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Pensions across generations: scenarios for the Maltese Islands

Melchior Vella and Philip von Brockdorff

Department of Economics, University of Malta, Msida, Malta

ABSTRACT

This paper tests whether in a PAYG system there is an inter-generational balance between the contributions made during the working-career and the pension benefit received in retirement; covering different cohorts. The analysis takes Malta as a case study. Though the dependency ratio is comparatively low, the population is rapidly ageing. The results show that there is a generational imbalance with the young cohort unlikely to be any better off than those who have already retired. This however is sensitive to the assumed discount rate and the 'no policy' change scenario. The results also show that future generations may be net-gainers assuming a sustained level of wage growth. If, on the other hand, wage growth slows, the younger generation may become increasingly reliant on the bequests of older generations. This would explain why pressure has increased to regularly adjust the existing PAYG system as well to introduce other forms of pension schemes.

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1. Introduction

Populations are ageing rapidly. This demographic trend puts strong pressures for pay-as-you-go (PAYG) pension retrenchments, since the financial sustainability is heavily dependent on the labour force participation rate of future generations. Since a PAYG is unfunded, the general consensus is that the financial viability is highly vulnerable subject to demographic and parametrical features designed in the pension system as well as potential output growth (Barr, 2002). As a response to higher life expectancy through piecemeal reforms of the traditional PAYG system and the introduction of defined-contributory schemes, notional defined contribution (NDC) pension schemes were introduced in a number of countries (Holzmann & Palmer, 2006). These schemes emulate an actuarially fair system, in which benefits reflect individual decisions and work preferences, however, with two exceptions. First, the NDC is a notional and not financial system whereby contributions to the system provide resources to pay current pensioners. Second, the rate of return is based on economic performance, reflecting the number of contributors and their average amount of contributions. Yet, the NDC system is also susceptible to ageing labour market demographics. In the indexation of NDC system, this burden can be borne by adjusting the notional capital of contributors or benefits of pensioners (Palmer, 1999).

CONTACT Melchior Vella mvell31@um.edu.mt; Philip von Brockdorff pvon1@um.edu.mt

Over the recent years there has been a growing body of literature on understanding the sustainability of public pensions from a generational perspective. It is generally acknowledged in the literature that an expansion of PAYG financed social retirement benefits helps the current elderly but harms current younger and future generations (Auerbach, Kotlikoff, & Leibfritz, 1999), everything else remaining constant. Different degrees of redistribution exist both in Bismarckian and Beveridgean PAYG systems (Conde-Ruiz & González, 2016). The former is designed to provide sufficient retirement income for all workers: from the low skilled to the highly skilled whereas the latter seeks to ensure sufficient minimum pension for all workers. Specifically, whereas in a PAYG, current retirees have a higher present value of net benefits, the young and future generations are confronted with higher remaining lifetime net taxes to pay off or at least service the government's bill (Kotlikoff & Leibfritz, 1999). By contrast, non-financial defined-benefit and NDC pension systems are designed to limit inter-generational distribution (Brooks & Weaver, 2006).

This paper revisits this motivation. Rather than assessing public pension expenditure over time, instead we attempt to answer how the inter-generational distribution of net-benefits has changed since the introduction of defined benefit pensions. In so doing, we estimate the present value of net-payments for each generation, incorporating actual and assumed wage developments, changes in life expectancy as well as legislated policy changes.

This paper will focus on Malta, which is the smallest EU member state, with a population of less than half a million. Understanding the distribution of burden from a generational perspective in Malta is important in many respects. Firstly, the present defined benefit system was introduced very recently in 1979 and is therefore expected to generate windfall gains for present generations balanced by losses of future generations who will have to pay for these pensions. Secondly, the prospective fast ageing of the population and, as a result, slower rates of economic growth intensifies further the generational imbalance. The share of the number of persons aged 65 years or over per one hundred persons aged 15–64 years is expected to increase from 29.6% in 2016 to 51.2% in 2070 in EU-28 (European Commission, 2018). While the ageing process will continue to advance amongst more developed regions, this process is expected to accelerate even faster in Malta from 29.1% in 2016 to 55.8% in 2070 and is likely to have a profound impact on various dimensions of society.

The rest of this paper is organised as follows: Section 2 presents a literature review of topics related to the main theme including the bequest motive, the median voter theorem, intergenerational redistribution and its effects, and the relevance of generational accounting. Given that the focus of the paper is on Malta, Section 3 is dedicated on the demographic transition and the parametric features of public pensions in Malta. Section 4 presents estimates of contributions payable and pension receipts under six scenarios according to recent pension reform. Conclusions derived from the results and their implications are presented in Section 5.

2. Literature review

2.1. Overlapping generation model

The system of PAYG social insurance has received considerable attention from mainstream economists especially those who have sought to analyse how taxes and transfers

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are determined. The studies have mainly been inspired by the overlapping generation model (OLG), developed by Samuelson (1958) and Diamond (1965), to illustrate the effect of the PAYG pension scheme on the economy in general. It can be shown that the first generation receives windfall gains as retirees receive a pension even though they have not contributed for it. Meanwhile, the effect on the younger generation is ambiguous as they must pay social contributions for entitlement of pension.

Individuals are assumed to live finitely and are allocated to finitely lived generations according to their date of birth and each generation trades with both generations – young and old. It is further assumed that the labour supply and retirement decisions are exogenous. Suppose that the government introduces an unfunded PAYG system, in which the pensions of the old are paid by the taxes from the young in the same period. As in period t, there are L_{t-1} pensioners each receiving pensions of P_t and L_t young workers paying T_t in taxes, the PAYG negative bequest effect is given by:

$$L_{t-1}P_t = L_t T_t \tag{1}$$

which implies that:

$$\begin{aligned} P_t &= \frac{L_t}{L_{t-1}} T_t \\ &= (1+n)T_t \end{aligned} \tag{2}$$

(2) shows that the rate of return of a PAYG is defined by the population growth rate, n. Assuming further that the contribution rate per person employed is kept unchanged over time implies that $T_{t+1} = T_t = T$, so that $P_t = (1+n)T$.

The budget constraints of an individual living in his two respective life periods are:

$$C_t^Y + S_t = W_t - T_t \tag{3}$$

$$C_{t+1}^O = (1 + r_{t+1})S_t + P_{t+1} \tag{4}$$

The lifetime budget constraint for this individual is:

$$W_t - T_t + \frac{P_{t+1}}{1 + r_{t+1}} = C_t^Y + \frac{C_{t+1}^O}{1 + r_{t+1}} \tag{5}$$

The left-hand side captures the after-tax wages and the received pension. Income must be equal to the consumption when young and old. By substituting P_t from (2), the lifetime budget constraint is:

$$\hat{W}_t = W_t - \left(\frac{r_{t+1} - n}{1 + r_{t+1}}\right)T = C_t^Y + \frac{C_{t+1}^O}{1 + r_{t+1}} \tag{6}$$

This condition shows that if $n > r_{t+1}$, lifetime wealth be higher with a PAYG scheme than with a funded one, as an individual is saving at a rate of return n that exceeds the private rate of return r_{t+1}. On the other hand, if $n < r_{t+1}$, the PAYG scheme is making the individual worse-off. This demonstrates the Aaron (1966) condition.

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An individual maximises lifetime utility:

$$\Lambda_t^Y = U(C_t^Y) + \left(\frac{1}{1+\rho}\right)U(C_{t+1}^O) \tag{7}$$

subject to (6). The Euler equation is given by

$$U'_Y[W_t - S_t - T_t] = \frac{(1+r_{t+1})}{(1+\rho)}U'_O[(1+r_{t+1})S_t + (1+n)T_t] \tag{8}$$

Using the implicit function theorem, we can show that the partial derivate of the savings function with respect to social security contribution is

$$S_T = -\frac{U''_Y(\cdot) + (1+\rho)^{-1}(1+n)U''_O(\cdot)}{U''_Y(\cdot) + (1+\rho)^{-1}(1+r_{t+1})U''_O(\cdot)} < 0 \tag{9}$$

This means that the PAYG system decreases private savings as it is a pure transfer from co-existing young to old generations with no formation of capital in the economy. In addition, $S_T \in (-1, 0)$ if $r_{t+1} > n$ and $S_T < -1$ if $r_{t+1} < n$. Furthermore $S_W > 0$. Assuming a unit-elastic model with a PAYG system, $S_r > 0$.

In a PAYG system the formation of capital depends only on private savings. Thus, future capital can be linked to current savings as follows

$$S(W_t, r_{t+1}, T) = (1+n)k_{t+1} \tag{10}$$

Assuming that production is specified by a Cobb-Douglas production function ($y_t = k_t^{1-\varepsilon_L}$), where ε_L is the share of labour, the factor prices are $W_t = W(k_t) = \varepsilon_L k_t^{1-\varepsilon_L}$ and $r_{t+1} = r(k_{t+1}) = (1-\varepsilon_L)k_{t+1}^{-\varepsilon_L} - \delta$. Substituting these into the saving function (10) gives us the following difference equation in implicit form characterising the economy under a PAYG system

$$(1+n)k_{t+1} = \frac{W(k_t) - T}{2+\rho} - \left(\frac{1+\rho}{2+\rho}\right)\left(\frac{(1+n)T}{1+r(k_{t+1})}\right) \tag{11}$$

(10) can be generalised as follows $k_{t+1} = g(k_t, T)$ and satisfies the following properties $g_k > 0, g_T < 0$ and $\mathrm{d}k_{t+1}/\mathrm{d}k_t \geq 0$. This means that $g(k_t, T)$ intersects the steady state line $k_{t+1} = k_t$ twice: from below and above.

If the PAYG system is introduced at time k_0, the old-generation receives a pension $P = (1+n)T$ even though they have not contributed to it. This is considered as a windfall gain and therefore they will consume all of it, assuming no bequest motive, and will be better-off.

However, the effect on the young generation is ambiguous as first they must pay T in taxes in the current period and receive P in pension benefit when they retire. The net effect then depends if $r(k_{t+1})$ is greater or less than n, as

$$\frac{\partial \hat{W}_0}{\partial T} = -\left(\frac{r(k_1) - n}{1+r(k_1)}\right) \tag{12}$$

Nevertheless, the overall effect of the PAYG system results into lower savings by the young and hence translate into lower capital stock in the following period, illustrated

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by the distance AC (Figure 1). Therefore, the new steady state is lower at E_0 compared to the unit-elastic model without a PAYG system.

The long-run effect on the capital-labour ratio is found by imposing $k_{t+1} = k_t$ at steady state and hence

$$\frac{\mathrm{d}k}{\mathrm{d}T} = \frac{g_T}{1 - g_k} < 0 \tag{13}$$

The key macro-economic impact of a PAYG system is that it crowds-out capital, lower capital per worker reduces the marginal product of labour and hence the wage rate (because $W'(k_t) > 0$) and raises the rate of interest (because $r'(k_t) < 0$).

In assessing the overall effect of the young generation following the introduction of the PAYG system we need to consider welfare at steady state. If the economy is dynamically inefficient with too much capital (i.e. $n > r$), the introduction of the PAYG system will increase welfare because the young-generation is over-saving and hence is driving downwards the rate of interest. If, on the other hand, $r > n$, then the reduction in wages is not offset by the increase in the interest rate following the implementation of the PAYG system, hence younger generations are worse-off. However, if $n = r$, then the PAYG system has no effect on steady-state welfare.

Another important study is the overlapping generation model (OLG), based on 'intergenerational altruism' and contained in Barro (1974). This model assumes that individuals consciously plan their economic behaviour over their lifetime in their effort to maximise utility. Work, leisure, consumption and saving are all assumed to be determined by their anticipated effect on lifetime earnings and wealth, and the rate of return on savings. Andersen and Gestsson (2016) extends the OLG in continuous time with different mortality rates for different generations. They argue that increases in productivity and longevity are shown to have very different implications for intergenerational distribution.

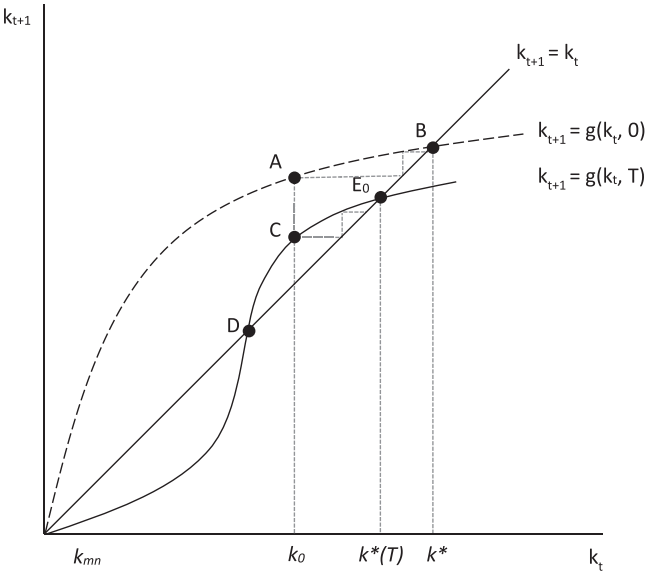

Figure 1. PAYG pensions in the unit-elastic model. Source: Blake (2006).

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While both longevity and productivity do not affect the socially optimal consumption profiles, they do affect the retirement age profile.

Allowing for trend increases in both longevity and productivity, we address the normative issue of intergenerational equity under a utilitarian criterion when future generations are better off in terms of both material and nonmaterial well-being. Increases in productivity and longevity are shown to have very different implications for intergenerational distribution. Further, the socially optimal retirement age, dependency ratio, and intergenerational burden sharing in the case of a trend increase in longevity are shown to depend on how individuals' utility for time/leisure is affected by age and longevity.

2.2. Generational accounting

Generational account, pioneered by Auerbach, Gokhale, and Kotlikoff (1991), defines the difference between the present value of the taxes paid and the benefits received by a specific generation. If the sum of the generational accounts across all current and future generations sum to zero, then a net benefit received by one generation must be paid for by another generation.

The concept of generational accounting is also related to the government's budget constraint. Using the OLG model with a constant population, the government's budget constraint is

$$B_{t+1} = (1 + r_t)B_t + G_t^O + G_t^Y - T_t^O - T_t^Y \tag{14}$$

where B_t is the stock of government bonds outstanding in period t, G^O and G^Y are the goods and services provided to the old and young generations whereas T^O and T^Y are the tax collected from the respective generations.

Using the methodology applied by Buiter (1997) to the OLG model, Equation (14) can be iterated forward over a finite T periods

$$B_t = R_{t-1,T}^{-1} B_{t+T+1} + \sum_{s=0}^{T} R_{t-1,s}^{-1}(T_{t+s}^O + T_{t+s}^Y - G_{t+s}^O - G_{t+s}^Y) \tag{15}$$

where

$$R_{t-1,s}^{-1} = \prod_{i=0}^{s}\left(\frac{1}{1 + r_{t+i}}\right) \tag{16}$$

is the discount factor.

The government's solvency condition necessitates that

$$\lim_{T\to\infty} R_{t-1,T}^{-1} B_{t+T+1} = 0 \tag{17}$$

so that the government debt cannot grow faster than the rate of interest in the long-run.

The government budget constraint is then given by

$$B_t = \sum_{s=0}^{\infty} R_{t-1,s}^{-1}(T_{t+s}^O + T_{t+s}^Y - G_{t+s}^O - G_{t+s}^Y) \tag{18}$$

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This means that if at any time the government is running a fiscal deficit so that $B_t > 0$, then the government must at some future point in time collect more in net taxes than it pays. If rearranged, Equation (18) also implies that the summation of the current value of the national debt and the present value of government consumption must equal the present value of the taxes on current and future generations. If old generations face a positive net-balance, i.e. the present value of earnings received exceeds the present value of taxes paid, then future generations have a higher tax burden than do young generations. This is required to necessitate fiscal sustainability in terms of the government's intertemporal budget constraint.

Clearly, the size of tax contributions depends to a significant extent on the size of the workforce relative to the number of pensioners, and the degree of 'maturity' of the pay-as-you-go social insurance. In effect, the 'greatest gains are captured by the initial generation which pays no contribution but receives windfall benefits' (Johnson & Falkingham, 1992, p. 130). However, when the ratio of workers to pensioners falls, benefits must be shared among a larger number of pensioners and an increase in per capita contributions will be required. As noted in Petersen (1988), Johnson, Conrad, and Thomson (1989), Walker (1990), Phillipson (1991) and von Brockdorff (1999), this may result in an 'intergenerational conflict' since workers will want to avoid paying higher rates of social security contributions.

The generational accounting literature contains an analysis of the effects of transfers from workers to pensioners (see Hills, 1992; Lee & Lapkoff, 1988; Thomson, 1991). Thomson, for instance, concluded that New Zealanders born between 1920 and 1945 were 'net gainers'. On average, social security benefits exceeded contributions but successive generations were 'net losers'. However, Hills (1992, p. 2) argued that Thomson's conclusions may not be true for other countries. For instance, Hills found no evidence of 'intergenerational inequity' in Britain. In other words, there were no substantial net gainers or net losers from social security. Though this study will show that Maltese retirees (in line with the assumed scenarios) *may* be net gainers, the extent of the gains depend on whether an individual is a current or a future retiree (nor allowing for either inflation or converting future flows to present value). The gains are derived because the contributions paid cover only a fraction of the benefits received.

The empirical literature on generational accounting concludes that in most of the developed countries the elderly component of the population is the most favoured generation alive. The least-favoured are generation currently working who are expected to pay out more in taxes than receive in benefits. By way of example, Kotlikoff and Leibfritz (1999) concludes that future generations in America could be faced with 50% higher net taxes over their lifetimes than the new-born generation. Meanwhile, on the current tax-transfer policy, the net tax rate is expected to be more than twice as much in Germany and Japan. Of the 17 countries surveyed only 3 countries were found to have negative imbalances, meaning that future taxpayers are faced with lower lifetime net tax rates than current new-borns. Indeed, such a result is expected in the light of non-severe ageing and commitment by the government to follow a strict course of fiscal consolidation. Similar results of imbalance apply for the UK and other developed countries (Auerbach et al., 1999; Cardarelli, Sefton, & Kotlikoff, 2000). European Commission (1999) includes studies for 12 of the EU-countries based upon a common framework and found that all countries, except Ireland, had generational accounts imbalance.

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Furthermore, Gjersem (2002) found that in all the Nordic countries, the results indicate that fiscal policy is in or rather close to intergenerational balance. Yet, the imbalance is highly sensitive to temporary business cycle fluctuations.

In theory, the fiscal burden imposed on future generations could be estimated by making assumptions about the future time paths of government consumption and the generational accounts of current generations. Projections of the population by age and sex, and average taxes for each generation in each year could be used for this purpose.

The generational accounting concept has been objected on several grounds. The underlying models used are not general-equilibrium and hence the lack of economic structure has been heavily criticised (Haveman, 1994). Another critique is that the effects of intergenerational redistribution for individuals or social welfare are not considered. In addition, the distinction between explicit and implicit government debt is not always so clear-cut (Franco, 1995).

2.3. Notional defined contribution

Related to the PAYG is the NDC scheme, designed to distribute the resources of the scheme through the time dimension of the internal rate of return – defined as the rate that sustains a financial balance and hence the present value of system assets is equal to the present value of system liabilities. By definition, the generic NDC does not embed internal redistribution, but is not necessarily free of distributional effects, either (Palmer, 2006). Because contributors are expected to pay the same fixed percentage of their earnings into the scheme, the NDC is considered to be intergenerationally fair. Each generation will then expect to receive a stream of benefits subject to the contribution history and the system rate of return. The NDC also contributes to intra-generational objectives as any form of distribution and the financial sources are transparent.

The NDC system is not free of criticism, nevertheless. Börsch-Supan (2006) contends that if one wants to have contributors of a generation paying for their own pension, rather than future generations, then only prefunding can alter this fact. Still, labour supply and longevity remain crucial parameters. A generic NDC is merely an optimisation of a PAYG system. In addition, Barr (2006, p. 65) also argues that an NDC system is susceptible to an inefficient outcome as 'though a strictly actuarial scheme may be efficient in a first-best world, policy design needs to cope with serious market imperfections.'

2.4. Trends and patters in the Maltese population ageing

Malta's population is ageing rapidly. This is the result of two causes: a decrease in fertility and an increase in longevity. Falling fertility rates directly reduced the share of young in the total population and have not been high enough to stabilise the population. Meanwhile, increases in longevity contributed to an increasing population, though with a higher dependency ratio such that the total population will eventually start to decline.

Malta is a good example to test the hypothesis of generation imbalances. The Maltese case is unique as the ageing transition has taken shape in a comparatively short time span. For a small island state with very limited endowment of resources, the mass emigration of younger age during the 1960s has accelerated the demographic transition. In addition,

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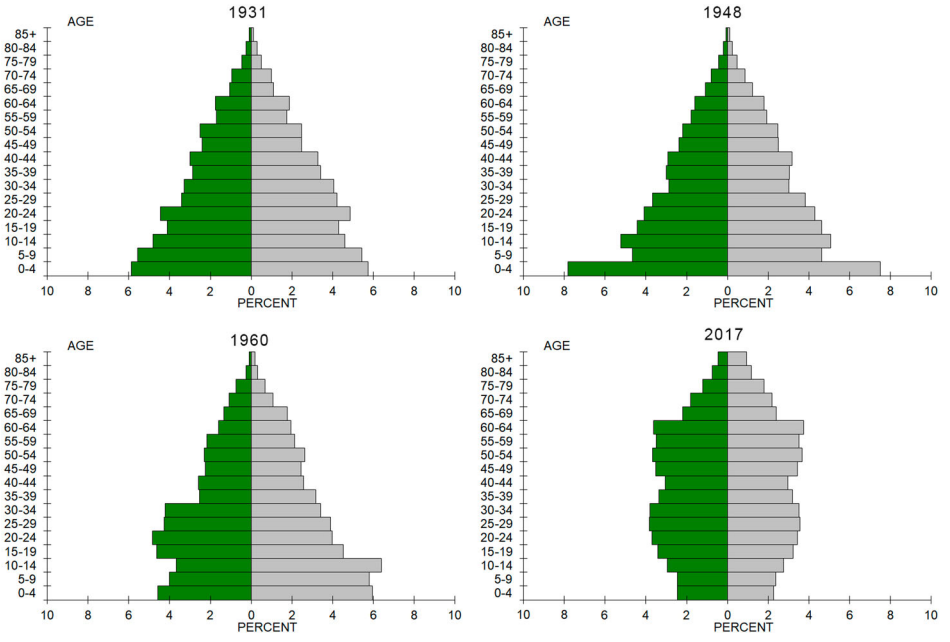

Figure 2. Demographic transition of the Malta.

lower fertility rates were the result of an improvement in the emancipation and participation rate of females and levels of education, and lower mortality rates. Developments in health services were also important factors in Malta's demographic transition.

These factors have affected the population pyramid at its base. Bigger cohorts have shifted into older age groups and the proportion of younger and of the working-age shrank. This is leading to an increased burden on those of working-age to provide for PAYG schemes. As illustrated in Figure 2, the population pyramid of the Maltese Islands provides evidence of the rapid demographic transition, notably in the 1960s with the first signs of an ageing population. This is shown by a low-fluctuating pyramid structure which also coincides with the introduction of the National Insurance scheme.

2.5. Parametric features of the pension system in Malta

Old-age pensions funded by contributions were brought into being by the National Insurance Act of 1956. Contributions are paid by the employee, the employer and the State. This scheme was obligatory and qualification to a benefit was subject to the contribution conditions attached to the payment. For each contribution week three contributions would be payable for each insured person: one by the self-/employed person, one by the employer, and one by the state. The paid contribution was a lump-sum amount, meaning that it was a regressive tax. The claimant needed to have paid not less than 3 years of contributions, which was later raised to 10 years, and that the yearly average of contributions paid or credited between the first day of contribution and ending on the last day of his last complete contribution year before beginning receiving benefit was not less than 1 year. Between 1956 and 1978 old-age beneficiaries were provided with a flat rate of pension.

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A new contributory pension system was introduced in 1979, what is known today as the Two-Thirds Pension. This scheme was supplemented by a reformed contributory system whereby a wage and income-related contribution were introduced in respect of employed persons and self-employed persons, respectively. The National Minimum Pension was also enacted whereby a person claiming a contributory pension would not fall below a certain threshold. The claimant needed to be in employment for not less than ten years in the aggregate prior to his or her retirement. A pensioner received a full rate of pension if he or she had 30 years of contribution or such a smaller number of years as corresponds to the number of years from 1956 or from 1965 up to the end of the contribution year immediately preceding his retirement. The contribution rate was set to 8.3% of the basic wage/income and subject to a ceiling, coined as the maximum pensionable income. In case of retirees, the pensionable income was reassessed based on the increases in salary of the last post on which pensionable income had been computed on the date of retirement, subject to a ceiling which in 1981 was fixed at €15,723.27.

In 1987, the social security system was consolidated in one Act. The contribution rate was increased to 9% in 1999 and to 10% in 2000 and remained thereafter unchanged. After 2006, new sets of parametric reforms were introduced with the aim to make them sustainable and more adequate. There was the introduction of a gradual rise in the retirement age from 61 years for men and 60 years for women to 65 years for both men and women. The contributory period was gradually increased from 30 to 41 years. The benefit formula was also changed; whereas in the case of an employee born before 1962 was determined based on the yearly average of the basic wage during the best 3 of the last 10 years, the pension for employees born on and after 1962 is computed on the best 10 calendar years within the last 40 years immediately preceding his retirement. The maximum pensionable income for persons born after 1961 was also indexed partially with wages and inflation whereas the ceiling for persons born on or before 1961 were topped-up with the cost of living adjustment. Another reform included the setting of the Guaranteed National Minimum Pension which shall be payable at such rate being not less than 60% of the national median income, as from 2027.

3. Methodology and main results

3.1. Methodology

Over the course of a person's life, workers in a PAYG system contribute by payments when in working-age, and later receive an old-age pension. To assess the pension system between different birth cohorts, we compare the expected discounted pension contributions from labour market earnings for each representative individual over the life course with discounted sum of pension benefits each individual is expected to receive. This methodology extracts from methods used to calculate the actuarial balance as well as the implications of legislations with the aim to correct generational imbalances (see Auerbach et al., 1999; Billig & Ménard, 2013; Miles & Iben, 2000; Sartor, 2001; Selén & Ståhlberg, 2007), with the modification that the net-present value is estimated on a number of representative individuals of different year of birth (von Brockdorff, 2012). It is expected that the first cohorts covered with the PAYG pension system are likely to receive higher benefits than what follows from their contributions – which is considered

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as a windfall gain. Meanwhile, if the size of each cohort at birth remains roughly the same then in the longer-term there may be a similarity between contributions paid and benefits received for each cohort. With an ageing population, however, the sum of benefits each generation receives is likely to be higher than their contribution, everything else remaining constant. Parametric reforms of the pension system – such as higher pension age – lowers the net-present value of the effected cohorts, while higher wage growth during the working career also lowers the ratio of discounted life time pension benefits to the discounted life time contributions.

A computation of the actual contributions and pensions received over the working career for each generation, requires data that is hardly available in any country. Projected values based on realistic assumptions, therefore, need to be used. In this study we use a scenario-based approach where contributions and pensions payable are projected using for hypothetical individuals in line with existing pension reforms. In all scenarios, we consider persons born on or after 1905 for whom a career starts at 18 years of age whereas the pension start is assumed to be the first calendar year following retirement. It is also assumed that an early pension option is not availed of and statutory bonuses, and other pensions/benefits (e.g. occupation pension) are not included. The results are then compared for each generation.

For this purpose, we consider 3 types of individuals for each age cohort – a minimum-wage earner, an average wage earner, and an earner with a salary equal to or above the maximum pensionable income. The pension is then calculated based on a fixed rate throughout life time in retirement and indexing the pension rate to wages and inflation, depending on the specificities of the pension reform. In all scenarios we assume that contributors work on full-time basis throughout their career.

Figure 3 shows how wages changed during the historical period, measured in nominal terms per week. The national minimum-wage increased from €23.29 per week in 1974 to €169.76 per week in 2017. Between 1982 and 1989, the minimum-wage remained unchanged due to the wage freeze policy that was operative during the 1980s. This rendered labour costs cheaper than otherwise would have been in the absence of such a policy. In the early 1990s a tripartite agreement granted adjustments for cost of living

Figure 3. Wage rates per week, in logs. Source: Authors' calculations.

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to all whole-time employees. This centralised agreement reflected moderate increases whilst ensuring that the minimum-wage was not compromised by inflation. In addition, the average wage rate increased persistently between 1956 and 1985, with the exception of few years. The opposite was the case in mid-1980 when the wage freeze policy was operative. Between 1988 and 1993 the basic salary increased approximately by an increasing rate, however, after 1993, it grew at a diminishing rate. Post-2015, the average wage rate seems to have accelerated again. In 2017, the average salary was €347.08 per week. Finally, the maximum insured wage rate was introduced in 1979 at €71.47 per week and raised substantially to €246.38 per week in 1981. Again, during the operation of the income policy, the ceiling was left unrevised. It can also be seen from Figure 3 that, post-1990, the maximum pensionable income has been topped-up year after year. In 2011, a new ceiling was introduced for persons born from 1st January 1962 onwards.

The historical and projected life expectancy at retirement are extracted from Eurostat, for which the latter is based on the 2015 population projections. In 1957, when the National Insurance Act was enacted, the life expectancy at retirement was on average 13 years (Table 1). In 2017, the average pensioner is anticipated to spend 23 years in retirement, whereas the projected life expectancy at retirement in 2036 is lower at 22 years; because in the recent years, gains in life expectancy are matched or outweighed by corresponding increases in retirement age. The historical minimum-wage, maximum pensionable income and pension rates data are extracted from legislations, whereas the average salary is sourced from the Labour Force Survey.[1] The underlying macroeconomic assumptions for the period 2017–2038 are extracted from the *2018 Ageing Report: Underlying Assumptions and Projection Methodologies*, which is a joint report prepared by the European Commission and the Ageing Working Group. Meanwhile, the future parametric features of the Maltese PAYG system are projected under 'no policy change' assumption. This means that changes brought about by either indexation or legislated reforms are taken into consideration.

The present value for contributions paid and pension receipts are estimated using a real discount rate of 5.0% and 3.0%. This implies that the costs and benefits of an insured person should be discounted at the rate at which society would trade consumption in year t for consumption in the present. Under the Ramsey discounting factor this depends on the utility rate of discount (normally assumed to be zero), and the rate of consumption growth between t and the present, weighted by the elasticity of marginal utility

Table 1. Life expectancy at retirement.

Retire in	Life expectancy at retirement
1957–1966	13
1967–1976	14
1977–1985	15
1986–1987	16
1988–1989	17
1990–1991	18
1992–1993	19
1994–2000	20
2001–2006	21
2007–2009	22
2010–2021	23
2023–2036	22

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of consumption. There is no strong consensus as to how the parameters might be determined empirically (Arrow et al., 2013). These issues can be traced back to Arrow et al. (1996) and is also reflected in recent literature (Nordhaus, 2007; Weitzman, 2007). Another question is how to approach intra-generational and inter-generational discounting in a consistent manner. Consistency requires that costs and benefits occurring in the same year are be discounted to the present using the same discount rate, whether intra- or inter-generational. Arrow et al. (2013) notes that benefits and costs are normally discounted at constant rates of 3.0% and 7.0%. The former is an approximation of the consumption rate of discount, whereas the latter is the pre-tax return on private investment in the US. A 5% discount rate, however, is generally applied for discounting public funds across the European Union (see Council Regulation (EC) 1083/2006).

3.2. Results

Figure 4 shows the estimated net-present values, with a constant discount value of 3% and with pension indexation according to the legislation, for a person with a basic salary of a minimum-wage, average wage and maximum insured wage earner.[2] Each hypothetical person is assumed to start his first employment at 18 years of age with the reference wage being the minimum wage till retirement age and with break in his/her working career.

As illustrated in Figure 4, a low discount rate changes significantly the trajectory path of the net-present value across retirees of different generations. This is because people with lower discount rate tend to be more patient and value more received benefits over the long-term. It appears that at a 3% discount rate the return on all types of earners increase from one generation to the next, with some few exceptions. Future generations of workers earning the maximum insurable wage were generally worse-off compared to the first

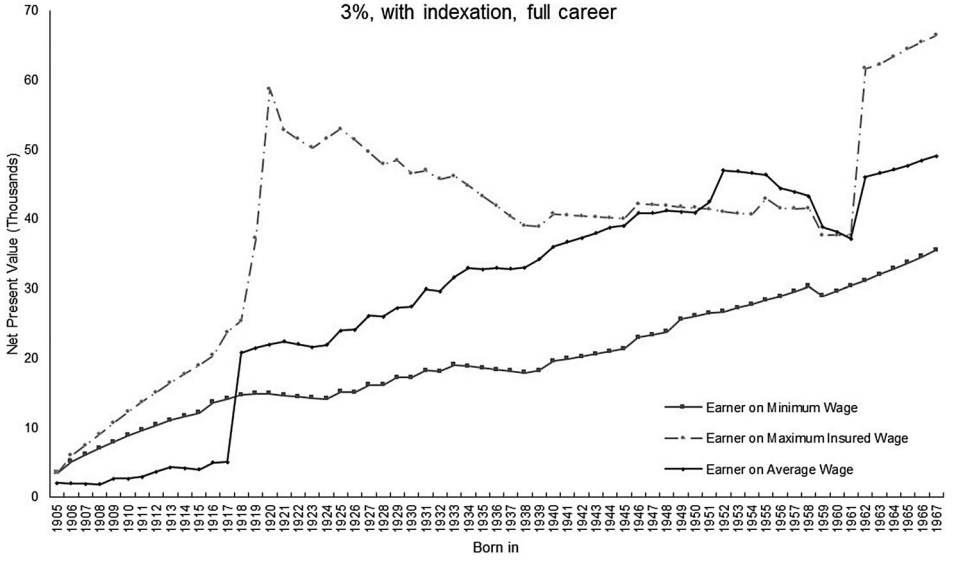

Figure 4. Net of contributions paid and pension receipts. Source: Authors' calculations.

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generation after the enactment of the PAYG scheme in 1979. Yet, the parametric changes for born on or after 1962 are likely to improve the relativity of pensions when compared to the previous generation of pensioners.

3.2.1. Higher discount value

The results are very sensitive to the assumed net-present value. In this study we use an alternative discount rate of 5% (Figure 5). As expected, applying the time value technique heavily discounts values occurring well into the future. Notable differences emerge when comparing different earners. Firstly, the setting of the PAYG scheme in 1979 generated windfall gains for the first generation in the social security system as they had contributed little. Nevertheless, the effect on the younger generation has generally been negative for retirees on maximum pension and, to a lesser extent, for persons on minimum pension till 2000 as they had to spend more years paying contributions as well as higher contribution rates during their career. This has been particularly the case for persons earning the maximum insurable wage as sluggish wage growth relative to the minimum and average wage added to this decline. Secondly, the net-present value for workers either spending their whole career on the maximum insurable wage or average wage is expected to fall from one generation to next until the new retirees in 2026. However, from 2027 onwards gains are anticipated to be made due to the setting of the Guaranteed National Minimum Pension and upward revision in the maximum pensionable income. These gains are likely to be sustained for future generations because the higher pension rate in the subsequent years lowers further the ratio of the discounted taxes relative to the benefits received.

Finally, the trajectory path for the average-wage earner is less stable as it is capturing both developments in the basic wage, on which contributions are paid, and the benefit formula which directly links wage at retirement to the received pension; subject to a maximum. Indeed, after the windfall gains by the first generations, the net-present

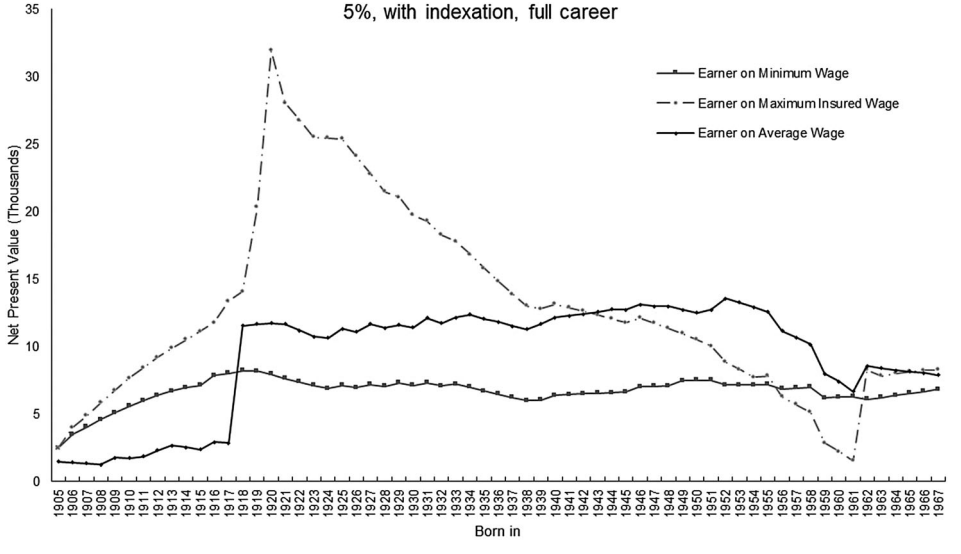

Figure 5. Net of contributions paid and pension receipts. Source: Authors' calculations.

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value for the person on an average pension declines from €11,654 for persons retired in 1982 to €10,633 for persons retiring in 1985. This is reflecting the sluggish wage growth during the same reference period. Then, improvements in life expectancy at retirement and robust wage growth gradually raised the net-present value for each subsequent generation; such that the discounted value for persons retired in 2013 stands at €13,538. Here, the steady increase brings about a net-present value which exceeds that of higher income earners, depicting a pattern of convergence, in which the average wage grew faster than the maximum pensionable income. Indeed, for the period 1990–2012, the average wage increased by an average rate of 4.9% per year, whereas the maximum insurable wage increased by 1.3% per year. Such fast wage growth results in a generous PAYG scheme, as the benefit formula only takes into consideration wages prior to retirement, with the individual being insured by smaller contribution amounts paid at the start of one's career, which matters most when discounting flows. The subsequent downturn for persons retiring on or after 2014 captures both stalling, and even declining expected years at retirement due to higher pension age, as well as the change in the benefit formula.

The results of these scenarios have important implications for the adequacy and sustainability of pensions. Wage growth is a key parameter in assuring that a balance is kept between past, current and future generations from the PAYG scheme. Indeed, fostering sustainable economic and wage growth through human capital development are crucial in supporting the pension system in the coming years, without a loss in return. Robust GDP growth and buoyant labour market performance over the long-term not only could yield gains in return but also safeguarding the sustainability of pensions for future generations.

It should be stressed that the results of this study are highly sensitive to the assumptions made. Pensioners could have other forms of income and/or be in receipt of other in-kind benefits which are not included in our estimations. A further limitation is that the assumptions are based on current policies. The persistence of current policy is unrealistic but as argued by Auerbach, Gokhale, and Kotlikoff (1994, p. 88):

> … in asking what would happen if policy were not to change, we are illustrating the inevitability of such policy changes, and offering an analytical framework within which the fiscal policy implications and intergenerational impacts of any changes can be examined.

4. Conclusion

This study, based on simulations of hypothetical individuals, reveals differences across generations in terms of the net-present value of PAYG which can be categorised into three phases. Based on a real discount rate of 5%, the PAYG scheme introduced in 1979 has generated windfall gains for the generations in the first phase balanced by relative losses of future generations who will have to pay for these pensions. Indeed, there is particularly a gradual decline for persons earning the maximum insurable wage, and to a lesser extent, minimum wage earners throughout their working life. Parametric reforms for persons expected to retire after 2027, however, is likely to generate higher net-present values for new retirees. The conclusion derived from the perspective of the average wage earner is less clear with some gains earned by some generations being outweighed by relative net-losses from subsequent generations.

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The presented results are sensitive to both developments in the basic wage, on which contributions are paid, and the benefit formula which directly links wage at retirement to the received pension; subject to a maximum. This suggests that policies in the face of the demographic challenge could include raising output and, hence, wages as an alternative to adjusting the rate of contribution or the level of pension benefits. One approach is to incentivise people to join and stay longer in the labour market, say by encouraging later retirement, import labour, and introducing active labour market policies to raise labour supply. A second approach is to increase the productivity of each worker, by *inter alia* investment in human and physical capital.

The results derived are also sensitive to the assumed discount rate. When assuming a lower discount rate, to factor in uncertainty and a preference favouring the longer-term, the estimates show that Maltese retirees may be net-gainers, but the extent of the gains depend on the whether an individual is a past, current or a future retiree. This reinforces our argument that the effect of an ageing population on the generational imbalance could be mitigated or outweighed by stronger wage growth. Fostering sustainable economic and wage growth through enhanced productivity are therefore crucial in supporting the pension system. Thus, the potential redistribution of resources from younger to older generations does not hold if an entire generation receives more than the sum of the past contributions.

The results of this study also imply that a redistribution effect from the male component of the population to the female component is also possible under the PAYG social insurance. A lot depends, however, on the differential life expectancy. In Malta, the average life expectancy for women exceeds that for men. This would suggest that the cumulated retirement benefits received by women are on average greater than the benefits received by male pensioners. However, the female participation rate is still relatively low by international standards. In spite of the differential life expectancy, therefore, it is doubtful whether the PAYG scheme has brought about a significant redistribution of income from the male component to female component of the population.

The derived results are also sensitive to the 'no policy' change assumption. Unlike any normal contract, the 'social contract' is imposed by the state on the working age population. It is not freely negotiated and the relationship between cohorts is mediated by the state. In the context of population ageing, the increasing burden faced by the working age population may place this 'social contract' at risk and may result, as in other countries, in a re-negotiation of intergenerational transfers. In some countries in the EU, in the aftermath of the Great Recession, the new *contracts* have led to cuts in social security pensions and reductions in pension rights. The driving force does not seem to be ideological but driven by economics as well as the supply-side view of the costs to employers of social security contributions.

Meanwhile, policies and reforms oriented towards raising potential output to sustain wages and encourage people to save more for retirement are called for. In this regard, policies directed to the total factor productivity and the effectiveness of human and capital resources are already in place (von Brockdorff & Amaira, 2017). The Government of Malta has also legislated incentives for the take-up of third pillar pension schemes as well as voluntarily occupation pensions. Besides raising the level of pensions, such policies may also help to diversify income.

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Notes

1. The National Minimum Wage was introduced in 1974. Prior to 1974, the minimum wage rate applied to civil servants. Prior to 2005, the average salary was indexed with the average employee compensation, derived from the National Accounts, as no other alternative indicator is available. This also allows to adjust for the break in time-series. Furthermore, the Maximum Pensionable Income was non-existent before 1979. Here, it is assumed that the maximum insured wage moves in tandem with the minimum wage for the period 1956 to 1978.
2. We take into consideration a discount rate lower than 5% to account for the fact that future discount rates are uncertain but have a permanent component, which implies that the 'effective' discount rate must be lower (Gollier, 2002). This is particularly justified when contrary to the standard assumption, shocks to the growth rate of consumption per capita are positively correlated over time (Arrow et al., 2013).

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The opinions expressed in this paper are those of the authors only.

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No potential conflict of interest was reported by the authors.

Notes on contributors

Melchior Vella is a Visiting Lecturer, Department of Economics at the University of Malta. He holds a MSc in Economics from the Department of Economics, University of Essex.

Philip von Brockdorff is Head, Department of Economics at the University of Malta. He holds a DPhil from the Department of Economics, University of York having specialised in the field of Economics of Ageing.

References

Aaron, H. (1966). The social insurance paradox. *Canadian Journal of Economics and Political Science*, *32*, 371–374.

Andersen, T. M., & Gestsson, M. H. (2016). Longevity, growth, and intergenerational equity: The deterministic case. *Macroeconomic Dynamics*, *20*(4), 985–1021.

Arrow, K. J., Cline, W. R., Maler, K. G., Munasinghe, M., Squitieri, R., & Stiglitz, J. E. (1996). Intertemporal equity, discounting, and economic efficiency. In J. P. Bruce, H. Lee, & E. F. Haites (Eds.), *Climate change 1995: Economic and social dimensions of climate change. Contribution of working group III to the second assessment report of the intergovernmental panel on climate change* (pp. 125–144). Cambridge: Cambridge University Press.

Arrow, K. J., Cropper, M. L., Gollier, C., Groom, B., Heal, G. M., Newell, R. G., … Weitzman, M. L. (2013). *How should benefits and costs be discounted in an intergenerational context? The views of an expert panel* (Resources for the Future Discussion Paper No. 12-53).

Auerbach, A. J., Gokhale, J., & Kotlikoff, L. J. (1991). Generational accounts: A meaningful alternative to deficit accounting. *Tax Policy and the Economy*, *5*, 55–110.

Auerbach, A. J., Gokhale, J., & Kotlikoff, L. J. (1994). Generational accounting: A meaningful way to evaluate fiscal policy. *Journal of Economic Perspectives*, *8*(1), 73–94.

Auerbach, A. J., Kotlikoff, L. J., & Leibfritz, W. (1999). The methodology of generational accounting. In A. J. Auerbach, L. J. Kotlikoff, & W. Leibfritz (Eds.), *Generational accounting around the world* (pp. 31–42). Chicago, IL: University of Chicago Press.

https://doi.org/10.1080/21699763.2019.1593878 Published online by Cambridge University Press

Barr, N. (2002). Reforming pensions: Myths, truths, and policy choices. *International Social Security Review*, *55*(2), 3–36.
Barr, N. (2006). Non-financial defined contribution pensions: Mapping the terrain. In R. Holzmann & E. Palmer (Eds.), *Pension reform: Issues and prospects for Non-financial Defined Contribution (NDC) schemes* (pp. 57–70). Washington, DC: World Bank.
Barro, R. J. (1974). Are government bonds net wealth? *Journal of Political Economy*, *82*(6), 1095–1117.
Billig, A., & Ménard, J. C. (2013). Actuarial balance sheets as a tool to assess the sustainability of social security pension systems. *International Social Security Review*, *66*(2), 31–52.
Blake, D. (2006). *Pension economics*. West Sussex: John Wiley & Sons.
Börsch-Supan, A. (2006). What are NDC systems? What do they bring to reform strategies? In R. Holzmann & E. Palmer (Eds.), *Pension reform: Issues and prospects for Non-financial Defined Contribution (NDC) schemes* (pp. 35–55). Washington, DC: World Bank.
Brooks, S. M., & Weaver, R. K. (2006). Lashed to the mast? The politics of NDC pension reform, chapter 15. In R. Holzmann & E. Palmer (Eds.), *Pension reform: Issues and prospects for Non-financial Defined Contribution (NDC) schemes* (pp. 345–385). Washington, DC: World Bank.
Buiter, W. (1997). Generational accounts, aggregate saving, and intergenerational distribution. *Economica*, *64*, 605–626.
Cardarelli, R., Sefton, J., & Kotlikoff, L. J. (2000). Generational accounting in the UK. *The Economic Journal*, *110*(467), 547–574.
Conde-Ruiz, J. I., & González, C. I. (2016). From bismarck to beveridge: The other pension reform in Spain. *SERIEs*, *7*(4), 461–490.
Diamond, P. (1965). National debt in a neoclassical growth model. *American Economic Review*, *55*, 1126–1150.
European Commission. (1999). *Reports and studies. Generational accounting in Europe*. Brussels: Economic and Financial Affairs.
European Commission. (2018). *The 2018 ageing report: Economic and budgetary projections for the EU member states (2016–2070)*. Brussels: Economic and Financial Affairs.
Franco, D. (1995, May). *Pension liabilities – Their use and misuse in the assessment of fiscal policies* (Economic Papers No. 110).
Gjersem, C. E. (2002). Generational accounting in the Nordic countries. *Nordic Journal of Political Economy*, *28*, 3–11.
Gollier, C. (2002). Discounting an uncertain future. *Journal of Public Economics*, *85*, 149–166.
Haveman, R. (1994). Should generational accounts replace public budgets and deficits? *Journal of Economic Perspectives*, *8*(1), 95–111.
Hills, J. (1992). *Does Britain have a 'welfare generation'?: An empirical analysis of intergenerational equity* (State Programme Discussion Paper WSP/76). London: London School of Economics.
Holzmann, R., & Palmer, E. (2006). The status of the NDC discussion: Introduction and overview, chapter 15. In R. Holzmann & E. Palmer (Eds.), *Pension reform: Issues and prospects for non-financial defined contribution (NDC) schemes* (pp. 9–11). Washington, DC: World Bank.
Johnson, P. A., Conrad, C., & Thomson, D. (Eds.). (1989). *Workers versus pensioners: Intergenerational justice in an ageing world*. Manchester: Manchester University Press.
Johnson, P., & Falkingham, J. (1992). *Ageing and economic welfare*. London: Sage.
Kotlikoff, L. J., & Leibfritz, W. (1999). An international comparison of generational accounts. In A. Auerbach, L. Kotlikoff, & W. Leibfritz (Eds.), *Generational accounting around the world* (pp. 73–102). Chicago, IL: University of Chicago Press.
Lee, R. D., & Lapkoff, S. (1988). Intergenerational flows of time and goods: Consequences of slowing population growth. *Journal of Political Economy*, *96*(3), 618–651.
Miles, D., & Iben, A. (2000). The reform of pension systems: Winners and losers across generations in the United Kingdom and Germany. *Economica*, *67*(266), 203–228.
Nordhaus, W. D. (2007). A review of the stern review on the economics of climate change. *Journal of Economic Literature*, *45*(3), 686–702.
Palmer, E. (1999). Exit from the labor force for older workers: Can the NDC pension system help? *Geneva Papers on Risk and Insurance - Issues and Practice*, *24*(4), 461–472.

https://doi.org/10.1080/21699763.2019.1593878 Published online by Cambridge University Press

Palmer, E. (2006). Conversion to NDCs—Issues and models. In R. Holzmann & E. Palmer (Eds.), *Pension reform: Issues and prospects for Non-financial Defined Contribution (NDC) schemes* (pp. 169–202). Washington, DC: World Bank.
Petersen, J. H. (1988). A note on old-age pensions, demography and the distribution between generations. *Journal of Institutional and Theoretical Economics*, *144*(2), 333–342.
Phillipson, C. (1991). Inter-generational relations: Conflict or consensus in the 21st century. *Policy & Politics*, *19*(1), 27–36.
Samuelson, P. A. (1958). An exact consumption-loan model of interest with or without the social contrivance of money. *Journal of Political Economy*, *66*(6), 467–482.
Sartor, N. (2001). The long-run effects of the Italian pension reforms. *International Tax and Public Finance*, *8*(1), 83–111.
Selén, J., & Ståhlberg, A. C. (2007). Why Sweden's pension reform was able to be successfully implemented. *European Journal of Political Economy*, *23*(4), 1175–1184.
Thomson, D. (1991). *Selfish generations? How welfare states grow old*. Wellington: Bridget Williams Books.
von Brockdorff, P. (1999). *A study of the economic consequences of ageing in the Maltese Islands* (D Phil thesis). University of York, York.
von Brockdorff, P. (2012). Pensions and intergenerational transfers: A Malta perspective. *Bank of Valletta Review*, *45*(Spring), 87–108.
von Brockdorff, P., & Amaira, B. (2017). Measuring human capital: A comparative study with emphasis on Malta. *Xjenza*, *5*(2), 110–124.
Walker, A. (1990). The economic 'burden' of ageing and the prospect of intergenerational conflict. *Ageing & Society*, *10*(4), 377–396.
Weitzman, M. L. (2007). Subjective expectations and asset-return puzzles. *American Economic Review*, *97*(4), 1102–1130.

https://doi.org/10.1080/21699763.2019.1593878 Published online by Cambridge University Press