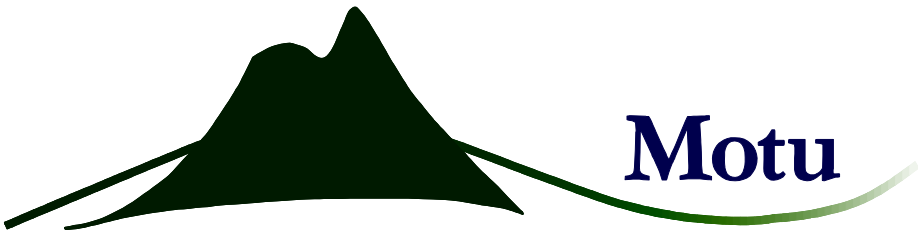

Pension Payments and Receipts by New Zealand Birth Cohorts, 1916–1986

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Abstract
This paper analyses how much different cohorts can expect to contribute into the PAYGO-funded New Zealand Superannuation scheme, and contrasts it with the amount each cohort can be expected to obtain in benefits if the current scheme is continued. The analysis is based on historic census and contributions data and SNZ projections of future population trends. The results show that cohorts born prior to 1980 can expect to pay half as much as they can expect to get in retirement benefits, because of the small number of pension recipients when they made the bulk of their payments.

JEL codes
E24, H55

Keywords
Retirement incomes, intergenerational transfers, government pension schemes

Summary Haiku

When offered a choice
The old like to be given
Much more than they gave

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1. Introduction

All OECD countries have compulsory saving schemes to provide resources to people when they retire. While these schemes differ in terms of the size of benefits they offer, on the extent to which benefits are linked to the contributions people make, and the age at which a person is eligible for a retirement benefit, their most interesting characteristics concern the way in which they are funded. There are two basic funding methods. Under a pay-as-you-go (PAYGO) scheme, taxes are collected and transferred directly to pensioners. Since resources are simply transferred to some people from others, no capital is accumulated in a PAYGO retirement system. In contrast, under a pure save-as-you-go (SAYGO) scheme, taxes are collected and transferred to a fund, where they accumulate. In time, the pension is financed by drawing down the fund. New Zealand Superannuation is largely PAYGO-funded, although in 2002 the New Zealand Superannuation Fund was created to partially prefund future retirement benefits.

In recent years, there has been active debate in many countries as to whether the PAYGO-funded components of their retirement income systems should be transformed into SAYGO-funded components.[1] The debate has been driven by the growing recognition that the demographic structure of most countries in the 21st century will make PAYGO-funded retirement systems much less attractive than they were in the 20th century. During the 20th century, relatively short life-spans and a growing population meant that the taxes imposed on working-age people to provide PAYGO-funded pensions to retired people were reasonably low. Stable or falling birth rates and increasing longevity in the 21st century mean that taxes will need to be increased substantially to maintain the same level of pensions, or pensions will need to be cut if taxes are not increased. Either way, policy analysts, politicians and economists have wondered if increasing fraction of a retirement scheme that is SAYGO-funded would make future retirement arrangements more palatable in terms of their likely tax/benefit ratios.

The intellectual argument that long-term funding costs might be reduced if the SAYGO-funded fraction of a retirement scheme were increased was first made in Diamond (1965), and is now well established. He showed that if the return to capital was *higher* than the rate of economic growth (per capita income growth plus population growth) any level of pension could be funded with lower contributions under a SAYGO system than a PAYGO system. This is because the contributions a person puts aside while working are invested in productive capital, which earns a

[1] See for example Diamond (1997), Sinn (2000), Feldstein and Liebman (2002), Lindbeck and Persson (2003), or, in the New Zealand context, Littlewood (2010).

return that compounds quickly through time. Empirically, the returns to capital have been higher than the economic growth rate, meaning there is a powerful case for believing a SAYGO-funded pension scheme would require lower taxes or contributions in the long run than a PAYGO-funded pension scheme.

If the long-term contribution or tax rate can be reduced for any level of pension by adopting a SAYGO-funded scheme, why don't more countries adopt SAYGO-funded retirement schemes? Again, the answer is well established. A country with an established PAYGO-funded retirement scheme collects taxes from the working age to give to the retired in one period, under the understanding that when the working age retire they will in turn be provided with a pension. If a country wants to adopt a SAYGO-funded scheme and honour its commitments to provide a pension to those who have already contributed taxes to others, some generations will have to "double pay": they will have to pay taxes to fund the retirement incomes of the currently retired, and make contributions to fund their own retirements. Any transition to a SAYGO-funded system must involve one or more generations paying more for the same level of retirement benefits than they would have paid if the PAYGO system had been maintained. Thus the transition to a SAYGO-funded system essentially involves some cohorts paying additional amounts when working, or receiving less when retired, so that cohorts in the more distant future can obtain the benefits of a greater SAYGO-funded system. For this reason it is difficult, although not impossible, to make the transition without making some people worse off than they otherwise would have been.[2]

Why should a country consider a reform that increases payments on the current generation in order to reduce them on subsequent generations? There is no right answer to this question. However, it is possible to try and indicate the scale of the issue, both in terms of the size of the temporary increase in taxation that would be necessary to make the transition, and the size of the permanent reduction in taxes or contributions that would be obtained in the long run. International evidence suggests that the potential costs and benefits from the transition are very large (see Feldstein and Liebman (2002) for a review). Moreover, this evidence suggests that the costs of maintaining the current PAYGO-funded retirement systems are likely to increase rapidly in the next few decades, as the ratio of retired to working-age people increases. In the New

[2] If the returns to capital are much greater than the growth rate of the economy, the reduction in taxes needed to fund to any level of pension contributions can be sufficiently large, and the transition sufficiently short, that a generation required to "pay twice" loses less from initially paying higher taxes than it gains from the subsequent reduction in taxation deadweight costs. Feldstein and Samwick (1997) argued this might be the case in the USA. In addition, Köthenbürger and Poutvaara (2006) argue that a transition to a SAYGO system can be Pareto improving if the reduction in long-term tax rates is capitalised into property values, so that those making the additional payments when working age benefit when retired from an increase in wealth that stems from the lower tax rates paid by their successors.

Zealand context, the taxes necessary to fund New Zealand Superannuation payments are likely to increase from the current level of 4.3% of GDP to 7.2% of GDP by 2055, if New Zealand Superannuation remains a PAYGO-funded system and entitlements are not cut (New Zealand Treasury, 2009). In contrast, if New Zealand had a mature SAYGO system, the exact same pensions could be financed with only 3.2% of GDP – 44% as much (Coleman, 2012). In current terms, this means a permanent tax reduction of approximately $2000 per person per year could be achieved if New Zealand made the transition to a SAYGO-funded retirement scheme. It is thus clear that the potential benefits from making some generations "double-pay" in order to increase the SAYGO-funded component of a retirement scheme are very large.

There are an infinitely large number of ways the transition to a SAYGO-funded retirement scheme could be made, and thus an infinitely large number of ways the costs on the transition generations could be increased. Rather than explore the costs and benefits of a particular transition, for each cohort since 1916 this paper calculates the average size of the taxes it paid or will pay to fund government pensions and the average size of the retirement benefits it received or will receive, under the assumption the current system is maintained. The aim is to calculate the average fraction of its income that a cohort pays over its lifetime, and the average benefit it receives, as a means of providing a baseline counterfactual to examine how egregious it would be to make particular cohorts increase their contributions as part of a transition to a SAYGO-funded pension system.

While the exercise is not straightforward, and there is room to debate the methodological approach, the results consistently suggest that most cohorts born before 1976 will get pension benefits that are nearly twice as large as the payments they made or will make. This is largely because when they were making (or will make) their payments, there were (or there will be) only a small number of retired people, and so only small payments were (or will be) necessary. For cohorts born after 1976, the arithmetic is not as favourable, but even these groups will receive much more than they pay if the current system is maintained. It is people born now who will benefit little from the PAYGO system, as the number of people they support when they are working will be comparable to the number of people who will be retired when they retire. This, of course, is why taxes will have to increase sharply after 2030 if the current system is maintained.

This calculus throws a new perspective on the New Zealand debate over whether it is fair to make a generation "double-pay" by increasing the SAYGO-funded component of retirement income. It is not the job of economists to provide definitive answers to questions of fairness. Nonetheless, if current cohorts are only paying half of what they are likely to receive, it is

perhaps not so unfair to ask them to contribute more so that the taxes and contributions made by future generations do not have to increase by so much.

2. Methodology

2.1. Methodological Overview

The aim is to calculate the average income fraction a cohort pays (or will pay) to fund pensions, and the average amount it receives in pensions. Because incomes increase over time, the calculations are valorised (or normalised) by the contemporary value of the average incomes earned by working-age people. Consequently, they have the interpretation that a particular cohort paid an average fraction x of its income for N person-years to fund pensions, and received pensions worth a fraction y of an average working-age income for M person-years. These numbers can then be compared to ascertain the extent a cohort contributed more or less in taxes than the value of the pensions it received.

The calculations are made for a cohort born in year c that turns 60 in year $t = c+60$. Demographic data from Statistics New Zealand historical records or population projections are used to calculate the size of the cohort at five year intervals in the years leading up to retirement and the years after retirement. These data are used to calculate the number of person-years members of the cohort were working age, and the number of person-years the cohort received pensions. The calculation is inclusive of migration flows.

The demographic data are supplemented with data on the taxes paid each year to fund pension transfers, and the pension benefits received. Historic data on the size of pensions and the size of total transfers were obtained from the Ministry of Social Welfare and cover the period 1940–2005. Data for the period 2005–2012 and projections for future years were obtained from the Treasury Long-term Fiscal Projections (New Zealand Treasury, 2009). The data capture changes in the retirement age and changes in the level of benefits through time.

To make the "contribution" calculations, the fraction of incomes collected as tax to pay for pensions is calculated for each year. To make the "receipt" calculations, the size of an individual pension as a fraction of average working-age incomes is calculated each year. These numbers are then used to calculate the average tax paid by a cohort over its working lifetime, and the average benefit it receives. The calculations are more difficult to make for New Zealand than elsewhere, as New Zealand is one of the very few countries to fund pensions from general taxation rather than a dedicated social security tax on labour income. This means the following issues have to be taken into account when the calculations are made.

(a) Taxes are only paid on net domestic product, not the depreciation component of gross domestic product. Hence the average tax rate is calculated as the ratio of the total pension expenditure in a year as a fraction of net domestic product, not gross domestic product.
(b) Taxes are collected from both working-age and retirement-age people, not just working-age people.
(c) While pensions are usually calculated as a fraction of average earnings, an adjustment needs to be made for changing labour force participation rates. Consequently, pensions are calculated as a fraction of the average incomes of working-age adults, not the average income of working adults.
(d) Direct measures of the average incomes of working-age people, and the incomes of people above and below the age of retirement income eligibility, are not generally available. Estimates were obtained from Statistics New Zealand Census records for the period 1966–2006, as these censuses provide estimates of the income distribution for men and women including those not in the workforce for each age group. While these data are closely related to other measures of income, in 1991 there is evidence that per capita incomes are understated in the census data.

2.2. Formula for Calculating Contributions and Receipts

Consider a cohort $c = t\text{-}20$ that enters the workforce at age 20 at time t. It obtains a pension at $t+K$ at age $20+K$, and lives until $t+K+d$

Let

n^c_t = number of cohort alive at time t

N^1_t = total number of people aged 20 to $19+K$ ("working age") at t

N^2_t = total number of people aged $20+K$ or more ("retirement age") at t

P_t = pension in dollars at time t

y_t = net domestic product per adult at GST inclusive prices at t

$y^c t$ = average incomes for cohort c people at time t

$y^1 t$ = average incomes for working-age people at time t

$y^2 t$ = average incomes for retirement-age people at time t

NOS_t = operating surplus at t, net of depreciation.

Note that y^c, $y^1 t$, $y^2 t$ equal the total income for the group divided by the number of people in the group, and thus take into account non-participation in the labour force.

Further, let

$\rho_t = \frac{P_t}{y_t^1}$ = pension as a fraction of average (working-age) incomes

$\theta_t = \frac{P_t N_t^2}{y_t (N_t^1 + N_t^2)}$ = the fraction of net domestic product spent on pensions in year t.

θ_t is the tax rate on net domestic product needed to finance pensions each year.

The tax payments on incomes paid by cohort $c = t\text{-}20$ are

$$Payments^c = \sum_{s=t}^{s=t+K-1} \theta_s y_s^c n_s^c + \sum_{s=t+K-1}^{s=t+K+d} \theta_s y_s^c n_s^c \quad (1)$$

The first term of the right hand side is earnings while working age; the second term is earnings after the retirement age.

If these are valorised by the average earnings of working-age people in each year,

$$Payments\_v^c = \sum_{s=t}^{s=t+K-1} \theta_s \frac{y_s^c}{y_s^1} n_s^c + \sum_{s=t+K-1}^{s=t+K+d} \theta_s \frac{y_s^c}{y_s^1} n_s^c \quad (2)$$

This measures the total person-years of average earnings that the cohort contributes to pay for pensions.

The pensions the cohort receives are

$$pension^c = \sum_{s=t+K}^{s=t+K+d} (\rho_s y_s^1) n_s^c \quad (3)$$

When these are normalised by the average earnings,

$$pension\_v^c = \sum_{s=t+K}^{s=t+K+d} \rho_s n_s^c \quad (4)$$

This measures the total person-years of average earnings the cohort receives as pensions.

Equations 2 and 4 can be further divided by the sum of person-years each cohort has while working age:

$$Contributions^c = \left(\sum_{s=t}^{s=t+K-1} \theta_s \frac{y_s^c}{y_s^1} n_s^c + \sum_{s=t+K-1}^{s=t+K+d} \theta_s \frac{y_s^c}{y_s^1} n_s^c \right) \Bigg/ \sum_{s=t}^{s=t+K-1} n_s^c \quad (5)$$

$$benefit^c = \sum_{s=t+K}^{s=t+K+d} \rho_s n_s^c \Bigg/ \sum_{s=t}^{s=t+K-1} n_s^c \quad (6)$$

Equation 5 measures the average tax rate paid by a member of cohort c to fund pensions. The first term in the parentheses is the tax it pays while working age. The second term is an adjustment that adds the tax it pays while older than the eligibility age: the adjustment takes into account (i) the lower incomes earned in retirement, (ii) the shorter number of years spent in

retirement, and (iii) the higher contribution rate typically paid in retirement. This adjustment adds approximately a third to the tax rate.

Equation 6 measures the average pension received by the cohort, as a fraction of average working-age incomes. It is adjusted downwards to reflect the length of time pensions are received compared to the length of time the cohort is of working age.

These ratios are calculated in section 4 using both historic and forecast data. First, however, it is of interest to look at the main demographic trends.

3. Demographic Trends

3.1. Data

The data are obtained for each five year period (census years) from 1941 onwards. For 1936–2001, the population data by age group come from Statistics New Zealand Long Term Data series. The numbers for 1941 and 1946 are modified to take into account war service abroad. The data for 2006 and 2011 come from Statistics New Zealand's Table Builder. The data for 2016 onwards are taken from the New Zealand Treasury's Long-term Fiscal Projections (2009), and are based on Statistics New Zealand's Mid-range Series 5 projection (March 2009). The data provide the number of people in a five-year age band alive each census year. I use this number as an estimate of the number of person-years the appropriate single-year cohort lived in that five-year period.

Statistics New Zealand data are available for each age group up to age 90, but are aggregated to "90+" for older people. I use the age group "90+" in a particular year as an approximation of the number of person-years the cohort turning 90 that year will live after age 90.

3.2. Pension Eligibility and Dependency Ratios

Figure 1 shows the actual and projected number of people by age for the cohorts that turned 65 in 1981 and in 2011. The data for the 1981 cohort are all historical; for the 2011 cohort, data for ages 70 and greater are Statistics New Zealand projections. The data take into account migrants.

The data are used to calculate the number the person-years the cohort had before and after the age of pension eligibility. These calculations are shown in Table 1. The table shows the ratio of the time a cohort spends older than the age of eligibility compared to the time it spends younger than the age of eligibility. The age of eligibility increased from 60 to 65 between 1995

and 2005. This ratio – the "pension eligibility ratio" – has varied little through time, and is approximately 50 percent.

Table 2 shows the number of people aged between 20 and the age of eligibility, and older than the age of eligibility, for different calendar years. Again, the data are a mixture of historical data and Statistics New Zealand projections. The dependency ratio is the ratio of the number of people over the age of eligibility to the number of people under the age of eligibility in a particular year. The ratio was under 30 percent between 1951 and 2011, but is forecast to increase to 43 percent by 2051.

Figure 2 shows the dependency ratio each year, along with the pension eligibility ratio for the cohort turning 60 that year. For cohorts turning 60 before 2021, the dependency ratio is at least 20 percentage points lower than the pension eligibility ratio. For example, the cohort turning 60 in 2015 has a pension eligibility ratio of 50 percent, meaning that it will spend half as many years aged over 65 (the age of eligibility) as it spent aged 20–64. In contrast, for its entire working-age life, between 1975 and 2025, the cohort will have faced a dependency ratio of between 21 percent and 29 percent, with an average of 26 percent. The low dependency ratio reflects the relatively small number of older people in New Zealand during the second half of the twentieth century, due both to low life expectancy and the rapid population increases during this period.

Table 3 and figure 3 show the forecast pension eligibility ratio for each cohort turning 60 from 1975–2045, and the average dependency ratio for that cohort over the previous 40 years.[3] The average cohort eligibility ratio exceeds 47 percent in all years. In contrast, the average dependency ratio is under 30 percent for every cohort except the last, which turns 60 in 2045. This means that most cohorts currently in the workforce or currently retired will have provided retirement income support for far fewer pension-year recipients than they will be supported. Indeed, cohorts turning 60 between 1981 and 2031 will receive pension support for more than 80 percent more pension-years than they provided pension support when they were of working age. The ratio declines quickly thereafter, but even for cohorts turning 60 in 2046 the ratio exceeds 50 percent.

It is possible to be quite concrete about these numbers. Consider the cohort turning 60 in 1981. Their pension eligibility age was 60. In total, they lived 1,124,000 person-years between ages 20 and 60, and will have lived 548,000 person-years when over 60. While aged 20–59 they provided pension support to a population only 27 percent their size (the average dependency

[3] The dependency ratio prior to 1951 is assumed to be 26 percent.

ratio 1941–1980), or a total of 303,000 person-years. It follows they will have gotten support for 84 percent more years (548000/303000) than they gave support.

These raw demographic numbers don't take into account the level of pension support, the participation rate, or the fact that some pension support is provided by people receiving pensions through the taxes they pay on the capital and labour income that they receive when older than the eligibility age. Nonetheless, they suggest that the combination of rapid population growth in the twentieth century and increasing life expectancy mean that most New Zealanders before 2050 will provide much less pension support than they obtain.

4. Pension Contributions and Receipts by Cohort

In this section, equations 5 (pension contributions as a fraction of average incomes) and 6 (pension receipts as a fraction of average incomes) are calculated for different cohorts.

4.1. Pension Contributions as a Fraction of Average Incomes

The average pension contribution rate or tax rate is given by equation 5:

$$Contributions^c = \left(\sum_{s=t}^{s=t+K-1} \theta_s \frac{y_s^c}{y_s^1} n_s^c + \sum_{s=t+K-1}^{s=t+K+d} \theta_s \frac{y_s^c}{y_s^1} n_s^c \right) \Big/ \sum_{s=t}^{s=t+K-1} n_s^c \qquad (5)$$

Four variables are used to make this calculation:

(i) $\theta_t = \dfrac{P_t N_t^2}{y_t (N_t^1 + N_t^2)}$ = the fraction of net domestic product spent on pensions in year *t*

(ii) y_s^1 = average income of working-age population (those aged between 20 and the age of eligibility) each year

(iii) y_s^c = average income of a particular cohort each year

(iv) n_s^c = the number of people in the cohort each year

4.1.1. The Fraction of Net Domestic Product Spent on Pensions

The fraction of net product spent on pensions each year is calculated by dividing government expenditure on pensions by Gross Domestic Product, and then adjusting upwards by 16 percent to reflect the average size of capital consumption (depreciation). Government expenditure on pensions is sourced either from the Ministry of Social Welfare (historic data) or

the Treasury Long Term Fiscal Projections. The 16 percent adjustment factor reflects depreciation, which averaged 14 percent of GDP in New Zealand from 1972–2010.[4]

The results are shown in figure 4. As a fraction of Net Domestic Production, pension expenditure steadily increased from 3.0 percent (1940) to 4.2 percent (1975) before jumping in the 1980s to 8 percent, as a result of increases in payments. It decreased to under 5 percent by 2005 due to reductions in the payment amount and increases in the age of eligibility, but is forecast to increase to 8.5 percent by 2050.

4.1.2. Average Incomes of Working-age People

The average income for working-age people is calculated using census data. For each census year between 1966 and 2006, the average income of men and women aged 20 to the eligibility age was calculated using the full distribution of income available from the census records. This procedure automatically takes into account the changes in the participation rate of working-age people. The average incomes are in table 4.

It is reasonable to question the accuracy of this data. For the period 1981–2006, these data can be compared with average wage data from the Quarterly Employment Survey, and the comparison suggests that with the exception of 1991 the data are sensible. From 1996–2006, the ratio of average census incomes to average annual earnings is consistently between 84 and 88 percent (see table 4). It is similar in 1986, but much lower in 1981 and 1991. The 1991 figure reflects well-known flaws in the census.[5] The very low 1981 figure appears to reflect female participation rates and female wages that were much lower relative to men in 1981 than in subsequent years.[6] With the exception of 1991, therefore, average incomes calculated using census data seem reasonable, so it is not insensible to use these data to measure the average incomes of working-age people.

For the period after 2006, average census incomes are increased at the expected growth rate of average earnings. As the pension is also increased at the expected growth rate of average earnings, the ratio of the pension to average incomes is set at the 2006 level for all subsequent periods.

[4] Hence Gross Domestic Product is 16 percent higher than Net Domestic Product

[5] The maximum income band in the census was *reduced* between 1981 and 1991 despite a 160 percent increase in the price level. This means the 1991 census significantly under-measures high income people.

[6] The ratio of female to male incomes 1981 was 35 percent, compared with 29 percent in 1976, 55 percent in 1986, and 59 percent in 1996.

4.1.3. Cohort Incomes by Year

Equation 5 requires deflating the income received by a particular cohort by the average income of working-age people. While the census data exist to do this, in this paper a two-fold simplification is used. The first simplification is to set the ratio in the first term of equation 5 equal to one, instead of calculating a weighted average of the ratio of cohort incomes to the average working-age incomes. This simplification essentially requires that each cohort has a similar lifecycle experience, so that the years in which they have relatively low incomes (when very young) are balanced by the years when they have relatively high incomes.

The second simplification concerns the way the ratio of a cohort's "retirement age" incomes to average working-age incomes is calculated. Rather than calculate this for each cohort separately, I calculate the average for all people who exceed the eligibility age. From 1996–2006, this ratio was 56 percent: the average retired person had an income 56 percent as large as the average working-age person, taking into account that not all working-age people participate. The ratio was higher in the 1970s and 1980s, in part because the pension was higher relative to average weekly earnings, and in part because participation rates for women were lower.[7]

4.1.4. Cohort Population by Year

The data used to calculate the population weighted average contributions are the same data used in section 2. Almost every cohort has had or will have two thirds of its life aged less than the age of eligibility, and one third greater than the age of eligibility.

4.1.5. Tax Payments to Fund Pensions by Cohort

Table 5 and figure 5 show the results of these calculations. The first column shows the average tax rate paid while a cohort is working age. The second column shows the additional tax paid while the cohort exceeds the retirement age. This column takes into account the lower average incomes, the smaller number of person-years the cohort spends post-retirement age, and the higher contribution rates typically faced because contribution rates rise through time. The third column adds the two components together. The remaining columns will be described below.

The calculations suggest that the cohort turning 60 in 2006 and eligible for the pension in 2011 will have paid an average tax rate to fund pensions equal to 5.8 percent of their income

[7] Prior to 1986, census incomes for older people do not appear to include the state pension. The state pension is added to the figures in table 4.

over their working age. In addition, they will pay the equivalent of a further 1.7 percent taxes while retired; the 1.7 percent reflects a higher tax rate of 6.2 percent paid on post-retirement incomes 56 percent as large as average incomes earned while working, for a period with only 49 percent as many person-years.

The tax rates increase through time. Whereas the cohort turning 60 in 1975 only contributed 4.7 percent of their income to fund pensions, the cohort turning 60 in 2016 will contribute 8.2 percent, and the cohort turning 60 in 2046 will contribute 9.2 percent. These numbers are still lower than they need to be in equilibrium, as the cohort turning 60 in 2046 will have paid the bulk of its taxes at a time when the ratio of working-age people to post–eligibility-age people is still relatively low.

4.2. Pension Receipts by Cohort

The average pension receipt or benefit is given by equation 6:

$$benefit^c = \sum_{s=t+K}^{s=t+K+d} \rho_s n_s^c \Big/ \sum_{s=t}^{s=t+K-1} n_s^c$$

ϱ_t is the fraction of the pension to average working-age income each year, where the latter is calculated over labour force participants and non-participants. The data are described in sections 4.1.1 and 4.1.2. The ratio is shown in Table 6. Except for 1991, when the census records are unreliable, the ratio varied from 28–39 percent of average incomes. In 2006, the ratio was 36 percent; it is assumed to remain at this level in the calculations.

The last two columns show of table 5 show the average pension benefit by cohort. Column 5 of the table shows the average size of the pension received by the cohort, as a fraction of contemporaneous working-age incomes. Typically a cohort receives a pension equal to 36 percent of average incomes. Column 16 adjusts the data for the number of person-years each cohort receives the pension, as a fraction of its working life. As this fraction is very close to 0.5, for every person-year a cohort lives between 20 and the age of eligibility it can expect to receive a pension benefit at some point in the future equal to 18 percent of contemporaneous average income.

4.3. A Comparison of Pension Payments and Receipts

Figure 6 shows a graph of average pension receipts and payments by cohort. Even though tax contributions are steadily increasing, the dominant feature of the graph is that the average receipts are much higher than the contributions. On a comparable basis, for every

working-age person-year lived by a cohort it will receive a future pension equal to 18-20 percent of contemporaneous average working-age income. Yet most cohorts can only expect to pay taxes equal to 7–9 percent of their income to fund their future pensions, three quarters of which is paid while they are working age, and one quarter paid when they are older than the eligibility age. Put bluntly, most cohorts currently alive have paid or will pay less than half the amount they can expect to receive. This will remain true even for the cohort turning 60 in 2045.

These data are broadly consistent with the results in section 3. There it was shown that most cohorts can expect to receive pension support for 80 percent more person-years than they provided pension support. Here it is shown that members of a cohort can expect to pay the equivalent of 7–9 percent of average incomes as taxes each year they are working age to pay for other people's pensions. When they retire, they get a pension that would have required paying 18 percent of average incomes as taxes for each year they were working age, or twice as much. Cohorts turning 60 before 1991 contributed even less.

It should be emphasised that the contribution rates have been adjusted to make them as large as possible. The tax rate each year has been calculated as a fraction of net domestic product, not gross domestic product, to take into account the fact that depreciation allowances are neither counted as income nor taxed. This raises the tax rate by 16 percent. In addition, an allowance has been made for the fact that most cohorts will continue to pay tax on their incomes after they retire, raising the tax rate by another 30 percent.

One further factor allows a partial reconciliation of these two figures. The tax payments are calculated as a fraction of a cohort's average income. However, taxes are also paid on other components of a nation's income, notably the undistributed net operating surplus. Consequently, to some extent the tax rate on working-age incomes can be relatively low because these tax receipts are supplemented by tax receipts from corporate income.

Table 7 shows an estimate of the undistributed operating surplus between 1976 and 2006. It is calculated by subtracting the estimate of census incomes from national incomes, the latter being the sum of wages and the net operating surplus.[8] In each year except 1986, the undistributed surplus is between 21 and 32 percent of census incomes, and highest at the end of the period. Thus, the tax on the undistributed operating could be expected to raise revenues by approximately a third. This amount is not large enough to bridge the gap between average payments and average receipts, although it does help somewhat.

[8] This is also equal to Net Domestic Product minus indirect taxes.

It would appear, therefore, that most cohorts currently receiving New Zealand Superannuation, and most cohorts receiving New Zealand Superannuation prior to 2046, will make contributions that are much smaller as a fraction of contemporaneous income than the benefits they will receive. In large part, this is because they have made or will make payments at a time when the fraction of population receiving payments is much smaller than the fraction of the population that will receive payments when they are retired. This means the amount of taxes they paid or will need to pay while of working age is much lower than the taxes that will be paid when they are over the eligibility age. This is one of the features of a pay-as-you-go retirement income scheme with a growing population: it transfers resources to the current generation from future cohorts.

5. Discussion

The calculations above suggest that if New Zealand Superannuation is continued unaltered, most New Zealand cohorts born before 1981 will receive considerably higher retirement income payments from the Government than they will have paid in taxes to fund other people's retirement incomes. As a rough rule of thumb, and calculated as a fraction of contemporaneous average incomes, these cohorts will have contributed half as much in taxes as they will receive in benefits. The main reason for this asymmetry is that the fraction of retired people in society has been, or will be, much smaller when these cohorts were working than it will be when they are retired themselves. As such, they have provided retirement income support for far fewer person-years than they will receive themselves.

The low contribution/benefit ratio possibly explains the popularity of New Zealand's PAYGO-funded retirement system among cohorts born prior to 1981. These cohorts can expect much higher retirement benefits than the payments they have made, or will make, which makes up for the relatively low rate at which the size of the payments has increased over time due to the low growth rate of the New Zealand economy. If you pay 6 percent of your income in taxes each year but gain an entitlement to a pension worth 18 percent of the future income level, it doesn't matter so much if the future income level grows slowly.

These data raise some questions about the difficulty of increasing the fraction of New Zealand's mandatory retirement schemes that are SAYGO-funded. It is well established that in order to make the transition to a SAYGO-funded system in order to reduce long-term costs, some generations will have to "double pay." This payment may be easier to swallow once it is realised that most current working-age people are paying only half of the retirement benefits they expect to obtain.

Of course, it is not appropriate to simply compare the tax contributions and benefits related to retirement incomes. Cohorts born prior to 1981 may have paid little in taxes to fund retirement incomes, but they may have paid high taxes to fund intergenerational assets such as education, or roads, or to pay off government debt. These calculations have not been attempted in this paper, and remain to be made. It is not clear that these generations invested heavily in intergenerational assets, however. Spending on education has deviated little from 5% of GDP over the last forty years, although has been slightly higher since teaching salaries were increased in 2006 (New Zealand Treasury, 2012). Moreover, except for a period between 1988 and 1998, tax revenues as a fraction of GDP have exceeded 30 percent of GDP only infrequently, whereas projections suggest that taxes will need to increase to 33 or 34 percent by 2050 if New Zealand Superannuation is not changed and debt levels are not to increase (New Zealand Treasury, 2009; 2012). If it is the case that taxes will have to increase by 3–4 percent of GDP over the next forty years, largely because of increased pension payments, it is perhaps less difficult to oppose making current cohorts "double pay" in order to lower future tax rates by introducing a SAYGO-funded pension scheme.

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7. Figures and Tables

Table 1: Pension eligibility ratio (person-years under and over the age of pension eligibility) by birth cohort

Birth year	Age 60	Eligibility age	Years < eligible age	Years ≥ eligible age	Ratio
1916	1976	60	1,111,974	521,496	47%
1921	1981	60	1,124,148	548,055	49%
1926	1986	60	1,226,711	629,385	51%
1931	1991	60	1,243,372	671,807	54%
1936	1996	61	1,189,721	653,175	55%
1941	2001	64	1,446,146	712,094	49%
1946	2006	65	1,701,430	824,470	48%
1951	2011	65	2,154,185	1,017,020	47%
1956	2016	65	2,273,236	1,133,960	50%
1961	2021	65	2,574,276	1,315,530	51%
1966	2026	65	2,701,133	1,359,790	50%
1971	2031	65	2,672,785	1,387,180	52%
1976	2036	65	2,499,531	1,284,343	51%
1981	2041	65	2,480,164	1,305,355	53%
1986	2046	65	2,772,250	1,432,382	52%

Statistics New Zealand data and Long Term Fiscal Projection forecasts; author's calculations

Table 2: Number of people under and over the age of eligibility, 1951–2051

Year	Eligibility age	Number < eligible age	Number ≥ eligible age	Ratio
1951	60	980,747	255,970	26%
1956	60	1,058,507	274,686	26%
1961	60	1,134,919	294,904	26%
1966	60	1,236,909	322,244	26%
1971	60	1,334,195	358,024	27%
1976	60	1,493,706	406,735	27%
1981	60	1,553,937	436,140	28%
1986	60	1,687,287	480,915	29%
1991	60	1,784,622	520,683	29%
1996	61	1,992,364	530,879	27%
2001	64	2,142,916	574,079	22%
2006	65	2471130	511630	21%
2011	65	2621050	586330	22%
2016	65	2712640	698400	26%
2021	65	2770240	811770	29%
2026	65	2791980	944080	34%
2031	65	2828190	1071720	38%
2036	65	2865090	1171510	41%
2041	65	2918490	1231940	42%
2046	65	2982370	1264390	42%
2051	65	3017060	1311560	43%

Statistics New Zealand data and Long Term Fiscal Projection forecasts; author's calculations

Table 3: Pension eligibility ratios and average dependency ratios by birth cohort

Year turning 60	Years < eligible age	Years ≥ eligible age	Pension eligibility ratio	Average dependency ratio prior 40 years	Ratio
1976	1,111,974	521,496	47%	26%	179%
1981	1,124,148	548,055	49%	27%	184%
1986	1,226,711	629,385	51%	27%	191%
1991	1,243,372	671,807	54%	27%	198%
1996	1,189,721	653,175	55%	27%	201%
2001	1,446,146	712,094	49%	27%	183%
2006	1,701,430	824,470	48%	26%	185%
2011	2,154,185	1,017,020	47%	26%	184%
2016	2,273,236	1,133,960	50%	25%	196%
2021	2,574,276	1,315,530	51%	26%	200%
2026	2,701,133	1,359,790	50%	26%	192%
2031	2,672,785	1,387,180	52%	27%	190%
2036	2,499,531	1,284,343	51%	29%	176%
2041	2,480,164	1,305,355	53%	32%	166%
2046	2,772,250	1,432,382	52%	34%	151%

Statistics New Zealand data and Long Term Fiscal Projection forecasts; author's calculations

Table 4: Average incomes for working-age people, from census data, and pensions

Year	Average working-age census income	Average earnings (QES)	Ratio	Average retired census income	Retired/ working-age income
1966	1598			1252	78%*
1971	2275			1634	72%*
1976	4302			3033	70%*
1981	9298	12012	77%	6634	71%*
1986	17541	19448	90%	12745	73%
1991	21334	28860	74%	13861	65%
1996	27351	31980	86%	15415	56%
2001	30961	36244	85%	17215	56%
2006	37724	43056	88%	21309	56%

Statistics New Zealand data; author's calculations. From 1966–1981, the census income data for people over 60 excludes the pension. The pension has been added to calculate these numbers.

Table 5: Average pension contributions by cohort

Cohort age 60 in	Working-age tax contribution	Adjustment for post-retirement taxes	Total tax contribution	Pension as fraction of working-age income	Total pension benefit
1976	3.0%	1.7%	4.7%	36%	17%
1981	3.5%	1.9%	5.5%	38%	19%
1986	4.1%	1.9%	6.0%	39%	20%
1991	4.8%	1.9%	6.6%	40%	21%
1996	5.2%	1.7%	6.9%	39%	21%
2001	5.3%	1.6%	6.9%	43%	21%
2006	5.8%	1.7%	7.5%	36%	17%
2011	6.0%	1.8%	7.7%	36%	17%
2016	6.1%	2.1%	8.2%	36%	18%
2021	6.3%	2.2%	8.6%	36%	18%
2026	6.2%	2.3%	8.5%	36%	18%
2031	6.2%	2.4%	8.6%	36%	19%
2036	6.2%	2.5%	8.7%	36%	18%
2041	6.5%	2.5%	9.0%	36%	19%
2046	6.8%	2.5%	9.2%	36%	19%

Statistics New Zealand data and Long Term Fiscal Projection forecasts; author's calculations

Table 6: The pension as a fraction of average working-age income

Year	Average census income	Pension ($)	Pension/ average income
1966	1598	514	32%
1971	2275	644	28%
1976	4302	1264	29%
1981	9298	3287	35%
1986	17541	5967	34%
1991	21334	10224	48%
1996	27351	10737	39%
2001	30961	12138	39%
2006	37724	13534	36%

Statistics New Zealand and Ministry of Social Welfare data; author's calculations

Table 7: Components of GDP

Year	**Wages**	**Net operating surplus**	**National income**	**Census income estimate**	**Undistributed operating surplus**	**Fraction of census income**
1976	6274	2531	8805	7053	1752	25%
1981	13066	4612	17678	14666	3012	21%
1986	22675	13133	35808	33886	1922	6%
1991	32944	20225	53169	43094	10075	23%
1996	39450	31295	70745	57144	13601	24%
2001	48163	38612	86775	65834	20941	32%
2006	69283	49606	118889	90544	28345	31%

Statistics New Zealand data; author's calculations

Figure 1: Historical and projected number of people by age, cohorts turning 65 in 1981, 2011

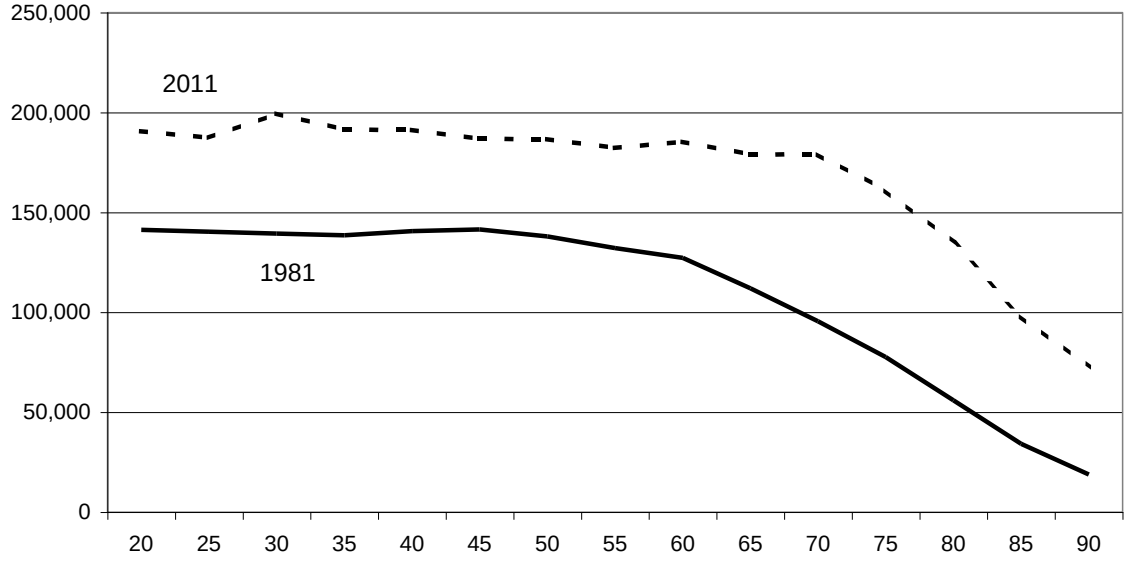


Figure 2: Dependency ratio and pension eligibility ratio, 1951–2051

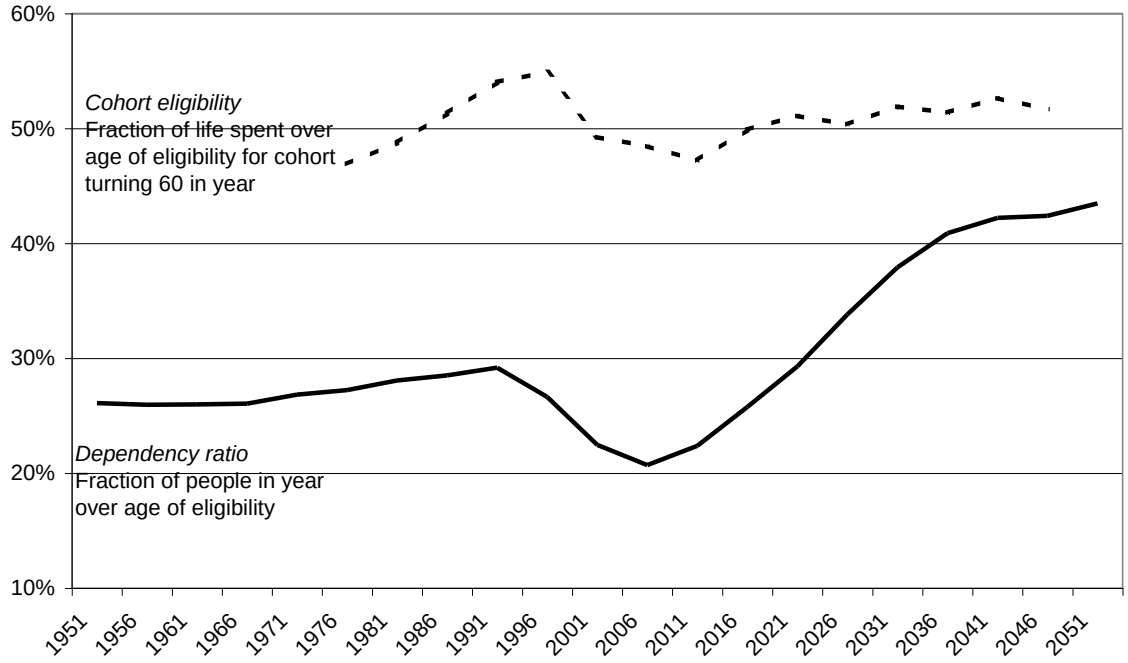


Figure 3: Average dependency ratio and pension eligibility ratio, cohorts turning 60, 1976–2046

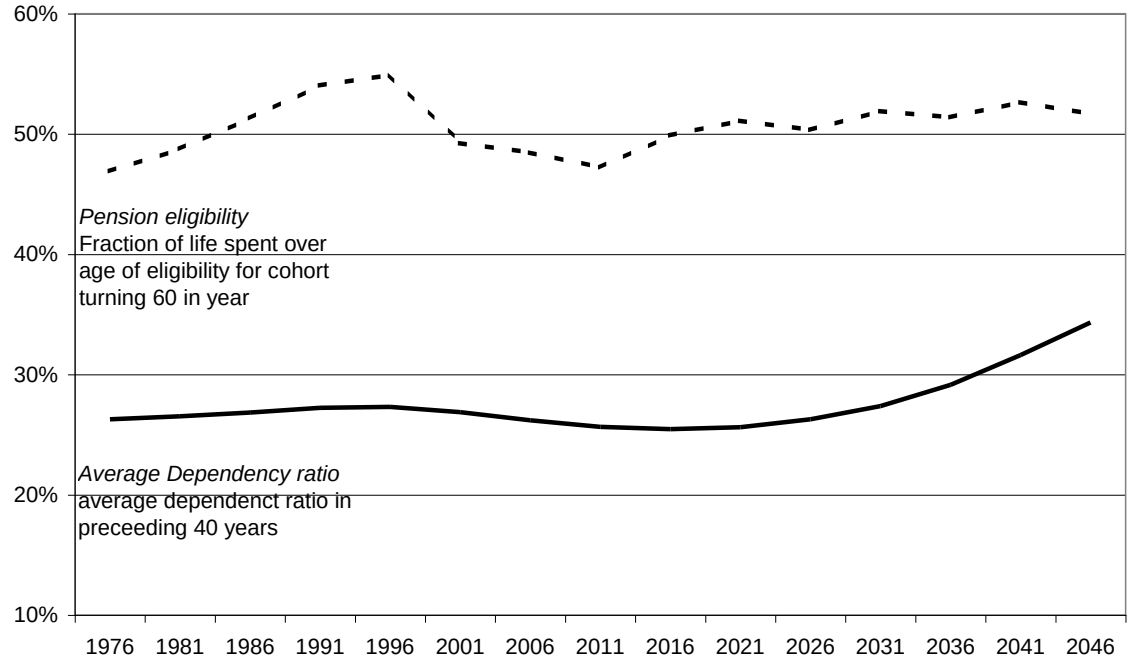


Figure 4: Pensions as a fraction of Net Domestic Product, 1940–2050

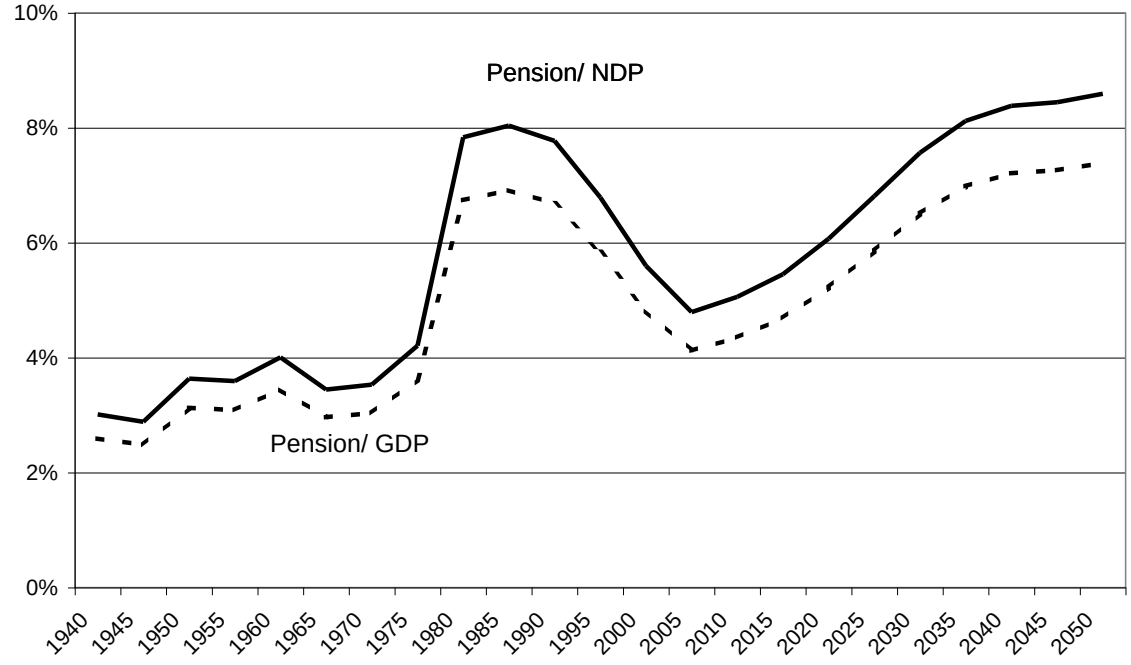


Figure 5: Average contributions to pay for pensions, by cohort

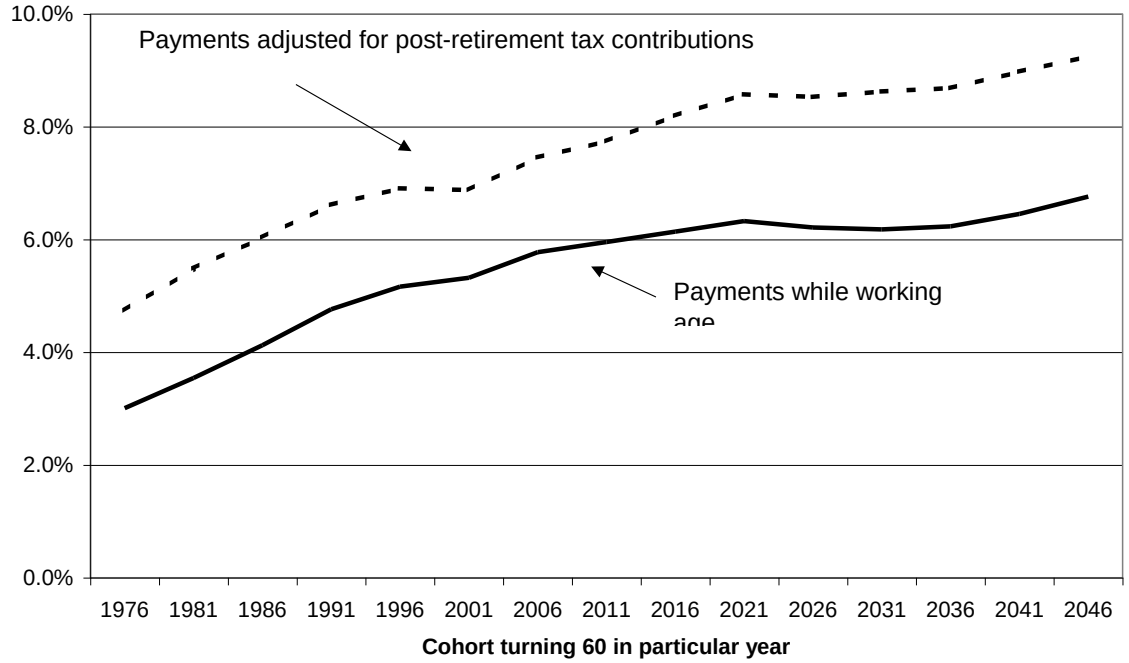
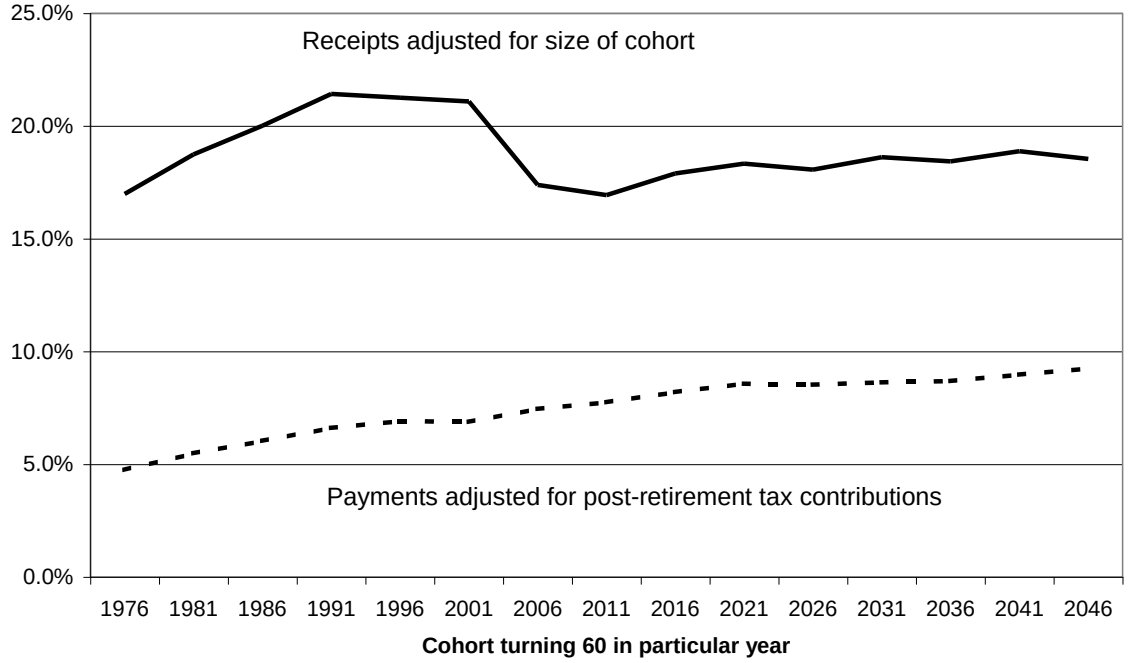


Figure 6: Average pension tax contributions and receipts, by cohort



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