Fiscal Policy, Fairness between Generations and National Saving

7th September 2009

Ray Barrell and Martin Weale

National Institute of Economic and Social Research,
2, Dean Trench Street,
London SW1P 3HE

ABSTRACT

We assess fiscal policy from the perspective of fairness between generations and the relationship between this and national saving, in the context where the United Kingdom is the lowest-saving of all the OECD economies. Cross-section and pooled data suggest that governments are in a position to influence national saving and we set out a simple overlapping generation model to show the effects of national debt, of pay as you benefit systems, of legacies and movements to land prices as means of effecting transfers between generations. Having shown that governments can influence the distribution of resources between generations we then discuss three notions of fairness between generations, i) that each cohort should pay its own way, ii) that a social planner should reallocate resources between generations to achieve and inter-temporal optimum and iii) that resources should be reallocated so that generations alive at the same time have similar living standards. In the light of these observations we discuss appropriate responses to a variety of economic shocks and we conclude with implications for policy in the aftermath of the recession.

Keywords: Fiscal Policy, National Saving, Generational Equality, Overlapping Generations Analysis.

JEL Codes: E21, E61, E62, H62, H63

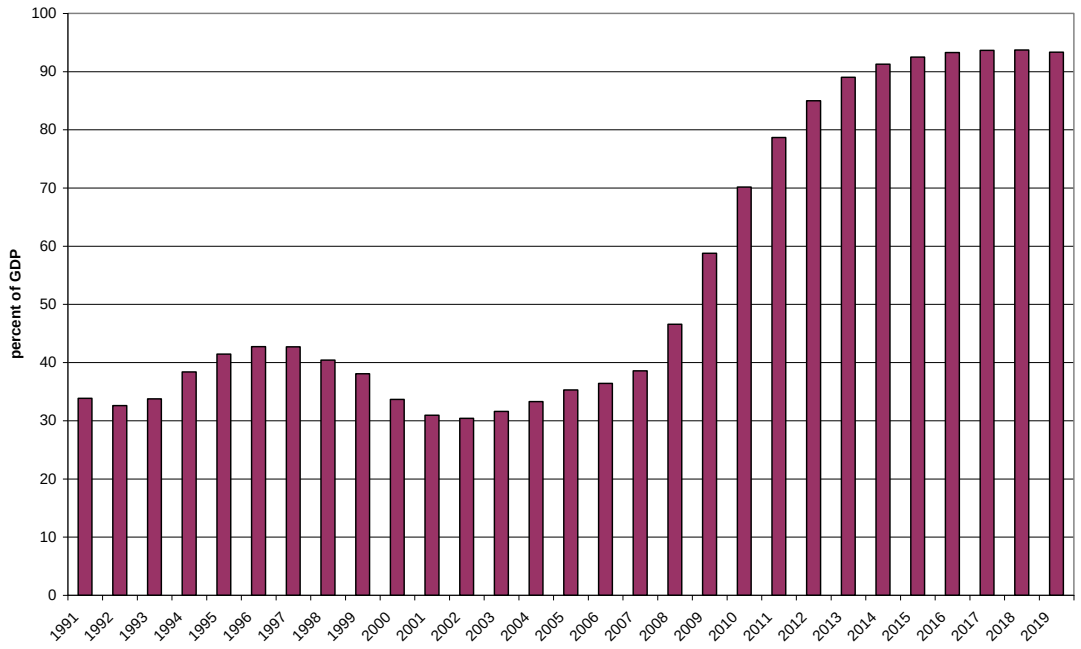
This paper is to be presented at the OECD meeting of National Economic Research Organisations on 21st September 2009 in Paris.

The authors are grateful to Philip Davis and David Vines for extensive comments and also for other comments received at seminars at the National Institute of Economic Research and Oxford University.

1 Introduction

The recession which began in 2008, and the related banking crisis, has created a new debate about the role of fiscal policy. For many years the guiding principle for policy makers, with a remarkable consensus among economists, was i) that fiscal policy should not be used for counter-cyclical management and ii) that governments should manage their budgets with reference to some indicator of government borrowing and the overall size of the public debt. Thus, in the United Kingdom the policy goal was to balance the government current budget over the cycle, so that the government neither added to, nor deducted from the overall level of national saving, and to limit the overall national debt to 40% of GDP, although the government current account tended to be in deficit during the boom. In the broader EU the Stability and Growth Pact set an upper limit of 3% of GDP to government financial borrowing and had, more as an aspiration than a reality, the target that the government budgets should be in balance or in surplus. This was in principle, but not in reality, enforceable among countries of the Euro Area but not among other members of the European Union. Associated with this was the related aspiration that governments should limit their debt to 60% of GDP.

Figure 1 UK Government Debt as a percent of GDP



The recession-induced decline in output as well as the fiscal bailout of banking systems seen in most OECD countries has impacted rapidly on government borrowing and projections for public sector debt. The UK, for instance had kept debt below 40 percent of GDP for some years, as we can see from Figure 1, but recent projections suggest it could easily exceed 90 percent of GDP by the middle of the next decade[1]. The recent debate on the importance of limiting debt has focused on the fear that higher levels of government debt will lead to a rise in risk premia on that debt, thus

[1] The bank bailout and subsequent nationalisation of some banks will probably raise debt by around 10 percent of GDP, and hence the remaining 40 percent increase may be seen as the cyclical or recession induce component.

raising the cost to the tax-payer of government borrowing. There is also concern that government solvency may be put into question (e.g. Mendoza and Ostry, 2008) or that high levels of debt may lead to pressure for higher inflation which central banks, despite their independence and clear inflation-targeting framework, may find difficult to resist as indexed linked borrowing forms a minority of government debt.

These issues, while of obvious importance, are not the only factors which need to be taken into account in evaluating the fiscal position, and the purpose of this paper is to explore a range of other factors based around the impact of the national debt and government deficits on the resources available to different generations. There is a long debate about whether the national debt is in any sense a parallel to other forms of debt, in that it imposes a burden on the country which carries it. Lerner (1948) argued that the only effects of internal (as opposed to externally held) national debt on the economy were as a result of the incentive effects of the taxes needed to finance it and on the distribution of resources between individuals in the economy. Beyond these the national debt had no macro-economic effect and neither did the deficits which led to it. His argument was, essentially that all expenditure has to be financed out of current income and that national debt was therefore simply a form of window-dressing. Critics of this approach included Meade (1958) who argued that the wealth effect, which he called the Pigou effect meant that a high stock of national debt depressed the flow of saving; he also pointed to the fact that high private sector wealth associated with a high level of debt would reduce the incentive to work. Bowen, Davis and Kopf (1960) developed an overlapping generations argument to show that expenditure financed by a budget deficit was paid for, in part by future rather than current generations, a point denied by Lerner. Barro (1974) appeared to support Lerner's view, showing that, if people planned to leave bequests and at the margin were as concerned about their descendents' welfare as they were about their own then an increase in national debt would lead to an equal increase in bequests neutralising the effect on future generations[2]. These bequests are the mirror image of the increase in the capital stock or, in an open economy, the holding of net foreign assets that would arise from restraining current consumption.

Atkinson and Stiglitz (1980) succinctly explained the error with Lerner's argument and its relationship with Barro's results. All current expenditure has to be met out of current income, but it is consumption and not expenditure which affects welfare. If debt finance of public consumption expenditure results in a higher level of consumption than does tax finance, then simple application of the inter-temporal budget constraint means that future consumption must be lower than it would have been in the case of tax finance[3]. With output largely supply-determined, higher consumption means lower investment and in that sense the government debt does indeed crowd out productive capital and reduce future consumption opportunities. Only if people are concerned about their descendents in the way that Barro suggests will private saving rise so as to offset the increase in public borrowing. In such circumstances there is no net effect on future consumption opportunities and thus no

[2] If the individual making the decision to offset the increase in debt has at the margin a twenty percent lower valuation of their descendents welfare than they do of their own then a £2000 increase in taxes for their descendents will be matched by a £1600 increase in bequests.

[3] This argument of course assumes that output is supply determined. In the circumstances discussed by Barro and Grossman (1971) that is not the case and in such a situation an increase in deficit-financed public consumption may also increase the present discounted value of total consumption

burden on future generations. But equally deficit finance does not raise current consumption. Thus, if a deficit has real effects (over and above the distortionary effects of the taxes needed to finance it) then it imposes a burden on future generations. If it has no real effects it does not impose a burden. In the next section we discuss the evidence on the impact of government budget deficits on national saving, and we can conclude that, at least in the OECD countries a rise in government borrowing will reduce national saving somewhat.

Concern that a national debt is a burden on the future has found a focus in the idea that the budget should be set in a way which is fair to future generations; policy-makers should balance the interests of future generations against those of people currently alive. The debate about the balance between the interests of current and future generations is essentially a debate about the appropriate level of national saving. A country with a high saving rate is making substantial provision for the future and it is of only secondary importance whether that saving is undertaken by the private sector or the government; what matters in the first instance is national saving. In this article we examine the interaction of fiscal policy, national saving and fairness between generations in more detail, putting the crisis and its aftermath into a policy context which reflects this.

Over the last decade or so land prices have risen markedly, and at least in the UK and the US, this appears to have led to a reduction in both private and national savings. In our the next section we compare international savings rates, discuss the relationship between property prices and saving and explore how far governments can influence national saving by means of fiscal policy.

After looking at the evidence on the impact of governments and property prices on saving we first present an overlapping generations analysis which demonstrates the point made by Bowen, Davis and Kopf (1960) and also shows that there are at least two other ways in which burdens on future generations can arise. The first is well-known, the introduction or extension of pay as you go benefits for old people, and the second, a rise in land prices, which has been scarcely discussed. We argue that both fiscal policy and legacies can be used to offset exogenous transfers between generations like those arising from movements in land prices and argue that a government concerned about fairness would offset such transfers, in effect setting fiscal policy not to achieve a given budget deficit but to achieve a given level of national saving or a target level of national wealth as proposed by Weale *et al.* (1989).

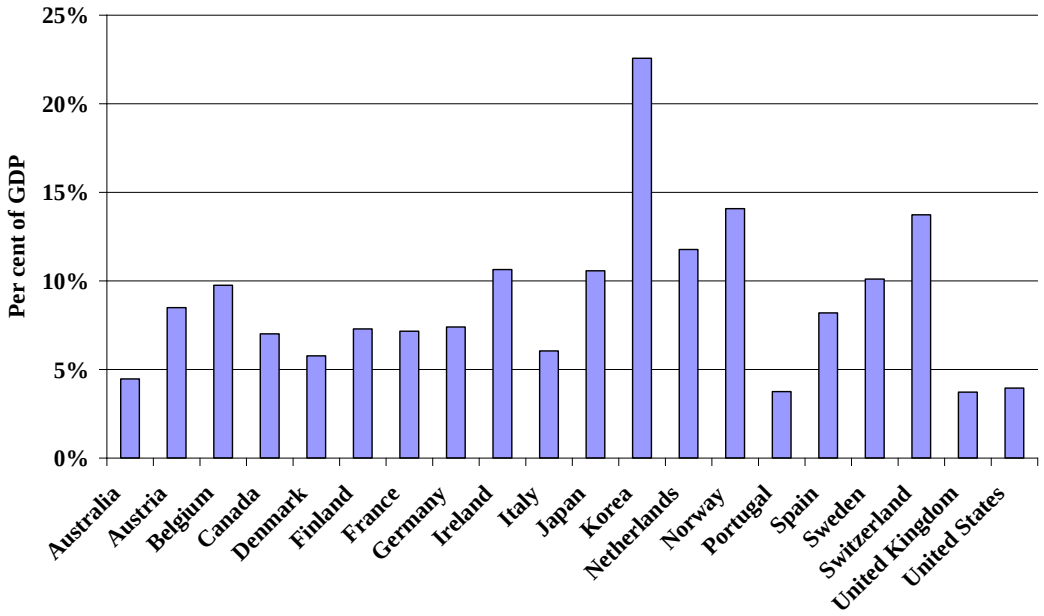
Having shown that governments can influence the distribution of resources between generations we examine three concepts of fairness, so as to establish what might be parameters of a fair fiscal policy. All suggest that fiscal targets should have been set differently before the crisis emerged, and that even 'in balance or surplus' was too loose an interpretation of the appropriate policy during a period of rising land prices. All point to the need for a significant surplus on the government current account in order that assets were accumulated to increase welfare of future generations and also have precautionary reserves available to face shocks. If the property boom could not have been prevented, it might at least have been offset by tighter fiscal policy, and, if a more appropriate fiscal policy had been run, the debt stock would not now be rising to such high levels. Tighter monetary and fiscal policies may have reduced the bubble, but it was probably more dependent on loose lending standards rather than

excess incomes and low interest rates. The appropriate policy response would have been stronger macro-prudential regulation combined with mechanisms like a tax on credit and hence less personal sector borrowing and higher national saving.

2 National Saving, Property Prices and Fiscal Policy

Ahead of the current recession the United Kingdom had the lowest saving of the advanced economies averaged over a twenty-year period as figure 2 shows. If one rules out the rather unlikely possibility that everyone else is over-saving, a reasonable conclusion is that saving in the UK has been too low. Much the same point could be made about the United States, Portugal and Australia, also countries with very low national savings rates.

Figure 2 Net National Saving 1987-2007 Average. Per cent of GDP



The causes of low saving are multiple, but could reflect a misperception of the permanence and viability of an increase in property prices, and if policies to reduce the property bubble had been in place perhaps net savings would have been higher and the gross debt stock lower, possibly reducing the risks of a financial crisis.. Barrell and Davis (2007), for instance, following Weale's (1990) work on the United Kingdom, produce clear evidence that real housing wealth affects the household consumption decision in the long run in countries such as the UK and the US, and, given this, an increase in property prices (in practice driven by a rise in land prices) would quickly reduce the level of personal sector saving. Unless either the corporate sector or the government deliberately offsets this by raising its saving, the outcome will be a low level of national saving.

But given these substantial differences in savings rates which we suspect are at least in part a consequence of different movements in property prices and the concern that this may affect adversely provision for the future, the question arises whether governments can actually influence national saving. This is as much an empirical question as a theoretical one, and we turn to the evidence first.

First of all we look at the relationship between the mean value of national saving and all government saving over the period. Secondly we look at the pooled relationship between the annual data after country fixed effects are removed. We initially use data for twenty-eight OECD countries (Luxemburg is excluded). Full data are not available for all countries for the whole period.

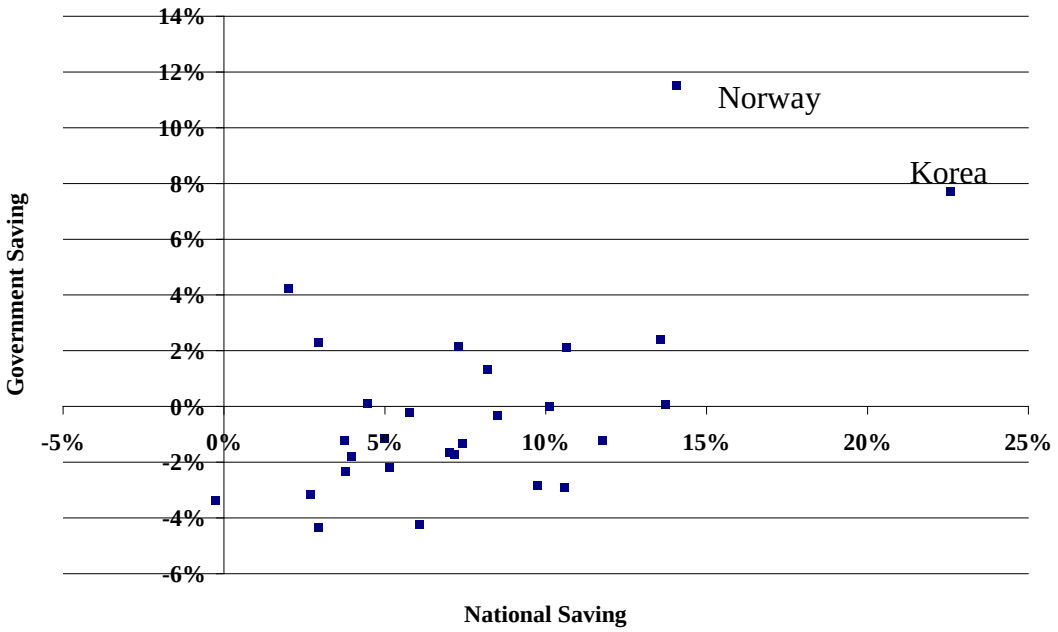
With NSG_{it} representing the national saving in country i in year t, and GS_{it} representing government saving, and with ¯ representing the mean as before, the data for the means in Figure 3 imply

$$\overline{NSG}_i = 0.98\overline{GS}_i + 7.51 \qquad R^2 = 0.45$$
$$(4.58) \qquad (10.17)$$

28 observations for mean of available data over the period 1987-2007; t- statistics in brackets

However, as Figure 3 shows, Korea and Norway are outliers.

Figure 3 Government Saving and National Saving 1978-2007 averages. Per Cent of GDP



If the figures for Korea and Norway are excluded from the analysis we find a weaker and statistically insignificant relationship between government and national saving

$$\overline{NSG}_i = 0.51\overline{GS}_i + 6.85 \qquad R^2 = 0.09$$
$$(1.56) \qquad (9.14)$$

26 observations for mean of available data over the period 1987-2007; t-statistics in brackets

Thus analysis of country averages does not point to statistically significant influences of government saving on national saving once the effects of outliers are removed. Looking now at the relationship using annual data and after taking account of country fixed effects, we find

$$NSG_{it} = 0.53GS_{it} \qquad R^2 = 0.26$$
(12.9)

464 observations from OECD countries excluding Luxemburg covering the period 1987-2007; t-statistics in brackets

With Korea and Norway excluded the results are

$$NSG_{it} = 0.50GS_{it} \qquad R^2 = 0.26$$
(14.0)

431 observations from OECD countries excluding Korea, Luxemburg and Norway covering the period 1987-2007; t-statistics in brackets

In this case the analysis of annual data with fixed effects accounted for is not greatly affected by whether Korea and Norway are included in the data set or not. But perhaps more importantly, these regression results, taken as a whole, do suggest that every 1 per cent increase in government saving as a proportion of GDP raises national saving by about ½ per cent of GDP, with the implication that the private sector offsets about half of any direct impact of government saving on the overall level of saving in the economy. It is therefore clear that governments exist in a world where they can influence national saving. We have to ask whether they should have done so, and this requires that we both understand why the crisis arose, and have reasons for justifying government actions. But before this we set out an overlapping generations model first in order to explore mechanisms which can lead to transfers of resources between generations and their impact on national saving and national wealth and secondly to study notions of fairness between generations.

3 An Overlapping Generations Model

We adapt a version of Allais' (1947) framework, with a situation where each generation lives for two periods being sufficient to illustrate the points that we wish to consider[4]. We assume that there is a productive capital good. The market rate of interest is r with $R=1+r$ and that the exogenous rate of growth of labour productivity is g with $G=1+g$. We start with a model of a closed economy, but extend it to an open economy where interest rates are taken from abroad rather than determined by the domestic saving and investment decisions. We then open the economy before considering also the effect of endogenous labour supply.

An individual has a unit endowment of labour income and we initially assume that they work only in period *1*. The output resulting from the employment of the generation whose first period of life is period t is $y_t=G^t f(k_t)$ and the wage paid is $w_t = G^t\{f(k_t)-k_t f'(k_t)\}$. This accrues to young people, while the return on capital, $rk_t = G^t k_t f'(k_t)$ accrues to the old people who are the only owners of capital. It is straightforward to show that, in a steady state the capital stock, output and the wage will all grow at rate g.

[4] It should be noted that the effects of pay as you go benefits on saving cannot be studied using conventional DSGE models. These assume either infinite horizons or, as suggested by Yaari (1965) and Blanchard (1985) that everyone has the same mortality rate. A consequence of this is that people do not have a period of youth in which they save for a clearly-defined old age and the heterogeneity required to represent pay as you go transfers is absent.

Consumption of those born in period *t*, generation *t*, is c_{1t} in the first period of their life and c_{2t} in the second period of their life. At the start of their life people allocate their consumption between the two periods to maximise their life-time utility given by the expression $U(c_{1t}, c_{2t})=U(W_t)$ subject to the life-time budget constraint $c_{1t} + c_{2t}/R = W_t$. If the utility function is homothetic then the proportion of wages consumed in the current period $\phi(r)= c_{1t}/W_t$ is constant over time with, normally $\phi'(r)<0$. We write ϕ rather than $\phi(r)$ for reasons of brevity.

The capital stock k_t is then equal to that component of wage income which is not consumed in the first period, so that

$$k_t= (1- \phi)G^t\{f(k_t)-k_t f'(k_t)\}=(1- \phi)w_t \qquad (1)$$

Since $r= G^t f'(k_t)$ it follows that

$$k_t= (1- \phi)G^t\{f(k_t)-k_t f'(k_t)\} \qquad (2)$$

is the equation which determines the capital stock and thus the real interest rate on the equilibrium trajectory. The real interest rate is therefore determined by the interplay of the production structure represented by $f(k_t)$ and the balance of preferences between consumption when young and consumption when old as represented by ϕ. If there are strong preferences for current consumption, with ϕ large, then k_t will be low and r will be high.

With this framework we examine four factors which may influence capital accumulation and the real rate of interest. First we look at the impact of the national debt.. We then sutdy the role of pay as you go transfers from young people to old people. This summarises the impact of a key feature of most countries' social security systems. Thirdly we look at legacies. And fourthly we look at the role of land. We show that, in broad terms the effects of national debt, pay as you go benefits and land values on capital accumulation and, in a closed economy, on interest rates are similar while legacies have an effect in the opposite direction. Thus a policy-maker who is concerned about fairness between generations should be concerned about pay as you go benefits and land prices as well as budget deficits. But the effect of all three can be offset by means of legacies.

3.1 The National Debt

We now move on to explore the role of the national debt and a budget deficit in transferring resources between generations. Suppose that generation 1 finances its retirement partly by issuing national debt certificates to value d_1 which it sells to generation 2 in exchange for goods which it consumes. Interest of rd_1 is also paid on this debt so the total value of the transfer to generation 1 is Rd_1. Generation 2 is willing to buy the certificates because it believes that it will be able to sell them to generation 3. It is prepared to see the debt increase by an amount gd_1 on the equilibrium path, so it incurs a burden of $(R-G)d_1$. Rolling this forward generation *t* faces a net payment of $(r-g)\, d_{t-1} =(R-G)\, d_{t-1}$.

The life-time budget constraint is now

$$c_{1t} + c_{2t}/R= w_t+d_t(1-R/G) \qquad (t>1) \qquad (3)$$

The life-time budget constraint is tightened if $G<R$ but increased if the reverse is true[5].

If we look at the savings equilibrium, we now have

$$d_t + k_t = G^{t-1}(1-\phi)(w_1 - d_1(R/G-1)) \qquad (t>1) \qquad (4)$$

and we can see that the capital stock is reduced for two reasons. First of all, from the point of view of savers, debt certificates are, by assumption, exact substitutes for productive capital. Secondly, life-time income is reduced by the need to service the debt and this reduces the demand for second-period consumption and thus for assets.

We can explore the relationship between debt service payments and the benefit received by the generation which floats the debt. The total discounted value of the service payments is

$$\sum_{t=2}^{\infty} d_1(R-G)\left(\frac{G}{R}\right)^{t-2} = Rd_1 \qquad (5)$$

and, not surprisingly, this is equal to the gain in consumption of the first generation. Thus government debt simply serves to transfer resources from future generations to the present.

3.2 Pay as You Go Benefits

Suppose that the government makes a transfer t_t to old people financed by a poll tax on young people. The government's budget is balanced in every period and the tax/donation grows at a rate g so as not to disturb our equilibrium path. Then each person pays a tax of $t_t = t_1 G^{t-1}$ when young and receives a transfer of $t_t G$ when old so that the life-time budget constraint becomes:

$$c_{1t} + c_{2t}/R = w_t + t_t(1/R - 1/G) \qquad (t>1) \qquad (6)$$

The transfer also has an impact on saving. The share of first-period consumption out of life-time income retains the same functional relationship to the real interest rate as before, but saving out of first-period income reflects the fact that the lump sum tax has to be paid. Thus with this transfer from young people to old people we have

$$k_t = G^{t-1}\{(1-\phi)(w_1 - t_1/G) - \phi(1/R)t_1\} \qquad (t>1) \qquad (7)$$

In fact saving is reduced for two reasons. First of all income is lower in the first period because the transfer has to be paid. And secondly, the fact that a transfer is received in the second period reduces the need for saving for second-period

[5] The case G>R is dynamically inefficient in that in such a case both short-term and long-term consumption can be increased by means of a reduction in saving. This can be seen very simply by writing a model with constant growth. If $c=y-gk$, then c is maximized with respect to k if $dy/dk=g$. If y is increasing in the capital stock then $dy/dk<g$ implies that k should be reduced. See Abel *et al.* (1989).

consumption. However, in a closed economy the lower saving means that the capital stock will be reduced. The new equilibrium will be one with a lower value of k_t, driving up R and thus also with a lower value of ϕ. The transfer payment, which is a pay as you go benefit crowds out saving and reduces capital but the rise in the interest rate to which it gives rise has the effect of offsetting, to some extent, the reduction in saving.

It is straightforward to show that the gain of the first generation to receive the transfer matches the present discounted sum of the reduction in consumption faced by all future generations. The first generation receives an extra amount t_1 while each subsequent generation faces a payment of $t_1(1/G-1/R)G^{t-1}$. The present discounted sum of these payments is

$$\sum_{t=2}^{\infty} t_1 \left(1-\frac{G}{R}\right)\left(\frac{G}{R}\right)^{t-2} = t_1 \qquad (8)$$

Thus the extra consumption enjoyed by the first generation to receive a transfer is exactly matched by the present discounted sum of the loss of consumption faced by future generations. Indeed, setting $t_t=Rd_t$ and comparing (7) with (4) we can see, again not surprisingly, that the with a transfer payment equal to the initial debt plus interest, the impact on saving of the two methods of burdening future generations is identical.

In neither of these cases is it very surprising that resources are simply transferred between generations. If supply is given, as it is in this account, it is difficult to see how financial engineering can raise the total consumption possibilities of all generations taken together. However, expansionary fiscal policies may be able to raise the present discounted value of consumption if the structure of the economy is different in the period of fiscal expansion from its structure when the debt is serviced (as in this model) or repaid. For example, during a recession, as Barro and Grossman (1971) suggest, a fiscal expansion may raise consumption by more than debt service/repayment outside a recession depresses it.

But this comparison between debt and transfers is important, because, at least in this overlapping generations context the effects of the two are the same while in conventional economic statistics they appear very differently. When debt is incurred the government self-evidently runs a budget deficit while when a pay as you go transfer payment is set up the budget remains in balance. Thus the budgetary position is, on its own, not a useful indicator of whether future generations are being burdened or not. The level of national wealth, k_t and the rate of net saving, gk_t are, by contrast, both affected in the same way by these equivalent policies.

3.3 The Effects of Legacies

Legacies can be seen as the mirror image of government debt. In a steady state the national legacy will grow at the growth rate of the economy. The first generation to leave a legacy has to reduce its life-time consumption by the amount of the legacy adjusted for the fact that, in our context a legacy will be left after the second period of life and will accrue to the successor generation in its second period of life. If we write e_1 as the value of the legacy left to generation 1, this is paid in a notional third period,

so the present value of the legacy in the second period is e_1/R. By replacing d_1 by $-e_1/R$ we can identify the impact of legacies on the capital stock and thus on the interest rate.

$$k_t = G^{t-1}(1-\phi)\{w_1-(e_1/R)(G/R-1)+e_1/R\} \qquad (t>1) \qquad (9)$$

While the national debt crowds out capital, legacies augment the capital stock and result in a reduced real rate of interest. Ricardo (1820) and Barro (1974) of course suggested that, if people were concerned about the welfare of their descendents they would leave legacies to offset the effects of budget deficits on their descendents' welfare.

3.4 The Role of Land

The final situation we explore is that created by land. Analysis of the way in which this creates transfers between generations is more involved than that associated with either the national debt or pay as you go transfers but is of considerable importance both because its economic impact is rarely discussed and also because its scope for operating as an engine of intergenerational transfers is large.

Land may function either as a third input into production or as a separate producer of a consumption good- housing[6]. For our purposes it is easier to illustrate the effects we have in mind if the services produced by land are consumed along with the produced good as composite consumption. In order to keep things simple we assume that there is a unit elasticity of substitution between housing and produced output. Thus, with housing services denoted by h_{it} the composite consumption good is assumed to take the form

$$C_{it}(c_{it},h_{it}) = c_{it}^{\gamma} h_{it}^{1-\gamma} \qquad (10)$$

If ρ_t is the rental rate on land then the utility function implies that

$$\rho_t h_{it} = (1-\gamma)(c_{it} + \rho_t h_{it}) \qquad (11)$$

Given the assumption we have made about the allocation of resources between consumption in the first and second periods, the total expenditure on housing is given as

$$\rho_t (h_{1t} + h_{2t-1}) = (1-\gamma)\{(1-\phi)w_t + R\phi w_{t-1}\} \qquad (12)$$

With the total stock of housing services determined exogenously by the stock of land and set at $h=h_{1t}+h_{2t-1}$ the rental on land is given as

$$\rho_t = (1-\gamma)\{(1-\phi)w_t + R\phi w_{t-1}\}/h \qquad (13)$$

[6] We assume that no produced capital is involved in the production of housing. This is an obvious simplification. The ratio depends on land prices relative to the price of buildings, but at the end of 2008 land comprised about 75% of the total value of housing in the UK economy.

and it is plain that, with the produced good as numeraire it grows at rate g. The growth rate of composite consumption is γg; the fixed supply of land imposes a drag on the growth of real consumption.

Finally, the unit price of land is $\pi_t = \rho_t/(r-g)$ and the savings equilibrium is now

$$\pi_t h + k_t = G^{t-1}(1-\phi)w_\tau \qquad (14)$$

By comparing (14) with (4) and (7) we can see that land exerts the same sort of crowding out of productive capital as do pay as you go transfers or national debt. But there is an important difference. Land, unlike transfers or national debt is productive. Instead of paying taxes to service the debt people pay rent to enjoy the housing services which land provides. The latter but not the former is a component of consumption. This means that the transfer payment/debt service terms present in (4) and (7) do not have any counterpart in (14).

3.5 A Small Open Economy

The steady state analysis of a small open economy does not yield any surprises. We now make the assumption that the interest rate is determined in world capital markets and that capital flows in or out in order to ensure that the marginal product of capital is equated to the world interest rate. If, at this interest rate, domestic savings are inadequate to finance the domestic capital stock, then the balance is financed by means of a foreign capital inflow. Alternatively, if domestic savings are excessive, the excess of savings over the domestic capital stock is invested abroad

We write the world real interest rate as r^W and put $R^W = 1 + r^W$. f denotes *per capita* domestic holdings of net foreign assets and $\phi^W = \phi(r^W)$. Then the expression for the capital stock in the presence of national debt becomes

$$f_t + k_t = G^t(1-\phi^W)\{w_t + d_1(G/R^W - 1) - d_1\} \qquad (t>1) \qquad (15)$$

and it is now even clearer how an increase in national debt depresses net foreign assets.In the same way, with transfers the savings balance equation is

$$f_t + k_t = G^t(1-\phi^W)\{f(w_t + t_1(G/R^W - 1) - t_1\} \qquad (t>1) \qquad (16)$$

and with legacies

$$f_t + k_t = G^t(1-\phi^W)\{w_t + e_1(G/R^W - 1) - e_1\} \qquad (t>1) \qquad (17)$$

Finally with land and no legacies

$$f_t + \pi_t h + k_t = G^t(1-\phi^W)w_t \qquad (18)$$

In all three cases k_t is determined by r^W, so that the effects of transfer payments/national debt/land prices are reflected in holdings of net foreign assets.

A key topic of interest to us when analysing the impact of the crisis on behaviour is the effect of an exogenous change in the price of land. In this model this can arise

either i) because the interest rate or growth rate change or ii) because preferences change. We study the effects of a change to preferences. This is most conveniently done with the interest rate constant. A constant real interest rate is to be expected in small open economy and not in a closed one. Individuals when faced with an adverse shock to their wealth have a number of options, and one is to work longer and we turn to that problem after looking at the effect on the distribution of resources between generations of an increase in land prices.

3.6 An Increase in Land Prices

The effect of a rise in land prices is very like a transfer or the national debt described above. Such a result is very important for policy purposes because, while governments concerned about fairness between generations may be reluctant to authorise high levels of borrowing or high pay as you go benefits, they, at least in the UK, tend to regard rising land prices favourably.

In the model with consumption split between housing services and produced goods, the simplest way to explore the effects of an increase in land prices is to assume that there is an unexpected change in preferences. We assume this affects generation 2 born at time 2. This generation wishes to spend a fraction $\gamma'<\gamma$ on produced goods, with the remainder going on housing services, and all future generations are expected to have the same preferences. Since the supply of land is fixed the rental rate on housing rises to a new steady state

$$\rho_t' = (1-\gamma')\{(1-\phi)w_t+R^W\phi^W w_{t-1}\}/h. \qquad (t>1) \qquad (19)$$
$$=(1-\gamma')\{(1-\phi)w_t+(R^W/G)\phi^W w_t\}/h$$

It should be noted that, with these assumptions, the land price does not move immediately to its steady state. When generation 2 is young, the demand for land will reflect the higher expenditure of young people and the old expenditure pattern of the old people from generation 1. Nevertheless, the old of generation 1 will enjoy extra consumption because they own the land whose price has increased as a result of the changed pattern to demand and they will spend this increase in value during their old age. Thus in all probability total demand for housing services will be higher than in its steady state and the rental rate will be above its steady state value. Subsequent fluctuations in the rental rate will affect the real rate of interest measured in aggregate consumption terms and thus the allocation of expenditure between period 1 and period 2 of each generation's life. Study of these fluctuations, while possible numerically, is of no great interest. It is much more helpful to assume that, when the demand pattern of the young changes unexpectedly, so too does that of the old of generation 1, so that, despite the windfall they enjoy, their demand for housing is such as to bring the rental rate to its new steady state value immediately. Since the old enjoy a windfall from capital gains on land this means that the share of housing in their total consumption falls rather than rises.

We can, however, explore this issue to understand the nature of the transfer from future generations to the generation of land-owners when the price of land rises. First we note, that for each generation from 2 onwards, expenditure on produced goods falls by $(\gamma-\gamma')w_t$. The present discounted value of the fall to consumption of produced goods when generation 2 is young and generation 1 is old is $(\gamma-\gamma')w_2/(1-G/R^W)$.But the

discounted value of the output of produced goods has not declined and it is this which makes possible increased consumption by the old people of generation 1.

The capital gain, however, is calculated as the present discounted sum of rental rates and, making the assumption generation 1 behaves in such a way that the rental rate adapts to its steady state value immediately we have

$$(\pi_2' - \pi_2)h=(\gamma-\gamma')\{(1-\phi) +(R^W/G)\phi^W\}w_2/(R^W-G) \quad (20)$$

Thus the capital gain on land held by generation 1 exceeds the reduction in present discounted consumption of all future generations by

$$(\gamma-\gamma')(R^W/G-1)\phi w_2/(1-G/R^W)= (\gamma-\gamma')\phi^W w_2(R^W/G)= (\gamma-\gamma')R^W \phi^W w_1 \quad (21)$$

But $(\gamma-\gamma')R^W \phi^W w_1$ is the amount by which generation 1 would, in old age need to increase its demand for housing if the price of land were to move immediately to its new equilibrium path.

Thus when an increase in the price of land happens as a result of an identical change to preferences by all generations except that currently owning land and when the demand for housing services by the generation which does own the land moves to the level it would have taken if its expenditure on housing services rose to a value consistent with the new equilibrium, then the resulting increased consumption of produced goods by the generation which owns the land exactly matches the present discounted value of the decline in the consumption of produced goods of all future generations. In this sense the increase in land prices is like an increase in the national debt or in transfer payments. While the most convenient way of demonstrating the effect of a rise in land prices is on the assumption that this is triggered by a change in preferences, there is no reason to believe that the result is specific to this case. When land prices rise for any reason the consumption possibilities of those who own land are increased and, since a change to land prices has no bearing on productive capacity it is hard to see that this increase in current consumption can come except at the expense of future consumption.

3.7 Implications for National and Private Saving

The implications for saving of the four different situations that we consider can be helpfully set out in tabular form so as to show how the various savings aggregates are compiled. We show in period $t(t>1)$ the saving of the generation which is young in this period and the dis-saving of the old. It should be remembered that consumption of the old is higher than their dis-saving; the former is paid for in three ways

i) out of the income earned of saving,
ii) out of transfers paid directly by young people and
iii) by dis-saving which includes building up national debt and spending capital gains on land.

The saving of the young and the dis-saving of the old add together to give net private saving. Since our model has no company sector this is analogous to personal saving net of depreciation as shown in the national accounts. We then add to this government saving to give total national saving which represents the accrual of productive capital.

In the case where the role of land is analysed, the dis-saving of the old is increased relative to the saving of the young because old people are assumed to spend not only the income which accrues on their land but also the capital gains. To put the point another way, with rising land prices the rental on land is below the real interest rate and the market return on land can be realised only by dis-saving.

In table 1 we show the components of national saving in the period in which a transfer takes place for the first time, national debt is run up, there is an increased preference for housing services or old people decide to leave legacies. These components are computed on the assumption that these policies or change to preferences had not been anticipated when the first generation was young.

In table 2 we show the situation in the steady state equilibrium where the transfer, the national debt or the new price of land are growing at rate g. It can be seen that, in all three cases the initial change results in a reduction in national saving and, in the steady state this means that, on the equilibrium path, saving has to be permanently lower. Conversely if people leave legacies national savings is increased.

Table 1: Saving at the Time a Transfer or its Equivalent is Introduced

	Saving of Young	Dis-saving of Old	Total Private Saving	Government Saving	National Saving
Debt	$G(1-\phi)(w_1 - d_1(R/G-1))$	$(1-\phi)w_1$	$g(1-\phi)w_1 - d_1(1-\phi)(R-G)$	$-d_1$	$g(1-\phi)w_1$ $-d_1(1-\phi)(R-G)-d_1$
Transfer	$G\ (1-\phi)(w_1 - t_1/G)$ $-\phi t_1 G\ /R$	$(1-\phi)w_1$	$g(1-\phi)w_1 - t_1 - \phi G t_1/R$	0	$g(1-\phi)w_1 - t_1 - \phi G t_1/R$
Legacy	$G(1-\phi)(w_1 + e_1(R/G-1))$	$(1-\phi)w_1 - e_1$	$g(1-\phi)w_1$ $+e_1(1-\phi)(R-G)+e_1$	0	$g(1-\phi)w_1$ $+e_1(1-\phi)(R-G)+e_1$
Land	$G(1-\phi)w_1$	$(1-\phi)w_1 + (\pi_2' - \pi_2)h + g\pi_1 h$	$(1-\phi)w_1 - (\pi_2' - \pi_2)h - g\pi_1 h$	0	$(1-\phi)w_1 - (\pi_2' - \pi_2)h$ $-g\pi_1 h$

Table 2: Saving in the Steady State

	Saving of Young	Dis-saving of Old+	Total Private Saving	Government Saving	National Saving
Debt	$G^{t-1}(1-\phi)(w_1 - d_1(R/G-1))$	$G^{t-2}(1-\phi)(w_1 - d_1(R/G-1))$	$gG^{t-2}(1-\phi)(w_1 - d_1(R/G-1))$	$-gG^{t-2}\ d_1$	$gG^{t-1}(1-\phi)(w_1 - d_1 R/G)$ $-gG^{t-2}d_1$
Transfer	$G^{t-1}(1-\phi)(w_1 - t_1/G)$ $-\phi t_1 G^{t-1}/R$	$G^{t-2}(1-\phi)(w_1 - t_1/G) - \phi t_1 G^t$	$gG^{t-2}(1-\phi)(w_1 - t_1/G)$ $-\phi g t_1 G^{t-2}/R$	0	$gG^{t-2}(1-\phi)(w_1 - t_1/G)$ $-\phi g t_1 G^{t-2}/R$
Legacy	$G^{t-1}(1-\phi)(w_1 + e_1(R/G-1))$	$G^{t-2}(1-\phi)(w_1 + e_1(R/G-1))$ $-G^{t-1}e_1$	$gG^{t-1}(1-\phi)(w_1 + e_1 R/G)$ $+gG^{t-2}e_1$	0	$gG^{t-1}(1-\phi)(w_1 + e_1 R/G)$ $+gG^{t-2}e_1$
Land	$G^t(1-\phi)w_1$	$G^{t-1}(1-\phi)w_1 + gG^{t-1}\pi_1 h$	$gG^{t-1}(1-\phi)w_1 - gG^{t-1}\pi_1 h$	0	$gG^{t-1}(1-\phi)w_1 - gG^{t-1}\pi_1 h$

4 Policy and Fairness between Generations

We have seen four mechanisms by which resources can be transferred between generations. Legacies are the most obvious and, since people cannot leave negative legacies, they must result in a shift in resources from the present to the future. They also lead to increased saving. Transfers from young to old and government borrowing depress saving as does a change in preferences which raises land prices. The recent crisis has involved a rise in land prices and then a smaller fall, along with a large rise in government borrowing. If the authorities had been concerned about future generations they would have reacted to the rise in land prices, and perhaps have prevented both it and the subsequent reversal. However, they did not, and the fall in land prices we have seen involves a significant reduction in the wealth of retired people and those close to retirement with obvious implications for their living standards. The rise in government debt transfers resources from the future to the present in a way which may not be socially desirable. But given this background, how far should the government promote or acquiesce in transfers between generations. Here we consider three notions of fairness:-

1. Fairness meaning each generation pays its own way
2. Fairness as seen by a social planner
3. Fairness as meaning that living standards of young and old people do not differ significantly

4.1 Each Generation pays its own Way

This concept of fairness implies that it is unfair either that parents should support their children or that children should support their parents. This idea, described by Meade (1968) as perfect selfishness, appears easily tractable. It provides a reference point for Auerbach and Kotlikoff (1988) who calculate how far each cohort can expect to receive more from the public purse than it contributes to it, a transfer which, if it takes place must inevitably be at the expense of future generations. Their calculations differ from a simple analysis of the government budget because they take account of the effects of pay as you go pension systems and the fact that, in many countries, important components of public consumption, such as health care, are delivered to people in old age while being substantially financed by the taxes of younger people. Khoman and Weale (2008) apply the same concept to the economy as a whole exploring what level of saving would be needed were each cohort currently alive to pay its own way.

If all wealth were produced wealth then application of this principle would be straightforward. But land is a large component of the nation's wealth. Since land is not produced, the principle that each generation pays its own way implies that it should bequeath rather than sell the stock of land to its successor. Thus the principle that each generation should pay its own way nevertheless implies that people should leave legacies to their children, or alternatively, if they choose not to do so, the government needs to accrue capital instead; Khoman and Weale allow for this.

With this notion of fairness, the appropriate fiscal policy is that which ensures each cohort can finance its consumption without imposing a burden on its successors. Either there are no transfers between generations beyond those arising from non-produced capital, or their effects are offset by an equivalent budget surplus.

4.2 Fairness from the Perspective of a Social Planner

The concept of fairness as seen by a social planner is best explored by considering the inter-temporal maximisation problem such a planner faces. Suppose that both the rate of interest, *r*, and the growth rate of output per person, *g*, are given exogenously and that the representative individual in generation *t* receives an endowment W_t. The life-time utility derived from this is $U(W_t)$ and there are no transfers between different generations except those resulting from the actions of the social planner. The social planner can determine the value of each generation's endowment by means of moving resources between generations. With a discount factor of δ the planner does this to maximise

$$V = \sum_{t=1}^{\infty} \delta^{t-1} U(W_t) \tag{22}$$

As is well-known, in the absence of uncertainty the solution to this is to choose the W_t so that

$$\frac{U'(W_t)}{U'(W_{t-1})} = \frac{1}{\delta(1+r)}. \tag{23}$$

If the utility function takes the standard constant elasticity of substitution form, so that

$$U(W_t) = \frac{W_t^{1-\alpha}}{1-\alpha} \tag{24}$$

Then

$$\frac{W_t}{W_{t-1}} = \{(1+r)\delta\}^{1/\alpha} = 1 + g_s = G_s \tag{25}$$

defines the optimal rate of growth, g_s of the endowment of each generation. If

$$\{(1+r)\delta\}^{1/\alpha} < 1 + g \tag{26}$$

Then, after taking account of any transfers effected by legacies, the social planner should transfer resources from future generations to the current generation while if the opposite is true the transfer should be in the opposite direction. Some combination of fiscal policy and pay as you go transfers can be used to have the required effect.

We note that the social planner has to observe the budget constraint. This implies that

$$\sum_{t=1}^{\infty} W_1 \left(\frac{G_S}{R^W}\right)^{t-1} = \sum_{t=1}^{\infty} w_1 \left(\frac{G}{R^W}\right)^{t-1} \tag{27}$$

or

$$W_1 = \frac{w_1(R^W - G_s)}{R^W - G} \tag{28}$$

If $G_s<G$ the implication is that the life-time consumption of the initial generation should be raised above what would be affordable out of wage income, i.e. by reducing the nation's wealth. The analysis above shows that this can be done by some combination of national debt and transfer payments. However, it is important to note that, while in section 4 we set out equilibria in all of which output of produced goods grew at the same rate, in this situation consumption grows at a rate different from output. If $G_s<G$ the economy will begin with a national debt but the fiscal authority will reduce this over time, thereby ensuring that consumption grows more slowly than output with the opposite being true if $G_s>G$. Thus, starting from a *tabula rasa*, a policy of reducing the growth rate involves an initial budget deficit followed by a persistent surplus. But the appropriate budget deficit is defined with reference to the required profile for generational consumption and thus with respect to required national saving and national wealth rather than with respect to any particular number for the budget deficit.

This framework implies that whether resources should be transferred from the present to future generations or in the opposite direction depends on the values of r, g, α and δ. Assumptions can be made about the values of r and g based on past experience. Khoman and Weale. (2008) find, for the UK, that r=4.4% p.a. and g could be assumed to be 2% p.a. Because r is substantially higher than g it is perfectly possible for discounting to take place ($\delta<1$) without there, nevertheless, being a case for transferring resources from the future to the present. There is no basis for being confident that appropriate parameter combinations justify a policy of burdening future generations, and that it is probably therefore inappropriate to embark on such a policy. This argument becomes all the stronger once we make some allowance for the inherent uncertainty about the future, in terms of both the rate of return and the sustainable growth rate of the economy. Deaton (1992) shows that uncertainty inevitably implies a degree of precautionary saving and thus a steeper rate of growth of each generation's endowment after transfer.

Given this we may safely conclude that an inter-generational planning analysis does not in itself justify a transfer of resources from future generations to the present and, in particular, the argument that future generations are going to be richer than those currently alive is not itself strong enough to justify such a policy. A fiscal policy which implements inter-generational transfers could be justified only if one had good reason to believe either i) that the appropriate social rate of discount is clearly above zero and, to be safe, high relative to the growth rate, implying a value of δ well below one and ii) that the inter-temporal elasticity of substitution is low, so that α is high. Thus the appropriate fiscal policy seen from the perspective of a social planner can coherently be described as the same as that derived from the idea that each generation should pay its own way. But, as we subsequently show, in section 5.3, there is a case for precautionary saving on top of this.

4.3 Fairness as Equality between Generations

An alternative view of inter-generational fairness is that the living standards of the population alive at any time should not depend on the age of people concerned. This was discussed at length by Meade (1968) and provides a useful structure for understanding the political pressures leading to fiscal burdens on future generations.

As before, in the absence of any transfers between generations

$$c_{1t} = \phi w_t$$
$$c_{2t} = R(1-\phi)w_t \tag{29}$$

Then the consumption of generation *t* in period 2 of its life is below that of generation *t+1* in the first period of its life if

$$R(1-\phi)w_t < G\phi w_t \tag{30}$$

with the opposite being true if the inequality is reversed.

Meade discusses the concept of altruism and defines a perfectly altruistic society as one in which $c_{2t}=Gc_{1t+1.}$ If inequality (29) holds, then this requires a transfer of resources from young people to old people while if it is reversed then the opposite is true. In an altruistic society such a transfer might be effected by people supporting their parents, making pay as you transfers directly. But equally it would be possible to imagine compulsory altruism effected by the fiscal authority. An alternative to that form of compulsory altruism would be for the state to take policy measures which reduce people's consumption when young, so that it can be increased when old. This can be done by some combination of compulsory saving and measures which make saving more attractive (such as a tax on consumption when young). Plainly, if the social planning argument that there is no strong case for transfers from future generations to the present is accepted, then policy needs to rely on the last two of these mechanisms. The appropriate fiscal policy consistent with this notion of fairness between generations is easily defined.

$$\phi' = \frac{1+r}{2+g+r}$$

is the value of ϕ consistent with perfect altruism and the net saving of the economy consistent with that is $g(1-\phi')w_{t.}$ Thus the fiscal position consistent with perfect altruism is whatever delivers this rate of saving; if there are policies in place designed to promote saving so that people choose this pattern of inter-temporal allocation of their own accord, then there is no need for the government also to run a fiscal surplus, while if $\phi>\phi'$ a fiscal surplus is also needed, with a deficit required if the opposite is true.

With this concept, unlike those in the previous two cases, the fiscal authority is concerned about the allocation of consumption during people's lives and not simply with transfers between generations. Thus this framework provides a case for fiscal re-distribution over time even if there is no fiscal redistribution of resources between generations. Equally, it has to be noted that the issue whether there should be transfers between generations can be separated from the question whether the government should aim to deliver greater equality of consumption across generations alive at the same time. But in all three cases, a policy of fairness between generations means that the appropriate government fiscal balance has to be computed as a reaction to the transfers which arise elsewhere in the economy and cannot be defined by any absolute number.

5 Policy Responses to Disturbances in the Light of Fairness between Generations

Having discussed the general principles of fairness between generations we now consider how they might be applied in three situations of policy relevance, the first with rising land prices, the second with a profligate cohort and the third with an economic shock. We then review the implications of our analysis for dealing with the recent recession.

5.1 Implications for Fiscal Policy of Rising Land Prices

Whatever the framework is adopted as the appropriate basis for deciding on transfers between generations, it is hard to see how a view of fairness should be affected by a change in land prices such as might result from changed preferences for housing services. Thus, to preserve any given *status quo ante* in the face of a rise in land prices, the government needs to run a fiscal surplus or to reduce transfer payments to old people who own land. The effect of an increase in land prices on consumption can be neutralised if the government sets its fiscal position (whether achieved by means of transfer payments or a more traditional surplus) to deliver that rate of national saving which was consistent with the desired inter-generational allocation of resources ahead of the rise in land prices. If the government ignores the issue then the balance of resources across generations and thus the government's notion of generational fairness, whatever that may be, will be upset.

5.2 Implications for Fiscal Policy of Profligate Cohorts

The issue of profligacy merits some discussion. Suppose that people choose a high level of first-period consumption not because they want low second-period consumption but because they expect a substantial second-period pay as you go benefit even if that benefit is quite inconsistent with both the government's plans and its notions of fairness between generations. If fairness is defined with reference to the relationship between the consumption levels of the young and old alive at any given time, then first, as the young enjoy their profligacy, there will be pressure on the government to distribute resources to the old members of the population. And secondly when the profligate generation reaches old age it will be poor relative to its children even if the latter are less profligate. This will create further pressure for an expansion of pay as you go transfers.

The problem of a profligate generation which expects to be bailed out in old age by means of compulsory support from its successors may arise because the government cannot make a credible commitment not to provide pay as you go support for people who have chosen not to save for their old age when young. The pressure can be offset if the government in effect undertakes additional saving on behalf of the profligate generation, restoring the level of national saving to what it would have been in the absence of profligacy. There is an obvious question whether it will have the means to do this, given that the profligate generation might be unlikely to vote for governments which offset their profligacy. But, reverting to the question what fiscal policy should do rather than what it is capable of doing, it should be noted that the situation described above does not lead to a fiscal deficit, at least at the time when saving is first depressed. Indeed a consumption boom may well lead to high tax revenues and a fiscal surplus. Thus a policy framework built round the fiscal deficit will not give the signal which is needed, while one built around national saving will.

5.3 Response to an Economic Shock

So far the analysis has been built round perfect foresight trajectories. We can, however, consider how best one might deal with an income shock. That might be represented in this model by a structure in which w_t is stochastic, around a deterministic trend growing at rate g. The principle that each generation should pay its own way would imply that some generations are lucky and others unlucky and that is the end of it. A social planner, by contrast would aim to maximise the expected value of the discounted sum of utility given by equation (21) so that

$$E\left[\frac{U'(W_t)}{U'(W_{t-1})}\right] = \frac{1}{\delta(1+r)} \tag{31}$$

Such a structure results in precautionary saving. Unless there are reasons to believe that the private sector does the precautionary saving for itself, the planner should build up a reserve fund in normal or good times which can be used to support the consumption of cohorts in bad times.

This has an interesting implication. As we noted earlier, Deaton (1992) shows that precautionary saving implies that the growth profile is steeper than it would be in the absence of uncertainty. So a planner who did not want to transfer resources between generations in the absence of uncertainty would want to do so, so as to raise the expected growth rate of consumption in the presence of uncertainty, although we assume that the planner does not want to raise it above the real rate of interest (which in a closed economy is itself of course endogenous). And Gordon and Varian (1988) show that such a policy is, not surprisingly, superior to that of leaving each generation to carry the full consequences of uncertainty for itself.

It should be noted that, if W_t follows a stochastic rather than deterministic trend, the case for precautionary saving remains but the benefits associated with this type of insurance are much reduced. An insurance fund which would pay out a given amount £X in response to a serially uncorrelated adverse income shock, would pay out only $£R^WX/(R^W-G_s)$ to each cohort in response to the same persistent shock if it wanted to make payments which grew in line with the economy. In practice, however, the social planner following equation (30) in a closed economy would find that a shock such as a permanent decline in the trend of labour productivity would result in an economy which had too much capital and thus a low interest rate relative the equilibrium state and the surplus would be gradually run down; thus the compensation payments made out of the fund would start off bigger than if they were to be paid permanently and decline gradually over time.

The principle of equality between generations alive at the same time plainly implies that the government should pursue precautionary saving so as to enable it to smooth, at least to some extent, the effects of shocks affecting different generations differently. It raises a particular issue if a young generation affected by an adverse shock is alive at the same time as an old generation which has not been affected. Then plainly the government should supplement any pay-out to the young generation possible as a result of past precautionary saving with the proceeds of a tax levied on the old generation. In order to smooth out this across all future generations, only a part of the proceeds of such a tax would be paid out immediately.

Thus if the shock affects only young people, for example because labour productivity has permanently declined, there are two offsetting influences on the budget. First of all the government should draw on past precautionary saving, with the implication that it runs a deficit. But secondly, it should levy a tax on old people and allocate the proceeds of this across all future generations. This will offset the deficit to some extent.

Conversely if a shock affects old people but not young people the principle of equality between generations alive at the same time implies that young people should be taxed to support old people. But this will put them at a disadvantage relative their descendents once they reach old age and it rapidly becomes clear that application of this principle implies that the burden of the support for old people should be spread across all future generations.

5.4 Dealing with Past Behavioural Errors

Shocks are not the only source of economic disturbance. One could imagine errors on the part of the both the private and the public sector. Our discussion of profligacy above has addressed how the government should handle the behaviour a generation which it knows to be profligate. But what if it did not realise it when the generation was young and now observes an old generation whose consumption is lower than the government regards as reasonable. This may be a consequence of myopic behaviour; that people when young apply a high discount rate to their consumption in old age and when old regret the consequences of the choices they made when young.

The choices available to the government are reasonably straightforward, although there are no clear principles about the decisions it should come to. It can leave the old generation to live with the consequences of its past behaviour, or it can introduce pay as you go benefits to support them. As we showed above, deficit financing is equivalent to making pay as you go transfers. In either case the burden is spread across all future generations if the economy grows along the new equilibrium path.

If a behavioural error of this type is seen as a random shock rather than something which will never recur, then, however, some allowance must be made for the risk of a recurrence. As with productivity shocks, this means that the government should run its budget so that the country's stock of wealth builds up a precautionary fund to pay for such shocks. The difficulty is, of course, that since savings behaviour is endogenous, indulging low saving by one generation will make it more likely in the future.

A similar situation may arise when the government makes a mistake; one particular generation has not paid enough tax when young and there is therefore an unexpectedly large amount of debt around when it is old. Either this generation is surcharged in old age or the burden is spread across future generations. If surcharging is to be avoided then the only fair behaviour by the government is to treat this in much the same way as a generational shock. It should bias its budgetary position towards a surplus so as to address the expected frequency of mistakes and maintain an additional precautionary component to its surplus.

In both cases the key question is how far the cost should be borne by the current old generation, who do have the possibility of working more and consuming less leisure,

as we have discussed above. Policy makers would have to take account of the drop in leisure consumption before coming to a decision on the nature of the split between current and future young. The remainder of the cost should be allocated across young people and all future generations in the same way as would be the effects of any other shock.

5.5 The Implications of Choice over Working Lives

In all the situations described above, except that of rising land prices, old people have fewer resources to consume in old age than they had hoped. The analysis so far has looked at a situation where people simply receive an endowment at the start of their lives, and have to budget for two periods, taking into account taxes that they may have to pay out of their endowment and also any benefits that they may receive at the start of their second period.

But an important policy question is how old people should be expected to adjust if their expectations are not fulfilled, either because they were inherently implausible in the first place or because there has been some sort of adverse shock. A model in which, people have no decisions to make except over how to allocate their consumption between the first and second periods, or between housing and other consumption has nothing to say about how they should be expected to respond. But we can extend the model by making the work/leisure decision endogenous so as to identify the sort of adjustment which is desirable. In order to avoid complex algebra we do this only qualitatively.

Suppose that people have unit endowment of time in each period and that people face a wage w_{1t} in the first period of their life and w_{2t} in the second period of their life. Total consumption includes both expenditure on goods, housing and on leisure. The latter is represented as l_{it}. We extend the composite consumption good (equation 9) further writing $C_{it}(c_{it},h_{it},l_{it})$ to reflect this. It is not, however, necessary to give it a specific functional form to reach qualitative conclusions.

As a consequence of the decisions made in the first period, an individual arrives at the second period of their life with a wealth holding as before; the budget problem is then to allocate resources between non-housing consumption, consumption of housing and consumption of leisure subject to the budget constraint on the assumption that there are no pay as you go transfers, national debt or legacies:

$$c_{2t,}+ \rho_t h_{2t} + w_2 l_{2t} = w_{2t} + \pi_t h + k_t = z_{2t} \qquad (32)$$

The outcome of the optimal choice that people make in this circumstance can be represented by considering the expenditure functions, showing non-housing consumption, housing consumption and leisure as functions of both the total resources that people have and the wage rate

$c_{2t}= c_{2t}(z_{2t},w_{2t},\rho_t)$
$h_{2t}= h\, c_{2t}(z_{2t},w_{2t},\rho_t)$
$l_{2t}= l_{2t}(z_{2t},w_{2t},,\rho_t)$
Provided that none of non-housing consumption, housing consumption and leisure are inferior goods it follows that

$$\frac{\partial c_{2t}}{\partial z_{2t}} > 0\,,\ \frac{\partial h_{2t}}{\partial z_{2t}} > 0\,,\ \frac{\partial l_{2t}}{\partial z_{2t}} > 0$$

and thus that, given the choice, if people's resources on reaching retirement are fewer than they had expected, they will rationally choose both to cut back on expenditures on both types of consumption and to reduce their leisure or to increase the amount that they work. In other words, after a fall in the land price, π_t, a natural response is to increase labour input. The same point arises if retirement resources change for any other reason, for example because the government finds it cannot afford to pay all the benefits it had led people to expect because there has been a negative shock to tax revenues. After shocks of these types, it follows that the government should seek to reduce obstacles to working faced by old people such as retirement conventions or aspects of the social security system which make work unattractive in some circumstances[7]. In other words, governments need to address situations which may lead to the private price of leisure being very different from the social cost of leisure. On the one hand changes of this type will allow old people to improve their welfare given the circumstances in which they now find themselves and, on the other hand, they will reduce the pressure for increased transfers from young people.

From this general analysis we now conclude with an explicit account of the appropriate fiscal response to the recent recession.

6 Conclusions: Implications for the Response to the Recent Recession

We see the recent recession and the associated economic disturbances as having the following effects:-

1. Following a sharp rise in land prices a part of the rise has been reversed. We assume that this is permanent in that, although land prices must be expected to rise overtime, the expected future trajectory is permanently lower than many people had anticipated ahead of the crisis
2. The crisis has been associated with a rise in risk premia; we assume that there is a permanent component to this rise with the consequence that the capital stock and therefore wages and output will be permanently lower than had been expected before the crisis.
3. There is a temporary reduction in output over and above the permanent effect mentioned in (2) because the financial disturbance has led to the economy operating at below capacity output.
4. Separately from the effects of the recession on public revenues there has been a discretionary increase in public debt as a consequence of expansionary fiscal measures. Our model is not an appropriate tool for showing the working of these or assessing their benefits but it does show the aftermath of them once the recession is over and output has returned to normal.

[7] For example, people aged 60 to 64 receive the Minimum Income Guarantee. Over the range of this guarantee there is withdrawal rate of 100% in response to earnings that people have; for people affected by the margin the wage rate/cost of leisure is effectively zero.

5. Changes to the structure of the economy which are not reflected in our model, such as reduced profitability of the financial sector mean that there is likely to be a fall in tax revenues over and above that associated with the permanent reduction to output.

The first component affects mainly old people adversely while the second and third have their largest impact on the young. The rise in the national debt consequence on expansionary policy has the effect of imposing a burden on future generations as shown in section 4. Finally, a reduction in public spending in the aftermath of reduced tax revenues is likely to affect mainly old people for the simply reason that they are disproportionate recipients of public spending; if this spending has, in large part, the characteristics of pay as you go transfers, then the reduction in public spending reduces the burden on future generations.

It is hard to argue for policy changes to offset the two factors which reduce the burden on future generations. One would need to believe that the rise in land prices in the period before the recession was inherently desirable in its inter-generational effects to argue that the subsequent fall should be offset. And the only mechanisms which might offset it, higher pay as you go transfers or debt finance of expenditure would require increased taxation at some point with the implication that tax rates would need to rise as a consequence of the recession. Similarly a reduction in the transfers associated with public spending could be avoided only if the reduction in spending itself were avoided which would imply sharp increases in tax rates.

If the resources available to old people are reduced, then, as we showed in section 5.5 that a natural response is for them to increase their labour supply and policy should facilitate this. Barrell, Hurst and Kirby (2009) analyse the impact of a one year increase in effective working life, or one an a half years extra on actual working lives as those near retirement on average work around 66 percent of normal hours. This would involve a 2 ½ percent increase in labour supply and hence, once the capital stock had adjusted, a similar increase in real output. They assume that the availability of increased labour and longer periods for earning are fully anticipated and hence the market adjusts and there is virtually no impact on the unemployment rate, which is determined by the wage bargain. Employers raise investment in advance of the anticipated increase in labour supply so that the capital stock can grow approximately in line with employment. They show that output rises in line with labour input in the long run, as we would expect from the production function.

An increase in working lives of one effective year (or about 2 ½ percent) would have three impacts on government finances, with an increase in direct and indirect tax receipts and a fall in transfer payments to those who are retired. These changes could improve the fiscal position by up to one percent of GDP, depending upon the impact of the increase in labour supply and output on government spending. Barrell, Hurst and Kirby (2009) show that such an increase in labour supply would prevent the debt stock rising as rapidly as it might, and after 20 years of so it might be 20 percent of GDP lower that suggested in Figure 1. Thus an increase in labour supplied by old people would also have the effect of reducing the fiscal problems associated with the recession. Nevertheless, as Khoman and Weale (2008) show, rising longevity means that, in the long term an increase in working lives of this magnitude is not adequate to remove a substantial savings short-fall.

The temporary income loss associated with the recession should clearly be spread into the future and for the government to support current consumption by means of a large budget deficit is an effective means of doing this. But at the same time policy-makers need to remember that there is a risk of further recessions and therefore, once the temporary shortfall to output has been closed the government needs to ensure that national saving is adequate bearing in mind this risk of future recessions. The risk cannot, of course, be estimated with any degree of precision, but it is clear that saving ought to be higher than it would be were there no risk of further similar events. If private sector saving does not take account of this government saving needs to since otherwise successive shocks will either have to be borne for the most part by the generations which experience them or the outcome will be a burden on future generations which rises with each future recession but which is not reduced in non-recessionary periods.

We noted that equation (31) implies that, after an adverse permanent productivity shock, an economy which has undertaken precautionary saving will find itself with excess reserves which it will gradually run down. But figure 2 suggests that it is rather unlikely that the UK will leave the recession with excess savings, at least unless the other advanced countries are grossly over-capitalised or working lives are substantially increased. While we have not presented a quantitative analysis of the UK's savings needs, a reasonable consequence of the low level of saving shown in the figure is that either people are not planning for their old age sensibly or that they expect to be supported in old age by transfers from their descendents, generated by some combination of pay as you go benefits and rising land prices. Unless this can be offset by a substantial increase in working lives, a government, which is concerned about fairness between generations and which also wants to avoid the problems that an impoverished old generation may give rise to, will introduce policies to raise UK saving once the recession is over and it is likely that a structural fiscal surplus will need to be a component of its policy framework.

7 References

Abel, A.B., N.G. Mankiw, , L.H. Summers and R.J. Zeckhauser. (1989). "Assessing Dynamic Efficiency: Theory and Evidence". *Review of Economic Studies*. VOl 56. pp. 1-19.

Allais, M. (1974). *Économie et Interêt* . Imprimerie Nationale. Paris.

Atkinson, A.B. and J.E. Stiglitz. (1980). *Lectures on Public Economics*. Chapter 8. McGraw-Hill. London

Auerbach, A.J. and L.K. Kotlikoff. (1999). "The Methodology of Generational Accounting". In *Generational Accounting around the World* ed. A.J. Auerbach, L.J. Kotlikoff and W. Elibfritz. Chicago University Press. Chicago.

Barrell, R and Davis, E. P., (2007) 'Consumption liquidity constraints and housing wealth in eight major economies' *Scottish Journal of Political Economy* May 2007

Barrell, R., Hurst, I., and Kirby, S. (2009) How to Pay for the Crisis or Macroeconomic implications of pension reform, NIESR Dp no. 333

Barro R. and H. Grossman. (1971). "A General Disequilibrium Model of Income and Employment". *American Economic Review*. Vol. 61. pp 82-93.

Barro, R. (1974). “Are Government Bonds Net Wealth? “ *Journal of Political Economy.* Vol 82. pp. 1095-1117.

Blanchard, O.J. (1985). “Debt, Deficits and Finite Horizons”. *Journal of Political Economy*. Vol 93. pp. 223-247.

Bowen, W.G., R.G. Davis and D.H. Kopf. (1960). “The Public Debt: a Burden on Future Generations?”. *American Economic Review*. Vol 50. pp 701-6.

Cardarelli, R., J. Sefton and L.J. Kotlikoff. (2000). “Generational Accounting in the UK”. *Economic Journal*. Vol 100. pp F547-574.

Deaton, A. (1992). *Understanding Consumption.* Clarendon Press. Oxford.

Deaton, A. and C. Paxson. (2000). “Growth and Saving among Individuals and Households”. *Review of Economics and Statistics*. Vol 82. pp. 212-225.

Gordon, R. and H. Varian,(1988), ‘Intergenerational risk-sharing’, *Journal of Public Economics* Vol. 37,185–202

Khoman E. and M.R. Weale. (2008). “Are we Living beyond our Means: a Comparison of France, Italy, Spain and the United Kingdom”. National Institute Discussion Paper No. 311. http://www.niesr.ac.uk/pdf/100408_94720.pdf

Lerner, A.P. (1948). The Burden of the National Debt”. *In* L.A. Meltzer *et al.* ed. *Income, Employment and Public Policy*. Norton (1948. pp 255-261.

Meade, J.E. (1958). “Is the National Debt a Burden?” . *Oxford Economic Papers*. Vol 10. pp 163-183.

Meade, J.E. (1968). *The Growing Economy*. Allen and Unwin.

Ricardo, D. (1820). “Essay on the Funding System”. *Encyclopaedia Britannica*. Sixth Edition.

Robinson, H. (2003) "Are you experienced? Recent British Evidence on Age-Earnings Profiles" *Applied Economics* 35 pp1101-1115.

Sefton, J., van de Ven, J., Weale, M., *(2008),* Means-testing Retirement Benefits: Fostering Equity or Discouraging Savings, *Economic Journal*

Weale, M.R. (1990). “Wealth Constraints and Consumer Behaviour”. *Economic Modelling.* Vol. 7. Pp. 165-178

Weale, M.R., A.P.Blake, N. Christodoulakis, J.E. Meade and D.A. Vines.(1989). *Macroeconomic Policy: Inflation, Wealth and the Exchange Rate*. London. Allen and Unwin.

Yaari, M. (1965). “Uncertain Life-time, Life Insurance and the Theory of the Consumer”. *Review of Economic Studies*. Vol 32. pp 137-150.