18,052	17,432	16,769
Unemployed Workers	15,378	14,866	14,306
Unemployment Rate	46.0%	46.0%	46.0%
Total Unemployment Rate	27.8%	28.2%	27.5%
Reduction of Jobs in Secondary Sector	-	1,019	1,173
Out-Migrants	-	2,536	3,251

* A indicates the company associated with 80/20 permanent/ temporary employment ratio.

B indicates the company associated with 20/80 permanent/ temporary employment ratio.

higher in the destination areas and is assumed to be 15 percent for this study. $\bar{P}$ would be 77 percent if the relationship between the proportion of time the temporary work force spends out of employment and the total unemployment rate is fixed in all regions. Since migrants face a lower unemployment rate in receiving regions, they are expected to have a lower duration of unemployment and, therefore, $\bar{f}$ must be higher than that in Cape Breton Island and is assumed to be .80.

Wage rates in Cape Breton Island do not seem to be determined in a competitive manner and appear to be higher than the wage rate that would bring about a competitive equilibrium. The regulated wage rates are assumed to be 1/3 higher than what the competitive wage rate would be, hence β is set equal to 4/3 in the study. Substituting the value of variables into (3) and (6) yields V_b = \$45.3, V_s = \$42.6, SOC_b^M = \$109.3 and SOC_s^M = \$103.4 per week.

The total social opportunity cost of 1,000 jobs eventually destroyed as a result of the company's closure is computed according to (18) and shown in Table 3. The SOCL and the ratio of the SOCL to the wage bill of the company are rising at a decreasing rate over time because the laid off workers are becoming migrants and now have a greater social opportunity cost than when they were idle in Cape Breton. However, it takes about eight years for the social opportunity cost of released workers for case A to reach 50 percent of what the company's annual wage bill would be if it were to continue operating. For case B, the ratio of SOCL to the annual wage bill is rising faster because there are more out-migrants (see Figure 1 line $SOCL_B$).

If the company were phased out over three years, the present value of the net social loss (shaded area in Figure 1) over 25 years would account for 61 percent of the total wage bill in the company for case A and 47 percent for case B, when a 10 percent social discount rate is used.[24] The difference between these two areas can be seen as the heavily shaded area in Figure 1.

It is quite clear that the closure of a company associated with a greater proportion of permanent employment would cost the society more as compared to the loss of the same number of jobs but associated with a higher proportion of temporary employment.

TABLE 3

SOCIAL OPPORTUNITY COST OF LABOUR AND EXTERNALITY
IF JOBS DESTROYED IN CAPE BRETON ISLAND
(Millions of Dollars in Price Level of Year 1)

Year	SOCL ($)		SOCL/Wage	
	A	B	A	B
1	.34	.34	.09	.09
2	.88	1.05	.15	.18
3	1.54	1.92	.20	.25
4	2.15	2.78	.28	.36
5	2.71	3.51	.35	.45
6	3.20	4.14	.41	.53
7	3.63	4.68	.46	.60
8	3.97	5.11	.51	.66
9	4.25	5.47	.54	.70
10	4.48	5.76	.57	.74
15	5.13	6.59	.66	.85
20	5.37	6.90	.69	.88
25	5.46	7.01	.70	.90

Calculation of Labour Externality (Years 1 - 25)

	A	B
Net Present Value of Wage Bill ($)	65.13	65.13
Net Present Value of Externality (loss $)	39.81	30.76
Externality as % of Wage Bill	61%	47%

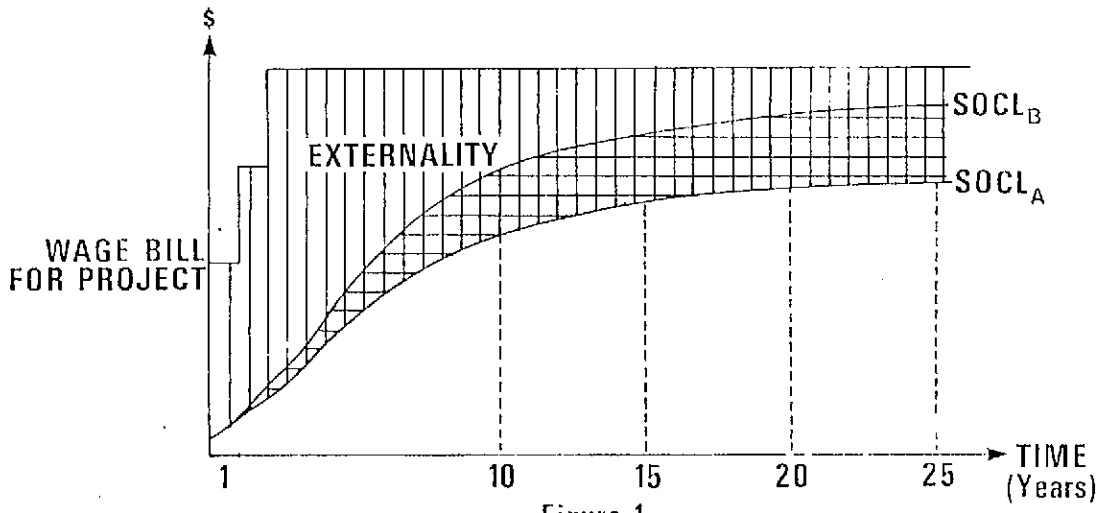

Figure 1

C. Simulation of Model: (2) Increase in Base Sector Activity

In this case we assume that two companies had been proposed to start operation in Cape Breton Island and each would create 1,000 man-years of employment. Of these 1,000 man-years 50 percent would begin immediately while another 25 percent will follow one year later and the remaining 25 percent will follow the next year. The permanent/temporary employment ratios associated with these companies are 80/20 for case A and 20/80 for case B. The assumptions on the average wage rate and capital/labour income ratio in the companies and the in-migration response are the same as the case of a decline examined previously.[25]

The effects on the creation of employment in either case on the economy of Cape Breton Island are shown in Table 4. The total induced in-migrants over 25 years would be 2,549 workers for case A and 3,263 workers for case B, in either case a great proportion of migrants would move in the first four years.

The total increase in man-year jobs in the secondary sector over 25 years would be 1,033 for case A and 1,187 for case B. Of these man-years, about 49 percent and 45 percent for case A and B respectively would take place in the first three years because of two factors. First, there is a substantial increase in the number of workers being hired and they will have increased incomes to be spent in the region because the wages paid to the new employees of the company are larger than the income they previously received through unemployment benefits. Secondly, there is an increase in capital income alloted to the local residents in those years. However, the size of the positive impact on secondary sector would start to decline from the fourth year onwards since the only stimulus is the migration effect on the economy.

The number of unemployed workers in Cape Breton Island drops considerably right after the company begins to operate and then gradually rises over time to as much as 15,894 persons for case A and 16,454 persons for case B by year 25, which are even higher

TABLE 4

ECONOMIC IMPACT OF CREATING JOBS ON CAPE BRETON ISLAND WITH ALTERNATIVE ASSUMPTIONS ON EMPLOYMENT STRUCTURES

	Initial State	Final State*	
		A	B
Total Labour Force	55,320	57,851	58,565
Permanent Sector: Jobs	21,890	23,280	22,770
Temporary Sector:			
Individuals	33,430	34,571	35,795
Jobs	18,052	18,678	19,341
Unemployed Workers	15,378	15,894	16,454
Unemployment Rate	46.0%	46.0%	46.0%
Total Unemployment Rate	27.8%	27.5%	28.1%
Increase of Jobs in Secondary Sector	-	1,033	1,187
In-Migrants	-	2,549	3,263

*A indicates the company associated with 80/20 permanent/ temporary employment ratio.

B indicates the company associated with 20/80 permanent/ temporary employment ratio.

than the situation before jobs were created. The increase in unemployment workers takes place because the induced in-migrants are added to the temporary work force thus driving up the average duration of unemployment. The total unemployment rate in the final equilibrium would become lower for case A (27.5 percent) and higher for case B (28.1 percent) relative to the initial situation.

In the case of created jobs, it is impossible to identify

whether unemployed workers are hired from either the base or secondary sector. Nor can we distinguish between migrants coming to either the base or secondary sector. If $\beta = 4/3$, the average value of leisure time per person across sectors on Cape Breton Island is equal to $43.9 per week in January 1976 dollars and the social opportunity cost of each migrant is approximately $106 per week.

If the proportion of people hired directly from the unemployment (u) is equal to .5, the social opportunity cost of hiring 1,000 man-years in period t can be calculated according to (23) and show in Table 5. The ratios of SOCL to the annual wage bill

TABLE 5

SOCIAL OPPORTUNITY COST OF LABOUR AND EXTERNALITY IF JOBS CREATED IN CAPE BRETON ISLAND

(Millions of Dollars in Price Level of Year 1)

Year	SOCL ($)		SOCL/Wage	
	A	B	A	B
1	1.16	1.16	.30	.30
2	1.92	2.14	.33	.37
3	2.45	2.91	.31	.37
4	2.71	3.43	.35	.44
5	2.99	3.88	.38	.50
6	3.41	4.43	.44	.57
7	3.78	4.89	.49	.63
8	4.08	5.28	.52	.68
9	4.33	5.59	.56	.72
10	4.54	5.85	.58	.75
15	5.12	6.59	.66	.85
20	5.33	6.86	.68	.88
25	5.41	6.96	.69	.89

Calculation of Labour Externality (Years 1 - 25)

	A	B
Net Present Value of Wage Bill ($)	65.13	65.13
Net Present Value of Externality (Gain$)	36.39	26.93
Externality as % of Wage Bill	56%	41%

paid by the company are increasing over time and remain constant at approximately 69 percent for case A and 89 percent for case B from the year 25 onward. The net social benefits attributable to the creation of jobs would account for 56 percent of the company's total wage bill for case A and 41 percent for case B. It is clear that the higher the proportion of permanent employment jobs created, the greater are the beneficial labour externalities.

V. Conclusions

In this paper, the theoretical framework of a dynamic labour model for the slow growth region has been developed to evaluate the full economic impact of eliminating and creating jobs in the area. The model allows for interaction between the regional labour markets of a country, which incorporates not only the direct and indirect effects but also the migration effects on the region over time. The social opportunity cost of labour is then measured by summing the value of incremental leisure time received by unemployed workers, the social opportunity cost of all migrants, and the gross change of foregone output in the secondary sectors.

A distinction in the labour market is drawn between permanent and temporary employment. This is the significant departure from the traditional view on migration. In this model it is the unemployment experience and the earnings of the temporary labour force rather than the general unemployment rate and income of the region that are the relevant variables in determining migration decision and also in the measurement of the social opportunity cost of induced migrants. The social opportunity cost of filling a permanent job for one year is equal to the social opportunity cost of one migrant for one year. But the creation of an additional temporary man-year of employment would result in more than one migrant's social opportunity cost because additional migrants are induced to the region.

The Cape Breton Island labour market has been examined and found that during the period of July 1972 to December 1974, the expected duration of unemployment was about 39.4 weeks, which is much longer than the duration of unemployment insurance claims (23.6 weeks). Since the unemployed workers experienced 1.5 periods of unemployment over 2.5 years, the unemployment rate in the temporary sector would be as high as 46 percent which is much higher than the general unemployment rate of the region.

This model has been applied to examples of eliminating and creating jobs in Cape Breton Island to measure the social opportunity cost of labour. A comparison is made of the social cost as a result of the change in jobs associated with various employment structures. We have shown that the elimination of jobs associated with a greater proportion of permanent employment would cost the society more than jobs associated with a greater proportion of temporary employment. By the same token, the higher the proportion of permanent jobs created, the greater are the net benefits received by the society.

FOOTNOTES

*The authors have benefitted greatly from working closely with John Evans, Arnold C. Harberger, Harvey Schwartz, and Donald G. Tate. The work reported in this paper builds on the theoretical and empirical research previously completed by these individuals. Needless to say, the opinions expressed in this paper and any errors that remain are the responsibility of the authors alone.

[1] See, e.g., T.J. Courchene, "Interprovincial Migration and Economic Adjustment", Canadian Journal of Economics, (November 1970); J. Vanderkamp, "Migration Flows, Their Determinants and Effects of Return Migration", Journal of Political Economy, (Sept./Oct. 1971).

[2] A.C.Harberger, "On Measuring the Social Opportunity Cost of Labour", in Project Evaluation, (London and Basingstoke: The MacMillan Press Ltd., 1972), Chap.7; and G.P. Jenkins and C. Montmarquette,"The Social Opportunity Cost of Displaced Workers", a paper presented at the Canadian Economics Association, Quebec City, (June 1976).

[3] J. Howe, K. Monds, and J. Evans, "On Estimating the Social Opportunity Cost of Labour for a Hydro Electric Project in a Remote Construction Site and for Alternative Generation Facilities Near the Metropolis", a paper prepared for the Department of Industry, Trade and Commerce, Government of Canada, (March 1975).

[4] The theory of the role of unemployment in controlling migration flows has been applied by J.R. Harris and M.P. Todaro, "Migration, Unemployment and Development: A Two Sector Analysis", American Economic Review, (March 1970); and A.C. Harberger, op. cit.

[5] For the migration analysis, it is the average personal income tax rate that is relevant because the decision to migrate is a function of the annual net of tax wages in the two areas not the net of tax wage rate on the marginal hours or weeks worked in the area.

[6] An alternative derivation for social opportunity cost of retaining a migrant which gives the same final result is the sum of the following items:

(i) social opportunity cost of labour in the slow growth region if no migration exists:

$PW + (1-P)V$ or

$PW + \left(\frac{W-\beta fU}{\beta}\right)(1-t)(1-P)$

(ii) net increase of income tax collections to society from a relocation in the high income area:

$\bar{P}\bar{W}\bar{T} - PWt$

(iii) saving of unemployment insurance payments to the society from the movement to the high income area:

$(1-P)fU(1-t) - (1-\bar{P})\bar{f}\bar{U}(1-\bar{t})$

[7] In this analysis we assume that the creation or elimination of jobs does not alter the rate of labour force participation. It is likely that the rate of labour force participation will be temporarily altered by such an action. However, to avoid unduly complicating the model we have held this variable constant.

[8] J. Vanderkamp, "The Effect of Out-migration on Regional Employment", Canadian Journal of Economics, (November 1970).

[9] The proportion of time a temporarily employed person spends in work is assumed to be the same on average in both the base and secondary sectors.

[10] An unemployed person in Canada is qualified to receive benefits if he has had eight or more weeks of insurable employment. For a detailed information, see Statistics Canada, Statistical Report on the Operation of the Unemployment Insurance Act, Catalogue 73-001. It has been proposed by the Department of Finance that at least twelve weeks of insurable employment be required before becoming eligible for unemployment benefits.

[11] If the migrant was not previously unemployed, his job would be filled by other employees or consequently by unemployed. The local income would be eventually reduced by unemployment insurance payment.

[12] The long run income multiplier can be measured by the ratio of the total regional income to the base sector income alloted to the residents of the region. The latter includes the income earned by the owners of factors of production in the base sector plus all government transfer payments which are income flows determined exogenously with respect to the region.

[13] All out migration that is caused by unemployment conditions is assumed to occur from the temporary sector's labour force. If a person migrates directly from the permanent sector, his job is assumed to be filled by a member of the temporary sector and thus inducing an additional in-migrant into the temporary sector.

[14] The annual flow of working age migrants has been equal to approximately five to ten percent of the total labour force in

Cape Breton. Because of these large flows of migrants which have existed for several years, it is unlikely that inframarginal rents are accruing to the people leaving Cape Breton Island. See Statistics Canada, "Inter-country Migration Data Base", (December 1973).

[15] The probit model we used was developed by J.G. Cragg, "Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods", Department of Economics, University of British Columbia (Aug. 1968). See, also, A.S. Goldberger, Econometric Theory (New York: John Wiley, 1964); J. Tobin, "Estimation of Relationships for Limited Dependent Variables", Econometrica,(1958). In Cape Breton Island, younger workers have a shorter duration of unemployment than all workers. Also, male workers have about seven weeks shorter length of unemployment as compared with females (36.7 weeks vs. 43.5 weeks). For a detailed analysis, see G.P. Jenkins and C.Y. Kuo,"The Social Cost of Filling Temporary and Permanent Jobs; A Regional Analysis", a paper prepared for the Department of Regional Economic Expansion, Government of Canada (April 1976).

[16] This is because many of the recipients of unemployment insurance benefits exhaust their insurance claims before they obtain their next jobs. The number of weeks an unemployed worker is entitled to claim unemployment insurance benefits depends upon the insured weeks, national unemployment rate, regional unemployment rate the individual lives, etc. See Statistics Canada, Statistical Report on the Operation of the Unemployment Insurance Act, Catalogue 73-001.

[17] In the same period, experienced unemployed male workers claimed 1.6 times of unemployment insurance benefits while 1.3 times for females.

[18] The current labour force in Cape Breton Island is likely to be the same as that in 1971 because the population in the region has not grown much during the past five years and if the labour force participation rate is assumed to be constant. See B.M. Selig and A. Harvey, "Nova Scotia Population Projections, 1972 - 81", Institute of Public Affairs, Dalhousie University (November 1974). For the breakdown of the labour force into the base and secondary sectors, see H. Schwartz, "The Long-Run Employment Multiplier for Cape Breton County", a paper prepared for the Department of Regional Economic Expansion, Government of Canada (January 1976).

[19] These estimates are slightly understated because approximately nine percent of the sample had actually earned at least the maximum insured earnings, but only the maximum insured earnings were recorded. The maximum weekly insurable earnings were

$150 in 1972, $160 in 1973, $170 in 1974, $185 in 1975 and $200 in 1976.

20 For Nova Scotia as a whole, the average personal income tax rate was 11.65% in 1973.

21 The formula to calculate the multiplier is:

$$k = 1 + \frac{W_s(1-t)Q_s}{\alpha_b I_b + W_b Q_b(1-t) + f(\frac{1-P}{P})(1-t)(U_b B_T Q_b + U_s S_T Q_s) + G}$$

where G is government transfer payments other than unemployment benefits which is about 25% of labour income; I_b is the capital income in the base sector which can be measured by assuming 30/70 capital/labour income ratio; and α_b is assumed as .5 for the study. See H. Schwartz,"Estimating Capital's Share and Labour's Share of Nova Scotia Income", a paper prepared for the Department of Regional Economic Expansion, Government of Canada, (February 1976).

22 See K.S. Wood and H. Verge,"A Study of the Problems of Certain Cape Breton Communities", Institute of Public Affairs Dalhousie University (1966). This study showed that a substantial proportion of migrants moved over a period of two years immediately following the closure of several large coal mines in the area.

23 This figure was obtained by the weighted weekly wage rate of all migrants in the receiving areas over the wage rate in Nova Scotia. The distribution of the male working age outmigrants from Cape Breton Island over the period 1966 - 71 was 46.37% to Ontario, 31.86% to other parts of Nova Scotia, 5.21% to New Brunswick, 4.49% to Newfoundland, 4.37% to Quebec, 2.90% to Alberta, 2.63% to British Columbia, 1.06% to Manitoba, 0.75% to Prince Edward Island, and 0.36% to Saskatchewan.

24 G.P. Jenkins, "Analysis of Rate of Return from Capital in Canada", an unpublished Ph.D. dissertation submitted to the University of Chicago (December 1972).

25 In the example, we assume that no directly imported manpower are needed for both cases A and B. However, if five percent of the total required manpower are assumed to be directly imported, the social opportunity cost of labour would be larger and hence the labour externalities become lower (54 percent of the company's wage bill for case A and 40 percent for case B) as compared with the example given in the text.

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