**Towards a sustainable public pension system: A simulation model**

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**Abstract**

This study presents a pension plan model to balance maintaining the resilience of a nation’s social security infrastructure and ensuring retirees’ welfare. The population’s aging, labor market shifts, legislative changes, and unexpected economic crises, including the COVID-19 crisis, create distortions between annuity expenditures and national revenue. Many countries are experiencing rising life expectancy and increasing public pressure to ensure a dignified existence for the growing retiree population, challenging decision-makers and pension managers to strengthen the financial soundness, stability, and distributive fairness of public and private annuity systems. Our model, focusing on the Israeli pension system, is applicable to similar pension systems in developed and developing countries.

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1. **Introduction**

Recent worldwide demographic trends present new challenges for public pension systems in developed and developing countries. According to a report published by the World Health Organization (WHO 2020),[[1]](#footnote-1) in 2020, an estimated 524 million people (8% of the world’s population) were aged 65 or older, and by 2050, this number is expected to triple to 1.5 billion people (16% of the world’s population). This remarkable demographic trend presents real challenges both for the security of retirees’ pension plans and the stability of the authorities and entities funding these pensions. These challenges are further compounded by evidence of a decrease in fertility and improvements in longevity (WHO 2020).

This paper offers a model to address this dilemma and attain a more sustainable public pension plan that will preserve the financial stability of pension authorities and the financial welfare of retirees. For simplicity, our model uses the Israeli market as an illustration for the proposed model, but the model can easily be applied in other developed and developing countries. Our paper joins previous works examining new pension plans and reforms, aimed at increasing the sustainability of both retirement income and social security agencies (e.g., Buyse et al. 2017; Fehr & Habermann 2006; Grech 2018; Schokkaert et al. 2020). We also extend the debate on the ex-ante and ex-post effects of increasing the pension retirement age (e.g., De La Fuente & Doménech 2013; Fehr et al. 2012; Miyazaki 2014; Soosaar et al. 2021; Van Dalen et al. 2019).

The pension system in Israel is a typical three-tier system. The first tier is the old-age pension, which is intended to provide a minimum level of subsistence; the second tier is the occupational pension, which is intended to enable savers to enjoy a standard of living comparable to that which they had before retirement. The third tier is voluntary, but provides tax benefits. First tier payments are received from the Israel National Insurance Institute (NII) and are based primarily on its revenue from employees, employers’ payments, and government transfers.

The aging of the population, increasing life expectancy, changes in the labor market and increases in the standard of living affect both pension systems and retirees. On the one hand, pension systems are obliged to pay annuities to a growing population of retirees, and on the other hand, retirees are required to accumulate savings over the years of work that will be sufficient to enable them to live with dignity after retirement. In 2018, the revenue of retirees from the NII constituted on average about 30% of the revenue of those aged 65 and over (Brodsky, Shnoor and Beer 2020).

Annuities paid to current retirees are funded through the transfer of insurance premiums received from the public and government supplementary contributions. Each year, any surplus in transfer payments is transferred to a virtual fund in the Treasury that carries a real return of 5.5 percent on half of the balance, and market interest on the other half. However, forecasts indicate that in less than 20 years, the NII expenditures will exceed its revenues, and it will have difficulty meeting its obligations to policyholders (Finkelstein 2019; Social Security 2020c). Although the State of Israel is characterized by a young population and a high birth rate relative to other developed countries, here too, the share of retirees is expected to increase from about 11% in 2015 to about 15% in 2065. (Central Bureau of Statistics, 2017a).

Like many countries in the world, Israel has also made changes aimed at strengthening and stabilizing the pension system, preventing actuarial deficits, and adapting to the changing labor market. These changes include: 1) raising the retirement age; 2) transitioning from defined benefit plans to defined contribution plans; 3) changing parties entitled to own pension funds; 4) providing tax annuities for pension savings; 5) introducing a mandatory pension for all employees; and 6) reducing the issuance of designated bonds*.*[[2]](#footnote-2) However, these measures are not sufficient. Further efforts must be made to strengthen the system so that it can meet its payment obligations that can ensure that retirees can lead a dignified existence.

The outbreak of the COVID-19 health crisis added an additional risk factor to the pension system by drastically reducing national insurance and pension deposits resulting from unanticipated layoffs leading to long periods of enforced unemployment. In this situation, the local national insurance entity, facing declining revenues and increasing expenses, mainly due to its obligations to pay more unemployment benefits and aid grants, will experience a deficit earlier than expected. Employees whose long-term savings are harmed (both from the cessation of transfer payments and constraints placed on the use of these funds) may find themselves with even lower income than expected after retirement.

One of the key steps that would benefit the payment system and the financial stability of retirees is to raise the retirement age in general, and of women in particular. The 2019 average normal retirement age across OECD countries for an individual with a full career who entered the labor market at age 22 was 63.5 for women and 64.2 for men. The gender difference ranges from five years in Austria and Israel to zero in most OECD countries (OECD 2019 Pension Report). Additionally, retirement should be linked to life expectancy for both men and women. Apart from the gaps in salaries between men and women, and work patterns that affect the degree of pension savings from employment (occupational continuity, maternity leave, and diminished job scopes), retirement at a young age also widens the gaps in retirement age. Although raising the retirement age denies retirees pension payments during the period of deferral, they do continue to receive wages and transfer payments for pension savings increase due to continued employment..

Regarding the rate of transfer payments for national insurance pensions, revenue from insurance premiums is affected by the rate of growth, the average wage, the employment rate, and changes in legislation. Apart from the unique composition of the population in Israel and the low wage levels among the ultra-Orthodox and Arabs, insurance premium rates in Israel are significantly lower than in other OECD countries. A comparison with developed countries shows that the average NII pension premium as a percentage of tax revenues in Israel is 16.7 percent, compared to the OECD average of 26 percent(OECD, 2020).

As part of this research, we examine various scenarios for stabilizing the xxxx?, combining suggestions for raising the retirement age and models for increasing NII security transfer payments, according to the extent of their impact on the NII’s financial situation.

In this research, we address the main issue concerning the first tier of the pension system: the financing difficulties resulting from the increase in life expectancy. In the first tier, the difficulties of financing the NII pension payments system, which is required to pay annuities to a growing number of beneficiaries is an issue that concerns policy makers, and may undermine the security of residents who fear for its stability.

This paper is structured as follows: in the next section, we describe in detail the current situation of the Israeli public pension system, in the third section we present our data and develop our methodology. We report the results for optimal values for the rate parameters of transfer payments (degree and revenue upper limit) and retirement age, based on the results of various scenarios that combine suggestions for raising the retirement age and models aimed at increasing the transfer payments for national insurance. In the fourth section we summarize our results and present our conclusions.

1. **The National Insurance Institute**

The public pension system in Israel is responsible for paying annuities or old age pensions to retired residents who have reached retirement age, typically 67. In 2019, the NII paid NIS 31.2 billion to 895,505 people entitled to retirement annuities (according to the National Insurance Law).

Figure 1: NII Deficit of the Retires sector. *Source*: Authors' Adaptations for NII data 2019.

Figure 1 shows the deficit in the retirees sector of the NII, between the years 1997 to 2020. A significant decrease in revenue can be seen in times of economic crisis (in 2001 and 2008), as opposed to an increase in revenue when the level of employment and retirement age increase (between 2004 and 2009). The revenue in the calculation is based on the rate of increase in actual collection. The sector deficit grew from 2009 until the end of the period under review (2019), and stands at about NIS 4.8 billion NIS as of 2019 (Sheshinski and Zaken 2020). This deficit reflects, among other things, the increase in expenses caused by the aging population, as well as poor policy decisions that were made without internalizing costs, when no measures were taken to increase the revenue from collection or decrease expenses (for example, raising the retirement age).

**2.1 NII revenue from transfer payments**

The national insurance pension system in Israel is funded by three main sources: transfer payments from the public (~ 52.3%), government participation (~ 38.4%) and interest on investments, funded mainly by transfer payments surpluses (~ 9.3%). National insurance pension transfer payments are collected by the NII at different rates from employees, employers, and the self-employed, according to the level of revenue, up to the set upper wage limit, while non-employed citizens pay minimum insurance contributions to ease their payment burden. Government participation is based on the idea of triple funding (insured, employers, and government), the need to supplement transfer payments following exemptions, and work agreements between government, employers, and the self-employed, to reduce their share of insurance premiums.

Revenue from insurance premiums is affected by the rate of growth, the average wage, the employment rate and changes in legislation. The unique composition of the population in Israel and the low wage levels among the ultra-Orthodox and Arabs affect the NII’s revenue from collection, as the share of the ultra-Orthodox population, in particular, is growing (and is expected to grow from 13% in 2020 to 32% in 2065). Moreover, as noted, insurance premium rates in Israel are significantly lower than in developed countries (Figure 2).

Figure 2: OECD Social Security Payments. ’

Thus, while the average insurance premium for the national insurance pension system as a percentage of tax revenues is about 26 percent in OECD countries, it is only 16.7 percent in Israel. The average insurance premium as a percentage of GDP among OECD countries is also significantly higher and stands at approximately 9 percent, compared to only 5.2 percent in Israel (OECD, 2020).

Forecasts made before the COVID-19 crisis showed a slowdown in economic growth from 2.8 percent per year in the current decade to 2.1 percent per year from 2060 through 2065 (Argov and Tzur 2019) and a significant slowdown in the average wage growth rate, from 1.3 percent at the beginning of the forecast period to 0.4 percent at the end (Finkelstein 2019). As mentioned, the slowdown is also explained by the unique composition of the population in Israel, which affects productivity in the economy. During the last year, with the COVID-19 crisis, growth forecasts have shrunk and it is not known how long it will take the economy to recover. Estimates for 2020 by the Israeli Central Bureau of Statistics (CBS) show a decrease of 2.5 percent in GDP and an unemployment rate of 4.8 percent in December (Central Bureau of Statistics 2021).

In order to increase the revenue of the NII and overcome the economic crises, while taking into account the fact that increasing taxation on employers reduces the demand for work, the model of transfer payments for National Insurance contributions has changed many times. In 2000, the minimum wage required to pay insurance premiums was raised, at the same time that the maximum wage was raised to a level that was four to five times the average wage in the economy. In 2002, the upper limit for taxable revenue was abolished, but was reinstated in July 2003. In 2005 and 2006, a labor cost reduction policy led to a reduction in insurance premiums for employers without indemnification. In 2009, the upper limit of revenue for national pension contributions was doubled to ten times the basic amount, and the rate for employers was increased by 0.4 percent. In the years 2011 and 2012, employers’ fees were raised and the upper limit for revenue was reduced to five times the average wage. In 2015 and 2016, insurance premiums for employers continued to rise. The reductions, the main purpose of which was to help employers during times of recession, led to the rate falling from 2002 for the share of wages, up to 60 percent of the average wage for employees and by 2.3 percentage points for employers and by 3.9 percentage points for the self-employed. In contrast, the rate from the wage shares above 60% of the average wage to the maximum amount increased by 2.1, 1.7 and 2.4 percentage points for employees, employers and the self-employed, respectively.

The lowering of national security payments for the lower income deciles contributes to a reduction in the taxation of low income earners and their employers, and increases the demand for work. However, these steps reduce national pension revenues from transfer payments, especially with the increase in workers with relatively low wages. Prior to the COVID-19 crisis, as part of recommendations to strengthen the financial stability of the NII, experts in the field recommended increasing national pension revenues from transfer payments (Committee Report 2012; Gottlieb 2017; The Israel Democracy Institute 2019).

**2.2 National Insurance expenditures**

The imbalance between national pension expenditures and revenues stems from several factors, including the aging population, changes in the labor market (late entry of young people into the labor market, changes in the composition of the population that affect employment rates, etc.) and long-term legislative changes. In addition, government spending on annuities tends to increase during periods of economic crisis, in which the level of employment declines and the number of people receiving unemployment benefits increases. Currently, after two closures imposed on the economy following the COVID-19 crisis, national insurance expenditures on unemployment benefits and other support payments have increased sharply. In normal times, the bulk of national insurance expenditure is for retirees and the nursing and disability sectors (68% in 2018 and an expectation of 75% in 2060). Following legislative changes, the share of the nursing and disability sectors in expenditures is expected to increase by 90 and 25 percent, respectively, as the share of expenditure on retirees decreases (the share of disability and nursing sectors linked to wages increases mainly at the expense of expenditure on retirees, survivors and children, which is price index linked). However, the share of expenditure on retirees remains the largest, and together with the nursing sector, is expected to reach about 50 percent in 2060 (Figure 3).

Figure 3: NII expenditures 2018 & 2060. ’

In the case of a public pension, apart from the longevity risk that affects the number of those entitled to pension benefits, expenses are affected by the age of entitlement to the annuity, the chosen index (in Israel, the Consumer Price Index) and the level of the pension, depending on seniority, the pension deferral supplement, and the number of dependants entitled to an annuity. In addition, the sector includes expenditures on survivors’ annuities of deceased insured parties, and as a result of the increase in employment rates, especially among women, the number of those entitled to pensions has gradually decreased (a decrease of about 10% over the last two decades), as has the portion of the expenditure of this sector (National Insurance Institute of Israel 2020b).

**2.3 Entitlement for a pension**

Over the last two decades, the number of those entitled to retirees’ annuities has grown at an average rate of about 3.7 percent, while the general population has grown on average by about two percent per year. The aging of the population in Israel is expected to continue, increasing the proportion of the population that is retired. According to forecasts, the proportion of people aged 65 and over will increase from 11.1 percent in 2015 to 14.3 percent in 2040 and 15.3 percent in 2065, and the share of people aged 85 and over will increase from 1.4 percent in 2015 to 3.6 percent in 2065. (Central Bureau of Statistics, 2017a).

Figure 4: Dependency Ratio. ’

Figure 4shows the inverse of the dependency ratio. There are currently about 4.3 people of working age per person aged 65 and over, but this estimate is expected to drop to 3.2 in 2053, and then stabilize.

**2.4 Allowance amount**

The basic allowance amount for retirees stands at NIS 1,558 per individual and NIS 2,342 per couple (2020). The allowance for a couple is for cases when the spouse is not entitled for individual allowance.

Figure 5: Retirees Allowance 1995-2020. ’

Figure 5shows the growth in average annuities linked to the price index (1995 = 100). Thus, since 1995, average annuities have increased by 19 percent, reaching a peak in 2001, and then declining until 2007, when the real value was the same as in 1995. Reasons for the decrease in the real value of the annuities in these later years include suspending annuity fees in 2002 and 2003, a change in the indexing of annuities from the average wage to the Consumer Price Index, and a reduction of 4 percent in July 2002. In 2004, allowances were not updated. After the economic crisis in 2008, a new trend emerged of an increase in average annuities due to efforts to increase allowances for retirees. The monthly allowance has gradually increased in real terms by 26 percent, so that in 2019 the average was NIS 3,310 (National Insurance Institute of Israel 2020b). This increase reflects both a change in the population composition of retirees (an increase in those whose pension has increased as a result of the accumulation of seniority and the temporary deferral of retirement) and policy changes in the form of additional seniority facilitations, granted in 2017.

The actual level of annuities is maintained by linking them to various indexes, such as the Consumer Price Index and the average wage. Since over time the average wage and the standard of living rise, the indexing of annuities to the average wage maintains the standard of living of the retirees in relation to the working population. As mentioned, in Israel, retirees’ annuities were not changed after the economic crisis of 2001, and subsequently, the method of indexing was changed from linkage to the average wage to linkage to the Consumer Price Index, a change which preserves the purchasing power of retirees.

Figure 6: CPI vs. Average wage. ’

As can be seen in Figure 6, pension and national insurance annuities, which are both linked to the Consumer Price Index, have eroded in comparison to the average wage in the economy, which is rising at a faster rate. In the last decade, the Consumer Price Index has risen by 11 percent, compared to the average wage, which has risen by 30 percent. Currently, the allowance of a retiring senior citizen entitled to a maximum of seniority and a three year deferral supplement is NIS 2,687. To understand the level of savings resulting from the current indexing, the expenditure on the sector must be multiplied by the percentage of change between the two indexes. Thus, linking the annuity to the average wage would bring annuities to a level of NIS 3,640 monthly and increase the sectorial expenditure by about NIS 11 billion.

An important discussion in this context concerns the question of whether the Consumer Price Index is indeed the most appropriate method for indexing retirees’ annuities. One of the main arguments against the use of this index as an anchor is that it does not necessarily reflect the price changes facing the retiree population. One reason is that the composition of expenditures by this demographic is different and expresses a variety of other needs. For example, retirees have higher expenditures for housing and health items, (1.3 and 1.6 times, respectively), while in the clothing and footwear and education and culture sectors, the share of expenditure of retirees is smaller, at 0.6 of the expenditure on clothing and footwear and 0.5 of the expenditure on education and culture of the general population (see Figure 7).

Figure 7: Household expenditures. ’

**2.5 Seniority and pension deferral supplements**

Eligibility for an NII pension is determined according to the retirement age and the age of entitlement to a pension. From the age of retirement (currently 62 for women and 67 for men) to the age of eligibility (70), receipt is subject to a personal revenue test, while at the age of eligibility, the citizen receives the pension unconditionally. Total annuities, in addition to the basic amount, include a seniority supplement and a pension deferral supplement. In addition, there are retirees who are entitled to an increased pension because they support their spouse or children, but this expenditure is negligible compared to the total expenditure of the sector and estimated at only NIS 30 million in 2019 (in 2020 prices). The accumulation of the seniority supplement begins from the first year of payment of national insurance transfer payments, when for each insured year, the basic annuities increase by two percent, but not by more than a total of fifty percent. By the end of 2016, the accumulation of the supplement began in the tenth year of insurance, but in recent years, there has been some easing in the requirements,, and from January 2019, the seniority supplement is paid for each insured year. The facilitations in providing the seniority supplement, along with an increase of the annuity, for those entitled to additional revenue, increased the sector’s expenditure significantly, and in 2018, it increased by seven percent compared to the previous year (National Insurance Institute of Israel, 2020b). Moreover, following these changes, the average entitlement to a seniority supplement is approaching the maximum of 50 percent. In 2020, it reached 47 percent for men 39 percent for women (National Insurance Institute of Israel, 2018a).

Eligibility for a supplement for pension deferral is more complex and depends on the retirement age and revenue test, and diverges significantly between men and women. According to the revenue test, a person who has reached retirement age and whose revenue does not exceed the upper revenue limit, is entitled to a full annuity: this is the “disregard,” which constitutes 57 percent of the average salary for an individual. Any additional work revenue, exceeding the disregard percentage, reduces the annuity by 60 percent of the value of the additional revenue, until the allowance is reset.[[3]](#footnote-3) For example, given an individual revenue of NIS 7,500 monthly (before revenue tax, national insurance, and health payments) and a disregard of NIS 6,014, annuities will be reduced by NIS 892 ({0.6 × [7,500-6,014] = 892}).

However, insured persons who have not passed the revenue test or insured persons who are entitled to a partial pension because they have revenue from work and have chosen to relinquish their pension rights, receive an additional pension deferral fee of five percent per year. In this way, men can postpone receiving annuities for no more than three years and women for up to eight years (the number of years between retirement age and the age of an unconditional eligibility for annuities). The main advantage of this addition is that it is an incentive to continue working while increasing pension savings on the one hand, and future national insurance payments on the other. However, there is a possibility that conditioning the annuities on the revenue test will create a situation of under-employment, as there will be those who would prefer to reduce work and receive a full annuity. For example, a person whose revenue from work is NIS 7,500 monthly and is entitled to a monthly pension of NIS 2,000 (2,000-892 = 1,108). General revenue is NIS 8,608 and the individual actually pays additional tax of about 10% for the revenue, including the pension. On the other hand, with the reduction of one working day per week (20% of working hours) and the reduction of the monthly revenue to NIS 6,000, the pension will not be reduced and the individual’s total revenue will reach NIS 8,000. Thus, in addition to maintaining a similar level of revenue, the retiree enjoys fewer working days per month.

**2.5 Retirement age**

 The actual retirement age is affected by factors such as health, status, personal lifestyle, and the official retirement age set by the law. Following a gradual increase in the retirement age in 2004, the participation rate of adults in the labor force has increased, and this rise has also contributed to increased revenue among the elderly in the last decade (Bank of Israel 2017). However, when retirement age remains constant, while life expectancy increases, the period after retirement also lengthens, which undermines the financial stability of the public pension system.

In Israel, there is a gap between the retirement age of men and women, currently of five years (67 for men and 62 for women). These differences perpetuate revenue disparities, widen inequality and increase the poverty rate among retired women. Although the issue of raising the retirement age for women occasionally appears on the public agenda, it has not been implemented to date, because it has a direct effect on older women with low revenues, on those employed in abrasive professions, and on women who have dropped out of the labor market. However, the data show that in Israel, although the legal retirement age for women is 62, the actual average retirement age is higher, standing at 65. In addition, an examination of the retirement age according to the revenue level shows that those who retire early are mainly those earning low revenues, including women, while high revenue earners continue to work and save. Therefore inequality increases after retirement (Sheshinski and Zaken 2019).

Differences in retirement age may have implications for the amount of the annuity male retirees will receive, compared to female retirees. Since each year of deferral entitles the retiree to an increase of five percent of the annuities to which they are entitled, and the retirement age in Israel is not uniform, men can accumulate an increase of 15 percent, and women can accumulate an increase of 40 percent. Thus, in 2018, 18.8 percent of the women who began receiving retirement benefits from the NII received an average increase of 3.6 percent, compared to 16 percent of the men who joined, receiving a two percent average increase. Until 2004, the maximum duration of deferral of annuities was gender-equal and stood at five years, between the ages of 60 and 65 for women and between the ages of 65 and 70 for men. In 2004, the retirement age was changed (for women from 60 to 62 and for men from 65 to 67), with the intention of continuing to raise the retirement age for women to 64, but this has not yet happened.

G. *Source*: NII data, 2021

|  |  |  |
| --- | --- | --- |
| **Men** | **Women** | **Age** |
|  |  |  |
|  | 2,337 | 62 |
|  | 2,454 | 63 |
|  | 2,571 | 64 |
|  | 2,688 | 65 |
|  | 2,804 | 66 |
| 2,337 | 2,921 | 67 |
| 2,454 | 3,038 | 68 |
| 2,571 | 3,155 | 69 |
| 2,688 | 3,272 | 70 |

Table 1 shows the amount of the annuities received with deferrals for men and women, with women between the ages of 67 and 70 receiving annuities 20 percent higher than the annuities received by men of the same age. This result is not surprising, since women can accumulate deferrals for five years more than can men.

To understand the implications of the differences in retirement age, we calculated an estimate of the capitalized value of total retirees’ annuities, in a sphere constrained differently for women and men, taking into account life expectancy.

Table 2: Present Value of Allowances, by Gender and Age. ’

|  |  |  |
| --- | --- | --- |
| **PV of allowances, by gender and age** | **Conditional life expectancy** |  |
| **Men** | **Women** | **Men** | **Women** | **Age** |
|   | 541,692 |   | 24.4 | 62 |
|   | 552,445 |   | 23.5 | 63 |
|   | 561,467 |   | 22.6 | 64 |
|   | 568,746 |   | 21.7 | 65 |
|   | 574,279 |   | 20.8 | 66 |
| 419,321 | 578,069 | 17.7 | 20 | 67 |
| 424,229 | 580,125 | 17 | 19.1 | 68 |
| 427,642 | 580,463 | 16.2 | 18.3 | 69 |
| 429,596 | 579,109 | 15.5 | 17.5 | 70 |

Table 2shows the differences between the total annuities received by women and men over the retirement years. A woman who receives an annuity from the age of 62 receives a total allowance that is about 30% higher than the total allowance received by a man who is entitled to an annuity only from the age of 67. The current value of annuities according to life expectancy at a given age is calculated in accordance with the latest mortality tables 2014–2018 (Central Bureau of Statistics 2020).

In the case of deferral, a woman who delays receiving the allowance until the age of 67 receives a total payment that is 38% higher than the total payments received by a man of the same age. This difference is due to two reasons: the gender gap in life expectancy and the fact that women accumulate an additional five-year deferral increase for their allowance compared to men.

In addition to gender differences, the maintenance of a fixed retirement age leads to intergenerational inequality. As life expectancy increases, younger generations receive more payment periods, and the total payments they receive are higher. Simulating the total payments received by those who retire today compared to those who retire later, assuming the retirement age and eligibility age do not change, reveals significant distributive injustice extending across generations. As a result of changes in life expectancy, the value of total pension payments to retirees is increasing. For example, a man who reached retirement age (67) in the years from 2008 to 2013, and began receiving an annuity (including a full seniority supplement) was expected to have a life expectancy of another 16.65 years and receive total annuities of NIS 397,000 . By contrast, a man who reached the same age in the years from 2013 to 2018 and began to receive an annuity (including a full seniority supplement) was expected to have a life expectancy of 17.75 years and receive a total amount of NIS 419,000, an increase of about six percent. Similarly, the total amount received by 67-year-old women has increased by 5.5 percent.

As in developed countries, the forecasts regarding life expectancy in Israel present a disturbing picture of the risks of increasing life expectancy. According to a medium-term forecast by the CBS, average life expectancy at birth will increase by about two years by 2030, and about eight years by 2065 (Central Bureau of Statistics 2017b). According to OECD data, average life expectancy at age 65 will increase by 4.5 years by 2065. This increase will lead to a higher value ofpensions paid to pensioners in 2030, compared to those who retire today, and the total amount they will receive will be higher.

Table 3: Present Value of deferred allowances, by gender and age. ’

|  |  |  |  |
| --- | --- | --- | --- |
| **PV of allowances, by gender and age NIS** | **Delta (%): men** | **Delta (%): women** | **Age of receiving Allowance** |
| **Men** | **Women** |
| 419,321 | 578,069 | - | - | 67 |
| 438,844 | 601,416 | 5 | 4 | 68 |
| 457,984 | 624,305 | 9 | 8 | 69 |
| 476,750 | 646,745 | 14 | 12 | 70 |

Table 3reflects the supplement received for each year of extension of life expectancy, without making changes in the age of entitlement to the annuities or their structure.

These findings show that the national insurance deficit develops when expenditures increase and revenues are insufficient to compensate for demographic changes, labor market trends, and changes in legislation. Under such conditions, the public pension annuities of retirees are eroded and they are required to increase their private pension savings. This is due to longevity probability, particularly the remaining life expectancy post-retirement. Therefore, changes should be made in the pension system in a way that will ensure retirees sufficient income for a dignified life after retirement. These changes include raising the retirement age for women and linking it to the life expectancy of the general population, increasing national insurance pension transfer payments, and strengthening pension savings from employment by linking them to suitable economic anchors.

**3. Data and Methodology**

**3.1 A Model for a public pension system**

The growing deficit in the retirees sector in the NII, the increase in sector expenses, and the expected decrease in revenues of the NII, require sustainable measures which will strengthen the financial basis of the NII system. We propose to do this through a dynamic and consistent system that makes changes according to an orderly method, and responds promptly to the various trends in the economy over time; a system with automatic mechanisms balancing annuities both economically and politically. From an economic point of view, these mechanisms can bring the financial system into a relatively rapid balance. Transparency is created regarding the expected changes, allowing employees to plan for retirement, while gradual changes in the system reduce inequality in the rates of transfer payments and in the retirement age between consecutive years and between generations. From a political point of view, automation protects the system from the populist policies of policymakers by not allowing external intervention, while also protecting politicians by operating outside their scope of control or discretion. For the public, there are fewer unexplained reductions benefits, such as indirect changes that affect eligibility qualifications (for example, increasing the number of qualification years or changing the method of linkage). Furthermore, policymakers cannot commit to future steps and then renege on them when the time to implement them arrives, for fear that their popularity will be affected negatively (Bosworth and Weaver 2011).

This chapter presents the results of simulations that examine the effect of changes in retirement age and the rate of transfer payments on national insurance expenditures and revenues in the retirement sector. The simulations take into account the chosenscenario for raising the retirement age for women, and its link to the life expectancy of the general population, as well as a progressive model for the increase of transfer payments rate. Finally, optimal combinations of the scenarios will be presented, leading to an automatic restoration of equilibrium in the system.

**3.2 Data source and population of study**

Through the simulations, which cover different scenarios, it is possible to understand how the expenses and revenues of retirees in the national insurance sector are affected by changes in the retirement age and the transfer payments model. To examine the impact of these changes, we considered the expense of retirees’ annuities. We use CBS, NII and self-calculated data. On the expenditure side, we assumed a basic annuity for an individual of NIS 1,558, as well as the current seniority supplement and deferral supplement, depending on retirement age. On the revenue side, we considered the number of people employed and the increase in the average wage.

The expected increase in expenditure on retirees’ annuities is mainly due to the increase in the eligible population, which is based on the medium-term forecast for the number of people aged 67 and older in Israel by the CBS. The forecast for the relevant population has been updated based on the deviation of the actual population from the forecast data during the years from 2016 to 2020 (Central Bureau of Statistics 2017).

The additions provided according to seniority and the deferral of annuities were estimated using past data, changes due to policy decisions made in recent years, and according to selected scenarios for changes in retirement age and the transfer payments model. It seems that the average increase in seniority of new beneficiaries, which was 47.4 percent among men and 38.8 percent among women in 2018 (The NII 2018), is expected to rise to 50 percent (the maximum rate) among men as early as 2026. In contrast, among women, some of whom have only joined the labor force in recent years, it is expected to rise to 45 percent in 2029 and to 47 percent in 2040.

While the seniority supplement does not vary between scenarios, as it is independent of other parameters, the deferral supplement is influenced by the chosen retirement age model. In 2018, the average deferral addition for new affiliates, which stood at about 2.8 percent, reflected a deferral of retirement of over half a year, in relation to normal retirement age (2% among men and 3.6% among women). In a simulation showing the existing situation, a gradual increase in the average rate of deferral was observed at between three and four percent (a deferral of 7.2 to 9.6 months). The existing model allows eight years of deferral for women and three years of deferral for men.

**3.3 Suggestion to increase the retirement age**

The deferral of the retirement age affects NII expenses for retirees’ annuities, both through a reduction in the number of those entitled to the annuities, and through annuities whose level decreases after a formal legal deferral that is not subject to a deferral supplement. Therefore, the effect of the changes was examined according to a number of scenarios, with each scenario having a different impact on the amount of the annuities that was supposed to be paid as a result of the deferral. For example, raising the retirement age of women from age 62 to 64 reduces annuities by 10 percent (5% increases for each year) and raising it from age 62 to 67 reduces the annuities by 25 percent.

In the simulations (Figure 8), we examined the following models for raising the retirement age of women compared to the current situation, in which women can retire and receive the retirees’ pension at the age of 62, and men at age of 67:

1. The retirement age for men remains 67 and the retirement age for all women rises to 64 over four years.
2. The retirement age for men remains 67 and the retirement age for all women rises to 67 over ten years.
3. The retirement age of women rises and the retirement age of the general population is linked to life expectancy according to the following scenarios:
4. *Gradually bringing the retirement age of women in line with the retirement age of men. A four-month rise in the retirement age each year for the first three years, a three-month rise every year until the age of 67, and a two-month rise every year until the gap between men and women is bridged. If this had commenced in 2020, the retirement age would have risen to 67 by 2038.*
5. *Linking retirement age to life expectancy. An additional two-thirds of the increase in life expectancy each year. According to the predicted data of life expectancy development, by 2065 the retirement age would reach 71 for both men and women.*

Figure 8: Retirement age Scenarios. ’

It is important to note that the advantage of the latter model (raising the retirement age of women and linking it to life expectancy for the general population) is that it progresses moderately and gradually, until both men and women reach a uniform retirement age. Also, unlike the other scenarios, it takes into account changes in life expectancy without the need for further adjustments to retirement age in the future.

**3.4 Model for raising the rate of transfer payments and NII contributions**

In examining the effect of changes in the National Insurance revenue model from transfer payments on retirees’ annuities, we assumed an increase in the sector’s revenue similar to the increase in general revenue. In the simulations, we examined selected models of transfer payments and scenarios with changes in transfer payments only, and with a combination of an increase in the retirement age for women and linkage to life expectancy for the general population.

The following are different models of transfer payments examined through with and without changes in retirement age, for six scenarios:

1. An overall change in basic insurance premium transfer payment rate (3.95%) including the upper limit (14.6%), without a change in the taxable upper limit (four times the average wage).
2. A change in transfer payments only for the upper limit (14.6%) without a change in the taxable upper limit (four times the average wage).
3. A transfer payments model that includes a moderate increase in relation to the low-revenue levels (using GOAL SEEK: striving for a goal with backward calculation) and increasing the taxable upper limit to five times the average wage.
	1. 3.95% to 60% of the average wage (as today).
	2. 10% transfer payments for revenue ranging from 60% of the average wage to 100% of the average wage.
	3. 14.6% of revenue between the average wage and twice the average wage.
	4. 15.9% for revenue above twice the average wage and up to 5 times the average wage.

The forecasts of the number of employed persons and the increase in wages are based on past CBS data (Central Bureau of Statistics 2019). Using two regression models based on employment data and the number of jobs in Israel in the years from 2000 to 2020 (Central Bureau of Statistics 2020), we estimated the number of anticipated jobs in the economy for the years from 2021 to 2040.

The first model is based on a long-term trend that does not take into account the effects of the COVID-19 pandemic, and assumes that the economy will return to the employment route that preceded COVID-19 by the end of 2021.

 (1)

The second model takes into consideration the impact of COVID-19 and long-term damage to employment, with an immediate effect of about 200,000 jobs, and unemployment levels remaining at a significantly higher level than in the pre-COVID-19 era. See Figure 9.

Figure 9: The impact of COVID-19 on unemployment.

This model is based on the assumption that the reduction in the number of jobs is long term, and it will take several years to fully restore these jobs back into the employment market.

 (2)

Figure 10 shows the estimates for the number of wage earner jobs according to two models of regression: with and without the impact of the crisis on employment. In both models, by 2040 the number of jobs will increase by only 38 percent, but the more reasonable scenario (with the impact of the crisis) shows a delay in the increase of number of jobs due to the COVID-19 crisis.

Additional assumptions are as follows:

* + 1. Retirees’ annuities constitute about 37% of the National Insurance transfer payments in 2019 (National Insurance 2020d). Since retirees’ annuities have been rising at a slower pace in recent years (mainly due to the accelerated increase in nursing and disability expenses), we assumed that the simulations would range from 35% to 40%, according to forecasts.
		2. The expected change in real wages ranges from 1.4% to 1.6%. We assumed in performing the simulations a scope of change between 0% and 2% per year, with a median of 1%.
		3. Distribution of revenue by deciles is similar to 2020.
		4. The employment scenario includes the effects of COVID-19. The impact of the pandemic in the medium range, in which employment is not expected to fully recover, cannot be ignored.

**4. Empirical Findings**

As mentioned, using the simulations, we calculated the differences between forecasts based on the current situation and forecasts which consider changes in various parameters of the system. In the current situation, a comparison between the growth rate of expenditure on retirees’ annuities and the expected growth rate of jobs in the economy gives an indication of the severity of the problem, when expenditure is expected to grow faster than the number of employed persons. The simulation results show a real increase in expenses of 43 percent by 2030 and 96 percent by 2040. Regarding revenue, the number of employee jobs is expected to increase by 16 percent by 2030 and by 38 percent by 2040. It should be noted that the simulation that takes into account the real increase in wages does not take into account expected changes in the make-up of wages and the labor market structure, which, if developed optimally, will have a positive effect on the change in revenue, and vice versa.

**4.1 Retirement Age - Different Scenarios**

Changes in retirement age affect the expected volume of expenditures of the retirees sector according to various scenarios, the main one being an increase in the retirement age for women. Figure 11 shows that among the scenarios examined, the scenario that includes linkage to life expectancy and leads to a uniform retirement age minimizes the sector’s deficit. The implementation of these measures would reduce the expected NII expenditures on retirees’ annuities, so that by 2065 expenditures will decrease by 28 percent. Regarding the other scenarios, raising the retirement age for women to 64 or 67 will reduce the projected expenditure by only five and ten percent, respectively. This is not surprising, since as long as it is within the forecast range (until 2065), the scenario that includes linkage to life expectancy leads to an increase in the retirement age for women and men to 71. In addition, the implementation of the described measures will moderate the increase in expenditure by 2040 to about 60 percent (instead of 96%).

**4.2 NII contributions: various scenarios**

Table 4: Current NII payments out of wages. *Source*: Authors’ calculations

|  |  |  |  |
| --- | --- | --- | --- |
|  |   |   |   |
| **Gross wage**  | **Payer** | **Percentage of Wage** | **Income Deciles**  |
|  Up to 60% of average wage (6330 NIS) | Employer | 3.55% | 1 to 4 |
| Employee | 0.40% |
| Total | 3.95% |
| Up to 44,000 NIS | Employer | 7.60% | 4 to 9 |
| Employee | 7% |
| Total | 14.60% |
| Above 44,000 NIS | Employer | 0.00% | 10 |
| Employee | 0.00% |
| Total | 0.00% |

Table 4 presents the existing model of NII transfer payments against average gross monetary income by deciles. It shows that, although social transfer payments are divided into just two levels, they are correlated with the revenue level, so that there is some degree of progressiveness in the existing model.

An examination of the degree of progressiveness in the transfer payments model, through an estimation of the average expenditure on NII contributions by revenue deciles, shows that in the current situation, earners in the top decile pay an average of 34 percent of their revenue, compared with 10 percent among earners in the seventh decile and one percent among earners of the first decile. [[4]](#footnote-4) We assumed that without changes in the model of transfer payments, the increase in the NII expenditure for the payment of annuities, financed from transfer payments, would be imposed mainly on earners in the upper deciles, specifically the eighth decile and above.

**4. Simulation results, discussion and recommendations**

The simulations make it possible to converge to the result required to increase the transfer payments, given the assumptions we detailed above. The simulations are run using an advanced mathematical tool that processes tens of thousands of statistical possibilities in a few minutes, while simultaneously considering an unlimited number of possibilities for various degrees of change in life expectancy, and changes in employment rates and real wages. The changes in transfer payments presented in the tables were calculated according to revenue quintiles, and they represent the rate of payments required for a stable system. The percentages (median and 5%) refer to scenarios taken into consideration by the model. Thus, the fifth percentile (5%) represents the extreme scenario, which presents the most difficult conditions for the payment system (a higher increase than forecast in life expectancy, and a lower increase than expected in the employment rate and real wages) and the middle quintile represents a scenario in which the system is faced by exceptional, unusual conditions for better or for worse.

* 1. *National Insurance transfer payments predicted when the deficit is applied to all wage levels, according to the existing model (3.95% and 14.6%):*

The simulation that examines the rates required in both payment stages, affects all revenue levels. It is shown in Table 5A, that the rates of transfer payments must be increased by 2030, from lower than 3.95 percent to a rate of between 4.14 and 4.19 percent, and at a level higher than 14.6 percent to a rate of between 14.79 and 14.84 percent. By 2040, the low level should be increased to a rate of between 4.46 and 4.64 percent and the higher to a rate of between 15.11 and 15.29 percent. With the application of the model for raising the retirement age and linking it to life expectancy, the increase in the required transfer payments is smaller, and is in the range of 0.18 to 0.23 percentage points, compared to 0.51 to 0.69 percentage points without the model.

* 1. *National Insurance transfer payments rates, predicted when the deficit is applied to the highest wage level only (14.6%): [02]*

The simulation that examines the required rates at the high-paying level only affects the third, fourth, and fifth quintiles. It is shown in Table 5B that the rates of the National Insurance transfer payments must be increased by 2030 to the highest level, from 14.6 percent to a rate of between 14.87 and 14.82 percent and in 2040 to a rate of between 15.13 and 15.31 percent. With the application of the model for the raise of the retirement age and linking it to life expectancy, the increase in the required transfer payments is smaller and is in the range of only 0.21 to 0.25 percentage points, compared to 0.53 to 0.71 percentage points without applying the model.

* 1. *Forecast National Insurance transfer payment rates through a model that includes a relatively moderate increase for low-wage levels and an increase in the taxable upper limit to five times the average wage.*

According to this model, there are four levels, with the first level unchanged (3.95% for up to 60% of the average wage); the second, ten percent for the part of revenue between sixty and one hundred percent of the average wage; the third, 14.6 percent for part of the revenue between the average wage and twice the average wage, and fourth, 15.9 percent for revenue above twice the average wage and up to five times the average wage. Under this scenario, the deficit is applied to all quintiles. It is shown in Table 5C that according to this model, by 2030 the rates of National Insurance transfer payments for the lower quintile will increase by 0.1 to 0.16 percent, for the second and third quintiles by 0.12 to 0.18 percent, and to the fourth and fifth quintiles by 0.13 to 0.2 percent. By 2040 in the same order, by 0.35 to 0.53, 0.35 to 0.55 and 0.36 to 0.57. With the application of the model to raise the retirement age and link it to life expectancy, the required transfer payments increase will be less significant and by 2030, will be in the range of 0.01 to 0.11 percentage points for all revenue quintiles, and by 2040, in the range of 0.09 to 0.19 percentage points.

An examination of expenditure on retirees’ annuities shows that immediate steps must to be taken to strengthen the National Insurance Institute’s finances. An analysis of the data reveals that this should be done with consideration for gender equality, intergenerational equality and how progressive the system is. The recommended steps are divided according to these aspects: increasing the strength of the system and increasing equality among retirees. Changes in the retirement age may affect vulnerable populations, but when coupled with complementary steps, any negative effects could be reversed. It is important to note that this study focuses on proposals to balance the retirees sector, which will moderate the increase in the sum of total annuities, but not eliminate it. This is because the changes that have taken place in recent years in the nursing and disability sectors, some of which are closely related to the increase in the number of residents aged 67 and over (especially the number aged 80 and over) are also expected to have a significant impact on future National Insurance Institute expenditures.

**First recommendation: Equal distribution of total retirees’ annuities, minimum age for the beginning of exercise, and actuarially reasonable coefficient of annuities deferral.**

Providing the option of receiving annuities for those who continue to work, while maintaining the strength of the system, can only be possible if the total amount of annuities is determined according to the forecast life expectancy. Thus, with the definition of a minimum age for entitlement for annuities, the insured will be allowed to decide when to start receiving the money, and its amount will be determined according to life expectancy and the prevailing interest rate in the economy. This way, the insured will be able to choose when to start receiving the annuity, without compromising actuarial fairness, thus increasing the trust in the public pension system since the capitalization rate, determined by economic conditions, affects the current value so that it is equivalent in each starting year.

**A model for calculating the total value of annuities and division into payments, that maintains gender equality and generational equality when the eligibility for annuities is from a minimum age:**

Where, TB is the total value of the annuities, BA is the basic amount, Pr is the statutory pension rate, Sr is the seniority rate, LE (70, 2020) is the life expectancy in months at age 70 (linked to life expectancy for men and women) in 2020.

Starting from retirement age, a person can decide when he or she begins to receive his annuities, according to the total value of the annuities divided into the number of payment periods to be determined according to his age and the mortality data tables published by the CBS. The amount of the annuities at age X, in year Y will be equal to:

For example, an individual who is entitled to a full seniority supplement received NIS 2,337 per month in 2020. Thus, the total capitalized value of the pension for a man at age 67 is NIS 419,321. If he prefers to receive the annuity a year later, then the rate of additional deferral that will maintain the total value of the annuities will be 3.8 percent for one year, 7.8 percent for two years and 12.3 percent for three years. In order to simplify the model, it would be possible to set a fixed rate of four percent for additional deferral. As for women, we believe that there is no point in maintaining the current gap in the fixed retirement age, leading to significant inequality. However, according to the same calculation, the rate of additional deferral should be about 3.5 percent.

**Second recommendation: the adoption of measures to raise the retirement age for women and link retirement age to life expectancy**

We propose raising the retirement age of women according to the model and to link the retirement age of men and women to life expectancy. Simulation results have shown that this leads to reduced expenditure in this sector, so that by 2065 the expenditure will fall by 28 percent. The model is divided to two main steps:

1. **Raising the retirement age for women and comparing it in the long run to the retirement age of men**. A four-month increase in the retirement age each year for the first three years, a three-month increase every year until the age of 67, and a two-month increase every year, until the gap between men and women is bridged. Thus, if the model had been activated in 2020, the retirement age would have risen to 67 by 2038 (born in 1973). Following the COVID-19 crisis, a moderate increase should be considered at the beginning, and the pace should be raised, once the economy recovers.
2. **Linking the retirement age to life expectancy.** An additional two-thirds of increase in life expectancy each year should be anticipated. Thus, according to the predicted data of life expectancy change, by 2065 the retirement age will be equalized between men and women and will reach 71 (born in 1994).

**Third recommendation: increase the rate of transfer payments and expand the upper limit for taxable revenue**

Through the simulations, we examined the stability of the system in an environment where the rate of increase in expenditure in the retirees sector is greater than the rate of increase in revenue. The proposed transfer payments model increases both the degree of progressiveness of the transfer payments and the revenue of the payments, contributing to its financial stability (Table 6). The application of the transfer payments model alongside a model for raising the retirement age for women (while linking to life expectancy to the general population) is recommended, as the necessary changes are moderated once one step is taken. Therefore, it is recommended to adopt the model for National Insurance Institute’s transfer payments, the results of which are presented in Table 5C and include a model for raising the retirement age. The combination of the two models will lead to stability of the payments and annuities systems of the retirees sector and will even lead to a surplus in the coming years. In this way, after the stabilization of employment and without significant changes in the economy, we believe that no further increase in transfer payment rates will be needed.

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1. <https://www.who.int/ageing/publications/global_health.pdf>.  [↑](#footnote-ref-1)
2. Designated bonds are issued by the State to pension funds exclusively, and they guarantee an annual interest of 4.86%, plus linkage to the Consumer Price Index (CPI). Until 2018, savings in pension funds were eligible for designated bonds, and they represented 30% of savings portfolios. With the aim of providing greater protects for elderly savers, the Ministry of Finance initiated a change in the way designated bonds are to be distributed. According to the plan, savers over the age of 60 are eligible to receive 60% of these bonds, while the balance would be dispersed to other savers, with this remainder to decrease over time. While the new scheme refers to age, it does not address differences in salary levels. [↑](#footnote-ref-2)
3. [9] Disregard is the revenue from work that a person can earn without the pension being reduced. [↑](#footnote-ref-3)
4. [↑](#footnote-ref-4)