

Briefing Note

on

The Use of Actuarial Techniques in Calculating Annuity Pension Payments

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TA 9010: Strengthening Specialized and Semi-Formal Financial Institutions to
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Introduction

In this briefing note we will discuss the way in which actuarial techniques can be used to calculate the level of annuities, in order to improve the pension levels as compared to the levels that are possible when such techniques are not used. These techniques are not new or revolutionary, but are based on standard pension- and life insurance practice, as applied in literally hundreds of millions of cases all over the world over the past century.

Main systems of pension payment

After the accumulation phase, upon the moment of retirement, there are different ways to pay out pensions:

- By providing the accumulated amount to the retiree in the form of a lump-sum.
- By providing the retiree with regular payments over a certain number of months, where at the moment of death the remaining account balance is inherited by family members or more distant heirs. This variant is sometimes referred to as “scheduled withdrawals” or “financial annuities”.
- By providing the retiree with a stream of payments for life (an “actuarial” life annuity).

Of course, a mix of these elements is also possible. Below we will discuss these systems one by one.

Lump sums

A lump sum payment upon retirement has as an advantage that it empowers the retiree to make his/her own spending and investment decisions after retirement. However, the whole point of setting up a pension system is to address the problem that most people have difficulty planning their finances over a lifetime. If the goal was to empower people as much as possible, the best solution would be to implement no pension system at all, leaving it entirely to employees to design and implement their lifetime savings and consumption pattern. It does not make sense to implement a system of a certain “paternalism”, with compulsory saving before retirement, while leaving retirees to fend for themselves after retirement. In practical terms, significant risks are as follows:

- The retiree may spend too much during initial years, falling into poverty and becoming reliant on the state or the community in later years.
- The retiree may fall in the hands of unscrupulous or incompetent self-proclaimed “investment managers”, who may suggest suboptimal investment choices or outright embezzle the amounts saved.
- The retiree may him/herself make erroneous investment decisions: buy high/ sell low, panic, be the victim of greed and fear, or engage in frequent trading (incurring high trading costs) or buy illiquid assets.

Experience shows, that these mistakes are made both by highly educated and uneducated people. Not only education, but also psychology plays an important role. Finally, for an individual it is much more difficult to diversify investments, especially if amounts involved are modest.

Therefore, in general, lump-sum payments should be avoided. The only situations in which a lump-sum payment makes sense are:

- If the pension amounts are exceedingly low, and the administration costs associated with paying such small pensions cannot be justified. What constitutes “exceedingly low” is partly a political decision.
- If pensions are more than sufficient for a comfortable lifestyle. In that case, a certain part of pension accumulations can be allowed to be withdrawn in the form of a lump-sum, with the explicit goal of allowing “young retirees” to start off retirement on a happy note, that is: to spend the money on a car, travel etc. A maximum could be 25% of accumulations. However, this feature would most likely be more suitable for the more well-off retirees in developed economies.

In developing countries lump-sum payments have often been introduced historically, as an easy-to-implement option rather than the best design option. We recommend for Thailand to limit the use of lumps-sum payments to situations where accumulations are small. What constitutes “small” we can discuss in follow-up research and discussion.

Scheduled withdrawals (financial annuities)

Under this option, the accumulations at retirement are converted into an annuity for a certain number of years, using a standard formula, taken from the regular financial toolkit, as it is used in the banking sector. In this formula, mortality is not taken into account. The only parameters that determine the level of the annuity are the accumulated capital at retirement and the discount rate (= assumed interest rate) used. There are various variants:

- A variant where the retiree him/herself chooses the amount, with a certain ceiling.
- A variant where the annuity is calculated in advance, using an interest rate based on the yield curve at retirement.
- A variant where the accumulations remain invested after retirement and annuities are corrected based on factual investment results (variable annuities).
- A variant where the retiree is obliged to keep a certain minimal amount of accumulations untouched, so that these can be used to buy a life-annuity if the retiree reaches certain age (for example: age 80).

However, these are all details. The main feature of this option is that upon death before the end date (in our example the 80th birthday), the remaining accumulations are inherited by heirs, in line with applicable legislation. This has as a disadvantage that significant sums “leak”

out of the system, towards members of the population who may have no special needs for them, for example grown-up children with a good income, or distant relatives. This means in turn that pensions under this option are significantly lower than they could have been if all accumulations were used to pay pensions to those in old age, to widows, widowers and orphans and to the disabled. Furthermore, even when the inheritance is received by a spouse, the amount may be insufficient, for example if the retiree dies just before the end of the annuity period (say, at age 79). We conclude that in many cases this system does not give rise to rational outcomes.

Then why is this system sometimes implemented? There are two main reasons:

- State structures may be unfamiliar with the actuarial methodology required to implement life annuities, and may lack the budget to recruit experts in this field, as a result of which these methodologies remain confined to the private (insurance) sector.
- It may be deemed too difficult a challenge to convince the population of the merits of risk sharing (insurance) in the pension area. People regularly insure their house against fire, or their car against third party liability and damage. However, insuring against longevity (= the risk to live longer than the average lifespan) can be unfamiliar to many. To take the money of someone who dies at age 61 and spend it on someone who lives to become 100 years of age, seems for many to add insult to injury.

We understand that in the current concept of the National Pension Fund (NPF), this option is foreseen: a financial annuity, starting at age 60 and ending at age 80. We advise to move away from this and to make use of life annuities.

Life annuities

Life annuities are ubiquitous in life- and pension insurance. They are calculated using three basic parameters: accumulations at retirement, discount rate and assumptions on the likelihood that the retiree will be alive in each future year (as evidenced by a mortality table). This means that the annuity can be paid until the death of the retiree, no matter how long he/she lives. This is an important advantage when compared to a financial annuity. On the other hand, the life annuity does not allow for any inheritance upon death. However, this can be solved by providing a separate annuity, exactly calculated to satisfy the needs of surviving dependents (see below).

A question that may come up is: isn't it expensive to continue payments beyond age 80, potentially up to age 100 and higher? We will address this question in the next section, based on exact calculations. Here we can already say that the extra cost arising from continuing payments beyond age 80 is to a large extent offset by the savings made in not paying an inheritance amount to the heirs of those who die before age 80.

Another question that may come up: isn't it dangerous for the fund to assume the risk of individuals living beyond the average life span? The answer is that in case of a small population (for example: less than 100 pensioners) indeed this is risky, however when insuring the whole of the formal sector, the "law of large numbers" applies and the actual payments will be very close to the expected payments. However, here two nuances are in order:

- The longevity of the population as a whole tends to increase over time. Furthermore, the longevity of those working in the formal sector tends to be higher than the longevity of the population as a whole. Therefore, we cannot just use current population tables, based on mortality statistics observed in the (recent) past. The mortality assumptions need to anticipate future longevity improvements and the effect that the population working in the formal sector is healthier than the population in general. Happily, there are techniques that can assist in incorporating these effects in mortality assumptions.
- There is always the danger of adverse self-selection if various organizations will be involved. We understand that employees working at employers who set up or joined Provident funds, may be exempted from participation in the NPF, provided that contributions to the Provident fund are at least equal to those mandated by the NPF. In this case, the NPF would fulfill the role of default fund for those employers who do not want to setup their own fund (similar to the way NEST fulfills this role in the United Kingdom). In that case, there will be three options:
 - There will be one provider of annuities: NPF or an organization related to NPF. That means that Provident funds are allowed to manage pension accumulations only up to retirement, and after retirement NPF (or an organization related to it) will take over.
 - Each Provident fund provides its own annuities for its own client base, and so will NPF. In that case, good supervision will be required, and advice and sign-off by professional actuaries will need to be made mandatory.
 - The payment of annuities will be delegated to the (insurance) market. This will be a stimulus for the insurance industry. However, also in this scenario supervision will be very important.

A related issue is whether annuity factors will be sex-specific or unisex. It is well-known that on average women live a number of years longer than men. In private insurance, this difference is taken into account. However, in mandatory, social insurance (including pension insurance), often unisex rates are applied. If this is the case, another assumption will need to be made: the ratio of men to women in the insured population.

Would such a scheme not be administratively difficult? Is it not difficult to allocate the forfeited heritage of those who die to those who live longer than expected.? The answer is no: this is not difficult at all. The Fund is the "recipient" of all account balances in case of death, and at the same time the fund creates sufficient provisions for those who are alive by adding amounts to their "accounts" as long as recipients continue to live. This is all done

automatically, and does not require sophisticated IT solutions. It could be done in Excel¹. This is really the least of all worries.

A final question that may come up: can't this system be perceived to have unfair outcomes? Take for example someone aged 60, who prepares to retire, but is terminally ill, or severely disabled with a less than average life expectancy. Is it fair to ask such a person to part with his/her accumulations and purchase a life annuity? The answer is that the decision to participate is not taken at retirement. Contributing to the system is mandatory from an early age, when most participants are still healthy and it is difficult to say who will have a longer or sort lifespan. People who have a disease or condition that will significantly decrease their lifespan, while still allowing them to work will be relatively rare. Indeed, when the system only provides old age pensions such individuals can be expected to subsidize other participants. However, in most pension systems there are other pensions foreseen such as survivors' (= widows' widowers' and orphans') pensions and/or disability pensions. In such cases, it is actually the healthy participants who subsidize the less healthy ones. Moreover, those with impairments or disabilities are also subsidized by the rest of society through the health care system and other mechanisms. Finally, much of longevity depends on lifestyle (smoking-, drinking-, driving-, nutrition) habits, rather than parameters preset by nature. For all these reason, for most participants, it is difficult to say in advance (while actively working and making contributions) whether they will be a net recipient of or donor to the system.

The level of pensions based on life annuities as compared with financial annuities

In the below we assumed the employee to be 50% male and 50% female and the spouse to be always of the opposite sex. Where for convenience we write "he" or "him" we actually mean the aforementioned statistical 50%/50% mix of he/she. In other words: we assume that the system will use unisex rates, and we assume that the weight of male and female employees will be 50% each. This assumption is not based on research, but is used just for the purpose of illustrating the point we want to make.

1. Base case: a 20-year financial annuity

Suppose an employee starts out with a wage of 10,000 Baht per month at age 20, receives a wage increase of 3% each year, and retires at age 60, after a 40-year career. We assume contributions are 20% of his wage in each year. Assuming an interest rate (used as the assumed investment return up to retirement, and the discount rate after that) of 2% per year, he will at age 60 have accumulated a capital of 2,580 thousand Baht. If we provide him with a 20-year financial annuity (from age 60 to age 80 with inheritance of the remaining amount upon death), as foreseen in the current NPF draft document, then his pension would be 12,892 Baht per month. This would be 68% of his average wage.

¹ Of course, it would not be a good idea to set the systems up in Excel, but this is not because of the need for any difficult calculation algorithms, but rather to ensure integrity, confidentiality etc. of basic participant data.

2. For comparison purposes only: a 20-year annuity, payable only when the recipient is alive (no inheritance)

Now, if we would remove the inheritance after retirement, and thus implicitly use such amounts to pay higher pensions to those who stay alive, we could increase the pension to 16,012 Baht per month². This is an increase with 24%! In other words: by means of inheritances, in the base case, 24% of all accumulations is leaking out of the pension system, back into society as a whole³.

3. A serious alternative: a life annuity, payable until death

Now if we would want to grant the person a life annuity (a pension starting at age 60 and payable until his death, no matter how long he lives), what could be the size of this pension? It turns out that this pension would be 13,858 Baht per month. This is still a 7% increase when compared to the base case (= the 20-year financial annuity with inheritance). This means that it costs less to provide an annuity from age 80 until death, than it costs to pay out the inheritances upon death before age 80! Of course, for the sake of fairness, we need to admit that we used a historic mortality table. In case projected (= lower) mortality will be used, the effect will be smaller. However, the main argument stands: a pension until death can to a large extent be funded from savings made in abolishing inheritance of pension accumulations.

4. For comparison purposes only: what if we would also prohibit inheritance of pension accumulations before retirement?

If we also prohibit inheritance of pension accumulations before retirement, the accumulations of the deceased can also be used to increase pensions. If we proceed from the previous variant (a life annuity until death) and we add this new feature, then the pension will become 15,338 Baht / month, which amounts to an increase of 11% as compared with the previous case, and a 19% increase as compared with the base case. This (in combination with an elaborate system of survivors' and disability pensions) is the way pensions are calculated in most developed economies. Of course, these other pensions also require some accumulations to finance them (with a negative effect on the level of the old age pension), but still this example provides food for thought. If we do not compel a bachelor (in the sense of someone who decides never to start a family) to contribute to others' survivors' pensions, then it turns out that instead of a pension for only 20 years (from age 60 to age 80), he can have a pension until death, which is moreover 19% higher! The only price he has to pay is to forfeit any payments to his heirs after his death, which anyway most likely would not be so important for him. However, for now we will not pursue this line of thought further and assume that inheritance of accumulations before retirement will stay in place, as the opposite may be difficult to explain to the population⁴. Furthermore, in the next alternative we will assume that bachelors will also contribute to shoulder the burden of survivors' pensions.

² In this calculation, we have used the Thai mortality table called "Standard 2008".

³ Part of this would be received by spouses, however the amount they would receive may not have a very good correlation with their remaining life expectation as a survivor. Below we will address this issue in more detail.

⁴ However, of course we will be happy to discuss such more sophisticated variants at any time at the request of the FPO.

5. Another serious alternative: life annuities with a survivors' pension component after retirement

Suppose that in case of death before retirement the accumulated capital is inherited, but that in case of death after retirement the spouse receives a pension equal to 50% of the old age pension that the deceased enjoyed before his death. We assume that all annuities (both the main pension and the survivors' pension) are paid until death of the recipients (that is: both are life annuities). We assume that at retirement (at age 60) the retiree has a likelihood of 80% to be married to a spouse of the same age, and opposite sex. In this case, the pension will become 12,931 Baht. This is 7% lower than when the annuity would have been a life annuity on the life of the main recipient only (the alternative numbered "3" above). As compared with the base case, the annuity is even 0.3% higher! So now we have situation where:

- Before retirement age, accumulations can still be inherited.
- The pension is paid for life, so age 80 comes and goes and the pension is continued until death.
- In case of death after retirement, the spouse receives a monthly pension equal to 50% of the original pension.

And the price is the same as for the Base Case, which did not possess the last two desirable features listed above.

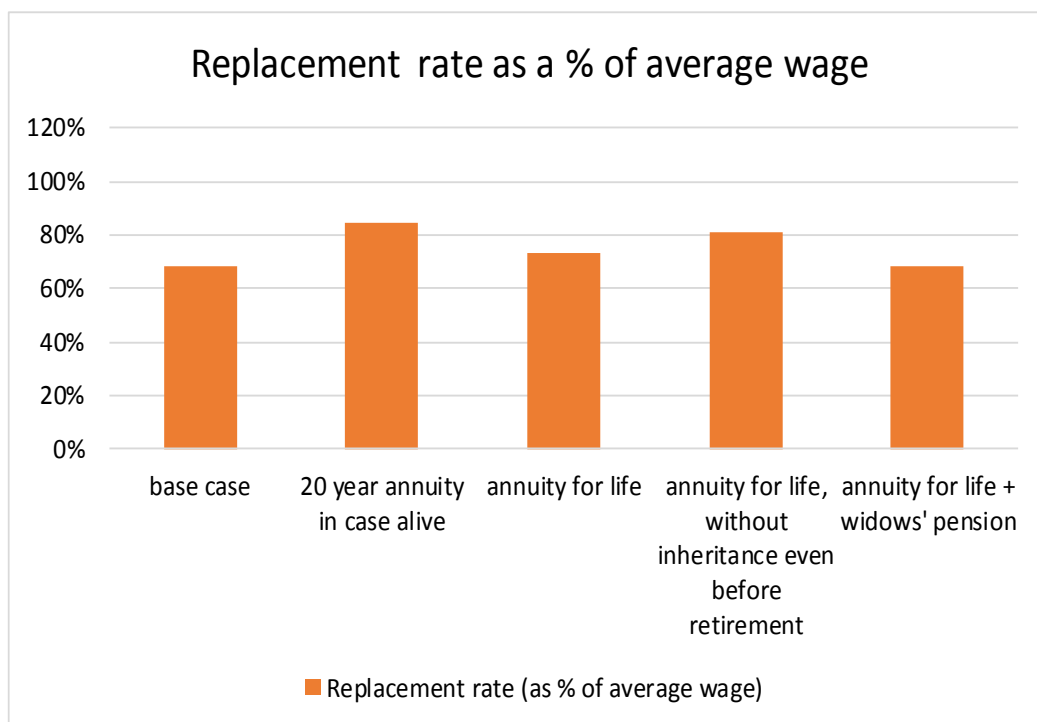
An explanation of this "miracle" is as follows. If we first look at the base case, we note that between ages 60 and 80 there are 20 years, which means 240 months. However, due to the fact that during this period some interest is generated (remember: we assumed a 2% interest rate), the accumulated capital at retirement that is required is only a little over 200 times the monthly pension. Now if we look at the multiple that the capital has to be of the monthly pension in the last alternative above (number 5), this number is also almost 200. It can be broken down as follows:

- For the annuity to the main recipient, only in case he lives, and only between ages 60 and 80 an amount of 161 times the monthly pension is needed. This is much less than 200, because no amounts are inherited, as discussed above.
- For the annuity payments after age 80, we need to reserve at age 60 an amount of 26 times the monthly pension amount. This is not so much (a bit over two years' worth of pension payments), because many people do not live until age 80, and those who do often die shortly after that. However, in the few cases where someone lives until age 90 and beyond, these people, their relatives and the state can rest assured that their pension is fully covered.
- For the potential future payments to a spouse, at age 60 only 14 times the monthly pension amount needs to be reserved. This is a little more than one year of pension payments. This amount is relatively modest due to a number of reasons:
 - In the first place, the retiree may not even have a spouse (we assumed only in 80% of cases he has).

- Secondly, the survivors' pension is only 50% of the original old-age pension. Therefore 14 months' worth of pension equates to 28 months of survivors' pension.
- In the third place, many spouses will die before the death of the main recipients, thus not giving rise to any payments.
- Finally, many survivors can be expected to die not very long after their spouse (= the former employee).

Nevertheless, spouses can rest assured that if their partners pass away early (for example at age 61) and they themselves reach a very high age (for example 99 years of age), they will be taken care of during all these years.

If we put these five results in a graph, we have the following picture:



The link to gender equality

In many countries, on average, women have lower pensions than men, because:

- Women live longer than men. This problem is solved by using unisex annuity rates.
- Women work on average positions with lower salaries than men.
- Women have broken careers due to child rearing.

Providing a survivors' pension helps to protect women against poverty, by automatically better sharing resources within the family:

- As long as husband and wife both live, they are supposed to pool resources and thus there should be no gender-based inequality.

- If one of both passes away, he/she will receive a survivors' pension based on the other party's pension and therefore there will be a "wealth cross-over".

Women who have no husband will in many cases have had the opportunity to work more years and/or divert more attention to their career. For those who were married but divorced, an equitable sharing of pension accumulations could be enshrined in law, if this is deemed desirable. We can provide advice on this as well.