Who bears the burden?

Tax Strategies to Reduce Long-term Debt in Italy: An overlapping generations model approach[1]

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Abstract

Since the financial crisis, many countries have particularly high public debt-to-GDP ratios. This imposes constraints on the public finances over the long run, which will have broad macroeconomic implications. Barring exceptional growth rates, financing and reducing these debts will likely involve some kind of fiscal squeeze, meaning some combination of higher taxes and/or lower public expenditure. The policy choices made will have consequences for the incentives to work and invest, and will have differing impacts across generations.

In this paper, we present an overlapping generations model calibrated for Italy, which currently has a debt-to-GDP ratio above 130%. We model a steady reduction in the debt level, during which time the outstanding debt must continue to be serviced. Our model incorporates seven adult generations (representing individuals aged 20-29 years old up to 80-89 years old), each of whom has a known earnings profile. The individual agents choose their levels of labour, consumption and savings so as optimise their lifetime utility. Data on labour is calibrated using the EUROMOD microsimulation model. We match the labour elasticities estimated using micro-data, to the more aggregated individual agents of our OLG model, producing our labour supply curve. This is one of the mechanisms through which a change in fiscal policy also changes incentives for the individuals. On the supply side, firms maximise profits generated from the production of a single good. Investment is determined by the availability of savings and by the demand for capital in the production function. Government collects revenues from consumption taxes, labour taxes and capital taxes and issues debt, which are used to finance spending on public consumption and transfer payments to the different generations.

As a policy simulation, we evaluate the reduction of the debt-to-GDP ratio to 60%, which is the upper limit set in the Stability and Growth Pact of the European Union. The reduction is achieved either through an increase in value-added tax or an increase in personal income tax, with the full reduction of the public debt-to-GDP ratio being achieved in 20 years. These simulations are first entered into EUROMOD to gauge carefully the impact by age group, which are then introduced into the OLG model. Our model estimates the key macro-variables including employment, investment and GDP over time. Crucially, it also estimates how income and wealth are affected across the generations.

Results from our stylised model show that key differences in how the choice of tax instrument impacts those currently employed during the period of high taxes, and those who are retired. A rise

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[1] **DISCLAIMER**: The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of any affiliated institution.

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in the wage tax rate naturally is not important for current retirees, and as such the current working population, especially those in their forties and fifties, face the largest fall in lifetime utility. In the case of the public debt being paid for through a rise in the consumption tax rate show that the burden is more broadly shared, with generations from those in their thirties to eighties in the first period of the higher tax rate experiencing a fall in their lifetime utility. In the long run, both simulations show a rise in lifetime utility (as debt service payments are greatly reduced), and that consumption is moved somewhat towards younger generations.

JEL Code: D58, D91, E62, H3, H63

Keywords: computable general equilibrium models, overlapping generation models, fiscal policy, sovereign debt

1 Introduction

Many countries in the EU face high level of public debt (relative to GDP), and the servicing of high public debt alone places a large burden on taxpayers. High levels of debt can also make the public finances more precarious as a need for additional borrowing (perhaps due to another temporary crisis) may not be readily met. Over the medium-term, it would desirable for many countries to consolidate their public debt levels. Indeed, all member states have agreed in principal to public debt-to-GDP ratio no higher than 60 percent as part of the Stability and Growth Pact. With many member states well above this ratio, a difficult transition period would be required. A rise in the government's primary balance (raising tax rates and/or lowering government expenditure) inevitably places a burden on at least some taxpayers and/or beneficiaries of government expenditure.

In this paper, we address the case of Italy, which at 131 percent, has one of the highest public debt-to-GDP ratios in the EU. We simulate reducing this figure to the Stability and Growth Pact limit of 60 percent. There are numerous ways in which this could be achieved. For the purposes of demonstration, we simulate a reduction purely through tax rises (maintaining the current level of government spending on services and transfers). The taxes rises will be either consumption taxes or labour taxes. Our interest is specifically on the generational impacts of the change.

In section 2, we present the overlapping generations model used to analyse the research question. Section 3 gives more details on the implementation of the simulations in the model. Section 4 presents the results, and section 5 offers some concluding remarks and directions for future work.

2 The Overlapping Generations (OLG) Model

The benefits of OLG models trace back to work by Allais (1947), Samuelson (1958) and Diamond (1965), who focused on more stylised models to highlight intergenerational aspects of economic policy.[3] A major step forward in the use of applied, computable OLG models came with the publication of *Dynamic Fiscal Policy* (Auerbach and Kotlikoff, 1987), which made full use of the newly available computing power to solve more complex and detailed models. Most applied OLG models

[3] For example, Samuelson (1958) was concerned with the determination of interest rates.

used today still recognise the Auerbach-Kotlikoff model as an important aspect of their heritage, despite the fact that such models have been extended and expanded across many dimensions since then (see Gorry and Hassett, 2013, for an overview of the impact of the Auerbach-Kotlikoff model and Diamond and Zodrow, 2013 for an overview of the tax policy analysis using overlapping generations models).

This explanation of the OLG model used here is split into the model structure (section 2.1), the data and calibration (section 2.2) and the baseline values (section 2.3).

2.1 OLG model: Structure

The OLG model we use for an applied analysis in this paper is the closed economy model for Italy, inspired by Auerbach and Kotlikoff (1987) and Merette and Georges (2010).[4]

In every period seven overlapping generations are alive: g20s, g30s, g40s, g50s, g60s, g70s and g80s, of which fist four are working and the last three are retired. Thus we are modelling individuals by decades, meaning that every single period in the model is equivalent to 10 years. Each individual enters the labour market at the age of 20, works until the age of 60,[5] then retires and at the end of age 89 he dies with certainty. At the beginning of age 20 the individual chooses his consumption level over the life cycle in order to maximize a CES type intertemporal utility function taking into account the lifetime endowments he has at his disposal. Since this is a perfect foresight model and individuals know the future the optimizing decision is made only once, at the beginning of the economic life of an individual.

$$U = \left[\frac{(Con_{t7,g1})^{1-\frac{1}{\sigma}}}{1+discr} + \frac{(Con_{t8,g2})^{1-\frac{1}{\sigma}}}{(1+discr)^2} + \frac{(Con_{t9,g3})^{1-\frac{1}{\sigma}}}{(1+discr)^3} + \ \dots \frac{(Con_{t13,g7})^{1-\frac{1}{\sigma}}}{(1+discr)^7} \right]^{\frac{\sigma}{\sigma-1}}$$

where: U – lifetime utility (time-separable), $Con_{t,g}$ – consumption level by generation at time t, $discr$ – discount rate, σ – intertemporal elasticity of substitution (assumed as 1.5 in the model)

The dynamic budget constraint makes distinction between the labour income, capital income, old-age pensions, other than pensions social benefits and social benefits in kind. In addition, the consumer is receiving the lump-sum tax-transfer from the government.

$$\begin{gathered}(1+ctxr) * Con_{t,g} + \Delta Ast_{t+1,g+1} = \\ (1-wtxr-contr) * Wage_t * Lab_t * EP_g + rint * (1-ktxr) * Ast_{t,g} \\ +(1-wtxr) * Pens_{t,g} + OthSocBen_{t,g} + SocBenKind_{t,g} + Lump\_g_{t,g}\end{gathered}$$

where: $ctxr$ – consumption tax rate, $Ast_{t,g}$ – assets by generation at time t, $wtxr$ – labour income tax rate, $contr$ – social contribution rate, $Wage_t$ – wage index at time t (equal to one in the base case), Lab_t – scaling factor at time t (correcting the difference between observed labour compensation and aggregated labour earnings on the basis of the earnings profile), EP_g – earnings profile through the life cycle, $rint$ – real interest rate, $ktxr$ – capital tax rate, $Pens_{t,g}$ – old-age pension benefit (average for generation) at time t, $OthSocBen_{t,g}$ – social benefit other than old-age pensions (average for generation) at time t, $SocBenKind_{t,g}$ – social benefit in kind (average for generation) at time t, $Lump\_g_{t,g}$ – lump-sum tax-transfer by generation at time t, Δ – first difference operator; other variables as above.

[4] Although Merette and Georges (2010) model is global one and our model is a single economy model, the remaining structure is very similar.

[5] The effective age of retirement for Italy in 2014 was 62.

Labour supply is fixed at the base year level. Effective labour supply takes into account the individual's age-dependent earning profiles which are defined as a cubic function of age.

$$Lsup_t = \sum_g \left(Pop_{t,g} * Lab_t * EP_g\right)$$

where: $Lsup_t$ – effective labour supply at time t, $Pop_{t,g}$ – population of generation g at time t; other variables as above.

As a result of the intertemporal utility maximization under the abovementioned household budget constraint the optimal consumption path can be determined (the Euler equation) as follows:

$$\frac{Con_{t+1,g+1}}{Con_{t,g}} = \left[\left(\frac{1 + rint_{t+1}(1 - ktxr)}{1 + discr}\right)\left(\frac{1 + ctxr_t}{1 + ctxr_{t+1}}\right)\right]^{\sigma}.$$

Old-age pension benefits ($Pens_{t,gr}$) are proportional to the lifetime labour earnings of the last working generation (EP_{gwl}) and the fraction coefficient ($bnfr$) is defined by a pension replacement rate that is calculated based on the Italian data for 2014.

$$Pens_{t,gr} = bnfr * WLdem_t * Lab_t * EP_{gwl}$$

Pension expenditures are covered by the social contributions collected from the labour income of working generations.

$$\sum_{gr} \left(Pop_{t,gr} * Pens_{t,gr}\right) = contr_t * \sum_g \left(Pop_{t,g} * WLdem_t * Lab_t * EP_g\right)$$

where $Pop_{t,gr}$ is population of retired persons; other variables as above.

On the supply side, firms maximise profits generated from the production of a single good. Government collects revenues from taxes on consumption, labour and capital which are used to finance spending on public consumption and transfer payments to different generations. The production technology is described by a Cobb-Douglas function.

$$Y_t = A_t * Kdem_t^{\propto} * Ldem_t^{(1-\propto)}$$

where Y_t – output at time t, A_t – scaling parameter for production (total factor productivity) at time t, $Kdem_t$ – capital demand by firm at time t, $Ldem_t$ – labour demand by firm at time t and $\propto$ - share of capital in the output.

As a result of the profit maximization problem given the above production technology frontier, formulas for factor demands are as follows:

$$Kdem_t * Rent_t = \propto * Y_t * PY_t$$

$$Ldem_t * WLdem_t = (1 - \propto) * Y_t * PY_t$$

where PY_t – producer's price index, other variables as above.

The rental price for capital ($Rent0$) is calculated as:

$$Rent0 = Rint0 - (1 - depr0)$$

where $Rint0 = 1 + rint0$.

The evolution of the capital is determined using the standard law of motion formula:

$$Kstock_{t+1} = Inv_t + (1 - depr) * Kstock_t$$

where $Kstock_t$ – stock of physical capital at time t, Inv_t – investment at time t; other variables as above.

Government collects revenues from taxes on consumption, labour and capital which are used to finance spending on public consumption, debt servicing and transfer payments to different generations. The government budget might be balanced every period or intertemporally. To close the gap between revenues and expenditures that are captured in the model, the lump-sum tax-transfer variable is introduced. This is described with the following equation:

$$\sum_g \{Pop_{t,g} * [(wtxr + contr) * WLdem_t * Lab_t * EP_g + ctxr * Con_{t,g} + ktxr * rint * Ast_{t,g}]\} \\ + \Delta Bond_{t+1} = GovC_t + rint * Bond_t + \\ + \sum_g \{Pop_{t,g} * (Pens_{t,g} + OthSocBnf_{t,g} + SocBnfKind_{t,g} - Lump\_g_{t,g})\}$$

where: $Lump_t$ – lump-sum tax-transfer at time t, $\Delta Bond_{t+1}$ – change in public debt from time *t+1* to time t, $GovC_t$ – government consumption at time t, $Bond_t$ – public debt at time t; other variable as above.

Since OLG model is a general equilibrium model, all markets must clear. On the goods market output must be equal to aggregate demand (domestic and foreign). The identity is as follows:

$$Y_t = \sum_g \{Pop_{t,g} * Con_{t,g}\} + Inv_t + GovC_t + Exp_t - Imp_t$$

where: Exp_t – export at time t (exogenous), Imp_t – import at time s; other variables as above.

On the labour market, total labour supply must be equal to labour demand by firm:

$$Lsup_t = Ldem_t.$$

Similarly, total capital stock must be equal to capital demand by firm:

$$Kstock_t = Kdem_t.$$

Equilibrium on the capital market requires that total assets be equal to physical capital, government bonds and foreign assets:

$$\sum_g \{Pop_{t+1,g+1} * Ast_{t+1,g+1}\} = Kstock_{t+1} + Bond_{t+1} + \frac{(Imp_{t+1} - Exp_{t+1})}{rint_{t+1}}$$

where $\frac{(Imp_{t+1} - Exp_{t+1})}{rint_{t+1}}$ defines foreign assets of Italy.

We assume perfect substitution between physical capital and government bonds meaning that the interest rates for these two types of assets are equal.

2.2 OLG model: Data and calibration

We use World Input Output Database (WIOD) data accompanied with detailed EUROSTAT data for general government accounts. Consistent with the WIOD 2016 release, the base year in our model is 2014. Since the Socioeconomic Accounts data (SEA) 2016 release were not available at the time the paper has been written, we use KLEMS data for the value added decomposition as well as for calculation of the implied depreciation rate for physical capital in Italy in 2014. For population age composition we use United Nations data.

The model is calibrated under the steady-state assumption. We first assume steady-state interest rate ($rint0$) at 3.5% in annual terms (40.8% for a decade). We then calculate implied initial capital stock ($Kstock0$) in the base year as in Rasmussen and Rutherford (2004) and Paltsev (2004), based on the calculated depreciation rate ($depr0$; 4.4% annually) and data on capital compensation ($Capcomp0$):

$$Kstock0 = \frac{Capcomp0}{rint0 + depr0}$$

Then we calculate the implied investment according to the formula ($gpop0$ is assumed steady-state growth of the economy):

$$Inv0 = (gpop0 + depr0) * Kstock0$$

As the so calculated investment value differs from the actual investment value for Italy in 2014 we adjusted the aggregate consumption accordingly to keep the aggregate demand-aggregate supply balance.

After the formation side of the economy has been calibrated we move to the calibration of parameters describing the consumer behaviour. To this end we jointly determine consumption by generation ($Con0_g$), assets by generation ($Ast0_g$), interest rate ($rint0$), discount rate ($discr0$), rental price for capital ($Rent0$), and the lump-sum tax-transfer ($lump0$) which is needed to provide the balanced government budget.[6] These variables are determined by the similar equations as in the model (see section 2.2.2), the only difference being the lack of time dimension here since it is base year values calibration.

The labour income profiles are calibrated consistently with EUROMOD EU-SILC data for 2014 (see, for example, Sutherland, 2007, for an overview of the EUROMOD model). The consumption profiles are at this stage simulated by the model as described above, but with future model developments they will be calibrated based on the EUROMOD model micro-data.[7]

On the government side we capture 3 types of taxes: consumption tax (mainly VAT tax), labour income tax (mainly PIT) and capital taxes (mainly CIT) as well as social contributions. On the expenditure side we cover government expenditures on goods and services (government consumption), old-age pension expenditures, social benefits other than old-age pensions and social benefits in kind. The revenue side covers ca. 81% of actual general government revenues and ca. 92% of expenditures. In calibration we keep the value of public debt fixed at the 2014 level,[8] meaning that the adjustment variable to ensure the balanced government budget is the abovementioned lump-sum tax-transfer ($lump$).

[6] As we are not covering all general government revenues and expenditures, this is not exactly equal to the general government deficit.
[7] Including exogenous consumption profiles into the OLG model requires some changes in the calibration procedure, like for example time-varying endogenous discount rates – see Rasmussen and Rutherford (2004).
[8] To keep the consistency of the flow-stock relations, we divide the public debt value of 2014 by 10, i.e. the number of years equivalent to a single period in the model.

In Table 2.1 we provide base year values for calibration.

Table 1: Base year calibration values

<table>
<tr><th>Parameter</th><th>Description</th><th>Value in model period (10-year)</th><th>Value on annual basis</th></tr>
<tr><td>rint0</td><td>Real interest rate</td><td>40.8%</td><td>3.5%</td></tr>
<tr><td>depr0</td><td>Depreciation rate</td><td>36.5%</td><td>4.4%</td></tr>
<tr><td>Rent0</td><td>Real rental price for capital</td><td>77.3%</td><td>5.9%</td></tr>
<tr><td>discr0</td><td>Discount rate</td><td>26.8%</td><td>2.4%</td></tr>
<tr><td>bnfr0</td><td>Replacement ratio for pensions</td><td>33.9%</td><td></td></tr>
<tr><td>contr0</td><td>Social contribution rate</td><td colspan="2">21.1%</td></tr>
<tr><td>ctxr0</td><td>Consumption tax rate</td><td colspan="2">21.7%</td></tr>
<tr><td>wtxr0</td><td>Labour tax rate</td><td colspan="2">21.7%</td></tr>
<tr><td>ktxr0</td><td>Capital tax rate</td><td colspan="2">6.8%</td></tr>
<tr><td>Pop20s</td><td>Share of population aged 20-29 in total population</td><td colspan="2">12.5%</td></tr>
<tr><td>Pop30s</td><td>Share of population aged 30-39 in total population</td><td colspan="2">15.3%</td></tr>
<tr><td>Pop40s</td><td>Share of population aged 40-49 in total population</td><td colspan="2">19.8%</td></tr>
<tr><td>Pop50s</td><td>Share of population aged 50-59 in total population</td><td colspan="2">18.3%</td></tr>
<tr><td>Pop60s</td><td>Share of population aged 60-69 in total population</td><td colspan="2">15.3%</td></tr>
<tr><td>Pop70s</td><td>Share of population aged 70-79 in total population</td><td colspan="2">11.8%</td></tr>
<tr><td>Pop80s</td><td>Share of population aged 80-89 in total population</td><td colspan="2">6.9%</td></tr>
</table>

Source: own calculations

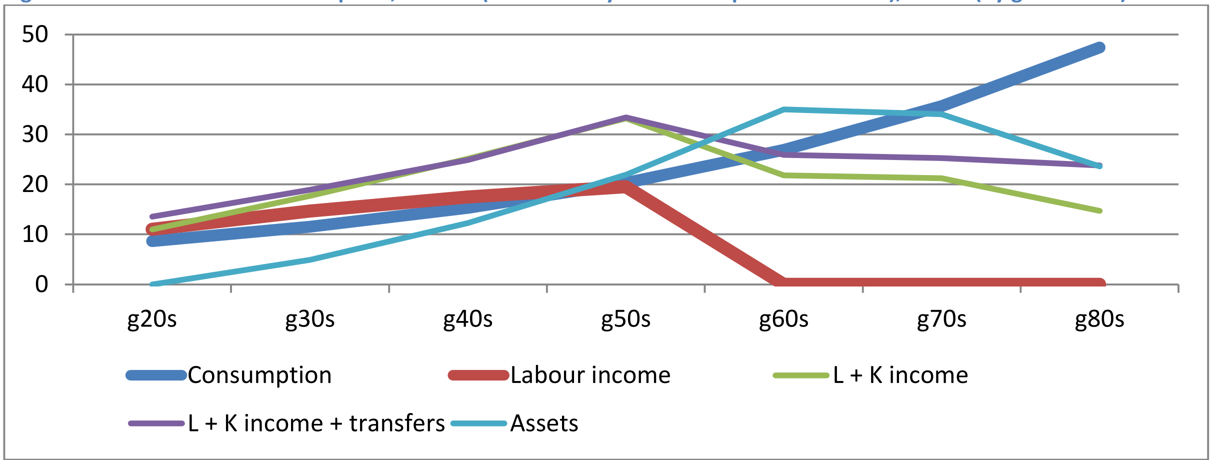
2.3 OLG model baseline values

The calibration and data entered, together with the model structure results in the following baseline values, which are shown in Table 2 and Figure 1. One sees the steadily rising consumption over the generations. Labour income rises through working life, falling to zero on retirement in generation g60s. Assets are zero initially (g20s), and therefore, so is capital income. As assets begin to be accumulated from the second generation onwards, capital income also becomes an important income source. Transfers are given to the working generation, and larger transfers are given to retirees as a public pension.

Table 2: Baseline values: consumption, income, assets (by generation)

	G1 20s	G2 30s	G3 40s	G4 50s	G5 60s	G6 70s	G7 80s
Consumption	8.7	11.5	15.3	20.3	26.9	35.7	47.4
Labour income	11.0	14.7	17.5	19.5	0.0	0.0	0.0
Capital income	0.0	3.0	7.7	13.7	21.8	21.2	14.7
Transfers (inc. pens)	7.6	6.2	4.8	5.2	9.1	9.1	9.1
Assets	0.0	4.9	12.3	21.9	35.0	34.0	23.6

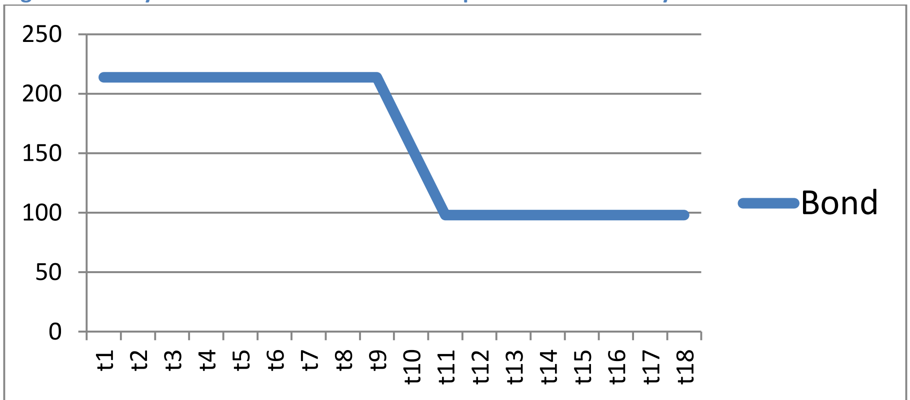
Figure 1: Baseline values: consumption, income (cumulatively labour + capital + transfers), assets (by generation)



3 Simulation Design

As already noted, the simulations reduce the public debt in Italy from 131 percent of GDP to 60 percent. This implies a reduction from €2.13 trillion to around €0.97 trillion[9]. The debt reduction shock is imposed over the course of two model time periods, which represents 20 years. We choose to implement the reduction in two equal steps as shown in Figure 2.

Figure 2: Policy simulation 1 & 2: reduction of public debt over 20 years



[9] This latter figure would vary if GDP levels also change. As will be shown, changes in GDP are small.

Note that Figure 2 shows the level of public debt at the beginning of the period. Therefore the reductions in public debt shown here in periods t10 and t11 are paid for in periods t9 and t10.

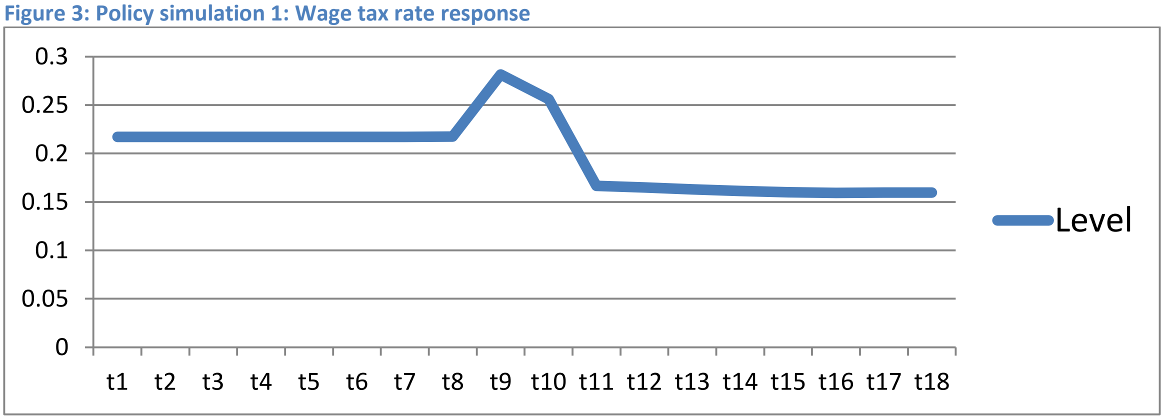
Whilst there are many ways to implements the shock (over a longer time period or in such a way as to cause a rise in tax rates by the same amount in each time period), we choose this implementation as demonstrates interesting responses by model agents (as will be shown in the results section).

In order to pay for this reduction in public debt, we allow one of two tax rates to become endogenous: first wage tax rates (simulation 1), then consumption tax rates (simulation 2). We maintain other government expenditures (including transfers) and other tax rates at their base level, such that all the adjustment is done either on wage tax or consumption taxes. Again many combinations of tax and expenditure policy could be considered, though these two are chosen so as to highlight the distinct consequences of each.

4 Results

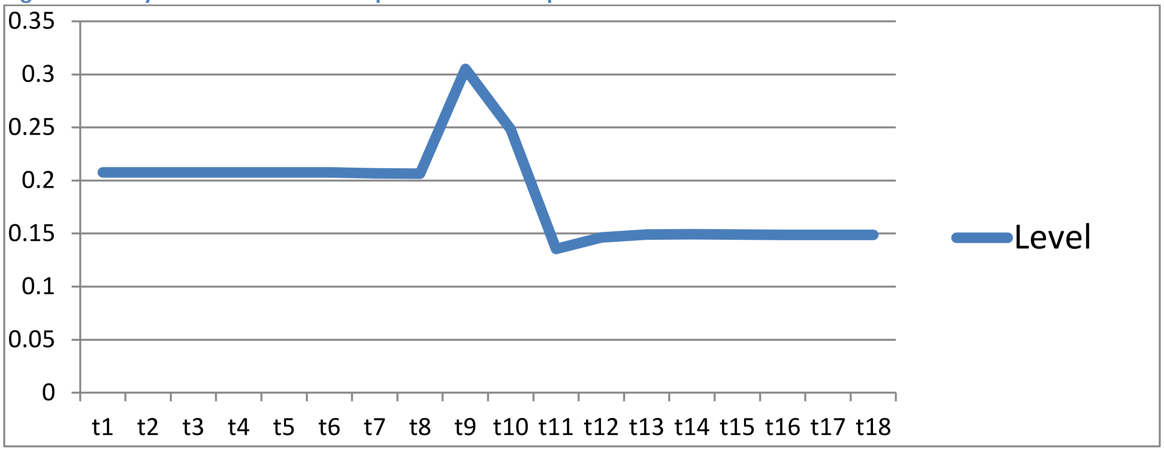
As explained above, the reduction in public debt is paid for in period t9 and t10 either by freeing up the wage tax rate (simulation 1) or the consumption tax rate (simulation 2). The results of the respective closures are shown in Figure 3 and Figure 4.

Figure 3: Policy simulation 1: Wage tax rate response



The wage tax rate is 22 percent is the baseline. In order to pay for the public debt reduction in simulation 1, this rises to 28 percent in period t9, and to 26 percent in period t10. The lower rate in period t10 is due to the lower debt servicing (even though the public debt reduction is equal to that in period t9). The long run wage tax rate is 16 percent, which is possible as debt servicing costs have fallen, and no further reduction is public debt is chosen.

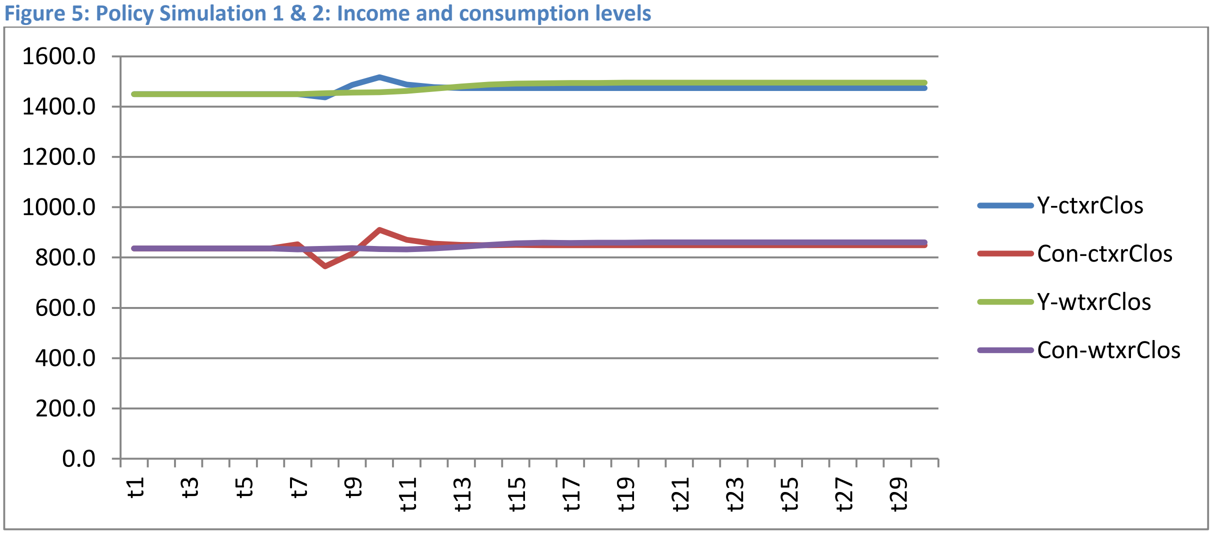
Figure 4: Policy simulation 2: Consumption tax rate response



The consumption tax rate is 21 percent in the baseline. In simulation 2, where the public debt reduction is paid for by freeing up the consumption tax rate, it rises to 31 percent in period t9. As for the wage tax rate in simulation 1, the consumption tax rate then falls to 25 percent in period t10. Again the reduction is due to the already reduced debt servicing costs (despite the same reduction in the public debt level). Period t11 shows a fall to 13 percent, which is slightly below the long run rate of 15 percent. The explanation for this is that a fair amount of consumption was postponed in periods t9 and t10, and so in t11 there is a recovery to above the long run level (see below). This extra consumption allows the government budget to be closed with a lower consumption tax rate. The long run rate of 15 percent is possible due to the lower level of debt servicing required.

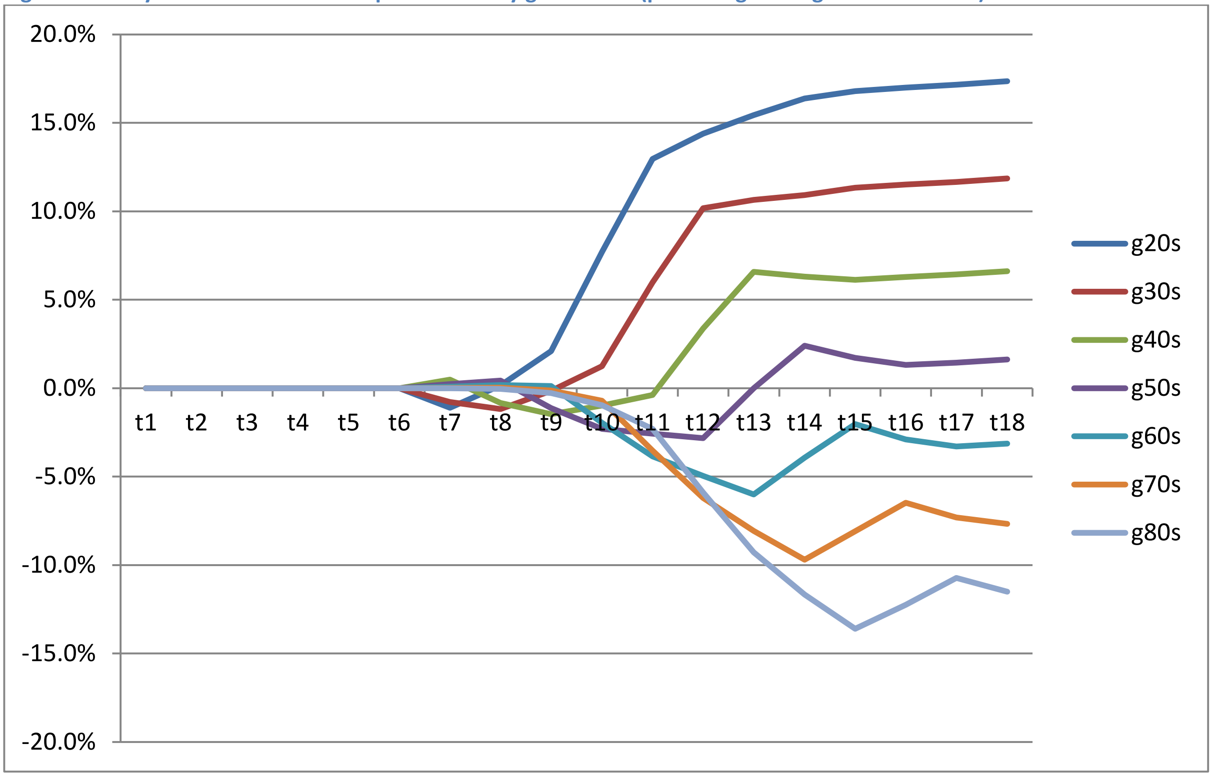
As shown in Figure 5, the simulations have fairly small impacts on consumption and production in the long run with both ultimately being just slightly higher. The noticeable difference between the simulations is that with the consumption tax rate closure (simulation 2), a drop in both consumption and production is visible as the public debt reduction begins (period t9), as is a recovery to above long run levels once the public debt reduction has finished (period t11). This shows how individuals optimally postpone consumption somewhat in period t9 and (to a lesser extent) in period t10, until the high consumption tax rates have been reduced. By contrast, the closure on labour tax rates (simulation 1) allows individuals to engage in more consumption smoothing.

Figure 5: Policy Simulation 1 & 2: Income and consumption levels



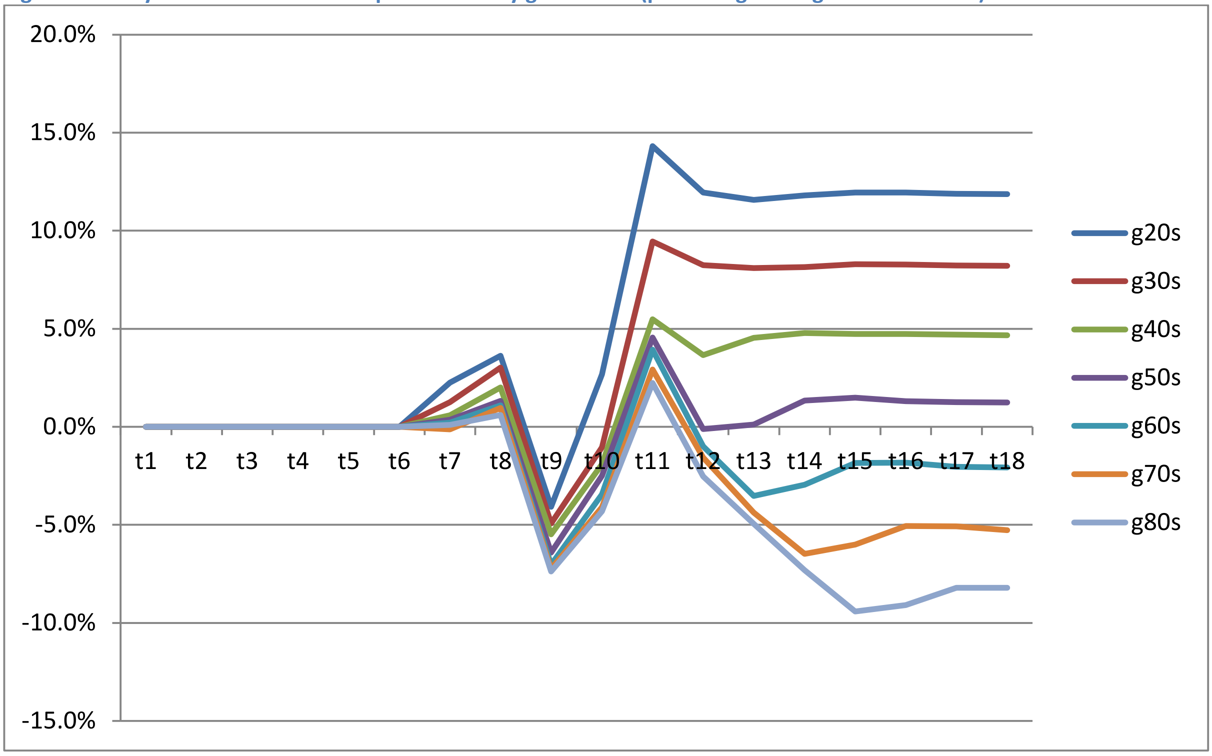
Splitting out the impact on consumption by generation for simulation 1 (Figure 6) shows how different generations are impacted. What is shown is that starting in period t9, the youngest generation (g20s) starts to increase consumption, moving towards a steady stat where future young generations are consuming in excess of 15 percent more. The next youngest generation (g30s) follows suit starting in period t10, and then g40s in period t11, and so on. This increased consumption early in the life cycle, necessarily implies less saving, and so once these young generations age to become the older generations, they have to curtail their consumption. This "squeeze" in consumption is the classic Diamond (1965) result.

Figure 6: Policy simulation 1: Consumption levels by generation (percentage change from baseline)



Turning to consumption by generation under the consumption tax rate closure (simulation 2, Figure 7), one sees that all generations are impact remarkably similarly in the initial periods of the shock. The highest consumption tax rate is in period t9, and all generations optimally reduce consumption in this time period. In order to do so, the prior period, t8, sees a small rise in consumption. The second period of somewhat high consumption tax rates, t10, sees all generations with higher consumption than t9, and g20s even has a higher level than the baseline. The first post-debt reduction period, t11, sees a recovery in consumption to above baseline levels by all generations. The largest increases come from the younger generations. Naturally, these young generations are saving less than before, and so as they age, they have to curtail consumption. This resembles the long run steady state for simulation 1.

Figure 7: Policy simulation 2: Consumption levels by generation (percentage change from baseline)



Looking at the consumption and asset profiles of the initial and the long run steady state for both the wage and consumption tax rate closures (Figure 9 and Figure 9), the pattern is again clearly visible. In both cases, consumption still increases throughout the life cycle, but at gentler rate, and asset accumulation occurs at a lower level.

Figure 8: Policy simulation 1: Consumption & asset profile – baseline v long-run post-shock

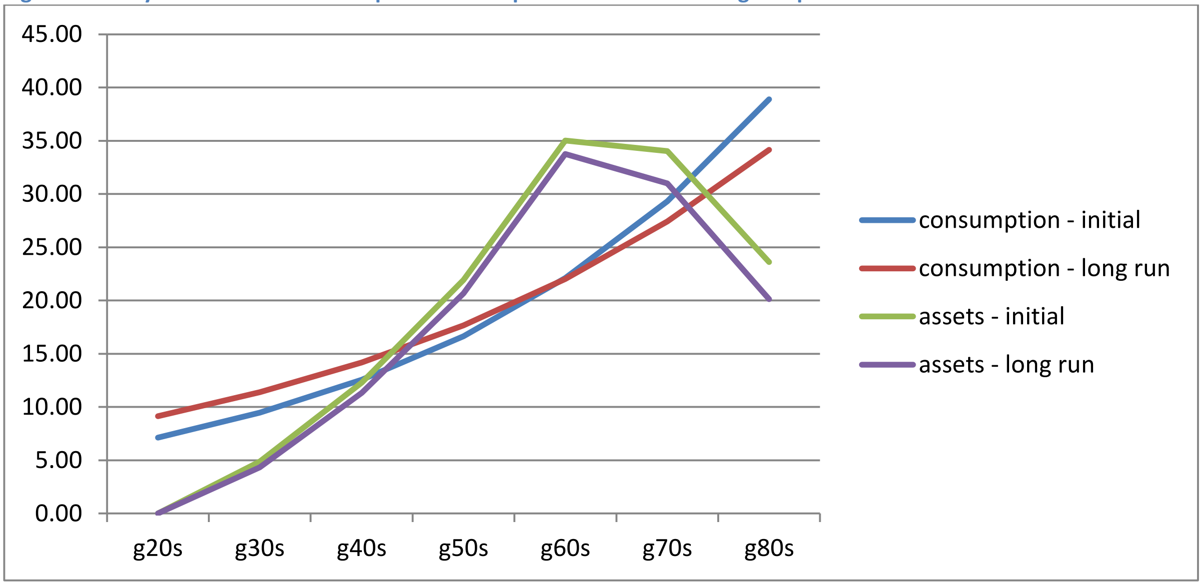
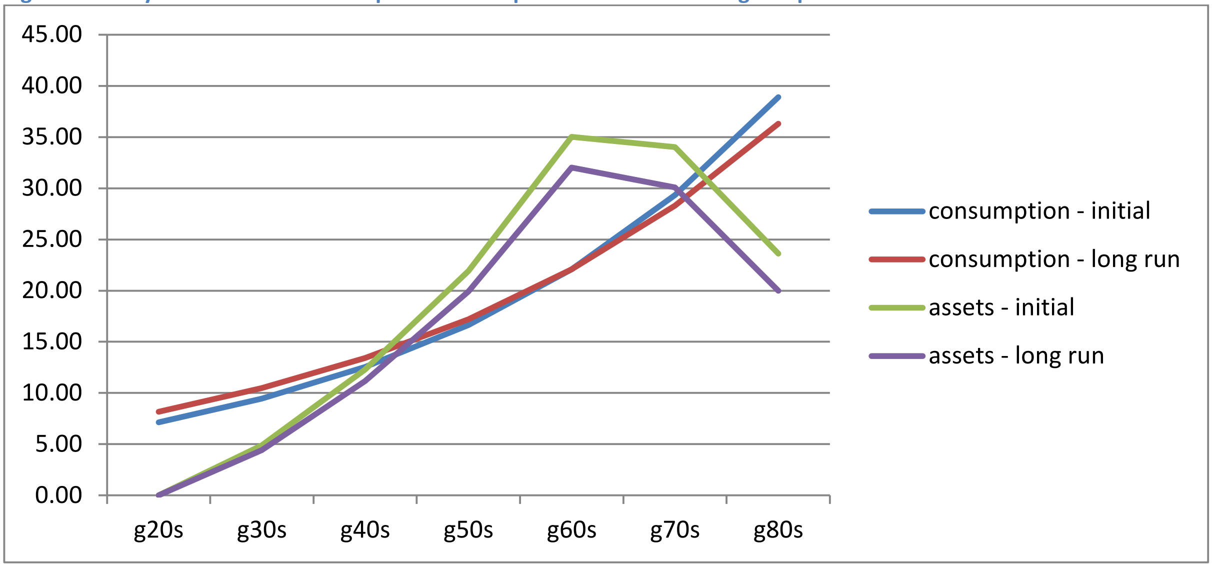


Figure 9: Policy simulation 2: Consumption & asset profile – baseline v long-run post-shock



The lifetime utility for each cohort can be calculated from the utility equation above, which can be taken as a summary measure of well-being. This information is shown below.

Figure 10: Policy simulation 1: Lifetime utility by birth time period

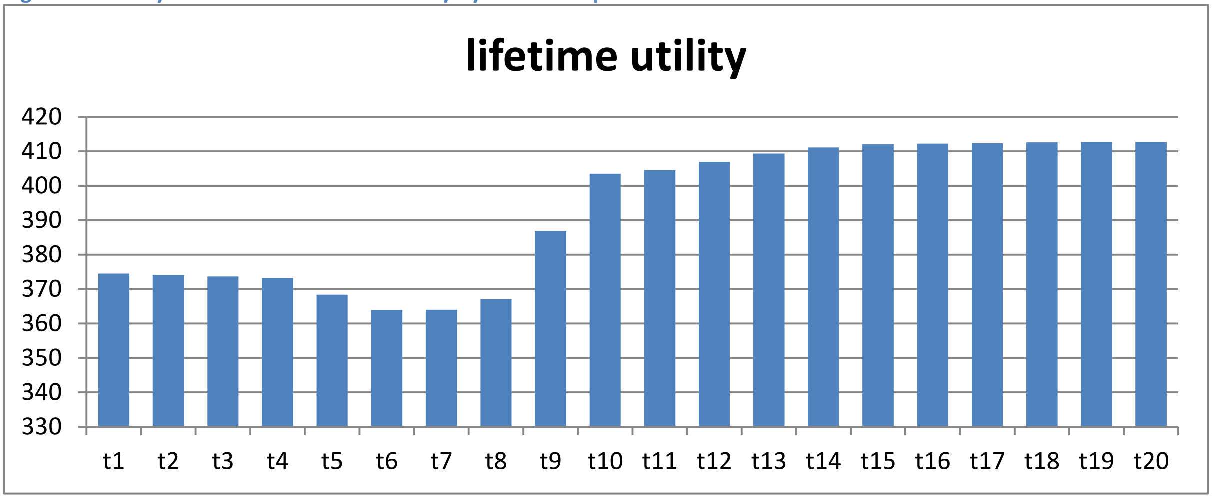
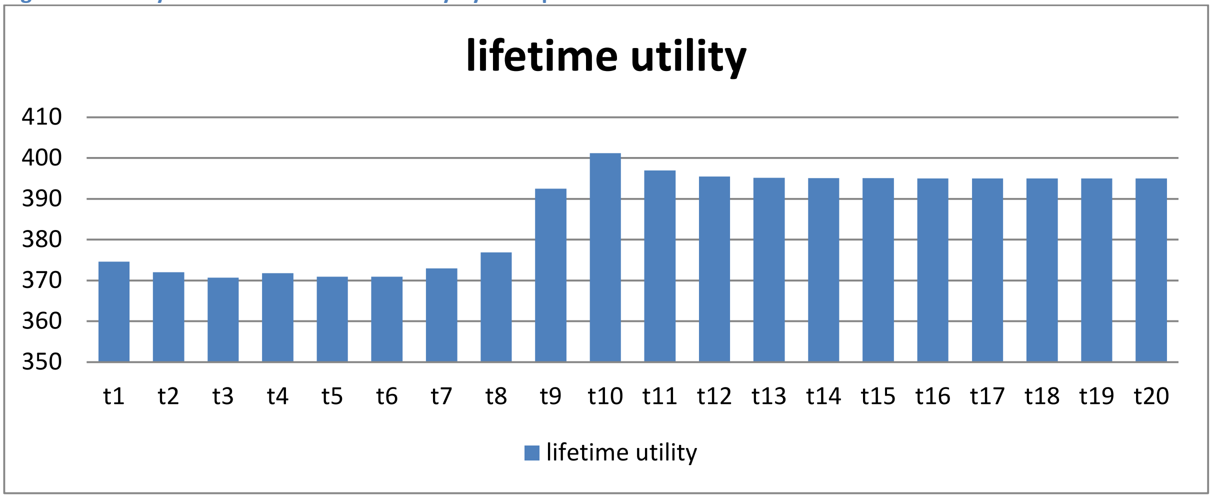


Figure 11: Policy simulation 2: Lifetime utility by birth period



Utility is, of course, an ordinal measure, so the calculation should only be used to provide a ranking of utility. With that in mind one sees that under the wage tax rate closure (simulation 1), the drop in utility is felt most by those born in periods t6 and t7, who are the cohorts who are in g50s and g40s, at the moment of the first period of higher taxes. Some drop in utility is also felt by those born in t5 and t8, i.e. those who are in g60s and g30s when the first period of higher taxes occurs. These correspond to how much of one's working life is impacted by the temporarily higher taxes. Those born in t9 already experience higher utility that the baseline and this continues in t10. Note that this is despite the fact that these groups do pay some of the higher taxes; they are compensated with lower wage taxes for most of their working life. In the long run, naturally, utility rises as wage tax rates are lower.

Under the consumption tax rate closure (simulation 2), the drop in utility is smaller but and more spread across cohorts. Some drop in lifetime utility is experienced by those born from t2 to t7 (relative to t1). This represents cohorts who are aged g30s to g80s, when the first period of higher taxes is introduced. This includes many who are retirees at the time the tax rise is implemented. Later generations, who benefit more from lower long run consumption taxes experience rising utility, and again the long run utility is above the baseline as consumption tax rates are lower.

5 Concluding Remarks and Directions for Future Research

We have presented a reasonably simple overlapping generations model specifically to address the generational burden of a reduction in public debt. Our model shows how those in the middle of their working life bear the greatest burden from an increase in wage taxes, whereas higher consumption taxes spreads the burden broadly across most current generations. In the long run, the public debt reduction allows for a lower overall tax burden as the cost of financing the public debt is greatly reduced. However, lifetime utility only starts to rise for those who are in their 30s in the first period of the debt reduction.

The model presented here can be fruitfully developed in a number of directions. Our first priority will be to have endogenous labour supply, which would likely generate a different response to the labour tax rise, and somewhat to the consumption tax rise. Secondly, the introduction of total factor productivity (TFP) growth would also impact on the burden borne by different generations. Essentially, if future generations are much more productive, future burdens become easier to bear, which would be demonstrated with simulations features different plausible TFP growth rates.

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