PENSION CORPORATION

Pension Corporation Research

Who will pay?
Inter-generational transfers and public sector pensions

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Key points

- This paper constructs a stylised society to analyse the different channels through which particular generations within one society can end up subsidising other generations through the functioning of the welfare state. In particular the paper studies in which way the different channels might be affected by the existence of funded or unfunded public sector pensions.
- The paper shows that inter-generational net transfers can arise for a number of reasons. The appropriate policy responses will depend on the exact nature of the underlying cause. The analysis shows that:
- First, an assessment of a generation's contribution to the welfare state can only be made at the end of their lifespan.
- Second, in steady state there should be no difference in terms of inter-generational fairness between unfunded and funded pension arrangements. However, societies are never in a steady state.
- Third, unfunded pensions could in fact lead to a higher degree of inter-generational fairness than funded pensions. For example, with unfunded pensions the large baby boom cohorts would pay the pension obligations arising from their own education. By contrast, with funded pensions the burden of paying for their education (teachers' wages and pensions) would fall on the baby boomers' parents only. The baby boomers would be net beneficiaries of the welfare state though whatever the funding arrangements.
- Fourth, introducing tax on the elderly in a world with varying cohort sizes makes the inter-generational transfer more even and fairer. This is the case whether public sector pensions are funded or unfunded.
- Fifth, tax smoothing and letting debt fluctuate are in particular circumstances the appropriate approach to achieving inter-generational fairness. This is particularly the case when the deviation from the steady state is of a temporary nature. This is for example the case as a result of the baby boomers, though "temporary" here means decades rather than months or years. The analysis suggests that the baby boomers' parents should have run up debt by more than they actually did, with today's workers (the baby boomers) paying it off. In fact, they ought to do more: they should leave assets to their own children so that these can pay for the baby boomers' pension and health care needs.
- Sixth, many developments are of a permanent nature, including the gradual extension of longevity. Tax smoothing would not suffice to establish inter-generational fairness. Parametric reforms would then be required, for example raising the pension age or making benefits less generous to deal with the fiscal consequences of an ageing population.
- Seventh, moving from an unfunded to a funded system will require one generation paying "twice". Given how well the baby boom generation is doing elsewhere, this suggests that the transition (if this is indeed deemed desirable) should perhaps take place (or at least a large part of it) while the baby boomers are of working age, in other words today.
- Eighth, given the complexities of the system, it seems very difficult to assess the effect of a policy change on inter-generational fairness.
- Ninth, the above example captures transactions between generations and the welfare state. Generations leave bigger legacies than merely public debt or assets, whether this is education, infrastructure, law and order, biodiversity or – not an asset but a liability – too much carbon in the earth's atmosphere, which might result in climate change.

Executive summary

This paper analyses the different channels through which particular generations within one society can end up subsidising other generations through the functioning of the welfare state. The welfare state, which is organised and funded by "society" through taxation, plays an important part in almost all countries, often providing services such as education and health care or transfers such as state pensions. Whether a generation receives a net subsidy from another generation (or other generations) can only be determined at the end of their life cycle and not at any particular point in time during their lives. The paper therefore focuses on the flows between the welfare state and generations over their whole lifespan, from birth to childhood, to working life to old age and eventual death. The paper argues that depending on the underlying cause of a potential inter-generational imbalance, the policy response might very well differ. Tax smoothing (and letting debt fluctuate as a buffer) is an appropriate response to varying cohort sizes (the baby boomer example). However, tax smoothing does not help with more structural changes such as the increase in longevity across successive generations. Increasing retirement ages in line with increases in longevity would be one appropriate response as would be making entitlements in old age less generous. In reality many developments take place at the same time so that a policy mix will be required. Last but not least the paper shows that the issue of funded versus unfunded public sector pensions is not as clear cut as some might believe it to be. Perhaps counter intuitively, having unfunded public sector pensions might actually be inter-generationally fairer than having funded pensions. This will depend on the circumstances though.

i. Introduction, motivation and definitions

This paper analyses the different channels through which particular generations within one society can end up subsidising other generations through the functioning of the welfare state. The welfare state, which is organised and funded by "society" through taxation, plays an important part in almost all countries, often providing services such as education and health care or transfers such as state pensions.

The paper *Public sector pensions – Rationale and international experiences*[1] argued that there were certain types of goods and services, which can only be provided by the state. These goods and services are generally "public goods" such as defence or law and order. In most countries the public sector provides and funds many other goods and services too, including health care and education even though this need not necessarily be the case as government could also define its role as providing the regulatory environment to let private businesses or organisations offer these goods and services. In any case, in most countries the public sector employs a significant number of workers – often representing a large share of the workforce – and these public sector workers get paid and receive a pension too.

Whether a generation receives a net subsidy from another generation (or other generations) can only be determined at the end of their life cycle and not at any particular point in time during their lives. The paper therefore focuses on the flows between the welfare state and generations over their whole lifespan, from birth to childhood, to working life to old age and eventual death. As such it follows in the tradition of previous studies (for example *The dynamic of welfare - The welfare state and the life cycle* by Falkingham and Hills) or fields of economic theory and research, the most obvious being generational accounting.[2] Generational accounting was developed in the mid 1990s to assess the degree of inter-generational fairness of current policies for future generations. Unlike the generational accounting literature though, this paper limits its contribution to the debate to illustrating the potential transfer mechanisms rather than to quantify the actual flows using complicated mathematical models, thus hopefully raising the awareness of the issue and arguments to a wider audience. It is further hoped that the paper enables the interested reader to use the methodologies presented in the context of other similar issues.

However, the paper also innovates. In particular, it investigates in what way different financing arrangements for public sector pensions – whether they are funded or unfunded - could affect the direction and magnitude of inter-generational net transfers. To do so the paper builds on the analysis in *Public sector pensions – Rationale and international experiences.* As such the paper contributes to the on-going debate in the UK on private and public sector pensions. Much of the debate focuses on the perceived divergence in the generosity of private and public sector pensions, with some arguing that the current private sector workers would be subsidising their public sector contemporaries. More work will be needed to verify this claim. An often-forgotten dimension to this debate is whether today's workers in general – private and public sector – might get a good deal with respect to previous or future workers. It is indeed possible that such a "subsidy" if it existed could be substantially larger than any potential private/public sector transfer currently.

This paper does not attempt to quantify the exact amount of the potential net transfers flowing between generations in the UK as this would be a very substantial undertaking going beyond the scope of this analysis. It would require an analysis of all spending and

[1] *Public sector pensions – Rationale and international experiences*, Frank Eich, 2009.
[2] *The dynamic of welfare – the welfare state and the life cycle*, Falkingham and Hills (eds), 1995 and *Generational accounting around the world, Auerbach,* Kotlikoff and Leibfritz, 1999. For a relatively recent assessment of the UK's generational accounts, see *Ehrbare Staaten? Die Ergebnisse der Generationenbilanzierung im internationalen Vergleich*, Hagist, Moog, Raffelhüschen and Vatter, 2009.

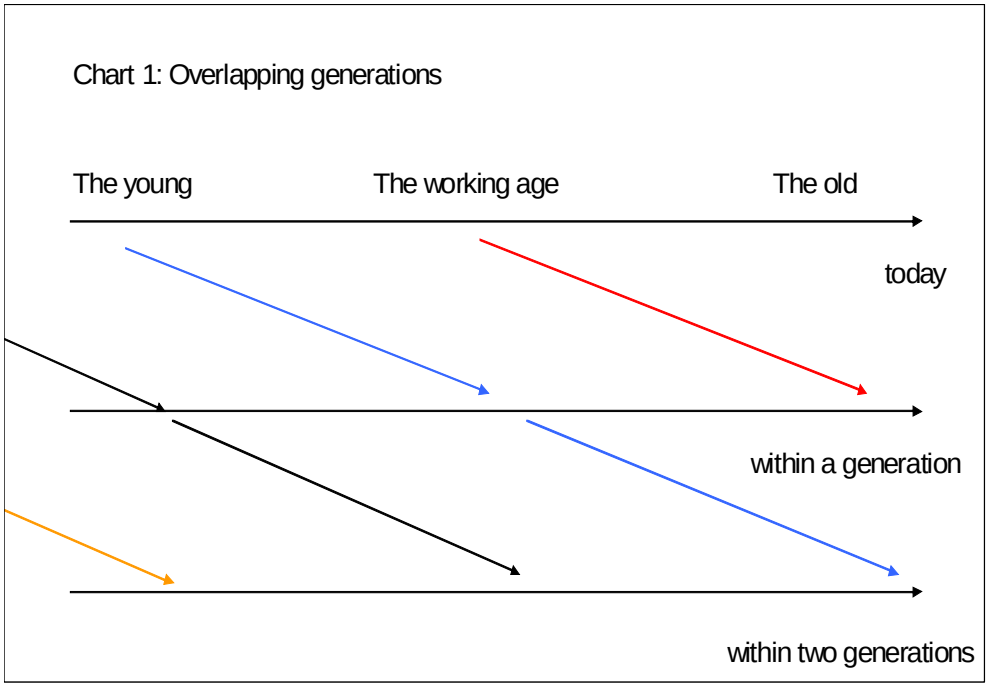
all revenue over decades, taking into account all the different age groups and even gender differences.

Instead the paper illustrates how these net transfers might arise, in what direction they might go and what policy could do to correct these potential imbalances. To do so the paper constructs a stylised society with a fully functioning welfare state. To keep the paper as tractable as possible, a number of simplifying assumptions are used, which can be relaxed. The simplicity of the model allows focussing on the key mechanisms at play and allows considering different policy options available to society to correct the imbalances in the welfare system. The paper shows that the appropriate policy response will depend on the nature of the underlying cause of the imbalance. One initially counter-intuitive result is that depending on the circumstances moving from an unfunded to a funded pension scheme environment could in fact *reduce* the degree of inter-generational fairness. This is particularly the case when dealing with the generational imbalances arising from the large baby boom cohorts. This is because an unfunded public sector pension scheme would shift the burden of paying the large pension bill arising from employing teachers to educate them from their parents to themselves. Equally, an unfunded pension scheme would spread the health sector's wage and pension cost of looking after the baby boomers in old age across their children and grandchildren. Whatever the funding arrangements of public sector pensions; the baby boomers would be net beneficiaries of the welfare state though. Dealing with this imbalance should be a policy priority.

Some definitions

Before constructing the stylised society, it is important provide a number of definitions.

Generation: At any point in time, society will comprise several generations. At its most basic, there will be a young, a working age and an old generation. Within a generation, the young will have become working age and the working age will be old. A new young generation will have been born. Society consists forever of overlapping generations. When studying the potential for inter-generational net transfers, it is thus important to look at these overlapping generations. Chart 1 illustrates this type of society.



Inter-generational net transfer: the fact that a particular generation might pay a significant amount of tax at a particular point of time to finance welfare spending in itself says nothing about inter-generational net transfers. The net transfer ought to be calculated over the entire lifetime of that particular generation and will also depend on

the value of goods and services consumed by that generation, which will be financed by someone else and as such are for "free" to the generation in question. The timing of the goods and services received might be very different to the payment. If the value of services received for "free" equal the value of taxes paid, then net transfers would be zero.

Table 1 shows the flow of goods and services received and payments made in a typical welfare state.

Table 1: The net transfer position across the life cycle

Age	*Type of flow*	*Stock of net transfers at end of age band*
0	Receiving health care at birth	negative
5-18	Receiving education	negative
20-65	Paying tax while working	positive
65-death	Receiving health and pensions etc	hopefully zero

The above table is for the aggregate of different age groups. In reality there will be individuals who even during working lives will remain net beneficiaries of the welfare state as they do not engage actively in the labour market and hence do not pay enough tax to make up for the upfront cost they received when young in the form of health and education. On aggregate though cohorts will make their most substantial contribution to the welfare state during working lives as they pay income tax and national insurance contributions. By the time they retire the generation should be in a significant surplus with respect to the welfare state as they will start to receive health and long-term care and pensions in older age. Over the entire lifespan the net transfer will hopefully be zero. The welfare state would be financially sustainable forever if for all generations the lifetime net transfer turned out to be zero.

While the above is about flows, the same rationale applies to stocks. For example, a generation, which leaves a stock of liability to the succeeding generation, is not necessarily a net beneficiary of the welfare state. For this to be true it would have had to leave a larger stock of liability than it inherited from the preceding generation. The focus of analysis and policy discussion should hence be on **net** payment or net liabilities. This cannot be determined with a snapshot in time but will require an analysis of lifetime flows.

Appendix A provides more insights into the age-specific spending and revenue flows between individuals (generations) and the welfare state.

Public sector pensions: are a payment made to public sector workers after they have retired. During working lives they receive a wage. Public sector workers are those people who out of the working-age population decide to provide public services.

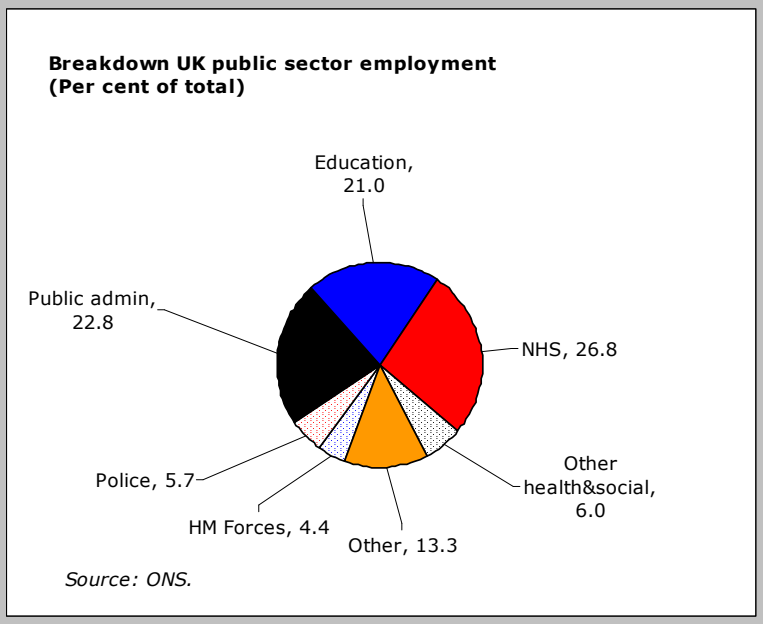
ii. A stylised society

Generations and their relationship with the welfare state

Let us assume that at any point in time there will always be three generations: the young, the working age and the old (Appendix B provides more information on actual cohort sizes in the UK). As we are interested only in the welfare state, we do not need to model explicitly what is going on in the private sector. The welfare state provides only two types of services: education and health care. The young consume education, which is provided by public sector teachers while the elderly consume health care provided by public sector doctors. For simplicity we assume that the working age consume no public services but that they are – at least in the baseline – the only source of revenue in the form of a tax on income. Box 1 provides a breakdown of public sector employment in the UK.

Box 1: The employment structure of the welfare state

While it is not possible to allocate the goods and services provided by civil servants, the police force or the armed forces among others across specific age groups (does a 5-year old consume more of a solider defending a country than a 70-year old?), the services provided by teachers can be allocated to children, while those of healthcare professionals mainly to the elderly. An increase in the number of health professionals – for example as the government follows calls for better health care provision – would hence disproportionately benefit the elderly. Similarly, a drive to recruit more teachers would benefit children. Teachers and health professionals make up nearly 50 per cent of total public sector employment in the UK.



In the baseline variant it is assumed that every generation is of the same size, consisting of 100 individuals, and that every generation has the same life expectancy. More precisely, every person lives exactly the same number of years. These assumptions will be relaxed at a later stage. For example, in the "baby boom" variant it will be assumed that one generation is twice the size of all other generations, while in the "living longer" variant it is assumed that individuals in successive generations live longer.

Labour market and pay

Within the working-age generation all individuals are assumed to be equal – e.g. in terms of productivity, skills, preferences etc – but some will work in the public sector while others will work in the private sector.

Given that all individuals are equal, individuals will only work as teachers or doctors if the salary (more precisely: lifetime earnings) offered is the same as in the private sector. This is required to clear the labour market and is what is seen in reality over the longer term.[3] Also as in the real world, real wages are set in the private sector and depend on productivity. It is assumed that the real wage is £50 per person. The per-unit cost of educating a young person or treating an elderly person is therefore determined by the wage in the private sector and the teacher/pupil and doctor/patient ratio.

With private sector workers earning £50 each and public sector workers expecting to receive the same wage, GDP is £50 times the number of workers, e.g. £5,000 in the case of a generation of 100 individuals.

[3] Alternatively we could make the assumption that workers get allocated to work in the public sector through a lottery.

It is assumed that one teacher can look after ten pupils and one doctor after ten elderly people. The demand for teaching and health care (and hence teachers and doctors) is determined by the number of young people and old people at any point in time. A doubling in the number of young people would therefore lead to a doubling in the number of teachers. Everything else equal, fewer workers would be employed in the private sector then.

Pensions

In the baseline variant it is assumed that there are no pensions but two pension variants will be developed: one in which the pension is funded (meaning that they will be paid for at the same time as the wage), the other in which the pension is unfunded (meaning that the pension promise will have to be paid by the following working-age generation). It is assumed that the pension will have to be paid out of existing working-age productivity of £50 in line with the notion that a pension is deferred pay.

Let us assume that in this case the wage is worth £40 and the pension worth £10. One could think of a funded pension as if workers received their retirement income already during working age but that the money would be locked away in a secure account, which can only be accessed once in retirement.

Other assumptions

To keep the model initially as simple as possible, it is assumed that:

- productivity remains unchanged across generations and hence real wages will remain unchanged;
- there is zero inflation so real wages equal nominal wages;
- the interest rate on government debt or assets is zero;
- pension income is not taxed (equivalent to a tax free 100 per cent lump sum or a comprehensive income tax allowance for older people); and
- the provision of education and health care does not require any capital, in other words the public sector is 100 per cent labour intensive.[4]

iii. Illustrative inter-generational net transfers

This section illustrates the causes and direction of inter-generational net transfers using a baseline variant with stable generations. By relaxing one by one some of the assumptions stated above, it is also possible to study a number of variants. These include:

- *Baby boom* with one generation larger than the other generations
- *Increasing longevity* with successive generations living longer
- *Improving the quality of education*
- *Widening the tax base* by taxing retirement income.

These variants can be analysed for the three sub-cases of: no pension, funded pension and unfunded pension. As we are interested in the lifetime net transfer between generations all variants cover several periods.

[4] In the real word, the fact that wages in the public sector are determined by the private sector and that many public sector services are very labour intensive and do not and will not benefit from major productivity gains (the best example is long-term care provision, which in its most extreme is about just spending time with someone) means that per unit costs can rise in the public sector when they fall due to productivity gains in the private sector. This is called the Baumol effect. We will not model this effect here as we will keep private sector real wages constant but the fact that productivity growth is often not as rapid in the public as in the private sector has led the general public to believe that significant efficiency gains could be made in the public sector if so desired.

Baseline with stable generations

It is assumed that in period 1 there will be 100 workers, 100 children and 100 elderly. Given the above assumptions and description of the stylised society, there will therefore be 10 teachers and 10 doctors, leaving 80 individuals to work in the private sector.

i. no pension

In this sub-case it is assumed that neither the private nor the public sector pays out any pensions. The total wage bill for the public sector is £1000, which will have to be financed by all 100 workers, regardless of whether they are in the public or private sector (this means that public sector workers partly pay for themselves, as is the case in reality). Per unit spending on education and health care is £5.

Despite financing £1000 of public services consumed by the young and the old through taxation while working, the net transfer to the working age is zero over their own lifetime. This is because they had enjoyed *income in kind* in the shape of free education when young (worth £500) and will enjoy free health care when old (worth £500).

In this baseline variant the inter-generational net transfer is always zero because every generation is the same and society in a steady state. For example, in period 2 the working age will have enjoyed free education in period 1 and will receive free health care in period 3 when old.

ii. funded pension

In period 1 private and public sector workers earn £40 each but they will also receive an untaxed pension of £10 when old. Given that the pension is funded, workers will still need to be taxed £1000 to pay for the 20 public sector workers, with the assets put away until public sector workers reach their retirement age. Out of a £4000 income during working life, £1000 is allocated towards providing education to the young and health care to the old. On retirement, they will receive their non-taxable lump sum of £1000 so that the lifetime financial net income available for consumption other than on education and health remains £4000.

Except for this, sub-cases i and ii are the same: the working age will have received £500 worth of education when young and will receive £500 of health care when old. Net lifetime transfers therefore remain zero for all generations.

iii. unfunded pension

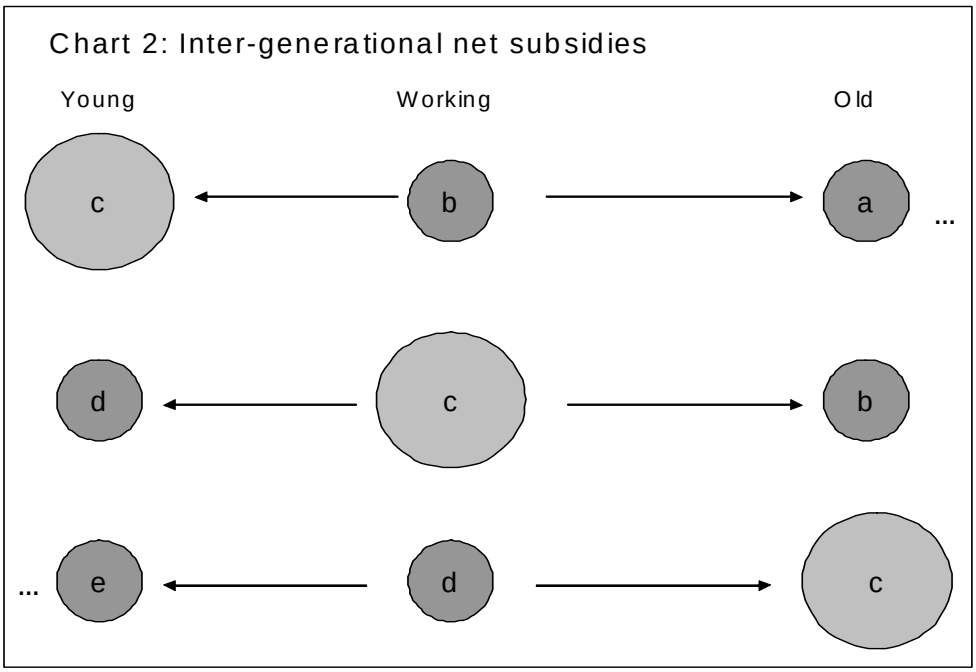
In period 1 private sector workers will receive £50 each, of which £10 will be put into a secure pensions account accessible on retirement in period 2. This means that workers only have £40 of "available" income during working lives. Matching the salary for 20 public sector workers in period 1 costs £800, with the next generation of workers paying their pensions (worth £200) in period 2 so that lifetime earnings remain the same in the private and public sectors. However, the working age generation is also obliged to pay for an outstanding pension liability of £200 coming from the previous generation. This means that the working age puts in £1,000 into the financing of the welfare state, just as has been the case in the previous two sub-cases. Over the lifetime, once taking into untaxed pensions of £1,000 in period 2 income net of transfers to the welfare state (and hence available for consumption other than on education and health) is again £4,000. Net transfers remain zero as the working age spent £1,000 on paying teachers and doctors but also received £500 in education when young and will £500 in health care when old.

Note that in all sub-cases net incomes are the same and that there have been no inter-generational net transfers. The introduction of funded or unfunded pensions makes the analysis more complex as it apparently disconnects payments from services provided but fundamentally nothing changes.

Baby boom variant

This variant differs from the previous variant in one aspect: one generation (called c = the "baby boomers") is larger than any of the other generations.

In period 1 the working age (called generation b) consists of 100 people who will have to look after 100 elderly (generation a) and 200 children (the baby boomers). In period 2 generation c with its 200 members will be of working age and they will look after generation d in terms of education and generation b in terms of health care. In period 3 there will once again be 100 workers (generation d), looking after 100 children (generation e) and 200 elderly (generation c). Chart 2 illustrates the population structure.



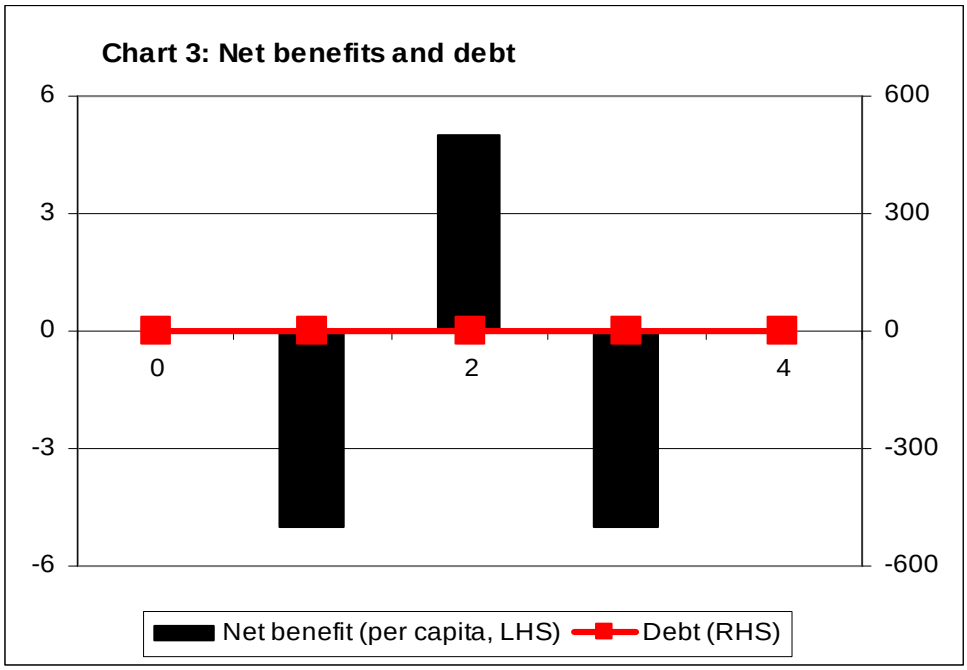
i. no pension

In period 1 there is a need for 30 public sector workers, whose gross wage bill is £1,500. Out of a total income of £5000, £1500 (or £15 per person) is hence allocated towards funding the welfare state, leaving £3500 for consumption other than on education and health. The net transfer is lower though as generation b received £500 of education when young in period 0 (worth £5 per person) and will receive £500 of healthcare in period 2 when old (again £5 per person). The net contribution is £500 or £5 per person. The interpretation is straightforward: it costs more to finance the education of the following large baby boom generation than generation b received itself from their parents.

The baby boom generation c starts life with free education worth £1,000 (£5 per head) and moves into working age in period 2. In period 2 there is the need for only 20 public sector workers to look after 100 children and 100 elderly. Generation c will therefore only pay £1,000 into the welfare state, equivalent to £5 per person. Before even reaching old age in period 3, the baby boom generation has already achieved a net balance with respect to the welfare state – everything it gets in old age is a net benefit. Indeed, in period 3 it receives £1,000 worth of healthcare (£5 per person).

Just as generation b loses out to generation c, so does generation d. This is because it has to foot a much larger health care bill for their baby boomer parents than they will receive themselves from their children. In detail: in period 2 generation d receives education worth £500 (£5 per person). In period 3 the generation is of working age and 30 of them will have to work in the public sector to look after 100 pupils and 200 elderly people. This costs £1,500 (£15 per person). Once it reaches retirement, generation d receives £500 worth in health care (£5 per person). So over their lifetime they will have made a net contribution of £500 (£5 per person) to the welfare state.

With every working-age generation paying fully for the welfare costs arising during that time, debt would always be zero. Chart 3 shows the debt path (which is a flat red line) and the three generations' different per capita net transfers.



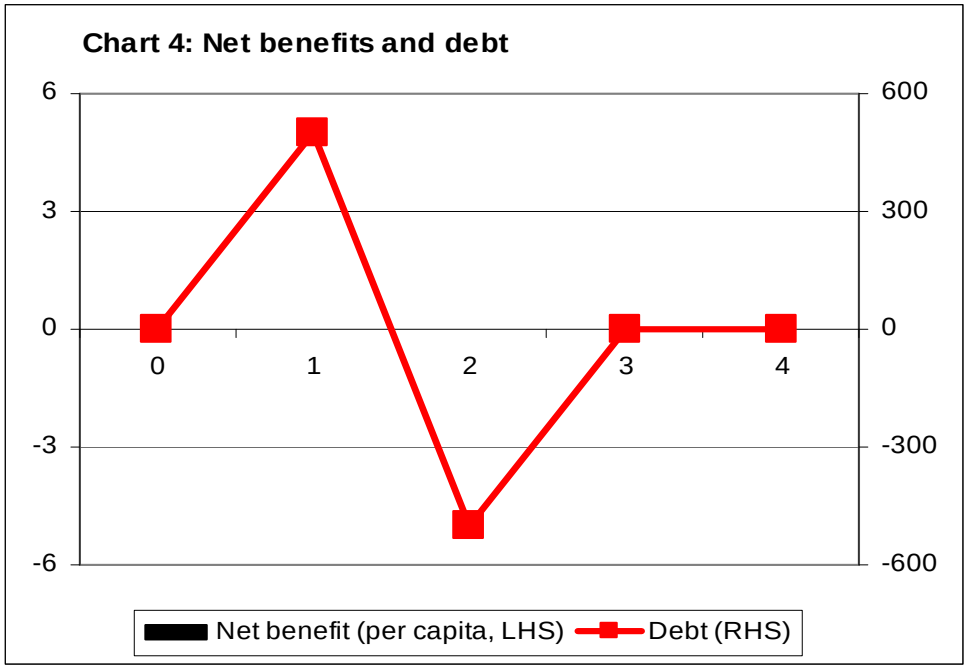
Note that the net benefits are for:

- generation b: -£500
- generation c: +£1000
- generation d: -£500

Total *£0*

In this simple example generation c has been a net beneficiary of the welfare state at the cost of the preceding and succeeding generations. The only way how this could be addressed is for the working age in period 1 to finance part of welfare spending by running up debt, then to ask generation c to run this debt down again and in addition to build up assets which it could hand over to their children to part finance their healthcare needs.

Chart 4 shows that if everybody allocated £10 towards the funding of the welfare state regardless of generation then the net transfer would be zero for every individual in every generation – which would be fair – and debt would end up again at zero at the end of period 3. In this case generation b would finance a third of its welfare spending by taking up debt (£500 out of £1500). The large generation c would then pay off that debt and accumulate £500 of assets for generation d. The fact that debt and assets amount to £500 is not coincidental: it reflects the fact that generation c consumes £2000 of education and health while b and d consume only £1000 each. Debt/assets are hence used to make generation c pay for its own additional consumption despite the fact that the system is unfunded.



Debt and tax smoothing can thus be used in this example to smooth out differences between generations. This is because the existence of the large generation c, though lasting decades, is a temporary phenomenon.

Such a strategy has been pursued in a number of countries, including Sweden, Finland, Australia and New Zealand.

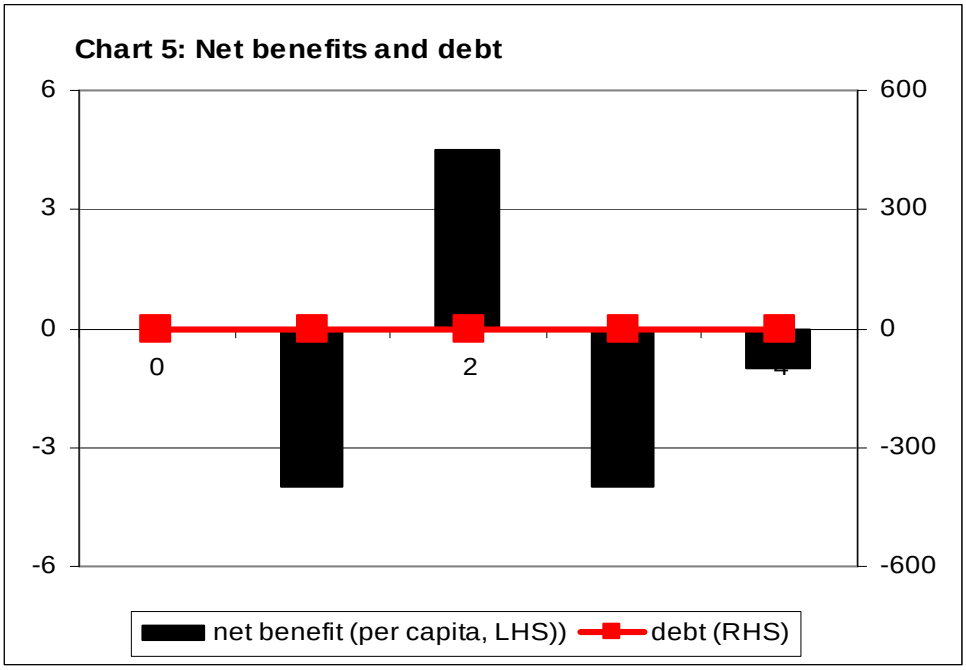
ii. funded pension
As in the baseline variant, it is assumed that workers get £40 per head while they work (which is taxable) and a non-taxable £10 in retirement. This pension is fully funded with workers building up assets during working life. This means that the cost of financing the welfare state will remain unaffected by the funded pension and hence the net transfers will be the same as in the "no pension" case.

iii. unfunded pension
The picture changes once an unfunded pension system is considered. In period 1 generation b pays the wage bill for 30 public sector workers (30*£40=£1,200) but nothing towards the accruing pension, which is equivalent to £300 (30*£10). That liability will be passed on to generation c to pay in period 2. However, generation b will also have to pay the pensions for the elderly in period 1 who used to be public sector workers. There are 20 of those, so overall spending is £1,400. This needs to be compared with the education they received previously and the health care they will receive in period 2. The value of this is the same as before, £1,000. The introduction of unfunded pensions has made generation b better off by £100 though it remains a net contributor to the welfare state with £400 (£4 per person).

In period 2 the large baby boom generation c is of working age and 20 of them will be employed in the public sector to provide education and health services. Their wage bill is £800. Rather than paying their pensions though (which amounts to £200), generation c will have to pay the pension liability they inherited: £300, so total welfare spending is £1,100. They will pass on the £200 as a pension liability to generation d. The value of education received and health care to be received remains unchanged though: it is worth £2,000, so that the net benefit is +£900 (+£4.50 per person). Moving to an unfunded pension system reduces the net benefit for the large baby boom generation as they finance the pension arising from their own education in the previous period, which was more costly than what they would have paid on teachers today themselves. Overall though, the baby boomers remain net beneficiaries.

In period 3 generation d is of working age, with 30 working in the public sector (10 as teachers, 20 as doctors). The wage bill is £1,200. Like generation b they also benefit from the introduction of the unfunded pension arrangement. This is because they will have to pay the £200 liability they inherited rather than the £300 their 30 public sector workers accrue (and which will be passed on to the next generation). Total spending is hence £1,400. Over their lifetime they consume education and health care worth £1,000 so their net contribution is £400, which is £4 per head. This is still negative but smaller than in if pensions had been funded.

Note that the introduction of unfunded pensions also affects generation e. In period 4 the population structure has stabilised again with all generations of the same size (100 young, 100 working age and 100 elderly). Generation e therefore employs 20 public sector workers to look after its children and elderly population (at a cost of £800). Rather than paying the accruing pensions of £200 though it pays off the £300 pension liability, which is larger because their grandparents were part of the large baby boom cohorts. Total spending is hence £1,100 which compares with a value of £1,000 for consumed education and health care. Hence generation e is a net loser with net benefits of -£100 (-£1 per person). See Chart 5.



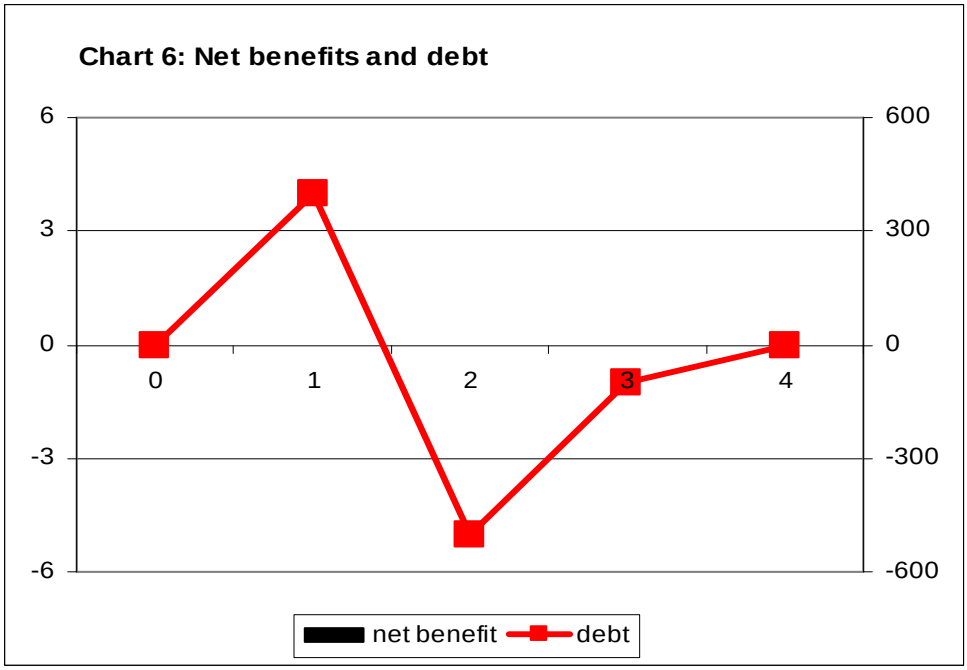
Note that the net benefits are for:

- generation b: -£400
- generation c: +£900
- generation d: -£400
- generation e: -£100

Total *£0*

To conclude this section: the introduction of an unfunded pension makes the generations immediately preceding and succeeding the large baby boom cohorts (in other words the baby boomers' parents and children) relatively better off even though they remain net contributors. Their relative improvement comes at the cost of the baby boomers themselves but also of the generation representing the baby boomers' grandchildren. The intuition for these relative changes is that an unfunded system leads to the baby boomers paying for the pensions that accrued as a result of educating them and their grandchildren paying for the pensions that accrued as a result of the baby boomers' health care provision.

As in the previous case, all generations could be made equally well off if they paid £10 each towards the welfare state regardless of spending pressures. This would mean that generation b should issue new debt worth £400 in period 1 as it pays for the baby boomers' education. The baby boomers themselves would pay off the inherited debt stock and would go further by accumulating assets worth £500; in other words they would have a budget surplus of £900 during their working lives. Generation d could run a deficit of £400 again, leaving their children (generation e) an asset stock of £100. This asset stock would compensate generation e for having to pay the pensions that accrued as a result of looking after the baby boomers in old age. See Chart 6.



In short: whether funded or unfunded, the baby boomers' parents should have deficit-financed parts of their welfare spending; the baby boomers should aggressively reduce the debt stock again and build up assets, which can then be used by their children and grandchildren to pay for the additional costs generated by the boomers' large cohort size.

Tax smoothing and letting debt fluctuate over the generations can eliminate the inter-generational net transfers (subsidies) that could arise as a result of a baby boom generation. This is because the baby boomers are a temporary phenomenon even though "temporary" here is measured in decades rather than weeks, months or even years.

In the following section we will show that this is not necessarily the case for other sources of inter-generational net transfers.

Increasing longevity variant

Inter-generational net transfers could also arise as a result of increases in longevity. Consider the case in which successive cohorts (of equal size) live longer and longer, for example rather than all living 10 years in retirement, they all live 11 years, then 12 years then 13 years etc. Everything else equal, successive cohorts would consume increasingly more healthcare.

Taking the above stylised trend as a starting point, let us assume that demand for health care increases linearly with years lived in retirement. For example, in period 1 the elderly live for 10 years, requiring 1 doctor for every 10 elderly. In period 2 the elderly live for 11 years, requiring 1.1 doctors for every 10 elderly. And so forth.

i. no pension
In period 1 generation b is of working age and employs 20 people in the public sector: 10 as teachers and 10 as doctors. The latter reflects the fact that life expectancy of the elderly is 10 years in retirement. This costs £1,000. Over their lifetimes though, generation b is a net beneficiary of the welfare state. This is because it consumed £500 worth in education when young and will consume £550 worth of health care when old as they will all live 11 years in retirement. Generation b will hence be a net beneficiary of the system by +£50 or 50 pence per person.

In period 2 generation c is of working age and employs 21 people in the public sector: 10 as teachers and 11 as doctors. This costs £1,050. However, when they themselves are old, they will consume £600 of health care, so that generation c is a net beneficiary of the welfare state by £50 or 50 pence per person.

While in this particular case every successive generation is a net beneficiary of the welfare state, it should also be noted that fewer and fewer resources will become available for consumption other than on education and health. This is in fact what we are experiencing in reality, with health budgets taking up ever greater shares of GDP. We have not specified a utility function for society at large but there will be a point where the marginal benefit from better health care in society will be more than offset by the marginal loss from being able to consume fewer private goods and services. The availability of labour also represents the natural limit to this trend: once all working age individuals are employed as teachers or doctors, the set up can no longer continue. In reality this limit will be reached much earlier as a society cannot survive on only education and health care services.

As this is not a temporary effect similar to that generated by the large baby boom cohorts but a structural trend, letting debt fluctuate through tax smoothing would not address this issue as the additional cost cannot be distributed across generations this way. Moreover, the provision of education and health care competes with the provision of private goods and services so there will be an optimum.

Ignoring the welfare implications of allocating an ever greater slice of resources to the provision of health care, as stated above, the system can be made fiscally sustainable by asking successive cohorts of the working age to pay more taxes (this includes the option discussed above where cohorts build up assets to fund their own increased longevity). This approach cannot continue forever though. In addition to raising taxes to finance an ever increasing demand for health care, society has one further policy to keep its finances under control: it can keep future spending increases at bay by reducing the generosity of services provided. It can do this by either:

- reducing the quality of health care provided in any given year in retirement so that per capita health care spending remains unchanged even as individuals live for longer in retirement; and/or
- increasing the age from which on citizens are entitled to the healthcare services provided by the welfare state.

In reality society will have to decide what the appropriate mix of the three policy options discussed ought to be. It is likely that all three policies – an increase in tax, a reduction in annual benefit and an increase in age of eligibility – will be used to keep the system sustainable.

These policy responses have their parallels in the world of pensions: as people live longer, governments can increase tax (or national insurance contributions) on the working age, reduce the lifetime generosity of state pensions by making annual payments less generous and/or by raising the official state pension age from which onwards an individual is eligible to the pension. Such an adjustment could even be automatic: as people live longer, generosity could be lowered and/or the state pension

age raised automatically. This has been done in a number of countries but not so far in the UK.

Improving the quality of education variant

Making health care less generous per person is one policy which could be introduced but there are countless others. Consider a policy aimed at improving the quality of education by reducing class sizes. For example, rather than having a teacher pupil ratio of 1:10 (as has been assumed so far) we could have a ratio of 1:5. For any given number of pupils, the number of teachers would have to double.

i. no pension

We can analyse the inter-generational transfer arising from this policy in a society with stable generation sizes. In period 1 there are three generations, each with 100 individuals. 20 individuals of working age (generation b) are employed in the public sector - 10 as teachers and 10 as doctors – leading to a public sector wage bill of £1,000. Their net contribution to the welfare state will be zero as they received £500 in education when young and will receive £500 in health care when old.

In period 2 the working age (generation c) will employ 10 doctors and as a result of a change in policy 20 teachers though the number of pupils remains the same at 100. The wage bill is hence £1,500. When young they received £500 in education and when old they will receive £500 in health care. Generation c will therefore make a net contribution of £500 to the welfare state.

In period 3 generation d will be of working age. They received £1,000 worth of education when young, will pay £1,500 of taxes during working age to finance the welfare state and will consume £500 of health care when old. Their net contribution to the welfare state is zero. Beyond period 3, society has returned to a new equilibrium, with all future generations making a zero net contribution.

In this case the working age generation which has decided to make education spending more generous will pay the whole cost of adjustment moving from one equilibrium to another. More generally, the generation which decides to have a step change in public service provision – much of it generally going to the young or elderly – will have to take the financial hit for that decision. Everything else equal, it could try to spread this hit by deficit financing the increase in spending.[5]

ii. funded pension

This will be the same as in the no pension case.

iii. unfunded pension

In period 1 the working age (generation b) employ 20 public sector workers and hence face a public sector wage bill of £800. The accruing pension liability will be paid in period 2 by generation c. However, generation b will also have to pay off the pension liability of £200 from the previous period so that it pays £1,000 into the financing of the welfare state. In return it receives £500 worth of education and £500 of health care; hence its net contribution is zero.

In period 2 generation c introduces a more generous education system and as a result employs 30 public sector workers (10 doctors and 20 teachers). Paying their wages costs £1,200 but generation c will also have to pay the inherited pension liability of £200 from period 1. As they have received education worth £500 and will receive health care worth £500, they make a net contribution of £400 to the welfare state (equivalent to the additional teacher pay).

[5] In reality, governments increase education spending with the expectation that this will raise the productivity of the future labour force, which in turn would make it easier to face the fiscal challenges arising from population ageing. As it is expected that much of the financial benefit of additional education remains with the individual, it is often argued that the person in question should make a substantial contribution to the education provided.

In period 3 generation d will be of working age. They will have received education worth £1,000 in period 2 and will receive health care worth £500 in period 4. In period 3 they will pay the wage bill of £1,200 for 30 public sector workers and pay the previously accrued pension liability of £300. Their net contribution is hence zero.

As the system is open-ended, in the case of unfunded pensions, generation b manages to shift parts of the additional costs associated with its new policy – that relating to pensions – to future generations.

Widening the tax base variant

So far it has been assumed that the elderly do not contribute financially to the funding of the welfare state. Using the baby boom variant as the starting point, it can be shown that relaxing this assumption makes the flows significantly more complex. As the variant requires the elderly having retirement income, it implies that they must receive pensions, either funded or unfunded.

As the interactions become increasingly complex, it is best to illustrate the flows in a table covering 5 periods and four generations.

i. funded pension

Table 2 shows the flows between the different generations a to d and the welfare state between period -1 and period 4. The grey shaded areas represent the flows the generations receive when young. All the flows are positive as they are the result of education; with generation c – the baby boomers – receiving more education on aggregate than the other generations (though per capita is the same). The green/blue shaded areas represent the flows during the generations' working lives. All are negative as they represent taxation. However, they are not sufficient to finance welfare spending on education and health during those periods. This is because the elderly contribute to the financing of welfare spending too now. This can be seen by the orange shaded areas, which represent the flows when the generations are elderly: they receive health care (always a positive entry) but also contribute to the welfare state (always a negative entry). Note that the horizontal sum of flows for the grey, green/blue and orange areas adds up to 0 as the welfare system has been set up to be fiscally sustainable. Note that the table also includes generations "a-1" and "d+1" to frame the generations under consideration here.

Per-capita tax take from a pensioner will always be a quarter of that taken from someone of working age. This reflects the fact that income in working life is four times the income during retirement (£40 versus £10).

Table 2: Inter-generational flows with funded pensions and the elderly paying tax							
	"d+1"	d	c	b	a	"a-1"	
Period -1	-	-	-	-	+500 (edu)	-800 (tax)	-
Period 0	-	-	-	+500 (edu)	-800 (tax)	+500 (health) -200 (tax)	**0**
Period 1	-	-	+1000 (edu)	-1200 (tax)	+500 (health) -300 (tax)		**0**
Period 2	-	+500 (edu)	-888 (tax)	+500 (health) -111 (tax)	-		**0**
Period 3	+500 (edu)	-1000 (tax)	+1000 (health) -500 (tax)	-	-		**0**
Period 4	-800 (tax)	+500 (health) -200 (tax)		-	-		**-**
Total	**-**	**-200**	**+611**	**-311**	**-100**	**-**	**0**
per capita	**-**	**-2**	**+3.05**	**-1.55**	**-1**	**-**	
Colours		Young = edu	Working age = tax	Old = health and tax			

The table shows that making the elderly contribute to the welfare state too implies that generation a will also now be affected by the existence of the baby boomers – previously it was only generations b and d. To be more precise, generation a contributes to the financing of the baby boomers' education. In return, generation b is better off than before as it shares the burden of educating the baby boomers.

Generation d also benefits from this arrangement as the baby boomers now contribute to the financing of their own health care needs when old. Overall the baby boomers remain net beneficiaries of the welfare state but by not as much as they used to. Generation d remains a net contributor but by less than previously. Overall, relaxing the assumption that the elderly do not contribute to the financing of the welfare state distributes the additional cost associated with the baby boomers more evenly across the generations.

ii. unfunded pension

The picture becomes even more complex with unfunded pensions. Five generations are affected by the existence of the large baby boom cohorts, with the baby boomers remaining a net beneficiary of the welfare state while the other four generations are net contributors to varying degrees.

The difference to the funded case is that the working age and the elderly finance the wage bill of their public sector workers and the pension liability inherited from the

previous generation. In return they pass on the pension liability from employing their public sector workers to the next generation. In a steady state with identical generation sizes this would make no difference, however in a stylised society with a large baby boom generation this symmetry breaks down as some generations pass on a larger liability than they themselves pay off.

It is noteworthy that the unfunded case leads to a fairer outcome than the funded case. This might initially sound counter-intuitive but there are good reasons for this. First, the wage cost of educating the large baby boom generation falls on their parents and their grandparents. Second, the pension cost of educating the large baby boom generation falls onto their parents and themselves. Third, the wage cost of providing health care to the elderly baby boom generation falls onto their children and themselves. Fourth, the pension cost associated with providing health to the elderly baby boomers falls onto their children and their grandchildren.

The key point to take away though is that even in this simple structure it is becoming increasingly difficult to track the different flows between generations and the welfare state. The introduction of changing policies would make it substantially more difficult still. See Table 3.

Table 3: Inter-generational flows with unfunded pensions and the elderly paying tax							
	"d+1"	d	c	b	a	"a-1"	
Period -1	-	-	-	-	+500 (edu)	-800 (tax)	-
Period 0	-	-	-	+500 (edu)	-800 (tax)	+500 (health) -200 (tax)	**0**
Period 1	-	-	+1000 (edu)	-1120 (tax)	+500 (health) -280 (tax)		**+100**
Period 2	-	+500 (edu)	-977.7 (tax)	+500 (health) -122.2 (tax)	-		**-100**
Period 3	+500 (edu)	-933.3 (tax)	+1000 (health) -466.7 (tax)	-	-		**+100**
Period 4	-880 (tax)	+500 (health) -220 (tax)		-	-		**-100**
Period 5	+500 (health) -200 (tax)	-	-	-	-	-	-
Total	**-80**	**-153.3**	**+555.5**	**-242.2**	**-80**	**-**	**0**
per capita	**-0.8**	**-1.53**	**+2.77**	**-2.42**	**-0.8**	**-**	
Colours		Young = edu	Working age = tax	Old = health and tax			

iv. Policy discussion

The above stylised example of a society might appear rather abstract but insights gained are nonetheless relevant in the context of today's policy discussion.

First, and as stated at the outset, an assessment of a generation's contribution to the welfare state can only be made at the end of their lifespan. As such a snapshot in time could (and in fact is likely to) lead to a distorted picture. As was argued, there is little point discussing the value of a generation's tax burden without putting that into the context of the value of public goods and services received for "free" when young and old. It appears human and only natural that those who are currently paying the most tax (i.e. the working age) would argue that their tax burden is too high. Whether this is indeed the case can only be determined though once welfare spending on them – be it in the form of education, health, long-term care or pensions – is taken into account. The fact that the timing of payments and receipts is not the same adds a layer of obscurity to the debate.

Second, in a steady state there should be no difference in terms of inter-generational fairness between unfunded and funded pension arrangements. However, societies are never in a steady state for a myriad of reasons, from demographic change, to policy variations to external factors such as fluctuating global interest rates or inflation rates.

Third, depending on the particular reason why the system might not be in steady state, unfunded pensions might actually lead to a higher degree of inter-generational fairness than funded pensions. This might be counter-intuitive at first but is illustrated by the "baby boomer" example above, in which the large baby boomer cohorts pay the pension obligations arising from their own education. In a funded system, their parents would have had to pay for teacher salaries **and** pensions to educate the large baby boom cohorts. Equally, an unfunded pension system would spread the wage and pension cost of looking after the baby boomers in old age across their children and grandchildren, which is fairer than burdening their children only. This suggests that funded pensions are not always inter-generationally fairer than unfunded pensions; it depends on the circumstances. Note though that the baby boomers would be net beneficiaries of the welfare state whatever the funding arrangements. Achieving inter-generational fairness between the baby boomers and their parents and their children would require other policy measures, see below.

Fourth, introducing tax on the elderly in a world with varying cohort sizes makes the inter-generational transfer more even and fairer. This is the case whether public sector pensions are funded or unfunded. One reason for this is that the baby boomers would contribute to the financing of their own health care needs rather than leaving it to their children (in the case of funded pensions) or children and grandchildren (in the case of unfunded pensions). Increasing the tax burden of older people is politically highly unpopular though, not least because older people are more likely to vote than younger people. In addition, it is often argued that elderly people are more vulnerable. It should not be forgotten though that many poorer pensioners were not poor during their working lives; in other words over their lifespan they had the financial means to build up sufficient assets to be financially secure also in old age. Many individuals decided not to do so, some due to myopia, others deliberately as they expect to receive a decent pension from the government whether that had been promised or not in advance (in other words individuals' behaviours can be time inconsistent).

Fifth, tax smoothing and letting debt fluctuate are in particular circumstances the appropriate approach to achieving inter-generational fairness. This is particularly the case when the deviation from the steady state is of a temporary nature. This is for example the case as a result of the baby boomers, though "temporary" deviation is here measured in decades rather than months or years as is the case for the business cycle (but the rationale is similar). The analysis suggests that the baby boomers' parents should have run up debt by more than they actually did, with today's workers in their 40s and early 50s (the large baby boom cohorts of the 1960s) paying it off. In fact, they

ought to do more: they should leave assets to their own children so that these can pay for the baby boomers' pension and health care needs. Keeping it below some pre-determined ceiling as has been the case in the UK or in the EU (Stability and Growth Pact) in the past was not ambitious enough to prepare for the fiscal costs of the ageing baby boomer generation. Taking points four and five together, an additional way for the baby boomers to pay their fair share is to increase the tax burden on the elderly once they are old themselves.

Sixth, many developments are of a permanent nature though, including the gradual extension of longevity. Tax smoothing would then not suffice to establish inter-generational fairness. Parametric reforms would then be required, for example raising the pension age or making benefits less generous to deal with the fiscal consequences of an ageing population (or as used here in the example, to raise the age of eligibility to free public health care). Indeed, these policies have been pursued in most countries but there are differences in implementation. In a number of countries, for example, the social security benefits will be adjusted downwards automatically if life expectancy continues to increase in the future. In some countries the adjustment is based on the solvency of the social security system. Denmark is so far the only country, which has indexed the future pension age to longevity trends. By contrast, in some other countries, including the UK, benefit trends or changes in the retirement age have been legislated for without due consideration for actual longevity trends in the future. This omission might require future governments to re-open the debate on pensions, for example if actual longevity increases turn out to be much larger (or indeed smaller) than currently projected.[6]

Seventh, based on all of the above, moving from an unfunded to a funded system will require one generation paying "twice". Given how well the baby boom generation is doing elsewhere, this suggests that the transition – if this is deemed desirable - should take place (or at least a large part of it) while the baby boomers are of working age, in other words today. Given the large size of the baby boom cohorts, this might however be politically difficult to push through.

Eighth, given the complexities of the system, it seems very difficult to assess the effect of a policy change on inter-generational fairness. Consider the current political context: after ten years of public spending increases up to the economic and financial crisis, the new Government has announced that it will rein in public spending. Taxes will most likely also have to go up to close the structural deficit on the UK's public finances. What will be the overall effect on inter-generational fairness once the contraction period is over (say by 2015 or 2020)?

Ninth, the above example captures transactions between generations and the welfare state. Generations obviously leave bigger legacies than merely public debt or assets, whether this is education, infrastructure, law and order, biodiversity or – not an asset but a liability – too much carbon in the earth's atmosphere, which might result in climate change.

v. Concluding comments

This paper had a number of purposes. The first was to emphasise the point that an analysis of inter-generational transfers ought to be conducted only over the lifespan of a generation. This seems obvious but appears to be conveniently forgotten in much of the policy debate. The second was to show that the issues can become very complex and difficult to analyse very quickly. This suggests that there will be few "obvious", headline-grapping answers. The third purpose was to show that depending on the underlying cause of a potential inter-generational imbalance, the policy response might very well differ. Tax smoothing (and letting debt fluctuate as a buffer) is an appropriate response to varying cohort sizes (the baby boomer example). However, tax smoothing does not help with more structural changes such as the increase in longevity across successive generations. Raising retirement ages in line with increases in longevity would be one

[6] *Social security financing: Automatic adjustments to restore solvency*, Turner, 2009.

appropriate response as would be making entitlements in old age less generous. In reality many developments take place at the same time so that a policy mix will be required.

The paper also showed that the issue of funded versus unfunded public sector pensions is not as clear cut as some might believe it to be. Perhaps counter intuitively, having unfunded public sector pensions might actually be inter-generationally fairer than having funded pensions. This will depend on the circumstances though.

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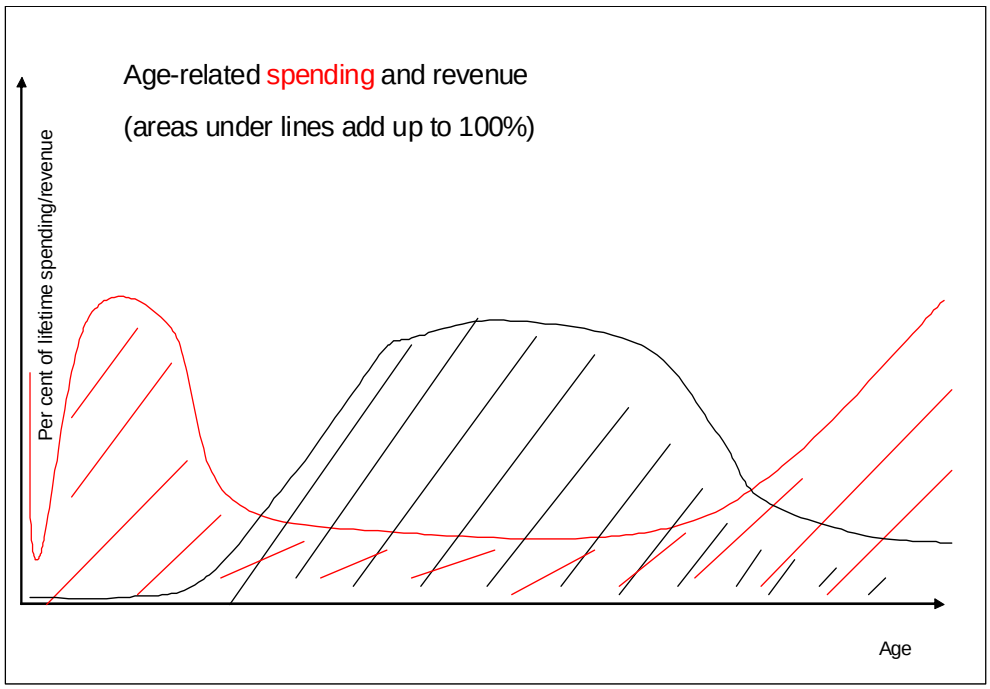
Appendix A

On aggregate and hence ignoring any intra-generational transfers between the "rich" and the "poor", those below and above working age are financially net beneficiaries of the welfare state, while those of working age will be financially net contributors to the welfare state. Over a normal lifetime, an individual will initially be a net beneficiary of the welfare state (birth and education), then for a long period of time a net contributor (income tax…) and then in older age a net beneficiary again (pensions, health). The funding of the welfare state would be sustainable if on aggregate contributions made equal benefits received over a lifetime. Such a set up could be fiscally sustainable forever as long as the demographic structure was in steady state and age-specific per capita spending and revenue would remain unchanged. The chart shows a stylised distribution of spending and revenue for a representative individual.



The chart ought to be interpreted as follows: let us assume that over a lifetime an individual consumes £1m of public goods and services. Over the lifetime all of this – 100 per cent - will be consumed. However, at certain ages the individual consumes a larger share of total lifetime spending than at other times. For example, the individual will consume relatively more at birth, then during schooling years and then again in older age. This is shown by the red line; the area underneath that red line adds up to 100%. Obviously even a working-age individual will consume some public goods and services – defence or transport infrastructure come to mind. Similarly on the revenue side: the individual will pay only a very small share of his/her lifetime revenue when young and only a small share when old. The lion's share will be paid during working lives in the form of income tax and national insurance contributions. When old, the individual will mainly pay consumption taxes.

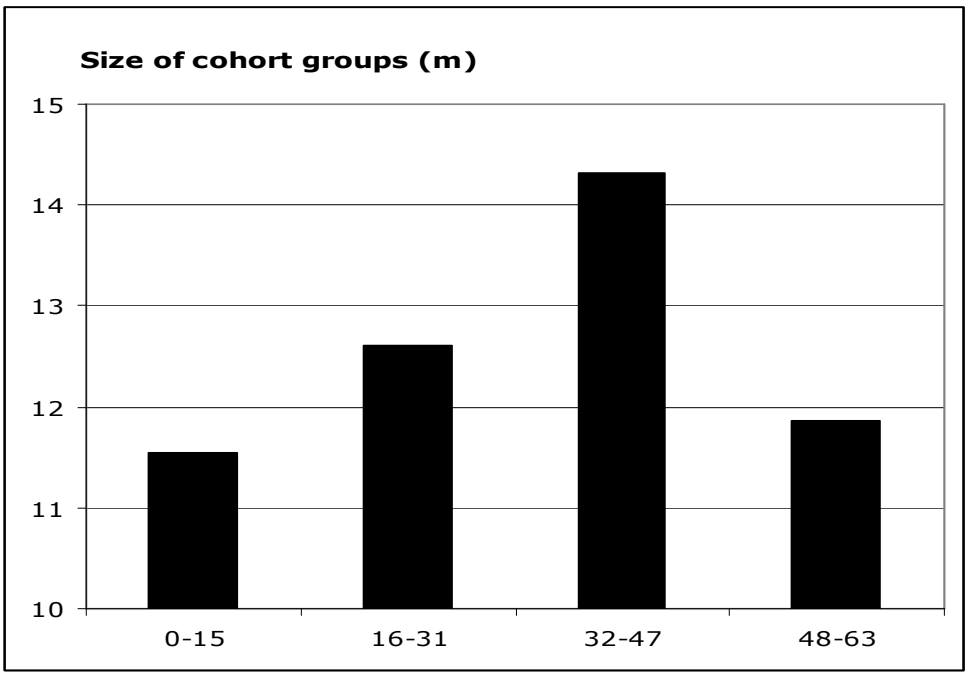
If consumption or taxation was the same regardless of age, then the lines would just be horizontal. Note that the shape of the age distributions says nothing about the amounts involved. It could be as much about £1 as about £1bn. In order to have a fiscally sustainable system, both spending and revenue would have to be the same though (which could be £1 or £1bn).

This stylised example captures women and men, and rich and poor. For example, someone paying very little income tax throughout his/her life (e.g. due being on very low

incomes or even on income support) would have a much more even revenue distribution over lifetime.

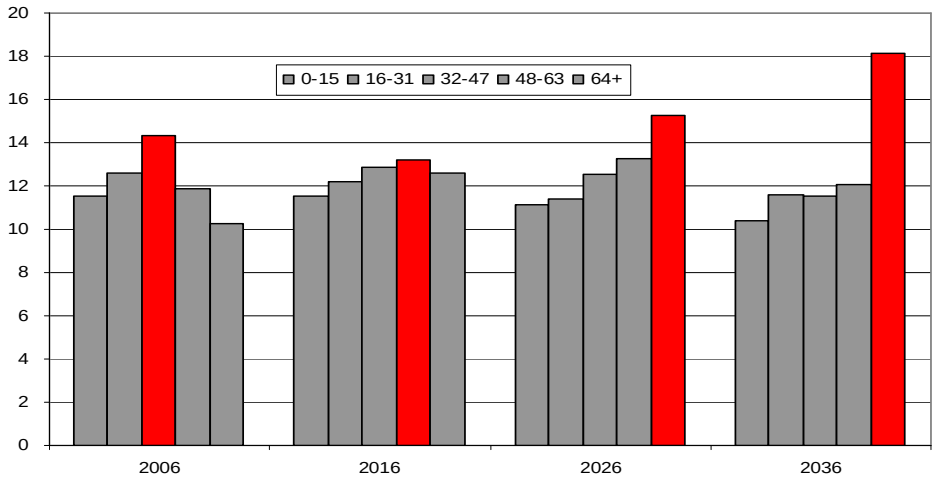
Appendix B

The simple generational breakdown presented in the main text hides important demographic patterns seen in reality. In particular the working-age population ought to be broken down further to differentiate the baby boom cohorts from the other cohorts. A better breakdown would for example be 0-15, 16-31, 32-47 and 48-63 (with each group covering 16 cohorts). The chart shows that in 2006 the group 32-47 was substantially larger than its predecessor (48-63) and its two successors (0-15 and 16-31). For example, it was nearly 15 per cent larger than the 16-31 age group.



The chart below shows the projected population structure under the assumption that there will be zero migration. It can be seen that today the age group 32 to 47 years is the largest. They represent the second baby boom cohorts born after the Second World War (the immediate post-war boom was smaller). In the absence of migration, which allows to study the ageing of the existing population - the age group 48 to 63 years will be largest in 2016 (which covers a large number of those who were in the 32 to 47 year group in 2006) and beyond that the 64+ group will be largest – again the baby boomers (note that in 2016 parts of the baby boom cohorts fall into the 32-47 year age group and hence the red bar is not as high as might otherwise be expected).

Size of cohorts over time with zero migration
(red bar represents main baby boom cohorts, m)



Source: ONS 2006-based population projections Zero migration variant.

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