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ALTERNATIVES FOR RAISING LIVING STANDARDS

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Alternatives for Raising Living Standards

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Abstract

Given the fundamental goal of raising living standards in the longer term, much attention is paid to policies that can be expected to increase national saving. With respect to private saving, the mechanism is tax reform – a lower tax on interest income. The basic problem with this approach is that, for a given size of government, some other tax or transfer must be adjusted to finance the interest-tax cut. This fact may make it difficult to ensure that those with only labour income will share in the spoils. An alternative is to concentrate on public saving. Ultimately, deficit reduction makes possible lower taxes and/or higher transfer payments across the board. This reasoning suggests that debt reduction may be the more equitable government initiative. But there are other options such as investing in human capital and altering the population growth rate through immigration policy. The latter option is pursued in this paper. According to the standard neoclassical growth model, a lower population growth rate raises steady-state living standards, but things are more complicated in an optimization-based overlapping-generations context. This paper extends Blanchard's constant-planning-horizon model of disjoint agents to allow for retirement, a subset of the population that remains liquidity constrained, and various taxes and transfers – in a small open-economy setting. Tax reform, debt reduction and population growth policies are compared in an internally consistent manner. For each policy, both the immediate and steady-state effects are derived, and the present value of the entire time path for consumption between these two end-points is also analyzed (for all three policy initiatives). A calibrated version of the model is used to identify policy combinations that can deliver long-term gain *without* short-term pain, and without problems for the hand-to-mouth subset of the population.

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1. Introduction

With average living standards barely growing over the last twenty years, there is keen interest in measures which might raise living standards in the years to come. Two options currently receiving attention are tax reform and debt reduction. But with tax reform those without interest income can suffer, and with debt reduction those currently alive must make sacrifices for future generations. Is there any initiative that can avoid both these problems?

This paper pursues this question by examining a small open economy model which extends the Blanchard (1985)-Nielsen (1994) specification of disjoint overlapping generations with retirement. We compare tax reform, debt reduction and changes in immigration quotas as alternative means for raising living standards. We find that a package policy – involving both debt reduction and increased population growth – has the most appealing equity features.

2. The Model

The model is defined by the following equations:

$$\dot{c} = (r(1-t) - q - n)c - (p+z)(p+q)(k+b-a) + p(p+q)y(1-a)(1-t) \quad (1)$$
$$y = (p+z)(e^{-lp})(e^{-zl} - e^{-r(1-t)l})/(r(1-t)-z)(1-e^{-(z+p)l}) \quad (2)$$

$$s = (1-p)[(1-a)(1-t)+m] \quad (3)$$

$$\dot{a} = (r-n-z)a - 1 + (n+z+d)k + g + c + s \quad (4)$$

$$\dot{b} = d - (n+z)b \quad (5)$$

$$d = g + r(1-t)b - trk + (1-b)rta - t(1-a) + m \quad (6)$$

$$r + d = f'(k) = a/k \quad (7)$$

The supply of labour, L, is defined as $e^{zt}(1-e^{-(z+p)l})$; it is the population (which increases at rate z) times the proportion of the population that has not reached retirement (the bracketed term in this expression). Many variables in equations (1) through (7) stand for the ratio of each aggregate to the labour supply measured in efficiency units. For example, y = Y/qL where Y and q are real output and the efficiency of each unit of labour (which increases exogenously at the productivity growth rate n). The production function is Cobb-Douglas: $y = f(k) = \Omega k^{a}$, and the value for Ω is chosen so that the initial value for y is unity. This scaling allows the variables to be interpreted as ratios to GDP as well. The general list of variables is as follows; a dot above any variable indicates a time derivative.

a	foreign debt ratio
b	government debt ratio
c	consumption spending ratio for group 1

d	budget deficit ratio
g	government spending ratio
k	physical capital ratio
m	transfer payments ratio
n	productivity growth rate
p	probability of death
r	interest rate
s	consumption spending ratio for group 2
t	tax rate applied to interest income
z	population growth rate
α	capital's exponent in the Cobb-Douglas production function
β	proportion of foreign interest income that is taxed by domestic government
δ	capital's depreciation rate
λ	retirement age
π	proportion of the population in group 1
θ	rate of time preference for individuals in group 1
τ	tax rate applied to labour income.

Equations (1) and (2) constitute the consumption function for the individuals who make up "group 1." These individuals do not face any liquidity constraints. As in Blanchard (1985), each has an instantaneous utility function equal to the log of consumption, and she discounts the future at rate (p+θ). Government spending could be specified as an additional argument in the utility function; but since we keep program spending constant in all experiments this would make no difference. This consumption function is a fundamental part of the model since it governs how private agents react to policy initiatives and to demographic developments. For this reason, it is explained more fully than the other relationships.

To simplify exposition initially, we ignore taxes and transfer payments, and the fact that only proportion π of the population has a rate of time preference low enough to cause them to operate with a forward-looking plan (that is, be in group 1). In this case, aggregate human wealth at time t, H, is the sum of each individual's wage payments, W, added up over her working lifetime (as defined by index j), and then summed over all relevant individuals (as defined by the i index):

$$H(t) = \int_{t-l}^{t} \int_{t}^{l+i} We^{-(r+p)(j-t)} dj (p+z) e^{-p(t-i)+zi} di \, .$$

Reversing the order of integration in this definition,

$$H(t) = \int_{t}^{t+l} \left[\int_{j-l}^{t} (p+z) e^{-p(t-i)+zi} di \right] We^{-(r+p)(j-t)} dj$$

$$= \int_{t}^{t+l} We^{zt}(1-e^{-(z+p)(t-j+l)})e^{-(r+p)(j-t)}dj\ .$$

Applying Liebniz's formula to this last expression, we have:

$$\dot{H} = (r+p+z)H - W(1-e^{-(p+z)l})e^{zt} + W(p+z)(e^{-zl} - e^{-rl})e^{zt-pl}\ /(r-z)\ .$$

We now add both interest and wage tax rates, t and τ respectively, transfer payments, M, and the fact that this theory only applies to proportion π of the population. (This group receives all the interest income and proportion π of the wage income and transfer payments. Group 2 individuals never save; as a result, they receive only the remainder of the wage income and transfer payments, and they consume this entire amount each period.) The corresponding human wealth accumulation identity for group 1 is:

$$\dot{H} = (r(1-t)+p+z)H - pW(1-t)(1-e^{-(p+z)l})e^{zt}$$

$$+p[W(1-t)(p+z)(e^{-zl} - e^{-rl})e^{zt-pl}\ /(r(1-t)-z)] - pMe^{zt}\ .$$

The accumulation identity for aggregate non-human wealth, V, is standard:

$$\dot{V} = r(1-t)V + pWL(1-t) + pMe^{zt} - C\ .$$

As already noted, to achieve a model which is stationary in full equilibrium, these identities are re-expressed in terms of variables which are ratios of each aggregate to the labour supply measured in efficiency terms. For example, consumption spending by group 1 households, c, equals C/qL where q is the efficiency of each unit of labour ($q = e^{nt}$) and L is the quantity of labour ($L = e^{zt}(1-e^{-(z+p)l})$). Thus, with w = W/q = (1-α), h = H/qL, v = V/qL and m = M/q$(1-e^{-(z+p)l})$, the accumulation identities become:

$$\dot{h} = (r(1-t)+p-n)h - pw(1-t)$$

$$+p[w(1-t)(p+z)(e^{-zl} - e^{-rl})e^{-pl}\ /(r(1-t)-z)] - pm\text{ , and}$$

$$\dot{v} = (r(1-t)-n-z)v + pw(1-t) + pm - c\ .$$

These last versions of the accumulation identities, with (1-α) replacing w, are substituted into the time derivative of the aggregate consumption function for group 1 individuals,

$$c = (p+q)(v+h)\ .$$

The results are equations (1) and (2) in the listing of the macro model above.

Since Blanchard's generalization of the representative agent formulation is familiar, we limit our interpretation of household behaviour to agents' reactions to demographic changes. Intuition concerning such events can best be appreciated by focusing on the steady-state expression for the per-capita human wealth of group 1 – which is the following total times proportion π:

$$[W(1-t)/(r(1-t)+p)][(1-e^{-(z+p)l})-(p+z)(e^{-pl})(e^{-zl}-e^{-r(1-t)l})/(r(1-t)-z)]$$

$$+M/(r(1-t)+p)\,. \qquad (8)$$

Demographics are embedded in parameters *p*, l and *z*. First, if agents never die (*p* = 0), all three parameters disappear, and the model reduces to the familiar one involving an infinitely lived representative agent. Second, with a positive death probability but no retirement, there is only one revision to the human wealth expression; the wage stream is discounted at a higher rate and the model coincides with Blanchard's (1985) specification. Finally, with finite lives and retirement (*p* > 0 and l less than infinity) as in Nielsen (1994), and with population growth (*z* > 0, an extension in this paper) all the demographic parameters affect human wealth.

Consider first the retirement age. The bigger is l, the larger is the proportion of the population that is working at each point in time, so the bigger is human wealth. (This accounts for the first λ entry in expression (8).) There is also an effect operating at the individual level. The older is the retirement age, the longer is the proportion of life that a person is working, so the smaller is the reduction in the value of the wage stream that needs to be made to properly specify human wealth. (This accounts for the remaining two λ terms in (8).) Scarth and Jackson (1997) have examined changes in the retirement age in a simplified version of this model.

Focus now on the death probability. A higher p means that the population is younger than otherwise, so the labour force is a higher proportion of the population and human wealth is higher. (This reasoning accounts for the first p in the numerator of expression (8).) In addition, there are two effects operating at the individual level. First, with the average individual being younger, she can expect to receive wage income for a longer proportion of her life. The bigger is p, the more important this effect is, and it is captured by the other two p entries in the numerator of expression (8). The second individual effect is that agents discount the future more heavily when the death probability is high, as noted earlier. Other things equal, this effect lowers human wealth. This effect is included via the p terms in the denominators of each part of expression (8).

Finally we consider the impact of more rapid population growth. One implication of a more rapid influx of newborns is that it raises the labour force as a proportion of the population. This dimension is captured by the first z term in expression (8). A second implication of a large flow of new entrants is that is that there is a larger proportion of the population which has a longer time to receive wage income before retirement. A higher z makes this effect more important, both directly and because it lowers the discount factor involved in calculating the value of the income stream. These effects are included via the other three z terms in expression (8). There is one additional causal mechanism through which a higher value for z affects human wealth. In the steady state, the government budget deficit ratio is proportional to the debt ratio: $d = (n+z)b$. If z rises and b is kept constant, the government must increase its annual deficit. Since we take transfer payments to individuals as the residually determined item in the government budget, the higher z implies a higher value for M. Thus, indirectly, the final z effect is included in expression (8) via the M term. Clearly, a change in the population growth rate has a much more complicated set of effects in this optimization-based overlapping generations setting, than it does in the Solow (1956) growth model. One purpose of this paper is to investigate the magnitude of the net effect of these several avenues of influence.

A brief account of the remaining equations ((3) through (7)) is now given. Equation (3) defines spending by the group 2 households who live hand-to-mouth. These individuals spend all of their after-wage-tax labour income and transfer payments. Equations (4) and (5) describe the evolution of foreign and government debt. Foreign debt increases whenever interest payments on the pre-existing foreign debt exceed the country's net exports, and the government debt ratio increases whenever the deficit ratio exceeds the GDP growth rate times the pre-existing debt ratio.

Equation (6) defines the government budget deficit ratio – the excess of government spending over tax revenue. The government spends on direct purchases, net interest payments on the outstanding debt, and transfer payments. Revenue is derived from interest-income and wage taxation. Only amount (k-a) of the physical capital that is employed within the country is domestically owned. β is a parameter which permits consideration of alternative foreign tax agreements. If $\beta = 1$, it is assumed that the government collects tax on all the interest income that is generated within the country. In effect, the government levies a withholding tax on foreigners that is equal to the tax that is levied on domestic residents. If $\beta = 0$, on the other hand, there is no withholding tax, and the government taxes only domestic residents. It is difficult to be precise concerning what value of β that might best reflect reality. In Canada, for example, foreign interest income is taxed differently depending on whether it is individual income or corporate profits. There is a 25 percent tax rate on dividends (that is reduced to 5 percent for countries with tax treaties). Foreign corporations pay the same tax rate as domestic firms and, when not waived by treaty, are liable for an additional tax of 25 percent on after-normal-corporate-tax earnings. Since the bulk of foreign "interest" income is earned in this corporate form, it may be that the tax on this income is on a par with that levied on domestic residents. This reasoning suggests that, as a first approximation, a value of unity for β may be appropriate. Nevertheless, we report results for both $\beta = 1$ and $\beta = 0$. In all policy experiments, the level of transfer payments adjusts to keep equation (6) satisfied; the tax rates and the foreign tax arrangements are exogenous.

Key assumptions concerning physical capital are specified in equation (7). Adjustment costs are ignored so capital is hired up to the point where its marginal product equals the rental cost. Supply is perfectly elastic, so the interest rate is exogenously determined in the rest of the world.

The model is used to explore three government policies. We compare a once-for-all reduction in the interest-income tax rate, a once-for-all reduction in the deficit ratio, and a once-for-all increase in the population growth rate. In all cases the level of government transfer payments adjusts as an endogenous variable. The purpose of the model is to allow an internally consistent comparison across these three alternative initiatives. The model is a particularly useful vehicle for this investigation because the entire time path for consumption between full equilibria is readily calculated. For example, we do not have to restrict our attention to the long-term gain that accompanies debt reduction. We can also derive the short-term pain, and the entire time path for consumption for both groups 1 and 2. The model is detailed enough to offer useful insights on these central policy questions, yet it is straightforward to understand, so that readers do not have to accept numerical results on faith.

3. Policy Analysis

The model is analyzed by focusing on a set of three differential equations in a, b and c; perfect capital mobility keeps k fixed. To achieve this more compact representation of the system, equations (2), (3) and (6) are used to eliminate ψ, s and m by substitution. After taking a total differential of the remaining relationships, the model can be represented as follows:

$$\begin{bmatrix} d\dot{b} & d\dot{a} & d\dot{c} \end{bmatrix}' = A\begin{bmatrix} db & da & dc \end{bmatrix}' + B\begin{bmatrix} dd & dz & dt \end{bmatrix}' \tag{9}$$

$$A = \begin{bmatrix} -(n+z) & 0 & 0 \\ -r(1-p)(1-t) & (r-n-z-(1-b)rt(1-p)) & 1 \\ -(p+q)(p+z) & (p+q)(p+z) & (r(1-t)-q-n) \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & -b & 0 \\ (1-p) & k-(1-b)a & r(1-p)(b+k-(1-b)a) \\ 0 & x_1 & x_2 \end{bmatrix}$$

$$x_1 = (p+q)[[p(1-a)(1-t)\{e^{-pl}[e^{-zl} - e^{-r(1-t)l})(1-(1+l(p+z)e^{-(p+z)l})$$

$$-l(p+z)e^{-(p+z)l}] + y(1-e^{-(p+z)l})\}/(r(1-t)-z)(1-e^{-(p+z)l})] + (k+b-a)]$$

$$x_2 = [[pr(p+q)(p+z)(1-a)(1-t)e^{-pl}(e^{-zl} - (1+l(r(1-t)-z))e^{-r(1-t)l})]/$$

$$(r(1-t)-z)^2(1-e^{-(p+z)l})] - rc$$

With two variables that are predetermined at each point in time (a and b), and one, c, that can jump, unique convergence to full equilibrium requires that two of the underlying characteristic roots be negative, and that the other be positive. Since the determinant of matrix A is the product of these three eigenvalues, it must be positive, and we calibrate the model accordingly. In fact, the full three-equation system is only needed for the debt-reduction experiment. In that case, we focus on a 50-percentage-point drop in the debt ratio, b, achieved by cutting the deficit ratio, d, by (.5/(n+z)) once-for-all and waiting for the debt ratio to reach its target value gradually as time passes. For the other two policy initiatives – a cut in the interest tax rate and an increase in the rate of population growth – the government debt ratio is kept constant so the first of the three differential equations in (9) is not involved. In those case, the system's two eigenvalues must have opposite signs.

It is left for the reader to use Cramer's rule and equations (9) to verify the full-equilibrium results that are reported below. The method used to derive the impact-period effects and the present value of the entire sequence of changes in consumption between full equilibria may be less familiar, however, so a brief sketch of that procedure is now given.

In the cases involving just two differential equations, the impact effects are determined by the magnitude of the jump on to the saddle path in a two-dimensional phase diagram. Using a zero subscript to denote the initial jump and an asterisk to indicate full equilibrium, the equation of the saddle path is

$$c_0 = c^* + f(a_0 - a^*) . \qquad (10)$$

As explained in Scarth (1996), both the slope of this saddle path, parameter ϕ, and the negative eigenvalue – which defines the system's speed of adjustment once on the saddle path – can be are readily calculated from the bottom right-hand four elements in matrix A. The initial consumption effect can then be calculated; according to equation (10), this outcome is simply a weighted average of two full-equilibrium multipliers.

It is customary in policy-oriented analysis to calculate the present value of the entire set of changes in consumption that accompany any contemplated initiative. Since the market interest rate indicates the relative price at which the rest of the world permits citizens in this economy to transfer goods from one period to another, that interest rate is the appropriate discount factor to use in any hypothetical compensation measure of this sort. Focusing on group 1, total consumption at each point in time is given by

$$C = ce^{(n+z)t}(1 - e^{-(p+z)t}) .$$

The present value index concerns per-capita consumption, so we measure

$$PV = \int_0^{\infty} C_t e^{-(r+z)t} dt = \int_0^{\infty} c_t (1 - e^{-(p+z)l})e^{-(r-n)t} dt$$

$$= [(r-n)c_0 - gc^*](1 - e^{-(p+z)l}) / (r-n)(r-n-g) , \qquad (11)$$

where γ is the negative (stable) eigenvalue, so -γ is the system's speed of adjustment once on the saddle path. According to (11), as first noted by Diamond (1980), the present value of the entire time path of consumption effects – both favourable and unfavourable – can be calculated as a weighted average of the impact and full-equilibrium effects. The impact effect gets more weight, the higher is the net discount rate (r-n); the full-equilibrium effect gets more weight the faster is the economy's adjustment speed (-γ). Results for the tax-reform and immigration-policy experiments reported below are derived by differentiating (11) with respect to t and z.

An extension of these methods is required to analyze deficit and debt reduction. In that third-order case, the equation of the saddle path is

$$c_0 = c^* + \sigma_1(b_0 - b^*) + \sigma_2(a_0 - a^*).$$

Values for the slope parameters, the σ's, are solved from

$$[\sigma_1 \quad \sigma_2 \quad -1][-A + m_3 I] = [0 \quad 0 \quad 0],$$

where I is the identity matrix and m_3 is the positive eigenvalue. Once on the saddle path, the law of motion is

$$c_t = c^* + J_1 e^{m_1 t} + J_2 e^{m_2 t},$$

where m_1 and m_2 denote the two negative eigenvalues, and the J's represent jumps at the instant the policy is announced and implemented. After integration, the appropriate present value calculation for group 1 is

$$PV = (1 - e^{-(p+z)l})[(c^*/(r-n)) + (J_1/(r-n-m_1)) + J_2/(r-n-m_2))].$$

Changes in PV can be calculated from the total differential of this equation, the third equation in matrix system (9) – evaluated at time zero, the following equation, and its time derivative:

$$c_0 = c^* + J_1 + J_2.$$

Similar methods can be applied for individuals in group 2.

Despite the simplified and highly aggregative nature of the model, the expressions for many of the policy multipliers are messy. Except for several full-equilibrium outcomes, the sign of many multipliers is indeterminate. As a result, we calibrate the model so that it can apply to the Canadian economy, and illustrate the outcomes in numerical terms.

4. Calibration and Quantitative Assessment of Alternative Policies

Representative values for sixteen parameters are required for calibration. The results reported below involve the values listed in Table 1.

Given these parameter values, the government budget identities determine the other policy variables – the transfer payments ratio and the initial government debt ratio. Both the deficit and debt ratios (0.015 and 0.75) are a bit higher than actual federal Canadian outcomes in 1999. Some differences are unavoidable since the actual economy is not likely in its steady state, and we need to impose full equilibrium as an initial condition to have well-defined policy experiments. Sensitivity testing suggests that the results are very similar when the initial conditions involve noticeably smaller deficit and debt ratios.

Calibrations for all aggregative models of this sort are always a little strained by the requirement that the one interest rate must represent both the net marginal product of capital and the rate of return on risk-free government debt. And this is just one requirement. As just indicated, the selected parameter values must satisfy all steady-state restrictions that are part of this rather tight specification. To accomplish this, one parameter has to be chosen residually, and the time preference rate for group 1 households was selected in this regard. (No specific time preference rate is involved for the hand-to-mouth group; it is assumed that these individuals are sufficiently impatient that they never save.) Sensible initial ratios of total private consumption, investment and net exports to GDP (0.603, 0.224 and 0.0225 respectively) are implied by the parameter values in Table 1. Also, the initial ratio of foreign debt service obligations to GDP is reasonable: 0.0325. The assumption concerning the probability of death implies a life expectancy of 50 years – so the average individual dies at her retirement age. It is worth noting that individuals begin work at their time of birth, so for calibration, "birth" has to be interpreted as when people typically start work. When viewed in this light, the life expectancy parameter is quite appropriate. In addition to our parameter values being plausible when considered independently, it is reassuring to note that these selected values are similar to those assumed in related studies (such as Macklem (1993)). Furthermore, they satisfy all the conditions necessary to ensure saddle path stability. Finally, we have experimented with several sets of parameter values to verify that the results reported in Table 2 are truly representative.

Tax Reform

Initially, we consider the case in which foreigners are taxed as domestics. Cutting the tax on interest income induces households in group 1 to save more. As a result, this group's consumption falls initially – by 1.8 percent for a 2.5 percentage point cut in the interest tax rate. Through time, however, the higher saving allows this group to decrease its level of foreign indebtedness. The resulting higher level of non-human wealth makes higher consumption possible in the new steady state and living standards for this group eventually rise by 3.7 percent. It has been shown (for example, in Scarth (1996)) that this long-term gain dominates the short-term pain in present value terms – at least in a simpler model which abstracts from retirement and population growth *if* the private rate of time preference is used as the discount rate. This practice has been motivated by Calvo and Obstfeld's (1988) derivation of a time-consistent social welfare function that is suitable for Blanchard's model. But since this derivation has not been extended so that it can apply in this more general setting, and since applied policy debate appears to be conducted in hypothetical compensation terms – not with reference to social welfare functions – we restrict our attention to the PV measure derived earlier. This index falls by one-tenth of one percentage point with the interest tax cut. Thus, by including all members of group 1 – both those living initially and those to be born later – we can conclude that the tax reform proposal does not quite pass the present-value test.

Things are more discouraging for the hand-to-mouth group. With perfect capital mobility, the higher wealth achieved by group 1 does not come in the form of more capital employed within this country. Instead, a bigger proportion of that fixed amount of capital is domestically owned (but not by members of group 2). With no additional capital for domestic labour to work with, there is no increase in pre-tax/transfer living standards for hand-to-mouth households. These individuals lose – both initially and in full equilibrium – since the government has cut transfer payments to finance the interest-tax cut. The full-equilibrium loss for this group appears to be about 30 percent of the other group's gain.

The outcome is very different if foreign interest income is not taxed by the domestic government. In this case the shrinking foreign indebtedness which accompanies tax reform *does* have revenue implications. As more of the fixed capital stock is owned domestically, more of the interest income is taxed; other things equal, this permits an increase in transfer payments, so the liquidity-constrained group can benefit after all, as time passes. The magnitude of this effect is illustrated in Table 2. With this gradual increase in after-tax-and-transfer income, the hand-to-mouth group *gains* in the new steady state – an improvement in living standards of 3.9 percent, instead of a loss of 1.1 percent. In this case, the liquidity-constrained group gains more than the forward-looking group. It appears, then, that whether the benefits of tax reform "trickle down" or not depends very much on the international tax agreements. But since the appropriate value for β (for Canada) is closer to one than zero, the analysis suggests that maintaining a healthy skepticism concerning trickle down is warranted.

Debt Reduction

Canadians have witnessed a 50 percentage point increase in the federal debt ratio over the last quarter century. We have used the model to illustrate the benefits of reversing that development, and for this initiative, the results are not very dependent on the foreign tax arrangements. Comparing full equilibria, the benefit is an increase in living standards in the 3.5 to 3.8 percent range for group 1, and in the 3.1 to 4.5 percent range for group 2. On average, these results imply an increase in living standards in the 3.4 to 3.9 percent range. It is encouraging that these estimates are in line with other studies that involve much more elaborate models. For example, work at the Bank of Canada (Macklem, Rose and Tetlow, 1994) and at the Department of Finance (James, 1994) have reported steady-state increases in total consumption for this amount of debt reduction of 3.4 percent and 5.6 percent respectively. Our results appear to lie in between, and at the lower end of, these other estimates.

As suggested in the introduction, increasing national saving via a reduction in public dissaving may be more appealing than increasing private saving via tax reform – for the simple equity consideration that the hand-to-mouth group can share the full-equilibrium gains. The formal model evaluates this conjecture and provides additional details. First, the conjecture is very much supported if foreign interest income is taxed domestically – as it is, to a significant degree at least, in Canada – but not otherwise. But independent of this international tax arrangements issue, we see that the liquidity-constrained group suffers an initial drop in consumption that is more than twice that suffered by the group that is not so dependent on transfer payments. Finally, in present value terms, debt reduction does not quite "pay" for the forward-looking group, and it certainly does not pay for the hand-to-mouth group.

Our general conclusion is that debt reduction dominates tax reform when both aggregate efficiency and equity aspects are considered. With debt reduction, the liquidity-constrained group achieves long-term gains whatever are the international tax arrangements. But since there are some unappealing dimensions to the outcomes in both cases – especially the magnitude of the short-term pain for the hand-to-mouth group under debt reduction – it is worth pursuing other policy options.

Increased Population Growth

A reduction in the population growth rate is supported in the Solow growth model. Lower population growth means that less household saving is needed to keep the capital-labour ratio constant. As a result, part of that saving leads to capital accumulation, and – in the new steady state – higher living standards. Since our model is also an exogenous growth model, it is not surprising that a similar effect operates here. In particular, a slower population growth rate leads to a decrease in steady-state foreign indebtedness – the small open economy analogue of increased capital intensity. However, as already noted, there is an important difference when the increased saving lowers foreign debt service obligations instead of raising the capital-labour ratio. Without the latter effect, there is no direct benefit for those completely dependent on labour income. Benefits for this group occur only if transfer payments can be increased.

There are additional important differences between our model and Solow's. The present system involves optimization underpinnings, explicit consideration of retirement, forward-looking expectations, and the fact that variations in the population growth rate change the steady-state relationship between government deficits and debt (and so the government is forced to allow *some* fiscal outcome to change). These considerations, taken together with the discussion in section 2 concerning how the population growth rate affects so many things such as the labour-force participation rate, suggest that at least some aspects of this model's predictions may be quite different from those of the Solow model.

This expectation is certainly confirmed in Table 2. One difference is that the impact effect on living standards is in the opposite direction than is the steady-state outcome – a result which cannot occur in Solow's model. There is an element of similarity as well, however, since our steady-state outcome is consistent with the Solow analysis: an increase in the population growth rate lowers steady-state consumption for both groups if $\beta = 0$. The size of these impacts is striking. For group 1, with $\beta = 1$, the steady-state implication of a one-half percentage point increase in the population growth rate is a 3.5 percent reduction in living standards, while the impact-period gain is an increase of 6.0 percent. In present value terms, consumption increases by 3.1 percent, so the short-term gain more than makes up for the long-term pain. With $\beta = 1$, the hand-to-mouth group gains in both the short and long run – by a striking 5.3 percent. Especially with foreign interest income taxed domestically, it appears that this policy initiative scores well on both efficiency and equity criteria – as long as equity is assessed with reference to the two groups living at each point in time.

There is at least one remaining issue however – the inter-generational dimension of equity. This policy initiative redistributes living standards across generations – improving the lot of those living in the near term and decreasing that of those to be born later on. But since this redistribution is in the *opposite* direction than that involved with debt reduction (or tax reform), a policy package appears to be recommended. Table 2 suggests that all groups might benefit if – as a coordinated initiative – the government cut the deficit ratio *and* raised the population growth rate. The identification of this policy package – along with the order of magnitudes involved – represents one of the central payoffs of this analysis.

5. Conclusions

The purpose of this paper has been to compare – in an internally consistent manner – several broad policy alternatives for raising living standards. This has been accomplished within a framework which allows for both a serious treatment of demographic details and the micro-foundations that represent the prerequisite for acceptable work in applied macroeconomics. The model adds population growth, government debt, and liquidity-constrained households to Nielsen's extension of Blanchard's overlapping generations model. The model directs our attention to straightforward indicators of three important concepts: equity across groups at each point in time, equity across groups living at different points in time, and the present value of the net benefits for all groups taken together (a rough measure of efficiency in the hypothetical compensation tradition).

The calibrated version of the model appears to be reliable – in the sense that it provides similar answers to questions that have been pursued by other researchers. Given this reassurance, it is hoped that the whole set of results has some direct relevance to actual policy debate. We have concluded that, to avoid the uncertainty associated with not knowing how to model a complicated set of international tax arrangements in this highly aggregative setting, and how this uncertainty affects the model's support for tax reform, debt reduction can be said to dominate tax reform as a mechanism for stimulating national savings in an equitable manner. Further, we have identified a package policy – involving debt reduction and an increase in the immigration quota – as a way of spreading benefits to all generations.

It must be admitted, of course, that our model is highly simplified. Any major policy package would be debated at length before its implementation. Since our analysis has been restricted to initiatives which are unanticipated by agents, further work – which allows the policies to be anticipated to a significant degree – should be pursued. Also, there are other simplifications, such as no adjustment costs for physical capital, and no nominal rigidities in the short run, so the model cannot consider the possibility that cyclical unemployment could increase temporarily with a move toward larger immigration quotas. Finally, there are more general issues. The illustrated population-growth policy involves an increase in immigration of roughly 150,000 people annually. To relate well with the model, all of these new immigrants should be immediately ready for employment. Further, the model does not consider whether peoples' utility may be affected directly by increased immigration of this magnitude – that is, in a way that is beyond its impact on private consumption. But pursuit of these issues goes beyond the intended scope of this paper. The logical first step is a rigorous comparison of the potential payoffs which accompany broad policy alternatives – one which is executed in an integrated manner. It is hoped that the identification of a promising policy package – with appealing equity properties – is a sufficient contribution at this stage.

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Table 1. Model Calibration

r	interest rate	.065
n	productivity growth	.005
z	population growth	.015
π	proportion of population not liquidity constrained	0.8
λ	retirement age	50
p	probability of death	.02
θ	rate of time preference – group 1	.0424
a	initial foreign debt ratio	.5
k	capital-output ratio	2.8
α	capital's share of output	.3
β	proportion of foreign income taxed domestically	1 and 0
δ	capital's depreciation rate	.06
t	initial interest income tax rate	.2
τ	wage income tax rate	.2
g	program spending ratio	.15
d	initial deficit ratio	.015

Table 2. A Comparison of Policies

Outcome	With Full (β=1) and No (β=0) Taxation of Foreign Interest Income					
Policy	Eliminate 1/8th Of Interest Tax Revenue		Cut the Debt Ratio by 50 Percentage Points		Increase Population Growth by 0.5 Percentage Points	
	β=1	β=0	β=1	β=0	β=1	β=0
Group 1						
% Δ in Full-Eq'm Consumption	+3.7	+3.4	+3.8	3.5	-3.5	-2.6
% Δ in Initial Consumption	-1.8	-1.9	-0.8	-0.8	+6.0	+6.5
% Δ in PV	-0.1	-0.2	-0.5	-0.5	+3.1	+3.7
Group 2						
% Δ in Full-Eq'm Consumption	-1.1	+3.9	+3.1	+4.5	+5.3	-1.7
% Δ in Initial Consumption	-1.1	-1.0	-2.0	-2.0	+5.3	+5.3
% Δ in PV	-1.1	-0.7	-0.1	-0.9	+5.3	+4.7

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