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Abstract
This paper evaluates four retirement income policies that could be adopted in response to increasing longevity in terms of their marginal effects on economic performance, equity, risk, social infrastructure, and sustainability. Compared to three policies involving save-as-you-go funding (voluntary saving, government prefunding, or a supplementary mandatory saving scheme), a pay-as-you-go funded expansion New Zealand Superannuation is unattractive as it has the most disadvantages for all but current middle-aged people. The other schemes provide different tradeoffs between risk, economic growth, and equity. There are many good arguments to use structured saving schemes in addition to New Zealand Superannuation.

JEL Codes
E21 Consumption; Saving; Wealth.
H55 Social security and Public Pensions

Keywords
Retirement income policy; intergenerational economics; Treasury Living Standards framework.

1. Introduction

All OECD countries have retirement income schemes that help people manage their retirements. Some schemes are mandatory, and are implemented through the tax system; others are voluntary but receive substantial subsidies. While these schemes are nearly all different, the typical OECD pension model has three tiers: a publicly provided pension that is unrelated to payments made to the government (tier 1); a contribution based pension that provides an individual with a retirement income that is related to their working-age earnings or tax payments (tier 2); and subsidies or tax-concessions aimed at encouraging voluntary personal retirement savings (tier 3).[1] Most countries use a range of schemes because their objectives for retirement policy are too complex for them to adopt simple solutions. Typically they use tier 1 pensions to prevent and alleviate poverty amongst older people and simultaneously use tier 2 and tier 3 programmes to ensure older people have enough financial resources to maintain their standards of living once they stop working.

In recent years many OECD countries changed their retirement programmes in response to increasing longevity by increasing the age of eligibility, reducing average payments, or adopting new tier 2 or tier 3 schemes. New Zealand is no exception. In 1991 the only public scheme was New Zealand Superannuation, a tier 1 scheme funded on a pay-as-you-go basis out of general taxation. All people over 60 meeting residency criteria received the same payment, an amount linked to average wages. Between 1992 and 2001, the eligibility age was raised to 65. The New Zealand Superannuation Fund was created in 2001 to allow a modest amount of prefunding. Finally, in 2006 a subsidized voluntary saving scheme, KiwiSaver, was introduced.

Longevity is continuing to increase (Christensen et al 2009.) If the current settings of New Zealand Superannuation are maintained - particularly if the current age of eligibility is held constant – the scheme will automatically increase in size as longevity increases because successive cohorts will receive retirement income payments for longer periods. This will necessitate tax increases or cuts to other expenditure programmes. Alternatively, the retirement income schemes could be changed to reduce the overall cost. Either way, the tax increases or programme adjustments that occur in response to increased longevity will affect economic performance and the distribution of income.

This paper examines four different retirement income policies that could be adopted in response to increased longevity in terms of their likely effects on five different dimensions of the Treasury Living Standards framework:

1. their effects on economic growth or performance;
2. the extent they reduce risk;
3. the extent they increase equity;
4. their effects on social infrastructure; and
5. their potential sustainability through time.

The first policy increases the age of eligibility for New Zealand Superannuation in line with increases with longevity. This policy provides future cohorts with retirement

[1] For a comparative description of the various schemes, see Holzmann and Hinz (2005), Whiteford and Whitehouse (2006); OECD (2009); Weaver (2010); and Whiteford (2010).

income for the same length of time as current cohorts and thus best represents the current scheme. Policy 2 maintains the age of eligibility for New Zealand Superannuation at 65, and funds the additional taxes on a "pay-as-you-go" basis, that is, as the additional payments are made. Policy 3 also maintains the age of eligibility for New Zealand Superannuation at 65. However, the additional taxes required to fund the extra payments are levied on a "save-as-you-go" basis by increasing taxes in advance of the additional payments. The surplus revenues are accumulated in a dedicated fund (the New Zealand Superannuation Fund) or used to repay debt. Policy 4 increases the age of eligibility for New Zealand Superannuation in line with increases in longevity, and simultaneously introduces a compulsory saving scheme to fund the period between the age of 65 and the higher age of eligibility.

These policies all have a common element – if longevity increases by k years, they all provide future cohorts with New Zealand Superannuation, funded on a pay-as-you-go basis, from age $65+k$. They differ in the way they help people manage the first k years after age 65 as longevity increases. For example, policy 1 provides no assistance, but policy 2 provides k years of New Zealand Superannuation funded on a pay-as-you-go basis. Thus the focus of the paper is on the *marginal* differences of the four policies, rather than the overall effect of each policy.

While no policy is dominant in all dimensions, several conclusions can be offered.

First, policy 2 is unlikely to be the best policy choice. Maintaining the current age of eligibility for New Zealand Superannuation while providing the additional funds on a pay-as-you-go basis entails the highest long term tax rates, the least wealth accumulation, and the greatest intergenerational transfers from young and future generations to current middle aged generations. The high future taxes and the high cost on future generations may undermine sustainability. While the main argument advanced in its favour is that it pushes out the necessary tax increases to generations who are likely to be richer and who can better afford them, standard welfare arguments suggest these transfers do not lead to an overall increase in welfare except under unusual circumstances. If there is a strong desire to keep the age of eligibility for New Zealand Superannuation at 65, the paper strongly suggests it would be better to fund the increased payments on a save-as-you-go basis, by raising taxes in advance of the additional payments. The extra funds would be accumulated in the New Zealand Superannuation Fund or used to repay debt.

Secondly, the three different save-as-you go options have different advantages and disadvantages. The three schemes either require voluntary personal saving, mandatory personal saving, or tax-funded government saving. They have different implications for taxes and economic growth, equity, and risk. All of these schemes have positive aspects, and each scheme seems likely to appeal to different segments of the community. For this reason, any choice is likely to be based upon social, political or philosophical preferences rather than purely economic arguments.

Thirdly, as New Zealand already has a small retirement income programme, further reductions should be contemplated with caution. The small size of the mandatory schemes may reflect a preference for private voluntary provision rather than compulsion, and this paper identifies some of the costs associated with the taxes or mandatory contributions associated with large tier 1 or tier 2 schemes. These schemes

can also provide risk diversification advantages that are not offered by private saving schemes, however. Ultimately these advantages stem from the ability of a long-lived government to shift risk through time in a manner that cannot be replicated by individuals. These advantages have been little analysed in the New Zealand context. The paper suggests that individuals may derive considerable benefits if policies were adopted that better enabled them to use the government balance sheet to help diversify the economic risks they face, although these benefits have not been quantified.

2. Objectives of retirement income policies.

2.1 New Zealand's current retirement income policies.

New Zealand is unusual within the OECD as it has tier 1 and tier 3 retirement income schemes, but no mandatory tier 2 scheme providing an earnings related pension. The tier 1 scheme is New Zealand Superannuation, provided to all people over 65 who meet residency requirements. New Zealand Superannuation provides a pension linked to average wages, with a couple receiving an after-tax pension equal to 66% of the after-tax average wage.[2] As New Zealand Superannuation provides the highest gross payment for a tier 1 scheme in the OECD, the current settings are effective at preventing poverty among the elderly. Nonetheless, the lack of a tier 2 scheme means average retirement benefits are low by OECD standards.[3]

New Zealand's voluntary tier 3 scheme is KiwiSaver. Members put at least 3% of their income into the scheme, which is matched by a 3% contribution by their employers. The government provides an annual tax credit of $521, provided the annual contribution is at least $1043. The government does not provide tax concessions for long-term savings and income earned in KiwiSaver accounts is taxed.

New Zealand Superannuation is largely funded from general taxation on a pay-as-you-go (PAYGO) basis, although in 2002 the New Zealand Superannuation Fund was created to partially fund future retirement benefits on a save-as-you-go (SAYGO) basis. In a PAYGO-funded scheme, taxes are levied when the payments are made, and, assuming New Zealand Superannuation payments are consumed immediately, no capital is accumulated. In a SAYGO-funded scheme, the taxes are levied in advance of the payments, and the surplus funds are accumulated in a government investment fund prior to being used to make retirement income payments.[4]

2.2 Retirement income policy objectives

There are two primary reasons why governments have retirement income policies. First, governments provide tier 1 schemes to prevent financial hardship amongst the elderly. Secondly, they provide an earnings-related (tier 2) retirement income scheme to help people smooth consumption over their lifetimes.

Financial hardship can occur for many reasons. Some people have little ability to earn an income when they are older because of poor health or redundant skills. Others may have had low income all of their lives and have been unable to save sufficient amounts to avoid poverty without government assistance. Some people may have

[2] In 1977 a couple received 80% of the average wage but this was subsequently reduced.
[3] OECD (2009). See the discussion in Whiteford (2010).
[4] The surplus tax receipts could also be used to retire debt. While this paper assumes the surplus will be accumulated in the New Zealand Superannuation Fund, the Fund could purchase New Zealand Government debt according to its preferences over the relative risks and returns of different assets.

saved little for retirement, despite adequate incomes. Others may have saved adequately for retirement, but invested poorly, or had most of their assets stolen or eroded by inflation. Some may have spent most of their resources on medical treatment, and yet others may simply have lived "too long" in the sense they outlived the provision they made for retirement. A tier 1 pension prevents financial hardship independently of the cause by providing resources to older people unconditionally.

Because there are so many reasons why older people could have low incomes, a tier 1 pension solves many different problems. As it prevents financial hardship stemming from a wide variety of random outcomes – investment risk, theft, ill health, a long life, or poor job opportunities – it provides insurance. As it prevents financial hardship stemming from low lifetime incomes or large child-related expenditures, it provides redistribution to one group of people. As it prevents financial hardship stemming from poor decision-making or spendthrift behaviour, it provides redistribution to a different group of people. In all cases, it prevents financial hardship. However, societies may value this achievement differently according to the cause of poverty. Bowles and Gintis (2000), and Fong (2001) argue that a large number of people, possibly a majority, are only willing to help people in hardship if they are in some sense deserving – that is they obey the prevailing society norms concerning effort, thrift, and hard work. Thus many people are more willing to help others if their misfortune is due to bad luck rather than poor choices.

Most OECD governments have earnings-related (tier 2) retirement income schemes. Some schemes provide a retirement income benefit that is proportional to lifetime tax or saving contributions (for example, Germany) while other schemes have a redistributive component (for example, the U.S. or Australia). These schemes reflect beliefs that many people will fail to smooth their consumption without help, either because they have difficulty saving, or because they have difficulty making an appropriate set of investments. The schemes are typically designed to minimize the distortionary effects of taxation, usually by linking retirement income to the amount paid as social security taxes or compulsory saving contributions.

Governments also intervene to promote "social infrastructure". When Kildal and Kuhnle (2008) examined why several countries introduced universal pensions they found that many governments wished to inculcate a sense of social cohesion by granting elderly people an entitlement to an income irrespective of their financial contribution to society. The "right of entitlement" argument, which has a parallel with the idea that all citizens are entitled to emergency medical care irrespective of income, has a long history in New Zealand.[5] In addition, some societies provided universal benefits to avoid the intrusive means-testing that can occur when benefits are only provided to low-income people. The 1972 Royal Commission of Inquiry into Social Security argued that support for a universal benefit and opposition to means-tested benefits was particularly strong in New Zealand.

These different objectives have been incorporated into formal economic models investigating the optimal type of retirement income policy, or the optimal age of eligibility for retirement income benefits. For example, Cutler, Liebman and Smyth

[5] It was advocated by the Labour Party prior to their election in 1935, and the 1938 Social Security Act introduced by that government provides the historic basis for New Zealand's retirement schemes.

(2007) derive a model based on Diamond and Mirrlees (1978) in which the optimal age of eligibility represents a trade-off between the insurance benefits gained by people who have low late-life income opportunities, possibly due to ill health, and administrative efficiency. When it is sufficiently costly or intrusive to screen people applying for a benefit due to ill health, it becomes more efficient to offer benefits to all people reaching a particular age. They also derive a model in which mandatory retirement income schemes represent a trade-off between the benefits obtained by individuals who have difficulty saving for retirement, and the costs imposed on those who have less difficulty. One implication of these models is that the optimal age of eligibility for retirement income is likely to change through time, reflecting changing longevity and the health status of older people amongst other factors. In all of these models, improving age-specific health status and declining age-specific death rates increase the optimal age of eligibility.

2.3 SAYGO and PAYGO funding.

The size of a retirement income scheme increases when life expectancy increases by a year for cohorts born after year *s*, but the age of eligibility stays at 65. The cohorts born after year *s* get additional payments as they receive the pension for a year longer than preceding cohorts. When this expansion is funded on a SAYGO basis, a cohort born in year *s* is required to pay sufficient additional taxes before it is 65 to cover the expected increase in pension payments, with the taxes accumulated in a government fund. When the expansion is funded on a PAYGO basis, younger cohorts are required to pay additional taxes when the cohort born in year *s* turns 65. Funding the expansion of New Zealand Superannuation on a PAYGO basis therefore involves a transfer to the first generation of recipients, as those cohorts obtain more years of pension benefits than they provided to earlier cohorts. While subsequent generations also get pension payments for longer, these payments are offset by the higher tax payments made to the previous generation of recipients.

In a dynamically efficient economy, a key feature of a PAYGO funded retirement scheme is that the additional transfers to the first generation of recipients comes at the expense of lower consumption for all subsequent generations, even if they also get additional pension benefits when they are older.[6] Future generations have less consumption because they pay taxes to fund pension payments, instead of saving the equivalent sum and earning interest and dividends. If the rate of return to capital (r) exceeds the growth rate of the economy (g), the opportunity cost on subsequent generations is $(r-g)/(1+r)\ T$, where T is the additional tax payments that have to be made to get a retirement income from a government pension rather than by saving.

Two observations can be made about this opportunity cost. First, it is large. If the return to capital is 2.5 percentage points higher than the growth rate - a gap similar to that experienced in the last two decades – the long term taxes needed to fund New Zealand Superannuation on a PAYGO basis are twice as large as the taxes needed to fund it on a SAYGO basis.[7] Lower taxes are possible in a SAYGO-funded scheme

[6] This literature was pioneered by Samuelson (1958) and Diamond (1965). A succinct statement of the theory is Sinn (2000). Coleman (2013) provides a discussion tailored to the New Zealand context. In a dynamically efficient economy the return to capital exceeds the growth rate of the economy. Most OECD economies were dynamically efficient last century (Abel et al 1989).

[7] See the calculations in the appendix of Coleman (2013). If $r-g=1.25\%$, in the long term PAYGO-based funding requires fifty percent higher taxes than SAYGO-based funding.

because taxes are increased earlier and the accumulated sum earns interest and dividends. As the opportunity cost increases with the size of the retirement income programme, and is likely to be reducing in the population growth rate, it is likely to be significantly higher for future New Zealand generations than current generations.

Secondly, when a retirement income scheme is expanded on a PAYGO-basis, the value of the transfer to the first generation of recipients is equal to the discounted sum of the opportunity costs on all subsequent generations, when the discount rate is the return to capital. In a significant sense, this is what "dynamically efficient" means: transfers that increase the consumption of one generation come at the expense of reductions in the consumption of other generations. The intuition of the result is that if the first cohort invested the resources they were given, and earned the rate of return to capital, the amount they would earn is equal to the opportunity cost imposed on subsequent cohorts. A simple proof of this result is shown in Sinn (2000). While the net present value of an expanded PAYGO scheme is zero when the discount rate is the rate of return to capital, this does not mean the scheme is welfare neutral. Rather, it involves a redistribution from one set of cohorts to others, including those yet born.

These considerations are central to the evaluation of a PAYGO-funded expansion of New Zealand Superannuation. This policy involves a transfer to the cohorts obtaining New Zealand Superannuation for more years than they were required to fund earlier cohorts, at the expense of a higher opportunity cost on subsequent generations. This opportunity cost is not imposed on subsequent generations when SAYGO funding mechanisms such as voluntary private saving, mandatory private saving, or the accumulation of assets in a central fund are adopted.

2.4 Voluntary versus mandatory schemes

The three SAYGO options differ in terms of the extent they are voluntary or mandatory. The choice between voluntary and mandatory schemes can be based on philosophical or economic grounds. For some, choice is an absolute "right", which rather ends the story. For others it is a question of efficiency, whether people are likely to make the best choices because they have the best knowledge of their own circumstances, preferences, and abilities.

Is it necessarily efficient to allow people to make their own choices about the amount, timing, and type of saving they do? Given that people may know when it is most difficult to save, perhaps because income is temporarily low, and given that people may know the type of saving that is most useful at any stage of their lives (repaying debt? investing in their own business?) it seems reasonable to believe that people should determine how and when they save. Yet there are at least five reasons why personal choices may not be efficient, and why Government intervention may be beneficial.

1. People may *save* inappropriate amounts, for psychological and behavioural reasons, and end up regretting the amount they save. A mandatory or tax-funded retirement income scheme can correct these tendencies.

2. People may *invest* in inappropriate ways, in part because it is difficult to invest well, and in part because "shysters" have an incentive to provide bad investment advice or poor investment options. Even if they save appropriate

amounts, they may end up with few resources in retirement. Mandatory or tax-funded retirement income schemes can correct these problems, providing insurance against poor investment choices or theft.

3. People can have sub-optimal patterns of saving and investment because of distortions induced by other government policies or tax arrangement. A mandatory retirement income scheme can offset these distortions.

4. Many societies adopt redistributive transfer policies to reduce poverty amongst the elderly. This induces a moral hazard problem by providing incentives for some people to save less for their retirement than they otherwise would have done (Homburg 2006). A mandatory or tax-funded retirement income scheme corrects these incentives while allowing a broadly redistributive policy by forcing people to make some provision for their own retirements.

5. A mandatory or tax-funded retirement income scheme can offer insurance or risk reduction possibilities that are not possible with voluntary schemes, as a long-lived government can shift risk through time in a manner individuals cannot. On an ex ante basis the "insurance" welfare improvements associated with these schemes may be greater than the costs associated with the compulsory contributions or taxes.

The issue is difficult as mandatory retirement income schemes reduce the freedom of choice, something cherished by many. Nonetheless, these freedoms are not absolute and it is clear that mandatory schemes can raise welfare as well as reduce it. While voluntary saving schemes may impose the least costs on individuals, they also provide the fewest benefits, and correct the fewest distortions induced by other policies.

Most of the costs of mandatory or tax-funded saving schemes fall on people who cannot alter their private saving or investment behaviour in response to the scheme. For this reason, the costs fall primarily on people who are liquidity constrained, often younger people or owners of small businesses. Mandatory private saving schemes adopted in other countries have been designed to reduce these costs, and these techniques could be adopted here. For instance, the Australian Guarantee scheme has exemptions for self-employed people so they can invest in their own businesses. Switzerland has age-dependent contributions. Income tax rates can be adjusted to take into account variations in household consumption patterns that may make particular years inconvenient times to save, as is already the case in New Zealand. While such feature can lower the cost of mandatory or tax-funded schemes while retaining their benefits, they are directly considered in this paper.

3. Evaluating a PAYGO-funded expansion of New Zealand Superannuation

3.1 *The four policies*.

The four polices are all designed to deal with increasing longevity. They all have a common element – they all provide a cohort born in year *s* with New Zealand Superannuation, funded on a pay-as-you-go basis, after age 65+k(s), where k(s) is chosen so that all cohorts have this common element for the same length of time.

Consequently, the policies only differ because of the way they provide income for the first k(s) years after age 65.

Policy 1 increases the age of eligibility for New Zealand Superannuation in line with longevity. People use savings and additional workforce participation to fund consumption prior to receiving a government pension. Policy 2 keeps the age of eligibility at 65, and funds the additional New Zealand Superannuation payments by raising taxes on a PAYGO basis. Policy 3 keeps the age of eligibility at 65, but funds the additional New Zealand Superannuation payments on a save-as-you-go basis by increasing taxes in advance of the additional payments. Policy 4 increases the eligibility age in line with longevity and simultaneously introduces a mandatory "structured" saving scheme to help people fund the first k(s) years after age 65. Rather than discuss tier 2 schemes in general, this paper considers a supplementary mandatory saving scheme similar to the voluntary scheme proposed by the Financial Services Council (2012).[8]

The 2012 Financial Services Council scheme can be summarised as follows.

(a) New Zealand Superannuation funded on a PAYGO basis is provided from age 65+k(s).
(b) Each individual or couple would place 10 – 12 percent of the income they earned prior to age 65 into their personal retirement account(s).[9]
(c) Upon turning 65, each person would purchase a fixed term pension that provided a retirement income as least as large as New Zealand Superannuation for the *k* years until the higher eligibility age.
(d) Any funds above this amount could be withdrawn at the person's discretion.
(e) All funds in the account would be part of the person's estate upon death.
(f) If a person has insufficient funds in their account at age 65 to purchase a *k* year fixed term pension, the government will top up the account.

The scheme is designed to supplement New Zealand Superannuation and is directly comparable to policy 2 and policy 3. Rather than paying additional taxes and getting an extra *k* years' Superannuation, people would make contributions into an account for the additional *k* years, with any surplus funds being available as a lump sum. Note that for most people the rate of contributions is considerably higher than needed to replace k(s) years of superannuation unless k(s) reaches 7 or 8 years or more. However, it is also intended to provide most people with sufficient resources to help them smooth consumption over the course of retirement.

3.2 The effect of the four policies on economic growth and performance.

The different schemes require additional taxes or mandatory savings contributions, causing two effects on economic performance and growth. First, higher taxes decrease the allocative efficiency of the economy, reducing the incentive to participate in the

[8] The author was part of the team that wrote the FSC proposal. The FSC intended the scheme would be voluntary but this paper evaluates the scheme assuming it is mandatory. In the "working paper" version of the paper, I discuss a mandatory scheme similar to the Australian Guarantee scheme. This scheme applies a means test to the tier 1 pension and cannot be compared on a marginal basis to the other policies, for it does not offer New Zealand Superannuation at the same rate to all people over 65+k.

[9] Individuals with partners could be required to divide their contribution between their own and their partner's accounts so that if the government "tops up" accounts with insufficient funds, it avoids topping up the accounts of low-income individuals with high income partners.

workforce and increasing the incentive to invest in tax sheltered assets. Secondly, they affect wealth and capital accumulation.

Policy 1, which increases the age of eligibility, has the smallest increase in taxes, and imposes the fewest tax distortions on the economy. Relative to this level, polices 2 and 3 require the imposition of additional taxes, whereas policy 4 requires additional mandatory saving contributions. Policy 2 and policy 3 offer identical benefits, but differ when the taxes are raised. As policy 2 raises taxes on a PAYGO basis, it requires the largest increase in taxes in the long term, plausibly twice as large as the increase required by policy 3 which requires taxes to increase earlier.[10] The mandatory contributions associated with policy 4 are higher than the taxes associated with policies 2 and 3, as considerably higher levels of retirement income are provided to most people. The distortionary effects of these contributions are likely to be smaller, however, because the contributions are kept by the contributor or his or her estate (Disney 2004.) The mandatory saving contributions in conjunction with the top-up arrangement may reduce the incentives for some people to participate in the workforce, as the rewards from work are not immediately available, although this effect should be much smaller than the distortionary effects of taxes.[11]

Higher taxes affect the private incentive to participate in the workforce and to save, further distort the incentive to invest in lightly taxed asset classes, and reduce the retained earnings that firms can reinvest. Since male full time participation rates are less affected by tax rates than other participation rates, it is plausible that the different distortionary effects of the four policies will be most keenly experienced by women (Disney 2004.) If firms are liquidity constrained, or are reluctant to increase their borrowing to fund investment, investment may decline. The mandatory saving scheme may alter investment patterns further as liquidity constrained small businesses divert savings from their businesses to other forms of saving.[12]

How large are these effects? In 2040 approximately 13% of the over 65 population will be aged 65-67, so that raising the age of entitlement by 3 years would reduce New Zealand Superannuation expenditure by 13% or by approximately 1 % of GDP. Since only approximately 70% of GDP is taxed, tax rates would need to increase by approximately 1.4 percent of taxable income by 2040 if raised on a PAYGO basis. Under policy 3 taxes would increase by half as much, but the increase would take place immediately. These increase are not large, but are in addition to the much larger tax increases that will be needed by 2040 because of the increases in the birth rates between the 1930s and 1970s.[13]

The different policies will also affect wealth accumulation and investment allocation. The largest effect concerns the difference between Policy 2 and the three SAYGO policies. The expansion of a pay-as-you-go retirement income can be expected to

[10] Higher taxes could be required under policy 3 rather than policy 2 for a couple of decades

[11] The proposal to "top up" accounts with insufficient funds to buy a k-year pension is equivalent to giving each person k years' pension and then imposing a 100 percent tax on the first contributions up to this amount. If the amount is small compared to the most people's lifetime accumulation, most people will have a zero *marginal* tax rate on their contributions and there will be little distortionary effect.

[12] This will not have large adverse effects if the returns to investments in small businesses are lower than the returns to investments in large businesses.

[13] The number of births were nearly 30000 per year from 1920 – 1938, but have exceeded 50000 since 1952. In turn, the number of people aged 65-69 increased from 112000 in 1981 to 179000 in 2011.

significantly reduce wealth accumulation compared to the other polices, as the amounts paid in taxes are not saved whereas the contributions made or taxes paid under the other policies are accumulated.[14] Policy 3 could increase asset accumulation in the long run by approximately $20 billion for each year of additional longevity relative to policy 2. The higher contribution rates of Policy 4 will increase the savings held in mandatory accounts by more than this amount, but much of the additional saving will be offset by reduced voluntary saving. Policy 1 can be expected to increase the capital owned by residents by an intermediate amount, as some people will work for additional periods or reduce consumption rather than save more. The reduced wealth accumulation will reduce the local capital stock unless there is a completely offsetting increase in foreign investment. If this substitution does not occur, the decrease in capital/ labour ratios will decrease wage levels.

3.3 Increasing Equity

It is inherently difficult to define "equity." This section examines how retirement income schemes redistribute resources, or affect some aspects of welfare, while trying to avoid some of the more contentious discussion of what it means for one scheme to be "fairer" than others. It focuses on four issues: inter-generational transfers, intra-generational transfers, household inter-temporal consumption paths, and bequests.

Intergenerational transfers

Policies 1, 3, and 4 are intergenerationally neutral as they are funded on a SAYGO basis. In contrast, policy 2 entails intergenerational transfers from future generations to the first generation of recipients. These transfers have two salient aspects. First, future generations are likely to have higher incomes than current generations because of economic growth. Secondly, the opportunity costs associated with New Zealand Superannuation already fall most heavily on future generations, so that the distribution of these costs will be exacerbated (Coleman 2013).

How should these transfers be evaluated from an equity perspective? In broad terms, the economics literature tackles the issue from the perspectives of "utilitarian discounting" and "sustainability". The "utilitarian discounting" approach examines how transfers alter the total sum of all generations' welfare, with the consumption of later generations discounted to take into account their likely higher levels as well as their delayed nature. Transfers to current generations from richer future generations *can* although need not be welfare improving as they raise the consumption of lower income people at the expense of higher income people. In contrast, the "sustainability" approach focuses on the average size of the transfers made by current and future cohorts, without discounting future transfers simply because they occur later. In this approach, policies that impose large costs on *all* future cohorts are valued poorly, because they lower average consumption levels of large numbers of people evaluated in their own time frames.

Will welfare increase in a dynamically efficient economy if there is a PAYGO-funded expansion of a retirement income scheme that transfers resources from future high-

[14] The expansion of a PAYGO retirement income programme reduces saving because it replaces voluntary saving with a scheme that does not accumulate capital. In contrast a mandatory saving programme accumulates capital, so even though it may crowd out voluntary saving the aggregate saving position changes by little. See de la Croix and Michel (2002) for a statement of this position, and Coleman (2013) for a short review of the empirical literature

income cohorts to current low-income cohorts? The answer is not straightforward. When a retirement income scheme is expanded on a PAYGO basis, the first generation's consumption gain equals the discounted value of all future generations' consumption losses, if the discount rate is the return to capital (Sinn 2000.) Welfare is not usually calculated in this manner, however. Rather, transfers are valued in terms of the discounted value of the change in the utility of consumption, where the discount rate is the rate of time preference (see Arrow et al (1995) for a discussion). This changes the calculation two ways. First, the welfare cost of future consumption losses will be smaller if the marginal utility of consumption is decreasing in income. Secondly, the welfare cost of future consumption losses will be higher if the discount rate is lower than the real return to capital. The two effects exactly offset each other when the real return to capital equals the time preference plus the elasticity of marginal utility multiplied by the growth rate of consumption. Because the real return to capital should equal this sum in the long run, intergenerational transfers to current cohorts should not *ordinarily* increase net welfare. They should increase aggregate welfare only if the social discount rate is higher than its normal long run value. This, of course, is the justification in times of enormous stress.

A PAYGO-funded expansion of a retirement income policy has fewer positive aspects if assessed through a "sustainability" lens, because the increase in consumption of the first generation is offset by lower average consumption of all future generations, and the latter are not discounted simply because they occur in the future. Moreover, since these future generations are young or unborn, they do not have voting rights and the decision to transfer resources from them essentially involves an expropriation of their resources. Thus if "sustainability" is an important component of equity, equity is reduced when PAYGO-funded transfers to older generations are expanded.

Chilchinisky's (1996) axiomatic approach to social welfare raises an additional wrinkle. She argued that any admissible welfare function should balance the "utilitarian discounting" and "sustainability" approaches. Since a PAYGO-funded expansion of retirement income is likely to generate zero welfare benefits by the utilitarian metric, unless consumption for the first generation is unusually low, and since it generates negative benefits by the sustainability metric, any combination is negative. It follows that the expansion can only be justified using standard welfare economic approaches in circumstances that a society is particularly concerned about the welfare of the current generation, such as in the aftermath of a war or natural disaster, or immediately prior to a dramatic economic transformation.

Intra-generational transfers

Relative to policy 1, policies 2 and 3 increase within-cohort transfers from high lifetime income to low lifetime income households, as the tax system is progressive. This will reduce income and consumption inequality amongst retired people by providing benefits to people with low late-life income opportunities for additional years. The extent of redistribution will be limited by the positive correlation between income and longevity. Some low lifetime income households will pay higher taxes when they are working to fund the expansion of New Zealand Superannuation, but not live long enough to enjoy the increased pension benefits (Liebman 2002).

In the long run, policy 3 entails smaller within-cohort transfers from high to low income households than policy 2 even though the retirement income payments are identical because high-income households will have to pay lower tax rates, as the

taxes are raised earlier. Thus a PAYGO-funded expansion of New Zealand Superannuation will cause a Pareto-worsening *decrease* in income inequality compared to a SAYGO-funded expansion of New Zealand Superannuation.
Policy 4 entails fewer intra-generational transfers than policies 2 or 3 as people with low incomes are likely to make higher savings contributions than the additional taxes they would pay to fund the expansion of New Zealand Superannuation. It is more progressive than policy 1, for while each person keeps their own contributions, there is a tax-funded transfer to people with low lifetime incomes.

Intertemporal consumption and liquidity constraints.
The increase in taxes or mandatory saving contributions associated with polices 2, 3, or 4 is likely to tighten borrowing constraints on liquidity constrained younger cohorts, and reduce their consumption. This may significantly reduce the welfare of low-income people, as it requires them to save more at times that may be particularly inconvenient. Coleman (2013b) developed a theoretical model to analyse this case and showed a PAYGO-funded expansion of New Zealand Superannuation involving proportional increases in tax rates would reduce lifetime welfare for rational savers in almost all positions of the income distribution. This is true even for those who pay less in taxes than the additional value of their retirement income.

The size of the adverse liquidity effects of policy 4 relative to policies 2 and 3 is unclear. While the contribution rates are higher, if young people can use some of the funds to purchase housing, the adverse effects of the mandatory contributions will be reduced.[15] The Government could also consider additional measures to make the tax system more progressive to make the mandatory payments more affordable.[16]

The returns from a mandatory contribution scheme differ according to investment performance. Since the skill of selecting and evaluating appropriate investments is not evenly distributed across the population, there is potential for risk averse, low skilled and low income investors to do worse than high income investors (Arenas de Mesa and Mesa-Lago 2006). Overseas evidence suggests that the transactions costs associated with retail mandatory investment accounts *can* be very high (Diamond 1996; Barr and Diamond 2006.) The evidence also suggests that transactions costs can be minimised, and that government has a crucial role in designing the regulatory regime to ensure that funds are invested appropriately, particularly those with limited investment experience. (Diamond 1997, 2011.)

Annuities and bequests
Policies 2 and 3 increase the fraction of their retirement income that older people receive in annuity form by increasing the average duration of annuity payments. Increases in the average duration of annuities have little effect on the welfare of people with moderate or high life expectancy, as people could simply decumulate wealth at the start of their retirement to fund the additional years. However, an increase in the fraction of retirement income paid out as annuity income is bad for people who have low life expectancy. U.S. studies indicate that there is a positive

[15] The KiwiSaver scheme already has this feature, and it is included in the FSC proposal.
[16] For example, social security payments in the United States are mandatory on the first dollar of earned income, but low income people with families have high exemption thresholds before they start paying income tax. The Working for Families programme already provides substantial income tax reductions to low and middle income households with children.

correlation between lifetime income and life expectancy that means low-income people are more likely to receive retirement incomes for short periods than high-lifetime income people, because they die young.

Schemes that provide relatively large amounts of annuity income can increase intergenerational wealth inequality by reducing the bequests of low lifetime-income households who typically die younger than high-lifetime income households (Feldstein and Ranguelova 2001.) For this reason, policy 4 could have the effect of reducing *wealth* inequality in the long run by increasing the bequests to low wealth families who experience the early death of a family member (Gokhale et al 2001).

3.3 Social Infrastructure

Policies 2, 3, and 4 all offer greater insurance against low late-life employment opportunities, perhaps because of ill health or technological redundancy, than policy 1 (Diamond and Mirrlees 1978; Diamond 2011.) Social infrastructure can be enhanced when this insurance is expanded, as alternative insurance is not offered by the private sector. In practice, however, the value of the insurance benefits obtained by people whose ill-health prevents employment is small because they are eligible for other (albeit smaller) government benefits. Moreover, the benefits of the insurance decrease if health improves with longevity (Cutler, Liebman, and Smyth 2007). Consequently, these effects may not be large. Nonetheless, if the receipt of a benefit is conditional upon an intrusive means test, there can be considerable adverse welfare consequences that do not occur when the benefit is conditional on age (Kildal and Kuhnle 2008.)

The intergenerational transfers associated with policy 2 may affect social infrastructure in one of two ways. Young and working age households could consider the expansion of a PAYGO-funded retirement income scheme to be an unjustified resource expropriation by a generation seeking additional years of retirement income – the basic argument of the "intergenerational conflict" literature (Kotlikoff and Burns 2012). Alternatively, they could consider it a community enhancing contribution to a deserving older generation. The latter interpretation is less likely than it was, given the generations affected by the Depression and World War II are unaffected by these policy changes. Intergenerational conflict is a less relevant concern for the other three policies as they are intergenerationally neutral.

Policy 4 is likely to affect social infrastructure differently from the other policies. If society believes social infrastructure is enhanced when all eligible people receive identical government pensions, it will worsen social infrastructure. This is true even if low income people receive as least as much as New Zealand Superannuation from age 65 as they would under the other policies, for receipt of a "top-up" may be considered socially demeaning, and reduce social infrastructure (Kildal and Kuhnle 2008). Conversely, if many people prefer a welfare system based on the "reciprocity" principle that welfare transfers should primarily go to the "deserving", the scheme may been considered to improve social infrastructure by linking benefits to contributions (Bowles and Gintis 2000.) Clearly the effect on social infrastructure will depend on the balance of the two groups in society. Policies 1 and 4 may have two other effects relative to policies 2 and 3, as the additional savings are private. If the funds can be used to purchase housing at a young age, they may improve owner-occupied home-ownership rates among younger households, which may improve

social infrastructure. Moreover, by enabling households to hold more of their wealth in a bequeathable form, they may reduce long run wealth inequality.

3.4 Reducing Risk

Idiosyncratic risk

Retirement income schemes help pool idiosyncratic risk – ill health, poor job opportunities, poor investment returns, theft, or even a longer life. Government retirement income policies address many of these idiosyncratic risks by providing annuity income after a certain age. As policy 1 is the only policy not to offer an income for the first k years after 65, it exposes people to the most idiosyncratic risk, particularly poor late-life employment opportunities, investment risk, and theft.

Mandatory savings accounts have mixed effects on idiosyncratic risk. Compared to a system of voluntary saving, they reduce some of the idiosyncratic risk associated with investing and provide insurance against very poor outcomes. Compared to policies 2 and 3, policy 4 increases individual exposure to capital market returns, although the downside of this risk is minimised because of the "top-up" provision. The risk associated with private investment accounts may be exaggerated. Historically, investment based retirement income schemes (such those operated in Denmark or Chile) have had high returns, and most policy simulations based on historical data suggest there is a very low risk of doing badly in well-structured retirement account schemes.[17] Moreover, as Barr and Diamond (2006) and Diamond (2011) argue, the idiosyncratic risk aspects of supplementary retirement account schemes can be minimized by reducing the investment choices available to people.

Macroeconomic risk.

Since New Zealand Superannuation provides a retirement income linked to average wages, its expansion increases the link between retirement incomes and average New Zealand wages, and reduces the link to capital market returns. Bohn (2005 p13) argues that since wage levels and local capital incomes are similarly affected by poor local productivity growth rates, but people work for much longer than they are retired, "working age individuals are more exposed to productivity risk than retirees." If only retirement income is considered, optimal risk sharing would suggest PAYGO-funded retirement income schemes should be used to reduce capital income risk. If income over the whole of life is considered, optimal risk sharing suggests retirees should have more capital income risk, particularly diversified foreign capital income risk, to reduce their exposure to local productivity shocks (Acemoglu and Zilibotti 1997.) For this reason, conclusions about the risk implications of different retirement income schemes depend on whether a narrow retirement income perspective or a broader whole of life perspective is considered.

[17] U.S. studies suggest there is a low probability that hypothetical "typical" individuals would have lower retirement income with private accounts than they would have with Social Security (for example Feldstein, Ranguelova and Samwick (2001); Feldstein and Liebman (2002)). Feldstein and Leibman (2002b) also used the actual tax and marriage records of a sample of U.S. tax payers born in the 1920s to analyse various alternative retirement schemes tax given actual and simulated investment returns. This study, which captures the effects of income volatility and family formation and dissolution, showed a mixed system with individual investment accounts and Social Security outperformed a system solely based on Social Security, even when the mixed system required smaller saving and tax contributions. That said, investment returns since 1982 have been unusually high, so extrapolation from recent evidence may be problematic. (Arnott and Bernstein (2002), and Dimson, Marsh, Staunton and Garthwaite (2013) discuss the high rate of returns earned since 1982.)

Policies 2 and 3 both increase a household's exposure to a retirement income stream that depends on average wages. However, PAYGO-funded retirement income schemes have different risk characteristics than SAYGO-funded schemes. Without requiring an adjustment to contribution or tax rates, PAYGO schemes can offer a return linked to the growth rate of wages while SAYGO schemes can offer a return linked to the return on capital. Because policy 3 accumulates capital to pay for the retirement incomes, it diversifies this risk by either by transferring the capital income risk to the government balance sheet or by transferring it between generations through variable tax rates. Policy 3 therefore reduces whole of life income risk without increasing retirement income risk relative to policy 2. As it increases capital accumulation and national wealth it may also reduce macroeconomic risks, particularly if it results in additional offshore investment.

The advantages of policy 3 come with the risk that political interference may reduce the returns from the New Zealand Superannuation Fund. There is also a risk that a government may try to use the funds for a different purpose, either directly by raiding the fund or indirectly by increasing debt levels in response to the increase in the Fund's assets. In contrast, policy 2 increases the risk of politically inspired changes in the scheme, typically leading to lower pensions and consumption (McHale 2001.)

The risk characteristics of policy 4 depend on the characteristics of the top up and the investment portfolios that investors can choose.[18] The scheme eliminates the risk that individuals have an income less than New Zealand Superannuation, transferring it to future generations of taxpayers. However, a cohort keeps the upside returns if they are large. Thus the scheme has features resembling those of buying and selling options on capital market returns (Bohn 2005). This means future generations both have the risk of higher tax payments should the private accounts of their elders be low, and insurance against their own returns being low. Such a risk-sharing strategy is likely to increase welfare on an ex-ante basis. It is also somewhat similar to the risk sharing under a SAYGO-funded expansion of New Zealand Superannuation.

3.5 Sustainability for the future

"Sustainability" can be interpreted in several different ways. A system can be considered sustainable if it can maintain its parameter settings (such as tax rates) unchanged indefinitely. Alternatively, a system can be considered sustainable if it is not subject to political pressure for change. By both metrics, policy 2 is the least attractive, as it is not intergenerationally neutral. Rather, it requires the largest long run increase in taxes, and the largest opportunity costs on future generations. To the extent that younger generations are unhappy that they are bearing a disproportionate share of these costs, the political sustainability of the scheme may be threatened. This could happen through the ballot box, or future working age people could choose to migrate to countries with retirement systems that have lower opportunity costs because they are funded on a save-as-you-go basis. In particular, policy 2 will increase the incentive to migrate to Australia, where the PAYGO-funded pension is supplemented by mandatory save-as-you-go private accounts.[19]

[18] Since idiosyncratic risk can be managed, a mandatory scheme should be designed so that appropriately diversified portfolios are the default option. People would have to explicitly choose high risk options if they wanted them, but lose the top up provisions if they chose these options.

[19] By 2060 the tax rates associated with policy 2 will nearly double, without a commensurate increase in the pension. At this time New Zealand tax payments will approach the combined total of Australian

McHale (2001) analysed the retrenchment of PAYGO-funded pension schemes in several OECD countries in the 1980s and 1990s. He showed that most countries cut the future entitlements of contemporaneous middle-aged people rather than the entitlements of contemporaneous retired people. He further argued that middle-aged people have an incentive to cut their own future entitlements if they are likely to become onerous on future working age people, to prevent even harsher cuts. This is because it is politically costly to cut the pensions of the contemporaneously retired, making it worthwhile only if really large cuts are made. If so, policy 2 increases the prospect of a subsequent retrenchment, by increasing the gains to younger cohorts from taking large and decisive actions.

Policy 3 also requires higher taxes in the long run, but the increase is considerably smaller and is matched by additional Superannuation payment of equal value. While policy 4 has contribution rates that are higher than the tax rates associated with other policies, they are likely to be less distortionary as people directly benefit from the contributions they make. The high mandatory contributions could lead to opposition amongst lower income households, because of the way they reduce consumption amongst these households, although this has not been a major issue in Australia. Moreover, since policy 4 has similar contributions as the Australian Guarantee scheme, it is unlikely to induce migration to Australia in the medium or long term.

4. Discussion and conclusions

This paper has considered four different ways New Zealand's retirement income and taxation policies could be changed in response to increasing longevity. The focus of the paper is the marginal social and economic consequences of each policy. For this reason it is assumed that all future cohorts receive the same basic PAYGO-funded entitlement to New Zealand Superannuation as current cohorts, irrespective of the option chosen. The options only differ in the way policies are changed to help people deal with the additional years of longevity.

I shall summarise by focussing on three issues.

(a) PAYGO versus SAYGO

Only policy 2 relies on a pay-as-you-go funded scheme to provide resources for the additional years of longevity. The funding structure reduces capital accumulation, requires high long run tax rates and is likely to adversely affect sustainability because it imposes large opportunity costs on young and future cohorts. These features all make it unattractive. If an expansion of New Zealand Superannuation is desirable because of redistribution concerns, or to enhance risk sharing, it is probable that many of the gains can be obtained by offering the same set of retirement benefits but by funding the expansion on a SAYGO-basis.

The main equity argument made in favour of policy 2 is that PAYGO-funded retirement income programmes are progressive if the economy grows, because then latter generations will have higher incomes than the first generations. This argument must be made carefully, however, for the policy is unlikely to increase welfare. This

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tax payments and Australia Guarantee contributions, but the retirement income will be approximately half as much. See the calculations in Financial Services Council (2012).

is because the gain of a single generation is balanced against the losses imposed on *all* future generations, and these losses, even when discounted to take into account these generations' higher incomes and the later timing of their consumption, offset the gains unless economic circumstances for the first generation are unusually dire. This may be the case during a war or a prolonged depression but it seems unlikely to be the case in a modern developed country experiencing its highest income levels ever.

There are really only two reasons to contemplate policy 2 other than as a deliberate attempt to transfer resources from future generations to current generations. First, the economy may be dynamically inefficient. This seems unlikely. Secondly, there may be a desire for the risk diversification and redistribution associated with policies 3 and 4, but concerns that it is not possible to manage the New Zealand Superannuation Fund efficiently or adopt a well run mandatory saving scheme. These concerns are possible, but the arguments in this paper suggest policy 2 should be used as an option only if the other options seem infeasible.

(b)Asset risk management and the government.

The key condition for whether or not an economy is dynamically efficient is whether or not the return to capital exceeds the economic growth rate. However, this condition is not the same as the criteria used by individual investors when deciding to purchase shares or make loans, for they take into account asset price volatility as well as earning volatility. As asset price volatility tends to be greater than the volatility of the underlying earnings, and asset prices have much greater mean reverting tendencies than fundamental capital earnings, finite-lived households are likely to avoid some investments that have high underlying profitability.

The differences in the volatility of capital earnings and asset market returns pose a quandary for individual investors and governments. The high volatility of asset prices reduces their attractiveness as a retirement saving vehicle. Yet the high returns to capital make capital accumulation a more attractive long-term retirement saving option than a PAYGO-funded transfer scheme that accumulates no capital. The solution is to find a way where the government can use its balance sheet and long horizon to reduce individual exposure to the mean-reverting component of asset price fluctuations while at the same time ensuring the economy utilizes individual saving behaviour to accumulate high returning real assets (Bohn 2005).

The easiest way to do this in New Zealand would be to adopt policy 3. In this case almost all of the investment risk associated with this component of individual's retirement saving is borne by the Government and ultimately shared across generations through variations in tax rates. Alternatively, the government could adopt a supplementary mandatory retirement income scheme and offer a minimum return guarantee. This removes some of the deterrent effect of low returns, again by spreading the risk across generations. Both of these options offer households a way of raising their welfare by using the government balance sheet to diversify risk in ways that would not be possible otherwise.

(c)The variety of SAYGO options.

The different SAYGO-funded options have different costs and benefits. Policy 3 is likely to provide the most income redistribution of the three SAYGO-funded schemes, by providing everyone with the same additional pension payments. Policy 4 provides

a similar minimum level of payments as New Zealand Superannuation, but it provides less income redistribution on a lifetime basis because it requires greater working-age contributions. The top-up means there is greater redistribution than policy 1. It may also reduce intergenerational *wealth* inequality, by allowing people to accumulate bequeatheable wealth.

The extent the mandatory and voluntary schemes redistribute resources differently should not be overstated. Normal welfare benefits are available for people who are unable to work due to accidents or ill health, who are out of work, or who have sufficiently low income that they are entitled to an accommodation supplement. These benefits are typically lower than New Zealand Superannuation, and can only be obtained if the applicant meets certain criteria. Thus if policy 1 were adopted the people who are most likely to be worse off financially would be those who have low incomes, but who are not entitled to normal welfare benefits.

All three policies lead to greater capital accumulation than the PAYGO system. Even if a mandatory scheme were not adopted, some households will save additional amounts before they turn 65, possibly using KiwiSaver as a vehicle. There is likely to be a large intra-generational and intergenerational variance in returns across schemes, in part related to the variance in investment experience, and in part because mandatory or tax-financed saving schemes can use the government balance sheet to diversify risk. The mandatory schemes will also alter investment patterns. Some households will be saving less in other forms, for example by investing less in their own businesses or by reducing debt less quickly than otherwise. In aggregate, these effects could be good or bad depending on the extent that household's private investment patterns are inefficient because of tax or other distortions. Altogether, mandatory schemes should generate greater risk diversification when people are older, but greater risk exposure earlier in life when debt may be high. At the aggregate level there is likely to be a larger quantity of funds invested offshore under professional management, diversifying the economy against domestic macroeconomic shocks.

While they may provide greater diversification against fundamental economic risks, mandatory saving schemes carry greater political risk than voluntary private savings. Their "special" nature may make them susceptible to political interventions such as special supplementary taxes, means-testing regimes, or rules governing when people can access their funds.

The mixture of positive and negative effects mean different people are likely to come to different conclusions as to the merits of the policy relative to increasing the age of eligibility. Ultimately the decision will reflect choices over the extent that a society believes people can manage resources to provide for themselves after age 65, and the extent that society believes governments should assist them in this endeavour (see Lindbeck and Persson (2003) or Coleman (2011)). Each option has costs and benefits, primarily concerning a trade-off between the economic efficiency costs associated with higher taxes and the possible welfare gains associated with enhanced risk sharing and redistribution.

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