Background Paper

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EMPLOYMENT INSURANCE

A Macroeconomic Comparison with Other Income-Support Initiatives

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APPLIED PUBLIC POLICY RESEARCH
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Executive Summary

This paper uses a simplified open-economy macroeconomic model to assess several income-support policies. Employment insurance is compared to a guaranteed annual income, a working income tax benefit, and an employer-based subsidy for hiring low-skilled individuals. The mobility of capital (the globalization constraint) is stressed since it limits government financing options. This constraint does not preclude the government helping unskilled labour as a group, but it does lead to a trade-off between the welfare of the working poor and that of the non-working poor. It is concluded that EI should not be replaced by other low-income support programs. The analysis suggests that such a replacement would bring a desirable but fairly small increase in efficiency (a reduction in the unemployment rate), but at the expense of a rather large loss in equity.

Employment Insurance
A Macroeconomic Comparison with Other Income-Support Initiatives

William Scarth

1 Introduction

There are three broad approaches to the provision of income support. EI makes support conditional on the individual *not* having a job. On the other hand, the Working Income Tax Benefit (WITB—Canada's version of an earned income tax credit) makes support conditional on the individual having a job. Between these approaches, a guaranteed annual income (otherwise known as basic income) is intended to make support independent of labour force status. Given this interpretation, and a focus on economic efficiency considerations, economists often prefer a WITB. First, since both EI and WITB are more targeted than basic income, these approaches involve the government relying less on distortionary taxation to finance them. Second, since standard analysis suggests that a lower level of unemployment emerges with the WITB, it gets the highest marks on efficiency grounds.

But it is almost certainly the case that policy decisions are based at least as much on equity considerations as on efficiency issues. Since a WITB focuses on the working poor, and not on those in most dire need of assistance, it is unlikely to receive top marks on equity grounds. At the intuitive level, EI and basic income would seem to have more appeal from this point of view. The macroeconomic analysis in this paper attempts to provide a balanced assessment of these several alternatives for providing support for those on low incomes.

Nobel Laureate Edmund Phelps (1997) has long argued that there is a better approach than any of the three discussed in the previous paragraph. He argues for the provision of subsidies to the employers of low-income individuals. Like the WITB, this policy is aimed at the working poor. Unlike the WITB, the preference in this policy is for government to intervene on the demand side, not the supply side, of the labour market.

The preference for intervention on the demand side is based on the impacts that Phelps expects for those other than the working poor. Stimulating labour demand rather than supply puts upward, not downward, pressure on the general level of wages of the unskilled. Thus, the individuals who do not qualify for direct participation in the program (those who are a bit too well off)—on the one hand, and those who are less well-off, namely the unemployed on the other hand—can both benefit. Since the benefit paid out to the unemployed under EI is a fraction of the market wage, the increase in wages that can be expected under Phelps' program would constitute an indirect increase in the generosity of EI. The additional benefit of this employer-based employment subsidy is that it can be expected to lower the unemployment rate, not raise unemployment, as a more traditional increase in the EI replacement rate does.

One purpose of this paper is to compare Phelps' proposal with the other three more traditional policy initiatives. The approach taken is relatively abstract, since the analysis involves a highly simplified general-equilibrium macroeconomic model. One advantage of this approach is that it focuses on each policy's *indirect* effects—those aspects that tend to receive insufficient attention when a detailed analysis of any one initiative is undertaken. A second advantage of this broad comparative approach is that the several competing policies are evaluated within the same analytical framework. But there are disadvantages as well. In order to focus on the full-model feedbacks within a fairly transparent model that non-specialists can fully appreciate, it is necessary to simplify each policy and to examine a stylized version of each. Thus, despite calibration of the model with realistic parameter values, the numerical results have to be interpreted as illustrative, not definitive.

Of particular interest for building a model that is suitable for Canada is the globalization constraint—that both physical capital and highly skilled labour are quite mobile internationally, while unskilled labour is not. The importance of the globalization constraint is that it makes it very difficult for the government to raise the revenue that is needed to provide EI without those taxes ending up being imposed on the "captive" factor of production—unskilled labour. Even if taxes are nominally levied on capital income, the true incidence of the tax is fully shifted to labour when the supply of capital is perfectly elastic at the yield that is available net of tax in the rest of the world. Granted, foreign investors continue to have some country-specific perceptions of risk, so capital is not perfectly mobile yet. But it is becoming more so as each decade passes. Policy makers need to look forward, and be ready for the day when the globalization constraint becomes fully binding. It is to ensure this readiness that perfect capital mobility is assumed in this analysis.

The more general question raised by the globalization constraint, then, is: how can we finance *any* of the policy options that aim to better the lot of unskilled labour if that group ultimately has to pay for these initiatives? In the second section of this essay (in material drawn from Scarth (2007, chapter 9)), I show how this challenge might be met. The key is that the policy needs to lower unemployment. But, even if the unemployment rate can be reduced and the unskilled *as a group* can be assisted, many policy initiatives involve a trade-off—helping *either* the working poor or the unemployed *at the expense* of the other subset of unskilled individuals.

After the basic nature of this trade-off is clarified, we pursue (in section 3 of the paper) a more extensive analysis involving numerical calibration and several policy options: a change in the level of EI benefits, both employee and employer payroll tax cuts, and the introduction of both basic income and Phelps' employment-subsidy proposal. The WITB is not examined explicitly, but within this simplified framework, it is very similar to an employee payroll tax cut. Following the paper's conclusions in section 4, the appendix explains the details of the model.

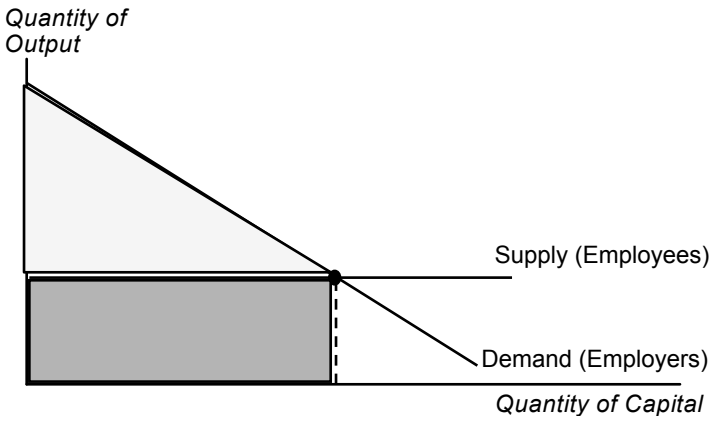
2 Equity and Efficiency: The Globalization Challenge

Many citizens expect their government to provide support for low-income individuals, but they fear that the government may no longer be able to do this. To address this question specifically, let us pull together skilled individuals (the owners of human capital) and the owners of physi-

cal capital into one group that I refer to as capitalists, or the "rich." I assume that these individuals have the ability to re-locate their capital costlessly to lower-tax jurisdictions. Further, let us use the term labour to refer to the unskilled "poor," and assume that these individuals cannot migrate to other countries. Can the government help the poor by raising the tax it imposes on the capitalists and using the revenue to finance a change in EI arrangements—for example, a cut in the employee payroll tax rate? Those who focus on the globalization constraint argue that the answer to this question is "obviously no." They expect capital to relocate to escape the higher tax, and the result will be less capital for the captive domestic labour force to work with. Labour's living standards may well decrease as a result.

The standard analysis can be reviewed by referring to Figure 1, which shows the initial demand and supply curves for capital. The demand curve is the diminishing marginal productivity relationship that is drawn for an assumed given level of labour employed. Firms are prepared to hire more capital only if the rent they have to pay for each unit is lower. The supply curve is perfectly elastic at the yield that owners of capital can receive on an after-tax basis in the rest of the world. If the return for foreign investors in our economy is above what is available in the rest of the world (the height of the supply line), they are prepared to supply what we regard (as a small entity in the whole world) as an infinite quantity. On the other hand, if that foreign return is higher than what is available here, they supply zero. Before the tax on capital is levied to finance the payroll tax cut, the economy is assumed to be observed at the intersection of these demand and supply relationships, and the nation's GDP is represented by the area under the demand curve up to point *A* (the sum of all the additions to output that were made possible by hiring all these units of capital). Capital receives the dark grey rectangle below the supply curve, while labour's income is the residual part of GDP (the light grey triangle above the supply line).

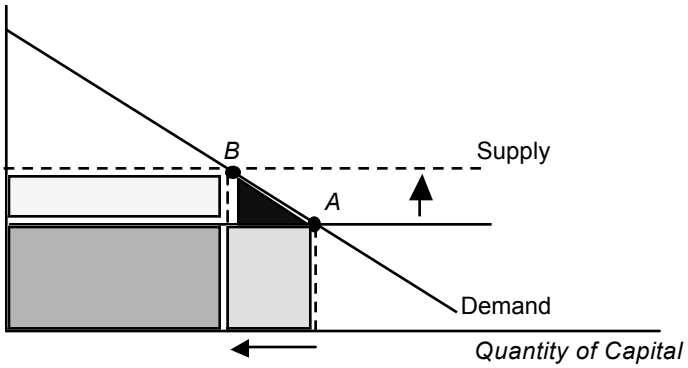
FIGURE 1 The Capital Market



When the government raises the tax on capital, capitalists demand a higher pre-tax return, an increase that is just enough to keep the after-tax yield equal to what is still available elsewhere. Thus, the higher (dashed) supply curve in Figure 2 becomes relevant, and the outcome is now given by point B. Domestically produced output falls (by an amount equal to the black triangle plus the rectangle that is shaded medium grey), but capital owners do not suffer. Those that move their capital elsewhere earn the same income (the medium shaded grey rectangle) there, while those who keep their capital within this country, receive an increase in their pretax

return (equal to the light grey rectangle) that is just sufficient to allow them to fully escape the burden of the tax. As usual in tax incidence analysis, a tax imposed on an item that is supplied perfectly elastically is fully passed on (in this case to labour). The capitalists still get the dark grey rectangle (after-tax), and the tax revenue that accrues to the government (the light grey triangle) comes completely from what used to be labour's income. But, abstracting from the inefficiency that is generated from the levying of the tax (discussed below), labour does not suffer. This is because the entire proceeds of the tax are given to labour. Let us suppose that this transfer takes the form of a guaranteed annual income. Since such a transfer has no incentive effects that could reduce some other pre-existing inefficiency in the economy (such as the level of unemployment), there will be nothing to compensate labour for the loss of the black triangle. This is the efficiency loss that is the analytical basis for the proposition that mobile capital is a bad thing to tax—it hurts labour.

FIGURE 2 A Tax on Capital with No Change in Unemployment

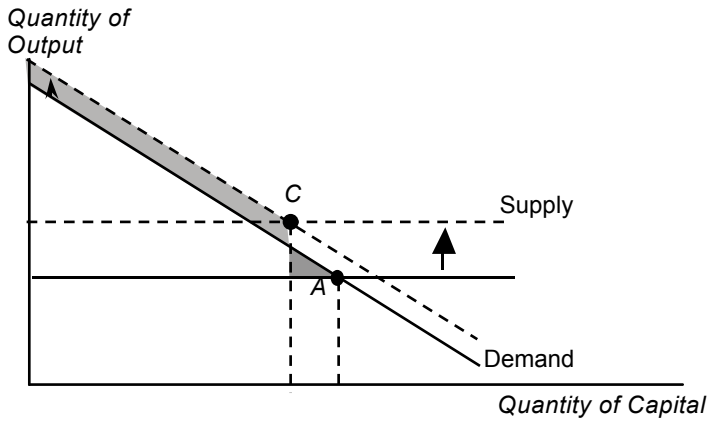


Now let us focus on a different use of the new tax revenue—a cut in the employee payroll tax rate. With this initiative, the unemployment rate can be expected to fall, so that each unit of capital is more productive since it has more labour to work with. This is shown in Figure 3 as a shift up in the position of the marginal product of capital curve (shown by the higher dashed demand curve). The economy is observed at the intersection of the now-relevant supply and demand curves—the dashed ones that intersect at point *C*. Overall, by comparing the trapazoids formed by dropping the perpendiculars from points *A* and *C*, bounded from above by the relevant demand curve in each case, we can assess what has happened to the total income that is available to labour. It has been reduced by the shaded triangle (due to the introduction of the distorting tax on capital), but it has been increased by the shaded parallelogram (due to the reduction of the pre-existing distortion in the labour market—unemployment).

If the gain exceeds the loss, the tax on capital might be recommended after all. When the revenue is used to lower unemployment, it raises the total income of the poor (labour) and it does not reduce the income of the rich (the owners of capital). This approach to low-income support is not a zero-sum game, in the sense that labour is not helped at the expense of capitalists. As already noted, this is because the size of the overall economic "pie" has been increased by policy. Labour receives a bigger slice, while capitalists get the same slice as before (as imposed by the globalization constraint). This encouraging possibility is stressed by Moutos and

Scarth (2004), who use an asymmetric information model to defend the pre-existing distortion interpretation of the labour market, by Koskala and Schob (2002), who base the labour market distortion on the presence of unions, and by Domeij (2005), who relies on search frictions to defend this interpretation.

FIGURE 3 A Tax on Capital to Finance an Employee Payroll Tax Cut



To complete this analysis, two questions must be pursued: First, is it reasonable to expect an employee payroll tax cut to lower unemployment? I summarize the standard analysis of this question in the appendix, and conclude that the answer is "yes." The second question concerns whether it is reasonable to argue that the gain can be bigger than the loss. I pursue this issue in the appendix as well (by specifying an algebraic version of the model summarized by Figure 1), and the answer is that—if there is no tax on capital in the first place—this revenue neutral cut in the payroll tax, financed by the introduction of a tax on capital, *must* be "good news" for labour. That is, this policy must raise the overall income that is available to unskilled labour—both the working and the non-working poor—taken together as a group. But there is one "bad news" development: the tax on capital drives some of this input out of the country. With fewer machines and skilled individuals to work with, unskilled labour is less productive, so the market wage falls. This hurts the working poor, but the payroll tax that these individuals pay falls enough to more than make up for the lower pre-tax wage, so these individuals turn out to be better off. But the unemployed poor do not fare so well. Since their EI receipts are tied to the going level of wages, there is an indirect and unintended cut in the generosity of EI. And since the unemployed do not pay payroll taxes, there is nothing to make-up this loss. So the attempt to shift the financing of EI from the payroll tax to a tax that is intended to be on capital is good news in that it lowers unemployment, but it is bad news since it helps the working poor at the expense of the unemployed poor.

Second-best theory is the key to understanding the good news dimension of this outcome at an intuitive level. Recall an example introduced in the original paper on this topic (Lipsey and Lancaster (1956)). In a two-good economy, standard analysis leads to the proposition that a selective sales tax is "bad." With a tax on the purchase of just one good, the ratio of market prices does not reflect the ratio of marginal costs, so decentralized markets cannot replicate what a perfect planner could accomplish—achieve the most efficient use of society's scarce resources. Society is producing and consuming "too little" of the taxed good, and "too much" of the untaxed good.

But this assumes that there is no *pre-existing* market distortion before the tax is levied. A different verdict emerges if it is assumed that there is an initial market failure. For example, if one good is produced by a monopolist who restricts output and raises price above marginal cost, a similar inefficiency is created (with society consuming "too little" of this good and "too much" of the competitively supplied good). One solution to this problem is to impose a selective excise tax on the sale of the *other* product. With this tax, *both* prices can be above their respective marginal costs by the same proportion, and society gets the efficient allocation of resources, even with the monopoly.

So the verdict concerning the desirability of a selective sales tax is completely reversed, when we switch from a no-other-distortions situation to a with-other-distortions setting. The analysis in this section of the paper shows that this same logic applies in a macroeconomic analysis of input markets. In this model, societal conventions involve the wage set at a value that fails to eliminate unemployment. Labour's price is "too high" so firms employ "too little" labour. By stimulating employment with the payroll tax cut, and by raising the revenue to finance this initiative by taxing the over-used input(capital), the government can increase overall efficiency (lower unemployment and raise GDP).

Despite the appeal of this intuition, we must remember that the size of the welfare loss that accompanies any distortion rises more than in proportion with the size of that distortion. By having no capital tax in the first instance, the analysis in this section of the paper is biased in favour of finding that a small loss accompanies that tax. With the pre-existing distortion in the labour market involving significant unemployment, a large loss accompanies that distortion. The policy package introduces one distortion (in the capital market) to make possible the reduction of the other (in the labour market). It is, perhaps, not surprising that welfare improves overall when a small distortion partially replaces a larger one. I assess the significance of this bias in the next section, by reporting the simulation results that have been derived from an extended model—one that allows for plausible levels of several taxes before various policies are examined.

3 A More Complete Model

The more complete model involves the addition of an employer payroll tax, a personal income tax levied on wage incomes, a Phelps-style employment subsidy issued to firms, and a guaranteed annual income program. The model also involves allowing for two groups within the unemployed. One group has no chance of becoming employed (given the policies examined here), for example due to disability, lack of appropriate training, or being constrained to remain in regions where jobs cannot be had. The other group within the unemployed can and do respond to the economic incentives that are part of the government programs that are examined.

The effects of all policies on the unemployment rate are standard, and they follow from one basic feature: anything that raises the relative return of work lowers unemployment, while anything that raises the relative return from being idle raises unemployment. Thus, increases in the wage income tax, the payroll taxes, and the generosity of the EI and basic income programs raise the unemployment rate, while increases in the Phelps subsidy to employers for hiring unskilled workers lowers the unemployment rate.

Perhaps one aspect of this set of predictions warrants further comment. The employer payroll tax does not raise unemployment if there is no Phelps program in place. This prediction emerges from a number of labour-market analyses, such as Summers' (1988) model of asymmetric information and efficiency wages. It is a feature of any labour market analysis in which increases in productivity raise wages one-for-one in the long run. Summers has argued that a century of data is consistent with this prediction, so it is appealing that our model share this feature.

The details of the model (the equations that define it and the numerical calibration) are given in the appendix. Here, I summarize the results. Table 1 reports two policy options. The first is an increase in the generosity of EI benefits, and the second is the introduction of a guaranteed annual income. Both policies are financed by an increase in the tax rate levied on domestically employed capital. The increase in the replacement rate within EI, from 30 per cent to 40 per cent, is large, but it is targeted to the unemployed, so even this increase in generosity of one third does not require a large rise in the tax on capital (just a rate increase from 20 per cent to 20.25 per cent). This is because, initially, capital (broadly defined to include both skilled labour and physical machines) earned 75 per cent of the GDP, while the unemployed received an amount equal to just 6 per cent of the remaining 25 per cent (that flowed to the unskilled). The guaranteed annual income, on the other hand, applies to all the unskilled, so the revenue implications are larger. Even limiting the level of basic income to 6.75 per cent of the unskilled wage rate means that the tax rate applied to capital must be increased by an amount that is eight times what is required to finance the more generous EI initiative (that tax rate must rise to 22 per cent).

TABLE 1

	Increase in EI Benefit by One-Third	Introduction of Basic Income: 6.75% of Wage
Effect on Unemployment Rate	up by 0.33 % points	no change
Effect on Total Income Available to Labour (Efficiency Index)	down by 0.82%	down by 4.0%
Effect on Income of Unemployed	up by 32.1%	up by 13.3%
Effect on Income of Working Poor	down by 0.94%	down by 0.94%

The unemployment rate rises with the increase in the generosity of EI benefits. The one-third increase in generosity leads to a one-third of one percentage point increase in the unemployment rate (from 6 per cent to 6.33 per cent). It is reassuring that this finding is broadly in line with the long history of empirical studies concerning earlier changes in Canadian EI legislation. Corak (1996) summarized that the doubling of EI generosity in previous decades raised the unemployment rate by between six-tenths and one full percentage point. Since both our

initiative here and the simulated outcome are roughly one-third of this magnitude, our calibrated model can be said to pass this consistency with previous empirical studies test.

The unemployment rate is not appreciably affected by the introduction of basic income. But there is still a bigger loss in total income available to the unskilled (taken as a group), since much more capital is driven out of the country. Specifically, as reported in Table 1, the total income available to all labour (working or not) falls by 4 per cent with the introduction of the guaranteed annual income, and by only 0.82 of one per cent with the increase in EI benefits. Even though the unemployment rate is higher with the EI initiative, so the distortion in the labour market is bigger with this policy, the distortion in the capital market is much higher with the introduction of basic income.

Now let us turn to the effects on the material living standards of those in each group *within* the unskilled labour part of the population. For this discussion, I refer to capitalists as the rich, employed individuals as the working poor, and the unemployed individuals as the very poor. There are no entries in the tables referring to the outcomes for the rich. This is because perfect capital mobility implies that the rich are completely unaffected by all policies (recall that this analysis assumes perfect mobility at no cost—open borders—for both skilled labour and capital). But Table 1 does record the outcomes for each member of the working poor and each member of the unemployed for both policies.

The very poor are helped more by the increase in EI benefit generosity. This policy raises their material welfare by 32 per cent, while the introduction of basic income raises their living standards by just 13 per cent. The working poor are indifferent between these two initiatives since their material welfare falls by the same amount in each case—by just less than one per cent. It seems that the EI initiative dominates the introduction of basic income on both equity and efficiency grounds.

The results for three other initiatives are reported in Table 2: two-percentage-point cuts in both the employer and employee payroll tax rates and the introduction of an employment subsidy equal to 5 per cent of the going wage. All three policies involve essentially no change in the unemployment rate, and quite small reductions in the material welfare of the working poor. From these points of view (small costs involved), these initiatives might be appealing. However, they are not appealing overall, since the very poor (the unemployed) are made *worse off*. This is because capital leaves the country and this indirect effect dominates the forces that push the after-tax wage up (the direct effect of each policy).

The purpose in having a complete macro model is to make it possible for us to sort out just such competing effects for both segments of the labour group in a logically consistent fashion. It is interesting that some of the results of this modeling strategy bear so centrally on policies that have actually been undertaken in Canada recently. For example, since a WITB is very similar to an employee payroll tax cut, this result implies that—when financed by an increase in the capital tax rate—this initiative hurts the very group that it was most designed to help—the working poor.

TABLE 2

	Cut in Employee Payroll Tax Rate of 2 % points	Cut in Employer Payroll Tax Rate of 2 % points	Introduction of Employment Subsidy: 5% of Wage
Effect on Unemployment Rate	no change	no change	down by 0.1 % points
Effect on Total Income Available to Labour (Efficiency Index)	down by 1.18%	down by 1.0%	down by 2.56%
Effect on Income of Unemployed	down by 2.4%	down by 0.1%	down by 0.34%
Effect on Income of Working Poor	down by 0.6%	down by 0.1%	down by 0.34%

From a political economy point of view, we would expect only the unemployed to vote for any of these initiatives. Capital owners would abstain, and the working poor would vote against each one. Economic advisors who focus on efficiency questions would vote against as well. This is because the overall income that is available to labour, including all those working and not working (see the second line in Tables 1 and 2), goes down in all cases.

But it would not take much altruism for the working poor to support a loss to themselves of just 0.94 per cent if the material welfare of those less well off, the unemployed, could increase by 32.1 per cent. Thus, if it has been decided that *some* initiative is to be adopted, the working poor can be expected to support the more generous EI benefit policy. Efficiency-oriented economists would agree, since the efficiency loss is the smallest in this case. When equity and efficiency goals involve a trade-off, it is appealing to choose the policy that delivers the biggest gain in equity along with the smallest loss in efficiency. However, it would be difficult to explain this policy choice to the group that is pushed from the working poor to the very poor, and the increased EI replacement rate policy involves a serious increase in unemployment. Nevertheless, if this dimension of the outcome is tolerated, the policy of increased generosity in the EI program appears to dominate the introduction of other new programs (an employment subsidy or basic income).

While not listed in the tables, I report one final policy option: an increase in EI generosity of the same amount (from a replacement rate of 30 per cent to 40 per cent) but in this case financed by an increase in the employer payroll tax rate, not by an increase in the tax rate that is legislated on domestically employed capital. This policy package involves the same increase in the unemployment rate (one-third of one percentage point) but no capital being driven out of the country. Thus, a smaller loss in overall efficiency emerges (a reduction of 0.38 per cent compared to 0.82 per cent when this initiative is financed by a higher tax on capital). There is also a smaller loss in material welfare for the working poor (a reduction of 0.90 per cent compared to the 0.94 per cent loss reported in Table 1). The pre-tax wage received by workers

is now pushed down for a different reason than capital leaving the country. In this case, labour demand falls because employers must pay a higher employer payroll tax (a tax rate of 6.9 per cent instead of 5 per cent), and this results in the wage being very slightly lower than in the Table 1 experiments. Overall, then, the analysis appears to support continued reliance on EI over the introduction of the other broad approaches to tackling poverty, and to continue to rely on payroll taxes to finance EI.

4 Conclusions

This paper has used a simplified general-equilibrium open-economy macroeconomic model to assess several income-support policies. The specification of each policy has been stylized, with no attempt being made to capture the details of caps on contributions, run-out dates on benefits, or claw-back arrangements that operate as an individual's income rises. The paper is intended as a complement to analyses that are much more specific on these matters. Their advantage lies in focusing on details; the advantage of the present study is in pursuing indirect feedback effects that are difficult to evaluate unless a full-economy perspective is taken. I remind the reader of just three of the insights that have emerged, as examples of the payoff of this modeling strategy:

1. an employee payroll tax cut can hurt workers,

2. contrary to what Phelps has argued, wages fall with the introduction of an employment subsidy in a small open-economy setting, and

3. the globalization constraint does not preclude the government helping unskilled labour as a group, but it does mean that there is a trade-off between the welfare of workers and that of the unemployed poor.

It is hoped that these insights may inspire others to pursue sensitivity tests in related macro models, so that the debate on EI reform involves increased awareness of the indirect, sometimes unexpected, feedback effects that emerge (often outside the labour market), when the financing of any labour-market policy initiative is an integral part of the analysis.

In the meantime, we can summarize the central recommendation that has emerged from this inquiry—that EI not be replaced by other low-income support programs. Our analysis suggests that such a replacement would bring a desirable but fairly small increase in efficiency, but at the expense of a rather large loss in equity.

Appendix

The following equations define the model used to examine the effect of the payroll tax cut financed by an increase in the tax rate aimed at capital in section 2 of the paper. The equations specify: a production function, factor demand functions based on profit maximization, perfect capital mobility with the rest of the world, a fixed domestic labour force, a government budget identity, and a simple model of unemployment.

$$y = Ak^{a} \quad (1)$$

$$aAk^{a-1} = r \quad (2)$$

$$(1 - a)Ak^{a} = w \quad (3)$$

$$r(1 - c) = r^{*} \quad (4)$$

$$u = b(1 - t) / (1 - t - f) \quad (5)$$

$$f\ wu = tw(1 - u) + crk(1 - u) \quad (6)$$

$$x = (y - r * k)(1 - u) \quad (7)$$

The first equation is a Cobb-Douglas production function; output per employee, *y*, is a function of capital per worker, *k*. Capital is defined quite broadly to include both machines and human capital, so labour refers to the unskilled. Firms hire each factor up to the point that the marginal product equals the rental cost. The rental price of capital is *r* (equation (2)) and the rental price of labour is *w* (equation (3)).

Very different assumptions are involved for factor supplies. The supply of labour (the population of unskilled individuals) is completely inelastic (immobile internationally) and is set at unity. As a result, employment is one minus the unemployment rate, *u*. Capital is supplied completely elastically at the rate of return that this factor can earn in the rest of the world, *r**. This perfect capital mobility assumption is what imposes the globalization constraint—that capital can avoid paying any tax in this small open economy. This assumption is imposed in equation (4) which stipulates that the domestic yield, *r*, must be just high enough to generate an after-tax yield equal to what is available elsewhere. *c* is the tax rate levied on the earnings of capital employed domestically.

Equation (5) indicates how the unemployment rate is determined; it is based on Pissarides (1998). The wage at each firm-worker level is set with considerations of market power, outside opportunities, and fairness all playing a role. Formally, the parties to the wage determination process are assumed to behave as if they submitted their cases to an arbitrator. The arbitrator respects each side's objectives, the customary weight that is put on each side's objectives, and

the reference points that are established by outside options such as welfare and EI. The parameter that embodies these market-power considerations in equation (5) is *b*. This relationship indicates that the unemployment rate rises with the generosity of EI (as parameter *f* (the fraction of wages individuals receive while unemployed) rises), and with the level of the employee payroll tax rate (as tax rate *t* rises).

Equation (6) defines a balanced government budget. The use of funds is listed on the left-hand side. As noted, parameter *f* is the "replacement rate" in the EI system—the fraction of market wages that an individual receives while out of work. For simplicity, we follow convention in the macro-theoretic literature (for example, Pissarides (1998) and Summers (1988)) and assume no waiting period or maximum period involved in EI coverage. Thus, the total of EI benefits distributed is equal to the payment made to each individual, *fw*, times the number of people unemployed, *u*. The sources of government funds that are used to finance EI appear on the right-hand side of equation (6). There is the employee payroll tax and it raises total revenue equal to the tax rate, *t*, times the total wage bill (wage rate, *w*, times total employment, $(1 - u)$). The second revenue source is the tax on capital, equal to the tax rate, *c*, times the earnings of capital (the product of the pre-tax return, *r*, times the amount of capital per worker, *k*, times the number of workers, $1 - u$).

The equations determine *y, k, r, w, u, x* and one of the policy parameters (in this case, *c*). I assume that, initially, there is no tax on capital; then, I examine a cut in the contribution rate for EI (the employee payroll tax rate). The model determines what capital tax rate must be introduced to pay for this initiative, and I focus on three responses: in the unemployment rate, the wage rate, and the overall income available for all unskilled individuals (denoted by *x* in equation (7)).

To find these effects, I take the total differential of the equations, and then simplify the coefficients in the resulting relationships by imposing the no-capital-tax initial condition. Two results are definite: one is that $du/dt>0$ and the second is $(dx/x)/dt<0$. The third result is that holds as long as $(1 - t)^2>f$. The first result confirms standard beliefs; the cut in the employee EI contribution rate lowers the level of structural unemployment. The second result indicates that, in this model, what appeared to be just a possibility in the graphic analysis in the text of the paper is an outcome that simply *must* occur. The payroll tax cut, financed by a tax aimed at perfectly mobile capital, is an initiative that *does* succeed in raising the material welfare of labour (when the employed and unemployed are lumped together in one group).

But the third result also indicates that it is dangerous to combine these two groups, since the income of the unemployed can be reduced by this initiative. The income of each unemployed equals *fw*, and since *f* is constant in this case, the verdict concerning the desirability of this payroll tax cut for the unemployed depends entirely on whether wages rise or fall. A sufficient, though not necessary, condition for wages to fall is that the EI replacement rate, *f*, be less than one half and that the employee payroll tax rate, *t*, be less than one quarter. Since these are conditions that are certainly met in the actual economy, the third result expression is surely positive. Unemployed individuals are not affected *directly* by the payroll tax cut, but there is an indirect effect. This initiative must be financed, and the imposition of the tax on capital drives some capital out of the country. With fewer machines and skilled individuals to work with, unskilled labour is less productive, so the market wage falls. Since the EI benefit payment is

proportional to the general level of wages, the payroll tax cut ends up being an unintentional reduction in the generosity of EI, so the very poor subset within the labour group is made worse off. This is an example of the important feedback effects that occur within a full macroeconomic context.

The more complete model reported in section 3 of the paper involves the addition of an employer payroll tax, rate *e*, a personal income tax levied on wage incomes, rate *i*, a Phelps-style employment subsidy issued to firms, equal to proportion *h* of the going wage, and a guaranteed annual income program, with each payment set at proportion *p* of the going wage. The personal income tax involves a fixed tax rate levied on wage incomes above a threshold. It is assumed that the EI and basic income benefits received by the unemployed are not sufficient to push an individual's income above this threshold.

The final change in the extended model involves allowing for two groups within the unemployed. The overall unemployment rate is defined as $u = u^* + v$, where u^* is the part that is independent of taxes and subsidies (the group of individuals that has no chance of becoming employed) and v is the part that is determined by the incentives-based model that is discussed below. EI benefits are available to all the unemployed.

Equations (1), (2), (4) and (7) are unaltered, and there is a very simple change in equation (3). The revised relationship in this case involves the payment made by firms for each worker to be higher because of the employer payroll tax, and lower because of the employment subsidy:

$$(1 - a)Ak^a = w(1 + e - h) \qquad (3a)$$

The unemployment rate is affected by many of the additional policy parameters (as discussed in the text of the paper). The model now involves:

$$u = u^* + v \qquad (5a)$$

$$v = b(1 + e - h)(1 - i - t)/((1 + e)(1 - i(1+p) - t - f)) \qquad (5b)$$

The final equation that differs in the more complete setting is the government budget constraint. There are now four uses of funds and four sources of funds:

$$G + pw + f\,wu + hw(1 - u) = i(1+p)w(1 - u) + tw(1 - u) + ew(1 - u) + crK \qquad (6a)$$

The most notable new items are G and K, the level of government spending on programs that have no direct effect on the labour market and the total capital stock: $K = k(1 - u)$. I assume that the ratio of this other spending to GDP, $g = G/Y$, stays constant throughout this analysis, so I replace *G* by $gY = y(1 - u)$ in the derivations. In addition to this other set of programs, the three uses of funds (in the order that they appear in (6a)) are basic income benefits, EI benefits, and employment subsidy expenditures. The four revenue sources are: income tax revenue collected from the employed, payroll taxes (EI contributions collected from employees and employers), and income tax revenue collected from the owners of domestically employed capital.

The numerical calibration of the model is now explained. It is assumed that there is no basic income or employment subsidy program initially, so the starting values for p and h are zero. The replacement rate in the EI system (parameter f) starts at 30 per cent. The initial income tax rate for employed labour, i, is 10 per cent, and the initial payroll tax rates, e and t, are 5 per cent. The initial tax rate on the earnings of capital, c, is 20 per cent. These assumptions, along with the specifications for unemployment and capital intensity that are noted below make the initial value of the other-programs-to-GDP ratio, g, be 19.3 per cent.

The foreign interest rate, r^*, is set at 10 per cent. The tax on domestically employed capital then implies that the starting value for the pre-tax return on capital within this small open economy is 12.5 per cent. Since I have followed Mankiw, Romer and Weil (1992) in defining capital to include skilled labour, I must specify capital's share of GDP to be much higher than is usual. I set a = 75 per cent. Then, with initial GDP set at unity and the initial unemployment rate being 6 per cent, these specifications imply that the starting values for k, w and A must be 6.0, 0.238 and 0.26 respectively. Finally, with the overall unemployment rate at 6 per cent, and the exogenous part, u^*, set at 4.5 per cent, equations (5a) and (5b) imply that parameter b must be 0.0097. With this information, the knowledge that the income of each member of the working poor, and of the non-working poor, are $w[(1 + p)(1 - i) - t]$ and $w(f + p)$, and with software that solves nonlinear simultaneous equations, interested readers can verify the results reported in Tables 1 and 2.

The purpose of the remainder of the appendix is to provide more details concerning the unemployment rate equation in the model. This specification is from Pissarides (1998), who intended that his model apply to an economy composed of a large number of union-employer pairs. The wage is set through an arbitration process involving both parties, and then the firm chooses the level of employment independently once the wage has been set. In this second stage, firms equate the marginal product of labour with the (net of subsidy and inclusive of taxes) wage that the firm has to pay (as is customary, and as is assumed in our full system).

I think that Pissarides' model is applicable to settings without formal unions. The employer must still balance its own objective of maximum profits with the norms of society concerning a "fair" wage, and with the options that workers have if they leave their current employer. As a result, I assume that workers and their employers interact *as if* they consulted a formal arbitrator. Here is a summary of the specific details.

The arbitrator's objective function is the product of the employees' and the employer's objectives, each raised to a power indicating the bargaining power of each constituency: $I^j P(1 - j)$. I is the excess income the workers get if they stay with this employer (over what they receive if they take their chances on a job elsewhere) and P is the firm's profits (the excess of what the firm owners get over what would emerge if they did not operate). With L, Y, q and w^* denoting the number of workers at this firm, the output (sales) of this firm, the unemployment rate among the subset of people in the country that have a possibility of working, and the average wage prevailing in the rest of the economy (assumed to be independent of decisions taken within each employer-employee pair) respectively, the expressions for I and P are:

$$P = Y - w(1 + e)L + (hw^*)L$$

$$I = wL(1 - i - t) + (pw^*)L(1 - i) - [(1 - q)[w^*L(1 - i - t) + (pw^*)L(1 - i)] + q[(f + p)w^*L$$

q and $(1 - q)$ are the probabilities that a separated worker is either unemployed or re-employed elsewhere. Since the population is unity and u^* individuals are chronically unemployed, the number of unemployed here is $v = q(1 - u^*)$. After differentiating the arbitrator's objective function with respect to her choice variable, w, setting that expression equal to zero, then imposing the fact that a full economy-wide equilibrium involves $w = w^*$, simplifying by using the fact that labour's share of income is $(wL/Y = (1 - a)/(1 + e - h)$, and by defining b to stand for $aj(1 - u^*)/((1 - a)(1 - j))$, we have the expression for v that appears in equation (5b) above.

The definition of I indicates that every individual faces a chance of unemployment after a job separation, so a literal application of this micro-foundation would not justify my interpreting the macro model's results as if the working poor and the unemployed were different groups. If readers are uncomfortable on these grounds, they should focus exclusively on the results that are reported for all of labour (the measure referred to as the efficiency index in the tables that lumps both these groups together). The conclusions of the paper are supported even when attention is focused in this way.

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About the EI Task Force

The Mowat Centre has convened a research-driven Employment Insurance Task Force to examine Canada's support system for the unemployed. The Task Force will develop an Ontario proposal for modernizing the EI system—conscious of the national context—that works for individuals and businesses.

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