ANNEX I.1

Differences between Defined-benefit, Points and Notional-accounts Pension Systems

This report has grouped together publicly provided, earnings-related pension schemes of three broad types. This annex provides a brief analysis of the difference between these three different programmes using some basic algebra.

A simple, generic **defined-benefit scheme** pays a constant accrual rate, *a*, for each year of service. It is based on lifetime average revalued earnings. The pension benefit can therefore be written as:

$$DB = \sum_{i=o}^{R} w_i (1+u)^{R-i} a$$

where w_i are individual earnings in a particular year, R is the year of retirement and *u* is the factor by which earlier years' earnings are revalued. In most OECD countries, this is the growth of economy-wide average earnings.

In a **points system**, pension points are calculated by dividing earnings by the cost of the pension point (*k*). The pension benefit then depends on the value of a point at the time of retirement, *v*. Thus, the pension benefit can be written as:

$$PP = \sum_{i=o}^{R} \frac{w_i v_R}{k_i}$$

A significant public-policy variable is the policy for uprating the value of the pension point, shown by the parameter x. By writing the pension-point value at the time of retirement as a function of its contemporaneous value, $v_R = v_i (1+x)^{R-i}$, the equation becomes:

$$PP = \sum_{i=o}^{R} \frac{w_i v_i}{k_i} (1+x)^{R-i} a$$

The inflow to **notional accounts** each year is wages multiplied by the contribution rate. The notional capital is increased each year by the notional interest rate, *n*. At retirement, the accumulated notional capital is divided by a notional annuity factor, *A*, sometimes called the g-value. The pension benefit can be written as:

$$NA = \sum_{i=o}^{R} \frac{w_i c}{A} (1+n)^{R-i}$$

All the schemes are clearly earnings-related, since their value depends deterministically on individual earnings, *w*. Furthermore, if the policy for valorising earlier years' earnings is the same as the uprating procedure for the pension point and the notional interest rate, then the structure of the three equations is very similar. In this case, the defined-benefit accrual rate is equal to the ratio of the pension-point value to its cost and to the ratio of the notional-accounts contribution rate to the annuity factor, or algebraically:

$$a = \frac{v_i}{k_i} = \frac{c}{A}$$

This has two implications for the comparison of these different types of pension scheme. First, the effective accrual rate can be calculated for pension-point schemes (the ratio of point value to cost) and notional-accounts schemes (the ratio of the contribution rate to the annuity factor). The results of this calculation are shown in Table 2.1 in Chapter 2. Secondly, the valorisation procedure in defined-benefit schemes, the uprating policy for the pension-point value and setting the notional interest rate are exactly parallel policies (as they are presented in Table 2.2 in Chapter 2). Different choices of variables have the same effect in the different types of systems.

Although defined-benefit, points and notional-accounts systems can appear very different, they are in fact closely related variants of earnings-related pension schemes.

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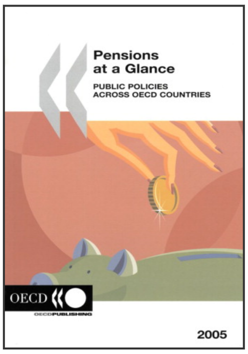

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