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QSEP Research Report No. 424

McMaster University
SOCIAL SCIENCES

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August 2007

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This report is cross-listed as No. 220 in the McMaster University SEDAP Research Paper Series.

An Evaluation of the Working Income Tax Benefit

by

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Abstract

The federal government has implemented an earned income tax credit – what it has called the Working Income Tax Benefit – in the 2007 *Budget*. Edmund Phelps has argued that the earned income tax credit in the United States should be replaced with an employment subsidy. This paper assesses the importance of Phelps' concern, and related issues, for Canada. This debate is important for two reasons: the plight of those blocked by the "welfare wall" is dire, and the entire community has an interest in lower structural unemployment in an environment that involves an aging population and an accompanying labour shortage.

Keywords: earned income tax credit, employment subsidy, open economy

JEL Classifications: I38, J38, E25, F41

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1. Introduction

The federal government's *Budget Plan* of 2007 contained a detailed discussion of the "welfare wall" – the fact that social assistance recipients face such significant financial barriers to paid employment that their after-tax-and-transfer-receipt resources can actually fall as they move into the workforce (pages 78-81). While some progress has been made in recent years by lowering the welfare wall for families with children, the government has now begun to address this problem more generally by introducing a Working Income Tax Benefit for all low-income Canadians. The annual funding starts at $500 million, and the program's scope is to increase to $1 billion annually soon.

It is interesting that – as the Canadian government is taking steps to catch up to its American counterpart on this front (the United States has had an earned income tax credit for 30 years) – there have been calls for disbanding the earned income tax credit program there. For example, Nobel laureate Edmund Phelps (1997) makes the case for replacing the earned income tax credit with an employment subsidy. In Phelps' proposal, firms would receive a per-person subsidy that would cover a fraction of the wage paid to each low-income employee. As Phelps argues (1997, pages 88, 132-134), with a subsidy to employers, the general level of low-skill wages would be bid up, so that even individuals not covered by the program would be helped. With the earned income tax credit given to employees, on the other hand, there is downward pressure on the pre-tax level of low-skill wage rates, so individuals not covered by the program are hurt.

This paper has two purposes: first, to evaluate the relevance of Phelps' concerns for Canada, and second, to assess the likely impact of Finance Canada's specific

initiative, by reporting some simulation results. The model that has been used to generate these results is outlined in sections 2 and 3 (and is listed formally in the Appendix). The results are discussed in sections 4 and 5, and concluding remarks are offered in section 6.

2. A Framework for Evaluating Broadly Available Earned-Income-Tax-Credit and Employment-Subsidy Programs

Several features are important for our model to be taken seriously as a vehicle for illuminating policy options for Canada. First, the production process in the model must allow skilled labour to be distinguished from unskilled labour, since the government initiatives under study apply only to the latter. For this reason, in the basic version of our analysis we define capital very broadly – to include both physical equipment and human capital (skilled labour). We report on a sensitivity test that treats these two forms of capital differently in the Appendix.

The second desirable feature of a model is that it respects the "globalization" constraint that confronts small open economies such as Canada. Owners of capital can and do relocate the employment of their factors of production to achieve the most favourable after-tax yield. If the domestic government raises taxes on capitalists or skilled individuals to finance initiatives that are intended to provide support for those on lower incomes, skilled labour and physical capital can leave the country. We expect that this international reallocation of skilled labour and capital proceeds up to the point that after-tax yields have returned to their pre-policy levels. Our model is consistent with this constraint, since the supply of broadly defined capital is assumed to be perfectly elastic at

the level of the after-tax yield that is available elsewhere. On the other hand, since the unskilled are not mobile internationally, a fixed supply of such individuals is specified.

A third important feature of the model is that there is involuntary unemployment among the unskilled. This is necessary for two reasons – the model needs to be realistic and there must be a subset of the population that does not benefit from the policies that we are examining (limited as they are for those who are in work). To address Phelps' concern, we need to focus on how the policies affect those who remain out of work. Further, it is desirable that this unemployment depend on market incentives in a standard fashion. After all, the underlying appeal of both the earned income tax credit and employment subsidies is that they try to create desirable market incentives – not undesirable ones (that lead individuals to stay unemployed). We satisfy this objective in the model by including the simplest version of efficiency-wage theory (Summers 1988). Given that firms are unable to perfectly monitor individual worker effort, but they want to induce a high level of worker motivation and productivity, firms pay a wage that is above the competitive level by the profit-maximizing amount. In the model, it is this increase in the general level of the unskilled wage that causes unemployment to persist in full equilibrium. There is no unemployment in the skilled labour market, since firms encounter no motivation problem among those who have "good jobs".

The fourth important feature of the model is the government budget constraint. This relationship makes explicit how the government is paying for either contemplated initiative that is intended to alleviate part of the welfare-wall problem.

The final prerequisite for an appealing analysis is that it be both optimization-based (so that it is acceptable to mainstream professional economists) and that it be

simplified and highly aggregative (so that it can be understood independently by the many non-economists who are involved in this policy debate).

The nine-equation system that is outlined in the remainder of this section of the paper defines a model that meets all the prerequisites just mentioned. For those who are interested, there is an Appendix that formally lists the equations, but the main text of the paper can be read without reference to the Appendix.

The input-output function is standard; output is higher if the employment of either broadly defined capital or unskilled labour is higher. Other things equal, more of one input raises output, but – given diminishing returns – by ever smaller amounts as the other input becomes relatively scarce. The most common specific relationship that embodies this feature is the Cobb-Douglas production function, which we assume. There is one key parameter in this relationship, which defines the share of income going to each factor, and we consider two assumptions when choosing a numerical value for this parameter.

Initially we focus on the broad question raised by Phelps: should the government provide support to those on low incomes through an initiative that operates on the demand-side, or one that operates on the supply-side, of the labour market? That is, should the government offer a subsidy to firms for employing low-skilled individuals, or should it offer an earned income tax credit directly to those receiving low incomes? We consider this question by comparing situations that involve a fully developed commitment to one policy or the other. Specifically, we assume that each government policy has been expanded so that all households that fall below the average income level qualify for support. We assume that there are two equal-sized groups in the population –

one “rich” and the other “poor”. The rich derive income in two ways, by renting out the physical capital that they own, and by working. Since these individuals have human capital, they receive the skilled wage rate. The “poor” have no capital; as a result – other than employment-insurance receipts – their income is employment earnings, and they are paid the unskilled wage. We assume that all three factors of production (physical capital, skilled labour and unskilled labour) each receive one-third of the total income that is created in the production process. Since, as noted, we assume that there are equal numbers of skilled and unskilled individuals, the "rich” receive two-thirds of national income. As noted, for simplicity, we assume that human capital and physical capital can be lumped together, and we specify a two-factor input-output function, with the exponents of broadly defined capital and unskilled labour being fractions a and $(1 - a)$. For realistic illustrative simulations, we calibrate by setting a equal to two-thirds.

As explained in the appendix, we consider an alternative definition of the production process that separates the two forms of capital. This alternative specification yields very similar results.

The modeling strategy that we have just outlined is appealing if we wish to investigate the relative appeal of the two broad approaches to a thorough-going attack on income inequality. That is, our initial simulations focus on outcomes that can be expected *after* each policy has been expanded to the point that its coverage extends to all those at the lower end of the economic ladder. Of course, at the current level of funding, Canada’s Working Income Tax Benefit does not cover anything like this proportion of the population. Thus, after comparing the alternative approaches to the general problem of income inequality, we adjust the model to make it more suitable for assessing the limited

initiative that the government has introduced at this time. These alterations, which include a very different value for the income-share parameter, *a*, are discussed in section 3 below.

Firms choose the employment levels of the two inputs to maximize profits, and – in the initial set of reported simulations – they also choose the level of wages they pay their unskilled workers with the same objective in mind. Profits equal sales revenue (output) minus the rental payments made to the owners of the two factors – "capital" (machines and skilled workers) and unskilled workers. Firms do not get to choose the rental rate they pay for the internationally mobile inputs (skilled labour and capital) since this level of remuneration is determined in international markets by what these factors can receive elsewhere. Firms' factor-demand functions are standard; they hire each of the factors up to the point that its marginal product is just equal to the rental payment that firms must pay to employ that input. The fact that firms find it profitable to use a "high" unskilled wage policy to induce higher productivity from its unskilled employees results in unemployment. The level of structural unemployment depends on five parameters. The higher is the workers' aversion-to-effort parameter, the income-tax rate, and the employment-insurance generosity parameter, the higher is the unemployment rate; while the higher is the earned-income-tax-credit and employment subsidy parameter, the lower is the unemployment rate. In the numerical simulations, all these policy parameters are set to realistic values, and the aversion-to-effort parameter is chosen to generate an initial unemployment rate for the entire nation of 6 percent.

As in Summers (1988), the level of effort on the job provided by unskilled workers depends on the proportionate excess of what the worker can receive (after-tax)

from her current employer, compared to her outside option. The outside option is a weighted average of two possible outcomes that follow a separation from the current employer. Let u denote the unemployment rate. One option following a separation is that the individual may get another job (and, in equilibrium, receive the same wage). The probability of this option is the employment rate $(1 - u)$. The other option following a separation is that the individual may become unemployed (and receive a fraction, f, of the previous wage through employment insurance). The probability of this option is the unemployment rate, u. Defining the outside option as z, the pre-tax unskilled wage as w, the tax rate as t, and the earned-income-tax-credit rate as c, we have

$$z = (1 - u)[w(1 - t(1 - c))] + ufw.$$

The worker effort function forms an integral part of the derivation of the unemployment-rate equation that was described in the previous paragraph. Further, this outside option relationship represents a natural measure for evaluating the alternative policies that are designed to help the unskilled. This is because z can be interpreted in an alternative way – as the average or expected income of an unskilled individual over the longer term (when that individual can be expected to go through periods of employment and unemployment). An unambiguously appealing policy is one that – simultaneously – lowers the unemployment rate, raises the unskilled wage rate, and lowers the effective tax rate – since all these measures make z higher. We focus on the effects of both the earned income tax credit and the employer employment subsidy below. The employment subsidy parameter does not directly enter the definition of z, but it has indirect effects through some of the other variables, since this policy does affect the wage rate, the unemployment rate, and (depending on how it is financed) the tax rate.

For the initial set of experiments, the number of unskilled individuals who choose to be in the labour force is fixed (at unity). As a result, the number of unskilled that are employed is one minus the unemployment rate. The number of citizens who are skilled is fixed as well, but the proportion that choose to work in the domestic economy is determined within the model. These individuals have the option of receiving the domestic skilled wage, r, and then paying tax rate, t, on that wage income, or of receiving an after-tax wage of r^* in the rest of the world. One of the equations in the model is $r(1 - t) = r^*$, which stipulates that once the domestic government sets the tax rate, the domestic skilled wage is determined by this equation. Since we are treating physical capital in exactly the same manner as workers with human capital (skilled labour), the same relationship that connects domestic and foreign skilled-labour wage rates pins down the domestic interest rate as well. In short, this relationship imposes the globalization constraint. The taxes that are nominally levied on the "rich" (owners of all mobile factors of production) are passed on to the "poor" (immobile unskilled individuals), since increases in the domestic tax rate simply raise the pre-tax rates of return received by the "rich" mobile factor owners. Note that, because of this perfect-mobility specification, it is *impossible* for any domestic government policy to affect the skilled individuals or the capitalists at all. One of two things happens whenever the incomes of these individuals are threatened. Either these individuals are "compensated" by the adjustment in their pre-tax return that is just necessary (if they stay employing their factor domestically), or they move without cost to the rest of the world (and receive there exactly what they had been receiving domestically). As a result, we know that these individuals are indifferent to all policies

we examine. That is why we can focus exclusively on the policy-induced effect on the average income of the unskilled individuals (the *z* measure discussed above).

Finally, the government budget constraint states that the uses of government funds (spending on programs that have no direct effect on labour markets, the employment subsidy payments, and employment insurance) equal the sources of government funds (the net-of-credit taxes on all earned incomes). Only the unskilled qualify for the tax credit, and it is only when firms hire the unskilled that they qualify for the employment subsidy. Initially, it is assumed that there is no working income tax benefit and no employment subsidy, but that there is an untaxed employment insurance payment given to the unemployed – equal to one-third of the pre-tax unskilled wage. The ratio of other program spending to *GDP* is set at 20%, and the proportional income tax rate is set to balance the budget.

3. A Framework for Evaluating a Narrowly-Targeted Earned-Income-Tax-Credit Policy

The second set of simulations that we report focuses specifically on a personal income tax cut that is offered to particularly poor households. Several alterations to the model are made to reflect the fact that the government's Working Income Tax Benefit is a narrowly targeted program. Specifically, with the new policy, if a family receives more than about $15,000 annually, the size of that household's tax break begins to be phased out. Once an annual income of about $22,000 is reached the household is too "rich" to qualify at all. Clearly, this initiative is not designed to affect 50% of the population. Further, at these low income levels, it is likely that many individuals would be earning no

more than the minimum wage. With a binding minimum wage, firms cannot choose the profit-maximizing wage. Thus, for the second set of reported simulations, we alter the model so that the minimum-wage constraint is binding for all the "poor." We assume that this targeted group represents only 10%, not 50% of the population, and – to reflect the estimated Canadian Lorenz curve – we assume that this bottom 10% of the population receives 2% of national income.

A second alteration to the model concerns the labour-force-participation behaviour of the poor. In our assessment of widely available low-income-support programs, we simplified the model by assuming that the aggregate wage elasticity of labour supply is zero. This is an entirely reasonable assumption on empirical grounds. But for an analysis that restricts the low-income group to the very poor, the zero labour-supply elasticity assumption is less appealing. Indeed, Finance Canada is hoping that some individuals may be tempted to join the labour force as a result of the Working Income Tax Benefit. To allow for this possibility, we consider values for the labour supply elasticity that range between zero and one in the simulations that concern the targeted-to-very-poor earned income tax credit. With a variable participation rate (that is, when p is not fixed at unity), the index of the poor's material welfare becomes $v = pz$.

The final alteration in the model that is used to simulate the government's limited initiative is that it is financed either by an increase in the tax on the rich, or by a cut in government spending. In either case, the amount involved involves the proportion of *GDP* that reflects the funding the federal government has actually earmarked for the Working Income Tax Benefit.

In the simulations it is assumed that *all* poor individuals benefit (and to the same extent) from the program. As noted above, the actual policy involves both phase-in and phase-out ranges of income, within which individuals and families receive only partial benefit. Unfortunately, if the model were adjusted to allow for this feature in a thorough manner, we would have to allow for an entire range of differing abilities within the low-skilled portion of the population. Such a re-specification would raise the level of complexity of the analysis, and detract from our intended focus – which is on open-economy macroeconomic effects. Existing research has focused on partial-equilibrium analyses of labour market behaviour, and on the associated micro empirical work. Our strategy has been to highlight some important issues that have received less attention, and to accomplish this goal in a transparent fashion we need to use a highly aggregative framework. Nevertheless, we have constructed the model in a way that makes heterogeneity across agents of limited concern.

The worker-effort function (which is taken directly from Summers (1988)) and the labour-force-participation-rate function both involve a constant-elasticity feature. This property implies that the *aggregate* labour-supply responses are the *same no matter how* the individual responses are distributed across individual poor households. As a result, even though we have not allowed some individuals to have their tax breaks reduced through phase-in or phase-out considerations, the simulations still provide the appropriate *aggregate* outcomes. This is true as long as we impose (as we do) that the government in the model provides the *same total amount* of tax relief as does the actual government policy, and as long as these constant-elasticity functional forms reflect actual behaviour. Of course, despite the fact that these functional forms are entirely standard, it

is possible that they do not. But even if this is the case, we know the direction of the bias that might be involved in our simulations, since they would then represent the maximum possible effects of the policy. And if our functional form assumptions are reasonably applicable to the "real world," this "upward bias" in our estimated effects is likely to be quite small.

Some upward bias may remain, however, since we have assumed a 100% "take-up" rate among potential beneficiaries of the policy. In actual fact, incomplete awareness of programs such as the Working Income Tax Benefit often results in less than a 100% utilization of the program by individuals. Our simulations involve the assumption that the government responds to this possibility by expanding the program so that all the designated funds are, in fact, spent. If this assumption about the government's response to incomplete take-up rates is accurate, then there is no reason to suspect a significant upward bias in our simulations.

4. Simulation Results: Broadly Available Low-Income Support Initiatives

As noted above, we discuss our results in two stages. We begin with the broadly based initiatives that are made available to all low-income individuals – assumed to be 50% of the population. In this setting, the emphasis is on comparing an earned income tax credit to alternative approaches to supporting the working poor. Following this discussion, in section 5, we focus on a Working Income Tax Benefit that is targeted to a much smaller, quite poor, segment of the population.

For the broadly available initiatives, five simulations are reported. First, we introduce an earned income tax credit for the unskilled – as big an initiative that is

possible after the overall income tax rate (that is applied to earned incomes, net of any allowed credit, of all factor owners) is raised by one percentage point. Second, we introduce an employer employment subsidy for firms that hire unskilled individuals – again, as much as can be done with an increase in the general income tax rate of one percentage point.

Some readers may prefer to consider financing these initiatives by cutting other program spending, or by using some of the room in the budget that would emerge as the government's interest payment obligations shrink following a policy of debt reduction. For example, the Canadian government is expected to receive a "fiscal dividend" of about 4% of *GDP* as the debt-to-*GDP* ratio falls from its peak in the early 1990s to its 20%-by-2020 target. Still other readers may think that it might be better to dispense with either initiative, and simply use such new room in the government's budget to finance a general tax cut. Such a policy would lead to more capital and skilled labour entering the country. With more complementary factors of production to work with, unskilled labour would be more productive, so pre-tax wages would increase. As a result, the unskilled would benefit, and perhaps by an even greater amount than with either an earned income tax credit or an employment subsidy. To ensure that we present results that will be of interest to readers who have any of these possible prior views, we report three further simulations. We cut other programs by one percentage point of *GDP*, and use the proceeds to finance three possible initiatives – the creation of an earned income tax credit, the creation of an employment subsidy, or the provision of a general tax cut.

As explained above, none of the policies affect the net position of the "rich" (the skilled individuals or the capitalists). Thus, we focus on the material welfare of the

"poor" – specifically four outcomes in each case: the effects of the policy on the unemployment rate, the unskilled worker wage rate, the income tax rate, and summary measure *z* (the average income of an unskilled individual). The outcomes for these four measures, for all five policy experiments, are reported in Table 1.

Table 1. Effects of Five Widely Available Low-Income Support Policies

Variable	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
unemployment rate	down by 1/10 of 1 pt	down by 1/6 of 1 pt	down by 1/6 of 1 pt	down by 1/4 of 1 pt	down by 1/20 of 1 pt
wage rate	down by 3%	up by 1 %	no change	up by 4%	up by 3%
tax rate	up by 1%-point	up by 1%-point	no change	no change	down by 1%-point
average income *z*	up by 1/14 of 1%	down by 1/12 of 1%	up by 4%	up by 4%	up by 4%

Policy 1	Earned income tax credit financed by 1%-point increase in the tax rate
Policy 2	Employment subsidy financed by 1%-point increase in the tax rate
Policy 3	Earned income tax credit financed by 1%-point cut in other spending
Policy 4	Employment subsidy financed by 1%-point cut in other spending
Policy 5	General income tax cut financed by 1%-point cut in other spending

The first thing readers will note is that the structural unemployment rate is reduced in all cases, by an amount ranging from one-twentieth of one percentage point to one-quarter of one percentage point. Given the purpose of these initiatives, this outcome is desirable, but the small magnitude may seem a bit discouraging.

More encouraging is the effect on the average income of an unskilled individual. In three of the five cases, this measure increases by 4 percent. It appears that there is

nothing to choose between the three initiatives on this score. What *is* important is whether the initiatives are financed by a tax increase or a spending cut. Tax increases hurt the unskilled both directly and indirectly. The indirect effect follows from the fact that tax increases induce skilled individuals and capitalists to shift their factors to employment opportunities outside the country. With less of these complementary factors to work with in the domestic economy, the unskilled are less productive, and this development puts downward pressure on their market wage. With the earned income tax credit, a 3 percent fall in wages results. Overall, with this policy, there are four competing effects on the economic welfare of the unskilled. They are helped by the lower unemployment rate and by the tax credit, but they are hurt by the lower pre-tax wage and by the higher tax rate to which the tax credit applies. The formal model is required to assess the relative magnitude of these four effects, and – as indicated in column 1 of Table 1 – we find that the four effects just about exactly cancel off. There is a very small rise in the average income measure of the unskilled, but for all intents and purposes, no noticeable change.

There are also competing effects with the employment subsidy. As Phelps has argued – other things equal – the subsidy *raises* the unskilled wage, so, in this case, we expect two favourable effects: higher wages and lower unemployment. But the unfavourable development – the higher tax rate – generates two undesirable outcomes. First, workers lose disposable income directly (through the higher tax), and – other things equal – there is downward pressure on their pre-tax wage (given that these individuals have less capital to work with). As already discussed, with the complementary inputs (skilled labour and physical capital) being less available (after the higher taxes have "pushed" some these factors out of the country) unskilled labour is less productive, so it

commands a lower wage. Phelps's analysis did not consider this indirect negative effect, since his "closed economy" analysis abstracts from this "globalization" constraint. We see, in the "Policy 2" column in Table 1, that this effect is important, but it is not the dominant one; on balance, the unskilled wage does rise – but by only a small amount (1 percent). As a result, the outcome which Phelps has stressed as an important feature of his proposal is much weaker than he expects it to be, and – overall – the average (after-tax) income level of the unskilled actually falls by a small amount. All in all, when financed by higher taxes, neither the earned income tax credit nor the employment subsidy receives any significant support from our analysis.

Readers may be puzzled as to why the average income of an unskilled individual falls slightly with the employment subsidy (Policy 2 in Table 1), while this summary measure increases slightly with the earned income tax credit (Policy 1 in Table 1). Given that the pre-tax wage rises more, and that the unemployment rate falls more, with the employment subsidy, why is it this policy that is slightly worse for the unskilled? This outcome emerges because the tax rate that applies with the employment subsidy, t, is bigger than the tax rate that confronts individuals who receive an earned income tax credit, $t(1 - c)$.

A different overall conclusion is warranted when the initiatives are financed by reallocating expenditures away from interest payments on the debt or from cutting other program spending (Policies 3, 4 and 5 in Table 1). In these cases, the average income of the unskilled measure rises by an impressive 4 percent. The main reason for this difference in results is that – in this case, with no increase in taxes – mobile capital is *not* induced to leave the country. Unskilled workers do not suffer the same loss in

productivity that was central to the earlier results, so in this case, their wages increase. In addition, a significant reduction in the unemployment rate accompanies both the earned income tax credit and the employment subsidy, so the analysis supports the proposition that either of these initiatives dominates a standard tax cut.

5. Simulation Results: A Narrowly Targeted Earned-Income-Tax-Credit Policy

We now focus on a tax cut for low-income individuals that is not so widely available. We consider an earned income tax credit that is limited to just the poorest 10% of the population, who work at minimum-wage levels of remuneration and receive just 2% of national income. These simulations are more relevant for evaluating actual government policy for two reasons. First, the policy in this version of the simulations is much more specifically targeted. Second, we examine a much smaller initiative – one that involves a commitment of funds that is equal to what the government will actually be spending on the Working Income Tax Benefit in a year's time.

Table 2. Effects of a Narrowly Targeted Earned Income Tax Credit in Four Settings

Variable	Setting 1	Setting 2	Setting 3	Setting 4
unemployment rate	down by 1/6 of 1 pt	down by 1/5 of 1 pt	down by 1/6 of 1 pt	down by 1/5 of 1 pt
average income *v*	up by 3.9%	up by 4.3%	up by 8.1%	up by 8.6%

Setting 1	financed by higher tax on rich; no change in labour-force participation
Setting 2	financed by cut in spending; no change in labour-force participation
Setting 3	financed by higher tax on rich; with change in labour-force participation
Setting 4	financed by cut in spending; with change in labour-force participation

We report four sets of outcomes in Table 2. There are two financing options (the tax break for the poor is financed either by a tax increase on the rich or by a cut in other program spending) and we report results both with and without a change in labour-force participation. With no change in labour force participation, and when the initiative is financed by a higher tax on the rich, we find that the earned income tax credit cuts the nation's unemployment rate by one-sixth of one percentage point, and it raises the average income of the poor households by 3.9%. Compared to the more widely available initiative financed by higher taxes that was discussed in section 4 (Policy 1 in Table 1), this effect on average income is certainly more substantial. And, as above, we find even more impressive results when the initiative is financed without a tax increase on the rich. In this case, without the loss in labour productivity stemming from some capital relocating to the rest of the world, the average income indicator for the poor rises by 4.3% (Setting 2 in Table 2). So the narrowly targeted Working Income Tax Benefit can be particularly helpful if it is financed out of the fiscal dividend that accompanies the ongoing debt reduction program.

Even more encouraging results emerge when we allow the policy to lead to increased labour-force participation. With a labour-supply elasticity of unity, the increase in a poor individual's average income is even bigger – over 8% (Settings 3 and 4 in Table 2). The bottom line is that there is strong support for this initiative when it is narrowly targeted. Readers may have expected this outcome, since targeting the initiative to just the very poor means smaller overall revenue needs, and a smaller increase in the tax on capital means less capital leaving the country. Further, with the minimum-wage constraint, the increased willingness to work cannot put downward pressure on the pre-

tax wage rate (so Phelps' main critique cannot apply). Nevertheless, these considerations are only two of the several effects that interact within the full macroeconomic framework, so detailed simulations were needed. It is reassuring that the results are consistent with existing partial-equilibrium analyses such as Eissa and Nichols (2005) and Neumark and Wascher (2007) – studies suggesting that important benefits for some particular low-income groups can be attributed to the earned income tax credit in the United States.

6. Conclusions

Overall, our analysis supports three conclusions. First, the government should finance its attack on the "welfare wall" by reserving some of the "fiscal dividend" for this initiative. Initially, it should decide how much of the new room in its budget (that is emerging as interest payments on the debt shrink) is to be devoted to attacking the "welfare wall." It should then declare that this part of the fiscal dividend is unavailable for spending increases in other areas, or for general tax cuts. Our second conclusion is that, as long as this bold earmarking of funds is imposed, *either* the earned income tax credit, *or* the alternative that Phelps prefers (employment subsidies) can be implemented – with essentially the same effects to be expected. The third conclusion that follows from our analysis is that – despite the modest size of the government's current commitment to the Working Income Tax Benefit – we can expect a worthwhile increase in the living standards of the targeted subset of the working poor.

Appendix

For readers who wish to experiment with extensions or sensitivity tests of our analysis, we list the specific equations in this Appendix. The production process is defined by a standard Cobb-Douglas relationship: $Y = A(qN)^{1-a} K^{a}$. Y, N and K refer to output, employment of unskilled individuals, and employment of broadly defined capital (skilled individuals and physical machines). The quality of unskilled labour, q, depends on worker effort, and this depends on how happy the worker is (compared to her outside option, z): $q = [(w(1-t(1-c)) - z)/z]^{d}$. w, t, c and d denote the unskilled-worker wage, the general income tax rate, the earned income tax credit rate, and the workers' propensity to "shirk" on the job. With no propensity to shirk (d = 0), there is no incentive for firms to offer wages higher than the market-clearing level, so there is no unemployment. As noted in the text, parameter d is set so that the model involves a sensible initial structural unemployment rate of 6 percent for the nation as a whole. As in Summers (1988), the outside option is a weighted average, since individuals may get another job after a separation, or they may become unemployed:
$z = (1-u)[w(1-t(1-c))] + ufw$. u and f are the unemployment rate and the "replacement rate" within the employment insurance system.

Without a minimum-wage constraint, profit maximization by firms leads to three relationships – that firms hire the two factors so that the marginal products equal the appropriate rental prices, and that they set the unskilled wage to their best advantage. As noted, this non-market clearing wage leads to unemployment among the unskilled. The relationships are: $(aY/K) = r$, $(1-a)Y/N = w(1-s)$ and
$u = [d(1-t(1-c))(1-s)]/[1-t(1-c)-f]$. The new notation, s, denotes the employment

subsidy rate. There is a fixed number of unskilled individuals (units chosen to equal unity). The proportion of these individuals who are in the labour force is *p*, so employment, *N*, equals $p(1-u)$. The participation rate depends on the after-tax wage: $p = (w(1-t(1-c)))^{e}$. We consider values for the labour-supply elasticity in the zero-to-one range $(0 \le e \le 1)$. The index of the poor's material welfare is $v = pz$. The supply relationship for the other (internationally mobile) factor was explained in the text: $r(1-t) = r^{*}$.

When the minimum-wage constraint binds, the unemployment-rate equation given in the previous paragraph is removed from the model. Employment is then determined by combining the exogenous minimum wage value with the labour-demand relationship.

The final equation in the model is the government budget constraint. For the results reported in Table 1, we have $t[wN(1-c) + rK] = fwu + swN + G$. This relationship states that tax revenue (which equals the tax rate times the taxable earnings of both factor owners) is used to finance the three expenditures (on employment insurance, employment subsidies and other programs, *G*). When formally solving the model, we divide this last equation through by *GDP* (*Y*), and then simplify by using several of the other relationships. $g = G/Y$ is then taken as a variable that can be lowered by one percentage point when we consider initiatives that are not financed by a tax increase.

To examine the effects of introducing either an earned income tax credit or an employment subsidy, the nine equations are solved to determine how *Y*, *N*, *K*, *u*, *w*, *r*, *q*, *z*

and either *c* or *s* respond to an assumed one-percentage point change in either *t* or *g* (*c* and *s* are assumed to be zero initially).

Some readers might object to our specification of the production process since it allows firms in the model to substitute one input for another with more ease than may be possible in reality. To examine this concern, we re-worked our analysis with a specification of technology that has been suggested by Thomas Moutos (Moutos and Scarth (2001)). In this alternative set up, which is a simplified version of the "O-ring" specification (Kremer (1993)), the production process involves a strict limit to how much firms can get along without skilled labour. Modern production operations seem to permit unskilled labour and physical capital to be substitutes for one another. For example, firms can use capital (robotics), or unskilled workers, but skilled workers are needed in either case (either to design and program the robots or to supervise the unskilled). Thus, following this "O-ring" approach, we specify that skilled labour is absolutely essential to production, while unskilled labour and physical capital can be substituted for one another with an elasticity of substitution equal to unity. This specification is consistent with what many analysts regard to be the essence of the modern economy – that it is "knowledge based." In this alternative specification, two relationships define the production process: $L = bY$ and $Y = A(qN)^{1-a}K^{a}$, where *L* denotes skilled labour, and *K* now refers to just physical capital. The factor demand functions for physical capital and unskilled labour are $(1-bx)(aY/K) = r$ and $(1-bx)((1-a)Y/N) = w(1-s),$ and the supply relationship for skilled individuals is $x(1-t) = x^{*},$ where *x* and *x** denote the domestic and foreign levels of the skilled wage rate. Finally, the revised government budget constraint is $t[wN(1-c) + rK + xL] = fwu + swN + G.$ When this model is calibrated to have the

same initial distribution of income as in the basic model, all results are very similar. Thus, our conclusions remain appropriate in the face of this sensitivity test.

When the focus shifts to a tax cut for a more targeted (smaller) group of low-income individuals, we define two different tax rates, so the government budget constraint is revised: $twN + hrK = fwu + swN + G$. We cut t by just the amount that involves the government losing 0.00067 of one percentage point of *GDP* from its revenue sources. We do so since the government has earmarked $1 billion annually to the Working Income Tax Benefit and *GDP* is roughly $1.5 trillion. As a result, these simulations are intended to reflect the actual government initiative. In the model, this revenue loss in financed in two ways (either by an increase in h (the income tax rate levied on the rich) or by a cut in the program spending rate, g, that involves the same revenue implications).

Calibration concerning income shares varies depending on whether the low-income support policies are broadly available or not. In the former case, as explained in the text, we set $a = 0.67$. To appreciate that this calibration is reasonable, it is useful to consider the equality between capital's marginal product and its market yield. With the pre-policy yield set at 12%, the $a = 0.67$ assumption implies that the capital/output ratio is 5.5. If capital referred to just physical capital, we would judge this ratio to be about double what is appropriate for the Canadian economy. But we follow Mankiw, Romer and Weil (1992) who assume a Cobb-Douglas exponent of one-third for both physical and human capital. Thus, our more broadly defined capital/output ratio should be double the usual number that is associated with just physical capital. Another way of appreciating the applicability of our calibration is to focus on unemployment. With

unemployment restricted to the poorer half of the population, $u = 0.12$ yields an entirely reasonable initial economy-wide unemployment rate of 6%. In the more targeted case, we focus on the fact that the poorest 10% of the Canadian population receives 2% of the income (quite appropriate – given estimates of the Canadian Lorenz curve). Thus, in this specification, we specify that $a = 0.98$ and $u = 0.60$ (so that, as in the other simulations, the initial economy-wide unemployment rate is 6%). Finally, in this minimum-wage case, the value of the initial unemployment rate does not pin down parameter d. To ensure that the assumed unemployment rate among the very poor is not too much above what would emerge if there were not a minimum wage, we set d equal to 0.3. Our results are not sensitive to changes in the assumed value of this parameter.

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