On Measuring the Social Opportunity Cost of Permanent and Temporary Employment

Glenn P. Jenkins
Department of Economics, Queen's University, Kingston, Ontario K7L 3N6, Canada and Eastern Mediterranean University, North Cyprus
E-mail: jenkins@econ.queensu.ca

Chun-Yan Kuo
Senior Fellow, John Deutsch International, Department of Economics, Queen's University, Canada,
E- mail: kuoc@qed.econ.queensu.ca

Development Discussion Paper: 1978-10

Abstract

Abstract. A model is developed to evaluate the social opportunity cost of labour employed in permanent and temporary jobs. It allows for labour migration between regions and includes a measurement of the secondary impact of job creation programs on the regions. An application of the model is carried out for the Cape Breton region of Canada. The principal policy conclusion is that the social opportunity cost per man-year of permanent employment is significantly less than the social opportunity cost per man-year of temporary employment; therefore, governments should be concerned not only with the number of jobs created by their programs but also with the quality of employment opportunities made available.

Note sur les coûts sociaux alternatifs de la création d'emplois permanents et temporaires. L'objectif principal de cet article est de développer un modèle dynamique d'un marché régional de travail afin d'évaluer le coût social alternatif du travail engagé dans des emplois temporaires et permanents. Ce modèle établit une distinction entre les postes qui assurent du travail continu à plein temps et ceux qui assurent seulement un travail temporaire. En plus de permettre la migration interrégionale des travailleurs, ce modèle permet de mesurer l'effet secondaire sur l'économie régionale des programmes de création d'emplois. Les auteurs appliquent le modèle à la région du Cap Breton. Il appert que le coût social alternatif de l'emploi permanent par année/homme est bien moindre que celui de l'emploi temporaire. De fait la création de travail temporaire peut même augmenter la quantité de chômage dans la région. Les auteurs concluent que les gouvernements ne devraient pas seulement se soucier du nombre d'emplois créés par un programme mais aussi de la qualité des emplois qu'ils mettent à la disposition des travailleurs.

Keywords: Social opportunity cost, employment, labour, Canada

JEL Classification: **J0**

Published as: Jenkins, G. P. and Chun-Yan K. (1978). **On Measuring the Social Opportunity Cost of Permanent and Temporary Employment**. *The Canadian Journal of Economics/Revue canadienne d'Economique*, Vol. 11, No. 2 (May, 1978), pp. 220-239

Abstract. A model is developed to evaluate the social opportunity cost of labour employed in permanent and temporary jobs. It allows for labour migration between regions and includes a measurement of the secondary impact of job creation programs on the regions. An application of the model is carried out for the Cape Breton region of Canada. The principal policy conclusion is that the social opportunity cost per man-year of permanent employment is significantly less than the social opportunity cost per man-year of temporary employment; therefore, governments should be concerned not only with the number of jobs created by their programs but also with the quality of employment opportunities made available.

Note sur les coûts sociaux alternatifs de la création d'emplois permanents et temporaires. L'objectif principal de cet article est de développer un modèle dynamique d'un marché régional de travail afin d'évaluer le coût social alternatif du travail engagé dans des emplois temporaires et permanents. Ce modèle établit une distinction entre les postes qui assurent du travail continu à plein temps et ceux qui assurent seulement un travail temporaire. En plus de permettre la migration interrégionale des travailleurs, ce modèle permet de mesurer l'effet secondaire sur l'économie régionale des programmes de création d'emplois. Les auteurs appliquent le modèle à la région du Cap Breton. Il appert que le coût social alternatif de l'emploi permanent par année/homme est bien moindre que celui de l'emploi temporaire. De fait la création de travail temporaire peut même augmenter la quantité de chômage dans la région. Les auteurs concluent que les gouvernements ne devraient pas seulement se soucier du nombre d'emplois créés par un programme mais aussi de la qualité des emplois qu'ils mettent à la disposition des travailleurs.

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

The authors are indebted to John Evans, Arnold C. Harberger, Harvey Schwartz, and Donald G. Tate for their comments and suggestions. Of course the opinions expressed in this paper and any errors that remain are responsibility of the authors alone.

cost of labour required to fill different kinds of employment opportunities. This parameter is important for both the economic evaluation of investment projects as well as the assessment of programs designed to promote full employment.

A distinctive feature 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 of unemployment are included in this temporary sector both when they are working and when they are unemployed.

Another feature of the 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. To add realism to the model it is assumed that wage rates in the slow-growth region are not determined by local market conditions but are given to the region by outside forces, such as collective bargaining agreements and minimum wage laws. To illustrate the measurement of the social opportunity cost of labour required to fill newly created jobs, this model is applied to the Cape Breton Island region of Canada. The case of Cape Breton is chosen because the characteristics of this regional labour market correspond closely to those in the labour market model.

EVALUATION OF THE SOCIAL OPPORTUNITY COST OF MIGRANTS, PERMANENT AND TEMPORARY JOBS

The fundamental determinant of the social opportunity cost of labour is the competitive supply price at which labour of a particular type will make itself available for employment in a specific area (Harberger, 1971a; Jenkins and Montmarquette, 1976). However, we do not wish to ignore the effects of taxation, unionization, unemployment insurance programs, or any other labour market distortion. On the contrary, it is essential to integrate the effects of these factors into any estimation of the social opportunity cost of labour.

The social opportunity cost of labour need not be determined by the marginal product of labour forgone elsewhere when the workers are employed in a particular project. This is particularly true when migration occurs between regions. Because of differences in working conditions and the environmental characteristics of regions, a worker may require very different levels of wages in alternative areas in order to derive equal utility. For example, the competi-

tive supply price of labour and the marginal product of labour for workers of a particular skill may be significantly higher in remote isolated regions than in central cities. However, the level of utility of workers moving to remote regions will be approximately equal to the level of utility they would have had if they had stayed in the central cities. The social opportunity cost of this type of labour in the central cities is therefore derived from the supply price of labour in the central city, not the forgone marginal product lost by not employing the worker in the remote area.

We will start with the case where the wage rates are determined by market prices to equate labour demand and supply in each region. If migration is allowed between regions, the long-term income difference will reflect differences in costs of living and environmental benefits or costs between the regions.

In the presence of taxes, unemployment, unemployment insurance, and migration the private supply price of labour in a region is no longer equal to the wage rate but is the dollar value that the marginal migrating worker places on an average unit of his time. This will include the net of tax wage $W(1-t)$ for the proportion of the time that he is working P, plus the net of tax income he receives for unemployment insurance $fU(1-t)$ for the proportion of time when he is unemployed $(1-P)$, plus the non-monetary value of the leisure the worker enjoys when he is unemployed V. This private supply price of a migrant S^M can be expressed as follows:

$$S^M = PW(1-t) + (1-P)[fU(1-t) + V], \tag{1}$$

where W is the gross of tax wage rate he can expect to receive while working, U is the unemployment insurance benefits received in each period that he is unemployed, f is the proportion of time while unemployed that a person expects to collect unemployment insurance benefits, and t is the average personal income tax rate for the temporary labour force in the slow-growth region.[1]

It is important to note that the private supply price of a potential migrant is generally different in the region that he is leaving and in the region he is moving to, while his level of utility in both regions is approximately equal. If we define equation (1) as the supply price of a potential migrant in the slow growth region then the supply price of the same migrant in the alternative region can be written similarly as follows:

$$S_a^M = P_a W_a(1-t_a) + (1-P_a)[f_a U_a(1-t_a) + V_a],$$

where symbols refer to the same variables as in equation (1) but the variables that refer to the alternative region are distinguished by the subscript a.

In many empirical studies of interregional migration the relative magnitudes of the over-all unemployment rate and the average income level in the two regions are identified as the major determinants of migration (see Courchene,

1 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.

1970; Vanderkamp, 1971). 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 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 determinants of migration and the social opportunity cost of labour for the region.

In a competitive equilibrium, the wage rate is determined by equating the demand and supply of labour. The net of tax market wage is approximately equal to the after-tax unemployment insurance payments the worker receives when not working plus the non-monetary value of his leisure time. This relationship can be expressed as,

$$W(1 - t') = fU(1 - t') + V, \tag{2}$$

where t′ is the marginal personal income tax rate. 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 and collective bargaining agreements. In the construction of this model we will make the assumption that wages in the slow-growth region are determined by collective bargaining agreements or minimum wage laws that prevail outside the region. The existing wage rate in this case will be greater than the market clearing wage rate. For individuals in such a labour market, the net of tax wage rate per period will be greater than the total of their after-tax unemployment insurance payment plus the value of the leisure time they receive per period when unemployed. These workers would prefer to work more than they now can at the high wage, and some may be unemployed until after they have exhausted their unemployment insurance benefits. At this artificially high wage the total labour demanded will be less than the labour supplied. Thus, in such a non-competitive labour market the marginal value of a unit of a worker's leisure time may be less than the difference between the after-tax wage rate he receives from working and the after-tax unemployment insurance benefit rate he receives when unemployed. Denoting the ratio of the actual regulated wage rate to the competitive wage rate as β we can then express the relationship between the market wage rate, unemployment insurance payments, and the non-monetary value of leisure time in the slow growth region as follows:

$$W(1 - t') = \beta[fU(1 - t') + V], \tag{3}$$

where β is equal to one when the wage rate is determined competitively and is greater than one when the wage rate is set above the competitive rate.

Solving for the value of leisure we have

$$V = (W - \beta fU)(1 - t')/\beta. \tag{4}$$

Substituting (4) into (1) yields the private supply price of a migrant before considering changes in tax and subsidy distortions caused by the migration of labour:

$$S^M = PW(1 - t) + (1 - P)[fU(1 - t) + (W - \beta fU)(1 - t')/\beta]. \tag{5}$$

In an economy which allows for labour mobility all the externalities created by the process of labour migration should be included in the measurement of the social opportunity cost of a migrant. Retaining a potential migrant in the slow-growth region will cause a welfare loss equal to the income taxes that would have been generated if he had moved to the high-income area, but there is also a welfare gain by the amount of any unemployment insurance payments that would have been paid to the person while living in the other region.[2] The net externality E becomes

$$E = P_a W_a t_a - (1 - P_a) f_a U_a (1 - t_a). \tag{6}$$

This is an additional welfare cost to the society resulting from retaining a potential migrant and must be added to private supply price of a migrant to constitute the social opportunity cost of retaining a migrant in the slow-growth region SOC^M, namely,[3]

$$\text{SOC}^M = PW(1 - t) + (1 - P)[fU(1 - t) + (W - \beta fU)(1 - t')/\beta] + P_a W_a t_a - (1 - P_a) f_a U_a (1 - t_a). \tag{7}$$

While equation (7) measures the social opportunity cost of retaining a potential migrant in the slow-growth region, we must distinguish this from the social opportunity cost of labour arising from filling alternative types of jobs. The social opportunity cost of a migrant can be measured independently of the labour market dynamics that arise when different kinds of employment are made available. However, the social opportunity cost of labour is tied to the type of employment that is created and uses the value for the social opportunity cost of a migrant as one of the input parameters.

2 This measurement of the welfare gains and losses from externalities caused by market distortions is consistent with the formulation of measuring welfare changes presented by Harberger (1971b).

3 An alternative derivation for the social opportunity cost of retaining a migrant which gives the same final result is the sum of the following items:
(*i*) the social opportunity cost of labour in the slow-growth region if no migration exists:

$PW + (1 - \text{P})V$, or $PW + (1 - P)(W - \beta fU)(1 - t')/\beta$;

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

$P_a W_a t_a - PWt$;

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

$(1 - P) fU(1 - t) - (1 - P_a) f_a U_a (1 - t_a)$.

For the purpose of this paper, we wish to examine the difference between the social opportunity cost of labour associated with the filling of permanent and temporary jobs in the slow-growth region. When additional permanent jobs are created they will be filled by hiring from the unemployed workers or from individuals employed elsewhere. If individuals are hired who were previously employed elsewhere, their 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 will fall, and this 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. Thus, when the labour market has reached its final equilibrium the social opportunity cost of labour associated with filling a permanent job is equal to the social opportunity cost of one migrant.

On the other hand, when an additional man-year of employment is created in the temporary sector, the members of the temporary labour force will now have the expectation of obtaining work for more than a proportion P of the time. In this situation P is the proportion of time that potential migrants in the slow-growth region must find work in order to remain in the region. Therefore, as temporary jobs are created a reduction in net out-migration will cause the labour force in the temporary sector to increase through the normal labour force growth.[4] In order for the expectation of employment to eventually return to its initial level P, it will require $1/P$ potential migrants to be retained in the region for every man-year of temporary employment created. As a result of the increase in temporary sector employment, the total number of unemployed man-years is increased, leading to a rise in the consumption of leisure time equal to the proportion of time each retained migrant spends unemployed times the increase in the number of migrants retained. Therefore, the social opportunity cost of labour that arises with the creation of temporary sector jobs will be equal to $[\mathrm{SOC}^M - (1 - P)V]/P$.

Consider the following example: suppose one thousand jobs are created in the permanent sector and filled by the temporary sector workers. As is shown in Table 1 (row 3d), the unemployment rate, which was previously 40 per cent in the temporary sector, will now be lower (29 per cent), and people who would have migrated out of the region will now not move while others who had not 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 one thousand workers who moved from the temporary labour market are

4 The rate of labour force participation is likely to be temporarily affected by the creation of jobs. However, to avoid unduly complicating the model this variable has been held unchanged in the analysis.

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: Individual/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 (man-years)	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

replaced and the labour force in this sector has returned to its previous level of 6,250 (column 3, row 3a). Thus, the social opportunity cost of creating one thousand permanent jobs is the cost of retaining one thousand potential migrants in the region.

On the other hand suppose one thousand 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 not be lower (24 per cent) but will rise gradually because of induced migration. When the equilibrium is re-established, the general unemployment rate will have increased to 17.7 per cent (column 5, row 4) from 15.4 per cent (column 1, row 4), the number of net in-migrants being 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 one thousand 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 significantly larger social cost than the creation of an equal number of man-years of permanent jobs.

THE MODEL OF A DYNAMIC LABOUR MARKET RESPONSE

To evaluate the full economic impact of an increase in a major employment creation activity in a region, a model should be formulated to take into consideration its direct and indirect effects over time. We consider a regional economy which consists of a base and secondary sectors. The base sector produces goods and services whose demand 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:

$$J_P = B_P Q_b + S_P Q_s, \qquad J_T = B_T Q_b + S_T Q_s, \tag{8}$$

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[5]:

$$L_P = B_P Q_b + S_P Q_s = J_P, \qquad L_T = (B_T Q_b + S_T Q_s)/P = J_T/P. \tag{9}$$

5 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. Also, no assumption is made as to whether or not the temporary jobs coincide in time. However, the model does assume that temporary jobs will be such as to employ people on average a proportion P of each period.

Each man-year of permanent employment consists of one job, so that the number of members of the permanent labour force is equal to the number of man-years of jobs. The second expression, which defines the size of the temporary labour force, utilizes the fact that temporary jobs on average last for less than one year, and migrants will come to the region or be retained in the region as long as the expected proportion of time spent in working is greater than P. Therefore, in equilibrium the number of members in the temporary labour force will be equal to the number of man-years of temporary employment available divided by the fraction of each period a member of the temporary labour force is on average employed.

When there is an increase in the base sector activity, the creation of jobs in the initial period will likely be only a fraction of the total base sector jobs ultimately created. We denote the total increase in man-years of jobs created as dQ and the proportion of these jobs that are available in period j as γ_j. It also may be difficult to find all the skilled and managerial manpower required for a large project in a slow-growth region; thus they will have to be directly hired from other areas. To simplify the model, these workers are assumed to be fully employed by the project and to receive a wage of W_b**. If δ is the proportion of new jobs filled by these direct migrants from other regions, and Q_{b0} and Q_{s0} denote the initial man-years of employment in the base and secondary sectors in the slow-growth region, then the total number of man-years of employment in the base sector available to the local labour force in the tth period Q_{bt} can be expressed as,

$$Q_{bt} = Q_{b0} + (B_P^* + B_T^*)(1 - \delta) \sum_{j=1}^{t} (\gamma_j dQ), \tag{10}$$

where B_P^* and B_T^* refer to the proportions of permanent and temporary sector employment in the specific base sector activity in question.

The new jobs created in the base sector that are temporary in nature are assumed to have the same characteristics as other regional temporary sector jobs in that they employ people for a proportion P of each time period. No further assumption as to whether or not they coincide in time with other temporary sector jobs is required.[6]

6 Because the expected or average experience of workers in the temporary sector is the determinant of the migration decision this model does not rule out the possibility that some workers will be fortunate enough to obtain another temporary job immediately after leaving one, while for others the interim period of unemployment will be longer than they had expected. If additional temporary jobs are created, the existing temporary sector workers will now be finding new jobs faster than is required in order for them to be willing to stay in the region. Therefore, fewer people will migrate out of the region and/or in-migration will take place. As these new workers search for work along with the existing workers they will start to find temporary jobs at the expense of the existing workers and will thus increase the amount of time the previous workers on average spend being unemployed between temporary jobs. This occurs because we assume that the temporary jobs are not assigned to particular workers without

The local workers employed in the newly expanded activities will come either from the unemployed or from those employed in other local activities. As we have assumed that the real wage rate in the slow-growth region is determined outside the region, the hiring of workers who are already employed will create job vacancies which eventually will be filled by the unemployed and in-migrants. Such a chain reaction process is assumed to be completed by the end of one period. However, the length of calendar time defined as a period in the model is arbitrary.

Over time there will be an additional impact on the activity in the secondary sector because the workers hired from the unemployed will now be receiving the wages in the project W_b* instead of unemployment insurance payments U_{bs}. The increase of capital income in this specific activity dI may also increase the local demand for secondary sector activities. Moreover, when migration takes place, migrants will earn income and receive transfer payments which they will spend in the region and further increase the demand for secondary sector activities.[7] Let k denote the long-run income multiplier between base and secondary sector activities.[8] This multiplier will likely take several periods to realize its full impact; thus we denote m_i as the proportion of this total multiplier effect that takes place in the ith 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 derived as follows[9]:

---

competition from other workers. After some time the average proportions of time spent being employed and unemployed by a member of the tempoary labour force will return to their equilibrium levels, causing the level of the migration flow also to return to its equilibrium level.

7 Vanderkamp (1970) showed that out-migration would cause more people to become unemployed. The reverse would also be true and applied to our analysis. In addition, because the created jobs are filled by unemployed or by workers employed elsewhere, and thus eventually by unemployed, the income in the region would be increased by the amount of unemployment insurance benefits per person multiplied by the number of retained migrants if the employment in the temporary sector is assumed to be unchanged. An unemployed person in Canada is qualified to receive benefits after eight or more weeks of insurable employment. For detailed information see Unemployment Insurance Act 1971.

8 The long-run income multiplier can be measured by the ratio of the total regional income to the base sector income allotted 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.

9 The term

$$A = \sum_{j=1}^{t} (\gamma_j dI) \sum_{i=1}^{t-j+1} m_i$$

can be expanded and is shown below:

$$t = 1, \quad A = (\gamma_1 dI)m_1,$$

$$t = 2, \quad A = (\gamma_1 dI)(m_1 + m_2) + (\gamma_2 dI)m_1,$$

$$t = 3, \quad A = (\gamma_1 dI)(m_1 + m_2 + m_3) + (\gamma_2 dI)(m_1 + m_2) + (\gamma_3 dI)m_1 \text{ [etc.]}.$$

$$Q_{st} = Q_{s0} + [(k-1)/(W_s(1-t))]\alpha_b \sum_{j=1}^{t} (\gamma_j dI) \sum_{i=1}^{t-j+1} m_i$$

$$+ [(k-1)/(W_s(1-t))][W_b^*(1-t) - fU_{bs}(1-t)](1-\delta)$$

$$\times \sum_{j=1}^{t} (\gamma_j dQ) \sum_{i=1}^{t-j+1} m_i$$

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

$$+ [(k-1)/(W_s(1-t))]fU_{bs}(1-t) \sum_{j=1}^{t} M_j \sum_{i=1}^{t-j+1} m_i, \quad (11)$$

where α_b is the proportion of the capital income that accrues to residents of the region from the base sector, M_j is the in-migration flows in the jth period, U_{bs} is the average unemployment insurance benefits received by the unemployed in the region, and W_s is the wage rate received by the individual who works in the secondary sector of the slow-growth region.

The first term in equation (11) is the initial level of man-years of employment in the secondary sector. The second term measures the multiplier impact on the secondary sector of an increase in capital income from the base sector. The third term measures the multiplier impact of an increase in wage income that is over and above the unemployment insurance benefits, while the fourth term measures the impact on the secondary sector due to direct hiring from other regions. The last term measures the impact on the secondary sector when induced migrants move in and start spending their income in the region. If dQ_{sj} stands for the combined effect of the gains of labour income, capital income, and income by in-migrants (last four terms in equation 11) on the secondary sector in the jth period, (11) can be rewritten as:

$$Q_{st} = Q_{s0} + \sum_{j=1}^{t} dQ_{sj}. \quad (12)$$

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 will determine the size of the flow of migrants from a region. If a simple linear relationship is assumed between unemployment and migration, the migration flows in the jth period can be estimated as follows:

$$M_j = -L_{Tj-1} \cdot b \cdot [(1 - P_{j-1}) - (1 - P^*)], \quad (13)$$

where b is the migration adjustment response to the 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 increase 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

$$1 - P_t = (L_{Tt} - J_{Tt})/L_{Tt}. \tag{14}$$

To measure the incremental impact of an increase in employment, the natural growth in the labour force can be assumed to be given. Since directly imported workers are permanently employed in the project, the size of labour force in the temporary sector at period t can be estimated as

$$L_{Tt} = L_{T0} - B_p^*(1 - \delta) \sum_{j=1}^{t} (\gamma_j dQ) - S_p \sum_{j=1}^{t} dQ_{sj} + \sum_{j=1}^{t} M_j. \tag{15}$$

The second term of (15) measures the number of individuals who are taken from the unemployed in the temporary sector and given permanent jobs in the base sector. The third term measures the number of individuals obtained from the temporary portion of the secondary sector and employed in the permanent sector because of the combined effects of the increase in the base sector's capital income, the switch from unemployment insurance compensation to wages, and the increase in aggregate demand in the region. Finally, the last term measures the increase in the temporary labour force when migrants move to the region.[10]

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

$$J_{Tt} = J_{T0} + B_T^* \sum_{j=1}^{t} (\gamma_j dQ) + S_T \sum_{j=1}^{t} dQ_{sj}. \tag{16}$$

The second term of (16) indicates the increase in temporary jobs in the base sector created in the specific activity. The last term measures the increase in temporary employment in the secondary sector that results from the multiplier effects of increased activity in the base sector.

This completes the model that describes the reaction of the labour market in a slow-growth region to an increase in base activity. After the values of b and P^* and the initial value of the variables are specified, equations (10) through (16) can be solved to determine the level of employment, the size of the labour force, and the number of employed in the secondary sector Q and the flow of migrants M for each period. From this information we can calculate the social opportunity cost of employing workers for this increase in base sector activity. This social cost of labour will consist of three principal components: first, there is a decrease in the value of leisure time for the people who were

10 All migration caused by unemployment conditions is assumed to occur from the temporary sector's labour force. Thus migrants are assumed to move from the temporary sector of one region to the temporary sector of the other.

previously unemployed; second, there is the social opportunity cost of the migrants who move to the region. The third item, the gain of increased output in the secondary sectors affected, serves to reduce the total social opportunity cost of labour measured by the first two items. An adjustment has to be made within these three terms to account for the fact that new jobs and subsequent vacancies are filled partially from the employed in other sectors and thus will create job vacancies. While ultimately these vacancies will be filled, there will be a loss in output during the period that these vacancies exist. If the process of filling job vacancies from the unemployed occurs at a constant rate throughout the period then the social opportunity cost of hiring additional workers at period t can be expressed as follows:

$$\begin{aligned} \text{SOCL}_t = &-\left[\sum_{j=1}^{t} dX_j - \tfrac{1}{2}(1-u)dX_t\right]V \\ &+\left[\sum_{j=1}^{t} dM_j - \tfrac{1}{2}(1-u)b(dJ_{pt-1} + dJ_{Tt-1})\right]\text{SOC}^M \\ &-\left[\left(\sum_{j=1}^{t} dQ_{sj}\right)W_s - \tfrac{1}{2}(1-u)(dQ_{st})W_{bs}\right] \\ &+ \tfrac{1}{2}(1-u)(1-\delta)\gamma_t(dQ_t)W_{bs} + \sum_{j=1}^{t}\gamma_t(dQ_t)\delta W_b^{**}, \quad (17) \end{aligned}$$

where u is the proportion of new hires for a project that was previously in a state of unemployment and W_{bs} is the average wage rate in the temporary sector of the region.

The first term of (17) 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, $1/2(1-u)dX_t$ jobs are on average not filled during that period.[11] The value of leisure time measured by $1/2(1-u)(dX_t)V$ represents extra leisure consumed in the region because of the creation of job vacancies. The amount must be deducted from the social opportunity cost of labour. The second item is the social opportunity cost of a migrant times the number of migrants that are induced to the region. The rate of migration has also been adjusted for the fact that unfilled job vacancies will slow down the migration response in the tth period. The third and fourth items measure the increase of employment in the secondary sectors and the forgone output in both the base and secondary sectors due to the bidding away of workers from these sectors. The last item is the forgone product of the migrants directly hired from other regions.

11 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 $1/2(1-u)$ times the number of new jobs filled.

From (17) we can see the relationship between the social opportunity cost of labour for different types of jobs and the social opportunity cost of migrants and the value of leisure. The changes in the quantity of migrants and idle workers caused by the creation of new employment opportunities are determined by the general equilibrium response of the regional labour market. This total response will be altered by the type of the new jobs created. The quantities of incremental migrants and idle workers are multiplied by their opportunity costs to determine the total social opportunity cost of labour used in these new positions.

EMPIRICAL ANALYSIS

In this section we wish to apply the data from the labour market of Cape Breton Island in Canada to the above model to provide an example of how this model can be used to estimate the social opportunity cost of labour. The characteristics of the labour market of this region are essentially the same as those assumed in the development of the model. The most important of these characteristics are as follows: first, wage rates are not determined in a perfectly competitive labour market but primarily fixed by national or provincial collective bargaining and minimum wage laws; second, large labour migration flows occur in both directions between this region and other high income areas of Canada[12]; and third, unemployment rate differentials persist between this region and other areas of Canada even in the presence of large migration flows.

Development of parameter values for the Cape Breton region

One of the most important parameters in the labour market model 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 during a period of thirty months. Using a 10 per cent sample of all the individuals who claimed unemployment insurance at least once on Cape Breton Island during the period July 1972 to December 1974, the expected duration of unemployment in the temporary sector has been estimated to be about 39.4 weeks when the total unemployment rate is set at its average for the past 2.5 years.[13] This expected duration of unemployment appears substantially higher than the average duration of unemployment insurance claims (23.6 weeks)

12 From income tax files we found that annual in-and-out flows of working age migrants have been equal to approximately 5 per cent of the total labour force in Cape Breton Island. 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 or returning to the island.

13 The estimation of the expected duration of unemployment is not presented in this paper but is available from the authors on request. The results show that younger workers are found to have a shorter duration of unemployment than older workers. Male workers have about seven weeks shorter length of unemployment compared with females (36.7 weeks versus 43.5 weeks).

because many of the recipients of unemployment insurance benefits exhaust their insurance claims before they obtain their next job. Hence unemployed workers in Cape Breton Island are expected to spend 60 per cent of their unemployed time collecting unemployment insurance payments (i.e. $f = 0.60$).

The workers who have experienced unemployment in Cape Breton Island have had, on average, 1.5 periods of unemployment over the 2.5 years from July 1972 to December 1974. This suggests that the workers in the temporary sectors spent about 54 per cent of their time working and 46 per cent not working (i.e. $p = 0.54$).

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.[14] The total number of workers who experienced unemployment was estimated to be approximately 33,430 persons, which can be further broken down into 16,706 persons from the base sector and 16,724 persons from the secondary sector. Because these people were employed only 54 per cent of their time, the total work done on a temporary basis amounted to 9,021 man-years for the base sector and 9,031 man-years for the secondary sector.

The permanent labour force, and thus the number of man-years of permanent employment, is estimated by subtracting the temporary labour force from the total labour force. Work done in the permanent sector amounted to 9,001 man-years for the base activities and 12,889 man-years for secondary activities. The total employment available on Cape Breton Island is therefore equal to 39,942 man-years, which consists of 18,022 in base activities and 21,920 in secondary activities. Thus $B_p = 0.499$, $B_T = 0.501$, $S_p = 0.588$, and $S_T = 0.412$.

From the same 10 per cent sample of unemployed workers on 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.[15] The average personal income tax rate for temporary labour force in Cape Breton Island is approximately 12 per cent and the marginal tax rate is approximately 25 per cent.

The long-run income multiplier has been estimated at 1.52 for Cape Breton Island.[16] The cumulative effect of indirect impact over time on the region ($\Sigma_i m_i$)

14 The current labour force in Cape Breton Island is about the same as that in the 1971 census year. For the breakdown of the labour force into the base and secondary sectors, see Schwartz (1976).

15 These estimates are slightly understated because approximately 9 per cent of the sample had actually earned at least the maximum insured earnings, but only the maximum insured earnings were recorded.

16 A more complete analysis of the regional multiplier can be found in Schwartz (1976). The formula to calculate the multiplier is

$$k = 1 + (Q_s W_s (1 - t)) / (\alpha_b I_b + W_b Q_b (1 - t) + f(1 - P) L_T U_{bs} (1 - t) + G),$$

where G is government transfer payments other than unemployment benefits (about 25 per cent of labour income), I_b is the capital income in the base sector which can be measured by applying the 30/70 capital/labour income ratio for the area, α_b is estimated as 0.5 for the analysis, and the rest of the variables are defined previously.

is assumed to be equal to 70 per cent, 85 per cent, and 95 per cent for the first three periods and 100 per cent for the following time periods.

Simulation of the model

Suppose there are two firms, A and B, which have been proposed to start operation in Cape Breton Island and each would create one thousand man-years of employment. Of these man-years, 50 per cent would begin immediately, another 25 per cent would follow one year later, and the remaining 25 per cent would be hired the next year. The permanent/temporary employment ratios associated with the firms differ. For Firm A, the permanent/temporary ratio is 80/20, and for Firm B it is 20/80. For example, Firm A might be a year-round manufacturing operation, while Firm B might be primarily a seasonal activity. The capital/labour income ratio for each firm is 30/70. Wage rates are equal in the firms and are assumed to be $150 per week. For simplicity, no directly imported migrants are introduced in this example. The impact of either Firm A or Firm B on the economy of the region can be obtained by solving the system of equations (10) to (16) where the migration adjustment to the temporary unemployment rate is assumed to be quite rapid ($b = 0.50$),[17] and the long-run unemployment rate in the temporary sector is calculated to be approximately 0.46.

The effects of job creation in either firm on the Cape Breton Island economy are shown in Table 2. The total number of migrants retained in the region over twenty-five years would be 2,549 workers for Firm A and 3,263 workers for Firm B. A greater retention of migrants results from Firm B's expansion because it generates a greater quantity of temporary jobs. In both cases a substantial share of the migrants are retained or move into the region during the first four years because of the subsequent indirect job creation. In final equilibrium, the total increase in man-years of work due to the multiplier effect on the secondary sector is 1,033 for Firm A and 1,187 for Firm B. Of these man-years, about 49 per cent and 45 per cent for Firm A and B respectively would take place in the first three years.

The number of unemployed workers in Cape Breton Island drops considerably immediately after the companies begin to operate and then gradually rises to a high of 15,894 persons for the case of Firm A and 16,454 persons for the case of Firm B by year 25, trends which imply larger numbers of unemployed than before firms expanded. The increase in unemployed workers takes place because the retained migrants are added to the temporary work force, thus driving up the average duration of unemployment. The unemployment rate in the final equilibrium for the whole labour force will become lower for

17 The value of $b = 0.5$ is consistent with the evidence on migration presented in Wood and Verge (1966, 107, Table 24). Since attractive jobs are created in the slow-growth area we expect to have a substantial proportion of migrants moving in in the first few years immediately following the job creation. When $b = 0.5$, it means that 50 per cent of the unemployment rate differential between the actual and the long-run unemployment is closed each year by in-migration.

TABLE 2
Economic impact of creating jobs on Cape Breton Island with alternative assumptions on employment structures

	Initial state	Final state	
		Firm A	Firm 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 (man-years)	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 in jobs in secondary sector	–	1,033	1,187
In-migrants	–	2,549	3,263

Firm A (27.5 per cent) and higher for Firm B (28.1 per cent) than in the initial situation (27.8 per cent). This suggests that creating permanent jobs by firms will improve the over-all unemployment rate in the economy, while the creation of temporary jobs will tend to lead to higher unemployment rates.

As was discussed above, the value of leisure time and the social opportunity cost of a potential migrant must be calculated before the social opportunity cost for jobs created in the project can be estimated. According to (7), the variables W_a, U_a, P_a, f_a, and t_a must first be estimated. We find that W_a in the regions that Cape Breton migrants move to is about 13 per cent higher than that in Cape Breton Island, and t_a is therefore expected to be higher in the sending areas and assumed as 15 per cent for this analysis. P_a is estimated to average 77 per cent in the temporary sector of the regions that the Cape Breton migrants tend to move to. Since potential migrants from Cape Breton face a lower unemployment rate in the high income regions, they would expect to have a lower duration of unemployment, so that f_a must be higher than that in Cape Breton and is estimated to be approximately 0.80.[18]

Because wage rates in Cape Breton Island are not determined in a competitive manner, the existing wage rates are estimated to be one-third higher than

18 W_a 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 male working-age out-migrants from Cape Breton Island over the period 1966 to 1971 was 46.37 per cent to Ontario, 31.8 per cent to other parts of Nova Scotia, 5.21 per cent to New Brunswick, 4.49 per cent to Newfoundland, 4.37 per cent to Quebec, 2.90 per cent to Alberta, 2.63 per cent to British Columbia, 1.06 per cent to Manitoba, 0.75 per cent to Prince Edward Island, and 0.36 per cent to Saskatchewan. The values for P_a and f_a were estimated from the one-in-ten sample of the unemployment insurance claimants for the regions to which people from Cape Breton Island migrated.

TABLE 3

Social opportunity cost of jobs created on Cape Breton Island and the labour externalities (millions of dollars in price level of Year 1)

Year	SOCL		SOCL/wage	
	Firm A	Firm B	Firm A	Firm B
1	1.16	1.16	0.30	0.30
2	1.92	2.14	0.33	0.37
3	2.45	2.91	0.31	0.37
4	2.71	3.43	0.35	0.44
5	2.99	3.88	0.38	0.50
6	3.41	4.43	0.44	0.57
7	3.78	4.89	0.49	0.63
8	4.08	5.28	0.52	0.68
9	4.33	5.59	0.56	0.72
10	4.54	5.85	0.58	0.75
15	5.12	6.59	0.66	0.85
20	5.33	6.86	0.68	0.88
25	5.41	6.96	0.69	0.89

Calculation of labour externality (Years 1 – 25)

	Firm A	Firm B
Net present value of wage bill	65.13	65.13
Net present value of externality (gain)	36.39	26.93
Externality as percentage of wage bill	56	41

the competitive wage rate.[19] Hence, β is set equal to 4/3 for this example. Substituting the value of variables into (4) and (7) yields $V = \$37.4$ and $SOC^M = \$109.8$ per week.

If the proportion of people hired directly from the unemployment u is equal to 0.5, the social opportunity cost of hiring one thousand man-years in the tth period can be calculated according to (17) and is shown in Table 3. The ratio of SOCL to the annual wage bill paid by the firm increases over time because the workers hired to this project initially are the unemployed in the region. Later there is a retention of potential migrants who have a greater social opportunity cost compared with those unemployed workers. It would take about eight years before the social opportunity cost of labour used by Firm A equalled 50 per cent of what the firm paid in wages. For Firm B, the ratio of SOCL to the annual wage bill would increase faster because more potential migrants would be induced to remain in the region (see Figure 1).

When a 10 per cent social discount rate is used (see Jenkins, 1972), the present value of the net social benefits attributable to the creation of jobs over

19 Setting $\beta = 4/3$ is consistent with the value found for the differential between union and non-union wages in the Maritime Provinces of Canada by Evans (1976).

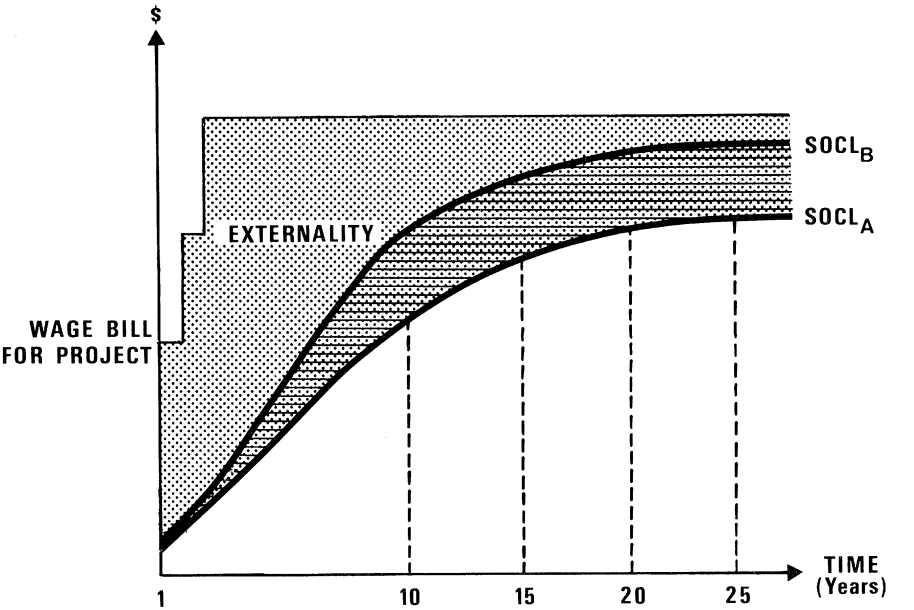

FIGURE 1

twenty-five years would account for 56 per cent of the firm's total wage bill for Firm A and 41 per cent for Firm B. The difference between these two areas can be seen as the heavily shaded area in Figure 1. It is clear that the higher the proportion of permanent jobs created the greater are the beneficial labour externalities.

CONCLUSION

In this paper the theoretical framework of a dynamic labour model for a slow-growth region has been developed to evaluate the full economic impact of job creation. The model incorporates not only the interaction between the regional labour markets of a country but also the direct and indirect multiplier effects on the region over time. The social opportunity cost of labour to a project is measured by the social opportunity cost of migrants retained in the region, plus the value of decreased leisure time previously received by unemployed workers, less the incremental increase in output in the secondary sectors.

The distinction drawn between permanent and temporary employment in the labour market is a significant departure from the traditional view of migration. 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 for the determination of migration as well as for the measurement of the social opportunity cost of a migrant. It is shown

that the social opportunity cost of filling a permanent job for one year after the final equilibrium is re-established will be equal to the social opportunity cost of one migrant for one year. But the creation of a temporary man-year of employment will result in more than one migrant being induced to remain or come to the region.

This model has been applied to the case of job creation in Cape Breton Island in order to provide an example of the measurement of the social opportunity cost of labour and the labour externality. A comparison is also made of the social benefits generated by different types of employment creation opportunities. It was found that the higher the proportion of permanent jobs that are created the greater is the relative size of the net social benefit.

REFERENCES

Barnes, W.F. (1975) 'Job search models, the duration of unemployment, and the asking wage: some empirical evidence.' *Journal of Human Resources* 10, 230–40

Chapin, G. (1971) 'Unemployment insurance, job research, and the demand for leisure.' *Western Economic Journal* 9, 102–7

Courchene, T.J. (1970) 'Interprovincial migration and economic adjustment.' This JOURNAL, 3, 550–76

Cragg, J.G. (1968) 'Some statistical models for limited dependent variables with application to the demand for durable goods.' University of British Columbia Discussion Paper No. 8

Evans, J.C. (1976) 'On estimating the union-nonunion wage differential in Canada.' Paper presented to Canadian Economics Association Annual Meeting

Feldstein, M.S. (1975) 'The importance of temporary layoffs: an empirical analysis.' Harvard University Discussion Paper No. 447

Gordon, R.J. (1973) 'The welfare cost of higher unemployment.' *Brookings Papers on Economic Activity* 1, 133–205

Hall, R.E. (1972) 'Turnover in the labour force.' *Brookings Papers on Economic Activity* 3, 709–64

Harberger, A.C. (1971a) 'On measuring the social opportunity cost of labour.' *International Labour Review* 103, 559–79

Harberger, A.C. (1971b) 'Three basic postulates for applied welfare economics: an interpretive essay.' *Journal of Economic Literature* 9, 785–97

Harris, J.R. and M.P. Todaro (1970) 'Migration, unemployment and development: a two-sector analysis.' *American Economic Review* 60, 126–42

Jenkins, G.P. (1972) 'Analysis of rate of return from capital in Canada.' Unpublished PHD dissertation submitted to the University of Chicago

Jenkins, G.P. and C. Montmarquette (1976) 'The social opportunity cost of displaced workers.' Paper given to Canadian Economics Association Annual Meeting

Schwartz, H. (1976) 'The long run employment multiplier for Cape Breton County.' Department of Regional Economic Expansion, Canada.

Vanderkamp, J. (1970) 'The effect of out-migration on regional employment.' This JOURNAL 3, 541–9

Vanderkamp, J. (1971) 'Migration flows, their determinants, and effects of return migration.' *Journal of Political Economy* 79, 1012–31

Wood, K.S. and H. Verge (1966) 'A study of the problems of certain Cape Breton communities.' Institute of Public Affairs, Dalhousie University