Canadian unemployment insurance as a Pareto-optimal policy instrument

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The Canadian unemployment insurance program has both insurance and distribu-
tional aspects. The mixing of these two aspects of public policy has often been
maligned. It is my goal in this paper to try to convince you that at least some of the
thinking behind such complaints is unfounded and that, as currently structured, the
Canadian Unemployment Insurance program has properties suggesting that it should
be used as an instrument in any Pareto-efficient redistribution scheme. I will begin
by summarizing the relevant aspects of the UI program and the standard criticisms
of it. I will then suggest that these critics base some of their arguments on first-best
economic theory, that is, on a conception of the economy where the first and second
theorems of welfare economics are valid. Although there are many reasons for
doubting the validity of such reasoning I will focus in this talk on one aspect only,
asymmetric information, where individuals know their own characteristics but these
are unknown to the government. I will appeal to the tools introduced into econom-
ics by Mirrlees (1971) to study the optimal taxation of income, and the actual work
upon which I will draw has been jointly done with Paul Beaudry. One inference
that can be drawn from this work is that the Canadian UI program has characteris-
tics of an optimal tax-redistribution program in a second-best economy.

That the Canadian UI program acts as insurance against both micro and macro
economic shocks is obvious. Employers and employees pay premiums that permit

1 This program has been euphemistically renamed Employment Insurance; I will continue to use the
more descriptive title. For a general discussion and description of the UI system see Nakamura
2 For a good textbook account see Myles (1995).
3 Beaudry and Blackorby (1997).
the employee to collect benefits in case he or she is laid off the job. Both eligibility and benefits levels depend not only on obvious characteristics of the employee, such as job tenure and salary, but also upon the level of unemployment in the region in which he or she is employed. The number of weeks (or more recently the number of hours) in employment needed in order to be eligible for UI depends upon the regional unemployment rate, as do the level and the length of the benefit period.

I wish to interpret this in a somewhat unusual fashion. Imagine someone who is eligible for UI after twenty weeks of employment and has benefits of 50 per cent of her or his salary for forty weeks. Conditional upon being unemployed, and ignoring discounting, this is equivalent to a wage subsidy of 100 per cent but for only twenty weeks of work. Now, wage subsidies for those with poor market opportunities have often been suggested as a tool for income redistribution. The main complaint against such programs is that they are too expensive and may result in excessive redistribution. If individuals are free to choose the number of hours that are worked, an individual who has been offered a wage subsidy may decide to work so many hours that her or his resulting income is high enough to cause envy among hard-working but non-subsidized workers. A wage subsidy with a limit on the number of hours or weeks of eligibility avoids, at least to some degree, this problem. I will refer to this policy as a phased-out wage subsidy.

The type of model that I propose to study this problem is in the Mirrlees optimal income tax tradition but differs in a number of aspects. I will not highlight these differences here but simply sketch the model that I have in mind. Imagine that workers have two characteristics that are known to the individual but not to the government, market skills and non-market skills. By market skills I means only those skills that can earn a known wage in the market sector; by market sector I mean only that sector of the economy where the government can observe an individual’s earned income and can therefore tax it if the government so wishes. The non-market sector is simply that sector of the economy in which the government can observe neither effort nor income and hence is unable to tax it. This is, of course, much broader than simply the underground economy. There are many parts of the private sector in which income tax avoidance is almost impossible, whereas in others it is relatively easier. If an individual moves from a salaried position where the employer reports earnings to some sort of self-employment, the opportunities for tax avoidance increase considerably. Anecdotal evidence suggests that some such people avail themselves of such opportunities. Some of you have no doubt been offered the opportunity to help someone avoid taxes in this way.

In designing a tax system the government must, first of all, pay attention to behavioural responses among those who are paying taxes. That is, it must worry about whether or not higher taxes will induce more or less effort from the taxpayer and hence whether or not its tax receipts will go up or down as a result of the change. In addition, however, it must pay attention to the possibility that a poorly designed tax system may encourage some individuals to move from the market to the non-market sector and thus avoid the tax collector in whole or in part.
Some individuals will be skilled in both sectors, some in only one, and of course some in neither. In all cases, however, this is private information. In the traditional optimal income tax problem, the government chooses an income tax schedule that maximizes some social welfare function. Given that it knows only the distribution of skills, it designs this tax schedule to satisfy a set incentive compatibility constraints, namely, that no one envies the position of anyone else, given the gross income and net incomes (or taxes) of the others.

Here, I assume that the government knows the distribution of skills in both sectors; in general, there is no reason to assume any particular correlation between the skills in the two sectors. The government will design an income tax that satisfies a set of no-envy constraints but, in addition, satisfies the participation constraints mentioned above, namely, that highly taxed individuals may drop out of the market sector and into the non-tax-paying part of the economy. In addition, I assume that the government can observe the number of hours or weeks worked in the market sector. Note that the latter assumption reflects one characteristic of the current UI system: individuals must be able to demonstrate that a sufficient number of hours have been worked in order to be eligible. In this context it can be shown that the one of the characteristics of an optimal income tax is a phased-out wage subsidy for those who have poor market opportunities.

Before laying out in more detail the model itself, I would like to reflect a few moments on the use of abstract models for thinking about broad issues of social policy; more specifically, I wish to argue that most policy analysts have some model in mind when choosing between alternatives. To paraphrase one of my mentors, Terrence Gorman, we build models for the same reason that we compute means and variances even though we possess the entire data set – we are too stupid to absorb an entire distribution of numbers. Hence we throw away information in order to focus our attention upon that which we can understand. Similarly, we are incapable of understanding the economy in its entire complexity, and so we focus on a small number of aspects in which we are interested at the moment. Whether or not the model in question is useful depends, then, not upon how close it is to the actual economy but upon how it helps us to understand some part of it.

That said, let me return to one of the main criticisms of the current UI program, namely, that it mixes and perhaps confuses the pure insurance aspects of an efficiently functioning unemployment insurance program with some of the distributional goals of the federal government. Now, why would someone think that such a mixture is such a bad thing? I suggest that these critics have in mind a very particular model of the economy, namely, a perfectly competitive Arrow-Debreu version of the world. In such a model, appropriately extended to deal with uncertainty, it makes sense to divorce income redistribution programs from efficiency enhancing ones. In an Arrow-Debreu world an appropriately designed unemployment insur-

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4 See Arrow and Debreu (1954). For an excellent textbook account see Mas-Colell, Whinston, and Green (1995).
ance program would not need to contain elements of redistribution. Distributive policies would be organized independently, mandating individual-specific lump-sum transfers or taxes, depending upon how the uncertainty had resolved itself.

As useful as the Arrow-Debreu model has been for thinking about many issues it seems as inappropriate for thinking about unemployment insurance as about income taxation. People have characteristics that are known only privately, such as the value they place on leisure or their skill levels in both market and non-market activities. In such circumstances the government does not have enough information to effectuate individual lump-sum transfers and must rely upon broader and necessarily cruder instruments. Thus, it is possible that the resulting policy tools of necessity confound efficiency and redistribution. Some critics of the Canadian UI program may have had an inappropriate model of the economy in mind. The model that I will sketch for you will be simple, perhaps too simple, but it will have the property that the government, in implementing its policies, must take account of the fact that it does not know the characteristics of each individual and must take account of the fact that an individual will reveal these characteristics only if it is in her or his own interest to do so.

Let me turn to the model. Each individual in the economy is characterized by two characteristics, \((\omega_i, \theta_i)\), the skill level (marginal product) in market activities and the skill level in non-market activities, respectively. Hours worked in either sector result in the production of a homogeneous consumption good whose price is normalised so as to be equivalent to income. One could be highly skilled in one sector but not in the other or be good in both or bad in both. For example, someone who is highly skilled in the market sector but poorly equipped to survive in the non-market sector – a high \(\omega_i\) and a low \(\theta_i\) – is highly attached to the market. The government can tax such an individual rather highly without fearing that he or she will drop out of the tax-paying sector of the economy. On the other hand, an individual who is highly skilled in the market sector and only slightly less so in terms of non-market activities cannot be too highly taxed, since he or she would simply opt for the non-market alternatives in order to avoid the tax collector. Conversely, someone who has rather poor skills in both sectors of the economy is exactly the type of person whom the government by its tax/transfer policies is trying to help. The only question is how to effectuate such redistribution in an efficient manner.

Other than their skill differences, everyone is assumed to be the same, having a concave utility function that depends only upon total consumption and is given by

\[
U(c_i + (1 - h_i)\theta_i);
\]

\(c_i\) is after-tax income (consumption) from the market sector, whereas \((1 - h_i)\) is the number of hours worked in the non-market sector (total hours are normalized to be equal to one) so that \((1 - h_i)\theta_i\) is income (and hence consumption) generated in the non-market, non-tax-paying sector. Taxable income is equal to the hours worked in the market sector of the economy times the number of worked, \(y_i = \omega_i h_i\), and hence
the tax bill of person $i$ is given by $y_i - c_i$. The number of hours worked is normalized so that $0 \leq h_i \leq 1$. Figure 1 has sample indifference curves for two individuals with different non-market (and possibly market) skills. These indifference curves are drawn in the space of hour worked in market sector and in consumption (net income) in the market sector. The solid lines are the indifference curves of someone who has $\theta = 0.6$, while the dashed lines are those of someone whose $\theta = 0.9$. Clearly, higher indifference curves are those to the northwest, and more net income and fewer hours in market activities are better.

An efficient tax must satisfy the participation constraints of these individuals. If, for example, the government offered the person with $\theta = 0.6$ the net income and hours worked marked by the bullet (or anywhere else on that indifference curve), the individual would refuse this option, preferring, instead, zero hours in the market place and zero net income from the market sector of the economy. This individual would work full time in the non-market sector of the economy and consume 0.6 of the consumption good and pay no taxes. A tax scheme that offered this person the bullet allocation would drive her or him out of the market economy altogether. This is designed to capture a phenomenon that is common enough in the Canadian economy. Most people have experienced some transaction in which the seller asks whether or not the buyer would like a receipt. If there is no receipt, the buyer saves the GST and the seller has moved a potential market transaction to the non-market sector of the economy, thus avoiding income tax on the income earned from that transaction.
Any tax scheme that is to avoid such a problem must satisfy the following system of participation constraints:

\[ U(c_i + (1 - h_i) \theta_i) \geq U(\theta_i) \quad \text{for all } i. \]  

The left side of (2) is the utility that individual \( i \) obtains from total consumption, consumption in the market sector plus consumption earned in the non-market sector. The right side is the utility the individual would obtain from working full time in the non-market sector.

In addition to the participation constraints, an efficient tax must satisfy a set of incentive compatibility constraints. That is, the tax system must leave each taxpayer a net income and hours-worked in the market sector package that he or she prefers to any bundle offered to anyone else whom he or she could imitate. Consider, for example, two people, one who is attached to the market sector with \( \omega = 1.0 \) and \( \theta = 0.6 \), and the other who is indifferent between working in the market or not, with \( \omega = 0.9 \) and \( \theta = 0.9 \). In figure 2, suppose that the second person is offered the allocation of net income and hours represented by the bullet, whereas the first person is offered an allocation somewhere on the solid indifference curve. This set of allocations is not feasible, given that the person with \( \theta = 0.6 \) has a skill level in the market sector that is higher than the person with \( \theta = 0.9 \). If the individual with \( \theta = 0.9 \) were to receive the bullet allocation, then the person with \( \theta = 0.6 \) could work at the less skilled job and obtain a higher level of utility; \( \theta = 0.6 \) would envy \( \theta = 0.9 \). On the other hand, any allocation on the dotted indifference curve of
\[ \theta = 0.9 \] below and to the left of the intersection with the indifference curve of \( \theta = 0.6 \) (following the arrow) would be feasible; he or she could imitate \( \theta = 0.9 \) in this case but would not want to do so, since it would lead to a lower utility level. This leads to a system of incentive compatibility constraints given by

\[ U(c_i + (1 - h_i) \theta_i) \geq U(c_j + (1 - h_j) \theta_j) \quad \text{if} \quad \omega_i \geq \omega_j. \]  

That is, if \( \omega_i \geq \omega_j \), the tax system must leave person \( i \) with a consumption-hours package, \((c_i, h_i)\), that he or she prefers to the consumption-hours package offered to person \( j \), \((c_j, h_j)\), because \( i \) could imitate \( j \) if \( i \) would obtain more utility from the consumption-hours bundle of \( j \). Tax schedules that satisfy constraints such as (3) guarantee that no one will wish to imitate anyone in the economy who could be imitated.

Finally, the government is constrained to allocations that satisfy the production possibilities of the society,

\[ \sum_i c_i \leq \sum_i \omega_i h_i. \]  

This says that the total amount of after-tax income allocated to individuals cannot exceed the total amount produced by the individuals working in the market sector of the economy.

The optimal tax schedule is one that maximizes total utility,

\[ \sum_i U(c_i + (1 - h_i) \theta_i) \]  

by choice of net income and hours worked in the market sector, \((c_i, h_i)\), for all \( i \), subject to the participation constraints, incentive compatibility constraints, and the materials balance constraint. Because the objective is utilitarian, the government is trying to bring up the well-being of those at the bottom by taxing those at the top. This, too, reflects the redistributional goals of the federal government of Canada.

It is worth noting that if the government knew the private characteristics, \((\omega_i, \theta_i)\), of everyone, then it would be optimal to set \( h_i = 1 \) if \( \omega_i > \theta_i \) and to set \( h_i = 0 \) if \( \omega_i < \theta_i \). Total utility would be maximized by allocating each person entirely to the sector in which he or she were more productive. This would be the first-best utilitarian outcome for this economy. However, given that the tax authority knows only the distribution of characteristics, not who has which characteristics, the government must settle for a second-best solution that satisfies the incentive compatibility constraints.

It is worth noting that the problem posed above is quite different from the standard optimal income tax program. There are two dimensions of unobserved characteristics instead of just one,\(^{5}\) the hours worked in the market sector are observable.

5 Formally, this is a multidimensional screening problem with two dimensions of unobserved characteristics. For recent advances in this area see Rochet and Choné (1998).
(in the standard problem this would be enough to generate a first-best outcome), the
participation constraints are binding in many cases, and the incentive compatibility
constraints are binding only downward. It is not surprising, then, that the solution to
this second-best problem is radically different from the standard. In general, the
solution to this problem has positive marginal tax rates for high incomes and neg-
ative marginal tax rates for low incomes. However, the aspect of the solution that I
wish to emphasize in this paper is the optimality of phased-out wage subsidies. I
will illustrate this by means of an extended example.

In this example there are four types of individuals \( i = 1, 2, 3, 4 \). Both individ-
ual 1 and individual 2 are highly productive in the market, with their market pro-
ductivity normalized to one, \( \omega_1 = \omega_2 = 1 \). However, individuals 1 and 2 differ with
respect to their non-market value of time. In particular, individual 1 is strongly
attached to the market with a non-market value of time, \( \theta_1 \), equal to .2. In contrast,
individual 2 is less attached to the labour market, having a high non-market value of
time, that is, \( \theta_2 \) is equal to .9. Nonetheless, in the informationally unconstrained
case, both these individuals would spend their full allocation of time in the market,
since \( \omega > \theta \).

The two remaining individuals have low productivity in the market, with \( \omega_3 = \omega_4 = .1 \). These individuals also differ with respect to their value of non-market time.
Individual 3 has a non-market value of time, \( \theta_3 \), equal to .2 and therefore in an
informationally unconstrained economy is not allocated any time in the market
sector of the economy. In contrast, individual 4 has a very low non-market value of
time, \( \theta = .05 \), and therefore in an informationally unconstrained economy allocates
all of her or his time to market even though market productivity of this individual is
relatively low. Table 1 summarizes this specification. With the above specification
of parameters and the additional assumption of log utility, the consumption (net
income) and hours worked that are optimal are given in table 2.

The solution is illustrated in figure 3. The bullets represent the optimal consump-
tion and hours worked in the market sector. To understand this solution it is helpful
to recognize that the government’s goal is to take income away from individuals 1 and 2 and to redistribute it to individuals 3 and 4. However, the weak market attach-
ment of individual 2 restricts the government’s capacity to do so without distorting
individual 2’s work incentive. In particular, to extract more than .1 unit (each) of the
market good from individuals 1 and 2, it is necessary to distort individual 2’s employ-

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**TABLE 1**

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<th>( \theta )</th>
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<tbody>
<tr>
<td>Person 1</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Person 2</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Person 3</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Person 4</td>
<td>0.1</td>
<td>0.05</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th></th>
<th>( \omega )</th>
<th>( \theta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td>0.507</td>
<td>1.0</td>
</tr>
<tr>
<td>Person 2</td>
<td>0.394</td>
<td>0.438</td>
</tr>
<tr>
<td>Person 3</td>
<td>0.264</td>
<td>0.292</td>
</tr>
<tr>
<td>Person 4</td>
<td>0.404</td>
<td>1.0</td>
</tr>
</tbody>
</table>
ment level down in order to satisfy the participation constraint. The government
does not like distorting down 2's employment level, since it loses revenue by doing
so; nonetheless, the government chooses this outcome owing to the fact that the lost
revenue on individual 2 is more than compensated for by the additional revenue
extracted from 1. The reason for distorting upward individual 3's labour supply is
quite different. In this case, the difficulty is to transfer income to individual 3 with-
out inciting individual 2 to mimic. If individual 3 were to receive an income transfer
without a work requirement (that is, without distorted labour supply), individual 2
would mimic individual 3. Individual 3's labour supply must be distorted upward as
a means of screening individual 3's low value of non-market time. Note that the
allocation of 3 can be achieved by a phased-out wage subsidy, 4 has an unlimited
wage subsidy, and 2 is on his or her participation constraint.

Focusing upon individual 3 demonstrates the main point that I wish to make, the
optimality of a phased-out wage subsidy. Working .29 hours, person 3 earns an
after-tax income of .26 for an effective wage rate of .9. However, this individual's
productivity in market activities is only .1. This amounts to a wage subsidy of 800
per cent. If an unconditional wage subsidy of this size were offered, then person 3
would work full time in the market sector earning 0.9, more than anyone else in the
economy.

It is easy to show that this pattern of distortions is robust to small changes in the
productivity of everyone. That is, increasing the productivity of everyone in the
formal sector makes everyone better off but does not change the pattern of distortions.
To understand the structure of the distortions better, modify the example by increasing the productivity of individual three: set $\theta_3 = .3$ while leaving all other parameter the same. The solution to the modified problem is $[(.579,1),(.487,.54), (.178,.198),(.417,1)]$. Individual 3 now has better outside options and person 4’s consumption can be increased more without 3 wanting to mimic. Reducing the hours that the wage subsidy is available to 3 allows the distortion on person 2 to be relaxed. If $\theta_3$ is increased to .6, then person 3 is no longer in the formal market at all and the optimal allocation is $[(.594,1),(.507,.563),(0,0),(.562,1)]$, while person 2 is still on his or her participation constraint and 1 is attracted to 2.

The model I have presented is a long way from the Canadian economy. On the other hand, so is the model of Arrow-Debreu. The model I have sketched has the merit of incorporating some of the constraints that must, of necessity, be faced by the federal government in designing its tax-redistribution policies. In the context of the model, phased-out wage subsidies for those with poor market opportunities is an optimal tax-redistribution policy. Appropriately interpreted, the Canadian UI program is a mixture of insurance and a phased-out wage subsidy. I cannot claim, on the basis of this simple model, that this mixture is optimal. I do claim, however, that critics of this mixture should defend their position, a stance that maintains that the Canadian Unemployment Insurance program should not be used for redistribution purposes, in spite of the fact that the UI program permits the implementation of phased-out wage subsidies. In particular, such arguments should confront the types of participation and incentive constraints that the government actually faces.

References


